Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science

Special Publication in Celebration of URISA's 50th Anniversary Conference

1963-2012

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Editor

Urban and Regional Information Systems Association

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Foreword

Welcome to *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science,* a special publication celebrating 50 years of URISA.

The Urban and Regional Information Systems Association has been blessed with devoted volunteer leaders since its inception. Hundreds, no thousands, of individuals have freely given their time and expertise as committee members, chapter leaders, board members and officers, all to support URISA and its mission.

Take a look at the list of international contributors to this publication. Bringing their experiences from governments at all levels, private sector firms, research institutes, and universities, they represent the 'Who's Who' of influencers in the field of urban and regional information systems and geographic information systems and science.

Years ago they chose to be involved with URISA, and they continue to contribute their enthusiasm and energy. URISA is one of the very few organizations which can boast of this unparalleled level of commitment.

Dr. Barry Wellar, editor of this book of celebration, became a URISA member in 1967, is a URISA past president (1978), a Horwood Award recipient (1985), and was inducted into the GIS Hall of Fame in 2011. We are indebted to him for completing this important project to the benefit of URISA's past, present, and future members.

No doubt URISA would have disappeared long ago if it weren't for the passion of its members. URISA is a professional home, a family, a support system, and we look forward to the next 50 years together!

Wendy Nelson,
Executive Director, URISA

Preface

In their roles as conference program chairs and committee members, workshop instructors, board members, conference presenters, paper reviewers, proceedings and journal editors, and other activities, URISA past presidents have made many significant original and fundamental contributions to urban and regional information systems and geographic information systems and science.

I am therefore very pleased to serve as the editor for *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science,* which is sponsored by the past presidents to mark their participation in URISA's 50th annual conference.

To date, URISA has produced more than 35,000 pages of text in its conference proceedings, journal, workbooks, newsletters, and other publications. As a rough estimate, about two-thirds of that impressive production occurred between 1963 and 1996 when the medium of communication was paper, with 1997 marking the year when URISA began to make much of its material available online through its website, www.urisa.org.

In this publication we review and overview some of the research, education, training, and applications foundations that URISA and its members have contributed to urban and regional information systems and geographic information systems and science. There are three primary objectives guiding the design and content of the book.

First and foremost, the articles in the book recognize many of the URISA members whose thinking, initiatives, and productions significantly affected and in many cases continue to affect the research, education, training, and applications activities in urban and regional information systems and geographic information systems and science.

As noted above and further discussed in objective three below, many of these thoughts and associated initiatives and productions were in articles, reports, workbooks, etc., that were published in the "print medium era". Consequently, due to their relatively limited distribution, important articles published as recently as the mid-1990s may not be widely known among current contributors to and users of urban and regional information systems and geographic information systems and science literature.

The occasion of the 50th annual conference is a timely opportunity to remind or inform readers of some of the numerous significant contributions made by URISA members to the foundations of urban and regional information systems and geographic information systems and science.

Second, URISA sponsored and supported many original research, education, training, and applications activities in urban and regional information systems and geographic information systems and science.

Indeed, since its initial conference in 1963 URISA has been and remains a leading innovator among international professional organizations involved with urban and regional information systems and geographic information systems and science, and many associated fields or sub-fields. The 50th annual conference is therefore a timely opportunity to remind or inform readers of the original contributions which have been made by URISA members, and of the debt which is owed to them for the derivative works that were spawned as a result of their thoughts and initiatives.

Third, URISA has been a sharing and inclusive organization beginning with its first conference in 1963. A hallmark of URISA has been an abiding interest in sharing what has been learned and is being learned about urban and regional information systems and geographic information systems and science, with an emphasis on inviting newcomers to actively participate in an exciting and rewarding search for new ways to acquire and use new knowledge about urban and regional information systems and geographic information systems and science. This book seeks to perpetuate that tradition by encouraging extensions of the research, education, training, and applications foundations that are outlined in these pages.

And, as a closing note, this book also seeks to give readers reason for taking a life's lesson from the URISA experience. That is, URISA flourished over the past 50 years by welcoming and sharing new ideas, directions, and initiatives.

It is therefore hoped that this book will promote a similar welcoming and sharing attitude among future URISA members, and the continued flourishing of URISA, over the next 50 years.

Barry Wellar,
Editor

Ottawa, Ontario
July 20, 2012

Acknowledgments

As editor of *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science,* I wish to acknowledge the support which URISA past presidents gave to the production of this volume commemorating URISA's 50th anniversary conference. Support by past presidents began with the decision to sponsor the *Foundations* book, and then the past presidents followed up on that decision in two important ways.

First, thanks are given to Barry Wellar, (the late) Edgar Horwood, Ken Dueker, Dianne Haley, Will Craig, Pete Croswell, Ed Wells, and Martha Wells for their contributions of chapters to this special publication celebrating URISA's 50th anniversary conference.

Second, a number of past presidents and past presidents-in-training financially supported production of *Foundations*. Donations from Greg Babinski, Connie Blackmon, Kathrine Cargo, Gil Castle, Will Craig, Ed Crane, Cindy Domenico, Ken Dueker, Joe Ferreira, Randy Gschwind, Dianne Haley, Bob Hurst, Bill Huxhold, Laurel McKay, David Moyer, Nancy Obermeyer, Hilary Perkins, Cy Smith, Nancy Tosta, Sam Trotter, Barry Wellar, Ed Wells, Martha Wells, and Lyna Wiggins are gratefully acknowledged. Thanks are also expressed for the donation by Wellar Consulting Inc. in memory of our deceased colleagues Bob Aangeenbrug, Dorothy Bomberger, and Dan Parr who would have enthusiastically participated in this endeavour.

My final words of appreciation recognize several individuals for their outstanding technical production work: Sam Herold for his text formatting, graphic design, and file management skills; Marjorie Wellar for proof reading and advising on design matters; and URISA executive director Wendy Nelson for promptly responding to requests for photographs, resource materials, and administrative information.

On behalf of the past presidents and all the contributors to *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science,* thank you for your assistance in producing this special book celebrating URISA's 50th anniversary.

Closing on a personal note, it has once again been a privilege to participate in creating a multi-author document which convincingly demonstrates why URISA is known by the motto, "Information is our middle name".

I thank the URISA past presidents for the opportunity to frequently re-visit that core message while *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science* was in process.

Barry Wellar,
Editor

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INTRODUCTION TO *FOUNDATIONS OF URBAN AND REGIONAL INFORMATION SYSTEMS AND GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE*

Barry Wellar
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Principal, Wellar Consulting Inc.

Abstract. During its 50-year history of conferences and productions, URISA established itself as the pre-eminent source of curiosity-driven and client-driven presentations and publications on research, education, training, and applications activities in urban and regional information systems and geographic information systems and science. *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science* overviews this outstanding record of achievement in six parts: “Tribute to Edgar Horwood”; “Forces and Ideas that Spawned the Field”, “Previous Benchmarking Experience”; “Institutional and Organizational Foundations”; “Topical and Visionary Foundations”; and “Reflecting Upon the ***Foundations*** Project and Its Implications”. This chapter puts the URISA record in context by identifying more than 240 information systems domains which have been the subject of attention by URISA, and then it outlines how the book is designed to create a major benchmarking report on the foundations which underlie the field.

1. Introduction

URISA has achieved an outstanding record of performance since its very humble beginnings in 1963. As of the 2012 conference, that record includes 50 annual conferences, 48 years of producing conference proceedings, two decades of publishing a journal, a dozen or more annual workshops and regional conferences, numerous special publications, as well as a variety of innovative initiatives including the GIS Hall of Fame Award, the Exemplary Systems in Government (ESIG) Award, the URISA Leadership Academy, URISA Certified Workshops, and the GIS Management Institute.

In addition, and as a foundation activity of increasing importance each passing year, URISA was at the forefront of the successful endeavour to create the Geographic Information Systems Certification Institute (GISCI). As a result of participating in that initiative, URISA contributed to the certification of thousands of individuals from academia, government agencies, non-governmental organizations, and businesses as a Geographic Information System Professional (GISP).

An overall consequence of those achievements, as well as a number of other success stories which are posted on the URISA website (urisa.org), is URISA’s paramount accomplishment of taking on a lead, international role in bringing urban and regional information systems and geographic information systems and science into governments at all levels, businesses of all sizes and product/services lines, academic institutions from elementary schools to colleges and universities, as well as into academic, professional and technical associations and various sectors of the public interest group community.

In the next few pages I introduce *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science* by briefly elaborating the three objectives guiding the design and content of the book, and then by briefly commenting on the chapters prepared for this special publication to celebrate URISA's 50th annual conference.

2. Book Objectives

The first objective of the book is to inform readers of some of the numerous, significant contributions made by URISA members to the foundations of urban and regional information systems and geographic information systems and science.

It is the view of the past presidents that such a book is one way to celebrate URISA's organizational accomplishments, while also recognizing some of URISA's thinkers and doers who made and make fundamental contributions to the evolution and advancement of urban and regional information systems and geographic information systems and science through their URISA conference contributions, conference proceedings papers, journal articles, and other professional services and products.

And, as an associated outcome, it is anticipated that this book will prompt international interest in learning more about the body of URISA literature – journal articles, proceedings papers, special publications, workshop workbooks, newsletters, website postings, and webinars – on research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

The second objective of the book is to emphasize the 50-year history of URISA conferences and productions as the pre-eminent source of curiosity-driven and client-driven presentations and publications on research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

By way of brief comment, URISA conference proceedings contain many of the original contributions to the literature on research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

Further, because of the academic, government, and business affiliations of its members, the derivative contributions to the URISA conference proceedings tend to be much broader in scope and more robust methodologically than the derivative papers contained in publications of organizations with a single-purpose interest and less demanding standards.

In view of the possibility that some readers are not familiar with the broad mix of information system domains (subject matters, purposes, jurisdictions, functions, operations, etc.), embraced by contributors to URISA conferences over its 50-year history, it may be instructive to identify some domains now, and others will be encountered in the papers that follow this chapter. The order of domains listed in Table1 is alphabetical for convenience.

The list in Table 1 is not intended to be exhaustive or even comprehensive, since it represents only a modest portion of the information system domains considered in URISA proceedings papers and other URISA publications on research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

However, I believe that even this partial list is sufficient to establish the exceptional diversity and depth of research, education, training, and applications expertise and experience which is inherent in the publications that URISA has produced over its history. And, I further believe, it provides a substantive introduction to the chapters which elaborate the proposition that URISA is a pre-eminent source of documentation in the field of urban and regional information systems and geographic information systems and science.

Objective three behind *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science* builds on the positive results arising from previous anniversary conference productions in 1977, 1985, 1992, and 2002. On those occasions, dedicated and talented individuals pooled their resources to create one-of-a-kind collections of outstanding benchmark papers. As discussed in the next several paragraphs, I believe that early adoption of the concept of **sharing** has been fundamental to the strength of URISA, and to its ability to undertake the benchmarking projects that were done in 1977 and 1992, and the preparation of this book in celebration of the organization's 50th anniversary conference.

A core lessons learned from those conferences is that it is institutionally important for a professional organization such as URISA to periodically take stock of its progress, but with a specific focus. That is, there needs to be an emphasis on identifying and appreciating the <u>building blocks</u> which it contributes to the literature on research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

Table 1. An Indicative List of the Information System Domains Discussed in URISA Proceedings Papers*

- access to data issues
- access to data policies
- access to information issues
- access to information policies
- applications of data systems
- applications of geographic information systems (GIS)
- applications of information systems (IS)
- applications of land information systems (LIS)
- assessing GIS benefits
- assessing IS benefits
- assessing management information system (MIS) benefits
- asset management systems
- attribute data
- automated cartography
- automated data processing
- automated mapping,
- automated vehicle tracking
- cartographic principles and practices
- census
- centralization/decentralization issues
- climate change monitoring system
- code enforcement information system
- community health information system
- community mapping/maps
- complaints-based municipal standard of care response system
- complaints-based inspector dispatch system
- computer-aided dispatch
- computer-aided mass appraisal
- computer-communications systems
- confidentiality and privacy issues and practices
- consultants and data conversion tasks
- consultants and IS/GIS/LIS design and implementation
- contour mapping,
- coordinate systems
- COTS – OSS/FS – Saas
- criminal justice information system
- data access control plan
- data acquisition alternatives
- data conversion processes
- data dictionary
- data generation techniques

Table 1 (cont'd). An Indicative List of the Information System Domains Discussed in URISA Proceedings Papers*

- data layers/overlays
- data maintenance
- data models
- data sharing issues/protocols
- data sources and data acquisition/transfer *caveats* and protocols
- data standards
- decision support information system
- development monitoring/tracking information system
- devolution impact on municipal government information services
- digital elevation model
- digital mapping
- digital terrain model
- dispatch Information system
- "Doomsday Map"
- economic development information system
- electronic data processing
- emergency response information system
- enterprise geographic information system
- environmental impact assessment information system
- environmental information system
- environmental technical information system
- evaluating information system performance
- exemplary systems/best practices
- expert and knowledge-based information system
- facility management system
- financial information system
- fiscal impact analysis
- fiscal information system
- geocoding
- geodatabase structures
- geographic base file
- geographically-referenced data storage and retrieval system
- geographic concepts defining GIS
- geographic information system (GIS)
- geographic knowledge system
- geomatics
- georeferencing
- geospatial technology
- geostatistics
- GIS planning and implementation
- GIS trends

Table 1 (cont'd). An Indicative List of the Information System Domains Discussed in URISA Proceedings Papers*

- global positioning systems
- globalization impact on community information strategies
- Google (street view, etc.)
- hazard information systems
- health information system
- housing information system
- human resources management information system
- imaging systems
- impact assessment principles/practices/techniques
- indexes and other metrics for evaluating/grading/measuring performance
- informatics
- information and knowledge bases for decision-making
- Information interchange protocols
- information management systems
- information research services
- information science
- information society
- information system architecture
- information system functionality
- information system performance
- information systems and critical/essential infrastructure
- information system trends
- informational activity criteria
- informing and listening to the public
- infrastructure management and maintenance information system
- in-house/out-source principles and practices
- institutional and organizational factors
- institutional maxims and conditions
- integrating land records databases
- integrated municipal information system
- integrated system development
- interactive GIS
- interdependent infrastructures and information systems
- intergovernmental information system
- internet GIS
- land information system
- land market information system
- land parcel information system
- land records information system
- land registration information system
- land/structure/occupancy database

Table 1 (cont'd). An Indicative List of the Information System Domains Discussed in URISA Proceedings Papers*

- land use classification systems
- legacy systems
- legal issues
- LiDAR
- management information system
- measuring information system return on investment
- mental health data system
- metadata
- methods and techniques of spatial analysis
- metropolitan information system
- mobile LiDAR
- motor vehicle accident records information system
- multi-jurisdictional geographic information system
- multimedia systems and applications in local government
- multipurpose cadastre
- multi-purpose land information system
- municipal information system
- national spatial data infrastructure (NSDI)
- natural resources information system
- needs analysis – data
- needs analysis – information
- needs analysis – policy information/knowledge bases
- object-oriented database
- online mapping
- open systems and architecture
- pedestrian-sensitive intersection traffic safety system
- plan, program, budget information system
- planning and evaluation information system
- planning information system
- planning research information system
- police management information system
- policy objective, formation, and evaluation system
- policy research information system
- privatization impact on public sector information services
- productivity measurement
- project performance information system
- property assessment information system
- property inspections information system
- property standards by-law enforcement system
- prosecution management information system
- public participation geographic information system

Table 1 (cont'd). An Indicative List of the Information System Domains Discussed in URISA Proceedings Paper*

- public policy and IS/GIS/LIS inputs
- quality assurance for GIS
- quality control procedures and systems
- real estate information system
- regional information system
- regional management information system
- relational database-management system,
- remote sensing systems
- residential appraisal information system
- resource allocation models
- return on investment principles and practices
- routing systems (vehicles, utilities, etc.)
- school districting information system
- small area data needs/issues
- social indicators information system
- spatial analysis for business
- spatial analysis techniques
- spatial data infrastructures
- spatial data transfer standard (SDTS)
- spatial data warehouse
- standard of care information obligations
- standardization processes
- street addressing
- topology
- traffic management information system
- transferability concepts, principles, and practices
- transit planning information system
- transportation information system
- water and wastewater information system
- urban data models
- urban development information system
- urban information system
- Urban Information System Inter-Agency Committee (USAC) project
- zoning information system

* The vast majority of domains were discussed in conference proceedings papers, but some were introduced in URISA conference keynote, plenary, or invited session presentations, or in workbooks and glossaries. They are included in Table 1 to provide a comprehensive, one-stop listing of the information system domains that URISA publications have contributed to the literature on urban and regional information systems and geographic information systems and science.

While this project is not as ambitious as those of 1977 and 1992, its explicit emphasis on <u>foundations</u> should serve to highlight the organization's major contributions to the literature, and to give due recognition to many of the individuals, agencies, firms, and groups responsible for those contributions.

Further, regarding the entries in Table 1, each one represents a topical domain which has been discussed in tens, dozens, and even hundreds of URISA productions, which now total some 35.000 pages of published material.

Table 1 and the following chapters will have served a valuable purpose if they induce readers to spend the necessary (quality) time examining or re-examining URISA's publications for foundation contributions to the literature on research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

Finally, and as also learned from the 1970, 1977, 1985, 1987, 1992, and 2002 conferences, it is institutionally important for a professional organization such as URISA to periodically take stock of how its work is affecting its individual members, its corporate members including businesses and government agencies, as well as its partnering and affiliated associations and institutions.

The entries in Table 1 are indicative of the subject matter reason that individuals from government agencies, universities, non-government organizations, businesses, other professional associations, and ordinary agencies, firms, groups, etc., attend URISA conferences and workshops to make presentations, participate in discussions, take away valuable lessons learned, and write about in their proceedings papers. However, high-quality and leading-edge subject matter, in my opinion, is just part of the URISA attendance story.

As the reader is no doubt aware, there are many ways to design presentations and papers, including the following: identify a need and put out or request proposals to address the need; pose questions and invite answers; state problems and request solutions; express concerns and solicit advice; raise research issues and inquire about research methods; and, posit theories or hypotheses and ask about precedents or empirical evidence.

However, and this is key to achieving productive outcomes, <u>if connections are to be made between questions and answers, problems and solutions, etc., there must be exchanges of data, information, and/or knowledge among the players in the piece.</u>

The foundation associated with objective three, therefore, is basically that of **sharing**, which in point of fact begins with the people responsible for the sharing of questions, problems, issues, concerns, solutions, alternatives, etc., that are contained in presentation and publication materials.

The major benchmarking projects in 1977 and 1992 were shared enterprises, in which dozens of talented and dedicated URISA members joined in common cause to create exceptional contributions to our understanding of the research, education, training, and applications activities of urban and regional information systems and geographic information systems and science.

As discussed in various chapters, we are all indebted to the individuals who shared their expertise and experience in producing those two seminal publications.

Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science continues that sharing tradition, courtesy of the URISA members who are once again sharing with us their time, energy, and talents in preparing chapters for inclusion in this book

3. Book Organization

Table 1 illustrates that there are many topics which lend themselves to chapters in a book discussing *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science.* Moreover, since the information system domains listed in Table 1 are from URISA presentations and productions (primarily proceedings papers, but also from journal articles, workbooks, etc.,), from an expertise point of view many of them are candidates for inclusion in a book on foundations of urban and regional information systems and geographic information systems and science.

However, from an operational point of view there is a severe limit on how much can be achieved due to the heavy demands on the time of potential contributors. As a result, the process for creating this book was not of a top-down nature. Rather, past presidents, Hall of Fame inductees, and Horwood Award recipients were invited to propose and assess potential book topics, and invitations were broadcast in search of chapter leaders and contributors. The overriding concern was to arrive at an arrangement of chapters and authors which in my opinion would result in a completed body of work by the time of the 50th anniversary conference in early October.

Relatively speaking, then, the benchmarking projects and productions for the 1977 and 1992 anniversary conferences were of a “grand design“ nature, and some 35 and 20 years later, respectively, they continue to be regarded as exceptional contributions to the literature on urban and regional information systems and geographic information systems and science. Participants in either of the earlier projects will readily identify with the comment that for reasons of rigor of design and comprehensiveness of scope, there are significant differences between the anniversary projects of 1977 and 1992 *vis-à-vis* that of 2012.

Further, let me hasten to add that what we are giving up on the one hand with regard to details, we are recouping on the other with regard to clear message.

That is, our focus in this book is on **foundations**, and all the chapters are directed at describing why and how each proposed foundation idea, event, practice, etc., has affected, is affecting, and/or is likely to affect the field of urban and regional information systems and geographic information systems and science, including their use in governments, business, academia, and society at large.

And, of course, the story does not end there if the past is a guide to subsequent events.

Within URISA for example, there will doubtless be many follow-on presentations and publications in the coming years that add to the body of documentation on foundations of urban and regional information systems and geographic information systems and science.

And, I fully expect, given that many previous URISA initiatives have been adopted by individuals and organizations external to URISA, this one will not be an exception. That being the case, it therefore follows that we can anticipate a widespread and substantial extra-URISA increase in papers, research proposals, calls for papers, website "blurbs" etc., etc., with a foundations emphasis.

To complete the Introduction, I briefly comment on the contribution each of the parts makes to *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science.*

3.1 Part I: Tribute to Edgar Horwood

Edgar Horwood was a pioneer thinker, doer, and motivator in the field of urban and regional information systems and geographic information systems and science. He made numerous significant contributions to the field from the late 1950s and early 1960s until his death in 1985, including the outstanding paper that he prepared for the 1977 anniversary conference proceedings.

In recognition of the excellence of that paper, and to provide context for the tributes paid to Dr. Horwood throughout the book, the 1977 paper is included in Part 1. I hasten to add that the 1977 proceedings was produced during the "pre-digital age", so this way the Horwood paper becomes available to a much wider and dispersed audience than was previously the case.

Other chapters in Part I include a ***URISA Newsletter*** column re-print in which Professor William L. Garrison tells us about his involvement with Edgar Horwood "back in the day", and an account by Ken Dueker which touches on some of the many Horwood-associated ideas, events, situations, circumstances, nuances, and people marking the early days and early years of URISA.

There could be other entries to the tributes section, but in my experience Dr. Horwood would insist that we "get on with it", so that is what we'll do.

3.2 Part II: Forces and Ideas that Spawned the Field

The topic of foundations is one which I believe is best recounted for this kind of book by those who were in on the action when the foundations were under discussion, being bounced around, being run up the flagpole, taking shape, being formulated, and then being implemented, tested, evaluated, and adopted.

Unfortunately, many of the individuals who contributed ideas and initiated or influenced forces that spawned the field 30 to 50, or as many as 60 years ago, are unable to assist in this endeavour. As a result, we do not have access to their first-hand stories.

Fortunately, however, beginning in the 1960s Barry Wellar, Mike Kevany, and Ken Dueker were in on the action affecting urban and regional information systems and geographic information systems and science action, and have stayed involved over the years. Their chapters identify individuals, agencies, situations, and circumstances responsible for many of the foundations which are pertinent to the unfolding of the field, including institutional, organizational, technical, technological, methodological, political, and social initiatives, events, processes, ideas, activities, products, services, and impacts.

3.3 Part III: Previous Benchmarking Projects

URISA conferences in 1970, 1977, 1987, 1992, and 2002 included a benchmarking component to document and discuss progress achieved in research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

Summaries of the 1970 and 1977 benchmarking efforts are included in Chapter 8, “URISA Proceedings, 1968-1978: A Defining Contribution to Urban and Regional Information Systems and Geographic Information Systems and Science”. They are presented in Part 2 because those two conferences were instrumental in framing the early, original discourse on information system foundations.

The 1992 benchmarking project was of a different order of business, for two reasons in particular. First, the field had moved from an early stage to a more mature stage, which required a different benchmarking design. And, second, between the 1977 and 1992 conferences, an increased emphasis was being placed on research, education, training, and applications activities involving and affecting geographic information systems and science.

Chapter 9, “IS/GIS/LIS and Public Policies, Plans, and Programs: Thirty Years in Perspective – Recalling a Major Benchmarking Project”, written by Barry Wellar, recognizes the outstanding contribution that the 25 authors and 16 papers made to the literature on the foundations of urban and regional information systems and geographic information systems and science.

3.4 Part IV: Institutional and Organizational Foundations

The value of research, education, training, and applications activities involving urban and regional information systems and geographic information systems and science is directly affected by the institutional and organizational foundations supporting those activities.

These foundations include: accords, agreements, and understandings among governments, and agencies of governments; inter-governmental arrangements; governmental and non-governmental body relationships; professional, trade, and technical associations, alliances, and affiliations; public-public, public-private, and private-private partnerships; mission statements, including duty of care and standard of care obligations of public, private, and quasi public bodies; and the internal instruments and mechanisms which entities create to serve and promote achieving their mission objectives.

Since its inception, URISA has been at the forefront of designing, developing, and implementing institutional and organizational foundations in support of information systems research, education, training, and applications. We are indebted to Peter Van Demark, Barry Wellar, Dianne Haley, Gary Hunter, Will Craig, Shoreh Elhami, Mike Goodchild, and Pete Croswell for their contributions to this important topic.

3.5 Part V: Topical and Visionary Foundations

Table 1, Chapter 1 lists about 240 of the information systems domains that have been discussed in URISA conference proceedings papers, as well as in URISA conference keynote, plenary, or invited session presentations, journal articles, or in workbooks and glossaries. Responses to the list indicate support for the position that it represents a small portion of the significant information system domains that receive consideration in the approximately 35,000 pages of text that URISA has contributed to the field of urban and regional information systems and geographic information systems and science.

Time and other resources permitting, dozens of chapters could have been included in this section. However, we are constrained in those regards, so it was deemed appropriate that a limited, illustrative selection of chapters on topical and visionary foundations be included in the book as a start on building a very important body of literature.

The long story short is that a small contingent of URISA past presidents, GIS Hall of Fame inductees, and Horwood Award recipients stepped forward and took on assignments to prepare chapters for this vital part of the book. Barry Wellar, Dana Tomlin, Martha Wells, Ed Wells, and Jack Dangermond are long-term, frequent, and influential contributors in urban and regional information systems and geographic information systems and science. Their contributions will no doubt promote further investigations into new, different, and emerging foundation issues, concerns, opportunities, and challenges.

And, I am pleased to add, Penny Baldock took the lead in a group project to prepare a chapter on behalf of the former Australian Urban and Regional Information Systems Association (AURISA) and the current Surveying and Spatial Sciences Institute (SSSI) of Australia and New Zealand.

3.6 Part VI: Concluding Remarks

This is my fifth benchmarking project on behalf of URISA (1977, 1985, 1992, 2002), and they are quite different in terms of design, most of the participants, and the productions or outcomes. However, they have several important features in common, I believe, including good representation of topics considered, thoughtful insights, usefulness, and a building-block approach for further, cumulative contributions.

In the case of *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science,* it is my impression that this book represents an original or near-original way dealing with a scientifically important and societally significant topic.

We are deeply indebted, therefore, to the chapter authors who inform us as to the individuals, groups, agencies, companies, events, processes, circumstances, etc., responsible for creating, nurturing, implementing, maintaining, promoting, and servicing the foundations over the past 50 years. The nature of this debt and its implications for future benchmarking projects are outlined in Chapter 23.

3.7. Contributors' Bio-Notes

The bio-notes section is a means to illustrate and recognize the outstanding credentials which the contributors bring, individually and collectively, to the task of producing ***Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science***.

As part of their bio-notes, authors are invited to include links to websites containing details about their publications, work experience, training, education, and other aspects of their careers. This approach provides contributors with an opportunity to indicate sources containing insights into the groundings upon which their chapters are based, and it may also assist readers seeking guidance about e-access to such sources.

Part I

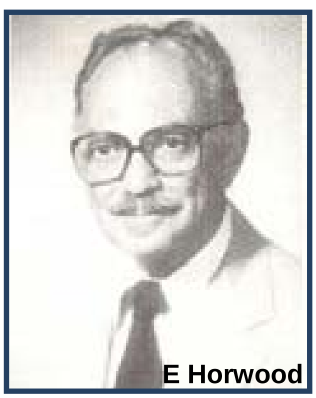
TRIBUTE TO EDGAR HORWOOD

By going to the Find function and entering “Horwood” in the Find what: field, the reader will be informed that (Edgar) “Horwood” is mentioned numerous times in the book, and upon scrolling through the text the reader will discover that “Horwood” is highlighted with regularity throughout the volume.

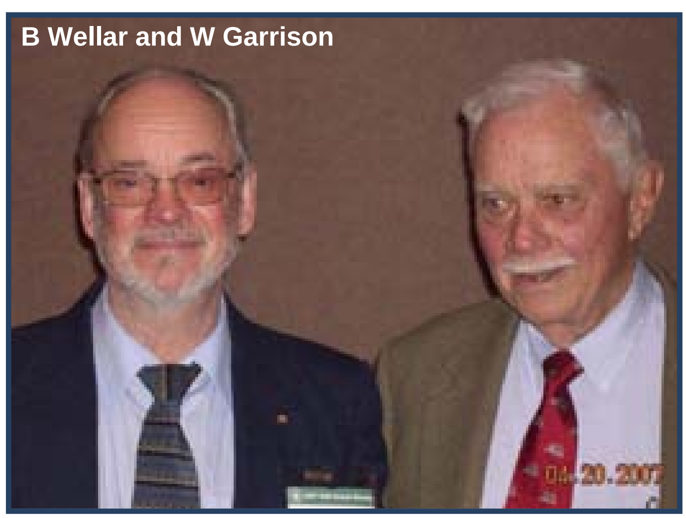
The few pages of this section barely “scratch the surface” of Edgar Horwood and the many contributions he made to the foundations of urban and regional information systems and geographic information systems and science. However, these few pages are sufficient to indicate why Dr. Horwood is accorded the highest regard and utmost respect by chapter authors.

On behalf of all contributors to and sponsors of this volume, therefore, it is my pleasure and privilege to recognize Edgar Horwood as the driving force behind the founding of URISA, as a founder of the field of urban and regional information systems and geographic information systems and science, and a most worthy recipient of the tribute section which opens *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science.*

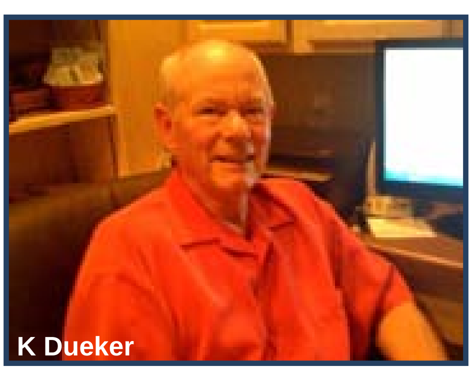
Barry Wellar



E Horwood



B Wellar and W Garrison



K Dueker

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BILL GARRISON TELLS US A BIT ABOUT HIS FRIEND AND COLLEAGUE, ED HORWOOD

Barry Wellar
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***Abstract*.** During the 1950s and 1960s, William L (Bill) Garrison, now Professor Emeritus, Civil and Environmental Engineering, Institute of Transportation Studies, University of California, Berkeley, was a colleague of Edgar Horwood at the University of Washington. This chapter reprints an article (Wellar, 2009) in which Professor Garrison provides insightful comments about the character of his friend and colleague Edgar Horwood, and then outlines some of the forces and circumstances in play during the years leading up to the creation of URISA, and several of the core themes around which information systems thinking and doing have evolved over the past half-century.

1. Introduction

A notice about contributing to URISA's history reminded me of the many times that I had participated in discussions about the origins of URISA, and the people who had the vision, energy, stamina, conviction, and motivation to make it happen. And, reflecting upon those good times reminded me of the people factor, which was the constant that made URISA the "place to be" throughout my career.

As good fortune would have it, I arrived within the ambit of the URISA scene just several years after its formal inception when I started graduate school in 1965 at Northwestern University. As result, I met many of the original cast of characters behind the formation of URISA, including Professor William L. (Bill) Garrison.

And, as a result of further good fortune, I have had occasion in recent years to exchange communications and co-author publications and presentations with Dr. Garrison, who is Emeritus Professor, Civil and Environmental Engineering, University of California at Berkeley.

In the hope that he would recall one or more of the accounts that he shared with me, I sent an email to Dr. Garrison, which included the following text:

> Bill,
>
> URISA is preparing a history of the origins of the organization, and we have some of the early papers written by Ed Horwood, so that part of the documentation process appears to be reasonably well-covered.
>
> However, the history will likely be very short on personal materials, and

> information about the circumstances in which URISA took shape may be scarce.
>
> It would be great if you could write a couple of paragraphs of an anecdotal nature about Ed, since you knew him better than most of us,
>
> And, several of your thoughts about URISA then and now, as well as any points or places in between, would be most welcome.
>
> Barry

I am delighted to report that Prof. Garrison agreed to prepare the following two items for what might be called *The Brief History of URISA Project*.

2. Edgar Horwood's URISA

I saw something like URISA as a gleam in Horwood's eye by the late 1950s. We were at the University of Washington at the time, lived about a block apart in the View Ridge neighborhood and worked on similar research. Available and receptive, I served as a listener and sounding board for Ed's ideas. In the 60s and in other venues I donated shoe leather to his efforts to gain political and financial support, hosted a meeting at Northwestern University, and was active in URISA in its first few years – all for a good cause striven for by warm, innovative, altruistic Edgar Horwood.

As for the man behind URISA, Ed's take-action and fit-action-to-circumstance skills warrant special mention.

Horwood's take-action at home was his grandiose 1960s proposal for an interlocked set of urban, planning, regional, and what-have-you data centers at the University. The proposal wandered from the Civil Engineering Department to Deans and Department Chairs, and was studied by committees and assailed by busybodies. After a couple of years it returned through bureaucratic channels with a "no" signal backed by 1,000 and 1 reasons, yet accompanied by claims on money and control.

But that was too late. Earlier, when asked by the Comptroller for names for his funded research projects, Horwood used URISA-like names. When the Regents of the University asked the Administration how it was responding to the great urban crisis of the 60s, the Comptroller was queried. A computer search yielded Horwood's array of project titles, and they were reported as the University's ahead-of-the-curve and sweeping organizational response to the crisis.

And Horwood loved to tell the story of how he was *de facto* rather than *de jure*. Even so, a bold move at the right place, right time came to the aid of innovation.

The American Institute of Planners met in Seattle in the late 50s, and Horwood arranged for me and several of my students to give papers at a plenary session. Not knowing the audience, we pontificated on how urban morphology could be captured by cluster and principal component analysis and other such things. There was a great silence when it was time for discussion, until Horwood stood in the back of the room, looked at his watch and said, “Can someone give me the correct time. My watch says it is 8:30, but these people have talked for hours.” That action broke the ice and fit the circumstances. Good for Horwood. He knew what do in the circumstances, and that kind of knowing served him well.

Edgar Horwood, a real person who knew what to do, and whose actions serve us well.

Bill Garrison, September 1, 2009.

3. URISA, Present at the Creation

Edgar Horwood made URISA a sure thing from the 1950s when he first imagined it. He had energy, a sense for innovation, and other attributes that made him the right person at the right place and time.

Questions were about, How soon? And, How all-encompassing? And not about if or whether.

I was a watcher and a booster in the early days. I kept up with the efforts of Edgar Horwood and others and helped when I could, mainly by joining Horwood in Washington and Ottawa in vain searches for some sort of government involvement and by attending early meetings.

It was good to be there at the creation, but my involvement tapered as URISA took off in the 70s and other things consumed my time and energy.

Looking around today, and looking back, I regret being pulled away and missing the personal, professional, and institutional interactions that URISA provides.

However, I judge that my early view of the potential for URISA-hosted activities was right on the mark. It went beyond better data to choices enriched by real- time, fine-grained, and flexible information systems.

And I said that in lots of places: American Political Science Association (1965), American Institute of Planners (1965), American Astronautical Society (1966), World Future Society (1970), and Association for Computing Machinery (1971), and elsewhere.

Themes touted then continue. Choices and new futures for urban areas was one theme. And scope and variety was another, as suggested by a view of the earth from space and the title, *World’s Largest Information System* in an Astronautical Society publication (Garrison, *et al*, 1966) (beating Google by decades).

On the upbeat, I see those themes emerging in rich and varied ways.

On the downbeat, the threat of information tipping the balance in favor of the political class seems not to have materialized. Instead, headwinds continue from folks that accept an inevitable and dreadful future locked-in by historic path dependence, hammered by anticipated natural disasters and resource depletion, and suffocated by urges to modify the behaviors of others.

Bill Garrison, September 1, 2009

4. Conclusion

Throughout his illustrious career, Prof. William L. Garrison has been directly involved In a range of research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

In this commentary which he originally assisted in preparing for *URISA News*, Prof. Garrison reveals his appreciation for what made Edgar Horwood "tick".

And, it also succinctly demonstrates his profound understanding of what makes information and information systems "tick", and why he would have been of great assistance to Edgar Horwood in the early days when knowledgeable and supportive colleagues were in extremely limited supply.

The contributors to this book, and the readers of this book, are indebted to Prof. Garrison for the tribute to his friend and colleague, Edgar Horwood. And, on a personal note, I am grateful to Professor Garrison for his willingness to contribute to the initial article and for permitting it to be included in ***Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science***.

5. References

Garrison, William L., *et al*. 1966. "Data Systems Requirements for Geographic Research." *American Astronautical Society Science and Technology Series*, Vol. 4, No. 11, pp. 139-151.

Wellar, Barry. 2009. "Bill Garrison Tells Us a Bit about His Friend And Colleague, Ed Horwood" *URISA News,* Issue 223, September/October pp. 8-9.

3

PERSPECTIVES ON URISA'S ORIGIN AND ON THE EMERGENCE OF A THEORY OF URBAN AND REGIONAL INFORMATION SYSTEMS

Reprinted from *Information System Inputs to Policies, Plans, and Programs*, Papers of the 15th Annual Conference of the Urban and Regional Information Systems Association, Vol. 1, pages 2-19, Chicago, 1977.

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Abstract. The incident of conception of URISA and the circumstances which brought the organization into being are recounted. Definitions of the field are presented and discussed. The association is viewed through the nature and type of its literature. Speculation is made on the disciplines of urban and regional information systems and the future of URISA.

1. Introduction

I have been asked as the first president of URISA and as one involved during its pre-organizational period to sketch the early background of URISA today, and coincidentally to make some comments that may give relevance to its present being and its emerging role. It has been several years since our last exercise in this respect, wherein we introduced the decades of the Seventies by a session on the examination of the past, present and future of our field (URISA, 1970). We have been an organization of substantial turnover, according to one of our historians (Kraemer, 1977), and there are only about 100 of us who have maintained continuous association with URISA for more than a decade. Perhaps it is also a sign of my advancing years that I am asked to recount the history of URISA and record early events and decision points before they are forgotten. History is only significant in that it can be related to current events and emergent prospects, therefore I will try to be more than just an historian in this role.

2. The Origins of URISA, 1962-1966

The concept of URISA got its start unbeknowingly in the fall of 1961 with the attempt of a few people to get information from the then new tape technology of the United States Census Bureau regarding the Census of Population and Housing of 1960. If I could point to one single incident, it would be a telephone discussion I had with Jack Beresford, a subsequent URISA president, who was then a member of the staff of the U.S. Bureau of the Census involved in handling requests regarding access to Census data. The conversation went something like this:

Ed. Horwood - "Jack, how can I get Seattle's block data without waiting for its hard copy publication in a couple of years?"

Jack Beresford - "Well, you can't, Ed. That information is only yet on computer tape."

Ed. Horwood - "Well, why don't you send us a copy of the tape and a write-up of what's on it?"

Jack Beresford - (deep pause) "Well, there's nothing I know of that tells me I can't. Providing there is appropriate suppression to avoid disclosure on small entries. I'll send it on out to you at cost."

The current generation of Census tape users should realize that there was no apparatus in 1960 for the dissemination of Census tapes. They were essentially an internal artifact of the Census Bureau. With the receipt of the tape at the University of Washington sometime in November, a new world opened. For one thing, with the advent of the relatively new automatic digitizer, the block centroids could be digitized from maps, merged with the tapes from Census, and Census data or symbols representing data could be printed out in the mapped format. [Note: The prototypical SYMAP software, also initially related to Census tape use, was under development by Howard T. Fisher at Northwestern University by 1963.] Further, computer printer graphics could be developed to show rank order arrays and distributions of data. The only thing Jack Beresford did not tell us was that there was a dummy word on the tape at the beginning and it took us several months to get a useful product.

The use of the first United States Census tapes came shortly after the advent of the first general computer programming language, FORTRAN, and with the assistance of Arnold Rom, of the Boeing Company, who had considerable experience with the then new IBM 709 computer, my colleagues [Clark Rogers and William L. Clark] and I developed a macro-compiler which produced ROMTRAN, the first known user's language for Census tape processing.

During the winter of 1962 we had a number of inquiries from people Jack Beresford referred to us, and decided under the demands of efficiency to produce a two-week workshop for a national audience, which included the then Chief of the Geography Branch of the Census, William T. Fay. Two weeks were required for a short course then because we also felt the need to teach the elements of data processing and general computer programming, insofar as the user language we developed included FORTRAN-type arithmetic capabilities. In retrospect, the main thing I learned from this experience was that 15 years ago people could leave their offices for two weeks without having them fall apart, whereas today that time has diminished to two days.

At the end of the first course we distributed object decks of the ROMTRAN programs as graduation gifts, and expected to go back to our research. However, a fraternity seems to have been formed that did not dissolve. A number of the graduates began using the new-found knowledge and kept us busy on the telephone lines and in visits to help them out with problems. And so we planned additional short courses, and by 1965 had given 11 at major universities in the United States and one in Europe. The faculty for these courses included names long active in URISA – Clark D. Rogers, Kenneth J. Dueker, and William L. Clark.

To return to the chronology, by mid-1963 there seemed to be a genuine interest of the users of the ROMTRAN language and some of the more active graduates of the courses to get together to discuss applications and on August 28, 1963, 48 people met on the University of Southern California campus to trade information on developments in "urban and regional information systems." This was billed as the "First Annual Conference on Urban Information Planning Systems and Program." In a sense, the organization founded itself.

No proceedings were issued from the first conference, which was essentially of a seminar nature, structured around a few topics of interest. Two things stand out in my mind from that first meeting. One is the demonstration of interactive computer graphics given after the meeting by Weldon Clarke, then of the Los Angeles Office of Bolt, Beranek, and Newman, and the other was the luncheon address given by Robert Goe, a chief aid to the then recently elected Mayor of Los Angeles, Sam Yorty.

The demonstration of interactive computer graphics, using a light pen and vector generating cathode ray tube operating from a small-scale computer, opened a new horizon of thought in the minds of the viewers toward the on-line editing of networks in connection with geocoding. In retrospect this causes one to consider how quickly the hardware systems' technology outdistances our capabilities to adapt to it, because it took us five years to gain this competence at my university and few metropolitan area DIME [Dual Independent Map Encoding, introduced by the New Haven Census Use Study in 1967] files are yet interactively edited.

The lunchtime talk by Robert Goe is memorable in the light of the 12-year history of the Yorty administration of Los Angeles. Mr. Goe personified the newly emerging style of public administrator dedicated to the incorporation of information systems into the fabric of the administrative process. With the computer now firmly incorporated in public management thinking, we were, according to Goe, at a new threshold of governmental efficiency and improved executive capabilities via harnessing of the new information automation capabilities. Los Angeles, situated in the center of a vast sea of competency in information processing technology related to the Southern California aerospace industry, was obviously well located to accommodate the transfer of the new technology for the betterment of the citizens of the region. Needless to say, the visions of Robert Goe were slow in materializing. Bunker Hill, the oldest unfinished urban renewal project in the country, was then entering its second decade of planning and is now, for all I know, in its fourth. In the interval, smog, riots, traffic, and the civil service did not show any signs of diminishing.

We see from the foregoing that URISA emerged from the need for communication among professionals in a new field and from their need to learn skills, outlooks and philosophies that had not been included in their formal scholastic background.

3. The Formation of URISA, 1966-1967

Returning to this brief history of URISA, conferences on urban and regional planning information systems and programs – *note emphasis on planning* – were held in Pittsburgh, Chicago and Berkeley in the successive three years, with attendance increasing and the inexorable movement toward an association. An *ad hoc* committee to study formal incorporation was impaneled in 1964 at Pittsburgh. The Chicago meeting of the informal group in 1965 called for the drawing up of a constitution, which was adopted the following year at Berkeley. The first formal annual meeting of URISA as an organization was held in 1967 in Garden City, New York, and the initial by-laws were adopted in 1968 at the second annual meeting in Clayton, Missouri.

4. The Organizational Model for URISA

It might be interesting to dwell for a moment on how URISA got its present organizational structure. As secretary and chairman of the constitutional drafting committee, Kenneth Dueker and I, respectively, looked for organizational models. We reflected on the organizations we belonged to at the time. I was then on the Board of the American Institute of Planners, which was again in the throes of searching for its identity and re-establishing criteria as the basis of membership. I had reluctantly come to the conclusion as a result of that experience that guild-type organizations, such as the AIP, spend about 80 per cent of their resources in determining who may or may not become members and by what process. On the other hand, the relatively new Regional Science Association, linking aspects of economics and geography, which Kenneth Dueker and I were also members of, spent no resources on screening membership and seemed never to have had the problem of either disinterested members or having members without learned credentials. It also had the excitement of being a new field and one catering to people trained in a range of disciplines and belonging to traditional societies like the American Economics Association and the American Society of Geographers.

We were impressed by the fact that a guild organization would be inappropriate for our colleagues in search of an association. We were trained in many different disciplines and involved in a wide range of job functions that could not be readily classified under guild criteria. Guild organizations, like the American Institute of Architects, the American Society of Civil Engineers, and the American Bar Association, are associations based on the historical needs of members who serve clients in formalized commissioned or contractual roles; even though they have broadened out somewhat. They are geared essentially to promote the consultant-client relationship. Guild organizations have strong interests in licensing criteria, fee schedules (and now advertising) and to a substantial extent the exercising of a quality control (read constraint) on the professional intake process. Not only does the guild-type organization become unduly involved in membership selection and the protection of its professional territory, but in my own view appears to be somewhat anachronistic for organizations that have not fairly structured client relationship and licensing requirements.

Other types of professional associations are based on specific role functions, rather than client service or broad intellectual interests. These include organizations relating to such role functions as municipal finance officers, chiefs of police, right-of-way agents, and so forth. In viewing the make-up of the *cognoscenti* in our filed of interest in the four years prior to formal organization, it occurred to those of us drawing up the constitution that the interest area encompassed those whose positions and backgrounds were widely varied, and who were not exclusively in any characteristic type of public service or private enterprise. Hence, we arrived at the "open membership" model characterized by the Regional Science Association rather than the, guild or role function organizations types just discussed. The URISA constitution welcomes all comers to membership who have an interest in the intellectual field of urban and regional information system, whatever it may be as determined by how its members define it in the totality of their respective interests and contributions. It then becomes necessary for the membership to continually test its interests against different views of what it perceives the field to be, which has essentially happened in the formation of the special interest groups and in the changing themes of its conferences. The URISA Constitutional Convention provided for the advancement of an interdisciplinary and multi-disciplinary approach to meeting the interests of the founding members, and subsequently these who would follow.

5. Interdisciplinary & Multi-disciplinary Basis of URISA

We recognized from the outset that most of the members-to-be of our organization were also members of other associations, organized on either the guild or functional role basis. Thus, the original need for URISA catered to some common interests, the depth of which was not probed in anyone of the guild or role organization associations to which the early advocates of URISA belonged. We seem therefore to have been performing from the beginning a synergistic role. The excitement of the early meetings arose out of our discovery of each other coincidentally with the emergent field. It was as if we had discovered the computer along with each other. The admixture of people with interest in computer science, the management sciences, the social sciences and other fields, as well as the mix of organizations represented in the membership and roles within organizations, was a very interesting matrix indeed. Our early conventions, at least, were like a weekend away from our families of orientation – they expressed the freshness of a new coupling. How did this come about? I will describe three reasons in my view.

First, at the beginning of the Sixties we had truly embarked on the era of computerization. Whereas commercial computers had been around for just about a decade, their use had been mystical and difficult. Before the advent of the general purpose programming languages, use of the computer was by machine language or codes that were difficult to remember. The first general programming language, FORTRAN came into widespread use only at the beginning of the Sixties. It opened the door to both a much wider group of users as well as to the introduction of computing capability to non-computer experts.

Secondly, the era of the early Sixties was a period of great infusion of federal money into urban and regional planning activities, stemming mainly from the housing and highway agencies. On the transportation side dozens of urban area transportation studies were coming into existence, presenting the first major thrust in large-scale data gathering and information production activities dealing with metropolitan areas. On the housing side we had expectations of large-scale urban renewal and housing rehabilitation in the community Renewal Program of the Housing and Home Finance Agency later to become the Department of Housing and Urban Development. There was a great demand for people who could work on the relationship of information to policy issues.

Thirdly, not only were there great deficiencies in the classical academic background of the new information systems specialists, based on their programs of origin having been within the conventional wisdom of pre-computer education, but the newly emergent graduate specialties such as public affairs, urban planning, business administration and a few other areas did not package the needed educational equipment for the new demands. This still appears to be the case, and provide probably the greatest *raison d' être* for the continued existence of URISA.

6. Definition of the Field

It is interesting to note that in the 15 years or so that we have been meeting we do not have in any of our organizational papers – constitution, bylaws, invitations to take out membership – any formal definition of urban and regional information systems. I have defined the field from time to time in papers and lecture notes and I have searched the early literature at some length as well as perused the later looking for definitions. I find yet only three, all of which I have been at least co-author of, and I have brought them together here as a start in the review of definitions of this field (see Table 1).

Table1. Early Definitions of Urban and Regional Information Systems

1. An urban and regional information system is one involving the sequence of steps in the synthesis of information from broad data inputs by the use of automated methods to bear on the solution of particular problems involving management decisions relating to the functions which control, shape or anticipate change in the urban and regional environment. (Horwood, 1965).

2. An urban and regional information system is one involving the sequence of steps in the synthesis of information from diverse data inputs by the use of automation to bear on the definition, display, and solution of a set of problems relating to planning,

political and management decisions in urban affairs. (Horwood and Calkins, 1970)

3. An (urban and regional) information system is a collection of people procedures, computer hardware, computer software, and a data base organized to develop the information required to support a particular mission. (U.S. Department of Housing and Urban Development, 1968)

Note: Underlining added for emphasis in discussion.

I do note in the literature of our field that there are often attempts made to define the field by its properties, impacts or outcomes. This has been done by my esteemed colleague, Professor Kenneth L. Kraemer, of the University of California at Irvine, in a recent salient paper entitled: "Present Status of Urban Information Systems in the United States"—a paper he delivered at the Sixth European Symposium on Data Management at Liege this spring. While no specific definition is given in the entire 50 pages, he does put together the basis of a definition, which in his view is the adoption of computing by urban management – a somewhat more constrained view than I have myself.

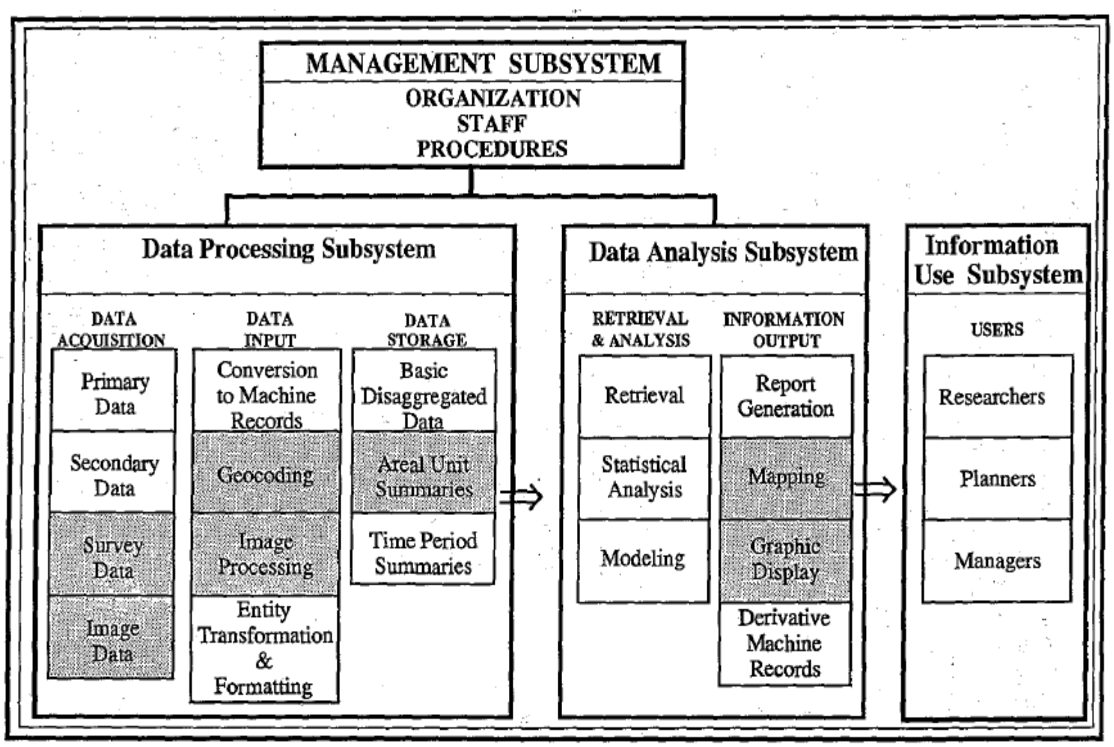
The definitions in Table 1 appear to me at least to be intuitively accurate, although all are cast in terms of relatively discrete events such as missions and decisions, rather than processes, which may not be specifically oriented to event-related goals. I am sure the thinking behind these definitions reflects the atmosphere of the early and mid-sixties in which information was collected more for *ad hoc* tasks than for continuous flow processes. A philosophy behind these definitions is that as the result of an information system, a decision would be made or a mission completed based on information supplied. It is almost as if we thought in terms of a series of discrete information systems projects, even though many of us at the time were also looking at the continuous development of data bases for multi-purposes. We also note reference to the solution of problems in the early definitions, creating the impression that an information system stems from a specific effort to solve a problem. In retrospect, I feel that the third definition is most reasonable if the word "mission" would be substituted by “missions or processes." I believe that this would bring the management side of information systems needs into the definitional picture.

The best visual representation of the field definition I could find was a diagram by Calkins (1972) which puts the various parts of the information system complex together, leaving only the subject of the system to be supplied. I submit that the interrelation of the boxes of Figure 1 is the general field of the information systems specialist, as it may be applied to the substantive area. Some of the boxes may be the exclusive turf of associated specialists, who may or may not be interested in the larger system A central theme of URISA interests has been in my view the interrelationships of the elements of Figure 1 applied to substantive issues and process in the urban region context, as well as both the problems of organizing for this process in a very imperfect political environment and looking at the system outcomes. The diagram becomes a form of definition of functional activities in the field and you may test yourself by seeing which box or boxes come closest to containing your interests.

As an educator I cannot help but reflect on the fact that it is the comprehensive view of this relationship system that escapes most of the formal training in academic programs. As an example, we teach statistical analysis, modeling and mapping in respective courses. It is only the occasional student who puts the system together in a thesis study. Perhaps this is one reason that we assemble here to view the parts of an information system in a holistic context.

In all of this definitional discussion I am struck with the thought that the same definitions and diagrams with a few words changed might apply to any field. With the exception of the interest in spatial definitions in urban and regional information systems, disclosed in the shaded boxes of Figure 1, the major difference between information systems in various fields is the environment of actors, institutions, programs, politics and substantive background of the information system builders, clients, managers and analysts. What we are looking at in Figure 1 is the substantive and procedural field of information systems, urban and regional in our case.

Figure 1. Elements of an Information System (Calkins, 1972)



7. What is the Philosophical Basis of URISA?

With this background of organizational structure and definition we might now pass to thoughts about the philosophical role established by the founding members of URISA.

Here I shall have to draw on the record of the pre-organization contributions of our leading members between 1962 and 1966, as well as their general philosophies as best as I can construct them from memory. First let us reflect on the themes of our annual conferences.

It is interesting to note from the record of Table 2 that in four of the first five conferences (all but 1962 being recorded in proceedings of the conferences) the word "urban planning" is included as a modifier to the term "information systems." This reflects the facts already alluded to, that the first field of general interest of the URISA stemmed from the involvements of its founding cadre in the information support area for physical planning, predominantly transportation and housing. While this founding cadre was not usually involved in front-line operational planning at the local level, from their vantage point of specialists in geography, urban land economics, computer use, etc., they stood at sufficient distance from the operational field to examine some of the emergent and fundamental issues and roles of information systems in those activities.

Table 2. Themes of URISA Annual Conferences

YEAR	CONFERENCE THEME
1962	Urban Planning Information Systems and Programs
1963	Urban Planning Information Systems and Programs
1964	Urban Information and Policy Decision
1965	Urban Planning Information Systems and Programs
1966	Urban Planning Information Systems and Programs
1967	Urban and Regional Information Systems (URIS) for Special Programs
1968	URIS: Federal Activities and Specialized Systems
1969	URIS: Service Systems for Cities
1970	URIS: Past, Present, and Future
1971	URIS: Information Systems and Political Systems
1972	URIS: Information Research for an Urban Society
1973	URIS: Perspectives on Information Systems
1974	URIS: Resources and Results
1975	URIS: Computers, Local Government and Productivity
1976	URIS: Information Systems as Services to Citizens
1977	URIS: Information System Inputs to Policies, Plans, and Programs

An examination of the authors through 1966 reveals participation of substantially those appended to, or consulting for, large regional studies arising out of the urban transportation planning process. It is only natural that the initial direction of URISA reflected the prominent application interests of the time. It was the area of yet still great suburban expansion. Urban region modeling studies were at the height of their expectations as a new scientific base for urban and regional planning. The cities had not yet burned up and the words of Martin Luther King were not yet in the foreground of the national conscience.

It is interesting to note that a marked departure took place in 1967 with concerns for social programs and the subsequent URISA conferences dealt with a broad variety of topics. Both understandably and fortunately the initial focus of urban region planning information systems was put aside as our attentions were taken by emerging problems. Thus, the substantive fabric that brought the organization together initially is now only one of the many concerns of its members. I believe it is a credit to the organization that it has not stuck to any one focus but has clearly recognized changes in the national mood and adjusted its sights accordingly.

In reviewing the literature of the organization between 1964 and 1967 inclusive, of the 60 articles published I note that approximately 20 percent were authored by academicians, 20 per cent by independent consultants or members of consulting firms, and approximately 60 percent of the titles were authored by governmental agency people, including a good representation from the U.S. Bureau of the Census. Consequently, it is not a fact that the organization has ever been an extension of the academic establishment, even though its first board had a majority of academicians. Obviously, academicians have figured prominently in its institutionalization because they have generally had freer lifestyles in regard to selection of their own long-term interests and in regard to their release from operational tasks.

The breakdown of titles of early contributions into a few classifications (Table 3) also reveals an interesting breadth as well as attention to the problems of the time. An interesting mix is noted here which again tells us something about the background and nature of our organization via the interest of its members and the prominent issues of the period.

Table 3. Classification of Published Papers-URISA, 1963-1967 From Annual Proceedings

Theme	Approximate % of Total[a]
Organization and Management[b]	25%
Technical Operations in General[c]	25%
Applications[d]	25%
Modeling[e]	15%
Geocoding	10%

Notes:

a) Universe of 60 papers
b) Institutional and organizational issues of information systems. Data base development and management. Computer use issues, etc.

c) Software and hardware. Automated mapping and graphics. Remote sensing, network analysis, query languages, etc.
d) To planning, social services, housing, etc.
e) General modeling theory and applications of modeling. Information requirements for modeling.

The excellent literature compendium of Matthews and Kraemer (1975) gives another view of our interests. The big three areas (Table 4) show up as contributions of information systems to physical planning, management and census-related activities over a ten-year period of time frame. I suspect that management concerns have been on the increase and physical planning on the wane.

Table 4. Subject Area Breakdown of URISA Literature, 1963-1973 From Matthews and Kraemer (1975)

KEYWORDS	ENTRIES	RANK
Physical Planning	96	1
Management Information Systems-31	79	2
Public Finance-8		
Public Safety-11		
Program Development-29		
Census	54	3
Decision Making	23	4
USAC (Federal Interagency Effort)	18	5
Privacy	11	6
Housing and Transportation	10	7
Implementation	10	7
Transferability	9	9
Data Base Management	7	10
State and Regional	7	10
Federal Role	5	12
Miscellaneous	52	-

Now let us look beyond the literature itself for clues as to our identity. As the introductory words of this discussion imply, URISA has always been closely associated with certain activities of the U.S. Census Bureau, particularly those relating to its Geographical Branch. From the earliest days of its pre-organizational period the pre-members, and later the members, have had a strong involvement with small-area Census data and particularly its automated mapped representation. While I do not like to think of URISA as being beholden to any one branch of government, I believe that its linkage with the Geography and Census Uses Branches of the U.S. Census Bureau has been important as it has been long lasting. This relationship has grown out of the fact that the specialized technical nature of using Census tapes and merging them with mapping codes falls through the cracks of the platforms of other organizations. Apart from this symbiosis, the Census Bureau has materially assisted URISA through the participation of its staff in URISA activities. Likewise, URISA, I am sure, has helped Census in the relation of its members to various organizations that make use of small-area Census data in a spatial context. Many URISA members serve as this interface.

Secondly, since the early Sixties the pre-association devotees have been interested in geoprocessing. This interest pre-dates the advent of the Census DIME Files through the work of such people as Robert B. Dial (1964) and Hugh W. Calkins (1965) in the National Science Foundation funded research of the early Sixties. The advent of GEOSIG attests to the continuing interest of the members in this activity insofar as GEOSIG has been one of the largest special interest groups, and a dissertation of considerable interest to Geoprocessing is that of Charles E. Barb (1974).

Thirdly, as I have alluded to earlier, the members of the founding cadre were interested in studying the uses, successes and failures of general purpose information systems in regard to questions of planning and management and decision making. This I believe is probably one of the most important activities for URISA to carry on as I see that no other organization seems to be as involved in this activity. This philosophical thrust has been concerned with the nature of data base organization in multi-governmental activities, the use of information in the feed back analysis of public policy, the role and limits of information in public decision-making; and the organization of information support centers both within organizations and as separate entities.

This stream of interest probably starts with the work of one of our early presidents, Edward F. R. Hearle, in his contribution with Raymond J. Mason, in A Data Base Processing System for State and Local Governments. Although that work dealt with the organization of information in state government, it stands as philosophical forerunner to the subsequent USAC [Federal Urban Information Systems Inter-Agency Committee] work which brought a number of federal departments of government together to commonly pursue the development of multi-purpose information systems for local government.

The role of information systems in the feedback analysis of public planning policy, or the concept of an information systems monitor, was substantially the theme of the Second Annual Conference on Urban Planning Information Systems and Program, held in Pittsburgh in 1964, producing a proceedings entitled, Urban Information and Policy Decisions. Interest in this area of information systems has been pioneered by Clark D. Rogers, still at Pittsburgh University, and Hugh W. Calkins, now at State University of New York, Buffalo. A landmark piece of literature in this respect is the doctoral dissertation of Calkins (1972), who traced down by direct contact or visitation every known planning information system in the country in the years approximately between 1965 and 1970. Calkins was able to document fateful flaws in the basic fabric of urban planning activities in the lack of a feedback monitor system which is well documented in both his dissertation and subsequent works.

8. Towards a Discipline of Urban and Regional Information Systems

Is there any theory of urban and regional information systems? Does there, in fact, have to be a theory base to sustain an organization? Is there in fact a theory of information systems, and if so is it different from that of urban and regional information systems? Questions like these are asked by most professional and scientific societies. As an example, in searching its soul along similar lines the president of the Regional Science Association – which is now a very well-founded international organization and publishes a journal – asked recently if the theories of regional science were any different from the theories of the disciplines it drew on. In that discussion Czamanski (1976) sets forth the following criteria for a discipline:

1. The set of objects with which a discipline is concerned;
2. The point of view from which the set of objects is viewed;
3. The level of theoretical integration, or theory construction;
4. The methods of transforming observables into data;
5. The analytical tools;
6. The practical applications; and
7. The historical circumstances of the discipline's origin and development.

If we accept this as an operational definition of a discipline we see that different disciplines may share some of the same theory provided there is a difference in their sets of objects, points of view from which the objects are viewed, or practical applications and analytical tools. Thus, urban and regional information systems, medical information systems, legal systems, and so forth may have some theory in common and yet have differentiation of the other elements of the definition of discipline.

I submit that any field claiming to be one of "information systems" shares a common information systems theory which I will allude to in greater detail shortly. I believe it is the intellectual content of information systems theory that is the basic glue that holds any information system group together and that the differences are mainly the sets of objects, the points of view from which the objects are viewed, the tools, the practical applications and the historical circumstances of a discipline's origin and development. From these seven elements let me present my view of the discipline of urban and regional information systems.

8.1 The Set of Objects with which URISA is Concerned

Our object field consists mainly of the U.S. Census data bases, the operational records of local government, the survey data of metropolitan planning organizations, the land cadastral files, the object entities of health, welfare and social service organizations, the data inputs to trade area analysis and special survey data relating to any of these areas of records or concerns.

8.2 Orientation of the Set of Objects

We view the objects mainly within the relationships of the activities of Figure 1, and in support of research, planning, programming, and management functions. In addition we have the orientation of the market use of information, in either an economic or political context. The latter may be outside of the sphere of a formally commissioned or supported information system.

8.3 The Level of Theoretical Integration

Theory is defined in a number of ways, but I think the most germane one from our point of view today is: "A set of theorems forming a connected system" (Oxford Universal Dictionary). A theorem is defined by the same source as: "A universal or general proposition or statement, not self-evident, but demonstrable by argument or necessary reasoning." Information is defined, again by the same source, as: "That of which one is apprised or told." The "one" may refer to an individual who receives information by design or accident, or an actor who commissions information for a particular function or purpose.

I am not surprised to see a rich background of thinking on the subject of information and its role in human interaction and feel frustrated in treating this subject in a few hundred words. The literature has its roots in sociology and social psychology (Parsons and Shils, 1959), political economy (Dahl and Lindblom, 1953) and even some of our own URISA authors (Webber, 1964 and Grundstein, 1970). I have assembled a handful of theorems which I believe constitute the field of information systems and are the philosophical base of the subject that we are concerned with. These theorems are not unique to urban and regional information systems, but the definition of a discipline that I have taken from Czamanski does not suggest that all elements of it are unique to any one discipline. Recall that it is the subject area or application of these theorems that gives us the common discipline of interest when juxtaposed with the intellectual content of this general information theory.

> **Theorem 1—Information is an Independent Force for Change**
> Broadly disseminated in its area or function of appropriate inclusion, information is an independent force of change operating on the fields of both leaders and non-leaders. Its raw impact on outcomes rivals decisions arising out of formal policy-making processes. In other words, information availability by non-leaders challenges leaders. The extent to which information systems design disseminates information or facilitates information dissemination thereby plays an important role on the shaping of public policy. The knowledge of A, the leader, that B, the non-leader, has access to the same information base constrains or modifies A's action.

Theorem 2—The Institutionalization of Information Systems Increases Social Overhead

Whether automated or not, the institutionalization of information systems creates new roles, new interactions among organizational parts, user expectations and the inertia of both personal and organizational tenure. These costs overwhelm the cost of automation itself. The increasing social entropy of the system has to be viewed in balance with its achievements.

Theorem 3—Information Systems Lead to Organizational Change

If at all successful, the institutionalization of information systems redefines roles and relationships, changing organizational structure to the detriment of some and advantage of others. There are some significant socio-political impacts as a consequence. The span of control of officials and decision-makers changes.

Theorem 4—Information Systems Tend to Make Decision-making More Difficult.

Information *per se* does not lead to better or easier decision-making. Again, if relatively successful, information systems tend to introduce more variables, knowledge of impact, checks and balances, opportunities for alternative actions and disseminated knowledge of the information base in regard to which decisions are made.

Theorem 5—Information Systems Expose the Frailties of Goals

Goals tend to be expressed in generalities sufficiently broad that the systems design to effectuate them soon discloses the unavailability of information, difficulties of monitoring policy outcomes, or externalities that obscure the measure of goal realization.

Theorem 6—Doctrine Eschews Facts

Much of our governmental fabric is based on doctrine. Governance has tended to be as much a function of intuitive reasoning as in attempts to arrive at rationality through the use of information. Information obfuscates (i.e., the don't-bother-me-with-the-facts outlook).

Theorem 7—Information Systems Contribute to an Understanding of System Complexities

Information system development assists in the understanding of system complexities and the gaining of a more fundamental view of the problem addressed. Many information systems that fail in their design missions are successful in this regard.

Theorem 8—To Be Credible, Planning Must Be Cast in an Information System Context

It is only by the development and acceptance of monitors relying upon information flows that we can judge accomplishment.

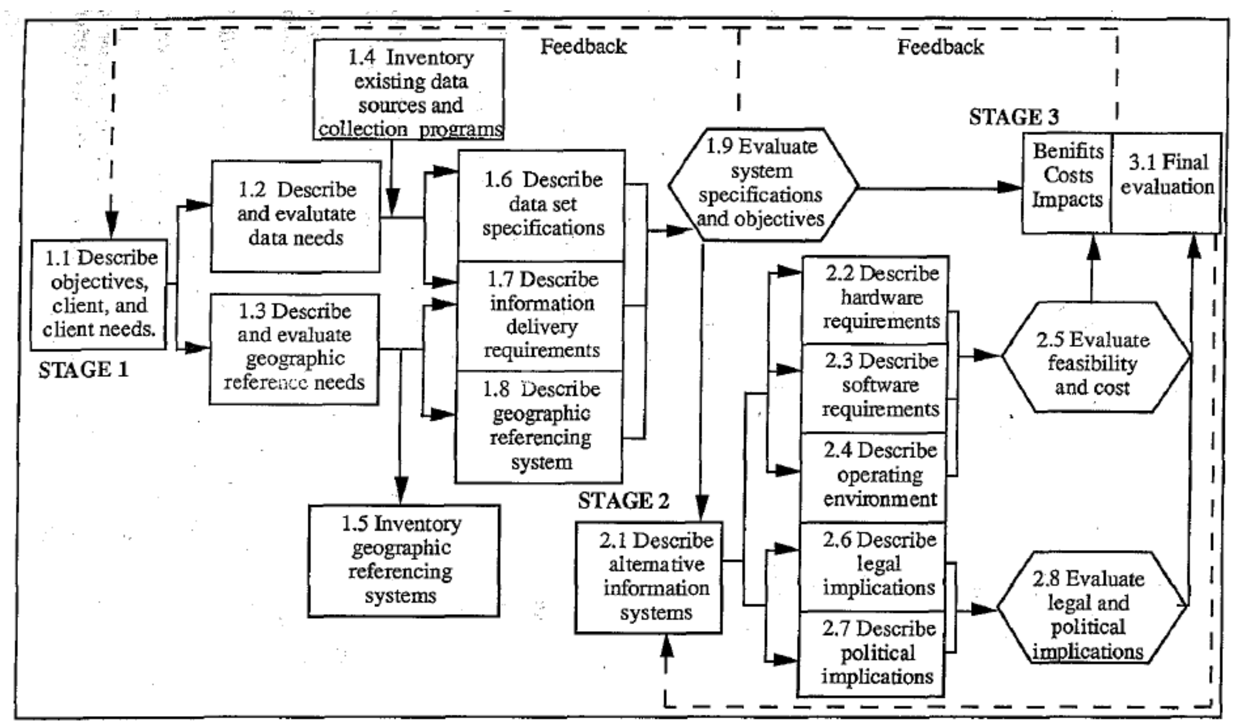
8.4 Methods of Transforming Observables into Data

Here we share a methodology with the social services, management and geography. It includes field survey, survey sampling, the administrative processes, remote sensing and digitizing.

8.5 The Analytical Tools

I shall refer here to the work of Tomlinson, Marble and Calkins (1975) arising out of previous work of Calkins (1972) in the development of an information system design and evaluation model. It is now undergoing further refinement in subsequent work being undertaken by Calkins (1977). [See Figure 2] What we have in Figure 2 is a model of how the different parts of an information system fit together and how they tend to be accomplished in sequence. This is actually an adaptation of the general systems model, but cast in the specifics of the activities of the information systems specialist, designer or analyst. Each box of this model is described in the references cited, but unfortunately it is not possible here to dwell on the details of this model. My students and I have found the model to be of fundamental importance, particularly in the analysis of information systems and their failures.

Figure 2. Information Systems Design and Evaluation Model (Calkins, Tomlinson and Marble, 1975)



8.6 Practical Applications of URISA

The practical applications areas of our field may be best viewed in the literature to which I have referred earlier. Generically, they relate to urban and regional planning; city management; social, health and transportation services; market analysis; the use of census products; etc.

8.7 The Historical Circumstances of URISA's Origins

I have dealt with this in length; it might be opportune to conclude on this point. Let me quote from Czamanski (1976):

> *"The achievements giving rise to new disciplines share two characteristics: (1) they are sufficiently unprecedented so as to attract an enduring group of adherents from competing modes of scientific activity; and* (2) *they are sufficiently open-ended so as to leave all sorts of problems to resolve."*

9. Conclusion (by Barry Wellar)

Edgar Horwood wrapped up his presentation with section 8.7, but as the 1977 URISA conference chairman, and the chairman of the papers and program committee, I was the one who asked Edgar Horwood to give the opening plenary, so I believe it is appropriate to offer a few words about the presenter and this presentation.

First, Dr. Horwood took this “assignment” very, very seriously. And in his own way. He asked me what he should talk about, how to design the paper, where would the effort lead, and so on. He already knew what he was going to do, but he wanted to know if I had a clue. Then, when he sent me the paper so that I could prepare my comments, he thanked me for pressing him to take on the opening plenary task. And, he urged me to inform him of any shortcomings. Yeah, right, like I was born yesterday. Growing up in Northern Ontario the phrase “Do not poke the bear” was used in a lot of situations, and it came to mind when Ed asked me to comment on his paper.

Second, the 1977 paper was reproduced for the1992 anniversary conference and it is reproduced again, for a very good reason. That is, many of the foundations of urban and regional information systems and geographic information systems and science are contained in a paper written 35 years ago, and it would disserve Ed Horwood, URISA, and the reader if that classic of classics was not included in the ***Foundations*** book celebrating URISA's 50th anniversary conference.

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4

ORIGIN AND EVOLUTION OF URISA

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***Abstract*:** This paper documents the origins of URISA and its evolution as an organization from 1962 through the late 80's, from the author's perspective as a participant. In particular the contribution of Edgar Horwood is emphasized.

1. Introduction

It seems like yesterday, not fifty years ago. I was fortunate to have been present at the beginning of URISA and would like to share my perspective on the origin and early-year evolution of URISA. I think I am the last original member of URISA still active, so I feel a responsibility to capture its early history in this memoir.

This presentation is organized in four sections: 1) the scene, or state-of-the art of computing as applied to local government in the early 60's that set the stage for URISA; 2) Ed Horwood's leadership in shaping URISA; 3) the evolution of and struggles within URISA in the early years, particularly between the analytical and automation factions, and the struggle of GIS to emerge from the computer-aided mapping field; and 4) my personal role in the founding and development of URISA.

2. The Scene and Stage for URISA

Although history has not been kind to the urban renewal program, it held much promise in the late 50s and early 60s, even though proponents acknowledged some problems. One problem was "project-itis" were renewal treatment stopped at project boundaries. One solution to this was an assessment of renewal needs for the entire city, called the Community Renewal Program.

Edgar Horwood, professor of civil engineering and urban planning at the University of Washington, envisioned the application of computing technology to the screening of census and assessor's data to assess the renewal needs of a whole city. This vision was based on early work by Clark Rogers, using the IBM 650 to map development around highway interchanges. Horwood and Rogers then developed a suite of programs that were used for the City of Spokane (and later Seattle) to screen 1960 census of housing and population data by tracts and blocks looking for concentrations of housing units lacking plumbing facilities, and that were observed as deteriorating or dilapidated. (Prior to self-enumeration and mail-out and mail-back forms, census takers observed housing conditions.)

Horwood envisioned analysis at two levels, the census tract level that involves 10 to 100 observations per typical city, and at the city block or parcel level that involves 1000 to 10,000+ observations. His solution was a suite of four computer programs. The Array and Card Mapping programs were developed for analysis at the tract level, and the Distribution and Tape Mapping programs were developed for analysis at the block level. The Array program ordered tracts by value so that users could identify break points in the data to set ranges for the subsequent mapping of the data. However, the Card Mapping program merely displayed the values at the center of the tract. With just the values mapped, a transparency of the tract outlines had to be overlaid on the computer printout as an interpretive aid. Tracts for a city had to be scaled to a single printout page width.

For city blocks, the Distribution program displayed a frequency diagram for larger number of observations, too large for an array. Again, the purpose was to identify break points in the data to establish mapping ranges for the Tape Mapping program. Standard printout characters were used for symbols for values falling within mapping ranges. The Tape Mapping program enabled maps of multiple width sheets. Again, a transparency of block outlines was used as an overlay to enhance map presentation and interpretation. (Later programs, such as SYMAP overprinted standard printout characters to form more pleasing mapping symbols.)

This suite of programs was written in Fortran. Users were able to customize the programs for use in different cities and with different data by means of parameters that were combined with keywords to give an appearance of a language, called Romtran, named after Arnold Rom, a Boeing engineer, hired by Horwood to write the Fortran programs. But without Rom on staff, Horwood decided not to allow distribution of the source code. He did not want the responsibility for maintenance and support. Consequently, when the IBM 709 series computers where phased out the compiled versions of the program no longer worked and the suite of programs languished.

Meanwhile, there was considerable interest in the computer programs. The Housing and Home Finance Agency (HHFA), now the Department of Housing and Urban Development (HUD), funded the development of a user's manual for the programs and Horwood developed a short course for instruction in their use. The first offering of the short course was in Los Angeles at USC in the summer of 1962. Its first offering as an academic course was Fall 1962 at the University of Washington (in which I was a student). In the summer of 1963 the short course was presented at five universities: Pittsburgh, Northwestern, Cal-Berkeley, New York University, and Yale. Howard Fisher attended the 1963 short course at Northwestern and was challenged to develop a better card mapping program. In 1964 Fisher released the first version of SYMAP that extended choropleth mapping to contour mapping and used overprint characters to produce solid map symbols. In 1965 he moved from Northwestern University to Harvard where he established the Harvard Computer Graphics Laboratory. Fisher released the source code and emphasized software R&D. ArcInfo descends from the Harvard R&D program.

A longer short course was held in Seattle in 1964, sponsored by the National Science Foundation, was geared to university faculty. These short courses provided the core or charter members of what became URISA.

A conference was held in Los Angeles in 1963 as a follow up for alumni of the 1962 and 1963 short courses and other interested persons. This conference is considered the first URISA conference although the name URISA had not been coined yet. The name Urban and Regional Information Systems was created at the 1966 conference.

The 1964 conference was held at the University of Pittsburgh and called the Second Annual Conference on Urban Planning Information Systems and Programs. It was organized by Clark Rogers, who was a doctoral student and lecturer at Pitt. Rogers left the University of Washington in 1963 (I was his replacement). At the UW, Rogers was Horwood's principal assistant in development of the suite of programs and their application in Spokane, and short course instruction. At the closing session in Pittsburgh there was discussion of a conference for next year and the need for an organization to foster computing technology for urban planning. Ed Hearle was charged with developing the first draft of incorporation papers.

The 1965 conference on Urban Planning Information Systems and Programs was held in Chicago, co-sponsored by Northwestern University and the American Society of Planning Officials (ASPO). (Later, ASPO and the American Institute of Planners (AIP) merged to form the American Planning Association (APA)). Dr. William Garrison, professor of geography and civil engineering at Northwestern University was the organizer of the conference. (Meanwhile, I had moved from the University of Washington to Northwestern and was his principal conference assistant). Although Horwood was in Europe and did not attend he submitted a paper that is in the conference proceedings titled, "Association Needs for the Urban Information Systems Field." He proposed an inter-disciplinary association of professionals rather than a professional society "that tend to be concerned with guild problems of their professions." In Horwood's absence the organizational need issue did not generate much discussion. That discussion was fully engaged at the 1966 Conference at UC-Berkeley.

At the 1966 conference on Urban Planning Information Systems and Programs there were several meetings to discuss formalizing the organization, which were moderated by Horwood. There was quick consensus on the inter-disciplinary association issue as attendees represented several fields including planning, engineering, geography, public administration, and economics, and included academic and practicing professionals. As a result the constitution of the Regional Science Association served as a model for the new organization. The principal issue was the name. Some wanted the new association with a broader focus, arguing that "urban" was too restrictive, implying a "local government" focus that left out federal and state interests. The compromise was "urban and regional". Similarly, the term "planning" was not inclusive enough for public administrators and technologists interested in the application of computer technology in the public sector. (This latter group was most actively represented by Joel Kibbee of the Systems Development Corporation (SDC), which was a spinoff of the RAND

Corporation. As well as developing computer systems for the Department of Defense, SDC had embarked on efforts to bring advanced technologies to the civilian sector to solve societal problems.) The name Urban and Regional Information Systems Association emerged from this discussion.

Edgar Horwood became the first president and he orchestrated the election of professional friends who were not in attendance at the 1966 conference: Barclay Jones, professor of city and regional planning, Cornell University, as president-elect, William Garrison as a board member, George Duggar, professor of urban planning, University of Pittsburgh as a board member. Similarly, he orchestrated the election of three of his students: Clark Rogers as vice president, Ken Dueker as treasurer, and William Clark as a board member.

In my mind, the 1967 conference in Garden City NY was the first real URISA conference. Substantively, the 1967 conference showcased issues emerging from preparations for the 1970 census of housing and population, which was to be the first mail out/mail back enumeration process. We heard reports from the census bureau's geography division about preparations of Address Coding Guides (ACG) to convert street addresses to census tracts and blocks, and from a new data access and use unit about developing plans to disseminate census data on summary tapes. In addition, Caby Smith brought his staff from the New Haven Census Use Study, who reported on their research applications of Dual Independent Map Encoding (DIME) that provided error detection of street network data files for use in street address translation to census geographies and other small areas and point locations. This started a contentious relationship between the Bureau of Census and its use study creation that continued when the New Haven staff moved to Los Angeles in the form of the Southern California Regional Information System.

Horwood was one of the first persons to request summary tapes from the Bureau of Census during his work on the Spokane Community Renewal Program in 1961-62. He did not want to wait for the printed reports and then have to keypunch the results. However, the Bureau was not equipped to disseminate data in digital form. What Horwood received was UNIVAC encoded summary data for census blocks with data suppression codes for block with less than some number of housing units. It took his student, William Clark, about a year to convert the data to the IBM 709. As a result of a several year discussion, the Bureau created under the direction of Jack Beresford (the seventh URISA president) a data access and use unit to disseminate summary tapes and documentation in more user-friendly forms.

The 1968 conference was memorable. There was a panel discussion of representatives of the new federal agencies created in the Johnson administration, HEW, HUD, and DOT. This resulted in the Urban Inter-Agency Advisory Committee (USAC) that funded municipal information system efforts, integrated systems in Charlotte and Wichita Falls, and subsystems in Reading, St Paul, Dayton, and Long Beach. This effort was reviewed by David Leininger in "Beyond USAC Atlas Shrugged" presented at the 1971 URISA Conference. Leininger identified the tension between analysis and automation, and the tilt of USAC to automation. This tension spilled over to URISA.

3. Horwood's Leadership in Shaping URISA

Horwood envisioned URISA as an interdisciplinary association of interest-based academics and practicing professionals. He orchestrated this by means of influencing the election of URISA presidents that followed him, Barclay Jones, urban planning academic; Ed Hearle, Rand Corporation author of a book on urban data banks; Will Steger, PhD economist with prior experience on simulation research for Rand Corporation; Bob Barrowclough, USDOT advocate for transportation data; John Beresford, census bureau advocate for delivery of census data in digital form; William Mitchell, leader of Urban-Information Advisory Committee (USAC). Horwood's effort to influence the leadership of URISA faltered in the 1972 race for president-elect between Bill Garrison (the chair of the small area data committee for the Bureau of the Census) and Gerald Fox (the City Manager of Wichita Falls TX, a USAC city). Horwood's candidate, Garrison, lost to Fox, the candidate of USAC forces, who were out to capture URISA. Though this ended Horwood's <u>direct</u> influence on URISA leadership, he continued to influence the substantive direction of URISA.

Horwood was bemused by the over-zealousness of those who tried to take URISA in too narrow of a direction. Breadth has been both the strength and weakness of URISA, a mile wide and an inch deep. Other organizations provide greater depth in specific areas, while URISA provided a broader perspective. Horwood characterized URISA as an association of misfits – persons who do not fit well within their primary discipline or profession. Yet he encouraged the formation of special interest groups (SIG) in URISA to provide depth in important areas. Specifically, one of his protégés, Charlie Barb, led the formation of several SIGs: Geo, Education, and Microcomputers.

SIG-Geo was the most successful. Luminary players in addition to Charlie Barb, were Don Cooke, Steve Kinzy, Peirce Eichelberger, and Mike Kevany.

Similarly, others, such as McDonald Barr and David Moyer led significant SIG efforts in land records, Barry Wellar in Standards, Sam Trotter and Bill Degroff in minicomputers, and Peirce Eichelberger in addressing. DeGroff recalls:

> *SIG Mini became one of the first outreach training SIGs to conduct workshops at conferences and on the road for other associations like Municipal Finance Officers Association in 1974, Houston, TX and for the Alaska League of Cities in 1976, Anchorage. Training sessions were also conducted for the National League of Cities. Instructors included Sam Trotter (City of Little Rock), John Scoggins (University of Georgia, Myron Weiner, University of Connecticut, Bob Foy, City of Redondo Beach, CA and DeGroff, City of Boise Idaho. Those were the days of long gone companies called Varian, ModComp, Dec, Data General and Prime. (Bill Degroff in an e-mail to Ken Dueker, October 25, 2011)*

Although Horwood was critical of accreditation, he expressed the need to expose unqualified consultants that he referred to as charlatans. He sought to do that by criticism and ridicule. However, this informal approach was insufficient, particularly as the field was growing and more systematic means needed. At the time of his death in 1985, he was observing the initial growth of GIS technology and expressed the need to nurture it by educating competent professionals, and saw the need for URISA leadership in ethical standards.

Clearly, Horwood was the major player in the founding and shaping of URISA. His leadership provided a firm foundation upon which others have contributed.

Those who knew him smile when thinking of him. His humor is much remembered. His ten laws of data processing are legendary and are appended to this paper. I have many memories of his humor, one of which is the banter between him and Barry Wellar when Horwood presented Barry with the Horwood Award in Ottawa at the 1985 conference. Barry's recollection of the award ceremony follows:

> "*During the award presentation I was apprehensive, because Ed was totally unpredictable, very quick, and could be hugely irreverent. In his introductory remarks Ed was very complimentary, but he was also very funny, throwing in a King Lear reference, and remarking about the central role that bastards have played in his ancestry, life, and URISA.*
>
> *And then he wraps it up by saying something like, 'And that brings me to presenting the Horwood Award to Barry Wellar. I cannot think of a more worthy recipient'.*
>
> *While we are fumbling with the handshakes and award plaque, people are having a good laugh because he had ended up talking about bastards before presenting the award.*
>
> *My comeback was, 'Ed, you are right about the bastards, and there is a large number of them all over this room'.*
>
> *And then he said, 'Yes, but you are a real, rare bastard, an original thinker who gets things done. My favorite kind of bastard'.*
>
> *(Barry's mentor,) Bill Garrison told me that I had received high praise from Edgar, but to tell the truth I think I was just glad to get off the stage before he came up with another zinger. Ed was charming, but scary smart." (Barry Wellar in an email to Ken Dueker, July 23, 2011)*

Wellar also captured impressions of Horwood from his early colleague, Bill Garrison. (Chapter 2)

Horwood's style was legendary. At the University of Washington Horwood was being pulled in various directions, and he relied on students as extenders to enable him to pursue many interests simultaneously. While Charlie Barb and Hugh Calkins were his urban and regional information systems extenders at the UW in the late 1960s and early

1970s, he had other students working in transportation planning software development, Bob Dial, Matt Rapp. He was also evaluating rail transit proposals for the World Bank and revising the undergraduate engineering curriculum. He entrusted his students with responsibility and enjoyed watching them grow in the process.

Charlie Barb writes:

> "*Ed's influence upon URISA and the field (was) his personality, intellect and off-center insight. He was so big that there was a recognizable "Horwood School" that we and many others were proud members – how many people have such an impact, influence or point of view. There were his memorable buffoonish antics, like hiding under the head table at a URISA conference while he was being introduced – he really lacked conventional pride and a preoccupation with self-importance.*
>
> *While preparing a eulogy for Ed at a memorial held at the University, I asked other students who had worked with him what set him apart. Matt Rapp's comment was the most insightful and memorable: his compassion – which, in its unique paternalistic fashion, was what set him apart and endeared him to his students. He was a gold standard "professor" and I think that we knew it. He was a creative intellect. A characteristic of it was his simultaneous grasp of an issue or topic from multiple perspectives, including the reverse. He was a great challenge to conventional wisdom and politically correctness. During his years, there really wasn't anyone in URISA that commanded his respect and at the same time, affection" (Barb, Charles, e-mail to Ken Dueker, December 27, 2001)*

As suggested by Horwood's Laws and the quotes from Barry Wellar and Charlie Barb, he loved to poke fun at people who took themselves too seriously. He would engage in debate with insights and humor that would cut to the heart of the issue. He appreciated good work and was quick to praise it. Similarly, he was quick to challenge sloppy work and thought; sometimes by interruptions with humorous or embarrassing comments.

4. Early Struggles within URISA

From the beginning there was tension between forces that saw the application of computer technology for analysis of urban data and those interested in automation to increase the efficiency of local government. This was mischaracterized at the time as a battle of control of URISA by the forces of Census and USAC. Nevertheless, the producers and users of small-area census data led in the analysis thrust within URISA, while those interested in increasing the efficiency of municipal governments led the automation thrust. This tension carried over into contentious elections of URISA officers. A sycophant of Bill Mitchell, Carl Davis, served as secretary in the early 70's. Davis got out the vote for Gerald Fox that defeated Bill Garrison. Garrison would have been a more effective president. Garrison chaired the Census Small Area Data Committee that was responsible for establishing the New Haven Census Use Study. He also led the quantitative revolution in the discipline of geography, conducted early research in remote sensing of the environment, and was a leader in transportation and land use modeling. He would have been uniquely qualified to lead URISA at a crucial time when linking theory and tools were needed. Absent his leadership, URISA focused heavily on tools, such as for geocoding, and too little on spatial analysis.

Davis orchestrated the nomination process in 1974 that resulted in a three-way race for President-Elect between Ken Dueker, Don Luria, and Caby Smith. Dueker and Smith split the analysis vote and Luria won the election with the automation vote. Davis' tenure as secretary heightened the struggle between the analysis and automation interests due to his control over the URISA secretariat function, and the attempts to regain when URISA shifted to a third party secretariat.

Bill DeGroff had a front row seat to the battles of the 70s. His work on the Board and as President helped heal the rift. He remembers:

> *In 1968-70, I worked for the City of Los Angeles, an early supporter of The Southern California Regional Information System (SCRIS), the successor to the New Haven Use Study directed by Caby Smith. I worked for the Community Analysis Bureau, also funded by HUD, and a real advocate for using data to improve the effectiveness of government. We were Caby Smith's largest local government customer and user for SCRIS. In 1970 I moved to the School of Public Administration at USC working alongside Carl Davis. I may have even helped him move old proceedings to his garage from his Claremont University office. I worked at USC in the Public Systems Research Institute (Mitchell's old unit) and used AdMatch to data encode millions of records for urban analysis including three years of Federal IRS records for the entire State of California. We used the IRS data, along with Assessor and DMV data, to help the State Department of Education develop a more equitable basis for distributing educational funds to underprivileged schools. We also used the data as analysis input for the initial California Coastal Zone Act legislative review. In 1973 I left USC to work for Long Beach, an original USAC city where I attended numerous USAC meetings, all trying to figure out ways to perpetuate the USAC funding. Finally, my first efforts as a Board Member in 1976 were to figure out how to migrate URISA to a third party secretariat function, MFOA in Chicago. In 1974 I left Long Beach to head up the new IT department in the City of Boise and began a multiple year focus on minicomputers and their application to local government information systems. Somewhere in that period, I also helped plan a midnight raid on Carl's garage to recover URISA's records so we could file our tax forms. (Bill Degroff in an e-mail to Ken Dueker, October 25, 2011)*

There were a number of third party secretariats, none of which had URISA's interest as a high priority, Public Technology Institute, Municipal Finance Officers Association, and a professional association management firm. Finally, we turned to a past president, Tom Palmerlee in 1984 to serve as our first Executive Director. He and his wife Chris ran URISA out of their house until 1996, during the rapidly growth era for URISA, corresponding to the emergence of GIS technology. During this period Rolf Schmitt, Mark Salling and David Moyer provided valuable support, especially in the editing and distribution of conference proceedings, ESIG publications, and special reports.

Palmerlee facilitated the growth of URISA, which coincided with the initial growth spurt of GIS software.

DeGroff fondly remembers his role in initiating the ESIG awards:

> *Following the 1980 Conference in Toronto, I launched the ESIG Awards Program. There is a newsletter from the fall of 1980 where I outlined the purpose and objectives of the program. The first awards were given at the 1981 Conference in New Orleans. This is probably my proudest accomplishment for URISA. (Bill Degroff in an e-mail to Ken Dueker, October 25, 2011)*

Bob Aangeenbrug and Barry Wellar also helped heal the rancor between the automation and analysis factions. They had a foot in both camps as they were part of the Wichita Falls USAC Consortium (University of Kansas, City of Wichita Falls, Booz-Allen) 1970-1973. Barry recalls:

> *"By 1972 both Bob and I were on the Board, and by 1974 we were making pretty good progress at bridging gaps and personality conflicts, and then we ran into a board rough patch for a year or so. We got things back on track by the 1976 conference, and then hammered it home in 1977 with what really was a healing kind of conference. By the 1978 conference we had been very influential (in my opinion) in getting many federal agencies engaged in data, information systems, etc., back on speaking terms, and working together terms. Again, in my opinion, URISA deserves a lot of credit for its service as a conciliator and mediator." (Barry Wellar in an email to Ken Dueker, July 23, 2011)*

After USAC funding dried up and SCRIS ended, much of the rancor that split URISA subsided and URISA was poised to embrace the emergence of the GIS software industry in the early 80s. Prior to the commercial GIS software early adopters of GIS had to homegrow their software. This was expensive and time consuming. Eugene, San Diego, and Milwaukee developed urban GIS software in-house. Similarly, New York state and Minnesota developed natural resource GIS software in house.

Esri introduced Arc/Info in the early 80s. It competed with several others, but the others did not survive, failing to invest in R&D to evolve their products. Esri made those investments and succeeded. One memory illustrates this. Shortly after the release of Arc/Info, Jack Dangermond gave me a personal demonstration and asked how I liked it. I said yes, but – it does not meet my needs for address geocoding and network analysis. He brought me and several others to Redlands to identify requirements that led to the development and release of Network Analyst. But, its success drove several firms with specialized network analysis systems built around TIGER files out of business. Similarly, grid-based Spatial Analysis was developed to supplement the polygon processing of the original Arc/Info.

The major competition for GIS proved to be computer-aided mapping systems, particularly Intergraph and AutoCAD, because many users had difficulty understanding and distinguishing the differences between GIS and computer-aided mapping (CAM).

Intergraph marketing obfuscated these differences claiming GIS functionality that did not exist with map layers rather than unique map features. Since their computer-aided mapping systems predated Arc/Info, they had a presence in an organization and related organizations, that enabled marketing that stressed compatibility with what exists and downplaying the absence of GIS functionality.

I recall a presentation by Jack Dangermond at an American Institute of Planners conference in Minneapolis in 1982, where he was trying to explain the difference between GIS and CAM to planners. I decided he needed help in communicating to planners, and began what turned out to be long process of writing a paper titled, GIS and Computer-Aided Mapping that was finally published in the JAPA in 1987, long after it was really needed.

As GIS software became commercially available, many governmental agencies began exploring the use of GIS in the late 80s and early 90s. Firms, such as Plangraphics that was led by long-time URISA members John Antenucci, Mike Kevany, and Pete Croswell conducted GIS feasibility and implementation studies for many organizations that needed technical assistance. Thus, GIS was disseminated rapidly throughout the country.

5. My Role in URISA

I met Horwood in my senior year of civil engineering at the University of Washington as a student in his intro to urban planning. I was impressed by his engaging style and perspectives. He was instrumental in placing me as the project engineer in the Office of Urban Renewal in the City of Tacoma upon graduation in 1960, where I worked on the first urban renewal project in the State of Washington. While in Tacoma he was instrumental in the hiring of my boss as the new director of renewal for the City of Spokane. I was offered a position in Spokane but declined as I was preparing to return to graduate school.

In 1962 I returned to graduate school at the University of Washington at the urging of Horwood. Upon completion of my MS in civil engineering in 1963, he offered me a position in the Urban Data Center, replacing Clark Rogers who moved to the University of Pittsburgh. This allowed me to enter the doctoral program.

In the Urban Data Center I worked on the Seattle CRP mapping block level census data, delivered in digital form and reformatted from UNIVAC for use on the IBM 709. Horwood and several students formed the Applied Computer Research Corporation that enabled contracts with former short course attendees for projects in San Juan, Puerto Rico, and Ottawa, Canada.

With the assistance of Horwood, I was one of several graduate students from several universities that were selected as attendees in a NSF-sponsored summer institute in Regional Science at UC-Berkeley in 1964. The Regional Science institute faculty included Ben Stevens, Penn; Duane Marble, Northwestern; Bill Garrison, Northwestern; Brian Berry, Chicago.

In 1964 I joined Bill Garrison at Northwestern for a temporary six-month teaching post in civil engineering to teach urban planning and computer applications in urban planning. I stayed at Northwestern for two years, moving to geography as a research assistant on Garrison's first project in remote sensing application to urban geography (I was able to use this project for some of my subsequent dissertation research on Spatial Data Systems at the University of Washington).

My predecessor in teaching urban planning at Northwestern was Howard Fisher who was in process of developing SYMAP and moving to Harvard. Fisher attended Horwood's short course at Northwestern in 1963 and was quoted as saying, "I can do that better". I ended up using both Horwood's suite of programs and SYMAP in my offering of computer applications in urban planning at Northwestern.

While at Northwestern, I was the principal staff for the 1965 conference on Urban Planning Information Systems and Programs. Meanwhile, Horwood was named chair of the committee on urban information systems for the Highway Research Board (now Transportation Research Board) and he appointed me as secretary. Also, he and I conducted the last short course at the University of Michigan in 1965.

In 1966 I moved to the University of Wisconsin-Madison as an assistant professor to civil engineering and urban and regional planning. Upon the official creation of URISA I was nominated by Horwood and elected as the first treasurer of URISA (dues were $5 per year). In 1969 I moved to the University of Iowa with a joint appointment in urban and regional planning, and geography. In 1979 I moved to Portland State University where I was a professor of urban studies and planning and directed the center for urban studies. I retired in 2002 and returned to the Seattle area in 2004. After all, Horwood sent me to Northwestern in 1964 for what was to be 6 months. I returned to Seattle 40 years later.

Clearly, Horwood was instrumental in my development. He was a tremendous mentor and I was a willing assistant. Consequently, I had a Forrest Gump-like presence in the formation and early years of URISA. For the first forty years of URISA I could claim to have attended every conference except the first.

In addition to my three year term as treasurer, I served URISA with two one-year terms as vice president, a three-year term on the Board, and three years in the presidential sequence. Dave Moyer, Ben Neimann, and I were founding co-editors of the URISA Journal in 1989. I received the prestigious Horwood Award in 1997, and a leadership award in 2008 for leading the effort that founded the student paper competition.

This is my perspective on the first 20-25 years of URISA. I will leave others to continue the story. I hope my story provides insight to understanding the roots and evolution of URISA.

Horwood's Short Laws of Data Processing and Information Systems.

1. Good data is the data you already have.
2. Bad data drives out good.
3. The data you have for the present crisis was collected to relate to the previous one.
4. The respectability of existing data grows with elapsed time and distance from the data source to the investigator.
5. Data can be moved from one office to another but it cannot be created or destroyed.
6. If you have the right data you have the wrong problem and vice versa.
7. The important thing is not what you do but how you measure it.
8. In complex systems there is no relationship between information gathered and the decision made.
9. Acquisition from knowledge is an exception.
10. Knowledge flows at half the rate at which academic courses proliferate.

Part II

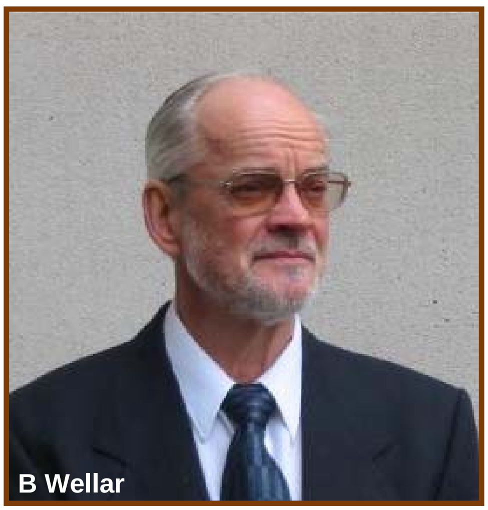
FORCES AND IDEAS THAT SPAWNED THE FIELD

Table 1 in Chapter 1 presents an indicative list of more than 200 information system domains which have been discussed in URISA conference proceedings, journal articles, workshop workbooks, website postings, and other publications.

And, I expect, that number could easily be doubled, which in a book of this nature prompts the question: Why and how did all these domains get started?

The chapters in this section highlight a selection of forces and ideas in play "back in the day", begin the documentation of why and how URISA itself became a pre-eminent force and source of ideas regarding research, education, training, and applications activities in urban and regional information systems and geographic information systems and science, and they also provide parameters and context for the sections and chapters that follow.

Barry Wellar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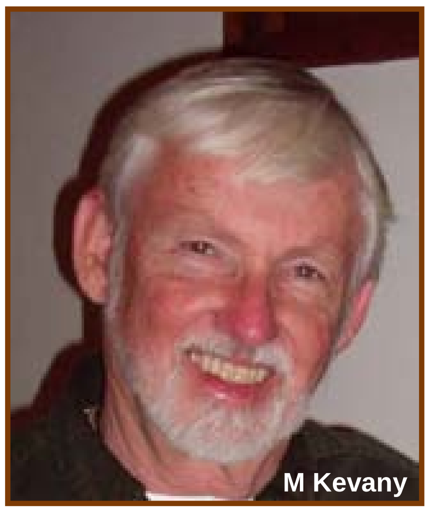
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FIVE MAJOR, EARLY CONTRIBUTORS TO THE FOUNDATIONS OF INFORMATION SYSTEMS EDUCATION, TRAINING, RESEARCH, AND APPLICATIONS

Barry Wellar
Professor Emeritus, University of Ottawa
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***Abstract*.** Many forces, ideas, disciplines, personalities, needs, events, problems, opportunities, challenges, etc., contributed to the spawning of the field of urban and regional information systems and geographic information systems. In this paper I outline why urbanization processes, the quantitative revolution, the Urban Information Systems Inter-Agency Committee (USAC) project RFP, the remote sensing revolution, and intergovernmental adjustments are selected as major, early contributors to the information systems field, and briefly describe how they affected the field when it was spawned some 50 years ago.

1. Introduction

In designing the book it was decided that a section titled "Forces and Ideas that Spawned the Field" would be appropriate for context purposes, and that it could be elaborated by one or more papers commenting on the situations, circumstances, movements, events, etc., that were instrumental in establishing the field some 50 years ago.

Consideration was given to a number of potential topics for this paper, and I selected urbanization processes, the quantitative revolution, the Urban Information Systems Inter-Agency Committee (USAC) project RFP, the remote sensing revolution, and intergovernmental adjustments, for three reasons in particular.

First, through graduate school courses and research projects, and my first posting after graduation, each of the topics was part of my introduction to the field when it began taking shape in the 1960s. And more important, they were all regarded as significant topics at the time. In my opinion, and taking into account the possibility of fading/failing memories over 50 years, the importance attached to them "back in the day" makes them solid choices for consideration in a review paper.

Second, through my career in government, academia, and consulting, I encountered and re-encountered these topics in a variety of countries, situations, places, venues, circumstances, etc. Regularly, these topics were among the top ten put forward as major, early contributors to the foundations of information systems education, training, research, and applications. Due to my changing circumstances, I was able to look at many sides of each topic, and my early regard for the topics was confirmed on a number of occasions in similar and different conditions.

Third, examination of recent URISA conference programs, and the conference programs of a number of other organizations, yields what is for me a compelling message to re-visit these topics.

That is, the 50-year old forces for change and ideas associated with urbanization processes, the quantitative revolution, the USAC project RFP, the remote sensing revolution, and intergovernmental adjustments, seemingly continue to play a major role in education, research, training, and applications activities associated with urban and regional information systems and geographic information systems and science.

In the remainder of the paper I discuss each topic in turn. The intent is to provide an indicative comment as to the significance of each contributor to the field, and to provide encouragement for further investigation of the matters which I raise.

2. Urbanization Processes

Beginning in the 1950s and accelerating into the 1960s, there was an international surge in the rate of the urbanization process, and in the numbers and sizes of towns and cities. The force behind the surge was a widespread and sustained shift from agrarian to industrial societies, which is discussed in numerous books and is marvelously illustrated by the film *A Sense of Place* (NFB, 1976) which covers the urbanization build-up over the previous decade.

> "The film deals with the mass movement of people from rural to urban areas, and the solutions being sought by the world's governments. There are many reasons behind this migration, but the main one is hope for a better life. The film shows human resourcefulness in coping with enormous problems and with change."

Defined in demographic terms, the urbanization surge meant that the proportion of a country's or a region's population located in cities as compared to rural areas increased from 30%, let us say, to 50% or 60% or more between 1945 and 1965.

The societal consequences of this kind of shift were many, and differed from country to country and region to region within countries. However, for the purposes of this paper the consequence of import is recalling why and how urbanization was a major, early contributor to the foundations of information systems education, training, research, and applications. The role of urbanization is related to the three levels of government, since it brought them all into the urban and regional information systems ambit.

At the municipal level, cities of 5,000-10,000 population were one thing for mayors, councilors, city managers, department heads, and staff, but cities climbing the size hierarchy of 25,000, 50,000, 100,000, 200,000, 500,000, one million, etc., as a result of urbanization were something else.

In brief, the larger cities became, the greater the number of activities and interactions; and, in association, the larger the numbers or amounts of land and building permits issued, inspections made, gallons of water pumped, tons of waste picked up and trucked to landfills, accidents reported and investigated, crimes reported and investigated, fire calls received and responded to, welfare claims received and processed, complaints and questions lodged and logged about broken water mains, broken sidewalks, potholes, downed power lines, school boundaries, etc., etc.

One result of the increased "action" was a massive increase in municipal data files and data bases, many of which were in the manual mode well into the 1960s, and were overwhelming municipal government filing cabinets, shoe boxes, and wherever else paper files were stored.

As for the nature of the relationship between urbanization and computerization in cities, Table 5.6, titled "Relationship of EDP operations to number of applications" in the report *Municipal Information Systems: The State of the Art in 1970* (DHUD, 1971, p.5.21) is instructive.

That is, the 79 cities which submitted proposals in response to the USAC project RFP (see section 4.0 below for comments on the USAC project) were surveyed, and Table 5.6 in the DHUD document reports on the year when 72 of the cities initiated EDP (electronic data processing) operations.

1956	1
1957	0
1958	1
1959	0
1960	1
1961	5
1962	4
1963	6
1964	8
1965	12
1966	7
1967	18
1968	9

Whether it was due to push or pull in the push-pull relationship, the pressures of urbanization in general, and the growing manifestations of "the urban problem" in particular, were responsible at least in part for the jump in the launch of EDP operations in municipal governments in the U.S. in the later years of the 1960s.

As for the state/provincial level, in many cases these governments had been driven for decades by single-purpose rural interests – e.g., agriculture, forestry, and mining – and now they were being confronted by a whole new order of demands upon their thinking about such complex matters as ranges of social services, multiple kinds of housing, different kinds of transportation, lower, middle and higher education support, growing municipal squabbles over land, lengthening line-ups for infrastructure funding, and the sharpening of questions about industrial waste and air and water pollution.

Urbanization brought with it a mix of direct benefits and costs, and an information matter of rapidly growing concern to state/provincial governments. That is, when the rate of urbanization went up sharply and began to affect an increasing number of municipalities, and especially larger municipalities, state and provincial governments were very hard-pressed to figure out how to get an evidence-based handle on knowing what was happening where, and especially when situations reached the regional scale, as in central cities and suburbs, urban-centered regions, commuter sheds, and metropolitan regions.

Central or federal governments for their part also had a mix of interests in municipal/urban affairs. For example, they had an interest in knowing whether, where, when, and at what rates economic growth was occurring and, depending upon the answer, whether they had policies and programs or could devise policies and programs that would slow down, speed up, and/or redistribute economic activity.

Instruments of intervention included fiscal policies, monetary policies, immigration policies, housing construction programs, transportation programs, industrial development programs, employment programs, infrastructure programs, land banking programs, and mortgage programs, all of which had urban and regional aspects.

And, all of the federal instruments of intervention had significant data/information requirements that involved analysis of policy options, as well as ascertaining where general or specific programs were needed, whether they were properly implemented, and whether they were effective.

Urbanization created a new and different data/information need and problem at all three levels of government, but it was at the municipal level of government (local and regional) that the massive data burden and overload was most sharply felt as early as the 1950s in some localities, and then began to affect municipal governments on a broad scale by the early 1960s.

Clearly, it is not possible to overstate the role that urbanization played more than 50 years ago in bringing about the data/information need situation in governments at all levels and, by extension, the need for a response founded on the objective of promoting information systems education, training, research, and applications in governments at all levels, but with a strong emphasis on urban and regional governments.

3. Quantitative Revolution

As discussed in numerous publications, there are three basic ways of representing situations, events, relationships, processes, etc.:

- qualitatively, through words;
- quantitatively, through symbols and numerics;
- visually, through images.

The thesis of this comment is that the foundations of information systems education, training, research, and applications were significantly affected by a "quantitative revolution" that was launched in the 1950s, took root over the next two decades, and became a central part of the mainstream thinking and doing throughout the field of urban and regional information systems and geographic information systems and science.

In terms of context, as of the 1950s the methods and techniques of numeric-oriented disciplines such as mathematics, statistics, physics, operations research, and engineering had made very limited incursions into the humanities and social sciences, or into professional planning. In large measure the means of representation and communication in the humanities and social sciences and the field of planning were words and text, and images such as maps, drawings, photographs, and arithmetic-based graphs and charts.

Towards the mid-fifties, however, thinking began to change, resulting in heightened interest in using the methods and techniques of mathematics, statistics, physics, operations research, and engineering in urban and regional transportation planning studies, location analysis, urban hierarchy studies, retail hierarchy studies, urban development model design, urban and regional economic planning and development analysis, labour market analysis, and a host of other subject matter domains.

And, central to much of this thinking, and of particular relevance to this paper, was the seemingly widespread common denominator of geography, and the matter of spatial relationships.

I hasten to acknowledge that not all was rosy with this movement. Indeed, there was in fact considerable resentment of the so-called "quantifiers", and even today there are many people who simply do not care for and may even dislike mathematics, statistics, physics, etc., but that is another story.

By the time of the early 1960s, significant inroads had been made in illustrating the potential utility of the quantitative approach as a means of extending, complementing, and supplementing the qualitative approach in dealing with a variety of issues, questions, problems, etc., that had been articulated but had not been taken very far down the research path.

Similarly, quantitative explorations were suggesting new and different ways of representing observed realities as spatial relationships by means of new and different kinds of visualization processes and products.

In terms of both attitude and capability, bridges were being built between quantitative, qualitative, and visualization methods and techniques. Bridge builders who come to my mind include Bill Garrison, Duane Marble, Waldo Tobler, Brian Berry, Michael Dacey, George Jenks, James Anderson, Walter Isard, Britton Harris, Ira Lowry, Will Steger, Leon Moses, T.R. Lakshmanan, William Alonso, Ben Stevens, Morton Schneider, Les Curry, and Gunnar Olsson.

Some fifty years after its inception, we are still benefiting from the quantitative revolution as one of the major, early contributors to the foundations of information systems education, training, research, and applications.

4. USAC Project Request for Proposals (RFP)

Request for Proposals No. H-2-70 for Municipal Information Systems was issued by the U.S. Department of Housing and Urban Development on July 31, 1969 (DHUD, 1969). This RFP was a major contributor to the foundations of information systems education, training, research, and applications for a number of reasons, but two in particular are especially pertinent to a book celebrating URISA's 50th anniversary conference.

First, the fact of the RFP being issued by an agency of the U.S. federal government was a key step in legitimizing the municipal information systems domain, or "giving cred" in today's parlance. Simply put, while the budget of about $12,000,000 over three years was not a huge amount of money, it was a quantum jump over previous federal agency allocations, and it carried a massive recognition feature.

In effect, the RFP "said" that municipal information systems were important to the federal government, and the federal government was putting up funds to support research needed at the municipal level. By definition that was a mindset-changing event, and provided a core, mental pillar in support of municipal information systems education, training, research, and applications.

Second, the RFP had been in process for several years, and it covered a lot of topics in its 130 pages of text. However, there are several sections of the RFP which contain materials that have been part-and-parcel of URISA conferences throughout much of its history, and have been major shapers of information systems education, training, research, and applications in many jurisdictions, literally from the moment the RFP was released.

Since it is my experience that relatively few people have read the RFP, I believe it may be instructive to set out a few of the particulars to demonstrate why this document is selected as a major contributor to the foundations of information systems education, training, research, and applications.

In the section on Research and Development (p.C-29) the RFP makes it clear that the project will not be a walk in the park.

> "What is required here is an almost revolutionary change of emphasis, i.e., from a data processing system to an information and decision system."

And then the RFP gets down and dirty by presenting a number of topics to be duly considered in designing and implementing an integrated municipal information system (pp. C-29 to C-40):

- Data acquisition
- Data base management
- Data base documentation
- Data compatibility
- Data release
- Data access control plan
- Data standardization
- Geocoding
- Interfacing
- Documentation
- Transferability
- Monitoring and evaluation.

Forty years later all the bullets still command attention.

As for the technical tasks or phases to be explicitly included in an integrated municipal information system proposal, these foundations of systems architecture described in the USAC RFP (pp. C-59 to C-75) have been front-and-center in many if not most subsequent urban and regional information systems and geographic information systems projects in the U.S., Canada, Australia, U.K., etc.:

- Systems analysis
- Systems conceptualization
- Systems design
- Systems development
- Systems implementation
- Systems evaluation.

URISA proceedings currently contain more than 3,000 papers and more than 30,000 pages of text. I believe it is likely that the roots of well over 1,000 of those papers can be traced back in large part to the USAC RFP. And, I further expect that many theses and dissertations in a variety of fields derived their research questions, issues, and problem statements from the USAC RFP.

As a participant in several phases of the USAC project (Wichita Falls TX, University of Kansas, Booz-Allen consortium), I was struck at the time by the state-of-the-art, state-of-the-science, and state-of-the-technology quality of the USAC RFP. Forty years later I am reviewing RFPs, research proposals, and statements of work (in the IS/GIS field) whose authors could take lessons from the USAC RFP written back in the techno dark ages.

The USAC RFP was a major, early contributor to the foundations of information systems education, training, research, and applications. Its authors are due a great deal of credit for the foundations that the USAC RFP and the USAC project brought to information systems education, training, research, and applications.

5. Remote Sensing Revolution

Any reader who is not familiar with the concept of "remote sensing", a term which was coined in 1960 or thereabouts, can begin to learn more by checking in with Google (15,200,000 results). Or, if paper-oriented, and wanting to cut to the chase directed by hundreds of experts, the reader can examine the *Manual of Remote Sensing* (ASP, 1975).

The *Manual* is comprised of two volumes (I-Theory, Instruments, and Techniques, and II-Interpretations and Applications), contains 26 chapters, is 2,100 pages in length, and demonstrates many of the ways of representing situations, events, relationships, processes, etc., qualitatively (through words), quantitatively (through symbols and numerics), and visually (through images).

Chapters particularly important to building the foundations of urban and regional information systems and geographic information systems and science include Remote Sensor Data Systems, Processing, and Management; Cartographic Presentations of Remote Sensor Data; Urban Environments: Inventory and Analysis; Engineering: Regional Inventories, Corridor Surveys, and Site Investigations; and Regional Analysis.

The import of remote sensing to urban and regional information systems and geographic information systems and science has a number of aspects, but from an early foundations perspective it may be summarized as follows:

> Remote sensing though conventional aerial photography, hyperaltitude photography, and satellite-based imaging and nonimaging systems presented an alternative means of generating, acquiring, storing, processing, analyzing, synthesizing, disseminating, and displaying data about the natural and built environments.

To recall what it was like in the 1950s and 1960s, much of the municipal data base consisted of records compiled through permitting, property sales, licenses, inspections, site visits, assessment billings, property tax notices, censuses, etc.

In general the records were paper documents, and required that people be directly involved in data base development through such activities as providing, collecting, recording, processing, and transmitting text and/or numeric data.

However, the remote sensing approach represented more than an opportunity and means to dramatically change existing data base development and information extraction processes and products in governments at all levels. That is, it also provided the means of obtaining new urban and regional data, and processing those data for input to urban and regional information systems and geographic information systems.

At the time of this writing in 2012, the widespread popularity and adoption of remote sensing systems is illustrated, for example, by the general acceptance of Google Earth and its associated remote sensing products and services.

However, this capability did not magically emerge from the ether. Rather, it had its roots in the remote sensing revolution of the 1960s and 1970s, and two of the catalysts underpinning this revolution were the National Aeronautics and Space Administration with its various satellites, and the U.S. Geological Survey through its Geographic Applications Program.

Credit is therefore given to these two agencies for their critical roles in firing up the remote sensing revolution, and engendering a major contribution to information systems education, training, research, and applications.

6. Intergovernmental Adjustments

The emergence of urban societies in a number of countries in the 1950s and 1960s resulted in a variety of initiatives by the end of the 1960s, and the beginning of the 1970s, to improve intergovernmental relations in both federal and unitary government systems.

By way of illustration, in 1968 the U.S. enacted the Intergovernmental Cooperation Act, and in 1971 Canada created a federal Ministry of State for Urban Affairs (MSUA) even though municipalities were “creatures” of the provinces. Both the U.S. and Canada were/are federal systems, and in both jurisdictions the emergence of an urban society had been rocking the governance boat.

In brief, the emergence of urbanizing societies was creating new needs and problems that were causing grief at all levels of government, and it was becoming apparent that intergovernmental adjustments were needed since the old ways of governance were no longer effective or efficient.

Frameworks for the adjustments were referred to by various names, including “creative federalism”, “co-operative federalism”, and “marble cake federalism” which as I recall received a lot of play in the U.S. And not to be outdone when it came to phrase spinning, Canada was big on “symmetrical federalism” and “compassionate fiscal federalism”.

As for unitary government systems, questions were also being raised about the efficacy of what was essentially a top-down approach to governance. A matter of particular concern was figuring out how the central governments could intelligently affect the performance of local authorities which became more complex entities as they grew larger.

Or, to look at the problem from a different perspective, the challenge was to figure out how to assist urbanizing local authorities acquire the needed capabilities to deal directly with their problems, and thereby take better care of themselves without being a “bother” to the central government.

The intergovernmental adjustment of common interest, then, in both federal and unitary political systems, was to find ways and means to improve the governing capabilities and operational performance of municipal governments/local authorities. The generally accepted understanding in both systems was that municipal governments/local authorities were the primary instruments for implementing central/federal and state/provincial government programs, so it was in the senior governments’ self-interest to enable local governments to better deal with their emerging urban situations.

A number of adjustment options were considered in North America and Europe, and consensus was achieved in one regard which is fundamental to this book. That is, in both federal and unitary systems, one of the perceived ways and means to achieve those better governance objectives was through better decisions based on better information derived from better use of better information systems.

Early contributors to pursuing that cause in the U.S. included the USAC project discussed above, federal agencies such as Housing and Urban Development, Bureau of Public Roads, and Bureau of the Census, and professional organizations such as Municipal Finance Officers’ Association, International City Managers’ Association, and URISA beginning with its initial conference in 1963. Canada’s response to the intergovernmental adjustment issue included building strong coordination and information-based research components into the terms of reference that created the Ministry of State for Urban Affairs.

In Europe, a number of countries (e.g., U.K, Germany, France, Sweden, and Netherlands) launched local authority information system programs.

Moreover, the Organization for Economic Cooperation and Development (OECD) with its large European membership (federal and unitary systems) convened panels and meetings to promote information system technology and services as a means of improving government performance (executive, management, planning, and operations) at all levels, and intergovernmental relations between levels.

It seems likely that progress in the information systems field could easily have been delayed by five or ten years had the intergovernmental adjustment issue not been identified, and then acted upon by proposing information systems as part of the adjustment process solution.

Fortunately, however, the connection was made between the need to have better information systems, better information, and better decisions in order to achieve better governance, and URISA has pursued that connection for 50 years and counting.

7. Conclusion

This paper outlines why urbanization processes, the quantitative revolution, the USAC project RFP, the remote sensing revolution, and intergovernmental adjustments are presented as major, early contributors to the foundations of information systems education, training, research, and applications, and briefly discusses how their contributions affected the information systems field. In addition to giving due recognition to some of the major forces for change and ideas which underpin the information systems field, however, I believe the discussion may have broader implications.

That is, since examination of just five of the major, early contributors yields a number of significant insights into the origins and motivations underlying the field, it occurs that perhaps there is much yet to be learned from more of such investigations involving other early contributors.

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6

MORE EARLY CONTRIBUTORS TO THE LAUNCH OF THE URBAN INFORMATION FIELD

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***Abstract*:** Events in the application of automation to urban management and planning and the setting in which URISA was launched contributed to the foundation on which URISA was established. Several activities and areas of interest were very significant in contributing to the foundation of URISA from its founding through the early years and in some cases continuing through many or all of its 50 years. This chapter provides a brief synopsis of the setting for automation of urban information in the early 1960s as URISA was being founded, and presents an overview of three key contributors to the foundations of urban and regional information systems (URIS).

1. Introduction

The intent of this chapter is to bring an understanding to the readers, some fifty years after its founding, of:

- The urban information system situation fifty years ago that was very different from today.
- Why a URISA was needed and founded.
- Significant contributors to the founding and early success of URISA.

With this background we can more fully appreciate URISA and its contributions to the evolution of the essential and valuable field of government information technology that we practice today.

The selection of the specific contributors for this chapter and the observations presented are drawn from my fifty years of experience in various roles and organizations in the urban and regional information systems (URIS) field. In particular my activities during the early years that are the focus of this chapter, and my participation in URISA from its founding led me to the four choices and to the information in the chapter. I faced, first hand, the challenges, and benefited from the opportunities presented by data processing technology in the early 1960s.

It was my good fortune to be involved in several of the urban information system foundation activities. I participated in the 1966 conference in Berkeley that preceded the formal incorporation of URISA. I worked with Joel Kibbee at System Development Corporation (SDC) when he became one of the founders of URISA. I was on the teams that produced the URIS book described later in this chapter, supported the Census Use Study and provided the staffing for the Charlotte USAC project, all early contributors to the URISA foundation.

As I evaluate my experiences and perceptions of the urban and regional information system field, I see the importance of these same elements to the foundation of URISA. Throughout my career I have recognized the value of those early experiences to my own understanding and success in the field. I now appreciate the value of those foundation elements to the field as a whole.

I also became active in URISA and over the years served in many roles including the Board of Directors, conference program committees and multiple Addressing and CAMA specialty conference committees.

I have benefited greatly from these experiences throughout my career and one of my objectives in writing this chapter is to encourage today's URISA members to read the original works upon which our field has evolved.

As it was established, URISA embarked on a new path of service that was not an incremental shift from an existing path or special niche in an existing profession. It grew out of a new technology area (new to the world of planning and urban administration) that offered solutions to limitations that were being experienced by transportation planning as well as state and local government worlds in the early 1960s.

In the early 1960s computer usage was spreading rapidly into new application areas. In parallel the field of transportation planning in particular, as well as other governmental functions, was grappling with the availability of large volumes of potentially useful data from the census and other sources. That data was beginning to become available in digital, computer-readable form. But most in the planning and local government fields had little or no experience with automation.

Several efforts had been launched to develop capabilities for use of computers in those fields, but the extent of development and use was extremely limited. A new field was emerging as a hybrid of computer technology and application of that technology in government functions. There was a lot to learn and there was a need, therefore, for a forum in which information on experiences in this new area could be shared.

As a new organization on a new path, URISA had to create itself. It did so by drawing together people from the fields of data processing, planning, modeling, and government functions at all levels.

It drew system analysts and programmers from data processing together with planners, modellers and administrators from government along with geographers, engineers, economists and other specialists to form a truly multi-disciplinary body that focused on the use, rather than the development, of computer technologies to support government functions.

Chapter 4, which is reprinted from the proceedings of the 1977 conference, presents the comments of Ed Horwood, a founder and first President, regarding his vision of URISA as an interdisciplinary association of interest-based academics and practicing professionals. As Ken Dueker recalls in Chapter 7, it was Horwood's view that "Breadth has been both the strength and weakness of URISA, a mile wide and an inch deep. Other organizations provide greater depth in specific areas, while URISA provided a broader perspective".

The early functions of focus were transportation planning, demographic analysis, land use planning, and municipal administration, though interest extended into most functions of state and local government.

The interests of URISA focused on the use of technology, though there was a division of interests between the application of computer technology for analysis of urban data and automation to increase the efficiency of local government.

The nature of the functional areas was such that, from the earliest years, there was a strong location or geographic interest, though geographic capabilities were extremely limited in the early technologies of the time, along with the promotion of use of automation in government generally. URISA provided an important, perhaps the most important, platform for encouraging and promoting automated geographic capabilities for government functions.

Two major challenges faced by government agencies in the early years,

- How to capture, manage, process, and analyze large amounts of data?
  and
- How to move the technology into the government functions?

gave impetus to the founding of URISA.

The common ground between these interests became the foundation for URISA. Those practicing or interested in the field began experiencing needs to share or acquire information on the experiences of others on such topics as:

- Who else is applying data processing to state or local government functions?
- What are others doing?
- What are they finding that works or does not?
- What has been accomplished already?
- What needs to be done to apply data processing to government functions?
- What are the fundamental issues underlying the application of DP?
- What is the baseline? Where are we at now? What is known and what is yet unknown?

2. The Setting at the Time of URISA'S Founding

In the early 1960s computer technology was expanding throughout society, though the capabilities of the technology were quite limited by today's standards. Computers were physically large, but provided limited capacity and were very expensive. The development and operation of automated systems were dependent on highly skilled programmers and other technicians, of which there was a very limited supply. The defense sector was an early user of computer technologies and became the most advanced user by the '60s. The automated SAGE North American air defense system was developed in the 1950s and by the 1960s included early interactive graphics and other tools that were not generally available in the civilian sector for another fifteen years.

The nature of government is conservative, bound by legal constraints, burdened with bureaucratic processes and chronically suffering from limited resources for exploring new areas like automation. Thus government organizations have been especially risk-averse, cautious and slow to adopt new technology and the processes based upon it. And so, in the early 1960s we find very little implementation of computer technology (EDP-Electronic Data Processing or ADP-Automated Data Processing as it was commonly named then) in local or state government, and only a few civilian federal agencies such as the Census Bureau were making significant use of the technology.

With this limited experience there was essentially no existing body of knowledge regarding EDP development or use in government to draw on for those wishing to employ the technology. Development and implementation methodologies were only beginning to be established. And education or training opportunities were scarce, constraining the availability of the needed skilled persons. With this limitation of knowledge, the complexity of applying DP to state and local government functions was not understood and was generally underestimated.

One of the few research endeavors focused on urban data processing was conducted by the RAND Corporation that performed early investigations of DP in government and published articles on the subject.

Developments were often carried out on a learn-as-you-go method or trial-and-error by individual organizations, groups or persons with specific interests in adoption of the technology and adequate knowledge or skills to embark on developments.

State and local government automation was a new area of technology application and thus the commercial, profit-motivated industries had not yet developed products to sell; and the small, immature market did not generate much interest for vendors. With this lack of commercial sources, solutions had to be developed individually; and it was often necessary for forefront organizations such as the Census Bureau and others to internally invent automated tools to support their operations.

Practitioners and researchers in the fields of planning and administration were developing ideas for data processing applications that were not yet available to government functions. Some of those could not be supported by the available technology and would wait for years to become available as the technology evolved.

By way of illustration of the nature of the situation, practitioners and researchers alike wanted to perform parcel-level analysis. However, they found that impractical due to limitations on the availability of digital data at that level of detail and on the existing capabilities of data processing systems, and so they settled for data aggregated to areal units. In parallel, emerging technologies enabled applications whose potential hadn't been recognized before their availability. For example, when interactive mapping systems became available they opened new applications for parcel map update and maintenance, and GIS enabled integration of tabular and graphic data.

Readers may also be interested in this anecdotal account of the relative "primitiveness" of the state of the art of government automation in the early '60s.

The Los Angeles County Assessor's office used a Honeywell Datamatic 1000 computer. Data were stored and managed using 2" magnetic tape on steel reels weighing 45 pounds each. At the time, California state law did not allow women to lift that weight above the waist and so women were excluded from the job of managing data. That assessor's parcel file contained records for all 1 million parcels in the county. The Regional Planning Commission requested that the Census Tract number be added to each parcel record. That seven-character field for the nearly one million parcel records would add several more tape reels and extend processing time (each application required processing of all tapes) too much, and so the request was rejected.

Automation was being addressed on what can be considered a piecemeal basis of developing specific capabilities for individual functions in individual organizations. There was little or no overall vision for long-term development of comprehensive systems that would facilitate integration of individual capabilities over time or that recognized the real potential for use of the same sets of data by multiple functions. This was an area that the broader focus of URISA increasingly brought to light.

The need to share the lessons being learned from early developments regarding both the potentials and limitations of the technology and the areas in which specific improvements were required added to the foundation on which URISA was established. In response to this need a group decided to create a forum and association – URISA.

3. Key Threads

In addition to the five early contributions introduced by Professor Wellar in Chapter 5, I suggest four additional areas or "threads", for want of a better designation. The threads include a mix of milestone events, publications, significant activities and supporting organizations that contributed to the foundation of URISA. These topics were chosen because they played a significant role in the foundation of URISA and made important contributions to its early success. The threads are:

- *A Data Processing System for State and Local Government.*
- *Urban and Regional Information Systems: Support for Planning in Metropolitan Areas.*
- US Census Bureau early developments and the Census Use Study.

3.1 A Data Processing System for State and Local Government

Given the setting as it existed in 1963, emergence of improved data processing capabilities and growing recognition of the potential by state and local governments, there was a significant need for information about the technology and its application to support governmental functions. Research had been underway for several years on the subject at the RAND Corporation and a valuable book was published in 1963. That book, *A Data Processing System for State and Local Government* (Hearle, 1963), made perhaps the first contribution to the establishment of a base of knowledge for urban information systems and begin filling the information/knowledge vacuum that existed.

The book was based on the prior years of research at RAND and provided a concise introduction to the technology, state and local government organizations and functions and data requirements for those functions, and offered forecasts for the near term in which the concept of unified information systems (UIS), defined in the book, could be implemented.

The book contains a combination of high-level descriptions of data processing in state and local governments, and relatively detailed descriptions of specific government functions, system components and data requirements. It presents a thorough background of the issues directing and impacting the data processing system for state and local governments. It was conceptual rather than procedural, addressing the performance of the entire range of state and local functions. It was also “futuristic”, directed toward the design of systems with upcoming new technologies supporting expanded government functions, the “long-range systems suitable for implementation in the 1970-1975 period” (Hearle, 1963, p.2), which was 7-12 years following publication of the book. The type of data processing discussed was operational records processing rather than document management or engineering computing. The long-range potential preferred approaches to utilize advanced DP equipment to support the functions of state and local agencies were addressed.

It was noted that two developments led state and local governments’ interest in improved data processing: growth in traditional activities requiring the handling of large volumes of data, and technology advances made in data processing equipment.

An important perspective about the nature of data used and the design of computer systems emphasized in the book involved the “total complex of functions”, not the interests of a specific agency avoiding organizational problems that lead to constraints for unified system implementation (Hearle, 1963, p.1) though these must be dealt with in reality.

This body of information became a valuable source of understanding and guidance for those embarking on the new field of government automation.

The characteristics and capabilities of individual categories of computer equipment were described along with a forecast of future equipment capabilities. The forecast generally limited advances to incremental improvements and gave little indication of the dramatic and extremely rapid evolution and advancement of what became information technology.

In its discussion of potential applications for state and local governments, the book notes that the environment and requirements set the design to fit state and local government functions, a concept proven over and over in actual implementation of systems.

Some interesting facts on the state and local governments were presented. For example, they supported one in nine employed persons in the country, three times the number of federal employees, and had a cumulative budget of $60 billion and growing in 1963.

The book listed twelve basic functions of state and local governments and 74 sub-functions ranging from fire and police departments to refuse and elections. The primary relevance was that they all depend on data, several were dominated by DP considerations and many processed large volumes of data with relatively simple transactions. The secondary relevance noted was that there was significant diversity among functions leading to separate systems. Automation in these functions was initially employed in well-defined clerical procedures such as payroll and taxes.

The exploration of the organizations discussed characteristics of the state and local governments and the significance of organization structure and relationships to data requirements. An understanding of the functions, structure, mutual relationships and characteristics of organizations provide the basis for development of information systems.

Six important characteristics impacting DP development were identified including:

- Great variety in size of units.
- Strong tradition of autonomy among units.
- Longstanding division between urban and rural interests.
- Strong departmental autonomy apart from the executive (mayor, governor).
- Weakness of executive authority.
- Governed by laws and thus strong legislative control.

Some observations on this book and its significance to the URISA foundation can be made. The book served well as a general “what to do and how to do it” guidebook for organizations considering or embarking on implementation of data processing technology in that period. Some aspects of the book are quite general while others are quite specific, providing conceptual information augmented with details on systems, data and implementation issues. It exhibits a thorough understanding of the components and issues involved in state and local data processing as perceived in the period leading up to the founding of URISA. Many important issues were raised that were not widely recognized by state and local governments at that time and guidance was provided for their handling.

Further, the Hearle book provided an initial structure and identification of fundamental aspects of systems, data and their implementation that have proved to be valuable foundations throughout the evolution of the field.

Use of data processing then involved great effort due to the rudimentary capabilities and nature of the technology, and thus it is significant to note that the programming and operation of the devices at that time required considerable training that was generally beyond the interest or time of most government employees or the resources of government agencies.

The contributions of this book to the foundation of URISA were early, numerous and valuable. It laid the initial layer to the foundation of the urban and regional information systems (URIS) field and knowledge base. It documented a structure for the combining of governmental functions and requirements with the data processing technology as an urban information system. The book raised awareness and promoted the consideration of a comprehensive vision to what were essentially fragmented, piecemeal development efforts. It introduced consideration of cost and benefits and methodological view of URIS implementation, all important issues in URISA's formative years.

3.2 Urban and Regional Information Systems: Support for Planning in Metropolitan Areas

The book *Urban and Regional Information Systems: Support for Planning in Metropolitan Areas* (SDC, 1968) was produced by a team in the Urban Systems Group at System Development Corporation (a spinoff from the RAND Corporation) under contract to the U.S. Department of Housing and Urban Development (HUD). HUD published the book in 1968 and distributed it to all planning agencies involved in HUD programs across the country, providing widespread recognition to the field of URIS.

Extensive research was conducted, including a literature review (a bibliography of 500 entries); interviews with researchers, practitioners and administrators; in-depth visits to work in progress, discussions with relevant parties and the formation of a seven-member Advisory Committee. The research and study drew on experiences and knowledge from the period prior to and during URISA's formation and the book provides guidelines for the 5-year period following publication (1969-1974).
The book was intended to contribute to the baseline of knowledge about this emerging field by providing immediate and long-term guidelines for development and implementation of computer-based URIS. It addressed fundamental issues to help define the field:

- Terminology to facilitate communications.
- The information system components and capabilities.
- The data base and its management.

- Urban information system requirements.
- Data base management components and requirements.

Issues and problems raised in the development of URIS were analyzed based on actual experiences that were being gained by 1968. At that time the major activities of URIS were focused in planning functions and HUD's interests were also in that area, as were URISA's, and so attention was focused on planning functions.

A definition of URIS was presented as:

> *"A collection of people, procedures, a database, and a data processing system organized to develop the information required to support the mission of an agency"*. (SDC, 1968, p.9)

The definition was intended to be open-ended to include a variety of concepts concerning the specification and development of information and information system capabilities needed to achieve agency obligations.

Importantly, a distinction was drawn between requirements for systems that are oriented toward planning, an open-ended heuristic process, and those oriented toward day-to-day government operations with specific work flows. While the book focused on information systems for urban planning, much of the information provided has proven useful to administration, operations and other functions of urban and regional government.

As an early attempt to organize and document information on automation in urban planning, it made a significant contribution to knowledge of the field, was widely used and became a part of the foundation for the URIS field. The book identified key issues that became of primary interest as foundations for the field, including:

- Data management.
- Definition of data processing terminology adapted to URIS.
- Data compatibility.
- Policies on data release.
- Continuing data acquisition.
- System operating features.
- Data sharing.
- On-line data retrieval.
- System flexibility.

It provided a command post analogy as a concept for urban information management. Also it made a differentiation between municipal/agency single-purpose and regional multi-agency systems and requirements and was itself focused on the regional requirements.

Since automation was new to many of those involved in the early days of urban data management, the terminology used was unfamiliar and so the book includes the definition of URIS and terminology describing automation in the context of urban data management by drawing from and adapting terms used in the computer field at that time.

A very significant area addressed extensively in the book was that of data management, identified as most essential to URIS. Several aspects of data management necessary for successful URIS development were addressed, including data base documentation, data compatibility, policies on data release, and continuing data acquisition. These were not well recognized at the time as solutions were being developed for specific requirements without adequate understanding of the overall complexity of a sustainable system.

Since the book focused primarily on systems for support of planning that typically involved the accumulation of data from multiple sources and agencies, data sharing was an important consideration that influenced the recommendations for data management. An interesting suggestion was for on-line data retrieval from directly accessible data bases by “remote terminals”, a capability that was rare in the world of urban data management as “batch processing” was considered the conventional approach at the time.

As a contributor to the foundations of the field, this book added valuable layers of information to the URIS foundation and knowledge base. Significant issues that became critical to URIS were highlighted for the first time. The URIS concepts that became the basis for URISA’s name were defined and documented. It extracted real world experiences in URIS development to address practical issues of concern to the field. The importance of data management was recognized and promoted. An extensive compendium of information of organizations, persons and resources at the time of URISA’s founding was documented and contributed to the foundation base of knowledge.

3.3 U.S. Bureau of Census

The mission of the U.S. Bureau of Census involves the acquisition, management and analysis of huge volumes of data, and so it was an early developer of automated data management tools. Over the years it has made several significant contributions to the foundation of the URIS field dating from long before and through the 1960s. For decades the Bureau was advancing the use of automation.

Herman Hollerith began the process in 1881, designing a machine for the Census Bureau that could tabulate enumeration data more efficiently than the manual methods used up to that time. Hollerith’s invention involved use of a punched card device that was employed to facilitate analysis of the 1890 census data. The invention was based on the use of electricity to read holes in the cards that represented the data values to perform counting and sorting of the punched cards. It reduced the processing time for the 1890 census by a factor of ten. A Bureau invention, FOSDIC, short for film optical sensing device for input to computers, was developed to automate and speed the conversion of data from the paper enumeration forms into digital form. It enabled enumerators to mark answers in pencil in pre-specified locations on forms that were then microphotographed and “read” by FOSDIC (Hearle 1963, p.5).

The nature of the mission generated requirements for geographic location, aggregation of data from collection address point to small statistical areas, and generation of maps to support enumeration activities and to present census results in a useful form. In the 1960s this led the Bureau to focus on development of tools for automation of geographic location within its acquisition, processing and publication operations. To support its operations the Bureau developed the Address Coding Guide (ACG), GBF/DIME and TIGER, Admatch software and others tools for management and use of geographic data.

Perhaps its most significant contribution to the URIS field foundation was the conduct of the Census Use Study in New Haven, Connecticut and subsequent Southern California Regional Information Study in Los Angeles. It was in the Use Study that the major breakthrough in relating address data to geographic location and mapping of census data was made with the creation of the Dual Independent Map Encoding (DIME) method and tools such as Admatch software.

DIME, which became GBF/DIME and later Tiger, emerged not only as Census Bureau tools but provided the foundation for a whole industry of location-based services. DIME and its variations, which are discussed in more detail by Professor Wellar in Chapter 8, enabled the encoding of the street network in a digital format that included validity checking and both address and census area coding. With this valuable source of location data and relationships, it became practical to process any data that includes addresses and geocode or reference the data to geographic areas such as census tracts and to digital map locations.

In terms of contributing to the foundation for URIS, the Census Bureau accomplishments became a part of much of the URIS field, and the use and extension of those accomplishments became a major component of URISA discussions for many years. Specifically, the contributions include:

- Primary early developer of URIS data and capabilities.
- Major source of a large volume of URIS data used throughout the field.
- Important research and development of critical URIS components.
- Publishing information which promoted the URIS field and supported URIS education programs.

4. Conclusion

The founding, early development, and ongoing success of URISA were heavily influenced by the activities and setting in which it was founded. The emergence of electronic data processing as an effective tool for use by governmental agencies, the growing demand for processing of large volumes of data and for improvements in the efficiency of government operations, and the growing interest in EDP in society in general became the basis for URIS foundation. EDP was moving from an esoteric tool of great cost and limited use in only a few application areas toward proliferation of an economically viable tool to be used in a wide array of commercial and governmental fields.

Over the 50 years of URISA our field has undergone dramatic changes, though the bases of the early foundations have proven durable and are still important today.

The lessons and understandings gained from those early foundations set the field and URISA on a sustaining path. URIS did not become a dead-end attempt at technology adoption as happened in some areas but the basic understanding of the technology and its use gained in those early experiences/foundations provided a solid foundation on which the evolution of URIS could proceed and grow in usage and usefulness.

The relationship between the knowledge of local government and its functions relative to the capabilities and potential usefulness of technology was developed through the foundation contributors; and that knowledge proved to be accurate so that the foundations were solid, enabling the field to grow successfully through the years.

Consider that time when there was no one who was expert in both local government functions and in data processing technology. There were people, however, from both government and technology fields who perceived that there was potential benefit to be gained by linking the two. The challenge was how that could be accomplished in the absence of combined knowledge of the fields. The solution lay in creating a forum in which those who were testing the linking and developing initial solutions could share their knowledge, integrate the knowledge of both fields and publish the growing knowledge to others as the interest in data processing in government was growing.

As someone who was there and has memories – though fading – of the early days I contemplated what, if anything, would be of interest or value to those in the field today. So much is now known and technology is so dramatically advanced – is anything from back then useful to know?

There is much that is useful and here are a few particular issues from two of the foundation contributors that come to mind. *A Data Processing System for State & Local Governments* identified a broad range of state and local government functions and data requirements with potential to benefit from automation. Have we expanded those in the years since? Are there elements that we have overlooked? Is our current perception, with the magic of current technology, missing anything that was hoped for back then? Are there any solutions missing from the opportunities presented in that book now?

Urban and Regional Information Systems: Support for Planning in Metropolitan Areas presented several critical components necessary for a successful URIS. Have we properly solved and exploited the challenges of data management raised in that book? As technology has become so “magic”, have we overlooked the significance of some of the data issues? Are there missing data solutions yet to be addressed?

In Chapter 5 Professor Wellar presents urbanization processes, the quantitative revolution, the Urban Information Systems Inter-Agency Committee (USAC) project RFP, the remote sensing revolution, and intergovernmental adjustments as five major, early contributors to the foundations of the information systems field. I am pleased to add two publications, *Data Processing Systems for State & Local Government,* and *Urban and Regional Information Systems: Support for Planning*, and the research and development work of the Bureau of Census, to this important part of our discussion about the foundations of urban and regional information systems and geographic information systems and science.

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7

1964-1967 PROCEEDINGS: SETTING THE STAGE

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***Abstract*.** The proceedings from the 1964-1967 period cover the transition from the Annual Conferences on Urban Planning Information Systems and Programs to the formation of URISA, leading to the first proceedings actually labelled URISA in 1967. The proceedings reflect an interesting tension between modellers whose data requirements put them into a data demand camp, and those interested in managing and retrieving urban and regional data who form a data supply camp.

1. Introduction

The period of 1964 -1967 was my transition from graduate student at the University of Washington to assistant professor of civil engineering and urban and regional planning at the University of Wisconsin-Madison. During that period I was also a research assistant at Northwestern University working on a remote sensing project for Professor William Garrison that I was able to use for my dissertation at the University of Washington.

The 1964-1967 conferences were a great opportunity for me to interact with leaders in the urban and regional information systems area. These conferences helped me develop my own career and gave me opportunity to develop a long term involvement in URISA.

2. The 1964 Conference

The 1964 conference was held at the University of Pittsburgh and called the Second Annual Conference on Urban Planning Information Systems and Programs, and the first year for which there are proceedings. It was organized by Clark Rogers, who was a doctoral student and lecturer at Pitt. Rogers left the University of Washington in 1963. At the UW, Rogers was Horwood's principal assistant in development of a suite of programs and their application in Spokane that provided the basis for short course instruction that led to URISA. At the closing session in Pittsburgh there was discussion of a conference for next year and the need for an organization to foster computing technology for urban planning.

The 1964 proceedings contained papers by Mel Webber and Cal Hamilton that focused on the role of information in the monitoring and planning of urban systems. Webber addressed the politics of information while Hamilton addressed the need to measure key variables to monitor change. The emerging field of simulation modeling of urban systems was addressed in papers by Robert Hayes, Ira Robinson, Kenneth Schlager, and Will Steger. Vlad Almendinger and Robert Barraclough presented papers that addressed the need for and design of systems to manage and retrieve urban and regional data. This communication among experts in planning, modeling, and data management was productive and set the stage for future conferences.

There was a healthy tension between modellers whose data requirements put them into a data demand camp, while those interested in managing and retrieving urban and regional data formed a data supply camp. Those in the demand camp thought they had the theory and knew what data they needed to build explanatory models, while those in the supply camp wanted to explore data to develop theory.

3. The 1965 Conference

The 1965 conference on Urban Planning Information Systems and Programs was held in Chicago, co-sponsored by Northwestern University and the American Society of Planning Officials (ASPO). (Later, ASPO and the American Institute of Planners (AIP) merged to form the American Planning Association (APA)) Dr. William Garrison, professor of geography and civil engineering at Northwestern University was the organizer of the conference, assisted by Ken Dueker. My role in organizing this conference initiated my active involvement in what was to become URISA.

Nathan Grundstein presented a public administration perspective on an urban management information system to aid in control decisions, while Andrei Rogers presented an operations research and planning perspective on the need for real-time urban information systems for researching urban systems.

Planning for the 1970 Census of Population and Housing was presented, particularly the release of digital data in the form of summary tapes of small-area data. Bill Garrison, chair of Census' small-area data committee, presented a paper on the demand for small-area data.

There were several papers on remote sensing and image processing for application to urban areas. There were also papers on general purpose programming systems for urban data management, and land records.

Although Ed Horwood was in Europe and did not attend the 1965 conference, he submitted a paper that is in the conference proceedings titled, Association Needs for the Urban Information Systems Field. He proposed an inter-disciplinary association of professionals rather than a professional society "that tend to be concerned with guild problems of their professions." In Horwood's absence the organizational need issue did not generate much discussion. That discussion was fully engaged at the 1966 Conference at UC-Berkeley.

In the closing paper, Dennis O'Hara, the long-time director of ASPO, warned "With automatic data processing we in planning are riding the wave of the future – beware of letting it engulf us."

4. The 1966 Conference

The 1966 conference on Urban Planning Information Systems and Programs was held at the University of California-Berkeley.

Information system projects in Los Angeles and New York City were described in papers by well known URISA members, Glenn Johnson and Will Steger. A noteworthy paper by Donald Foley, professor of urban and regional planning, UC-Berkeley presented an analysis of tract data from the 1960 Census for selected cities in California using computer mapping and statistical analysis. There were two papers assessing the effectiveness of urban land use models, one by Claude Gruen that critiqued the paper about the San Francisco urban renewal model by Ira Robinson that was presented at the 1964 conference. There were two papers about urban development gaming, one by Richard Duke and one by Alan Felt, the two big names in urban gaming.

Waldo Tobler presented a paper calling for analysis of spatial series, analogous to time series data. Ken Dueker presented a paper using list structures for land use data. This approach did not catch on as relational data bases developed.

There were several informal meetings at the 1966 conference on Urban Planning Information Systems and Programs that discussed formalizing the organization, which were moderated by Horwood.

There was quick consensus on the inter-disciplinary association issue as attendees represented several fields including planning, engineering, geography, public administration, and economics, and included academic and practicing professionals. As a result the constitution of the Regional Science Association served as a model for the new organization.

The principal issue was the name. The term “urban planning” used in the conference title became the main stumbling block. Some attendees wanted the new association with a broader focus, arguing that “urban” was too restrictive, implying “local government”, leaving out federal and state interests. The compromise was “urban and regional”.

Similarly, the term “planning” was not inclusive enough for public administrators and technologists interested in the application of computer technology in the public sector. The name Urban and Regional Information Systems Association emerged from this discussion.

Edgar Horwood became the first president and he orchestrated the election of professional friends who were not in attendance at the 1966 conference: Barclay Jones, professor of city and regional planning, Cornell University, as president-elect, William Garrison, Professor of Geography and Civil Engineering, Northwestern University, and George Duggar, professor of urban planning, University of Pittsburgh as board members. Similarly, he orchestrated the election of three of his students: Clark Rogers as vice president, Ken Dueker as Treasurer, and William Clark as a board member.

5. The 1967 Conference

The 1967 conference in Garden City NY was the first real URISA conference. Substantively, the 1967 conference showcased issues emerging from preparations for the 1970 census of housing and population, which was to be the first mail out/mail back enumeration process. We heard reports from the census bureau's geography division about preparations of Address Coding Guides (ACG) to convert street addresses to census tracts and blocks, and from a new data access and use unit about developing plans to disseminate census data on summary tapes.

In addition, Caby Smith brought his staff from the New Haven Census Use Study, who reported on their research applications of Dual Independent Map Encoding (DIME) that provided error detection of street network data files for use in street address translation to census geographies and other small areas and point locations. This started a contentious relationship between the Bureau of Census and its use study creation that continued when the New Haven staff moved to Los Angeles in the form of the Southern California Regional Information System.

The proceedings also contain papers on a variety of other topics. There were papers on social indicators, health systems, and invasion of privacy. There were also papers on information systems for regional planning and management, including an insightful paper by Charles Laidlaw, Regional Planning Council: Baltimore, critiquing information systems for regional management. He presented danger signs and problems in the world of information systems and systems analysis, including the difficulty of analyzing large number of alternatives, over-promising and over-committing, considering the model as the real world, resistance to change, over confidence in machines and methods, running a model is not a decision, and garbage in yields garbage out.

There were also technology papers on scanning, digitizing, plotting, and computer graphics.

6. Conclusion

The first four proceedings provide evidence of substance and a broad range of topics that has provided an on-going agenda for URISA.

8

URISA PROCEEDINGS, 1968-1978: A DEFINING CONTRIBUTION TO URBAN AND REGIONAL INFORMATION SYSTEMS AND GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE

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Abstract. The 1968-1978 URISA conference proceedings made fundamental, far-reaching, and longstanding contributions that significantly affected and continue to affect the structure, function, use, impact, value and reputation of urban and regional information systems and geographic information systems and science. And, to focus on a matter of increasing importance over the past decade or so, those proceedings establish and elaborate many of the foundations which underlie the increased regard for urban and regional information systems and geographic information systems as essential infrastructure in urban societies. In this paper I identify some of the original thoughts, principles, axioms, and practices presented in the 1968-1978 URISA conference proceedings, and I also outline why I believe that these proceedings represent must-read materials for anyone wanting to better understand the people, forces, and dynamics responsible for the creation, emergence, and widespread professional recognition that is being accorded to urban and regional information systems and geographic information systems and science.

1. Background

I attended my initial URISA conference in 1968, and made my first conference presentation in 1969 at the meeting in Clayton, Missouri. Over the next 40+ years I made many presentations at URISA conferences, published in URISA News, the URISA Journal, and a number of conference proceedings, and I participated in various activities as a board member, special interest group leader, and as chair and/or a member of the workshop committee, education committee, policy committee, publications committee, marketing committee, program committee, and so on.

I am of course pleased that my long-term involvement in URISA lent itself to several suggested contributions to mark URISA's record of achievement as we celebrate the organization's 50th anniversary conference. However, for personal and professional reasons, I believe that one way in which I am best able to contribute to elaborating the URISA record of achievement is by focusing on the years 1968-1978.

Three reasons in particular account for a focus on the 1968-1978 time span, and the design of the paper. Further, I believe that the following discussion of the reasons will be informative for readers who were not attending URISA conferences at that time, who may not have read one or more of the 1968-1978 proceedings, and who may have very little appreciation of the early thinkers behind the thoughts that have played major roles over the past 40+ years in defining urban and regional information systems and geographic information systems and science.

2. Why the Emphasis on 1968-1978?

First and foremost, these were exciting years for me to be associated with URISA, and I expect that many of the younger readers and perhaps even some of the older ones can relate to this brief summary of serious career-related changes that I experienced during that time span:

- 1968-1969, completing a PhD degree in Geography, Northwestern University, with financial support through scholarships and research assistantships sponsored by Canada Mortgage and Housing Corporation, National Aeronautics and Space Administration, (NASA), U.S. Geological Survey (USGS), and Bureau of Public Roads (BPR,) and involvement with agencies such as Bureau of the Census, Department of Health, Education, and Welfare (DHEW), and the President's Commission on Urban Problems.
- 1969-1972, Assistant Professor (Geography), Research Associate (Institute for Social and Environmental Studies), and Research Scientist (Lab for Space Technology), University of Kansas.
- 1972-1979, Senior Research Officer, Urban Information Theme Coordinator, Assistant Director of Data Processing, Director of Non-Metropolitan Community Development, and Senior Policy Advisor, Ministry of State for Urban Affairs, Government of Canada.
- 1972-1979, Director, Vice-President, President-Elect, President, Past President of URISA, and program chair, 1977 URISA conference.

To use a sports cliché, those years were "game changers" for me personally and professionally, and this paper is an appropriate way to acknowledge many of the key thinkers and thoughts behind the changes.

Second, I was very fortunate to have been introduced to URISA and the information systems field shortly after entering graduate school in 1965, and to have been allowed/encouraged/retained to continue that interest throughout the 1968-1978 time span in various education, research, and applications endeavours.

Further, during my time on the URISA Board from 1972 to 1979 I took great interest in analysing and documenting how URISA conferences contributed to my professional work environments and, conversely, how my work environments contributed to conference programs, presentations, and papers, as well as to the business of URISA.
This paper is an opportunity to give credit to whom and where credit is due, not just from me but from everyone who has benefitted from the exceptional amount of thinking and doing that marked the surge of URISA during the 1968-1978 time span when it

emerged as the foremost association of academics, government officials, and private sector individuals and enterprises involved in defining the field of urban and regional information systems and geographic information systems and science.

And, third, reasons one and two combine to create reason three, which revolves around the question "What were they thinking?" The pertinence of this question to the decision to select the years 1968-1978 for a contribution to documenting the history and evolution of URISA can be outlined as follows.

Current, recent, and likely even long-ago PhD candidates are familiar with the concern that a dissertation proposal involves original research, and that literature searches and reviews are comprehensive and complete when it comes to identifying anything that could discount the validity of a dissertation's research question, and/or the research funding proposals that might flow from a dissertation.

When I was a graduate student caught up in the challenging task of building and maintaining a "What were they thinking?" mindset, URISA conferences were an invaluable addition to the suite of available information resources. Simply put, they were an excellent venue for meeting and asking leading academic and government researchers about their work, and whether they or anyone they knew had already done or proposed doing what I had in mind for my dissertation research design.

For the record, and to underline the importance of the arrival of URISA conferences, Google and electronic search engines <u>did not exist</u> during the 1968-1978 time span. As a result, back then students (and other researchers) went to libraries and read books, sent snail mail letters, made telephone calls, visited offices, attended seminars and/or workshops and, resources permitting, went to national conferences to hear things "directly from the horse's mouth".

Fast-forwarding 40 years, I continue to be interested in finding out what leading thinkers were thinking when they engaged in educational, research, or applications initiatives associated with urban and regional information systems and geographic information systems and science. However, I credit much of this abiding interest to the fact that during the 1968-1978 time span URISA conference programs and proceedings offered something that in my experience was not available elsewhere:

> A steady, high-quality mix of curiosity-driven and client-driven productions (Wellar, 2010); that is, presentations, papers, workshops, and special interest group discussions on all manner of education, research, and applications, thoughts, issues, questions, experiences, etc., associated with urban and regional information systems and geographic information systems and science.

By focusing on the question, "What were they thinking?" this paper recognizes some of the thinkers from 1968-1978 who not only shaped many subsequent URISA conferences and proceedings, but also played a major role in shaping urban and regional information systems and geographic information systems and science.

3. Design of the Overview

It is anticipated that at some point in time, and preferably sooner rather than later, the URISA conference proceedings which are currently paper documents will be digitally accessible. As a result, in this paper I do not repeat tables of contents or other details that are best viewed in their larger contexts.

Rather, emphasis is on describing and explaining when possible what conference program chairs and their colleagues, as well as others responsible for programs and proceedings were thinking when they selected themes, speakers, session topics, venues, etc.

It is expected that this kind of interpretive approach will provide a valuable and informative context for those examining URISA proceedings for the first time. And, it is further expected that this approach will enable me to give credit where credit is due. That is, to acknowledge, seemingly for the first time in some cases, the major contributions that URISA's 1968-1978 conference thinkers made to defining the field of urban and regional information systems and geographic information systems and science.

Accordingly, for each year the conference chair and program chair are identified, and then I present my interpretation of the thinking/thoughts behind the respective conferences and conference productions.

As for the interpretations, there is a twist that cannot be over-emphasized. That is, they are based on my situation at the time. So, for example, in 1968 I was a PhD candidate at Northwestern University, and that is the perspective for my interpretation of the thinking and thoughts that distinguished the 1968 conference. Further, by the time of the 1978 conference I was Senior Policy Advisor, Ministry of State for Urban Affairs, Government of Canada, and my impressions of the state of thinking and doing in the field of urban and regional information systems and geographic information systems and science had changed significantly since my graduate school days.

However, and as outlined in Section 2, during the 1968-1978 time span I was actively involved in the conceptualization, design, development, implementation, transfer, evaluation, application, and other aspects of urban and regional information systems and geographic information systems and science. Further, from 1972 through 1979 I was engaged in URISA Board and related matters.

I am therefore confident that in combination my career-related activities and my involvement with URISA allow me to fairly and accurately overview the defining contributions which the 1968-1978 URISA proceedings made to urban and regional information systems and geographic information systems and science.

Finally, a brief Retro bio-note is included at the end of each proceedings statement. In this way the reader has a context for my remarks regarding the thinking behind individual conferences and the 1968-1978 conferences as a set.

3.1 URISA 1968 Conference: *Papers from the Sixth Annual Conference of the Urban and Regional Information Systems Association – Urban and Regional Information Systems: Federal Activities and Specialized Systems* (Rickert, 1968)

The 1968 conference chair was Barclay Jones, Cornell University, and the program chair was Ed Hearle of Booz, Allen and Hamilton.

The 1968 URISA conference was a major event in my graduate school days, and answers to the question "What were they thinking?" were of critical significance to my dissertation, and to my career path upon impending graduation in 1969.

From a dissertation point of view, what I needed to know was whether anyone was thinking in ways that would pre-empt or throw a wrench into the originality of my research. As it turned out, a number of presentations contained what I regarded as original research, and many of them complemented or supplemented or could build on my research (A Program for Selection and Acquisition of Housing-Environment Data), but no one introduced anything to cause me originality concerns.

On the other hand, URISA '68 was an eye-opener for me in terms of the many different and frequently original ways that people from universities, governments, and business were thinking about various aspects of *Urban and Regional Information Systems: Federal Activities and Specialized Systems*. It was my impression at the time that the ratio of original to derived research thinking presented at URISA '68 was very high, and a recent review of the 1968 proceedings confirms that impression.

As for the career dimension, the preceding three years had been a rewarding graduate student experience: the combination of classes, course assignments, and funded project tasks allowed me to engage in both curiosity-driven and client-driven research from design through to development and applications. Good stuff, but could it be continued?

The Census Bureau got on a serious roll at the URISA '67 meeting, and continued into 1968 with another batch of papers involving all kinds of research issues, ideas, questions, problems, approaches, you name it. The 1970 census was on the immediate horizon and it seemed that many if not most people at the meeting were thinking about census-related opportunities and challenges.

However, it was my perception that Royce Lowry and Rod Symmes were taking things in a new direction at URISA '68 when it came to thinking about *Urban and Regional Information Systems: Federal Activities and Specialized Systems.*

Their papers, "Federal activities affecting urban and regional information systems: Survey, issues, and plans" by Lowry (1968), and "How to marshall federal agency programs to help urban information systems" by Symmes (1968), were very assertive, very ambitious. It was my impression that they were either dropping a lot of hints, or were actually presenting a serious "heads up", regarding the Urban Information Systems Inter-Agency Committee (USAC) project that was launched the following year. Either way, URISA '68 attendees were among the first information systems people to learn about the possibility of the USAC project.

Finally, the influence of the thinking behind the 1968 conference was not of the "one-off" variety. URISA Presidents involved in the Wichita Falls USAC project which was introduced to URISA in 1968 included Ed Hearle, who was also program chair of the 1968 conference, William Mitchell, Jerry Fox, Bob Aangeenbrug and Barry Wellar. Moreover, a number of future URISA Board Members also participated in the Wichita Falls project or one of the other USAC projects.

Retro Bio-Note: This perspective comes as a result of attending my first URISA conference in 1968, but the lead-in to my attendance began in the Fall of 1965 when I started graduate studies at Northwestern University. Courtesy of Duane Marble and Bill Garrison, I became an early member of URISA, and I was given copies of proceedings and other background materials, including productions of Edgar Horwood.

Further, by 1968 I had been a research assistant on three years of projects that tied in directly with the theme of the 1968 conference, and had written research reports for and/or exchanged project-related communications with officials from the National Aeronautics and Space Administration, Geological Survey, Census Bureau, Housing and Urban Development, Health, Education and Welfare, and the Bureau of Public Roads at the federal level in the U.S., and Canada Mortgage and Housing Corporation.

3.2 URISA 1969 Conference: *Papers from the Seventh Annual Conference of the Urban and Regional Information Systems Association – Urban and Regional Information Systems: Service Systems for Cities* (Rickert and Hale, 1969)

Ed Hearle of Booz, Allen and Hamilton was the 1969 conference chair, and Bob Barraclough, consultant, was program chair.

During the 1960s the phrases "urban problem" and "urban crisis" were frequently used to characterize various aspects of things gone and going wrong in U.S. cities. And, they were also in use to a lesser degree in other countries, including Canada.

The 1969 conference occurred after the release of several major reports in 1968 detailing the social, economic, fiscal, political, and institutional situations of cities across the U.S., and in large measure set both the tone and the terms of reference for several URISA conferences. Examination of just the following documents should be sufficient to inform anyone reading the proceedings that adopting the theme "Service Systems for

Cities" marked the decision by URISA to get into the ring with the policy, plan, and program heavyweights of urban and regional development in the U.S.

- National Commission on Urban Problems (1968a). *Building the American City*.
- National Commission on Urban Problems (1968b). *Hearings.* Volumes 1, 2, 3, 4, and 5.
- U.S. Senate (1968). *Federal Role in Urban Affairs.* Volumes 1-20.

URISA and its members had received a heads up about USAC at the 1968 conference, and when these and dozens of other, related reports also came out in 1968, the organization had to either fish or cut bait. In short, would it get into the midst of it all, or play at the margins? URISA chose to enter the fray, and the 1969 conference set wheels in motion for a number of conferences to follow over the next decade.

As older readers may recall from personal and professional experience, in the 1960s in the U.S., Canada, and other countries, housing was a core issue in every aspect of the national fabric – social, economic, political, health, business, crime, you name it. Fortunately, URISA already had good connections with the Census Bureau, so it had a foot in the door when it came to housing data generation, analyses using housing data, and housing data applications.

Further, readers who were around at the time will no doubt also recall their experience with various federal programs, including urban renewal, model cities, 701, metropolitan land use planning, and continuing transportation planning, to name a few. And, they will also recall that the money was not a free good. The agencies as a matter of course attached data-related and information-related requirements to the programs.

Regrettably, federal agencies as a rule did not coordinate their data/information requests in a top down, coordinated manner. As a result, municipal governments struggled to create the bottom up data/information needed to obtain federal program funding, monitor and evaluate project progress, submit required status reports and, simultaneously, provide the management, planning, and operations services expected of them by citizens, businesses, and other interested parties, including the state governments.

The thinking behind *Service Systems for Cities* was that cities needed to get out front with their own agenda, and that included taking the lead in framing the discussion about information systems.

As demonstrated in the proceedings papers, management information systems serving elected officials and senior administrators was a featured topic, and a regional perspective was frequently applied to a variety of service delivery functions (e.g., health, public safety, criminal justice, social services, districting).

In addition, however, there seemed to be a prevailing sense that if federal programs are to properly flow through municipal governments to reach citizens, then there needs to be higher regard for and better thinking (at all levels of government) about how information systems work, how service systems for cities work, and how information systems support service systems for cities. The 1969 conference was an important step towards putting in perspective some of the fundamentals which are identified in the documents listed for context purposes.

Finally, my thinking about the 1969 conference (and subsequent conferences) was significantly affected by a meeting in 1968 in Washington with former U.S. Senator Paul Douglas and other members of the President's Committee on Urban Problems.

At the invitation of the Committee I discussed my research on housing and its environment as an element of the urban condition, as well as alternative means of incorporating housing and its environment data in urban information systems.

According to Dr. Douglas, this "new" research on urban information systems was crucial to dealing with the urban problem, and his remarks persuaded me that involvement in URISA should mean a lot more than just publishing papers.

That is, the organization needed to be a force for change. *Urban and Regional Information Systems: Service Systems for Cities* was a step in the force-for-change direction, and also provided some very instructive food for thought about the impending Integrated Municipal Information System project funded by the Urban Systems Inter-Agency Committee (USAC).

Retro Bio-Note: By the time of the URISA conference in 1969 I was winding up my graduate school experience at Northwestern, and preparing for my engagement at the University of Kansas. I had negotiated an appointment which included a half-time research component to be portioned among Geography, the Institute for Social and Environmental Studies, and the Space Tech Lab, so setting out a research program turned out to be a serious introduction to the concept of a "work in progress".

After getting my feet wet at URISA '68, making contact with organizers and presenters at URISA '69 came relatively easily, and particularly because many of them knew my former professors Duane Marble and Bill Garrison at Northwestern. And, seemingly they all knew Bob Aangeenbrug who had taken the lead in achieving my appointment at Kansas.

Following discussions with Bob my focus for URISA '69 was to identify the players and ideas most likely to serve my immediate and longer-term research interests. And, we also agreed that it would be prudent to have ideas and names of people "in the bank" should there be a need to ask for more resources from any of my three immediate KU employers, or from senior KU administrators who had funding authority. Research topics on the table included GIS, a municipal information systems initiative created by the federal government (turned out to be USAC), environmental assessment methodology, census practices, and a geographically-based land use and physical infrastructure monitoring system.

3.3 URISA 1970 Conference: *Papers from the Eighth Annual Conference of the Urban and Regional Information Systems Association – Urban and Regional Information Systems: Past, Present, and Future* (Rickert and Hale, 1970)

The 1970 conference chair was Robert Barraclough, consultant, and Wilbur Steger, President, CONSAD Research Corporation, was program chair.

During the decade of the 1960s, the urban and regional information systems field experienced a significant surge of activity. Indeed, presentations at URISA conferences, other conferences, and among government officials at all levels were increasingly lamenting or cautioning that things were moving too quickly, that mistakes were being made that should not have happened, lessons learned were not being adequately documented and then widely and quickly disseminated, etc.

Bearing in mind that that communications were relatively slow and relatively expensive, that expertise and experience were in relatively short supply, and that funding was tight, there were good reasons behind the lamenting.

The thinking behind the 1970 conference to my recollection was that URISA needed to take a time out of sorts, that is, to undertake a serious stock taking, which included calling on presenters to do some deep thinking about where the field had been for the past decade or so, where it was at as of the 1970 conference, and where it would be, could be, or should be going in future years.

By way of a brief comment on the problem of too many balls in the air, and hence the call for a time out, or maybe just a deep breath to gather its wits, the 1970 census was in process, automated geocoding was a rapid-growth industry, the USAC project was in process, a batch of federal housing, urban development, transportation, and other programs were being introduced and modified, and NASA was opening a whole new set of windows on the world with its satellite imagery. Under the circumstances, a step-back and re-think conference was a very practical approach to getting a handle on or perhaps a better grip on the field of urban and regional information systems.

In addition to making practical good sense, however, it was my impression that there was a scientific inquiry or research methodology undercurrent in the thinking behind the 1970 conference.

That is, a number of the presenters cut to the science chase by discussing whether, why, and how their work or their papers added to knowledge, added to ways and means of continuing to add to knowledge, or did both. And, I hasten to add, these presenters were very established members of the urban and regional information systems community, so they fully understood the importance of building block research, and the cumulative nature of scientific inquiry.

In my case, having completed a dissertation in 1969, I had a particular interest in the role that science and research methodology had played, was playing, and would, could, or should play in the design, development, implementation, use, and management of urban and regional information systems. The 1970 conference confirmed that when compared to other organizations to which I belonged, URISA was the one which best combined the curiosity-driven and client-driven agendas of academics, consultants, vendors, and public officials.

However, and most likely due to the fact that there were only six previous proceedings, the conference theme of past, present, and future did not seem to apply directly to URISA itself. That is, presenters tended to pick a functional, structural, institutional, political, technical, technological, operational, methodological, etc., topic of interest, and give it a past, present, and/or future treatment. Further, upon re-examining the proceedings, I did not locate a paper "benchmarking" URISA's progress or evolution.

As a closing note, there are about 40 papers covering some 470 pages of text in the 1970 proceedings. It was and is my impression that the best original thinking about urban and regional information systems occurred in the 1960s and 1970s. This conference was smack in the middle of that era, and all 40 papers are worth a careful read for those who want to know more about the earlier thinking behind today's doing in regard to urban and regional information systems.

Retro Bio-Note**:** At the time of the 1970 conference I was at the University of Kansas as an Assistant Professor, Department of Geography, with cross appointments to the Institute for Social and Environmental Studies and the Space Tech Lab. In addition to launching GIS courses with Bob Aangeenbrug I continued my involvement with the Census Bureau, and I participated in the USAC action as a member of the University of Kansas, Booz, Allen Systems (BASYS) Inc., and Wichita Falls, Texas consortium that was funded to conduct an integrated municipal information systems R&D project, 1970-1973. Further, as co-investigator with Frank Cross, State Biological Survey of Kansas, for the *Environmental Inventory of the Grand (Neosho) River Basin,* which was undertaken for the U.S. Army Corps of Engineers, I was involved in the early days of environmental assessment and constructing geographic base files.

3.4 URISA 1971 Conference: *Papers from the Ninth Annual Conference of the Urban and Regional Information Systems Association – Urban and Regional Information Systems: Information Systems and Political Systems* (Rickert and Hale, 1971)

The 1971 conference chair was Wilbur Steger, CONSAD Research Corporation, and the program chair was John Beresford, Census Bureau.

Politics, policies, and politicians in political parties, governments, government agencies, academic organizations, professional organizations, and other formal and informal institutions received regular mention at every URISA conference since its inception. As a result, it made eminent good sense to have *Information Systems and Political Systems* as a conference theme.

As Wil Steger and John Beresford were fully aware, the essence of political systems (federal/central, state/provincial, regional, municipal) in 1971 was as it is today, that is, policies, programs, plans, and projects. And, as they were also fully aware, the utility of information systems to political systems in 1971 was measured pretty much the same way as it is today. That is, how well did they contribute to articulating and achieving policy, program, plan, and project objectives, with effectiveness, efficiency, economy, equity, public participation, public safety, and quality of life among the measures employed in 1971 to evaluate information system inputs and performance.

Further, and no one was naïve about it, the utility of information systems to politicians also had a narrower aspect. That is, politicians had and still have the same self-interest in information system infrastructure as in any other piece of public infrastructure, and their measuring stick can be illustrated by the question,

"How well does my support for information systems serve my political career?"

Two lines of comment illustrate some of the thinking behind the 1971 conference.

First, the 1971 proceedings contain papers on information systems and political systems representing all levels of government. This balanced mix was consistent with URISA thinking about the interdependencies among governments at all levels in democratic societies. As cases in point: the standardization issues paper by Wellar and Parker (1971) tied work done on standards for the Wichita Falls, Texas USAC project with the protocols and procedures of the Office of Management and Budget (OMB); papers by Lyon (1971), Hysom (1971), Stevens (1971), and others discuss linkages among municipal, county and metro government systems; and a dozen papers connect census data with local government data.

Second, the thinking behind the 1971 conference also demonstrated a certain grasp of the need to clearly relate URISA activities to the politicians and politics of political systems. Many papers went outside or beyond technical and technological matters, and gave due consideration to the social, economic, and financial concerns of ordinary people, which in turn could become problematic for politicians if solutions to concerns are not found. Very pragmatic stuff.

Finally, back in 1971 when *Information Systems and Political Systems* was announced as the conference theme, I puzzled over how the theme related to Canada's motto of "Peace, Order, and Good Government", and the U.S motto of "Life, Liberty, and the Pursuit of Happiness".

By the end of the conference, however, it seemed that the mottos were referring to many of the same things when it came to *Information Systems and Political Systems.*

Interesting what one can learn by attending URISA conferences and reading URISA proceedings.

Retro Bio-Note**:** As an assistant professor at Kansas with appointments in three units (Geography, Institute for Social and Environmental Studies, Space Tech Lab) I was dealing with daily, academic doses of *information systems and political systems.* And, as a senior researcher for the University of Kansas, Booz-Allen, and City of Wichita Falls consortium that had been contracted for work on the USAC (Urban Information Systems Inter-Agency Committee) project, my exposure to *information systems and political systems* included the inter-governmental and inter-institutional aspects, but it also put me in the midst of the politics of the public-private partnership approach to designing and implementing information systems.

3.5 URISA 1971 Conference: *Geocoding-71. Papers from the Working Session on Geographic Base File Developments* (Cooke, 1971)

The 1971 conference chair was Wilbur Steger, CONSAD Research Corporation, and the program chair was John Beresford, Census Bureau. The *Geocoding-71* track was sponsored by the Special Interest Group-Geographic Base File (SIG-GBF), and was held as part of the 1971 conference.

The SIG-GBF development chair was Don Cooke, Urban Data Processing Inc., who organized the working session and oversaw production of *Geocoding-71: Papers from the Working Session on Geographic Base File Developments.*

The term "working session" was appropriate because the proceedings consisted of an introduction by Don Cooke, and fifteen, 2-5 page briefs on works-in-progress projects and activities, or summaries of conference papers. The proceedings concluded with a list of SIG-GBF members who were from Canada, England, France, Germany, Greece, India, Japan, Norway, Republic of South Africa, Spain, Switzerland, and 44 states and the District of Columbia in the U.S.

As might be expected, the vast majority of time and thought expended during the working session was on technical and technological matters, and I return to those considerations in the remainder of my perspective.

However, it warrants explicitly noting that presenters were fully aware of the politics of information systems, and that future funding for geo-based systems and services depended on creating tools that elected and appointed officials could understand and use. Those were serious days back in 1971, and "Tinker Toys" were not on the buy list.

There were about 75 attendees at the *Geocoding-71* working session. Of the fifteen papers presented, 13 were on thinking about the past, present, and future of the U.S. geocoding story, and there was one presentation from each of Canada and Germany.

On day 1, presentations by Bill Fay, Ron Crellin, and Jim Corbett and George Farnsworth of the U.S. Census Bureau outlined the thinking behind many of the issues, initiatives, challenges, and opportunities surrounding the agency's experience with the design, development, and implementation of geographic base files.

These presentations were in part elaborations or variations of papers on address coding guides, the Dual Independent Map Encoding (DIME) system, geographic base files, data standards of various kinds, and other geocoding topics at previous URISA conferences.

However, the reality was that due to the very difficult nature of the beast, research on geographic base files in the late 1960s and early 1970s was in a very fluid state. As a result, Bureau presentations at *Geocoding-71* included continuation and refinement of the discourse on GBF pre-tests, pilot studies, trial runs, and prototypes.

[Aside: The pre-test, pilot study, and trial run language behind Census activities in the 1960s and 1970s was consistent with the works of research methodologists such as Russell Ackoff (1953). However, in my experience Ackoff's book (The Design of Social Research) and similar research methods books have been read by a relatively small proportion of university students in such domains as the natural and social sciences, engineering, public administration, and planning.

It is small wonder, therefore, that in 2011, some 40 years after Geocoding-71, media stories continue to reveal that elected and appointed officials in governments at all levels in Canada, the U.S., and elsewhere have a very limited and often erroneous understanding of what the three phases of research design actually mean in structural and functional terms. And, in a related vein, it should come as no surprise that, as a result of such a shortcoming, some of these officials approve and undertake projects which cannot logically yield the evidence needed to make an informed decision of a policy, plan, program, or operational nature.

Back then, it was my perception that the Bureau was practising good methodology, end of story, but there may have been more to the Bureau agenda than met my eye. That is, the Bureau may have been encouraging more rigorous thinking among a lot of people who, unfortunately, found that to be an extremely difficult if not impossible task.]

And, as if complexity was not enough, conducting the first (U.S) national census (1970) by mail added to the pressure to get all the bits and pieces and players and processes in place to establish an up-and-running, nation-wide geographic base file. Interesting times indeed, at the Bureau, with much to think about.

Day 2 burned through about a dozen papers on various geocoding topics and experiences, and represented the thinking of academics, consultants, and members of local governments.

Some of the papers complemented or supplemented the day 1 offerings, and others presented new takes on geocoding education, training, research, and applications. The constant theme was high regard for the geographical concepts underlying geocoding principles and practices.

Review of *Geocoding-71* some 40 years after participating in the working session reminds me of the large amount of original thought, earnestness, dedication, and open-mindedness that was manifest during the two-day event.

Retro Bio-Note: As an assistant professor at Kansas with appointments in three units (Geography, Institute for Social and Environmental Studies, Space Tech Lab), one of my tasks was to conduct research for the University of Kansas, Booz-Allen, and City of Wichita Falls consortium that had been contracted for work on the USAC (Urban Information Systems Inter-Agency Committee) project.

Geocoding-71 was of particular interest to me because I had prepared the data standardization section of *Wichita Falls Consortium Phase II Report, Volume XII, Conceptualization Themes: Transferability, Data Standardization, Confidentiality, Geographic Information Systems* (Wellar, 1970a, 1970b). Further, I had worked with Bob Aangeenbrug on the geographic information systems section in the Consortium report, and on his *Geocoding-71* paper (Aangeenbrug, 1971). Of particular interest from an operational and professional standpoint was the feedback that was received on the work that had been done, and the many references to or suggestions about work that could have been done and perhaps should have been done had time and resources permitted us to extend our original work.

Overall, then, the *Geocoding-71* document and the working session discussions provided very informative feedback on our geocoding-related activities in Wichita Falls, and included a number of bright thoughts to consider incorporating in projects and research proposals at the University of Kansas.

Moreover, and following on from a very rich graduate experience at Northwestern where a number of faculty members and invited lecturers encouraged students to push the envelope, the *Geocoding-71* experience confirmed that there is nothing like a run with the big dogs to learn just how well they can run, and to appreciate what separates the big dogs from the rest of the pack.

3.6 URISA 1972 Conference: *Papers from the Tenth Annual Conference of the Urban and Regional Information Systems Association – Urban and Regional Information Systems: Information Systems for an Urban Society* (Rickert, *et al*, 1973)

The 1972 conference chair was John Beresford, Census Bureau, and the program chair was William Mitchell, Claremont Graduate University.

URISA previously met in San Francisco in 1965, and by the time it came to thinking about meeting there again in 1972 significant changes had occurred to the urban and regional sphere in general, including the information systems component.

In particular, by the time of the early 1970s the term “urban” had gone beyond being widely regarded as some vague conceptual notion, and had moved into the realm of operational reality, and especially of the problem kind, as in urban transportation problem, urban housing problem, urban poverty problem, urban unemployment problem, urban crime problem, urban water problem, urban waste management problem, and so on.

Whereas, it was increasingly being recognized that the process of urbanization could itself be a problem, such as when the rate of demographic, economic, and social change significantly exceeds the take-up capacity of receiving communities, or when the shift to urban centers causes serious out-migration of people, jobs, enterprises, etc., from smaller communities and rural areas.

In the run-up to the 1972 conference, preceding conference themes connected information systems with political systems, service systems for cities, federal activities and specialized systems, social programs, planning, and policy decisions.

The 1972 theme of connecting information systems and an urban society was a neat way to tie together a lot of loose ends, but it was also a tactical way of staking URISA's claim to the word urban, as in urban and regional information systems.

As for major changes in urban and regional information systems over the seven years, they included: the results from the decennial census (1970 in the U.S., 1971 in Canada, either of those years in other countries) which continued to roll in (see the *Geocoding '71* proceedings perspective for insights); rapid growth in the numbers of research reports from the six USAC project sites; a considerable amount of R&D and application activity in non-USAC sites; and an expanding, keen interest in information systems evaluation methods, implementation procedures, and transferability issues.

The 1972 proceedings (volumes I and II) contain more than 90 papers and about 1,000 pages of text. The conference attendance was a new high at about 500, and the conference participation rate was high at about a paper for every five attendees.

In terms of an urban society context, URISA '72 was the genuine article in that many presentations were by people who were speaking from a demand point of view or, to re-phrase, laying the foundation for a client-driven, urban-oriented information systems research and applications agenda.

As for members of the information systems community, a review of the proceedings assists in recalling why their 1972 presentations were so useful in my research and advisor roles at Urban Affairs.

Even as information systems were being adopted, there was considerable grumbling (to put it mildly) in governments, businesses, and universities about the attitudes of information systems firms and proponents for being of the "I have a solution, what's your problem?" mindset.

The 1972 conference may have been a breakthrough meeting for URISA, because many of the presenters from the IS/IT community did show increased regard for serving the interests of an urban society, and to better identifying the clients and constituencies for their products and processes.

Further, and consistent with its record of leading edge information systems research, development, and applications reporting, the URISA ’72 program was “wide open” through inclusion of presentations on such varied topics as USAC project progress, impact assessment methods and techniques, interchange protocols for data and information sharing, public participation, privacy and confidentiality, and numerous things “geo”, including databases and base files, coding, processing, etc., etc.

I made frequent and in-depth use of the ’72 proceedings within Urban Affairs and the rest of the federal government, and also referred the proceedings to provincial and municipal offices across Canada. As a result, my answer to the question “What were they thinking?” is “No small thoughts, and thank you one and all very much for your contributions to my job”.

Closing comment: I believe that putting the proceedings online could be an excellent resource for ascertaining how many doctoral and masters’ theses can be traced back to papers in URISA proceedings, and I expect that URISA ’72 will get a lot of “hits”.

<u>Retro Bio-Note</u>**:** By the time of the 1972 conference I had been recruited to return to Canada to a posting as Senior Research Officer, Research Branch, at the recently-created Ministry of State for Urban Affairs.

One of the reasons for my recruitment was my involvement in information systems, and I was tasked with bringing my expertise and experience in information systems and research methodology not just into the Research Branch, but also to assist and advise members of the Policy Branch and the Coordination Wing, and to provide support to other federal agencies, as well as to provincial, regional, and municipal governments.

Fortunately for me the thinking behind the URISA 1972 conference connected directly and immediately with my role at Urban Affairs, which included adding to the ways that information systems could better serve an urban society.

3.7 URISA 1973 Conference: ***Papers from the Tenth Annual Conference of the Urban and Regional Information Systems Association – Urban and Regional Information Systems: Perspectives on Information Systems*** (Rickert, *et al*, 1974)

The 1973 conference chair was William Mitchell, Claremont Graduate University, and the program chair was Gerald Fox, City of Wichita Falls, Texas.

By the close of the very successful 1972 conference in San Francisco, URISA as an organization had a lot of balls in play.

These balls in play, which were sometimes referred to in the context of "running such-and-such up the flagpole to see who salutes", included partnering with another organization, establishing a secretariat, starting a quarterly journal, reconciling the role of special interest groups (SIGs) within the URISA structure, and dealing with the growing pains of a small, relatively modest association (annual member dues of $13 and an annual budget of about $35,000) which was perceived to be coming of age as a professional society in a field that was gaining international acceptance among public agencies at all levels, was causing a stir in business circles, and was becoming the premier venue for substantive academic papers on the topic of urban and regional information systems.

For the 1973 conference the initial thinking was to hold it in Washington D.C., so that attending members could physically connect with "information system friendly" agencies such as Census, HUD, OMB, USGS, HEW, NASA, TRB, and USDA. And, if memory serves, it was anticipated that being in Washington could contribute to the search for funding from foundations and/or federal agencies. However, that arrangement did not come to pass, and the conference was held in Atlantic City.

Nevertheless, a "Washington presence" made itself felt throughout the conference, and the Perspectives theme provided plenty of room for inputs. More than 40 papers and about 525 pages of text were organized around the sub-themes of government user or function perspectives and government jurisdiction perspectives, as well as information exchange sessions, and a half-day was allotted to workshops (e.g., census data and census use, geocoding, confidentiality, transferability, and cost-benefit analysis), and a half-day to SIG sessions (e.g., industry and utility data generation, use, and exchange; data standardization; evaluation methodologies; and state/regional land and natural resource information systems).

<u>Retro Bio-Note</u>**:** I joined the URISA Board at the 1972 conference, and by the time of the 1973 conference I had completed my USAC project assignments, was named Urban Information Theme Coordinator at Urban Affairs, Canada, and was serving on a number of inter-departmental, inter-governmental, and international committees and panels on computer/communications, statistics, social indicators, modeling and simulation, information technology, and information systems.

3.8 URISA 1974 Conference: *Urban and Regional Information Systems – Resources and Results* (Davis, *et al*, 1975)

The 1974 conference chair was Gerald Fox, City of Wichita Falls, Texas, and the program chair was George Farnsworth, U.S. Census Bureau.

The 1974 meeting in Montreal was the first URISA conference outside the U.S. As a member of the program committee and the person responsible for the Urban Information Theme program at the Ministry of State for Urban Affairs, Government of Canada, I had a "career affecting" insider role in the conference.

Specifically, at my request the Secretary of the Ministry agreed to be the keynote speaker on the "results" aspect, and I would be writing much (or likely all) of his paper. I had to answer a lot of questions about URISA, about how the conference tied in with the Ministry's policy, coordination, and research mandates, and how the keynote remarks would play with other federal departments. And, of course, since our agency vied with other departments for funding, it would be good if giving the keynote on "results" had the beneficial side effect of supporting budget requests for resources.

Fortunately for me, George Farnsworth had first-hand knowledge about the intricacies and significance of the resources and results relationship. And, for that matter, so did every member of the program committee. (Bob Aangeenbrug, Jack Barrett, Sid Brounstein, Carolee Bush, Carl Davis, Dani Emery, Ruth Kaplan, Ruth Kemper, Jon Rickert, Caby Smith, Mike Weaver, Myron Weiner, Barry Wellar). Perhaps the fact that everyone named to the committee either worked for, or had experience working with the Census Bureau, was more than mere coincidence!

As emphasized in the Call for Papers, the "hot button" word for 1974 was <u>relevant</u>, and the focus was on papers containing materials that directly and meaningfully contributed to elaborating the resources-results relationship in operational terms. Two days started off with keynotes on resources and results, respectively, to set the tone for the conference program, and then the selected papers provided real-world, operations-based discussions of resources and results.

The thinking in this regard that I recall was a variation on the adage, "Tell them what you are going to do, do it, and then tell them what you have done". Contrary to many keynote presentations in which the keynoter is often given free rein, at URISA '74 the keynoters were given their topics, the papers supplemented and complemented the keynotes, and the panel sessions were organized around the twin conference themes of resources and results.

As to the topics discussed in the keynotes, papers, and panels, the phrase "*<u>Plus ça change, plus c'est la même chose"</u>* comes to mind. That is, while mainframes were the underlying information technology of the day, and great technological and technical changes occurred in the information systems field over the intervening years since 1974, the discussions about resources needed and available and results needed and achieved have changed relatively little in terms of fundamentals.

My closing comment, therefore, is to refer readers interested in straightforward, relevant discussions about the resources and results aspects of information systems, and I mean all kinds of information systems, to the 1974 URISA proceedings.

The thinking behind the conference program was both well-grounded and forward-looking, and the high-quality results achieved with relatively few resources may be an inspiration to those struggling to do more with less, be more relevant or, perhaps, wanting to connect with some of early return-on- investment (ROI) thinkers in our field.

Retro Bio-Note**:** In my experience it is a rare day indeed when government officials responsible for polices, plans, programs, or projects are not confronted by the relationship between resources and results, and questions and suggestions about bang for the buck, costs and benefits, return on investment, inputs and outputs, more for less, more for more, and so on. The 1974 conference theme of *Resources and Results* and the proceedings papers were therefore smack on the money in terms of the kind of thinking that contributed directly to my mission at Urban Affairs. And, my involvement in the 1974 conference seemingly lent considerable credibility to the policy and research work and advice that I was presenting to Urban Affairs executives, as well as to country representatives of international committees and panels.

3.9 URISA 1975 Conference: *Urban and Regional Information Systems: Computers, Local Government, and Productivity* (Davis, *et al*, 1976)

The 1975 conference chair was George Farnsworth, U.S. Census Bureau, and Don Luria, U.S. Department of Housing and Urban Development, was program chair.

With two “feds” in charge of the conference and program, it was not surprising that the run-up URISA ‘75 was marked by more than a few expressions of dry humour along the lines of changing the theme to “Computers, Federal Government, and Productivity”.

However, by the time the conference (in Seattle) rolled around, it was abundantly clear that the conference committee was well-grounded when it came to thinking about how to achieve informed connections among computers, local government, and productivity.

First, the thinking about productivity was very clear-headed. In 1975 government revenues at all levels in the U.S., Canada, and many other countries were tight and revenue growth was trending down, but demand for local government services was increasing, as was the cost of service delivery.

The focus on increased productivity was therefore on-target: finding ways and means through information technology to maintain or increase the level of services without increasing the unit costs or, preferably, by reducing the unit costs.

In addition to being good business thinking, the “productivity” angle was a solid marketing tool because it clearly put URISA on the side of the value-for-money people, and that was a good side to be on when your products are information and information systems.

As anyone who follows elections campaigns is aware, “buzz words” often become the word bites of choice, and include among their top five such terms or catch phrases as jobs, value for money, and productivity.

URISA ’75 was a campaign for hearts, minds, and memberships, and the thinking was that a focus on productivity was a strong plank to include in the organization’s platform.

Second, formal exhibits were introduced at URISA ’75, with a significant condition. The commercial firm had to include a local government customer as part of the exhibit, with the intent being that the local government representative would provide a real-world assessment of the product or service, and cut down on the amount of “smoke” being blown by vendors.

This was a major venture on the part of URISA which to date had been somewhat leery about exhibitors participating in the annual conference, but the fact of the matter was that members of the private sector had presented papers and served on the URISA Board of Directors within the initial years of the organization being formed.

Third, and being fully aware that the concept of productivity had (and has) huge traction in local governments when a financial aspect is involved, URISA ’75 included a major workshop put on by the Transferability SIG and the Municipal Finance Officers Association (MFOA). Twelve local governments participated in the workshop by making presentations on their experiences in acquiring and using computers for a variety of public finance applications.

Retro Bio-Note**:** In 1975 I was Assistant Director, Information Technology at the Ministry of State for Urban Affairs, which included representing the Government of Canada internationally on OECD panels and committees, and also holding information technology-related discussions with municipal and provincial officials as well as academics across Canada. As a member of the 1975 conference committee, and a much-travelled senior federal bureaucrat who seemed to give a lot of conference presentations, I was in an excellent position to inform my Canadian contacts about URISA in general and URISA ’75 in particular, which offered a massive *potpourri* of topics.

And, I hasten to add in this latter regard, the 1975 URISA conference was another instance in which a substantial amount of pertinent research and information systems applications were being made available for the cost of registration, hotel room, and air fare. The URISA conference itself was therefore an exercise in demonstrated productivity, because my agency could not possibly have been able to fund what I was obtaining at a cost of less than a thousand dollars in about three days. What a deal.

3.10 URISA 1975 Conference: *Ten Years of URISA Proceedings: Indexes and Abstracts* (Matthews and Kraemer, 1975)

I became a member of the URISA Board of Directors in 1972, and was the Board representative, Committee on URISA Proceedings Index, which was appointed to oversee production of the indexes and abstracts publication. Other members of the Committee included Clark Rogers and John Rickert.

The compilation of materials for *TEN YEARS OF URISA PROCEEDINGS: Indexes and Abstracts***,** was done by Joe Matthews and Ken Kraemer, Public Policy Research

Organization, University of California-Irvine. The project commenced in 1972, and was concluded in 1975.

The mandate of the Committee was to provide the terms of reference for the publication, which included leading the discussion about the kinds of (cataloguing) indexes to be used to organize the proceedings papers. As I recall, and the *Newsletters* of the day appear to confirm, doable and affordable were primary considerations, followed closely by making the publication as useful to current members as resources allowed.

The thinking of the Committee, therefore, was to create several indexes which were most likely to serve the search procedures of the majority of members. At that time, literature search and review procedures were still electronically challenging, and search procedures tended to be relatively simple.

The decision was therefore made that four kinds of “indexes” would be used to guide members to abstracts and/or papers published in the proceedings, 1964-1973:

1. Personal Author Listing, which was an alphabetical listing by author name, accompanied by the paper title, year of publication, and a document number.
2. Corporate Author Listing, which was an alphabetical listing by corporate name, accompanied by the paper title and a document number.
3. KWIC Title Listing, which selected keywords out of titles and listed documents alphabetically according to the selected keywords.
4. Keyword Listing, which used seventeen selected keywords to catalogue or categorize the papers according to subject matter.

One part of the keyword listing index section may benefit from a brief explanatory note about our thinking behind the seventeen keywords.

Again, and as noted above, this publication was to be doable and affordable, which meant that a complex keyword listing design was out of the question. The 17 keywords were a compromise choice, and at the time they seemed to be appropriate for the majority of members, many of whom may have had their needs served by 5 or 6 of the relatively broad keywords (e.g., census, housing and transportation, public finance, and state and regional).

As for including the abstracts, that was perceived as an inexpensive way to create an overview of presenters and presentations at URISA conferences. It was realized at the time that URISA proceedings were not universally available, and in due course the printed supply would be exhausted. However, by creating this publication (free to members and only $10.00 for non-members), a record of the abstracts would be available for examination for years to come. And, it could be reproduced at low cost.

Finally, while URISA was tight for money and hence strapped to provide services for members, this publication was treated as a high priority information product. That is, documenting who was thinking or doing what in designing, developing, and implementing information systems was regarded as important information, and deserved to be treated accordingly.

Retro Bio-Note**:** During the time (1972-1975) of producing the *TEN YEARS OF URISA PROCEEDINGS: Indexes and Abstracts,* I was on the URISA Board, and participated in all the conferences, including service on program committees and through presentations and proceedings papers. My URISA activity was supported at a very high level by my employer, the Ministry of State for Urban Affairs, and work on this publication was part-and-parcel of my workload because the argument had been made and accepted that the publication would be of immediate benefit to Ministry researchers, as well as to the information systems community across Canada.

It is my recollection that in the late 1960s and early to mid-1970s there was an "iffyness" to URISA-related publications because URISA did not represent a particular and established discipline, such as geography, surveying, etc. However, as someone who was active in publishing and in conference presenting at that time, and working on my research credentials for career and other purposes while at Urban Affairs, I believe that the creation of the index document was a key feature in establishing the "arrival" of URISA in general, and the information systems field in particular. In brief, our record was sufficiently substantive to warrant index-level attention.

3.11 URISA 1976 Conference: *Information Systems as Services to Citizens*
(Anochie, 1976)

Bob Aangeenbrug, University of Kansas, was the 1976 conference chairman, and Irene Wreen, City of Atlanta, chaired the papers committee.

My involvement in the 1976 conference included working with Bob in preparation for the 1977 conference, and I also headed up the papers review committee with Doug Herman from the Ontario Ministry of Culture and Recreation.

We were assisted in the paper review process by Herm Lujan (University of Kansas), Jim McManama (City of Dayton), and all the Special Interest Group chairs. A total of some 70 papers and about 650 pages of text are published in the proceedings.

In regard to the question, "What were they were thinking?" the focus point or end game that I recall being emphasized by both Bob and Irene was delivering the goods on the conference theme.

Briefly put, the mission was to demonstrate that information systems do provide services to citizens and, as a result of the 1976 URISA conference, more information-based services to citizens would follow. And, to complete the circle, by getting the services-to-citizens part right, the consequence would be continuing and/or increased support for information systems research, development, and applications.

The strategic thinking behind the doing for the 1976 conference and conference program was based (in my opinion) on Bob's experience of dealing with elected officials at all levels, and on his understanding of the interests and concerns of ordinary citizens as people who pay taxes for public services, and who vote.

Bob's message as conference chair, therefore, was of a pragmatic nature: there will be presentations and photo ops involving elected officials to get them into the URISA camp, we will talk about services to citizens as the primary motivation behind the 1976 conference to win hearts and minds for URISA as a public-spirited organization, and it is up to the proceedings papers, workshops, etc., to convincingly demonstrate the information systems link between elected officials and citizens.

As for the operational thinking behind the doing, that was the primary responsibility of Irene. Again, this was the time of paper papers, so to speak, so great emphasis was put on laying out specs well in advance, soliciting abstracts in a timely manner, persuading people to do thorough edits before shipping us their papers, etc.

And, as good luck or good planning would have it, Irene, Doug, and I were on the same page when it came to appreciating and respecting the connection between elected officials and citizens. In 1976 Irene was with the City of Atlanta, Doug was with the Government of Ontario, and I was with the Government of Canada. We all had responsibilities that involved us with elected officials who wanted to see political pay-offs from their buy-ins, and we all had day-to-day duties that engaged us in information systems research, development, and applications activities that provided or enabled services to citizens.

Our thinking, as I recall, was that we could use our own work environments as context when reviewing papers for their contributions to the conference theme, "information systems as services to citizens". Specifically, we had a very good sense of information systems-based services that governments at all levels delivered to citizens in 1976, and we all had research obligations in our jobs that required us to be on the lookout for new, different, or better ways of using information systems to deliver new, different, or better services to citizens.

At the time of this writing in 2011, it is some 35 years after the 1976 conference, and the conference theme "information systems as services to citizens" is still pertinent at all levels of government in the U.S., Canada, Europe, Australia, etc.

These thoughts on what the organizers were thinking are intended as context for readers of the proceedings who may have difficulty with the notion that 35 years ago URISA had taken up the challenge of demonstrating how information systems provide services to citizens.

Finally, since modern text search technology allows us to examine the proceedings for “bright ideas” in a matter of minutes, I suggest there are many nuggets to be found in these proceedings by anyone who is still learning about the fundamentals of “information systems as services to citizens”.

Retro Bio-Note**:** In 1976 I was appointed a Director in the Policy Analysis Branch, Ministry of State for Urban Affairs, Government of Canada. Due to an agency re-organization I continued to have a seemingly full plate of activity in the information systems and research methodology domains, but my “sphere of involvement” was expanded to encompass the directorate of Non-Metropolitan Community Development. My new responsibilities included preparing cabinet documents which could become the basis of federal policies, representing the Government of Canada on national and international bodies and missions involving the development of urban fringe regions, smaller communities, and rural areas, and representing the Ministry at inter-governmental and inter-departmental meetings on community and regional development.

Other activities included designing, supervising, and conducting policy research projects, and giving presentations at conferences, workshops, and seminars in Canada, the U.S., and abroad on industrial, transportation, housing, management and planning, adoption and use of computers by local governments. My thinking as a member of the program committee reviewing papers was that government officials at all levels in Canada, the U.S., and elsewhere frequently talk about services to citizens, and especially when elections are in sight, but that URISA needed to do better than just talk, it needed to actually deliver on its theme of *Information Systems as Services to Citizens.* I believe that the other members of the program committee were thinking along the same lines.

3.12 URISA 1977 Conference: *Information System Inputs to Policies, Plans, and Programs* (Wellar, 1977)

Bob Aangeenbrug, University of Kansas, was conference chair, and Barry Wellar, Ministry of State for Urban Affairs (Canada) was program chair.

Planning for the 1977 conference in Kansas City began at the URISA ’76 conference in Atlanta. It was agreed in Atlanta that a URISA anniversary conference (15th) was the place and time to tie together information system design, development and applications activities with the full range of public sector interests, that is, policies, plans, and programs, and their associated research activities.

The conference committee, which included Barclay Jones, Wil Steger, John Beresford, Jerry Fox, Bob Aangeenbrug, Dorothy Bomberger, Ken Dueker, Tom Palmerlee, and Bob Hurst, (five past and four future URISA presidents) was extremely well-connected, and took a lot of the risk out of what was an ambitious, three-volume proceedings venture. As I recall, four guiding principles were behind the design of URISA ’77.

First, there was an explicit, directed emphasis on the use of information systems in governments at all levels for policy, planning and program purposes. I believe that the 1977 conference was the first international conference to go in this direction, and over the subsequent 35 years many URISA conferences have extended thoughts presented in 1977. And, truth be told, lots of other organizations have duplicated what was first done at the 1977 URISA conference.

Second, URISA ’77 featured plenary and invited presentations, as well as contributed papers. As an anniversary conference the thinking was that there should be an emphasis on benchmarking what had already been said and done at URISA conferences. And, to provide some food for future thought, speakers were asked to make recommendations about directions that the field and practitioners <u>should</u> take. Back in the day all URISA proceedings were paper documents, so it was a good job that all this was decided while we were in Atlanta and had a year to do the deed.

Third, it was appreciated early on in URISA’s history that upper level managers in governments at all levels were not stampeding to get in the door at our annual conferences. However, it had been my experience at previous URISA conferences and during my involvement with governments at all levels in Canada, the U.S. and elsewhere, that the best way to attract senior public sector people who were responsible for policies, plans, and programs, was to invite them to make presentations.

Once that step was achieved, the next step that frequently followed was for them to ask their information systems people for assistance, in some cases to the point where the IS person wrote the paper and acquired credibility points in the process. URISA ’77 involved a large number of senior managers, and people on their way to becoming senior managers, and was one of URISA’s more successful conferences in terms of the mix of participating public officials.

And, the fourth principle involved designing the conference to advance the methodological underpinnings of the urban and regional information systems field for two reasons: a) to increase the credibility of participating in URISA within the academic and scientific communities; and b) to show by example in the plenary, invited, and contributed presentations that URISA was the place to be to discuss and learn about connecting research methods, research techniques, and research operations with information system design, development, and applications.

The thinking (strategy) was that Professor Edgar Horwood would prepare a thought-provoking presentation (Horwood, 1977) for the opening plenary, and other presenters would elaborate what he had to say, as well as adding their own interpretations of where URISA had been and where it was going methodologically.

In terms of the size of the production, the URISA ’77 proceedings contain 13 plenary papers (140 pages), 25 invited papers (270 pages), and 42 contributed papers (about 400 pages), for an overall total of 80 papers and 800 pages of text.

Three impressions arise from a brief re-examination of the proceedings.

1. They include numerous foundation or building block papers for anyone in any discipline or profession wanting to learn more, in 1977 and also today, about the whys and hows of achieving better information to support better decisions for better policies, plans, and programs. I expect that online access will significantly increase the reading and referencing of these papers.

2. They present a large number of ideas and relationships – theoretical, hypothetical, empirical, spatial and aspatial, technical and technological, and so on – covering a number of disciplines and professions, and include what I believe were many original contributions to the extant literature. Again I expect that online access will significantly increase the reading and referencing of these papers. Moreover, I also expect that their e-availability could precipitate some "re-visiting" of post-1977 work in several fields (e.g., planning, engineering, surveying, geography, operations research, public administration, management science, and computer science) that may not have given this precedent material its due regard.

3. The diversity of papers suggests that these proceedings may seriously challenge the keywording and/or indexing component of the Development Program project to make the proceedings accessible online. However, since the real heavy lifting was actually done when the papers were written 35 years ago, I am sure all the authors expect that the keywording/indexing process will not miss any of the key terms and concepts that were put to paper for the 1977 URISA conference.

That said, there may be more than a few contributors to the proceedings who are very curious about how well the keywording/indexing methodology used today matches up with the thinking and the language that went into the papers back in 1977. I have no doubt that the late Edgar Horwood, URISA's esteemed founder, would be among those with a keen interest in the epistemological, ontological, and praxis aspects of such a discussion.

Retro Bio-Note: In 1976-77 I was Director, Non-Metropolitan Community Development, Ministry of State for Urban Affairs, Government of Canada. My responsibilities included preparing cabinet documents which could become the basis of federal policies, representing the Government of Canada on national and international bodies and missions involving the development of urban fringe regions, smaller communities, and rural areas, and representing the Ministry at intergovernmental and interdepartmental meetings on community and regional development.

By the time of the URISA '77 conference I had spent much of my earlier career discussing/explaining/justifying why and how better data, better information, and better knowledge could lead to more informed decision-making, and then I entered a phase when I was responsible for designing and contributing to public policies, plans, and programs which represented the interests of political parties and senior administrators. I believed my experiences to be very similar to those of many URISA members, and since I was contemplating a career change I wanted URISA ’77 to be as complete a story about public sector use of information systems as time and resources allowed.

3.13 URISA 1978 Conference: *Data Resources and Requirements: Federal and Local Perspectives* (Schmitt and Crellin, 1978)

Barry Wellar, Ministry of State for Urban Affairs (Canada) was conference chair, and program chair was Dorothy Bomberger, Institute of Electrical and Electronics Engineers.

In terms of the question “What were they thinking?” when designing the program and selecting papers for the proceedings, the Washington conference in 1978 probably outdid all others when it came to wheels-within-wheels.

Dorothy Bomberger was the program chair, and she was very astute when it came to the “political” side of information systems, urban and regional or otherwise. Her approach for taking the URISA show to Washington, D.C. was to use the findings from the 1977 conference about policies, plans, and programs as context, to connect with the themes of as many prior conferences as practical, and to put together a conference package that would have the greatest long-term impact that a volunteer, under-funded organization could create in the span of a four-day meeting.

I was the URISA president at the time, and as a result I was in the midst of a lot of what Dorothy did, and what she wanted done. Four particular perspectives come to mind that may assist the reader to better appreciate the proceedings as the product of a very sophisticated process.

First, Dorothy and her conference committee arranged for an impressive array of federal and local elected officials as speakers, including Senator Alan Cranston, Congressmen James Corman and Charles Rose, and Mayors Bill Hanna and Walter Washington. And, there was a well-attended, high-intensity, collegial reception on “The Hill”, and the politicians and staffers actually seemed happy to be there to discuss information systems and their applications.

Second, as a result of bringing a strong political presence to the conference, a strong contingent of appointed officials followed. The “heavy hitters” from federal agencies and local governments included: Joseph Califano, Secretary of HEW; Alice Rivlin, Director, Congressional Budget Office; Manuel Plotkin, Director, Census Bureau; Nathan Levy, Government of the District of Columbia; Fred Bohl, City of Ann Arbor; Roy Larson, Twin Cities Metro Council; Dick Renshaw, County of Santa Clara; and Steve Kinzy, City of Omaha. This was not a federal-local conference in name only!

Third, by raising the bar in terms of the politicians and senior management types participating, it followed that the program bar should also be raised, which included addressing an emerging problem in governments at all levels. Specifically, by the late 1970s the information systems field in general was in the throes of introducing microcomputers into what had been a mainframe world.

In the pre-conference *URISA News*, Dorothy noted that the program would address my concerns about technology surpassing users' abilities to effectively use it to meet their service delivery needs. This was a difficult challenge to meet in a conference setting, and credit is due the program committee (Ron Crellin (chair), Rolf Schmitt, David Matthews, and Bill Wadsworth) for organizing panels and sessions that put federal, state, and local officials at the same tables, and very wisely added consulting, research institute, and university expertise to the mix.

Fourth, a premier body of thought was added to the 1978 conference by Dr. Wil Steger, URISA president in 1971, a Horwood Award recipient (1979), and President of CONSAD Research Corporation. I met with Wil on many occasions over the years, and knew that he ran with the big dogs in Washington, but I received a telecommunication (no email in those days) on August 1, just a week before the conference that beat all.

Martha Davis, Special Assistant to the Chief Economist, Department of Commerce, asked Wil to plan a meeting between officials from URISA and the Interagency Task Force on Urban Data. The objective of the meeting included exploring the issues involved in developing a government-wide urban information base to bring together social, economic, and fiscal data that could be used to improve federal and municipal development strategies.

The meeting was held August 6, right smack in the middle of the URISA conference, and attendees with URISA connections included Wil Steger, Barry Wellar, Bob Aangeenbrug, Dorothy Bomberger, John Beresford, and Mike Garland.

I believe it is fair to say that by the end of the discussion the Task Force was very appreciative of the alternative approaches that were suggested, and a compelling case had been made for the Task Force to include URISA conference proceedings in its reading material.

From this insider's perspective the 1978 conference was instructive, productive, on message, and great fun. Moreover, the proceedings contain a number of papers which made contributions to the literature which are still pertinent today. That order of achievement is not bad, not bad at all, for an organization that wondered whether it could get any attention or traction by holding its annual conference in Washington, D.C. in August. Those were the days.

<u>Retro Bio-Note:</u> In 1978 I was Senior Policy Advisor, Ministry of State for Urban Affairs, Government of Canada, and my introduction to the conference theme of *Data Resources and Requirements: Federal and Local Perspectives* began with my graduate school experience 1965-1969, courtesy of professors William L. Garrison and Duane Marble.

My engagement with the theme was sharply increased during my time at Urban Affairs (1972-1979) when my responsibilities included a presence on Statistics Canada committees, interacting with the Federation of Canadian Municipalities, serving on intergovernmental and inter-departmental data groups, designing, supervising, and conducting data-information-knowledge transform studies, and having what seemed like daily communications with local governments of all sizes across Canada about data, data bases, information systems, and a variety of information technology issues and concerns.

In addition, I was involved in related discussions in the U.S. on two fronts. First, due to my experience at Urban Affairs, the National Association of Towns and Townships (NATaT) in the U.S. asked for advice on small community development topics, and particularly those dealing with computer-based information systems. And, in a related vein, NATaT sought advice on how to deal with federal mandates that required local data for federal programs which many towns and townships had difficulty obtaining and only slightly less difficulty providing to outside agencies since many of these organizations were still on paper with limited staff support.

Second, I was involved with the Carter Administration's Small Community Development Act of 1978, and again I was a participant in discussions about the federal-local relationship, and in particular with regard to federal requirements for data from local governments, and the source of the resources needed to produce the data to meet federal program and plan requirements.

4. Conclusion

There are a number of conclusions that could be drawn from the 1968-1978 proceedings overview, but my comments are limited to three "big picture" findings that I think best serve past, present, and future URISA members, and other readers of this paper.

First, I believe the evidence is abundantly clear that the 1968-1978 URISA conferences and proceedings played a major role in defining urban and regional information systems and geographic information systems and science. Unfortunately, to this point in time the availability of the proceedings has been extremely limited due to the fact that the proceedings were produced as print documents and as a result knowledge of that defining role is relatively limited. However, it is my expectation that publication of *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science* in digital form, and eventual digital access to the 1968-1978 proceedings, will sharply increase the attention and respect given to what I rate as a body of "game-changing" literature.

Second, by virtue of the academic, government, and business affiliations of URISA program chairs and conference participants, the 1968-1978 conferences and proceedings were original contributors to client-driven research and applications, and curiosity-driven research and applications in urban and regional information systems and geographic information systems and science. Given that circumstance, the term "defining" is used in the title of this paper with good reason. That is, URISA presenters were doing most of the heavy lifting when it came to original research and applications, and provided the bases for numerous others to engage in the relatively easier tasks of derivative research and applications. In my opinion that is defining of the highest order.

Third, examination of conference titles reveals that during the 1968-1978 time span, URISA was on the leading edge when it came to identifying the fundamentals which underlie the fields of urban and regional information systems, and geographic information systems and science. The conference titles and years are recalled for convenience.

1968. Federal Activities and Specialized Systems.

1969. Service Systems for Cities.

1970. Past, Present, and Future.

1971. Information Systems and Political Systems.

1971. Geocoding-71. Papers from the Working Session on Geographic Base File Developments.

1972. Information Systems for an Urban Society.

1973. Perspectives on Information Systems.

1974. Resources and Results.

1975. Computers, Local Government, and Productivity.

1975. Ten Years of URISA Proceedings: Indexes and Abstracts.

1976. Information Systems as Services to Citizens.

1977. Information System Inputs to Policies, Plans, and Programs.

1978. Data Resources and Requirements: Federal and Local Perspectives.

The conference titles/themes and associated conference programs had high regard for an emerging urban society, the make-or-break significance of inter-governmental relations, and the need to make societally significant connections between information systems and their users and uses. It is therefore no surprise that those conference title terms and phrases have been “drivers” of research, education, design and development, and applications since they were first published more than 30 years ago, and are still used in conference programs and various publications. This is an outstanding achievement, and speaks to the URISA record of original, fundamental contributions to the core aspects of urban and regional information systems and geographic information systems and science.

In recognition of that record of achievement and as a testament to its longevity and continuing pertinence, it figured prominently in the design and content of my 2009 URISA conference opening keynote address, *"Core Information Challenges and Opportunities, 2010-2020: Building on Strengths"* (Wellar, 2009). The strengths that I discussed in 2009 have many of their roots in the 1968-1978 publications that were re-visited for this paper, and I am most pleased that this publication allows me to give credit where credit is due.

Finally, visitors to the URISA website (urisa.org) who follow the path from "About URISA" to "History" encounter the list of Past-Presidents. In the introductory remark they are described as distinguished, and I believe there is widespread agreement in that regard. However, in the absence of any details, readers might justifiably wonder what they did to warrant such high praise.

I believe that this paper is an important step in documenting the thinking and thoughts that many of these individuals contributed to defining the fields of urban and regional information systems, and geographic information systems and science. For reasons given at the outset of the paper my focus is on the 1968-1978 time span, and I look forward to additional reports that acknowledge other URISA leaders and their achievements.

For my closing note, I have had the privilege of knowing all URISA presidents since the beginning of URISA, and I am still in contact with many of them through URISA conferences and the past presidents' list serve. I acknowledge the important contribution that these individuals and their communications made to my thinking over the years, and to the design and contents of this book and paper in particular.

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Part III

PREVIOUS BENCHMARKING PROJECTS

Prudent organizations periodically take stock of challenges and opportunities, successes and failures, strengths and weaknesses, accomplishments and disappointments, and achievements and malfunctions.

In URISA's case, benchmarking projects occurred in 1970, 1977, 1987, 1992, and 2002, and they generally focused on discussing:

(a) What has been done, not done, and needs to be done in terms of creating better data, information, and knowledge bases from better information systems; and

(b) Tracking where we have been and could be going with regard to research, education, training, and applications activities in urban and regional information systems and geographic information systems and science.

The 1992 conference benchmarking was a comprehensive exercise. It provides an instructive context for this volume, and illustrates the high-level competence which URISA members bring to multiple aspects of the information systems field.

Barry Wellar

9

IS/GIS/LIS AND PUBLIC POLICIES, PLANS, AND PROGRAMS: THIRTY YEARS IN PERSPECTIVE – RECALLING A MAJOR BENCHMARKING PROJECT

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Abstract. The Perspectives track at the 1992 URISA conference was a benchmarking project involving a 30-year overview of previous conference programs and the search and review (analysis, synthesis) of many hundreds of proceedings papers. Volume V was foundations-oriented by virtue of its focus on proceedings papers that made substantive, fundamental contributions to the literature on urban and regional information systems and geographic information systems and science. The 16 papers in Volume V identify and discuss foundations, and connections among foundations, from several perspectives, including the science aspect (e.g., theories, hypotheses, catalogues, methods and techniques, data-information-knowledge transform processes and products), the governance aspect (e.g., horizontal and vertical integration, mandates, inter-governmental and inter-institutional relationships), the technological aspect (e.g., hardware, software, peripherals) the functional aspect (e.g., executive, management, planning, operations), as well as the aspect of the public sector-private sector relationship.

1. Background

The 1992 conference chair was Ed Crane, and the program chairs were Randy Gschwind and Mike Kevany. However, they were responsible only in a default kind of way for the Perspectives track because it was pretty much turned over to me and my collaborator, the late Dan Parr, to do the deed. From a foundations aspect, the nature of our collaboration warrants explanation because it epitomizes the URISA spirit.

I had already done many months of heavy lifting with the 15th anniversary conference in 1977, and had not intended to get overly involved in any stock-taking for 1992. However, Dan Parr, who may have been an emissary of Ed Crane on this matter, convinced me to take the lead on the deep thinking part, because he guaranteed that all the production things would happen on time, under budget, etc., etc. The deal sounded too good to be true, but who was I to refuse an opportunity to serve URISA?

“Making Connections” was the theme of the 1992 conference, and to my mind there was a special connections ingredient which was largely responsible for the richness of the materials created throughout URISA’s history, which helped to make this review doable at a very high level of expertise, and which prompted Dan Parr and I to ensure that the 30-year review component of URISA '92 was much more than just a dry, boring inventory of subject matter.

The special connections ingredient that I have in mind involves personal and professional connections among URISA's members from academe, government, industry, public interest groups, research institutes, and so on.

Without exception, to my knowledge, any URISA member who wanted to become involved in special interest groups, committees, chapters, workshops, conferences, you name it, could do so. And as Volume V demonstrates, the professional connections can unfold over a long period of time, and may lead to results that no one of us alone would seriously think about pursuing.

The professional connections part of the 30-year review project began back in the 1960s when I first met Edgar Horwood and Ken Dueker, and over the years I met other contributors to Volume V. My professional connection with Ed Crane began at the 1977 URISA conference. I was program chair, and it was Ed's first URISA conference.

I believe that the 1977 conference represented a significant and original benchmarking exercise (Wellar, 1977a) but it paled in comparison to what I agreed to do for Ed and his URISA '92 conference. That is, serve as the opening keynote speaker, and direct another benchmarking exercise along with my collaborator, Dan Parr.

To be clear, giving the 1992 opening keynote on the topic of "Information Systems: A 30-Year Perspective" was a privilege and an honour rather than a burden. Indeed, upon listening to the tape of my remarks and viewing the PowerPoint slides in preparation for writing this paper, I am reminded that putting the presentation together was an enlightening challenge, and giving the presentation was a lot of fun.

As discussed before and after the keynote address, using newspaper headlines and stories to make connections between information systems and real-world issues and concerns related to land, water, air, climate change/global warming, waste disposal, urban development, etc., was a thoughtfully provocative and provocatively thoughtful way to engage attendees in the 'Making Connections' conference theme.

However, beyond the matter of their usefulness as a means of engaging attendees in the keynote presentation through PowerPoint slides containing headlines covering hundreds of cities, counties, states, provinces, etc., there remains a negative aspect to the headlines used in the keynote address.

That is, and in brief, many of the bad news media stories that I cited in my remarks and illustrated via slides in 1992 are still appearing in media stories in 2012, some 20 years later. Seemingly, the data-information-knowledge transform process has been getting better, much better, but the same cannot be said about land-related, water-related, air-related, waste disposal-related, natural resources-related, energy-related, and numerous other spatially-significant decisions and actions by individuals, corporations, and governments.

As for the benchmarking exercise, it was a complex, lengthy, and strenuous task due to its scope, the large volume of materials to be reviewed, the large number of participants, and the mix of styles involved in writing the proceedings papers.

In retrospect, it was very good planning by the program organizers to hold perspectives sessions on each of the four days of the conference, as there was much to present and process.

For any reader not familiar with URISA, the long story short is that the benchmarking task for URISA had become very, very challenging. Simply put, between 1977 and 1992 URISA produced another 10,000+ pages of proceedings, for a grand total of more than 20,000 pages over 30 years. Moreover, and befitting the leading professional organization involved in defining urban and regional information systems and geographic information systems and science, each and every conference continued the tradition of introducing new and different education, research, training, and applications topics, issues, practices, empirical evidence, etc. Clearly, a serious benchmarking activity would not be "a walk in the park", so to speak.

Fortunately for me, the conference and program chairs, as well as URISA and its members, Dan Parr was on board to assist with this heavy-duty benchmarking endeavour. His involvement made designing and implementing *IS/GIS/LIS and Public Policies, Plans, and Programs: Thirty Years in Perspective* (Wellar and Parr, 1992b) a positive, enjoyable, and highly productive venture.

2. Designing the 1992 Conference Benchmarking

Learning from the 1977 experience, a lead article "IS/GIS Progress in Perspective: The Rationale and Terms of Reference for a Major Benchmarking" (Wellar and Parr, 1992a) was prepared well in advance for distribution to contributors to Volume V of the 1992 conference proceedings. In addition to guiding the 1992 benchmarking, it was anticipated that the rationale and terms of reference could be useful for subsequent benchmarkings, and as a result considerable thought went into explaining the benchmarking approach adopted for the 30-year perspective.

I hasten to add here that by 1992 I had taught research methods courses and directed theses and dissertations at the University of Kansas and the University of Ottawa, and directed many research projects while at the universities and the Ministry of State for Urban Affairs, Government of Canada. Consequently, it had become first nature for me to specify as explicitly as words permitted, the whys and hows of research initiatives, with the amount of "specification" increasing as the difficulty of the research challenge increased.

In this case, however, the research design challenge was accompanied by a complex operational challenge, and both challenges were fraught with numerous unseens and unknowns.

Fortunately, I had learned from mentors Edgar Horwood and William Garrison that a positive attitude is a very useful ally when dealing with perplexity, and their advice would have been to give the best directions that you can, ask the best questions that you can, and learn from your mistakes and your successes. Dan Parr was okay with that line of thinking and doing, so it was game on.

As a result, the foremost thought was to provide detailed, explicit, directive instructions from the get-go to attempt to ensure that all contributors to the review were on the same page.

With the terms of reference in place, and injecting only an occasional word of "encouragement" into the process, it was our impression that we had given the review design our best shot, and we could only hope for best shots in return from the distinguished members of URISA who were invited to prepare the review papers.

3. Article Contributions to the 1992 Benchmarking

The Perspectives volume includes the plenary papers which were presented by Edgar Horwood (Horwood, 1977, reprinted in Chapter 4) and Barry Wellar (Wellar, 1977b) at the 1977 conference, and 14 progress reports and review papers on the themes of:

- Policies, Plans and Programs in Perspective: The Big IS/GIS Picture;
- Information System Inputs to Policies;
- Information System Inputs to Plans; and,
- Information System Inputs to Programs.

The 1992 benchmarking project represents one of the most definitive and comprehensive contributions of its type to the literature on urban and regional information systems, land information systems, and geographic information systems and science (Wellar, 1993). It is therefore appropriate to present the titles of papers and the names of the contributors to that foundation-building document in recognition of an exceptional achievement.

Again, I hasten to add, the 1992 benchmarking project was done "back in the day" that preceded the easy, electronic production and exchange of documents, so each of the individual papers and the proceedings compilation itself were first-order operational achievements.

1. "IS/GIS in Perspective: The Rationale and Terms of Reference for a Major Benchmarking". Barry Wellar, University of Ottawa and Dan Parr, systems consultant. (pp.1-14).

2. "Perspectives on URISA's Origin and on the Emergence of a Theory of Urban and Regional Information Systems". Edgar Horwood, University of Washington. (Reprinted from 1977 URISA Proceedings). (pp.15-33).
3. "Evolution of Information Systems as Essential Infrastructure in Urban and Regional Governments". Barry Wellar, Ministry of State for Urban Affairs, Government of Canada. (Reprinted from 1977 URISA Proceedings). (pp.34-41).
4. "Issues and Trends of Concern to the URISA Membership: A Thirty Year Survey of URISA's Literature". Joel Morrison, U. S. Geological Survey, and Ben Ramey, U. S. Geological Survey. (pp. 42-57).
5. "IS/GIS Hardware/Software/Data Features and Capabilities: What's Done, What's On, What's Next?" Lyna Wiggins, MIT, William Craig, University of Minnesota, and Richard Langendorf, University of Miami. (pp. 59-84).
6. "Information and Knowledge Bases for Decision-Making: A Progress Report". Barry Wellar, University of Ottawa, and Britton Harris, University of Pennsylvania. (pp. 85-105).
7. "Information Systems Inputs to Policies: 1977 Revisited". Wilbur Steger, CONSAD Research Corporation, and Wayne Bannister, Los Angeles County. (pp. 106-116).
8. "A Progress Report on Public Policy Objectives Achieved Through IS/GIS/LIS". Ralph Smith, R.A. Smith Associates and Barry Wellar, University of Ottawa. (pp.117-144).
9. "Role and Use of IS/GIS in the Planning Process". Chuck Kindleberger, City of St. Louis, and Kenneth Topping, urban planning consultant. (pp. 146-167).
10. "Role and Use of IS/GIS in Assessing Land Use/Transportation Plans". Ken Dueker, Portland State University. (pp. 168-176).
11. "Information Systems Technology in Planning Education: A Retrospective of URISA's Role". David Arbeit, City of Austin. (pp. 177-205).
12. "Information Systems Inputs to Programs: Application of IS/GIS in Government". Barry Giffin, Province of Alberta, Laurel McKay, Province of Alberta, Chris Michell-Viret, Athabasca University, James Gutherie, City of Edmonton, and Ron Jacob, City of Calgary. (pp. 206-240).
13. "IS/GIS, URISA, and the Private Sector". Dan Parr, systems consultant. (pp. 241-255).
14. "Applications of IS/GIS: Science and Education". Gary Jeffress, Corpus Christi State University. (pp. 255-261).
15. "Building the IS/GIS Capability to Support Policies, Plans, and Programs: a Local Government Perspective". Peirce Eichelberger, Orange County (FL). (pp. 262-271).

16. “The Effects of ‘Policies’ on the Implementation and Use of Information Technology”. Nancy Tosta, U. S. Geological Survey, and Peter Croswell, Plangraphics Inc. (pp. 272-289).

It was my opinion at the completion of *IS/GIS/LIS and Public Policies, Plans, and Programs: Thirty Years in Perspective,* that this collection of articles represented an exceptional contribution to the literature on the education, research, training, and applications aspects of information systems, geographic information systems, and land information systems.

As a result, over the years I have used Volume V as a course text in undergraduate and graduate courses, it was required reading for masters and doctoral students under my supervision as well as for those students who asked me to serve on their thesis/dissertation committees, and I have called on and recommended Volume V as a reference text in discussions with private sector firms, public sector agencies, research councils, advisory groups, interest groups, and individuals interested in any of the topics considered in Volume V.

It is now 20 years later, and between 1992 and 2012 a large body of material has been published on the themes that formed the foundations of the 1992 benchmarking.

I believe it is logical to suggest, however, that methodologically sound, related works over the past 20 years on the education, research, training, and applications aspects of urban and regional information systems, geographic information systems and science, and land information systems, are likely to be those which have due regard for the 1992 benchmarking papers.

Simply put, whether a research investigation is exploratory or confirmative, or original or derivative in nature, it is methodologically sound if and only if it has due regard for all the relevant literature which is in the public domain.

It therefore follows, in my opinion, that since many of the foundations of urban and regional information systems and geographic information systems and science originated in URISA 30 years prior to the 1992 conference, and since many contributions to the URISA proceedings beginning in 1964 have been authored by credentialed academics, government officials, industry researchers, etc., methodologically sound research in this field Is that for which the benchmarking design and review papers done for the 1992 conference represent not just must-read documents, but must-respect and must-reference documents.

As a result, it is with great anticipation that I await the day when Volume V of the 1992 proceedings is digitally accessible, and it becomes possible to conduct comparative, keyword-based electronic searches of Volume V **and** related materials (dissertations, theses, journal articles, conference presentations, manuals, website postings, technical reports, workshop workbooks, etc.,) produced subsequent to 1992.

On the one hand, when that day of digital access comes, it will be possible to learn how much attribution/credit has been given to the contributors and contributions to the 1992 benchmarking. And, of course, it also becomes possible to learn how much credit remains due by whom, to whom.

And, on the other hand, with regard to work done in the field of urban and regional information systems and geographic information systems and science after Volume V becomes electronically accessible, it will no doubt be of considerable satisfaction to contributors to Volume V to be able to learn about how agencies, institutions, interest groups, businesses, and individuals are benefitting from the foundations that were put in place by Volume V of the 1992 proceedings.

4. Creating an "Index for Making Connections with People, Terms, Issues, and Ideas"

The Perspectives project was a year-long enterprise with an ambitious objective, that is, "… to connect URISA members with our wealth of knowledge, ideas and issues, and to each other" (Wellar and Parr, 1992b, p. 290). Further, it was an ambitious project in terms of effort expended, as confirmed when the writing was done. At some 290 pages of text, including a number of tables, the writing might best be described as "dense", or perhaps "intense", because the papers packed large amounts of knowledge, ideas, and issues into their pages.

It therefore seemed appropriate that an index be designed and included in Volume V to assist in promoting connections among people, knowledge, ideas, and issues. And, it also seemed appropriate to build on and extend the 1975 report, *Ten Years of URISA Proceedings: Indexes and Abstracts* (Matthews and Kraemer, 1975).

Unfortunately, in terms of building on and taking advantage of precedent, up to that point in time no URISA proceedings had received the full index treatment. As a result, guidelines were in short supply. Further, and unlike the 1975 publication, it seemed to us that when preparing a 30-year benchmarking index, we needed to base the index on more than just terms in the titles of papers.

The decision was therefore made to "push the indexing envelope" in two ways.

First, the papers would be searched for terms that described entities, concepts, activities, ideas, and issues which were:

- Emphasized by contributors; or
- Had achieved standing in the literature.

And, second, in recognition of the relatively rapid rate of change in the fields of urban and regional information systems, geographic information systems, and land information systems, Wellar and Parr as organizers of the Perspectives project reviewed the papers in search of terms that represented relationships, methods or techniques, institutions, innovations, as well as challenges or opportunities which in our opinion were significant factors in the history and/or the future education, research, training, and applications aspects of urban and regional information systems, geographic information systems, and land information systems.

Having participated in the 1975 indexing activity, I knew that it was one thing to talk about and design an index, and quite something else to make it happen. Which leads me to a closing remark about my friend and colleague, Dan Parr.

Throughout the Perspectives project, but in particular during the index component, Dan exhibited top-notch operational and technical skills, and a deep dedication to URISA and to its individual members.

It was my thinking from the outset of the project that Dan was not only the right person to carry out the index task, he was the best person. How right I was, and full credit to Dan for an excellent index outcome.

5. Conclusion

The design and production of *IS/GIS/LIS and Public Policies, Plans, and Programs: Thirty Years in Perspective* represents a major, leading-edge contribution to the foundations of urban and regional information systems, land information systems, and geographic information systems and science.

It is therefore a privilege to recognize the contributors to Volume V of the 1992 proceedings, and to suggest to them that their benchmarking papers written 20 years ago may be in for some overdue attention and regard.

Specifically, and as I have made known on various occasions, it is my belief that the papers in the 1992 benchmarking of URISA proceedings represent a fundamental contribution to the foundation literature on the education, research, training, and applications aspects of urban and regional information systems and geographic information systems and science information systems.

As a result, it is my associated belief that *IS/GIS/LIS and Public Policies, Plans, and Programs: Thirty Years in Perspective* should be treated as a must-read, must-respect, and must-reference document for anyone who has prepared or is preparing a post-1992 masters thesis, doctoral dissertation, journal article, conference presentation, book, manual, etc., involving one or more of the education, research, training, or applications aspects of urban and regional information systems, land information systems, and geographic information systems and science.

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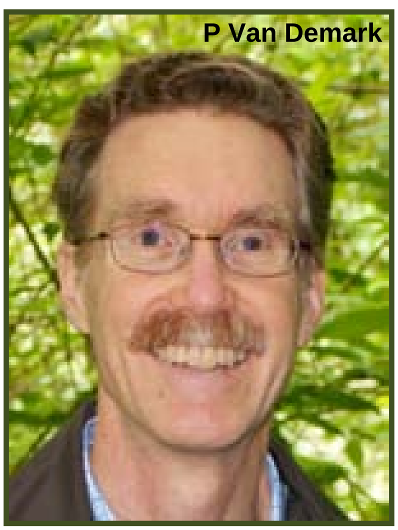
Part IV

INSTITUTIONAL AND ORGANIZATIONAL FOUNDATIONS

Over its fifty years of existence URISA undertook a number of initiatives which proved to be fundamental to defining, developing, and applying urban and regional information systems and geographic information systems and science in governments at all levels, in businesses of various types and sizes, in academic institutions from elementary schools to colleges and universities, and among the general public.

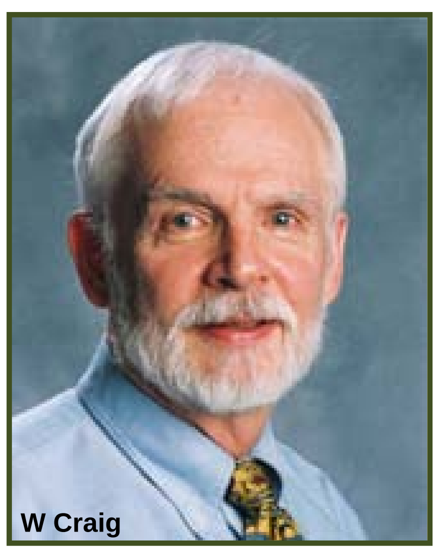
The chapters in this section overview some of URISA's many accomplishments to date, and they also outline the legacy which URISA boards, staff, and members have put in place to support and promote information systems research, education, training, applications in general, and advancing the status and standing of geographic information system professionals (GISPS).

Barry Wellar



P Van Demark

B Wellar



W Craig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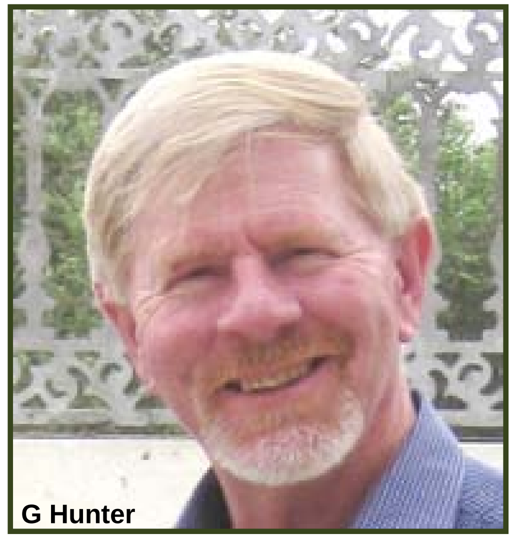
G Hunter


D Haley


M Goodchild


P Croswell

10

SPECIAL INTEREST GROUPS (SIGS)

Peter H. Van Demark
Director of GIS Products and Training, Caliper Corporation

***Abstract*:** Special Interest Groups (SIGs) were central to the development of URISA from a small conference to an international professional organization. During the first half of URISA's history, at least 46 SIGs were formed. SIGs were the primary way that members coalesced around topics of interest, and SIGs had newsletters, conference tracks, workshops, and other means to collect, organize, and share knowledge. SIGs died out in the early 1990s as new tools for communication, including Chapters, computer bulletin boards, and the Internet, made it quicker and easier for members to work together at other times and in other places.

1. Introduction – What Were the SIGs?

Special Interest Groups (SIGs) were groups of people, URISA members and non-members, interested in the same topic. That topic could be anything, and the 46 SIGs that can be counted span an impressive range of topics, from artificial intelligence to water/waste water. All it took to form a SIG were a few people of like mind, one or more leaders, and enough interest in the topic to sustain correspondence, newsletters, meetings, and other group activities. SIGs were recognized by the URISA Board of Directors, and were mentioned in Board minutes and newsletters, but they often were quite informal and depended on a few leaders. SIGs lasted as long as interest was sustained, then quietly died, having served their purpose.

To illustrate, the author bought an Apple Macintosh computer when it first came out in the spring of 1984. It was the first popular personal computer with a graphical interface and, as a cartographer, the opportunities for mapping and geographical analysis were clear. Other URISA members had the same realization, and they formed a MacSIG at the 1986 URISA conference. It soon merged into the Microcomputer SIG, and died out a few years later, when the hardware was no longer the focus and the applications using that hardware took the lead.

2. How SIGs Got Started

SIGs are almost as old as URISA. The first was the GBF SIG (SIG-GBF, later called SIG-Geoprocessing or SIG-GEO for short). It was spawned by the interest in the first DIME (Dual Independent Map Encoding) file, created in June 1967 by the New Haven Census Use Study. "URISA got into the act within three months of the advent of DIME," according to a "10 Years Ago This Month" newsletter article (Cooke, Donald, 1977). George Farnsworth, Donald Cooke, and Bill Maxfield gave two papers at the 1967 Conference in Garden City, Long Island, the first URISA conference after URISA was formed in 1966. "The Special Interest Group on Geographic Base File Developments

(SIG-GBF) was formed by Charles Barb of the University of Washington (Seattle) Urban Data Center, during the 1970 URISA annual conference" (Cooke, Donald, ed., 1971, preface). "The first URISA SIG focused on DIME and other GBF [Geographic Base File] activities; it has evolved into the current SIG-GEO and is still the largest and most active Special Interest Group" (Cooke, Donald, 1977).

Barry Wellar reports in Chapter 9 that "the SIG-GBF development chair was Donald Cooke, Urban Data Processing Inc., who organized the working session and oversaw production of *Geocoding-71: Papers from the Working Session on Geographic Base File Developments.*"

A second SIG that had an early, formal presence was SIG-Standardization, which developed under the leadership of Barry Wellar. He recalls some of those early days, and comments on the value of the SIG experience:

> "The Standardization SIG originated directly from my 1969-1972 involvement as a member of the Wichita Falls, Texas USAC Consortium (Wichita Falls, Booz-Allen, and University of Kansas). Among other tasks I had the lead role for the Standardization Theme, and I more or less jump-started the URISA dialogue about standards through presentations at the 1971, 1972, and 1973 conferences. It was clear to me early on in the USAC experience that the standards challenge was brutal for technical, technological, and political reasons, and that I needed help, lots of help, but informed help.
>
> As I recall the Standardization SIG was created in 1972, and over the next 7-8 years we produced a dozen or so papers, exchanged many hundreds of communications (this was in the pre-email era so the number of exchanges was significant), and held meetings at every URISA conference. Concepts, approaches, etc., generated by SIG-Standardization were the subject of discussion at national and international conferences, within government agencies in the U.S., Canada, and abroad, were adopted in a number of jurisdictions and, quite frankly, continue to be "re-invented" with regularity.
>
> The value of URISA as <u>the</u> organization which encouraged this kind of "meeting of the minds" during the formative years of the information systems field cannot be over-estimated." (Barry Wellar, personal communication, June 3, 2012)

For many SIGS, however, it is difficult to date starts before 1976 due to the lack of archival material, and/or the continuing engagement of SIG leaders in the information systems field. In 1976, at the URISA Board Meeting on September 3rd in Atlanta GA, Caby Smith provided a list of SIG chairs and reported on changes (URISA Secretary, 1976). The Federal SIG was dormant, and the Board moved to establish a data base system SIG and immediately passed a new motion to change its name to Data Base Management. Showing informality and humor, the minutes also state:

> "It is moved that we have a Wine-Tasting SIG with D. Cooke as Chairman. Motion by A. Livingood; seconded by D. Luria. Comments: The group will be self-supporting and will conduct its affairs at a very low profile. Motion was made to table discussion of this until October. Motion passed."

In those minutes there were individual reports, including one from Rick Schweitzer of Geo SIG, indicating that 51 of the 56 workshop attendees stayed on for the conference and 25% of them became URISA members, helping the organization fiscally. The other reports were from Student SIG, Evaluation SIG and Transfer SIG. In all, 10 SIGs are mentioned in those Board minutes.

One SIG that the Board approved was the Transportation SIG, one of the strongest and longest, existing past 1997. A handwritten petition states:

> "We the undersigned support the formation of a Transportation Special Interest Group in the Urban and Regional Information Systems Association. The purpose of this Special Interest Group is to facilitate communication among providers and users of information relevant to transportation planning, research, and applications at national, regional, and local scales." (Schmitt, Rolf R. and Harlan J. Smolin, 1976)

Twenty-one people signed the petition, including the acting co-chairs, Rolf Schmitt and Harlan Smolin. The next year a SIG-Cadastre was formed, and it illustrates that SIG members often paid dues and did not have to be members of URISA:

> "At Kansas City, a SIG-Cadastre will be formally constituted. The URISA President, Bob Aangeenbrug, is spearheading this SIG. To get in on the ground floor, send Bob $2.00 SIG dues…. You do not need to be a URISA member to do so; an interest in this field is all that is required." (Cooke, Donald, 1977)

3. SIGs at Their Height

Rosters have been found for SIGs from the 1976-77 year to the 1994-95 year. There were 16 SIGs listed in the first roster and 10 in the last. The height was in 1979, with 20 SIGs listed. Note the discontinuity between 1979-80 and 1983-84, and the low number for the latter year; the numbers may have increased more and then started decreasing. Table 1 shows the numbers of SIGs in each roster.

Table 1. Numbers of SIGs by Year

Year	Number
1976-77	16
1977-78	19
1978-79	15
1979-80	20
1983-84	8
1984-85	10
1985-86	12
1986-87	12
1987-88	12
1988-89	14
1989-90	16
1990-91	15
1991-92	14
1992-93	12
1993-94	12
1994-95	10

Using the names in the rosters there were 75 SIGs, but when name variants and changes are removed there were only 46. Table 2 shows the primary name, plus start and end dates. Because there is no solid evidence for the dates of many SIGs, a great number have "before" for a start date and all have "after" for an end date.

Table 2. SIGs with Start and End Dates

Name	Start Date	End Date
AI-SIG	1988	After 1994
Cadastre	1977	After 1980
Criminal Justice Applications	Before 1976	After 1980
Data Base Management	Before 1976	After 1980
Decennial Census	Before 1976	After 1980
Education and Technology Transfer	1988	After 1993
Education and Training	Before 1976	After 1980
End-User	1989	After 1990
Environment & Natural Resources	Before 1978	After 1997
Evaluation	Before 1976	After 1980
Facilities Management & Mapping	1985	After 1988
Federal Information Systems	Before 1976	After 1977
GBF	1971	After 1993
Human Service Systems	Before 1976	After 1980
Information Resources Management	1983	After 1989
Infrastructure Management	1987	After 1993
Integrated Systems	1989	After 1997
International	Before 1976	After 1980

Name	Start Date	End Date
Land Records Modernization	1983	After 1994
Low Cost Technology	Before 1978	After 1980
Mapping Lead Exposure	1993	After 1997
Metadata	Between 1993 & 1997	After 1997
Microcomputers/MacSIG	Between 1979 & 1983	After 1991
Minicomputer Technology	Before 1976	After 1980
Multi-Media	1993	After 1997
Privacy & Confidentiality	1977	After 1978
Private Sector	Before 1976	After 1977
Public Administration	1983	After 1991
Public Information Access	1986	After 1997
Public Safety	1989	After 1994
Public Works	1984	After 1988
Regional Agencies	Before 1988	After 1997
Remote Sensing Applications	Before 1976	After 1980
Small Cities & Counties	Before 1978	After 1980
Social Indicators	Before 1976	After 1980
Spatial Decision Support Systems	1992	After 1992
Standards	1972	After 1977
State/Province	1989	After 1993
Student	Before 1976	After 1978
Systems Integration	1985	After 1989
Technology Transfer	Before 1976	After 1978
Tiger Census	1995	After 1997
Transportation	1977	After 1997
Urban & Regional Analysis	1987	After 1993
User Access	1977	After 1980
Water/Water Waste Public Works	1993	After 1997

Table 3 shows the seven SIGs that lasted the longest. They were listed in ten or more rosters, and are shown in descending order of longevity:

Table 3. SIGs Lasting Ten or More Years

Name	Years
GBF (using start year of 1970)	23
Transportation (using start year of 1977)	21
Environment & Natural Resources	18
Information Resources Management	12
Regional Agencies	11
Land Records Modernization	11
Public Information Access	10

In a 1987 newsletter article called “SIGnificant Progress,” Randy Gschwind wrote “URISA’s Special Interest Groups (SIGs) exist for the purpose of communication and learning in focused, topical subject areas of urban and regional information systems. SIGs provide members the opportunity to stay in touch with other experts throughout the year, and to participate in the URISA organization at a grassroots level. As URISA continues to grow, SIGs are fast becoming the base from which organizational research directions are defined. In short, SIGs are on the cutting edge of URISA's progress" (Randy Gschwind, 1987).

4. Why SIGs Declined

In the 1980s computers moved from mainframes and minicomputers in labs and computer centers to microcomputers in people's offices. With the advent of modems, computer bulletin boards could provide a new avenue for communication, all year rather than just at annual conferences. The development and spread of the Internet provided ever-greater means for e-mail, file sharing, web sites, and other services that are now taken for granted. The speed of communication increased, time differences between people (especially internationally) became less of a factor, and costs to move correspondence, news, and data dropped essentially to zero.

With greater numbers of people interested in the topics that URISA covered, Chapters began to provide more local and more regular ways to get together. SIGs were a form of social networking, rooted in the days when networking usually meant face-to-face meetings, workshops, and other direct interaction, strung together by newsletters printed and mailed by SIG leaders or included in the URISA newsletter. Chapters provided a way to find people nearby, working in the same environment and on similar problems. SIGs often moved more toward taking the national or international view, such as getting involved with setting research agendas and developing standards (see Chapter 13, Research Agenda).

SIGs also provided the expertise and labor for creating and giving workshops before each annual conference, and for organizing tracks of papers and panels during the conferences. As URISA evolved, workshops became more centrally managed. This was to ensure quality and provide consistency and to create a pool of instructors, so that the workshops could be given at other times and places (see Chapter 11, Workshops and Workbooks). As conferences became larger and more complex, the conference committee developed a group of track leaders who worked within the conference theme to provide a set of tracks, replacing the efforts of the SIGs.

5. Conclusion: The Legacy of SIGs

SIGs were central to the formation of URISA. They provided a structure for people interested in a topic to share information, define and solve problems, and otherwise advance their field. Information was shared by publishing newsletters, giving workshops, and organizing paper and panel sessions at conferences. Allowing non-URISA members to join exposed new people to URISA and helped to expand the URISA membership. More members meant bigger annual conferences, with more tracks supported by the increased number of SIGs. That activity attracted companies, often ones where members worked, to exhibit and become corporate sponsors. SIGs were a major force in the halcyon days of URISA.

URISA does not have SIGs today. It does have an advocacy agenda, which develops standards, models, and policy statements, very much in keeping with activities that used to be carried on by SIGs. URISA currently offers 18 workshops, some direct descendants of workshops that were started by SIGs. In addition to the URISA Annual Conference there are specialty conferences that carry on topics championed by SIGs, such as public transportation, public health, and especially the URISA/NENA Addressing Conference, carrying on the legacy of the first special interest group, the GBF SIG (see Chapter 19, Street Addressing).

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URISA Secretary, 1976. *URISA Board Meeting Minutes*. Thursday, September 3, 1976, 8:10 a.m., the Flagroom, Peachtree Plaza Hotel, Atlanta GA.

Acknowledgement

Special thanks go to Will Craig, who helped collect early SIG-related materials, and his student Rob Kulhanek, who completed a spreadsheet of, as far as we can tell, all of the SIGs. He chased down start and end dates, SIG leaders, track coordinators, workshop leaders, and descriptions, and created a genealogy as SIGs split, joined, changed names, and otherwise evolved. He also assembled the rosters of SIGs for years from 1976-77 to 1994-95. Rob's results are in a spreadsheet that is available on the URISA website. Thanks also go to Don Cooke, who found some fascinating early documents.

11

WORKSHOPS AND WORKBOOKS: LEADING THE WAY IN EDUCATION AND TRAINING BASED ON RESEARCH AND APPLICATIONS SUPPORT

Barry Wellar
Professor Emeritus, University of Ottawa
Principal, Wellar Consulting Inc.

Abstract. The focus of Chapter 11 is on the contribution which URISA workshops and workbooks made to information systems education and training programs and events, with emphasis on the role that research and applications played and play in workshop and workbook design, testing, and presentation. Matters discussed include: why and how workshops became part of URISA conferences beginning in the early 1960s; how topics are chosen; how workbooks are qualified for use in workshops; and how instructors are selected and qualified to present the workshops. Distinct workshop topics covered to date number 125, which represents an extraordinary contribution to the foundations of urban and regional information systems and geographic information systems.

1. Introduction

Within a decade of its first conference in 1963 URISA began to offer workshops, and it has been offering them ever since. In this paper I explain why and how URISA workshops and workbooks are among the foundations of research, education, training, and applications activities in urban and regional information systems and geographic information systems and science.

My approach is to focus on the contribution which the workshops and workbooks make to education and training programs and events, with emphasis on the role that research and applications played in workshop and workbook design, testing, and presentation.

Matters discussed include: why and how workshops became part of URISA conferences beginning in the early 1960s; how topics came to be chosen; how workbooks were qualified for use in workshops; and how instructors were selected and qualified to present the workshops.

Due to the book's emphasis on foundations, historical detail is limited. I am aware that there could be interest in a general overview of URISA's experience with workshops and workbooks, but that task amounts to a separate book in its own right. As a modest contribution towards that end, several suggestions and references (URISA, 1996; Wellar, 1998) are included to assist those who might undertake the overview task.

By way of context for the content of this presentation, after informal meetings that began in 1970 as a result of involvement in the USAC project (discussed in Chapter 5) I presented the first formal data standardization workshop in 1973 (as I recall), instructed in at least 40 Introduction to GIS workshops at URISA, GIS/LIS, APA, IAAO, and other conferences, participated in revising the ***Introduction to GIS*** workbook on four or five occasions, appeared in several ***Intro*** videos, and was a member of the URISA Workshop Committee for more than a decade beginning in the late 1980s.

All in all, my direct involvement in URISA workshop design, development, review, instruction, etc., spans about 25 years.

2. Workshop Origins: Connecting Domains and Foundations

There are diverse reasons behind proposing and presenting workshops, whether they are of the traditional, all-in-the-same-room type or the webinar variety where participants can be in different countries. In either case, the matter at issue here is whether URISA workshop origins affect creating, developing, implementing, promoting, or sustaining the foundations of urban and regional information systems and geographic information systems and science.

I believe such a relationship exists, and it may be outlined as follows.

The ideas or motivations to create workshops come from multiple sources, including requests from members, suggestions by federal, provincial/state or municipal governments and/or agencies, and requests from other organizations.

In addition, workshop proposals can be extensions of currently funded projects, the basis of new research projects, included as research project deliverables, add-ons to current research projects, the means of promoting partnering opportunities, and vehicles for realizing marketing and consulting opportunities.

An important consideration from a foundations perspective is that workshops tend to originate in response to actual needs and perceived opportunities.

Further, to justify the investment of brains, time, effort, and money expended in preparing workshop materials, including the workbook, solid indications are sought to establish that for several to many years people will be attending a workshop because it deals with a significant education, training, research, and/or applications aspect of urban and regional information systems and geographic information systems and science. Or, to re-phrase, people develop and attend workshops primarily because they deal with one or more foundations of the field.

The long story short for URISA workshop origins, therefore, is that they arose in order to support connecting foundations and many of the information system domains in Table 1, Chapter 1, and numerous additional domains cited in other chapters in this book.

The connection between domains, workshops, and foundations is illustrated in Figure 1.

Figure 1. Graphically Illustrating the Connection Among Information System Domains, URISA Workshops, and Information System Foundations

On the left side of the schematic are information system domains, on the right side are information system foundations – topical, substantial, ontological, epistemological, institutional, organizational, legal, political, technical, technological, methodological, administrative, and so on – and the hinge linking domains and foundations is URISA workshops. In the remainder of this paper I briefly discuss the relationships that are in play. As will be demonstrated, this topic deserves serious research consideration, and I believe the material which follows may assist in designing inquiries.

3. Workshop Offerings: Foundation Builders

Feedback reveals that the listing approach employed in Table 1 in Chapter 1 is an instructive introduction to the information system domains which have been part-and-parcel of URISA's evolution over the past 50 years.

As a result, in this chapter the listing approach is again used, but the entries are ordered alphabetically and then chronologically.

The alphabetical ordering approach used in Table 1 is the same as that of Table 1 in Chapter 1. This way, it is convenient for readers to check for correspondence in terminology between the entries in the two tables. As for the nature of the foundations connection between the two tables, it may be summarized as follows:

> The greater the number of information system domains that can be explicitly or implicitly associated with a workshop title, the higher the likelihood that the workshop represents or contributes to the foundations which direct and support education, training, research, and/or applications activities involving urban and regional information systems and geographic information systems and science.

In some cases the content behind a workshop title is not evident and, as a result, there may be no apparent connection between information system domains and such titles. In a future production, it would be very useful to include the description of each workshop and, even better, the tables of contents.

For the purposes of this paper, however, it is sufficient to note that there are many obvious connections in terminology between the information system domains listed in Table 1 in Chapter 1, and the entries in Table 1 in this chapter.

And again, the correspondence is by design. That is, workshops tend to be developed as a means to deal with information system foundations and/or information system domains that involve new or different challenges which are not met by in-house training programs, current courses, available books or videos, etc.

Should there be interest in further documenting and analysing the connections among information systems domains, URISA workshops, and information system foundations, one way to begin the process is to prepare a (very large) table containing three columns listing:

1. The information system domains in Table 1, Chapter 1, and other domains identified in the chapters of this book.

2. The titles of URISA workshops and, preferably, time and other resources permitting, information system domains and information system foundations noted in the workshop descriptions and tables of contents.

3. All the information system foundations – topical, substantial, ontological, epistemological, institutional, organizational, legal, political, technical, technological, methodological, administrative, and so on – which direct and support education, training, research, and/or applications activities involving urban and regional information systems and geographic information systems and science, and are identified throughout the book.

Analysis of the entries in the columns is a start on revealing the connections that are in place, and also provides a start on revealing needs and opportunities for connections yet to be made. Or, to re-phrase, much remains to be done in elaborating the entries in all three columns in Table 1, and in considering the nature of connections, and the sooner this work is started the sooner significant benefits will be realized.

Which brings me to the leading edge kind of research which is undertaken within URISA, and why a different kind of thinking is involved in understanding what I mean by suggesting that significant value should be attached to the creation and presentation of peer-reviewed workshops and workbooks.

And, as a second suggestion for expanding and elaborating the research data base, I suggest that consideration be given to the various ways of organizing and connecting the entries in Table 1. In particular, presenting the offerings in chronological order provides time-ordered insights which can be very instructive in terms of ascertaining which offerings followed which offerings, and, perhaps, ascertaining which offerings are the primary drivers and hence the foundation pillars underlying the field of urban and regional information systems and geographic information systems and science.

Table 1. Partial* Listing of URISA Workshops in Alphabetical Order and Year of Initial Presentation*****

1. Addressing – 1995
2. Address Issues and IS/GIS Implementation – 1999
3. AI/Expert systems – 1988
4. AM/FM/GIS for Infrastructure Management – 1987
5. AM/FM/GIS for Public Works – 2000
6. AM/FM/GIS for Water/Wastewater – 1995
7. Assessment and Performance Measurement – 1977
8. Asset Management – 2004
9. Automated Data Processing –1968
10. Automated Mapping and Geoprocessing (Introduction) – 1985
11. Benefits for Small Cities (Establishing Information) – 1971
12. Bridging the Geo Spatial Knowledge Gap – 1999
13. Building Files (Master) – 1974
14. Business Intelligence – 2011
15. Cartography & Map Design – 1991
16. Census Data and Census Use – 1973
17. Census Data in Information Systems (Extending Use) – 1971
18. Census Data User Feedback and Interchange – 1971
19. Census Geography – 1998
20. Census TIGER Data – 1989
21. Census 1980 – 1977
22. Census 2000 – 1998
23. Civil Engineering and GIS/IT Integration – 2006
24. Clean Water Act – 1991
25. Communication Skills – 1997
26. Computer Graphics – 1983
27. Computers (Getting Started in) – 1983
28. Computers and Information Systems: A Financial Manager's Perspective –1980
29. Computers and Public Finance: Alternatives for the Future – 1976
30. Confidentiality – 1973
31. Consensus Building – 1993
32. Consultants and Vendors (Roles and Responsibilities) – 1977
33. Cost-Benefit Analysis in Municipal Information Systems – 1973
34. Crime Mapping – 2009
35. Curricula and Information Systems Programs (University) – 1977
36. Database Development and Conversion – 1999
37. Data Conversion – 1993
38. Data Distribution Policies, Costs, Indexes, Systems – 1999
39. Data Distribution Policies/E-Government – 1996
40. Data Generation Techniques – 1968
41. Data Management Systems – 1973
42. Data Standardization – 1973

Table 1 (Cont'd). Partial* Listing of URISA Workshops in Alphabetical Order and Year of Initial Presentation*****

43. Desktop Mapping (Beyond) – 1995
44. Digital Orthophotography: Production and Application – 1999
45. Digital Orthophotos –1994
46. Disaster Preparedness – 2000
47. Disaster Strikes – 1997
48. Document Imaging & Integrating documents with GIS – 1999
49. Document Retrieval in Information Systems – 1971
50. E-Commerce for Local Governments – 1999
51. Electronic Data Processing and Its Application to Planning – 1964
52. Electronic Data Processing Systems – 1965
53. Emergency Preparedness – 2012
54. Enterprise Information Modeling – 1993
55. Evaluation – 1974
56. Federal Actions (How to Bring About) – 1971
57. Field Automation – 2004
58. Financial Manager's Perspective (Computers and Information Systems) – 1980
59. Financial Management Systems (Modernizing) – 1995Fire Services – 1976
60. Freedom of Information – 1977
61. Functional Roles in Information System Design – 1976
62. Geocoding (User) – 1973
63. Geocoding (Techniques) – 1973
64. Geodetic Control – 1978
65. Geodetic Reference System – 1988
66. Geographic Base Files – 1975
67. Geographic Base File Developments – 1971
68. Geoprocessing – 1974
69. Geoprocessing (Advanced: A Database Approach) – 1985
70. Geoprocessing for Local Government (Introduction) – 1987
71. Geoscience Career Growth – 1998
72. GIS & Business – 1997
73. GIS & Document Imaging – 1994
74. GIS & Emergency Management – 1991
75. GIS & Geographic Imaging (Integrating) – 1999
76. GIS & Internet – 1995
77. GIS & Information Systems Integration – 1999
78. GIS & Natural Resource Management – 1989
79. GIS & Public Works – 1999
80. GIS & Real Estate – 1991
81. GIS & Transportation – 1989
82. GIS & Transportation: Introduction to GIS-T – 1992
83. GIS & Urban and Regional Planning – 1997
84. GIS (Advanced Topics) – 1987

Table 1 (Cont'd). Partial* Listing of URISA Workshops in Alphabetical Order and Year of Initial Presentation*****

85. GIS Applications for Assessors – 1993
86. GIS Conceptual Data Model (Implementation) – 1993
87. GIS Database Construction (Advanced) – 1993
88. GIS for Data Processors – 1989
89. GIS Conversion Strategies (Optimizing) – 1990
90. GIS Database Design/Models – 1993
91. GIS Data Base Development – 1989
92. GIS Enterprise Architecture and System Integration –1994
93. GIS Implementation (Managing) - 1999
94. GIS (Introduction) – 1984
95. GIS Management – 1988
96. GIS Partnerships (Consensus Building Techniques) – 1993
97. GIS Procurement – 1999
98. GIS Program Management – 2004
99. GIS ROI – 2012
100. GIS Strategic Planning – 2008
101. Goals of URISA – 1971
102. GPS – 1994
103. GPS (Hands-on) – 1996
104. GPS, Imagery, and GIS – 1997
105. GPS (Introduction) – 1999
106. Hardware Alternatives for GIS and Office Automation (Understanding) –1992
107. Highway Inventory and Maintenance – 1997
108. Human Element in Information Systems – 1973
109. IGIS Technology (Low Cost) – 1974
110. Information at Your Fingertips – 1985
111. Information Benefits for Small Cities (Establishing) – 1971
112. Information Management – 1965
113. Information Systems Technology Transfer – 1976
114. Interactive Computer Graphics – 1982
115. Intergovernmental Relations – 1977
116. Integrated Information Systems – 1972
117. International Exchanges – 1977
118. International Information Systems – 1985
119. International Information Technology for Development – 1976
120. Internet GIS – 1998
121. ISO Geostandards – 2011
122. Land Classification Detection –1997
123. Land Management Systems – 1984
124. Land Records Modernization and the Multipurpose Cadastre – 1987
125. Law and Public Information Policy – 1999
126. Law Enforcement and Criminal Justice Information Systems – 1976

Table 1 (Cont'd). Partial* Listing of URISA Workshops in Alphabetical Order and Year of Initial Presentation*****

127. Leadership – 1988
128. LiDAR – 2006
129. Low Cost IGIS Technology – 1974
130. Low Cost Technology – 1977
131. Management Topics in GIS Development – 1988
132. Managing EDP Systems –1968
133. Map design: Making Better Maps – 1992
134. Mapping on the Macintosh – 1989
135. Marketing Information Services and Products – 1985
136. Marketing Management for Public Agencies – 1985
137. Metadata – 1998
138. Micros: How to Select and Procure – 1984
139. Microcomputer Issues (Advanced) – 1984
140. Microcomputers and Transit Management – 1984
141. Microcomputers for Local Government – 1982
142. Microcomputer Techniques for Growth Management – 1987
143. Minicomputer Applications – 1978
144. Minicomputers and Low-cost Data processing – 1976
145. Minicomputers and State and Local Government Data Processing – 1976
146. Model Cities Applications and Developments – 1971
147. Multimedia – 1991
148. Multimedia GIS and the Web – 1997
149. Municipal Information Systems Research – 1966
150. Municipal Mapping & Geoprocessing Systems – 1984
151. NASA/NSF Remote Sensing Forum – 2000
152. National Spatial Data Infrastructure framework – 1998
153. National Statistical Programs – 1977
154. Natural Resources/Environmental Assessment: The Minnesota Land Management Information System – 1982
155. New Directions in Urban Management: Geoprocessing and Data Base Management – 1982
156. 911 (Next Generation) – 2012
157. 1980 Census Data Processing – 1982
158. Object-Oriented GIS Technology (Introduction) – 1999
159. Object-Oriented Spatio-Temporal Modeling – 2006
160. Open Source GIS – 2005
161. Parcel Mapping Fundamentals – 1991
162. Parcel Mapping/GIS for Assessors – 1989
163. Permit Tracking and Development Monitoring – 1987
164. Photogrammetric Methods – 1986
165. Policy Processes – 1977
166. Positioning Accuracy Standards (New) – 2000
167. Presentation Skills – 1986

Table 1 (Cont'd). Partial* Listing of URISA Workshops in Alphabetical Order and Year of Initial Presentation*****

168. Procurement and Contract Management – 1999
169. Project Management – 1999
170. Public Access and Privacy – 1985
171. Public Data, Public Access, Privacy, and Security – 2004
172. Public Information: Legal Issues – 1988
173. Public Finance – 1975
174. Public Information for the People: Issues about Access – 1985
175. Public Participation GIS – 2006
176. Public Safety – 1988
177. Public Works – 1976
178. Quality Management – 2007
179. Quality Spatial Data – 2007
180. Recreation and Parks – 1976
181. Re-Engineering Government – 1996
182. Remote Sensing for Urban and Regional Applications – 2000
183. Research Fundamentals – 2005
184. Role of Computers – 1967
185. Role of Models in Setting Values – 1966
186. Security – 1973
187. Small Area Data – 1965
188. Small Area Modelling – 1990
189. Social Indicators – 1973
190. Spatial Analysis (Introduction) – 1989
191. Spatial Data Transfer Standard – 1998
192. SQL and Relational Basics for GIS – 1991
193. Small Area Data – 1965
194. Standards/Geographic Base File – 1973
195. Statistics Canada 1996 Census – 1997
196. Systems Assessment and Performance Measurement – 1977
197. Telecommunications Strategies – 1987
198. 3-D Visualization – 2003
199. 3-D Geospatial – 2005
200. Transferability – 1972
201. Transportation Spatial Database – 2006
202. Urban and Regional Information Systems –1968
203. Urban Data Needs – 1966
204. Urban Geoprocessing: New Technologies – 1986
205. Urban Information Systems for Economic Development – 1989
206. Urban Simulation – 1965
207. USAC Transferability Accomplishments – 1971
208. Vertical and Horizontal Data Linkages – 1970
209. Virtual Reality Nets – 1997

* This compilation is extensive relative to previously published lists, but new entries for the early years continue to surface as we sort through the language used to describe (seemingly) workshop-related activities. Two primary sources of difficulty in achieving complete records may be summarized as follows.

During the start-up years it appears that there were concerns among major players about spending a lot of time and effort documenting events, given the perception that the loose collection of individuals could be "here today and gone tomorrow" as a group. In the absence of a secretariat in the early days it fell to individuals to create files, and not everyone was diligent or even interested in what might be referred to as high-order documentation.

Further, due to incomplete records and fuzzy terminology (See ** below for details about scope of coverage associated with "workshop"), it is likely that not all workshop "equivalents" sponsored by Special Interest Groups (SIGs) at national and other meetings of URISA and URISA partners are included in the present list. It is prudent, therefore, to include the qualifier 'partial' in the title of the table, and to recommend that deeper examination of URISA's workshop activity take into account the chapter on Special Interest Groups prepared under the lead of Peter Van Demark.

Finally with regard to the entries in the listing, information compiled by Ed Wells indicates that to date workshops have been presented on 125 distinct topics. Table 1 includes all those distinct topics, as well as others which in my opinion represent significant changes to the original contributions.

** In this table the term workshop covers meetings titled workshop, workshop panel, workshop group, working session, *ad hoc* working group, question/answer panel, seminar, working seminar, tutorial, forum, roundtable, and other comparable terms which were used in the spirit of education and training instruction in urban and regional information systems and geographic information systems and science.

Broadening the terminology scope recognizes that before the term workshop was adopted by URISA, meeting organizers from universities, government, and the private sector used different terms for similar education and training events.

My position is that if the record indicates that these meetings were precursors to subsequent workshops, then they are original contributions and are included.

That reasoning is consistent with communications with Prof. William Garrison who reminds that "back in the day" (e.g., decades before the Internet arrived on the scene), meetings-within-meetings sometimes just happened in unofficial ways to take advantage of assemblies of people with like interests, and may not have been officially proclaimed as workshops. Since we have an obligation to our early thinkers and doers to give credit where credit is apparently due, it seems reasonable to focus on the meetings themselves rather than the terms used to describe the assemblies.

*** Some workshops went through a form of pilot study, pre-test, trial run process, some were partnered activities that were “tried out” at meetings of organizations other than URISA, and others went through name changes, so I cannot be certain of the exact year of presentation in all cases. However, any shuffling would likely be of a minor nature, that is, several years at most.

Acknowledgement. I am pleased to emphasize that much credit is due to Ed Wells for his work on tabulating which workshops were given on which years by whom.

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Aspects of this approach were implemented in the 1990s when I chaired the URISA Workshop Committee, and we were making workshop rationalization decisions (Wellar, 1997). Such a task would be much easier now due to major (electronic) advances in text and document handling capabilities, and I welcome someone taking on this task. I expect that it would be a challenging as well as an enlightening endeavour, and would yield a very valuable product.

To perhaps promote research in the direction suggested, Table 2 organizes the entries in Table 1 in chronological order. Discussion of Table 2 is limited to two comments, which I believe is sufficient to underscore the significance of URISA workshops and associated workbooks as foundations of the field.

First, feedback from early members reveals that I have listed a number of pertinent titles, but by no means all of them. There is research to be done that involves searching for historical records which could be in a variety of government, academic, association, and other locations. That kind of searching goes well beyond what is appropriate for this book which is designed more in the way of an overview than a “deep review”. However, the assurance that there is a “lot of good material still out there” may inspire the needed search effort.

Second, over the years many URISA productions – including workbooks – have preceded theses and dissertations, journal articles, and proceedings papers in urban and regional information systems and geographic information systems and science.

Which brings to mind the significance of precedents for those conducting or claiming to have performed original research.

Claims or impressions about originality can be “shot down” in a hurry if one’s homework has not been done properly. In the case of URISA workshops and related events, these number in excess of 200 and, as shown by Table 2 they encompass a significant number of the information system domains illustrated by Table 1 in Chapter 1.

Table 2. List of URISA Workshops* in Approximate Chronological Order of Initial Presentation**

1964. Electronic Data Processing and Its Application to Planning
1965. Electronic Data Processing Systems
1965. Information Management
1965. Small Area Data
1965. Urban Game-Simulation
1966. Municipal Information Systems Research
1966. Role of Models in Setting Values
1966. Urban Data Needs
1967. Meeting Urban Data Needs
1967. Role of Computers
1968. Automated Data Processing
1968. Data Generation Techniques
1968. Managing EDP Systems
1968. Urban and Regional Information Systems
1970. Vertical and Horizontal Data Linkages
1971. Census Data in Information Systems (Extending Use)
1971. Census Data User Feedback and Interchange
1971. Document Retrieval in Information Systems
1971. Federal Actions (How to Bring About)
1971. Geographic Base File Developments
1971. Goals of URISA
1971. Information Benefits for Small Cities (Establishing)
1971. Model Cities Applications and Developments
1971. USAC Transferability Accomplishments
1972. Integrated Information Systems
1972. Transferability
1973. Census Data and Census Use
1973. Confidentiality
1973. Cost-Benefit Analysis in Municipal Information Systems
1973. Data Management Systems)
1973. Geocoding (Techniques)
1973. Geocoding (User)
1973. Geoprocessing
1973. Human Element in Information Systems
1973. Security
1973. Social Indicators
1973. Standards/Geographic Base File
1973. Data Standardization
1973. Transferability
1974. Building Files (Master)
1974. Evaluation
1974. Geographic Base Files
1974. IGIS Technology (Low Cost)

Table 2 (Cont'd). List of URISA Workshops* in Approximate Chronological Order of Initial Presentation**

1975. Public Finance
1976. Computers and Public Finance: Alternatives for the Future
1976. Fire Services
1976. Functional Roles in Information System Design
1976. Information Systems Technology Transfer
1976. International Information Technology for Development
1976. Law Enforcement and Criminal Justice Information Systems
1976. Minicomputers and Low-cost Data Processing
1976. Minicomputers and State and Local Government Data Processing
1976. Public Works
1976. Recreation and Parks
1977. Assessment and Performance Measurement
1977. Census 1980
1977. Consultants and Vendors (Roles and Responsibilities)
1977. Curricula and Information Systems Programs (University)
1977. Freedom of Information
1977. Functional Roles Framework for Building Information Systems
1977. Intergovernmental Relations
1977. International Exchanges
1977. Low Cost Technology
1977. International Exchanges
1977. National Statistical Programs
1977. Policy Processes
1977. Systems Assessment and Performance Measurement
1977. University Curricula and Information Systems Programs
1978. Geodetic Control
1978. Minicomputer Applications
1980. Computers and Information Systems: A Financial Manager's Perspective
1982. Interactive Computer Graphics
1982. Microcomputers for Local Government
1982. Natural Resources/Environmental Assessment: The Minnesota Land Management Information System
1982. New Directions in Urban Management: Geoprocessing and Data Base Management
1982. 1980 Census Data Processing
1983. Computers (Getting Started)
1983. Computer Graphics
1984. GIS (Introduction)
1984. Land Management Systems
1984. Microcomputer Issues (Advanced)
1984. Microcomputers and Transit Management
1984. Micros: How to Select and Procure
1984. Municipal Mapping & Geoprocessing Systems

Table 2 (Cont'd). List of URISA Workshops* in Approximate Chronological Order of Initial Presentation**

1985. Automated Mapping and Geoprocessing (Introduction)
1985. Geoprocessing: A Database Approach (Advanced :)
1985. Information at Your Fingertips
1985. International Information Systems
1985. Introduction to Automated Mapping and Geoprocessing
1985. Land Management Systems
1985. Marketing Information Services and Products
1985. Marketing Management for Public Agencies
1985. Microcomputer Applications
1985. Microcomputer Issues (Advanced)
1985. Public Access and Privacy
1985. Public Information for the People – Issues about Access
1986. AM/FM/GIS for Infrastructure Management
1986. Photogrammetric Methods
1986. Urban Geoprocessing: New Technologies
1987. Geoprocessing for Local Government (Introduction)
1987. GIS (Advanced Topics)
1987. Land Records Modernization and the Multipurpose Cadastre
1987. Microcomputer Techniques for Growth Management
1987. Permit Tracking and Development Monitoring
1987. Telecommunications Strategies
1987. AI/Expert systems
1988. Geodetic Reference System
1988. GIS Management
1988. Leadership
1988. Management Topics in GIS Development
1988. Public Information: Legal Issues
1988. Public Safety
1989. Census TIGER Data
1989. GIS Data Base Development
1989. GIS for Data Processors
1989. GIS & Natural Resource Management
1989. GIS & Transportation
1989. Mapping on the Macintosh
1989. Parcel Mapping/GIS for Assessors
1989. Spatial Analysis (Introduction)
1989. Urban Information Systems for Economic Development
1990. GIS Conversion Strategies (Optimizing)
1990. Small Area Modelling
1991. Cartography & Map Design
1991. Clean Water Act
1991. GIS & Emergency Management
1991. GIS & Real Estate

Table 2 (Cont'd). List of URISA Workshops* in Approximate Chronological Order of Initial Presentation**

1991. Multimedia
1991. Parcel Mapping Fundamentals
1991. SQL and Relational Basics for GIS
1992. GIS & Transportation: Introduction to GIS-T
1992. Hardware Alternatives for GIS and Office Automation (Understanding)
1992. Map Design: Making Better Maps
1993. GIS Conceptual Data Model (Implementation)
1993. Consensus Building
1993. GIS Database Design/Models
1993. Data Conversion
1993. Enterprise Information Modeling
1993. GIS Applications for Assessors
1993. GIS Database Construction (Advanced)
1993. GIS Partnerships (Consensus Building Techniques)
1994. Digital Orthophotos
1994. GIS & Document Imaging
1994. GIS Enterprise Architecture and System Integration
1994. GPS
1995. Addressing
1995. AM/FM/GIS for Water/Wastewater
1995. Desktop Mapping (Beyond)
1995. Financial Management Systems (Modernizing)
1995. GIS & Internet
1996. Data Distribution Policies/E-Government
1996. GPS (Hands-on)
1996. National Spatial Data Infrastructure Framework
1996. Presentation Skills
1996. Re-Engineering Government
1997. Communication Skills1998.
1997. Census Geography
1997. Disaster Strikes
1997. GIS & Business
1997. GPS, Imagery, and GIS
1997. Highway Inventory and Maintenance
1997. Land Classification Detection
1997. Multimedia GIS and the Web
1997. Statistics Canada 1996 Census
1997. Virtual Reality Nets
1998. Metadata
1999. GIS & Urban and Regional Planning
1998. Census 2000
1998. Geoscience Career Growth
1998. Internet GIS

Table 2 (Cont'd). List of URISA Workshops* in Approximate Chronological Order of Initial Presentation**

1998. Spatial Data Transfer Standard
1999. Address Issues and IS/GIS Implementation
1999. Bridging the Geo Spatial Knowledge Gap
1999. Database Development and Conversion
1999. Data Distribution Policies, Costs, Indexes, Systems
1999. Document Imaging & Integrating Documents with GIS
1999. Digital Orthophotography: Production and Application
1999. E-Commerce for Local Governments
1999. GIS & Geographic Imaging (Integrating)
1999. GIS & Information Systems Integration
1999. Law and Public Information Policy
1999. GIS & Public Works
1999. GIS Implementation (Managing
1999. GPS (Introduction)
1999. Object-Oriented GIS Technology (Introduction)
1999. Procurement and Contract Management
1999. Project Management
2000. AM/FM/GIS for Public Works
2000. NASA/NSF Remote Sensing Forum
2000. Positioning Accuracy Standards
2000. Remote Sensing for Urban and Regional Applications
2004. Asset Management
2004. Disaster Preparedness
2004. Field Automation
2004. GIS Program Management
2004. Public Data, Public Access, Privacy, and Security
2005. Open Source GIS
2005. Research Fundamentals
2005. 3-D Visualization
2006. Civil Engineering and GIS/IT Integration
2006. LiDAR
2006. Public Participation GIS
2006. Transportation Spatial Database
2006. Object-Oriented Spatio-Temporal Modeling
2006. Quality Management
2007. Quality Spatial Data
2007. Crime Mapping
2008. GIS Strategic Planning
2011. Business Intelligence
2011. ISO Geostandards
2012. Emergency Preparedness
2012. GIS ROI
2012. 911 (Next Generation)

* As discussed in note ** at the conclusion of Table 1, the term workshop covers meetings titled workshop, workshop panel, workshop group, working session, *ad hoc* working group, question/answer panel, seminar, working seminar, tutorial, forum, roundtable, and other comparable terms.

** Some workshops went through a form of pilot study, pre-test, trial run process, some were partnered activities that were "tried out" at meetings of organizations other than URISA, and a number of workshops went through name changes, so I cannot be certain of the exact year of initial presentation in all cases. However, any shuffling would likely be of a minor nature, that is, several years at most.

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The associated suggestion, therefore, is that authors of completed and in-process theses and dissertations, as well as journal articles and proceedings papers, in urban and regional information systems and geographic information systems and science, might be well-advised to check their work against URISA workshops and workbooks.

This caution and suggestion is re-visited in section 6 which discusses the matter of attribution.

4. Research and Application Inputs to Workshop Offerings

As indicated above, workshops do not emerge from the ether. Rather they are the product of the workshop committee interacting with individuals who propose, develop, and present workshops.

The review process used in deciding which workshops to adopt is similar to that which is used by research project funding agencies, even to the point that both agencies and the committee may invite proposals, and may also accept unsolicited proposals.

To slightly expand that line of thought, in both the workshop committee and agency environments there is an evaluation process which directs decisions about whether to continue or renew workshops and projects for what reasons. I elaborate the significance of the evaluation process in practical, professional terms in section 6.0, where I refer to attribution, and suggest that <u>significant</u> value should be attached to the creation and presentation of peer-reviewed workshops and workbooks.

There are elements of both curiosity-driven and client-driven research in the design and implementation of the workshop program, which is perhaps best illustrated by the individuals who serve on the committee and propose, develop, and present workshops.

In brief, committee members and workshop leaders come from all of URISA's member groups, including academia (universities and colleges), all levels of government (federal, provincial/state, and municipal), business (vendors, consultants, users) research organizations, other professional organizations, and public interest organizations.

I suggest that URISA's workshops were leading edge precisely because of this mix, which is further discussed in Chapter 17, "Connecting Research Methodology and the Reality-Data-Information-Knowledge Transform Process". That is, beginning with its very first workshops, and because of its mix of members, URISA put together a research-grounded workshop program that is unmatched in the field of urban and regional information systems and geographic information systems and science.

As for the applications input to the workshops, it is illustrated in part by the information system domains in Table 1, Chapter 1, and the titles of workshops in Table 1 of this chapter.

The dozens of "A to Z" applications (assessing to zoning) included in the information system domains are just a small portion of those contained in workshop workbooks.

By way of brief comment, workshops dealing with major operational units such as finance, assessing, public safety, public works, planning, transportation, and water and waste water, may involve dozens and even hundreds of applications activities.

Moreover, workshops with general or global titles such as *Introduction to GIS*, *Project Management*, *Census Data and Census Use, Geocoding*, *Land Management Systems, Model Cities,* and *Social Indicators* were and are presented to officials from the executive, management, planning, operations, and other functions.

Consequently, a demonstration of GIS applications in the *Intro to GIS* workshop, for example, was tailored to fit the needs and interests of the audience.

As a result, multiple overheads and slides were created so that instructors could get on the same pages of workshop attendees from a variety of disciplines.

And, in the same vein, overheads and slides were also at the ready in anticipation that workshop attendees might want a demonstration of applying GIS in assessing, housing, waste disposal, environmental protection, open space, transportation, police, fire, forestry, urban development, and so on.

In combination, then, research and application inputs contribute to ensuring that URISA workshops and workbooks are substantively grounded, and effectively serve the education and training needs of a diverse and changing clientele in urban and regional information systems and geographic information systems and science.

5. URISA Workbooks as Foundation Documents

To this point in the chapter, emphasis is placed on the contributions that URISA workshops make to various information system foundations – topical, substantial, ontological, epistemological, institutional, organizational, legal, political, technical, technological, methodological, administrative, and so on.

It is now appropriate to discuss workbooks, which present the education and training objectives and fundamentals of the workshop program and are, in my opinion, core foundation documents.

Beginning with the 1964 conference, URISA began the process of producing original documents – workbooks – in the field of urban and regional information systems and geographic information systems and science. (Readers are reminded of Table 1 and the different terms associated with "workbooks".)

An original workbook is by definition a foundation document because, at the time of first presentation, it is the only document in existence for one or more information system domains. Annual reviews may result in minor changes, and even major changes, but if this workbook is "the only show in town" then it remains the foundation document.

Whether it continues to be the foundation document depends upon the nature of any extra-URISA workbook that may be produced.

For example, if an extra-URISA workbook is a variation (knock-off, duplication, copy, etc.,) of the original, then the original URISA workbook remains the foundation document and the variation is a derivative. (The relationship between original and derivative research and productions is discussed in detail in Chapters 5, 8, 17.)

However, if an extra-URISA workbook introduces new or different, non-trivial education and training ideas, empirical evidence, approaches, etc, then the URISA workbook becomes a foundation document rather than the foundation document.

In my experience as URISA Workshop Committee member and chair, all URISA workbooks were the foundation documents for a number of years. Annual reviews resulted in changes to most if not all workbooks, but on a year-to-year basis these changes tended to be at the margins, or reflected updates involving recent developments in hardware, peripherals, and software, news events, legislation, public policies, and other frequent-change matters.

During my term of workshop committee activity I do not recall any extra-URISA alternatives being proposed for any of the workshop offerings in Table 1 within at least four years of the initial production.

And, flagship workbooks, such as *Introduction to GIS*, seem to have been primary foundation documents in urban and regional information systems and geographic information systems and science for eight or ten or more years after their initial presentations.

The contribution of more than 200 workbooks to the literature on information system foundations is a significant achievement, and attests to the commitment, expertise, and energy which dozens of workbook developers brought and continue to bring to the URISA workshop program.

6. Workbook Attribution

In this closing section I recognize the individuals who design, develop and present the workbooks. I believe that they are overdue to receive more respect in two ways in particular.

First, URISA is a professional organization, and many of the authors of workbooks are professionally accredited planners, engineers, lawyers, assessors, finance officers, accountants, surveyors, and geographic information system professionals (GISPs).

Further, a number of workbook authors have earned or are earning advanced degrees, including M.A., M.S., MSc., MSW, MBA, MPA, and PhD.

Workbooks authored by these individuals deserve to be treated as citable works.

Or, to re-phrase, workbooks involve intellectual capital as well as a peer review evaluation process and, as a result, credit in the form of full and complete referencing is due the authors of these contributions to the literature. Anything less is flat-out plagiarism or, to be perfectly blunt in the plainest of terms, theft.

I am aware of concerns that URISA workbook materials have made unattributed appearances in books, journal articles, proceedings papers, extra-URISA workbooks, and website postings.

The friendly reminder to anyone committing such malpractice in the past, or thinking about doing so in future, is that passing off someone else's material as your own can be a career-wrecker. Give credit where credit is due.

Second, URISA workbooks go through a demanding review process. In my experience, the workshop and workbook approval process can be as rigorous as the review process for journal articles, and for reviews of publications for professional accreditation.

It is my recommendation, therefore, that an approved URISA workbook be regarded as the equivalent of <u>at least</u> one peer-reviewed journal article in the academic sphere, and as <u>a significant body of work</u> in a professional accreditation portfolio. I would be pleased to support any workbook author who wishes to have me write a letter of recommendation in that regard.

7. Conclusion

Through their grounding in research and applications, URISA workshops and workbooks have made many significant contributions to the education and training foundations of the field of urban and regional information systems and geographic information systems and science.

Further, by serving as the hinge connecting information system domains and information system foundations, URISA workshops and workbooks have become “how to” education and training foundations in their own right.

Creating, updating, and revising 200 workshops and workbooks is an exceptional achievement, and one which warrants celebrating at the 50^{th} anniversary conference. However, if the past is any indication of the future, then for one reason in particular URISA will be called upon to continue supporting this activity.

That is, preparing and presenting workshops and workbooks connecting information system domains and information system foundations requires a hard-to-find mix of interest, skill, experience, and dedication.

To my knowledge URISA is the only such organization at present, and it seems likely that it will continue to occupy that leading edge position for the foreseeable future.

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12

THE URISA EXEMPLARY SYSTEMS IN GOVERNMENT (ESIG) AWARDS; RECOGNIZING INFORMATION SYSTEMS DELIVERING VALUE

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***Abstract*:** The Exemplary Systems in Government (ESIG) awards, inaugurated in 1980 by the Urban and Regional Information Systems Association (URISA), recognize extraordinary achievement by government agencies in the use of automated information systems. This achievement is defined as the effective application of computer technology that can be measured in terms of improved government services and increased benefits to citizens. The award competition is open to all public agencies at the federal, state/provincial, regional and local levels. This chapter explains how the awards came into being and how they have progressed over the past 30 years.

1. Early Years of the ESIG Awards

In 1980, URISA proposed a new awards program to recognize the best applications of computer technology in terms of improved government. Known as both the “Information Systems Awards” and “Exemplary Systems in Government”, the details of the program and the initial call for nominations were announced in the Association’s newsletter as shown below (URISA, 1980, p. 12).

> *NEW URISA AWARDS PROGRAM*
>
> *The Urban and Regional Information Systems Association (URISA) has announced the establishment of a new awards program; Exemplary Systems in Government. "The objective of this awards program is to recognize outstanding achievements by government institutions in the field of information systems", according to William De Groff, President of URISA. "We all too frequently hear of government waste and inefficiency. These awards are intended to draw attention to those highly innovative and effective uses of computer technology in government, especially where these systems have served to cut operating expenses, improve operating efficiency, or have significantly increased the level of service and benefits the citizens." De Groff also stresses that "these are not awards for technological achievement but rather are awards for the effective application of computer technology which can be measured in terms of improved government."*

An awards committee has been named to review submissions and nominations. Members of this committee include William ller, City of Chicago Data Center; Craig Caywood, C & P Telephone; Barry Wellar, University of Ottawa; and Donald Cooke, Geoprocessing Sciences. This committee will make recommendations on award nominees with final selection to be made by the URISA Board of Directors. Winners will be announced in July of 1981 and awards will be presented at the 1981 URISA Conference to be held August 16-20 in New Orleans. The award winners will be invited to make presentations on their systems as part of URISA 81. The guidelines for submission have been established to insure a broad base of competition and to adequately represent the multitude of interests within URISA.

1. *Competition is open to all public sector agencies at the federal, state, provincial, regional and local levels.*
2. *Submissions for consideration are to be made by the public agency and should include the following:*
   a. *A description of the nominated system(s) including the major functions performed, the technology used, the major benefits derived, the development approach, the costs of the system and the availability of documentation and potential for transferability (approximately 8 pages double spaced and typed).*
   b. *A letter submitted by the primary end user(s) of the system attesting to its benefits and functionality.*
   c. *A letter from the chief executive or elected officer of the agency indicating their support of the nominated system and authorization for URISA to use the material submitted in the URISA annual conference proceedings, newsletters or special publications highlighting the awards process.*
3. *All final submissions must be received by URISA no later than March 31, 1981. Send submissions to URISA, Information System Awards, 2033 M Street, N.W., Washington, D.C. 20036. Questions may be directed to Dorothy Bomberger at the URISA offices, Tel: (202) 466·7406.*
4. *All submissions must be typewritten.*
5. *The nominated system(s) may be in any application area for which the jurisdiction has responsibility. Major areas of interest include finance and administration, public safety, physical and economic development, human services, planning and zoning, libraries, hospitals, public works and transportation. Considerations will be given to systems using technological approaches such as geoprocessing, computer graphics, packaged software, database management, low-cost computer technology (mini/micro) and data processing cooperatives to the extent that these technological approaches to systems have directly contributed to improved government operations and service delivery.*

The URISA Board of Directors will select four winners in 1981. Representatives of the winning jurisdictions will be invited to receive their awards in New Orleans at the 1981 URISA Conference. Special sessions at URISA 81 will be held for presentations on these systems.

The article above was written by the URISA President at the time, William De Groff, who recalls that period in detail (W. De Groff, in pers. comm. to D. Haley, 2012):

"I became President that year [1980] and the Board focused on how to increase the membership and how to grow the membership base. We decided that URISA needed to expand its local government participation. Local government agencies represented the largest potential base of new members from which to draw new members and conference attendees. We had had a strong local government participation in Toronto and the 1980 conference in New Orleans was putting together strong local government participation.

I was the IT Manager for the City of Boise in the 70s and Sam Trotter was the IT Director for the City of Little Rock. He was also the President Elect and Conference Chairman for the New Orleans conference. The association was focused on using local governments as the growth engine for the future. Throughout the 80s URISA's membership and conferences expanded substantially, much of it driven by expanded local government participation. A substantial number of the Board Members and Presidents also came from local government during that period. With increasing local government involvement URISA was able to expand its vendor participation to all-time highs and the associated revenue helped bring URISA to a new level of success. The local government strategy worked exceptionally well.

The first awards were given at the 1981 New Orleans conference. We were not sure we would get any submissions the first year. But at the last minute, we got seven submissions. I quickly assembled a committee of three members to review the submissions and pick the winners. We didn't have any formal criteria. We just tried to pick systems that we thought were innovative and would be of interest to other government agencies. We picked a federal system, a state system and three local government systems. All of the initial winners came from strong member agencies of URISA.

In the early years of ESIG we didn't put any limits on the submissions, thus we had systems for fire agencies, parking violations, budgeting, payroll, building inspection, etc. Later the categories for size and subject were created. We also had submissions from all levels of government, and we gave awards to all systems that were innovative. In 1989 the number of winners grew to 11. Soon after, the ESIG people created categories and began to limit the number of winners.

> *The fact that ESIG has lasted 20+ years is amazing to me. Over that period URISA has reinvented itself several times, but ESIG lives on."*

Indeed, the ESIG Awards programs has well and truly 'lived on' and De Groff recently stated that *"This is probably my proudest accomplishment for URISA"* (W. De Groff, in pers. comm. to K. Dueker, October 2011). Another strong champion of the awards was Stephen Kinzy, a URISA Board member from 1978-1982, who recalls that the discussion of the awards arose:

> *"…as a way of getting more attention and executive commitment for local Geoprocessing programs (which is what we called GIS in those days) … I believe that the importance of the ESIG awards, then and now, are that they recognize the value of GIS and other IT technology in the public sector as a way of improving the efficiency and effectiveness of government in a very open and transparent way. By honoring the best practices of our members we help document and share their experiences and most importantly reinforce the use of information systems technology with executives, elected officials and the public. … At the time we tried to recognize as many organizations as possible that met our minimum criteria, so that we could help them promote their success both locally and nationally. It gave our ESIG winners much needed professional recognition, it increased attendance and generated great presentations for the conference."* (S. Kinzy, in pers. comm. to D. Haley, 2012).

2. Growth of the ESIG Awards

The ESIG program grew steadily during the 1980s and the full list of recipients from 1981-2011 is provided in the Appendix to this chapter. Initially, there were no particular categories for the award winners, however it is significant that in only the second year of the awards, 1982, a Special Recognition Award was made to the U.S. Bureau of the Census for its outstanding ground-breaking work of the late 1970s to introduce topologically-structured street centerline files with matching address ranges.

In addition, there was no requirement in those early days for the awards to be made to systems having a geographic component to them, however within a few short years and given the nature of the URISA membership, a dominant theme of applications devoted to land-related data soon emerged.

The first non-U.S. award was made to a Canadian application from Edmonton in 1983, while the first non-North American award went to a South Australian entry in 1984. Thereafter, Canadian and Australian award winners have continued to feature regularly in the ESIG program right through to the present day. Other countries to feature in the awards include Egypt, Qatar, Singapore and Sweden.

The early years of the ESIG program were also less competitive that they are today, and this has been a subject of continuing discussion within URISA. One side of the debate is the view that all entries that are exemplary should receive an award, while the opposing argument is that only the very best applications should be rewarded, and indeed there is at least one other international systems award program that follows the former view and makes several hundred awards annually.

By 1987, URISA was producing an annual report which documented the ESIG award winners each year and which were considered to reflect the state-of-the-art in the use of information systems in government. There was also a growing need to categorize the entries and in the 1987 State-of-the-Art report by Robert Lima these categories were identified for the first time (URISA, 1987, p. 1).

> *“It wasn't that long ago that the visionaries wondered when computer technology would become more accessible to the "masses." Not much later, the concern was with integration of the technology into the daily functions of the workplace. This year's "The State of the Art" report suggests that both areas have been advanced greatly, at least in the public sector arena.*
>
> *The Exemplary Systems in Government Awards seek to recognize outstanding achievement by government agencies in the use of automated information systems. This achievement is measured in terms of improved government services and increased benefits to citizens. Access to computer technology, alone, is no longer enough. The integration of the technology into the government work environment to better facilitate services and deliver increased benefits to citizens is paramount. This edition of "The State of the Art" documents a few of those who merit recognition through the URISA Awards Program.*
>
> *The nine systems described in this report represent a broad spectrum of applications. Some of these systems are multi-purpose in function performing a multitude of tasks. Still others have been designed solely to address the information and decision making needs related to a more finite set of relevant issues. What is most impressive about these systems is that they, in total, cross-cut the various scales of government – local to national – and address a diverse set of issues and functional needs.*
>
> *For this report, the systems have been organized for presentation into three general groups. These groupings include the following types of systems:*
>
> - *OPERATIONS AUTOMATION - Systems which are directed towards automating an existing manual or computerized system into an integrated operation;*
> - *INTERNATIONAL SYSTEMS - A special category of systems which have been designed for use by governments outside of the U.S. border; and*

- *SMALL JURISDICTION SYSTEMS - For systems used and/or developed by jurisdictions with a population of less than 100,000.*

These groups are somewhat arbitrary. Many of the systems are sufficiently multi-purpose in nature and adaptable in scale that they could be legitimately classified at a functional level in more than one category. Because of space limitations, it has not been possible to include all the exhibits that were originally submitted with each paper for review by the Exemplary Systems in Government (ESIG) Awards Committee. A list of contacts is documented at the end of the report in order to assist in obtaining further details about each system.

Many public agencies have implemented successful automated information systems that provide a variety of benefits to citizens. The URISA Exemplary Systems in Government Awards Program seeks to identify and recognize those systems that have excelled in providing direct benefits such as service improvements, and/or direct benefits, such as streamlining government administration. Additionally, the Awards program recognizes the technical sophistication, value as a management tool, and degree to which a system generates real solutions to real government problems. The nine systems presented in this report have strived to excel in these areas."

These categories, however, were modified again in 1990 when the additional classes of Corporate Systems Award and Honorable Mentions were included. By 1992 the international award had been removed and entries from overseas were judged on their merits alongside all others in the same category. Following the well-known 1994 Presidential order regarding the formation of a national spatial data infrastructure, a special NSDI award was established for five years between 1995 and 1999 as SDI partnerships grew rapidly around the world.

The next revision of the ESIG categories was implemented in 2000 when the following classes were created: Single Process System Awards; Enterprise Systems Awards; and Honorable Mentions in both these classes. Since then, the only change that has occurred has been to rename Honorable Mentions as Distinguished Systems.

The way the ESIG committee has operated over the past 30 years has essentially remained unchanged, although now the process is well refined and established. The focus now is on systems in government that have some form of spatial component embedded within them and each year the Call for Nominations is issued about ten months before ESIG category winners are announced prior to the annual conference. The award committee chair and deputy-chair positions change annually and there is no limit on the number of committee members who may serve as application entry assessors – typically numbering between 10 and 20 people.

All entries are independently assessed, using the same well-established criteria which are also provided to applicants. Three to four committee members complete a first review on each submission and a 'short list' is prepared in the Single Process System and Enterprise System classes. Each of these is then independently assessed again by another 3-4 committee members, so that 6-8 scores are available to determine winners based on the highest average scores achieved. ESIG Award winners are notified well in advance of the annual conference and publicly announced to the media just before the conference. Award recipients then each receive a plaque and one free registration to attend the conference and receive their awards. Award recipients are encouraged to participate in the conference and make a presentation on their award winning system to conference delegates.

3. Prestige of the ESIG Awards

Of course, the success of any awards system lies in how the awards are perceived, and what is important here is not how we view the ESIGs within URISA, but how they are recognized and accepted by those who receive them. By the third year of the awards program in 1983, URISA was already publishing what the ESIG winners thought of their awards, and the following quotation is from an association newsletter at the time (URISA, 1983, pp. 12).

> *"URISA's Exemplary Systems in Government (ESIG) Awards Program, now in its third year, has brought recognition to the winning agencies and their systems. In completing an ESIG awards submission an agency compiles documentation that includes user and top management statements on the system's effectiveness. This often brings the system to the attention of agency staff that were previously not aware of the benefits derived from the system. Awards submissions are judged by the ESIG Awards Committee, a panel of prominent information systems professionals. Through this exposure an agency and its system become known to key members of the government information systems community. When an agency's system wins an Exemplary Systems Award, the Chief Executive is notified, and the system is publicized through URISA publications and releases to the media.*
>
> *The mutual benefits of the ESIG Awards Program are demonstrated by New Orlean's Mayor Ernest N. Morial when he wrote to the then URISA President Sam Trotter after their Economic Development Information System (EDIS) received a 1982 ESIG Award:*
>
> > *"The Exemplary Systems Award plaque is quite handsome; it holds a prominent place of display in our reception area. We greatly appreciate the national recognition you and the Awards Committee have afforded EDIS."*

Other award winners' testimonials can be found on the URISA website (http://www.urisa.org/ESIG_Testimonials), such as:

"Winning the ESIG Single Process Award and being recognized on an international level was a tremendous achievement for Prince William County. It represents the hard work and accomplishments that our entire division achieved in the 18 month conversion process. It symbolizes the teamwork that went into the project and dedication of bringing a fifteen year old workflow into the most current technology and all the change that comes with it. The ESIG application process and award gave our customers a chance to see that GIS is not just about making pretty maps but that it is a powerful tool that can be used daily by our public administrators and citizens to make decisions and that there are endless possibilities of integrating it more in our future business processes."

Angela Mills, GISP
Prince William County GIS
2007 ESIG Winner

"At the San Diego County Regional Airport Authority, we have a major objective in mind, that is, to provide our customers with a World-Class level of service. We have received many complements regarding our GIS system from internal (Authority staff) and external (consultants) users of the system in the past, but we needed to know how we are doing compared to other remarkable GIS applications implemented by other agencies. Winning the distinguished Award of the ESIG 2007 has emphasized that we are on the right track. It proved the hard work and cooperative efforts of our staff, and it also showed that the Authority is committed to providing high-quality work for San Diego."

Ataa A. Aly, P.E.
Project Engineer
San Diego County Regional Airport Authority
2007 ESIG Winner

"One of the most rewarding aspects of participating in the ESIG Awards process was the rare opportunity to formally acknowledge the outstanding efforts of our staff and regional partner agencies for their collaborative work. Recognition of their achievements by URISA's respected community of GIS professionals and peers has provided quite a charge."

Eric Brandt, GISP
GIS Program Manager
Lane Council of Governments, OR
2009 ESIG winner

"I believe the award has done two things for me professionally. The first relates to leadership. The award was a source of pride for my team and reinforced the team's belief in my ability to pull all the pieces together to develop a product worthy of national recognition and their ability to be successful in their roles. The second relates to credibility. Many of the District's senior leaders have little experience in GIS. However, many of

these leaders are familiar with URISA. Receiving this award has reinforced their decision to entrust me with this large, complex project and has demonstrated that I can deliver despite the statistics related to failed and overly expensive IT projects."

Don Nehmer
Capital Program Business Manager
Milwaukee Metropolitan Sewerage District
2009 ESIG winner

"It was an honor to receive the ESIG award from URISA this past year. By participating in the ESIG award process we were able to exercise another reason to evaluate our system, by doing so we were able to find ways to improve our current system. We also received local media exposure because of the ESIG award, this helped us inform the Forsyth County public of how we were applying GIS for public safety in their county. This award also validated all of the hard work and development that went into this system, this helped the GIS department fortify a trust with the Forsyth County Administration."

John Kilgore, GISP
GIS Director, Forsyth County, GA
2009 ESIG winner

4. Conclusion

Since its' inception in 1981, the URISA Exemplary Systems in Government (ESIG) Awards Program has continued to recognize outstanding achievements and benefits to citizens and communities through the use of information technology in government. The fact that this awards program has operated for 30 years, and that an ESIG Award is sought after by government agencies, is a tribute to the members of the 1980 Board of Directors who nurtured an idea to reality. While the essence of the program has remained the same over that time span, modifications to the award categories have been made in alignment with the use of technologies in government. The ESIG Awards Program is truly recognized as a pillar initiative of URISA, and will continue to be so for years to come.

5. References

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Acknowledgements

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Appendix

List of ESIG Award Recipients 1981-2011

1981
- Eugene (Oregon) fire Information Management System.
- U.S. Department of Commerce, Decision Information Display System.
- Milwaukee (Wisconsin) Policy Development and Management Projects.
- Washington (D.C.) Municipal automated Geographic Information system.
- Montgomery County (Maryland) Parking Violation System.

1982
- Arlington (Texas) Building Inspection Department System.
- Boston (Massachusetts) Policy Management Information System.
- Hennepin County (Minnesota) Mapping and Planning System.
- State of Minnesota, Minnesota Land Management Information System.
- New Haven (Connecticut) Arson Information Management System.
- New Orleans (Louisiana) Economic Development System.

Special Recognition Award
- U.S. Department of Commerce, State Data Center Program, Bureau of the Census.

1983
- Anchorage (Alaska) Parking Civil Violation Enforcement System.
- Dallas (Texas) Direct Case Filing System.
- DeKalb County (Georgia) Property Inventory Control System.
- Edmonton (Alberta) Manpower Payroll Information System.
- Forsyth County (North Carolina) Land Records Information System.
- Saint Louis County (Missouri) Land Data Base System.

1984
- Cincinnati (Ohio) Planning and Management Support System.
- Phoenix (Arizona) Fire Department Computer Aided Dispatch & Mobile Digital Terminal Dispatch System.
- Seattle Public Schools, Seattle (Washington) Geoprocessing at the Seattle School District.
- State of South Australia, Adelaide (South Australia) Land Ownership and Tenure System.
- TNRIS Task Force, Austin (Texas) Texas Natural Resources Information System.
- Wyandotte County, Kansas City (Kansas) A Multi-Purpose Land Data System.

1985
- Dallas (Texas) Request for Inspection Subsystem.
- Environment Canada, Canada Land Data System.
- Fort Collins (Colorado) Meter Reading System.

- New York (New York) Street Lighting Interactive Maintenance System (SLIMS).
- San Diego (California) Water Utility Department Work Assignment Order System.
- Toronto (Ontario) Central Property Register.

1986

- Elk Grove Village (Illinois) Civil Defense Computer Program.
- St. Petersburg (Florida) Police Portable Computer Project.
- Cape Breton (Nova Scotia) Multi-User Automated Permit System.
- State of Mississippi Automated Resource Information System (MARIS).
- State of Colorado Oil and Gas Information Management System (COGIMS).
- U.S. Army, Geographical Resource Analysis Support System (GRASS).

1987

- Richmond (British Columbia) Property Management System.
- Eau Claire (Wisconsin) Citizen Request for Service Monitoring System.
- Anchorage (Alaska) Automated Mapping System (AMS).
- State of Queensland (Australia) Cadastral Mapping Project.

1988

- City of Austin (Texas) Geographical Information & Policy Analysis System
- State of North Carolina Land Resources Information Service.
- Government of Singapore School Link Project.
- State of Queensland (Australia) Rainforest Geographic Information System.
- County of Oxford, Ontario (Canada) Land Related Information System.
- City of Indianapolis (Indiana) Mapping and Geographic Infrastructure System.
- Commonwealth of Pennsylvania Economic Development Information Network.
- Regional Municipality of Ottawa-Carleton, Ontario, Priority Program Management Systems.
- Province of Alberta (Canada) Land Status Automated System.
- City of Overland Park (Kansas) Planning and Research Tracking System.
- City of Fort Collins (Colorado) Reimbursement Account Management System.

1989

- State of New Hampshire Economic Development Data System (NEDDS).
- City of Hartford (Connecticut) Critical Success Factor/Measure of Success Performance Evaluation System.
- State of South Australia Land Information System.
- City of Santa Monica (California) Public Electronic Network.
- State of California Job Service Automation.
- Queensland (Australia) GIS Technology Trade Centre.
- City of Manchester (New Hampshire) Landfill Operations System.

1990

Small Municipal Systems Award

- City of Greenville (South Carolina) Hazardous Material Evacuation Model.

Operations Automation Systems Award

- Pierce County (Washington) Development Center Information System (DCIS) for Permits and Land Services.

Corporate Systems Award

- State of Alaska, Department of Natural Resources, Exxon Valdez Oil Spill Damage Assessment Subsystem.

Special Award

International Award

- Brisbane (Australia) City Council, Brisbane Integrated Map of Assets and Property (BIMAP).

Honorable Mentions

Operations Automation

- United State Department of Commerce, Bureau of the Census, TIGER System.

Corporate Systems

- Montgomery County (Pennsylvania) Montgomery County Information System.

Small Municipalities

- Inc. Village of Massapequa Park (New York) Cost/Benefit Infrastructure Analysis and Long Range Capital Improvement Planning Program.

1991

Small Municipal Systems Award

- Loudon County (Virginia) GIS Support for Comprehensive Planning & Zoning Processes.

Operations Automation Systems Award

- Merced County (California) Merced Automated Global Information Control System (MAGIC).

Corporate Systems Award

- Massachusetts Executive Office of Environmental Affairs, Environmental Affairs Systems Modernization Project.
- City of Calgary (Alberta, Canada) Electric System Construction Information System (ESCIS).

Special Award

International Award

- Swedish Central Board of Real Estate, The Land Data Bank System.

Honorable Mentions

Operations Automation

- Costra Costa (California) On-Line 278LM* On-line Welfare Case Budgeting.
- North Dakota State Land Department, North Dakota Automated Land Management System.

Small Municipalities

- Alliance (Nebraska) Police Department, Alliance Police Department Managed Information System.

1992

Small Municipal Systems Award

- City of Alhambra (California) The City of Alhambra Geographic Information

System

Operations Automation Systems Award

- City of Calgary (Alberta, Canada) Planning & Building Dept., Making Connections: Enhancing the City of Calgary's Building Permit System.

Corporate Systems Award

- State of Qatar, Ministry of Industry & Public Works, Impact of the Digital Base Map Database & GIS on the Drainage Division—Ministry of Industry and Public Works.

Honorable Mentions

Small Municipalities

- City of Port Adelaide (South Australia) City of Port Adelaide Local Information Utility.

Operations Automation

- City of Houston (Texas) Public Utilities Dept., Computer Aided Solutions to Wastewater Systems Problems: How Houston, Texas Manages Its System.

1993

Small Municipal Systems Award

- City of Concord (New Hampshire) Dept. of Public Works, Geographic Information System.

Operations Automation Systems Award

- State of North Carolina, Dept. of Public Instruction, Transportation Information Management System.

Corporate Systems Award

- City of Edmonton (Alberta, Canada) Dept. of Planning & Development, Socio-economic and Land Use Systems.

Honorable Mentions

Operations Automation Systems

- City of Phoenix (Arizona) Dept. of Management Information Systems, Geographic Information System.

Corporate Systems

- City of Minneapolis (Minnesota) Dept. of Public Works, Cookbook.

1994

Small Municipal Systems Award

- Wilson Automated Government Enhancement Systems (WAGES), City of Wilson (North Carolina).

Operations Automation Systems Award

- Presidio Graphic Management Information System (PGMIS), National Park Service at the Presidio, San Francisco (California).

Corporate Systems Award

- Executive Information System (EIS), City of Mississauga (Ontario, Canada).

Honorable Mentions

Operations Automation Systems

- NeighborLINE, Carnegie Library of Pittsburgh (Pennsylvania).

Corporate Systems
- Providence Plan, City of Providence (Rhode Island).

1995
Small Municipal Systems Award
- Barry County (Michigan), Barry County GIS.

Operations Automation Systems Award
- Albuquerque (New Mexico), Site Environmental Audit Information System (SEA).

Corporate Systems Award
- San Diego (California), Regional Urban Information System (RUIS).

Special Award
- Contributions to NSDI Award: Department of Natural Resources Canada for Delta-X-System 1995.

Honorable Mentions
Corporate Systems
- Queensland (Australia), Geographic Information for Public Safety (GIPS).

Operations Automation
- Pinellas County (Florida), Land Information Management System (LIMS).
- Mecklenburg County (North Carolina), GIS Precinct Splitting Application.
- Prince George's County (Maryland), GIS-Based Flood Management Simulation Model.

1996
Operations Automation Systems Award
- Burbank (California) Housing Authority for the Housing Authority Section 8 Program.

Corporate Systems Award
- Irving (Texas), City of Irving Citywide GIS.

Special Award
Public Works & Engineering Systems Award
- Johnson City (Tennessee), Street Sweeping Zoning and Routing System.

NSDI/Data Partnership Systems Award
- State of Montana for Montana GIS Data Clearinghouse.

1997
NSDI/Data Partnership Systems Award
- Egyptian Cabinet Information & Decision Support Centre, Socio-Economic Indicator and for City District Housing License and Tax Collection Information System.

Operations Automation Systems Award
- City of Edmonton (Alberta, Canada), Planning One Stop Service (POSSE).

Corporate Systems Award
- City of Scottsdale (Arizona), Land and Information System (LIS).

Special Award
Public Works and Engineering Systems Award
- State of Qatar, Drainage Geographic Information Kiosk.

Honorable Mentions

- The City of Mississauga (Ontario, Canada), Mississauga Approvals Xpress (MAX) System.

1998

Small Municipal Systems Award

- City of Loveland Community Services, City of Loveland (Colorado), The Loveland Geographic Information/Cartographic (LOGIC) System.

Operations Automation Systems Award

- Mecklenburg County (North Carolina), Board of Elections GIS.

Corporate Systems Award

- Pierce County Information Services Department (Tacoma, Washington), CountyView.
- New Brunswick Geographic Information Corporation, Fredericton, (Canada), Completing the Vision: Public Access to the Provincial Land Information Infrastructure — New Brunswick's Real Property Information Internet Service.

Special Award

NSDI/Data Partnership Systems Award

- New York State Library (Albany, New York), New York State GIS Clearinghouse.

Honorable Mentions

Small Municipality

- Blue Valley School District (Overland Park, Kansas), Student Enrolment Decision Support System (SEDSS).
- Turtle River Watershed Conservation District, Watershed: The System.

Operations Automation

- Lucas County (Ohio), Auditor's Real Estate Information System (AREIS).

1999

Operations Automation Systems Award

- City of San Diego (California) SWIMpen Field Computing System, City of San Diego Water & Metropolitan Wastewater Departments.

Corporate Systems Award

- Oakland County (California), Oakland County Enterprise GIS Program.

Special Award

NSDI/Data Partnership Systems Award

- Land Information System, Tasmania (LIST), State of Tasmania (Australia).

2000

Single Process System Award

- Atlanta (Georgia), Georgia GIS Clearinghouse.

Enterprise Systems Award

- Pierce County (Washington), Pierce County Responder System.

Honorable Mentions

Single Process System

- Colorado Springs (Colorado), Colorado Springs Utilities Facilities Information Management System.

Enterprise Systems
- Eugene (Oregon), Lane Council of Governments.

2001

Single Process System Award
- City of Tucson (Arizona), City of Tucson's Commercial Property Online.
- Alberta Government Services (Canada), The Alberta Spatial Information (SPIN) System.

Enterprise Systems Award
- Mecklenburg County (North Carolina), North Carolina GIS on the Internet.

Honorable Mentions

Single Process System
- City of Columbus (Ohio), Construction Drawing Imaging and Management System (CDIMS).

Enterprise Systems
- Land Victoria Department of Natural Resources and Environment (Australia), The Property Information Project.

2002

Single Process System Award
- Fire Department of New York City (FDNY), World Trade Center Disaster Response–GPS Recovery System.

Enterprise Systems Award
- MetroGIS Geodata Collaborative Metropolitan Council, Serving the Seven-County Minneapolis-St. Paul Metropolitan Area.

Honorable Mentions

Single Process Systems
- New York Department of IT and Telecommunications (DoITT), Emergency Management Online Locator System (EMOLS).

Enterprise Systems
- State of Arkansas, GeoStor.
- Chester County (Pennsylvania), Land Record Modernization.

2003

Single Process System Award
- Leon County, Tallahassee (Florida).
- Topographic Partnering Group/LiDAR Project.

Enterprise System Award
- Louisville and Jefferson County Information Consortium (LOJIC).

Honorable Mentions

Single Process Systems
- City of Elkhart (Indiana), InPlant - Interactive Plant
- Chatham-Kent (Ontario, Canada), Chatham-Kent Online.

Enterprise Systems
- Department of the Army, The Intelligent Road/Rail Information Server (IRRIS).

2004

Single Process System Award

- South Florida Water Management District, The Lake Okeechobee Stage-Area-Capacity Lookup Application.
- Maryland Department of the Environment, Maryland Online Tier II Reporting System.

Enterprise System Award

- Victoria (Australia), Vicmap Topographic 1:30,000.
- City of Charlotte Enterprise GIS Program, GIS Street Centerline Enhancement Project.
- Sacramento County WebGIS.

Honorable Mentions

Single Process Systems

- Washoe County (Nevada), Washoe County Map Warehouse.
- District of Columbia Emergency Information Center.

Enterprise Systems

- District of Columbia, DC Guide.
- City of Fitchburg (Wisconsin), Staff Analyst.
- Jackson County (Oregon), Front Counter Application.

2005

Single Process System Award

- Baltimore City (Maryland), U-View.

Enterprise System Award

- State of Massachusetts, MassGIS Web Mapping Services.
- Brampton (Ontario, Canada), Enabling the Enterprise: Brampton's Web-Based GIS Solution.
- Clayton County (Georgia), Clayton County Water Authority GIS System.

Honorable Mentions

Single Process Systems

- Douglas County (Colorado), Mapping and Addressing Parcels (MAP).
- Delaware County (Ohio), Delaware County Auditor, DALIS Web.

Enterprise Systems

- Atlanta Regional Commission (Georgia), Oblique Imagery & Geo-Referenced GIS Data Pilot Project.
- DCStat, Washington, DC.
- Paulding County (Georgia), GIS Geodatabase Project.
- City of Loveland (Colorado), The Loveland Geographic Information/Cartographic (LOGIC) System.
- Georgia Department of Transportation, Transportation Explorer (TREX).
- Province of British Columbia (Canada), Integrated Land and Resource Registry.

2006

Single Process System Award

- City of Dallas (Texas), POSSE Land Management System Enterprise System Award.

Enterprise System Award

- Illinois State Toll Highway Authority, GeoSource.
- Johnson County (Kansas), myAIMS Web Portal.
- Washington, DC, Regional Pawn Data Sharing System (RPDSS).

Distinguished Single Process Systems

- City of Calgary (Alberta, Canada), ePlans.
- Allegheny County (Pennsylvania), Department of Human Services, HumanServices.net.
- Badger Army Ammunition Plant, Geographic Information System.
- Oakland County (Michigan), E-Health Well & Septic Permitting System.

Distinguished Enterprise Systems

- City of Calgary (Alberta, Canada), 311 Program.
- Illinois Tollway, Lane Closure Application.
- Jefferson County (Colorado), Hart Data Resolver Application.
- Lucas County (Ohio), GIS-Enabled Enterprise Content Management (ECM).
- Shelby County (Alabama), Shelby Knowledge Suite.
- Victoria (Australia), Victorian Mapping and Address Service (VMAS).
- Warren County (Ohio), Integrated Mapping System.
- Washington County (Oregon), Cadastral Ownership Registry (CORe).

2007

Single Process System Award

- Prince William County (Virginia), Prince William County Parcel Maintenance Process.

Enterprise System Awards

- REGIS Agency, GVMC, Grand Rapids (Michigan), REGIS: REgional Geographic Information System.
- PSMA, Australia – LYNX.

Distinguished Systems

Distinguished Single Process System

- City of Philadelphia (Pennsylvania), PhillyHistory.org

Distinguished Enterprise Systems

- San Diego County (California) Regional Airport Authority, Infrastructure Database Management Project (IDMP)
- Republic of Singapore, Integrated Planning and Land Use System (IPLAN).

2008

Single Process Systems Award

- Public Works GIS Viewer – City of Fontana (California).

Enterprise Systems Award

- Geospatial Incident Management System, Horry County (South Carolina).

Distinguished Single Process Systems

- GIPSE (Geographic Information Portal System for Everyone), City of Aurora (Colorado).

- North Carolina's Economic Development Intelligence System (EDIS), NC Department of Commerce.

Distinguished Enterprise Systems

- Illinois Virtual Tollway, Illinois Tollway.
- Land Information Network (LandNet), Singapore Land Authority.
- WebPuff TM, Automated Emergency Management Decision Support System, US Army Chemical Materials Agency.

2009

Single Process Systems Award

- Online Census, City of Airdrie (Alberta, Canada).
- GIS Mobile Emergency Response System (ERS), Forsyth County (Georgia).

Enterprise Systems Award

- Virtual Charlotte, City of Charlotte (North Carolina).

Distinguished Enterprise Systems

- Regional Land Information Database (RLID), Lane Council of Governments (Oregon).
- SewerView, Milwaukee Metropolitan Sewerage District (Wisconsin).

2010

Single Process Systems Award

- Situational Awareness for Field Operations Support System, New York City Office of Emergency Management.

Enterprise Systems Award

- OneMap, A Multi-Agency Window for Geospatial Information and Service Delivery, Singapore Land Authority.

Distinguished Single Process Systems

- Pierce County GIS Online Budget System, County of Pierce (Washington).

Distinguished Enterprise Systems

- City IQ, City of Bellingham (Washington).

2011

Single Process Systems Award

- Philadelphia Stormwater Billing Application: PhillyStormwater, *City of Philadelphia Water Department.*

Enterprise Systems Award

- URA Digital 3D Urban Model System*, Urban Redevelopment Authority, Republic of Singapore.*

Distinguished Single Process Systems

- Clark County Utility Tracker (C-CUT)**,** *Clark County (Washington).*

Distinguished Enterprise Systems

- CAGIS Enterprise County Wide Construction Coordination System*, Cincinnati (Ohio) Area Geographic Information System.*
- City of Calgary Cadastral Management System (CMS)*, City of Calgary (Alberta, Canada).*

- iMAPS: Using Collaboration and Technology to Color Outside the Organizational Lines, *Wake County (North Carolina) and City of Raleigh (North Carolina).*
- Portage County Enterprise Wide GIS*, Portage County (Ohio).*

13

A Research Agenda Focused on Institutional Issues

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Abstract: In 1987 URISA created a research agenda that focused on the needs of the user community. That agenda was developed to influence the research about to be funded by the US National Science Foundation in creating a new National Center for Geographic Information and Analysis (NCGIA). Our goal was to push the NCGIA to consider social and institutional issues, not just technical ones. The effort to create and promote that agenda had a strong impact on the NCGIA and ultimately on the GIS profession and on society. Short and long term impacts are described. Certification of GIS professionals, a Coalition of Geospatial Organizations, Public Participation GIS, and other positive outcomes have their roots in URISA's early research agenda. Most of the original topics have been resolved, but not all. The chapter closes with a recommendation that the user community would benefit from creating and promoting a new research agenda.

1. Introduction

Today's reader will have a hard time understanding the research needs of the late 1980s. Mainframe computers had recently disappeared from the GIS world and users were now using minicomputers, but stuck with command line interfaces. GIS shops were weird outposts, not integrated into any agency operations. Each shop created data for their own needs with little documentation or need to share with others. The market was full of GIS vendors with no clear winner in sight. There were few educational programs and no textbooks. There was no Internet and no way to learn about GIS except through international conferences like URISA.

In 1987 the National Science Foundation (NSF) issued a Request for Proposals to create a new National Center for Geographic Information and Analysis. The NCGIA would be the major focus of research on geographic information systems in the United States with funding up to $1.25 million per year for up to eight years. In today's dollars, that is over $20 million for the eight year period. URISA and others paid attention and spoke up about what was needed from this new program.

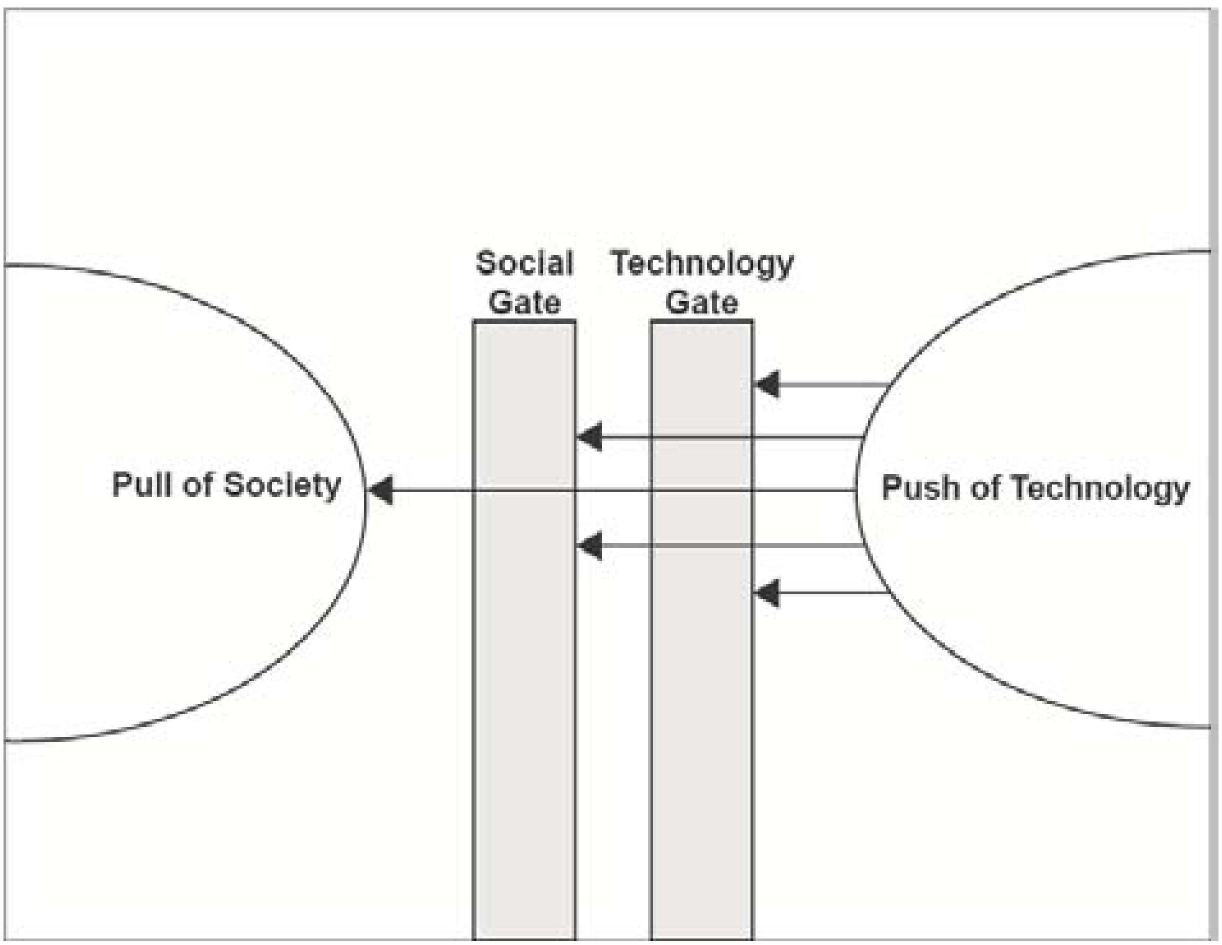
2. URISA Creates a Research Agenda

2.1 Why have a Research Agenda?

In 1987, URISA was 25 years old. Its members had been battling technologies and bureaucracies for a quarter of a century, making decent progress on both fronts. Still, we saw countless problems in our daily work, which we battled to overcome with our own research efforts (see Chapter 17). We felt that we had a great deal to say about where new research should be focused to yield the greatest good. We felt that research on our issues was not just short-term applied research, but would stimulate basic research with high potential for long-term payoffs.

In some ways, URISA wanted to balance the technical solutions we saw coming out of an NSF funded research project with the real world in which we lived and worked. We found a paper produced by the National Academies press that underscored our concerns. John Mayo, an executive at Bell Labs, had written about the tension between the push of technology and the pull of society to illustrate what technical innovations get adopted; i.e. what proves useful.[1] The figure below shows the general outline of his argument.

Figure 1: Why a Limited Number of Technical Solutions Become Adopted by Society. Based on Mayo (1985)



[1] RAG member Ben Niemann brought this work to our attention. He elaborated on its value in Craig et al (1988).

Mayo saw scientists generating many more solutions than ever are adopted by society. These scientists are driven by curiosity and their own ideas about potential innovations. Some of those innovations never make it past his *Technology Gate*. Some are beyond the prowess of the scientist. Others are out of sequence; they need prior work done before they can be launched. In a few cases, accepted standards rule out exploration into new areas.

The *Social Gate* weeds out other innovations. Some examples include regulation and legislation, economics, and public receptivity. Stem cell research is an example of a current idea with high potential being held back because of societal concerns.

The few research ideas that make it through to societal acceptance are those that make it through both the Technology Gate and the Social Gate. Most often, these are solutions to problems that society has been facing. Society needs a solution and here it is. Cell phones and GPS maps were imaginary solutions in Dick Tracy and Batman comics long before the technology was delivered to us. We had wanted them for decades.

The needs of the user community should be central to a research agenda for two reasons. First, those needs provide an interesting list of activities that should capture the imagination of the research community. Second, solutions emanating from such a list offer the highest chance of being adopted by the user community.

URISA represented the user community and felt that it should create a research agenda that presented the needs of that community. We had three goals in mind when we created it.

1. We wanted to affect the NSF-NCGIA selection process. A formal research agenda gave credibility to the issues that we thought were important. Proposals that addressed our issues would be considered favorably.
2. We wanted to affect the research community – both the funded NCGIA organization and other researchers looking for interesting and critical issues to address.
3. We wanted to affect our own members who too often ignore past research that could solve their problems. By formalizing a statement of their issues, we would draw their attention to the value of research.

2.2 URISA's 1987-88 Research Agenda

URISA heard about the NCGIA competition at its 1987 annual conference, early August in Fort Lauderdale. URISA Past President Bob Aangeenbrug was then the Executive Director of AAG, the Association of American Geographers. He was very focused on this initiative and was planning an event where people could express their views on the research agenda. The International Geographic Information System (IGIS) Symposium was to be held in Arlington Virginia in mid-November that year. He encouraged URISA to participate and present its own agenda.

I was just finishing my term as URISA president and looking forward to a quiet year. Instead, I was drafted to chair the new RAG – Research Agenda Group. We put together a group of URISA members who had appreciation for research and who did research to address user issues. They came from local government, academia, and the private sector. Members included James Clapp (University of Wisconsin and president of the American Congress on Surveying and Mapping), Jack Dangermond (Esri), Kenneth Dueker (Portland State University), Joseph Ferriera (Massachusetts Institute of Technology), Charles Kindleberger (City of St. Louis), Bernard Niemann (University of Wisconsin), Vincent Robinson (University of Calgary), and Barry Wellar (University of Ottawa).

The RAG was active for most of the next year. We met in Los Angeles in early Fall to develop the agenda itself. We organized a plenary panel session for the IGIS Symposium that included presentations by some of us, augmented by people who could clearly explain the current situation in state and local government (Craig, et al., 1988). And we organized a Super Session at the 1988 annual URISA conference to present and discuss our research agenda.

We had five major issues that drove us as we worked on the agenda:

1. GIS development should match user needs. This was our overarching issue.
2. Potential users need good descriptions of GIS capabilities and shortcomings, so they can make good decisions about whether and when to adopt the technology.
3. Data is the fuel the drives the GIS engine. Research and development is necessary to refine the data delivery system
4. As GIS technology becomes more diffused, management and related institutional issues become more profound.
5. Work is needed to fit GIS technology into corporate management and decision-making processes.

The agenda URISA developed is presented in Table 1 (appendix). We broke it into major sections: social concerns and technical concerns. These labels match those used by Mayo, a purposeful decision on our part. But note that we are writing strictly from left side of Mayo's diagram, the need for research that meets the social and technical needs of the GIS community. We present it as originally published. Some of this agenda may seem arcane, but it needs to be read in the context of the times as outlined in the introduction to this chapter.[2]

Our focus on user needs can be described as *applied research*; we were looking for solutions to real-world problems. This approach opens the Social Gate for researchers,

[2] Several years later, in 1992, Professor Steven McCrary of Louisiana State University contacted the chairs and co-chairs of URISA's dozen Special Interest Groups (SIGS – see Chapter 10) asking them, "What are the technical and social problems that need to be overcome before people in your interest area will begin to realize the benefits we think are available using IS/GIS technology." The resulting themes were very similar to those produced by the more academic RAG approach five years earlier. See Craig, McCrary, and Wellar, 1993.

increasing the probability of success. It does not decrease the potential for increases in basic knowledge. Much good theory has come from applied research, probably more than the reverse: useful applications from theory.

3. Impact of URISA's Research Agenda

URISA's Research Agenda had immediate impacts on nascent NCGIA and the GIS community. More importantly, we had an impact on what research was accomplished, thereby yielding significant benefits to the user community.

3.1 Short Term Impacts

URISA had an impact on the winning NCGIA proposal. Barry Wellar, a RAG member, was nominated by URISA to join the NSF review team and that nomination was accepted. URISA was the only professional organization so represented.

The winning NCGIA proposal was submitted by a 3-university consortium from the University of Maine, the University at Buffalo, and the University of California at Santa Barbara. Goodchild writes about their origins and impacts in Chapter 15 of this book. I compared their proposal to URISA's research agenda in the first issue of the new *URISA Journal* (Craig 1989) and found fairly good overlap. Roughly half of URISA's research agenda would be covered by NCGIA's research initiatives.

URISA's involvement in the IGIS Symposium led to the GIS/LIS conferences in 1988. Two professional organizations had been holding a small conference by this name for a couple of years before the IGIS Symposium: ACSM (American Congress on Surveying and Mapping) and ASPRS (American Society of Photogrammetry and Remote Sensing). For the 1988 GIS/LIS conference, AAG and URISA joined as sponsors. In 1989, these organizations were joined by GITA (then named AM/FM International). The American Public Works Association (APWA) joined in 1995.

The GIS/LIS Conferences ran for 11 years, through 1998. It was a chance for GIS professionals to grow by exposure to issues that were important to their peers in other associations. Papers were presented by members from all organizations. Each sponsoring organization, URISA included, offered workshops that were open to all participants. The exhibit halls filled with vendors who could show their technologies once and reach the members of all six sponsor organizations. The conference steering committees included 2-3 members from each organization,[3] plus their executive directors. These meetings built wonderful camaraderie among the professions, something being accomplished today by the Coalition of Geospatial Organizations, COGO.

[3] URISA's representatives for that 1988 conference included me, Mike Kevany, and Laurel McKay. I had the honor of chairing that first Steering Committee.

3.2 Longer Term Impacts

The right academic research team was chosen for the NCGIA award. They delivered useful products for more than a decade and researchers at those universities continue to be among the most productive in the nation. *Sharing Geographic Data* (Onsrud and Rushton 1995) is but one example of a product that addressed URISA's concerns head on.

URISA continued to play a productive role in the work of the NCGIA. David Moyer served on the NCGIA Advisory Committee. URISA members contributed over one-third of the chapters to *Sharing Geographic Data* book. We were invited to many of the NCGIA *Specialist Meetings* held to refine their proposed research initiatives. Bill Huxhold and David Moyer were invited to the Initiative-4 Specialist Meeting on the Use and Value of Geographic Information. I participated in I-13, User Interfaces for Geographic Information Systems, polling URISA members before the meeting so I could best represent our views. I also participated in I-19 on GIS and Society. Barry Wellar provided input to I-16, Information Policy and Spatial Databases (Wellar 1994).

URISA is responsible for launching the PPGIS movement, Public Participation GIS, and the NCGIA supported those activities. Dangermond (1988) had put the public on URISA's research agenda and presented a more detailed argument at the 1988 conference. In 1998, the NCGIA funded a specialist meeting on *Empowerment, Marginalization, and Public Participation GIS*. This resulted in the seminal PPGIS book, *Community Participation and Geographic Information System* (Craig, Harris, and Weiner 2002).

The research agenda had an impact on URISA conferences for years after 1987 when the agenda was first written. Program chairs looked for speakers who cover key topics. Calls for papers listed topics from the research agenda and our members responded. Here are some examples of what happened over the next few years:[4]

- The 1988 conference in Los Angeles held a super session on our research agenda.
- The 1989 conference in Edmonton brought in speakers from Australia and the United Kingdom, putting them in a session with representatives on the new US-based NCGIA to talk about how to connect research to practice.
- Rebecca Somers, John Antenucci, and Laurel McKay developed and launched a workshop in 1988 on GIS Management.[5] The workshop was an immediate hit and continues to this day under the title "GIS Program Management." See Chapters 10 and 16.

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[4] Along with URISA colleagues, I reviewed conference papers for three subsequent URISA conferences with respect to their contributions to the research agenda. Review papers were published in the *URISA Journal*: Craig (1990), Craig and Moyer (1991) and Craig, McCrary and Wellar (1993).

[5] Somers says the workshop was not in response to URISA's research agenda, but admits it grew out of the same concerns discussed at URISA meetings. For a more mature summary of her message, see Somers (1998).

- Croswell's 1989 content analysis of 39 articles proved that system implementation failures are more often institutional/social than technical. For this paper, Croswell received URISA Horwood Critique prize for the best article published in the conference proceedings (Croswell, 1991).
- Craig et al. (1991) looked at the technical problems of sharing data across different GIS and proved them to be easily overcome, leaving the real barrier to be institutional.
- Wellar (1988) began a campaign to make Canadian and other politicians aware of the need for them to understand and support information technology of all types.
- Obermeyer's (1992) paper launched the GIS Certification movement.
- Dando's 1992 Horwood Critique Prize winning paper about the Supreme Court's *Feist* decision: its impact on government ability to use copyright to protect their data and its implications for cost recovery (Dando, 1992).
- Citizen Access Day was held at the 1994 conference in Milwaukee. This full-day event brought together leading practitioners of PPGIS to share ideas with themselves and the audience. (Craig, 1994; Sawicki and Craig, 1996)
- URISA's own journal was launched in the Fall of 1989, the *Journal of the Urban and Regional Information Systems Association*. Under Harlan Onsrud's leadership, it became the GIS field's first open access journal in 1999. For over 30 years, that journal has provided significant research results that are useful to users of the technology.

That was just the beginning. URISA's research agenda inspired its members and others to pursue research issues that were important to the user community. It is impossible to list all the books and journal articles that have roots, direct or indirect, that grew out of that early effort.

4. Impact as of Today

It is possible to provide a list of the impacts of URISA's research agenda work, things that are the basis of today's GIS environment. In some cases, I am claiming glory that is only partially deserved, but never-the-less their roots can be traced by to URISA:

- URISA's insights and pressure enhanced the value and output from the NSF's funding of the National Center for Geographic Information and Analysis. Harlan Onsrud from the University of Maine, for example, would eventually lead a research team showing how to use licensing as a way to encourage data sharing (National Research Council, 2004).
- Good management principles were developed and documented by people involved in URISA and the NCGIA. Stellar examples include Croswell (2009), Obermeyer and Pinto (1994) and Huxhold and Levinson (1995). These provided

a solid foundation for the profession to be productive and successful. See Chapter 16 for more on this topic.

- The PPGIS movement, Public Participation GIS, was envisioned and launched by URISA. The Urban Institute's 36-city National Neighborhood Indicators Partnership and other efforts, organized and individual, have a blood-line to the 1987-88 research agenda.
- The GIS Code of Ethics grew out of the interdisciplinary collaborations of the GIS/LIS Conferences. I took the lead in that effort, but was driven by a desire to find common concerns across many fields (Craig 1993). The code was first adopted by URISA, then by the entire GIS Certification Institute.
- Certification of GIS professionals and the GIS Certification Institute (GISCI) grew directly out of URISA's research agenda. Initially certification credentials have been based on individual portfolios documenting education, experience, and contributions to the profession. Now GISCI is looking to move toward a knowledge based approach, probably based on the Body of Knowledge.
- The *Geographic Information Science & Technology Body of Knowledge* (DiBiase, et al. 2006) has roots in the URISA research agenda and its demands for educational programs for professionals. Leadership for this effort came from the University Consortium for Geographic Information Science which built on the early work of the NCGIA.[6]
- The Coalition of Geospatial Organizations (COGO) grew out of the GIS/LIS conferences by way of the initial IGIS Symposium. Geospatial organizations learned to trust each other and work together.[7]

5. Conclusions and Recommendations

URISA's 1987-88 Research Agenda had a major impact on the NCGIA and the GIS community as a whole. Taken in sum, those impacts have had a positive impact on the field and made it more valuable to society.

Other breakthroughs occurred that resolved other issues on URISA's research agenda. We have developed Metadata standards and clearinghouses at all levels of government that allow us to discover data and determine its fitness for use. Esri gave us a graphical user interface (GUI) to make GIS easier to use. Much progress has been made on Enterprise GIS. Data sharing across platforms has become trivial. Google is providing enormous amounts of geographic data to citizens. In these and other cases technology improvements transcended the social, economic, and institutional barriers that concerned the RAG in 1987-88.[8] The list of solutions developed in the last 25 years is large and significant.

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[6] Significant credit goes to Duane Marble, Ohio State University, and his Model Curricula project.

[7] The National States Geographic Information Systems Council (NSGIC) took the lead in bringing COGO together in its recent manifestation in 2008. NSGIC was formed by URISA members who spun off their own organization in 1991.

[8] This observation came from Ken Dueker, a member of the Research Agenda Group, who reviewed an earlier draft of this chapter. Personal communication, April 24, 2012.

There are many issues not solved. We continue to struggle with the need for economical and credible ways to measure costs and benefits, though recent work in King County Washington (2012) gives us hope. We still have no good library of models, but Esri's ArcGIS Online includes the potential for the user community to share application solutions. While these old issues have not been solved, new problems have arisen or become more obvious. Sharing data with the federal government is frustrated by differing views over what data is needed and what scales are appropriate. The links between GIS operations and the more institutional Information Technology (IT) offices are still too *ad hoc* and confusing. We do not know how to organize and use crowd-sourced data. And we still do not know whether it is better for local government to give away their data or sell it on the open market.

I close with a question about whether it is time for URISA to develop and promote a new research agenda. My first reaction was to say, no, wait for another large NSF funded project; that will be your audience. On reflection, I think this is the wrong answer. URISA's 1987-88 research agenda provided a rallying point for significant work by academics (like those at NCGIA), URISA members, the private sector, and others looking to exploit GIS for the greater public good. If not URISA, who will create a research agenda focused on increasing the value of our technology to society? At a minimum, URISA should put significant thought into planning its annual GIS-Pro conference, producing a call-for-papers that addresses issues critical to the user community with new research solutions.

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Appendix

Table 1: 1987-88 URISA Research Agenda

SOCIAL CONCERNS

System Adoption

- Codify concepts and terminology.
- Improve access to literature.
- Research real-world experiences to document actions and conditions which lead to success.
- Develop educational programs for staff and other users.

Social and Legal Impacts

- Document the impact on the host institution, management, staff, elected officials, and the public.
- Determine criteria such as accessibility, objectivity, equity, that will encourage system utilization by the broadest range of publics and policy makers.
- Investigate legal imperatives for providing access to data, considering privacy laws, and determine conditions of legal liability for incomplete or inaccurate data.

Management Issues

- Develop effective strategies for day-to-day management, including how to bridge the gap between technicians and the user community.
- Assess the social, political, and behavioral conditions that inhibit data sharing and recommend means for improvement.
- Examine the problems and potential for a distributed corporate GIS, where each unit has its own unique domain of definitions, needs, and hardware.

Economic Factors

- Define a methodology to estimate costs and benefits.
- Measure cost effectiveness and productivity compared to manual systems.
- Explicitly measure the costs of data capture, conversion, and maintenance.
- Attempt to determine the value of "public information".
- Explore the unique aspects of measuring costs, benefits, and decision structures of information systems as compared to other enterprises. To what extent is the uniqueness more profound in the public sector?

TECHNICAL CONCERNS

Database Development

- Lower data capture costs through improvements in scanning technology and better utilization of remotely sensed data, especially through incorporation of artificial intelligence techniques.

- Develop data quality standards and methods for "stamping" or documenting the quality. Include both purity and spatial precision as measures of quality.
- Determine the need for access to a variety of human and physical geographic data sets and define an approach for developing a "National Library" to meet that need.
- Develop tools to assist with database design, procedures for updating, techniques to improve the database over time, and methods for archiving.
- Develop models for networked systems in governmental organizations where data are distributed to meet operational needs, and analysis and problem solving must use these diverse data sets. Identify problem areas such as the need for data refining and the impact of independent upgrades at various nodes.

User Interface and Empowerment

- Improve processing speeds so analysis can be done in "real time". This will require both improvements in hardware and database structures as well as vastly improved processing algorithms.
- Add to the range of models available to the GIS analyst, e.g. transportation and ecological models. A library of functional models would be useful. GIS software might be modified to readily accept such modules. In many cases the models have developed and their usefulness could be enhanced greatly with the addition of the graphical component that a GIS could provide. Gaming/simulation packages are another type of useful module.
- Make GIS software accessible to users with different levels of technical expertise through the use of artificial intelligence, help screens, relational databases, and software layering.
- Analyze the needs of planners and other public officials, see what potential applications they have for this technology, and develop applications for the products to meet those needs.

Software Critique

- Develop a comprehensive list of major software packages and the major applications of each.
- Develop a list of common and exceptional GIS functions.
- Create benchmark tests that would fairly compare systems on features most important to users. Run these tests on the major software packages and report results.
- Determine and document the constraints imposed by selecting particular software, data scales and classification schemes, and database structures.

14

URISA'S GISCORPS: GIS PROFESSIONALS VOLUNTEERING FOR A BETTER WORLD

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Abstract**:** GISCorps started with a simple idea and question: Why can't we, as GIS professionals, volunteer our expertise to underserved communities around the world for a short period of time during the year? Operating under the auspices of the Urban and Regional Information Systems Association (URISA), GISCorps coordinates short term, volunteer-based GIS services to underprivileged communities. GISCorps implements URISA's vision of advancing the effective use of spatial information technologies. The Program makes available highly specialized GIS expertise to improve the well-being of developing and transitional communities without exploitation or regard for profit. This chapter briefly describes GISCorps, what they do and how they operate, and some of the projects supported over the past nine years. Additional details can be found on the GISCorps web site (www.giscorps.org).

1. Introduction – What is GISCorps and What Do They Do?

GISCorps is a purely volunteer effort that was born in October 2003 in Atlanta, Georgia, when the URISA Board unanimously approved it as a Program of URISA. This approval occurred after an intensive summer of brainstorming, conceptualizing and hard work – all of which was required to translate an idea into a well-designed proposal.

The GISCorps Program is run by a Core Committee with administrative help from the staff of URISA. Core Committee members are themselves GISCorps volunteers. They reside in different states and provinces across the United States and Canada and use various forms of technology to work collaboratively, mostly at nights and on weekends. While conference calls are held monthly, the members of the Core Committee e-communicate daily and meet face-to-face at least once a year.

GISCorps implements URISA's vision of advancing the effective use of spatial information technologies. The Program makes available highly specialized GIS expertise to improve the well-being of developing and transitional communities without exploitation or regard for profit. GISCorps coordinates the open exchange of volunteer GIS expertise cooperatively among and along with other agencies. The GISCorps volunteers strengthen the host community's spatial data infrastructure through implementation of the best and most widely accepted GIS practices. GISCorps fosters the development of professional organizations in host communities to help sustain and grow local spatial expertise.

Operating under the auspices of URISA, GISCorps coordinates short term, volunteer-based GIS services to underprivileged communities. The services provided by GISCorps volunteers help to improve the quality of life in these communities by:

- Supporting humanitarian relief, disaster response, and human rights
- Enhancing environmental analysis
- Encouraging/fostering economic development
- Supporting community planning and development
- Strengthening local capacity by adopting and using information technology
- Supporting health and education related activities.

The activities performed by GISCorps' volunteers benefit:

- Communities in need
- GISCorps volunteers
- URISA
- GISCorps' partner organizations
- Volunteers' own communities
- Spatial information technologies
- Global professional networking.

2. The Formation of GISCorps

GISCorps started with a simple idea and question: Why can't we, as GIS professionals, volunteer our expertise to underserved communities around the world for a short period of time during the year?

The idea behind GISCorps came from Shoreh Elhami in a form of a short paper/proposal that was sent to the International Task Force members in 2001; discussions followed the proposal and the idea was then further discussed with URISA members Sanjiv Gandhi, Martha Wells, Tom Conry, Ed Wells and Jack Dangermond.

Between November 2002 and March 2003, Shoreh and Ed worked on a position paper that was later presented to the URISA Board. In April 2003, URISA staff created a GISCorps website under the URISA main home page. An on-line Volunteer Application form was debuted and Shoreh signed up as the first GISCorps volunteer.

By July 2003, 26 volunteers had joined GISCorps and Shoreh started the task of compiling a volunteer database. A short article on the concept of GISCorps was then published in the URISA newsletter. In July 2003, Shoreh presented the GISCorps concept to several user group meetings at the ESRI User Conference, and met with several GIS industry leaders. Shortly thereafter, donations from the University of Florida Department of Urban and Regional Planning, and the Alachua County (Florida) Property Appraisers were received.

On October 15, 2003, the GISCorps Core Committee (Shoreh Elhami, Ed Wells, Juna Papajorgji, Martha Wells, Sanjiv Gandhi and Tom Conry) presented an overall plan for GISCorps to the URISA Board of Directors, who unanimously endorsed GISCorps as an initiative under the auspices of URISA. Over the next few days, the concept of GISCorps was presented to the conference audience, and the number of volunteers increased to 41.

Following the conference, the Core Committee was charged with developing a Strategic Plan and an Operational Plan, both of which were presented to the URISA Board in March of 2004. Shoreh Elhami was elected as the first Chair of the Core Committee with Juna Papajorgji as the Co-Chair. GISCorps went live on the Web in June 2004.

3. GISCorps Principles and Policies

The GISCorps Organizing Principles and Policies were first approved in 2005. They have been reviewed, enhanced and modified as needed over the years, and are posted on the GISCorps web site (www.giscorps.org).

The Organizing Principles and Polices are presented in seven sections.

- Section 1 describes GISCorps as a Program under the auspices of, and pursuant to the objectives and principles of URISA.
- Section 2 speaks to the type of volunteer-based GIS services provided by GISCorps, and to the four kinds of supporters on which GISCorps relies.
- Section 3 describes the ethical principles under which GISCorps operates, including a code of conduct and the GIS Code of Ethics.
- Section 4 indicates the scope and limits of GISCorps activities, and gives indication as to how GISCorps operates.
- Section 5 discusses membership in GISCorps and its various committees.
- Section 6 describes the organizational structure of GISCorps.
- Section 7 indicates the process used to amend the principles and policies.

4. The GISCorps Operation Process – From Project Inception to Conclusion

GISCorps does not sponsor projects directly; rather, the process is initiated when a request for assistance is submitted via a GISCorps Partner Agency Application form through the GISCorps web site. Once an application has been received, it is reviewed by the Core Committee and if required, research on the agency is undertaken to ensure the proposed project and sponsoring agency match GISCorps objectives. Communication between GISCorps and the Partner Agency is undertaken (email, telephone, Skype, etc.) to guarantee a solid understanding of the proposed project and the skills required. Armed with that knowledge, a Job Description is prepared for the proposed project.

One of the Core Committee members then takes on the role of recruiter. Understanding the skills required for the proposed project, the GISCorps volunteer database is searched for individuals with the appropriate skills and experience. Those that qualify are contacted with a description of the project and the Job Description and asked to indicate if they are interested in volunteering for the mission in question. Those that respond in the affirmative are interviewed to ensure qualifications and compatibility with the project/mission.

GISCorps recommends the most qualified volunteers for a given assignment, but will also seek to provide volunteer opportunities to as many volunteers as possible. The Partner Agency is asked to select the volunteer they wish to work with, but may delegate that decision to the Core Committee member recruiting for the project. Once the volunteer(s) has been selected, he/she is (virtually) introduced to the representative of the Partner Agency.

GISCorps missions (projects) are classified as 'remote' or 'on-site'. Remote missions enable the volunteer to work from their (home) location, providing the Partner Agency with the deliverables via any number of technologies. On-site missions require the volunteer to travel to the location of the mission. Neither URISA nor the GISCorps is responsible for food, lodging, living expenses, insurance of its volunteers, travel, or any other expenses. Expenses should be defrayed either by the individual, her/his institution, the Partner Agency and their affiliates, or by the host community on a project-by-project basis.

GISCorps may, at its discretion, provide limited reimbursement of direct costs incurred by the volunteer in traveling to and from the project location. Guidelines and procedures on providing such assistance are presented in GISCorps' Travel Guidelines and Travel Reimbursement Procedure (posted on the GISCorps website).

While the project is underway, the Core Committee member responsible for the recruitment will – from time to time – connect with the volunteer and the Partner Agency, to ensure the project is moving along as expected towards completion and delivery of the requested products. At the conclusion of the mission, both the volunteer and the Partner Agency are requested to complete Feedback forms; the information on these forms is used by the Core Committee to refine the program as may be required. The volunteer and the Partner Agency may also be asked to write a brief article on the mission for publication in one of GISCorps' quarterly newsletters.

5. GISCorps Missions – A Summary

As of January 2012, GISCorps had more than 2,500 enlisted volunteers from over 93 countries around the world. Large numbers of volunteers have enlisted with GISCorps after major disasters, such as the tsunami in Indonesia and Hurricane Katrina. Since inception, GISCorps has deployed 272 volunteers to 88 projects in 42 countries, and has provided more than 10,000 hours of volunteer professional expertise to underprivileged communities. Of the 88 missions, 62 have been conducted remotely (volunteers worked from their offices or homes) and 26 were on-site missions.

Table 1 highlights the number of missions that have been undertaken by GISCorps since its inception as well as the number of volunteers deployed by year.

Table 1. GISCorps Missions and Volunteers

	2004	2005	2006	2007	2008	2009	2010	2011	Total
Missions	2	8	9	9	14	12	8	26	88
Volunteers	2	47	13	12	50	20	50	78	272

GISCorps provides volunteer expertise in critical technology to non-profit and governmental organizations that are unable to acquire it on their own. GISCorps volunteers have used GIS technology in:

- rescue operations for Hurricane Katrina victims,
- vital service location for refugees in Cairo, Egypt,
- rescue and remediation efforts in the Indian Ocean Tsunami disaster,
- GIS capacity building in Afghanistan,
- free medical care referrals for the poor in Central America,
- development of a national web map portal of volcanoes in Armenia,
- mapping of locations of atrocities in Darfur, Sudan,
- disaster recovery efforts post Cyclone Nargis in Myanmar (Burma),
- and in numerous other similar projects.

While most missions undertaken by GISCorps are in support of communities in developing countries, some missions have been undertaken to support K-12 initiatives or initiatives in underprivileged communities in North America.

GISCorps has also entered into several Memorandums of Understanding (MOU) with like-minded organizations, such as Global Spatial Data Infrastructure (GSDI), MapAction, and Information Management & Mine Action Programs (iMMAP).

A complete list of GISCorps Projects can be found on the GISCorps website.

6. GISCorps Volunteers, Friends and Donations

GISCorps has had a very successful beginning. Its founders built upon an existing professional culture with a history of strong commitment to public service and to caring for the disadvantaged, preserving the environment, and making communities and regions better places. The GIS profession, comprised of people with a unique technological expertise and with idealistic visions for a better world, makes a powerful dynamic with much to offer to peoples and organizations around the world.

The founders saw this dormant potential when they set out to design GISCorps. Inspired by the concept of the Peace Corps and Doctors Without Borders, GISCorps was first established on a small scale. After testing the vision at a small scale, GISCorps has now acquired sufficient experience and reputation to move onto the next plateau.

GISCorps has relied on the donations of like-minded individuals to sustain operations over the past nine years. As the program has grown and the number of missions supported increased, so too have expenses. A fund drive is planned for the future to seek funding for a number of areas.

- Travel Costs: Travel costs have been a hurdle when deploying a volunteer. These costs have been borne by the host agency or volunteer, but some worthy requests have been set aside or abandoned due to lack of travel funds.
- Program Development Specialist: The greatest hurdle faced by the GISCorps today is the time required of the Core Committee to develop and handle partnerships and projects. The potential of the volunteer population is still vastly under-realized, as illustrated by the difference in the number of volunteers (2500) VS the number deployed (272). GISCorps' strategic plan has identified the need for staff to handle project solicitation, volunteer recruitment, routine communications, and other administrative and clerical functions. This will free-up the leadership to develop strategic relationships with potential partners, and increase opportunities for the volunteers.
- Website/Database Enhancements: In order to elevate the program to the next level, GISCorps needs to enhance the website and the database on volunteers, partners, projects, and donors. This will facilitate more effective communication between and among GISCorps leadership, volunteers, and partners.
- Emergency Assistance Fund: After Hurricane Katrina hit the coasts of Mississippi and Louisiana, GISCorps deployed 33 volunteers to the region. The volunteers paid for their own travel expenses at the time of the disaster and though they were reimbursed later by various agencies the delay caused considerable hardship. An emergency assistance fund will enable GISCorps to provide assistance to its volunteers as soon as a disaster occurs and action is required, getting volunteers to the site quickly and efficiently.

7. Summary & Conclusion

In less than 10 years, GISCorps has grown from an idea to a distinguished international organization that has assisted many communities in need worldwide.

GISCorps has succeeded by deploying its dedicated and professional volunteers to meet the needs of the requesting agencies. In recognition of the efforts and dedication of its volunteers, GISCorps was awarded a Service Award at the 2005 Esri Health GIS Conference, Esri's Outstanding Special Exhibit in 2006, an Esri Special Achievement in

GIS (SAG) Award in 2006, and more recently (2012) has been awarded the Presidential Volunteer Award and the Daily Point of Light Award. GISCorps, the Core Committee, Volunteers and Friends of GISCorps are determined to continue this success in years to come and lend a helping hand to those who are unable to achieve their technological goals on their own.

GISCorps is evidence of the integrity and dedication of URISA and its members to fostering the growth of spatial information technologies and supporting communities in need. It has proven to be an extremely successful program of URISA, garnering recognition not only for GISCorps, but also for URISA.

15

NCGIA: ITS ORIGINS AND IMPACTS

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***Abstract*:** The National Center for Geographic Information and Analysis was established through an award from the US National Science Foundation to a consortium of three universities in 1988. Members of URISA played a significant role in the discussions and negotiations leading up to its establishment. The center was mandated to conduct basic research in GIS, to promote its use across the sciences, and to foster the training of experts in GIS. Basic research was organized into Research Initiatives, periods of intensive research on defined topics. Following the end of core NSF funding in 1996 the center personnel continued to receive major awards. Projects analogous to NCGIA were funded in many countries, and several continue today.

1. Introduction

It's an honor for me to be asked to write this account of the US National Center for Geographic Information and Analysis, which was founded in 1988 through a cooperative agreement between the University of California, Santa Barbara (UCSB), and the US National Science Foundation. NCGIA is a collaboration between UCSB, the State University of New York at Buffalo (UB), and the University of Maine (UM), who formed a consortium in 1987 to compete for the NSF award. The groundwork that made it possible for this major development was laid over many years, and many members of URISA played key roles both in the establishment of NCGIA and in its subsequent success, as documented by Will Craig in Chapter 13. Although core funding for the center from NSF ended in 1996, additional grants to the three institutions, along with other outgrowth activities, have ensured that collaboration continues and have helped to sustain the value of the NCGIA brand.

The first section of this chapter focuses on the origins of NCGIA. They are complex, and it is impossible to document them all, especially decades after the event. Any omissions and distortions are entirely mine, and I apologize in advance and accept full responsibility for them. The second section discusses the activities of NCGIA, focusing on the period 1988 to 1996 when NSF provided core funding. The third section identifies the major impacts, the post-1996 activities of the consortium, and analogous organizations worldwide.

2. Origins

There have been several successful efforts to document the origins of geographic information systems and technologies, most notably in the collection of essays assembled by Foresman (1998). Roger Tomlinson's success in persuading the Government of Canada to invest heavily in the mid 1960s in the development of the

Canada Geographic Information System is one of the more widely recognized. But the seeds sown at the University of Washington in the late 1950s, inspired in part by Edgar Horwood, were also important to the evolution of GIS, and arguably closer to what eventually crystallized in URISA. They found fertile ground in the presence of a stellar group of graduate students that included Waldo Tobler, Brian Berry, William Bunge, Arthur Getis, and Duane Marble. Tobler went on to make some of the most significant contributions to cartography of the 20th Century; he and Berry were both elected at a comparatively young age to the National Academy of Sciences; and Duane Marble moved to Northwestern University and eventually UB to found one of the first and most influential research groups in geographic information and analysis, later aided by Hugh Calkins, another Washington graduate.

Another thread originated at Harvard, where Howard Fisher had moved in the early 1960s to establish a Center for Computer Graphics, and to lead the development of some of the first mapping software, a story ably documented by Chrisman (2006). Yet another arose in landscape architecture, with the work of Ian McHarg (1969) at the University of Pennsylvania and that of Carl Steinitz at Harvard. At the US Bureau of the Census computers were being used to map and keep track of the complex street networks and reporting-zone boundaries that were central to the operations of the 1970 census. And in the UK David Bickmore established the Experimental Cartography Unit and began to work towards the computerization of map production.

These and many other efforts at about that time had little in common except the use of computers to handle geographic information. Purposes and applications varied widely, as did the methods used to explore them. Convergence into a single, integrated software package might never have happened were it not for the vision of a handful of individuals, most notably Roger Tomlinson, who organized two meetings under the auspices of the International Geographical Union in the early 1970s to which he invited a disparate collection of individuals from around the world to discuss what he had come to term the “computer handling of geographic data”. Another key individual was Jack Dangermond, who set up the Environmental Systems Research Institute as a consulting company in Redlands, California, in the late 1960s, and by 1980 had begun to offer a comprehensive software package that could reliably perform many of the key functions of a geographic information system.

Early efforts in this area had referred to “handling”, and it was indeed difficult at that time to see how the contents of maps might be handled in a machine designed primarily for numeric calculations. But it rapidly became clear that success in handling could lead to the use of computers to create and edit maps by analogy to word processing; to perform statistical analyses of data obtained from maps; to model the human and physical processes that modify the Earth’s surface; and to image the Earth from space. By the late 1970s the concept of a geographic information system (GIS) was starting to be implemented in a range of software, and researchers were beginning to use GIS in scientific investigations of phenomena as diverse as archaeology and hydrology. Dobson (1983) was writing about the prospects of “automated geography”, using GIS to subject vast and diverse quantities of raw data to analysis; and Openshaw (*e.g.*, Openshaw *et al.*, 1987) was promoting the concept of a “geographical analysis machine”.

It is probably impossible to determine the date at which the prospect of a major investment by the National Science Foundation was first mooted. Ron Abler, who became the NSF program officer responsible for geography in the mid 1980s, played a key role, as did Bob Aangeenbrug at the Association of American Geographers, and many others who like Aangeenbrug were closely associated with URISA. Following common practice, Abler instigated a discussion in the research community about the form such an investment might take. Should it be a center, with many researchers spread perhaps across many institutional partners, or should it be a major grant to a small number of individuals? What would be the appropriate balance between research and education? Should the research be basic or applied in nature? What should be the basic research questions?

Abler’s account (Abler, 1987) of the events leading up to the establishment of NCGIA is by far the most complete and authoritative. In 1984 NSF had given high priority to funding large-scale databases, and in the same year Jerry Dobson had submitted a proposal to NSF urging the establishment of a center that would offer resources of spatial data and software, staff expertise, and training. In 1985 NSF announced an initiative to fund science and technology centers, which provided an institutional framework for the promotion of a GIS center. Conferences were held, the research community was polled regarding its ideas for the putative center’s research agenda, and in 1986 NSF issued a document outlining the structure and objectives of a National Geographical Information and Analysis Center as “a clearinghouse for research on GIS technology in the academic, government, and private sectors.”

After many further discussions and internal negotiations at NSF, the final solicitation for NCGIA was issued on 24 June 1987, with a budget limit of $1.25 million per year for up to eight years. It called for bids to establish a center that would primarily focus on research, but with additional activities in the areas of education and outreach, in “expanding the nation’s supply of experts in GIS” and “promoting the use of GIS throughout the sciences.” Research was to be directed to some combination of five suggested topics: spatial analysis and spatial statistics; spatial relationships and database structures; artificial intelligence and expert systems; visualization; and social, economic, and institutional issues.

An intense period of activity followed, as various institutions looked for partners, key researchers were enticed to move, and proposals were developed. In the end eight proposals were received, some from single institutions and some from consortia. Proposals were reviewed by NSF and by a panel of experts convened for the purpose, two finalists were given site visits, and a final decision was announced in early August 1988, with funding, now reduced to $1.1 million per year, to commence on December 1, 1988 under the leadership of UCSB geography professor David Simonett.

3. NCGIA Activities, 1988-1996

The winning consortium had proposed a novel way of engaging the community in the center's research, based around the concept of Research Initiatives. Each of these would pick a topic of current interest, assemble a meeting of specialists to discuss the state of knowledge in the area, focus research for a period of two years, and end with a set of presentations and publications and a report. The first Initiative, on Accuracy of Spatial Databases, began with a specialist meeting in Santa Barbara in December 1988. An edited book was published (Goodchild and Gopal, 1989) based on the discussions and presentations at the meeting; groundbreaking research followed, conducted by NCGIA researchers, visitors, and collaborators around the world; and the initiative ended with presentations at an international conference. Eventually the initiative spawned two biennial conference series, plus numerous research papers and dissertations. By the end of the period of base NSF funding in 1996 over 20 research initiatives had been sponsored, on topics ranging from Very Large Spatial Databases to The Value of Geographic Information. The reports and working papers, along with the annual reports of the center, are available at www.ncgia.ucsb.edu.

In 1988 there was still substantial confusion about GIS education: what should be taught and at what level, where did it belong in the curriculum, and what exactly were its fundamental principles? The first edition of Peter Burrough's textbook (Burrough, 1986) provided some guidance, but it was clear that something more comprehensive and detailed would be needed if NCGIA was to achieve its educational objective. In the first months of the center, and with the collaboration of Karen Kemp, an effort was begun to construct a Core Curriculum in GIS. It was conceived as a collection of lecture notes to support a year-long program, plus supporting information and documentation. With the Core Curriculum as a framework, an instructor could draw from it the most appropriate elements to match the local context, and quickly assemble the resources needed to offer a program. Contributors and reviewers were recruited from around the world, and by 1990 a complete set of tested materials was made available. The project eventually had a significant impact in jump-starting GIS education in universities; the materials can still be found at http://www.geog.ubc.ca/courses/klink/gis.notes/ncgia/toc.html.

Once NCGIA was launched it quickly became apparent that the center would have to make some difficult choices in serving what was clearly a very rapidly expanding need, especially in the application areas commonly associated with URISA. Local government representatives called to find out what services NCGIA would be able to offer them; yet even $1.1 million per year would do little to service the needs of tens of thousands of local governments, all of whom could see an expanding role for GIS. Research Initiatives were launched to address some of those needs, especially by focusing on the costs and benefits of GIS, and on the problems of sharing geographic information among organizations. The Open GIS Consortium (later the Open Geospatial Consortium) came into being in the early 1990s, and proved to be a very successful approach to the development of common standards in the interests of interoperability. This and other initiatives helped by allowing NCGIA to concentrate on NSF's core mandate of basic research.

In that respect one early focus of NCGIA proved to be immensely valuable. David Simonett, the original Principal Investigator of the project, was a specialist in remote sensing, and had been involved in many of the debates over the stature of remote sensing as a science, within the sciences. The basic nature of the NCGIA research agenda clearly pointed in the direction of science, but GIS's role as a set of software tools also invited the suggestion that it was a "mere tool". Were there fundamental issues underlying GIS, and were there scientific discoveries to be made in the domain of geographic information? Was GIS more analogous to the science of statistics or to word processing? Several comments in the broader literature of the discipline of geography at about this time had suggested the latter.

It was clear to the senior NCGIA researchers that a case for GIS as science could and should be made. Accordingly I gave several keynotes along those lines shortly after the establishment of the center, and in 1992 published a paper outlining what I argued should rightly be called geographic information science (GIScience; Goodchild, 1992). The term took root, several journals and programs were renamed, and the University Consortium for Geographic Information Science was established at a series of meetings beginning in 1994. Unfortunately David Simonett's untimely death due to cancer in 1990 meant that he was never able to enjoy the eventual outcome of the debate.

4. NCGIA After 1996

NSF had originally planned eight years of funding for NCGIA, ending in 1996. However the consortium's performance was such that a new proposal was invited, scaling the center down over a period of three years. The consortium responded with a proposal entitled "Varenius: NCGIA's Project to Advance Geographic Information Science". The allusion to the 17th Century geographer Varenius was very appropriate: GIS could be seen as a combination of general principles, embodied in software and database design, with the specifics of the database's contents, just as Varenius had distinguished between the principles of "general geography" and the details of "specific geography." Varenius's writings had also attracted the attention of Isaac Newton at Cambridge (Warntz, 1989).

The Varenius project was designed around a triangle formed by the Computer, the Individual, and Society. Research issues of the user interface, for example, were visualized as located between the Computer and Individual vertices. Continuing the NCGIA tradition, a total of nine specialist meetings were held in the three years of the project on topics at various locations in the triangle.

Several other major projects were begun by NCGIA personnel. A major grant for interdisciplinary graduate training in GIScience was awarded to UB to fund an effort led by David Mark, and a subsequent award from the same program has funded graduate training in distributed sensor networks at UM. At UCSB, a major NSF award to establish the Alexandria Digital Library resulted in one of the first online repositories of geographic data. A Core Curriculum for Technical Programs was aimed at the more technically oriented GIS training provided by two-year colleges. Project Battuta, also centered at UCSB, experimented with field collection of geographic data using then-novel wearable devices. In 1999 an NSF award to establish a Center for Spatially Integrated Social Science at UCSB represented yet another expansion and focusing of GIS, in this case on research in the social sciences.

Although the investment by NSF was relatively small in comparison with more recent awards to establish centers for engineering research, science and technology, and the science of learning, it had a tremendous impact in spurring research, promoting GIS, and advancing GIS technology, all at a time when GIS was a fairly minor application of computing technology. Other countries have also made investments in GIS at the national level. In the UK, the Regional Research Laboratory program was established by the Economic and Social Research Council in the late 1980s, somewhat before NCGIA, and is credited by Abler with providing a model, of an admittedly more dispersed kind and less focused on basic research. National GIS research centers somewhat comparable to NCGIA have been funded for varying periods in Japan, Ireland, France, and the Netherlands, among other countries. In Canada, the GEOIDE (GEOmatics for Informed DEcisions) network represents a rather different model of funding to promote collaboration among distributed institutions, each of which lacks a sufficient number of researchers to become a focus in its own right. GEOIDE also places much more emphasis on collaboration with industry and technology transfer. The Commonwealth Research Center - Spatial Information (CRC-SI) in Australia follows a similar model, and both have received many times NCGIA's funding from their respective central governments.

GIS and geographic information science have grown by several orders of magnitude since the establishment of NCGIA in the late 1980s. Although creation of a new US national center comparable to NCGIA has been mooted many times since 1996, it seems more likely that continuing basic research will be funded through awards in specialized areas. Geographic information retrieval, the semantics of geographic information, geospatial cyberinfrastructure, and spatial uncertainty are among the many topics that would once have been candidates for NCGIA Research Initiatives, but now are the subject of funding competitions in their own right. There continues to be an evident role, however, for workshops on cutting-edge topics in geographic information science on the model of the Specialist Meetings developed by NCGIA, and UCSB continues to offer such workshops on a regular basis.

Also relevant is the potential expansion of GIS to address the problems of research and decision-making not only in geographic space, but for any space, from that of the cosmos to that of the human brain. As GIS technology has advanced and become easier to use, focus can shift from the technical details to the concepts and thought processes of the user. In recent years there has been an increasing focus, therefore, on what has been termed spatial thinking, reflected in the establishment by NSF of the Spatial Intelligence Learning Center through an award to Temple University and its collaborators, and in the establishment in 2007 at UCSB of the Center for Spatial Studies, a center based on a broad concept of spatial thinking that embraces the previous work of the UCSB site of NCGIA.

5. Conclusion

There is no doubt that NCGIA had a very substantial impact during its funding period, and that URISA and its members had a major influence in its successful establishment. The investment in NCGIA proved its worth on any metric, whether it be publications in refereed journals, books, researchers engaged, conference series established, or students trained. By the late 1990s, and partly as a result of the activities of NCGIA, GIS had become a commonly used technology among all of the sciences dealing with phenomena distributed over the surface of the Earth. At the level of the citizen, services such as Google Earth succeeded in vastly increasing awareness of GIS technology, admittedly in greatly simplified form, and everyone today is familiar with the uses of GPS and remote sensing. Yet we remain, I am convinced, at the very lowest end of the growth curve, and what is to come will be very much greater and more interesting.

Much of the early stimulus for GIS came from applications to land and resources management. Tomlinson's Canada Geographic Information System was entirely devoted to the measurement of land in rural and undeveloped areas, and the first round of sales of Esri's ARC/INFO went to resource-management agencies. Remote sensing similarly tended to favor rural and outdoor applications, at least initially, because of comparatively coarse resolution. My successful 1999 proposal to NSF to establish the Center for Spatially Integrated Social Science was in part driven by my concern that GIS was overly dominated by environmental applications. It is only recently that 3D technologies have begun to show their usefulness for the 87% of their time that average Americans spend indoors. In a sense, then, GIS is beginning to come full circle, by focusing more and more on the kinds of urban and regional issues that drove much of URISA's original interest in promoting GIS and NCGIA.

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16

GIS MANAGEMENT:
MAJOR INITIATIVES AND LESSONS LEARNED

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Abstract. This chapter offers a comprehensive summary of GIS management concepts, issues, and practices and contributions to GIS management by URISA – its members and participants in its programs and events. Management is defined as "the planning, organization, coordination, and oversight of activities, people, and resources for the achievement of defined objectives". In addition, it provides a substantial overview of GIS program and project management covering a historical perspective and evolution over the last 50 years, tools as frameworks supporting sound GIS management, and a description of URISA's contributions. Chapter 16 concludes with lessons learned and practical suggestions on the planning and management of GIS programs and projects.

1. GIS Management Definition and Context

Concepts and practices of GIS management are not fundamentally different from those of other, non-GIS disciplines and organizational environments. Many management scientists and practitioners have defined and described organizational management (e.g., Fayol, 1949; Drucker, 1973; Moore, 1995). For the purposes of this book, "management" is defined as, "the planning, organization, coordination, and oversight of activities, people, and resources for the achievement of defined objectives." For its entire history, URISA members and leaders have been in the forefront of applying sound management principles adopted in other fields and disciplines to the planning and operation of GIS programs and projects.

At a high level, GIS management encompasses both *projects* and *programs*. A GIS *program* is defined as an ongoing effort or initiative established by an organization to support its mission and business needs by providing geographic data and GIS services. According to the Project Management Institute (PMI), a project is a "temporary endeavor undertaken to create a unique product or service" (PMI, 2009). A GIS project may help launch a GIS program. A GIS program usually encompasses and directs multiple projects. Management issues and practices apply to programs and projects in different ways.

Many management experts along with URISA through its URISA Leadership Academy (http://www.urisa.org/ula) link management with the concept of *leadership*. Leadership is a characteristic of a person (i.e., a GIS Manager) in an influential position and the processes and practices that he or she employs to obtain and leverage resources and motivate people to accept stated goals and accomplish results. Leadership qualities and skills necessary for successful management are concisely conveyed in the *Successful*

Manager's Handbook (Gebelein, et al, 2004) through the "leadership/management wheel" (see Figure 1).

Figure 1: Leadership/Management Wheel
(from Gebelein, et al, 2004)

In 2011, URISA led an initiative, sponsored by the U.S. Department of Labor (DOL) to develop a Geospatial Management Competency Model (GMCM). This is one element of the DOL's Employment and Training Administration programs to enhance employment opportunities for the nation. URISA organized a Task Force that created the model which defines 18 "competency areas" listed in Table 1, and 74 "essential competencies" that address specific job-related functions and skills of GIS managers. The GMCM competency areas and essential competencies reflect many of the topics addressed by URISA publications and conference proceedings papers (see Chapter 1, Table 1). The GCGM provides a comprehensive picture of GIS management and the skills and job functions of GIS program and project managers in public and private sector organizations.

Table 1. Geospatial Management Competency Model Competency Areas

A. Self-Management	J. Professional Development
B. Human Resource Management	K. Strategic Planning and Action
C. Performance management	L. Work Management
D. Legal Affairs Management	M. Geospatial Project Management
E. Communication	N. Political Skills
F. Team Management	O. Contract Management
G. Relationship Management	P. Financial Management
H. Business Development	Q. Asset Management
I. Leadership	

2. Historical Perspective and Evolution of GIS Management Practices

The adoption and application of sound management principles and practices for GIS programs and projects has evolved as the advance of GIS technology and its use has matured over the past 45 years. Early implementations of GIS were lead mainly by discipline specialists within those fields where GIS was being applied (e.g., natural resources, land planning, public works) who often did not have formal training in management. In the early days, GIS was new and it was enough of a challenge to get the technology to work. Therefore, the focus was on the technology, and how it could be tamed and used to produce useful products and results.

As GIS became more prominent in many organizations and its use began to expand, the need for more effective GIS planning and operational management became obvious. GIS practitioners and organization managers looked to other fields, particularly “mainstream” information technology (IT) to borrow practices and tools for GIS project and program planning and management. This link between GIS and IT has been broadly accepted — with the concept that GIS should not be managed separately from general IT but should be embraced as an important part of an organization’s overall information technology program and services. The evolution of GIS as a separate tool to one major component of overall “information technology” would make an interesting topic for future research.

A number of professionals, including URISA-affiliated individuals, have played a major role in this evolution including Prior (1991 and 1997), Bennett (1997), Gallaher (2002), Obermeyer and Pinto (2007), and Croswell (2009). These authors and others present arguments for GIS being managed as one part of overall mainstream IT:

- GIS software, data, and applications usually make use of a common system infrastructure with general IT systems and applications.
- Many IT standards and best practices also apply to GIS and applying traditional software development practices can improve GIS applications and databases.
- In many cases, GIS and non-GIS applications share common, enterprise software (e.g., database management systems).
- Integration between GIS and external systems is critical for many organizations.

- Security and disaster recovery concerns are shared and can benefit from co-management.
- Efficiencies and cost savings can result from sharing of technical staff with IT system design, development, and administration skills.

A significant number of URISA members serve or have served as GIS managers with leadership roles inside their organizations' IT departments. Also, a notable number, over the last 15 years, have moved from GIS management roles to senior IT management positions.

One historical trend that has characterized GIS programs since the mid-1980s has been the formation of multi-organizational partnerships and consortia for joint development and operation of GIS programs — often bringing together multiple government entities, regional bodies, utility organizations, and universities. Many authors of URISA papers and publications have provided practical information on multi-organizational GIS programs and projects (Croswell, 2009; Johnson, 2005; Jones and Slutzah, 1994; Lee, 1991; Little, 1991; Nedovic-Budic and Pinto, 1999; Pornon, 2003).

Forming and running these partnerships and consortia have presented management challenges including the formation of legal structures, joint funding, consensus building, coordinating work from participants of multiple organizations, and routine GIS operations. As explained below, URISA members have lead many of these multi-organization initiatives that have brought together multiple government entities and utility organizations. Some of the early multi-organizational GIS consortia (originally formed in the late 1980s and early 1990s) which have sustained successful operations to this day include:

- Knoxville/Knox County/KUB (Tennessee) GIS Organization (KGIS)
- Indianapolis Mapping and Geographic Infrastructure System (IMAGIS)
- Cincinnati Area GIS (CAGIS)
- Louisville/Jefferson County (Kentucky) Information Consortium (LoJIC)
- MetroGIS — GIS organization serving jurisdictions in the Minneapolis/St. Paul area.

3. Major Management Initiatives and URISA's Role

3.1 Formalization of Management Practices and Methods

GIS management has benefited from professional developments in the management science that have supported all aspects of program and project management – planning, resource management, tracking and reporting, service delivery, etc. There is insufficient space in this chapter to comprehensively cite specific documented practices, methodologies, and tools, but Table 2 summarizes these contributions with some selected examples.

Table 2. Overview of Key Management Practices, Methods, and Tools

Documented Practice, Methodology, or Tool	Description
Planning Methodologies and Templates	• Formalization of approaches and methodologies to guide strategic and implementation planning are well-documented by many authors. • Documented principles of, and approaches to, business process evaluation and improvement which help tie GIS projects and programs to the needs of organizations (Croswell, 2009; Babinski, 2003; Harrington, et al, 1997; Linden, 1994; Littman and Carr 1991; Bennett, 1990; Hunt and Hunt, 1975) **not just URISA. • GIS Strategic and Business Planning templates developed in a joint FGDC/NSGIC effort as part of the "50 States Initiative" (see http://www.fgdc.gov/policyandplanning).
Professional Societies	A number of professional societies devoted specifically to sound management provide forums, resources, and professional networking including: • PMI, Academy of Management (www.aomonline.org), • American Management Association (amanet.org), • The Association for Work Process Improvement (TAWPI), www.tawpi.org.
Documented Management Best Practices	Several major initiatives in rich, comprehensive sets of documented best practices, methodologies, and tools supporting sound IT and GIS planning and management: • Information Technology Infrastructure Library (ITIL): A set of concepts and practices for managing IT infrastructure, development, and operations with a focus on responsive and quality of service delivery and user support (see http://www.itil-officialsite.com). • Control Objectives for Information and Related Technology (COBIT): A framework for IT management created by the Information Systems Audit and Control Association (ISACA), and the IT Governance Institute (ITGI). COBIT provides a set of generally accepted measures, indicators, processes, and best practices to maximize IT benefits and improve IT governance and control (see http://www.isaca.org/Knowledge-Center/COBIT). • Project Management Body of Knowledge (PMBOK): Comprehensive documentation of project planning and management concepts and practices developed by the Project Management Institute (PMI). • Recommendations from the 3CTF Task Force: URISA sponsored National Geographic Information Cooperation, Coordination, Collaboration Task Force (3CTF) provided practical recommendations addressing roles/responsibilities, financing, data access, and standards (see www.fgdc.gov/library). In addition, nearly 50 years of professional papers and special publications from URISA provides a rich body of knowledge on concepts, practices, and methods for GIS project and program planning and management.

Documented Practice, Methodology, or Tool	Description
Standard Planning and Management Architectures and Models	In the last 15 years, a number of IT and GIS architecture framework initiatives have been developed. These architecture frameworks take into account a full range of technical and organizational factors (business needs, people, system infrastructure, organizational structure, and other key factors) and provide a context and foundation for IT and GIS program planning and management. Some of the more prominent of these frameworks are listed below: • Zachman Institute for Framework Advancement: Provides a formal and structured way to view all aspects of an organization (people, resources, business needs, policies, etc.) to support IT planning, development, and operation. Now maintained by the Pinnacle Business Group Enterprise Architecture Center of Excellence (see http://www.eacoe.org). • Federal Enterprise Architecture Geospatial Profile: developed by Federal Geographic Data Committee as an implementation of the Federal Enterprise Architecture Framework of the Federal CIO Council (see http://www.cio.gov/documents/FEA_Geospatial_Profile_v1-1.pdf). • NASCIO Enterprise Architecture Toolkit: A model, documented methods, and templates, developed by the National Association of State CIOs, to support public sector IT planning and management for more effective coordination and delivery of services (see http://www.nascio.org/resources/EAresources.cfm). • NSGIC Model for Coordination of Geographic Information: An organizational model and set of practices to enable and support more effective collaboration and multi-departmental and multi-organizational collaboration and coordination for GIS programs. Developed by the National States Geographic Information Council (NSGIC).
Project Planning and Management Software	Some excellent software packages have been developed, particularly in the last 10 years, which support project and program management (planning and scheduling, time and resource management, monitoring and reporting, etc.). Other software packages provide tools specific to software and database development projects for technical personnel (software development, quality control, testing, etc.).

Documented Practice, Methodology, or Tool	Description
Web-based Meeting and Collaboration Tools	A variety of Web-based tools support improved collaboration and communication in GIS project and program environments and are particularly useful when people and organizations are geographically dispersed. This category of tools encompasses: Web-based interaction–Interactive sessions among multiple locations making use of such technologies as Goto Meeting, Live Meeting, and Webex to share computer desktops, in an interactive session, to support meetings, demonstrations, or training sessions. Web-based Information Portals: Web sites set up specifically to provide information to a target group. This may be: a) GIS program Web site that provides information about program mission and operations, contacts, and downloads of documents; b) GIS data clearinghouse set up for efficient data search and access or download; and c) project-based sites providing specific information about project activities, status, documents, etc., and which may provide tools for project team or stakeholder input. Weblogs (Blogs) and Wiki sites fall into this category. Project/Document Collaboration–Includes any of a variety of software tools that support group collaboration. In a document environment, tools include workflow and document comment/revision tracking tools from such vendors as Adobe, Microsoft, Filenet, and others. Also includes a growing set of tools for project team collaboration in GIS projects, including collaboration functions in project management software packages and specialized GIS project management tools (e.g., GeoCue).
Quality Management	In the last 20 years, there have been many advances in methods and tools for GIS quality control (QC) and quality assurance (QA) with a heavy focus on GIS data. These advances have been part of a broader evolution of GIS standards and have followed general quality movements (sometimes lead by consulting companies) under such labels "total quality management" and "continuous improvement". The International Organization for Standardization (ISO) has comprehensive set of standards and practices for quality management under ISO 9000. The ISO standards are complemented by standards approved by the National Institute of Standards and Technology (NIST), the American National Standards Institute (ANSI), Canadian General Standards Board (CGSB), and other organizations. GIS data quality standards and QC/QA practices have been incorporated into a number of approved standards and guidelines from the Federal Geographic Data Committee (FGDC), Canadian GeoConnections initiative, the ISO's Technical Committee 211, The Open Geospatial Consortium (OGC) and other government and independent organizations throughout the world.

3.2 Evolution and Acceptance of Enterprise GIS

Many broadly based GIS programs are now characterized by the term *enterprise GIS.* This term has been used with increasing frequency since the mid-1990s to describe GIS programs and operations that have an organization-wide focus. Enterprise GIS programs have the following key characteristics:

- Focus on organization-wide business needs and strategic goals.
- Long-term vision and focus.
- Coordination among and service to user groups in multiple departments and business units.
- GIS data and infrastructure are managed as an investment with ongoing value and benefits.
- Integration of GIS with an overall information technology architecture.
- Policies and management structure that encourage and support coordination and collaboration.
- Shared data, applications, and support.

For most of its history, URISA has been a leader in enterprise GIS through its educational programs, publications, and sponsored initiatives. Important enterprise GIS themes evident in URISA programs and publications include multi-departmental/multi-organizational structure, legal and policy foundations, collaborative practices, and technology/data integration. A small sample of URISA's offerings gives a picture of the role that URISA has played and continues to play in providing practical approaches for enterprise GIS development and management:

URISA Conference Proceedings and Journal Articles

- "The Dynamics of Using an Integrated Information System", James Kunde, *1971 URISA Annual Conference Proceedings*.
- "The Management of Intergovernmental Data Sharing", Robert Blanning and J. Ramon Palacio, *1975 URISA Annual Conference Proceedings*.
- Multiparticipant Projects–Achieving Consensus on Technical and Funding Cost Allocation Issues, Glenn Montgomery, *1987 URISA Annual Conference Proceedings*.
- "An Enterprise-wide GIS: The Integration of GIS with I/S", Gene Cook, *1989 URISA Annual Conference Proceedings*.
- Promoting a mature multi-jurisdictional GIS Sharon L. Edwards, *1991 URISA Annual Conference Proceedings*.
- Multi-user, Multi-vendor GIS Project Implementation, Andrew Hawkes, *1992 URISA Annual Conference Proceedings.*
- "A Framework For Multi-Participant/Cooperative GIS: Process, Public Records and Data Products", Joseph T. Jones and Richard P. Slutzah, *1994 URISA Annual Conference Proceedings*.
- GIS: A Corporate Approach to Information System Integration, Peter G. Bennett, *1997 URISA Annual Conference Proceedings*.
- Nedovic-Budic, Zorica and Jeffrey Pinto (1999). "Understanding Interorganizational GIS Activities: A Conceptual Framework," *URISA Journal*, 1999, Vol. 11, No. 1.
- "Developing an Enterprise Perspective for the Implementation of GIS", Barbara G. Quinn, *2002 URISA Annual Conference Proceedings*.

- "Challenges for Enterprise GIS", Gordon N. Keating, Paul M. Rich, Marc S. Witkowski, *URISA Journal*, 2003, Vol. 15, No. 2.
- "Moving Up to an Enterprise GIS: Making a Successful Transition", Rebecca Somers, *2004 URISA Annual Conference Proceedings*.
- "GIS Governance and Operational Management: Models and Best Practice Consideration", Peter Thum, *2005 URISA Annual Conference Proceedings*.
- *Enterprise-Wide GIS Implementation: How to Support the Whole Organization, Brian Sovik, Michael Franschman, Jeff Albee, 2006 URISA Annual Conference Proceedings.*

URISA Books and Special Programs and Publications

- *Enterprise GIS*, special URISA publication, 1999.
- *Quick Guide to GIS Implementation and Management*, Rebecca Somers, URISA QuickStudy guide, 2001.
- *The GIS Management Handbook* (comprehensive book on GIS planning and management authored by URISA member Peter Croswell and published in cooperation with URISA.
- URISA National Geographic Information Cooperation, Coordination, Collaboration Task Force (3CTF), Special Task Force (2003-2004) in cooperation with the FGDC resulting in published recommendations.

3.3 National GIS Programs and Initiatives

At the heart of sound GIS management is a set of accepted standards with a considerable focus on data, GIS integration, and quality management. Management of GIS system and data procurements, data maintenance programs, and a wide range of operational decisions are dependent on well-documented standards. URISA and its members have been leaders in the development and practical adoption of standards and related policies and guidelines that support sound planning and operational management. One could argue that, from its inception, a core purpose of URISA has been standards and policy development.

One of the earliest projects of national scope with a "GIS" management theme (although the GIS term was not initially used) was the major initiative sponsored by the U.S. Department of Housing and Urban Development (HUD) Urban Information Systems Inter-Agency Committee launched in 1969. This initiative, referred to as USAC was undertaken to support and guide information systems research aimed at practical applications for urban environments. Key themes were intergovernmental cooperation and integration of systems and digital data.

Through a number of USAC projects in different urban areas in the U.S., researchers in collaboration with local governments and private companies investigated and documented practical principles and methods for urban information systems. While much of the focus of the USAC projects was on technical topics, there was a major emphasis on management — how urban information systems are designed, developed, staffed, and sustained. Many URISA members and leaders played a major role as

USAC researchers, including Past Presidents, Edward Hearle, William Mitchel, Gerald Fox, Donald Luria, Robert Aangeenbrug, and Barry Wellar. The USAC initiative laid a foundation for future progress in the design, development, and management of GIS programs. See Chapters 5, 6, and 8 for more information about USAC.

Contributions from URISA come through URISA-sponsored committees and special programs, as well as involvement and support for national initiatives in the U.S. and Canada including:

- Involvement and support by URISA and its members (in cooperation with the FGDC and sister societies) in planning and development of the National Spatial Data Infrastructure (NSDI) and similar work in establishment of the Canadian Geospatial Data Infrastructure (CGDI). See www.fgdc.gov/nsdi and http://geoconnections.org/en/aboutcgdi.html.
- Support by URISA and service by many members on a wide range of FGDC Standards. Some notable examples include spatial data transfer standard (SDTS), geospatial metadata (CSGM), geographic information framework data, cadastral data, and address data standards.
- Support in review and comment on the FGDCs Geospatial Line of Business initiative (http://www.fgdc.gov/geospatial-lob).
- URISA member support and involvement in promotion and project use of materials from the FGDC's "50 States Initiative" (http://www.fgdc.gov/policyandplanning/50states).

3.4 Legal and Policy Foundations for GIS Management

A range of legal issues directly influences GIS program management and operations. Some of these legal topics are common to all organizations and programs, (e.g., human resources management and financial management). Other legal concerns that are more unique to GIS and IT projects and programs include:

- Understanding legal issues and authority affecting geographic data management and distribution including federal and state/provincial freedom of information, public records, and right-to-know laws and regulations.
- Legal restrictions, exemptions on limiting information access in areas of personal privacy, trade secrets, and sensitive public safety or "critical infrastructure" data.
- Liability policies defined in disclaimer statements to provide protection from damage claims in use of systems or data.
- Professional licensure impacts on procuring and provision of GIS services (e.g., surveyor and professional engineer and surveyor laws, Brooks Act impact).
- Copyright law and its application formally establishing ownership and control of intellectual property including GIS data.
- Formal agreements and data licenses for multi-organization data subscriptions, joint funding, and data sharing.

- Legal and policy foundation for revenue generation through selling GIS products and services.
- Preparing and managing legal contracts defining roles, authority, and terms for provision of GIS data and services.
- Managing vendor maintenance/support contracts for GIS hardware, software, network services, etc.
- Records retention requirements (for GIS data and generated products) mandated by government authorities.
- Ensuring that GIS and IT systems and services are designed, implemented and maintained to meet duty of care and standard of care obligations.

Through research and practical experience reflected in programs, conference papers, and special publications from URISA and other professional organizations over the last 40+ years, one could well argue that URISA members have “written the book” on legal and policy impacts and requirements for GIS programs (see Chapter 20). For instance, the theme of privacy was prevalent early in URISA conference papers by Deuker (1967), Gallati (1967) and later by a number of URISA authors including Gurthrie (2001), Dansby (1992), and Anderson (2005). Several URISA members, notably Hugh Archer (1989, 1994), Howard Roitman (1988, 1990), Harlan Onsrud (1992, 1995, 1996, 2002), Earl Epstein (1987, 1996, 1997) and others have thoroughly explored topics of liability, copyright, open access of geographic information, and cost recovery for GIS programs. Several URISA members participated in the National Research Council’s Committee on Licensing Geographic Data and Services and produced an excellent publication on Licensing (NRC, 2004). URISA has an active Workshop on “Public Data, Public Access, Privacy, and Security” and a QuickStudy publication, *GIS Program Revenue Generation and Legal Issues in Public Sector Organizations*.

3.5 Training and Education Programs

A core element of URISA’s mission is education. Through its publications, workshops, (see details in Chapter 11) and special education programs, URISA has provided and continues to offer an extensive and growing array of products and services with a strong emphasis on GIS project and program planning and management. Some examples include:

- GIS Program Management (URISA Workshop)
- GIS/Information System Integration (URISA Workshop)
- Enterprise Information Modeling (URISA Workshop)
- Public Participation GIS (URISA Workshop)
- Public Data, Access, Privacy and Security (URISA Workshop)
- URISA Leadership Academy (well-received intensive multi-day training seminar launched in 2007 aimed at GIS leaders and managers to augment their skills and tools for success). see http://www.urisa.org/ula.

These training programs are complemented by organized tracks at URISA annual and specialty conferences focusing on a wide range of GIS management topics — with resulting published papers.

3.6 URISA Member and Participant Experiences and Contributions

Individual URISA members, including chapter participants, represent the core of URISA. The value that members provide to and derive from URISA resources and services, in the area of GIS management practices and tools, is immense. Throughout URISA's history, its members have contributed a rich set of experience as researchers, practitioners, and managers. Through their participation in conferences (annual, specialty, and chapter), workshops, and a wide range of special programs, a large body of published intellectual property has been assembled. This material, including published works from URISA's "early days", continues to be useful to those professionals involved in GIS planning, development, and operational management. In addition to papers and publications focused on management concepts and tutorials, many are documents on user experiences, which convey "lessons learned"— best practices, pitfalls, and practical suggestions on management. Some examples, out of hundreds, paint a picture of these valuable resources collectively referred to as the "URISA Body of Knowledge":

- "A Fundamental Look at Urban Information Systems", Edgar Horwood, *Proceedings from Second Annual Conference on Urban Planning Information Systems and Programs*, 1964.
- "Development of a Management Information System for the New York City Planning Department", Wilbur Steger, *Fourth Annual Conference on Urban Planning Information Systems and Programs, 1966.*
- "The Strategy Needed to Establish a Metropolitan Information System", Stuart Eurman*, 1968 URISA Annual Conference Proceedings.*
- "Managing the Unmanageable", Frederick Hayes, *1970 URISA Annual Conference Proceedings.*
- "Design of a Data Base Management System: Relationship of User Requirements", Gary Gack, *1971 URISA Annual Conference Proceedings.*
- "An Incremental Approach to the Design of a Geographic Information System", Kenneth Dueker and Richard Talcott, *1977 URISA Annual Conference Proceedings.*
- "Geoprocessing System Planning", Stephen Kinzy, *1978 URISA Annual Conference Proceedings.*
- "The State-of-the-Art in Implementing 'Successful' Management Oriented Urban and Regional Information Systems", Donald Blumberg, *1980 URISA Annual Conference Proceedings.*
- "Staffing and Managing a Geographic Information System Project for Local Government: Experiences of the GEOMAX Project", Stanley S. Latimer, Paul D. Zwick, *1988 URISA Annual Conference Proceedings*.
- "Assessing Organizational Preparedness for a Comprehensive, Distributed, LIS/GIS," Patricia Brown and Dale Friedley, *1988 URISA Annual Conference Proceedings*.

- “Incorporating the Policy Dimension In Local Government Information Systems: Getting Our Priorities Right”, Barry Wellar, *1988 URISA Annual Conference Proceedings*.
- “Organizational Change for Successful GIS implementation”, Rebecca Somers, *1989 URISA Annual Conference Proceedings*.
- “A Professional Approach to Managing the Large Municipal Mapping Project”, Rex Cowden, *1989 URISA Annual Conference Proceedings*.
- “Analysis of some management issues in GIS implementation”, Ian Crain, *1990 URISA Annual Conference Proceedings*.
- “Understanding Interorganizational GIS Activities: A Conceptual Framework”, Zorica Nedovic-Budic, Jeffery Pinto, *URISA Journal*, Vol. 11, No. 1, 1999.
- Evaluating Information Systems Performance Using Informational Activity Criteria, Barry Wellar, *1995 URISA Annual Conference Proceedings*.
- “Municipal GIS Implementation Planning and Strategies”, Karen Lauritsen, *2002 URISA Annual Conference Proceedings*.
- “Lessons Learned from Case Studies on the Implementation of Geospatial Technologies,” Claude Caron and Yvan Bedard, *URISA Journal*, 2002, Vol. 14, No. 1.
- “A New Approach to Staffing GIS in Small-to-Medium-Sized Communities”, Jennifer Hughes, Dave Ellstrand, *2002 URISA Annual Conference Proceedings*.
- “A Business-Line Approach to Enterprise GIS Finance”, Greg Babinski, *2003 URISA Annual Conference Proceedings*.
- “GIS Governance and Operational Management: Models and Best Practice Consideration”, Peter Thum, *2005 URISA Annual Conference Proceedings.*
- *Managing Geographic Information Systems,* book authored by URISA member Nancy Obermeyer and co-author Jeffrey Pinto, 2007, 2nd Edition, Guilford Press.
- “Project Management From Start To Finish”, Tiffany Burns, Ko Clifton, Trish Dunbar, *2008 GIS/CAMA Conference Proceedings (URISA/IAAO joint conference).*
- Project Management White Paper Series in *URISA News*, Keith Fournier, Issues 219 to 224, 2007-2008.
- *The GIS Management Handbook*, authored by URISA member Peter Croswell and jointly published by Kessey Dewitt Publications in association with URISA, 2009.
- *URISA 2012 Salary Survey* providing information for GIS managers on compensation levels, job titles and qualifications, and position descriptions. Previous surveys published in 1998, 2003, and 2006.

3.7 URISA Corporate Members and Sponsors

URISA corporate members have always been a vital part of URISA programs and services. Private sector companies and non-profit organizations have provided material support and extremely valuable contribution of their members’ time and talent in support of URISA programs and publications on GIS management topics. Equally important have been the experiences that these companies have shared in supporting user organizations in GIS planning and development and in establishing sound GIS management structures and practices. In addition, corporate members have benefited from URISA products and services and have helped to show their value in actual GIS projects and programs. The role of corporate members and company participants in URISA programs and events, throughout its history, has been extremely valuable in the development and promotion of sound GIS management practices.

4. Management Lessons Learned from Research and Practice

What has the last 50 years told us about GIS management and what lessons can be derived from a large body of knowledge and experiences that are useful to GIS managers today? In the first 15 years after the formation of URISA in 1962, the foundations of GIS management were laid by its pioneers. In the years following, GIS management practices and tools matured — with large amount of practical experience by URISA members.

In his paper which received the Horwood Award for Best URISA Conference Papers, (Croswell, 1989, 1991) presented a set of "organization-specific" and "societal and industry" maxims for successful GIS programs based on an extensive literature review and survey of GIS professionals. These maxims, many of which seem like common sense today, are still applicable.

Organization-specific Maxims

- ✓ Perform an Initial Evaluation of Organizational Risk
- ✓ Get Commitment from Management
- ✓ Assign a GIS Manager Early in the Project
- ✓ Adopt a Structured Approach to System Development
- ✓ Involve Users in System Design
- ✓ Formulate a Goal-oriented Plan and Schedule
- ✓ Develop a Project Organization that Encourages Cooperation and Consensus
- ✓ Allocate Sufficient Staff Time
- ✓ Keep Users, Managers, and Constituents Informed
- ✓ Provide Education and Training at all Implementation Stages

Societal and Industry Maxims

- ✓ The User Community Should Encourage the Adoption of Standards
- ✓ Modify Organizational Structures to Take Advantage of GIS Technology
- ✓ Actively Promote Better Education in Elementary Schools, High Schools, and Universities

At a more focused level, the recently completed Geospatial Management Competency Model (GMCM) introduced in 1.0 identifies 18 "competency areas" (see below) associated with 74 specific competencies. The GMCM establishes a framework for skills and qualifications of GIS managers as well as overall "best practices" for GIS program and project management.

GMCM Competency Areas:

- Geospatial Technology Competencies
- Self-Management
- Human Resource Management
- Performance Management
- Legal Affairs and Policy Management
- Communication
- Team Management
- Relationship Management
- Business Development
- Leadership
- Professional Development
- Strategic Planning and Action
- Work Management
- Geospatial Project Management
- Political Skills
- Contract Management
- Financial Management
- Asset Management

A review of this list gives the correct impression that successful GIS programs, projects, and managers must respond to a broad set of technical, organizational, financial, and communications issues. To handle all these areas effectively, it requires education and ongoing training, experience, a competent staff, and good relations and networking with experts inside and outside the organization.

GIS management "lessons learned" which have been gleaned from URISA publications, conference presentations, and workshop materials may be summarized as follows:

- Carry out strategic planning and business case preparation as a foundation for successful GIS projects and program.
- Prepare and regularly adjust a comprehensive implementation plan for all GIS projects and initiatives.
- Maintain an enterprise GIS perspective and position GIS as part of overall IT architecture.
- Put in place effective PM best practices (project monitoring and reporting, communication, scope management, financial management).
- Recruit and support competent staff members and project teams and put in place effective procedures for staff evaluation, recognition, and productivity improvements.

- Keep track of GIS and IT technology trends, standards, and practices and respond appropriately to make program improvements and manage procurements.
- Maintain an active training and education program for all GIS management, technical staff and users.
- Be aware of and adhere to organization's overall policies and procedures influencing key GIS management areas (personnel management, procurements, contract management, financial management, etc.).
- Examine and respond to important legal and policy requirements that influence GIS data and product management, access and outside distribution.
- Maintain contact with senior management and provide information on GIS program status and accomplishments.
- Continually promote the GIS program to encourage active use and maintain effective communications with users.

5. Conclusion

This chapter presents a comprehensive summary of GIS management concepts, issues, and practices. As stated, GIS management involves much of the same tools, skill sets, and practices as any public sector or private technology management domain – save for the specific familiarity with GIS technology and applications that sound management requires. The chapter concludes with lessons learned and practical suggestions on the planning and management of GIS programs and projects. Over the last 50 years, URISA members and participants in URISA programs and events have played a critical role in establishing sound GIS management practices and conveying this knowledge through a large body of literature and educational programs and tools.

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Part V

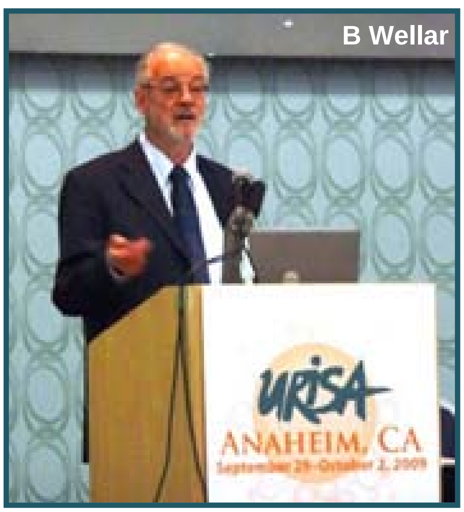
TOPICAL AND VISIONARY FOUNDATIONS

Through its conference proceedings, journal articles, workbooks, website postings, and other publications, URISA has been responsible for producing more than 35,000 pages of text, including hundreds of papers which are original contributions to the literature on urban and regional information systems and geographic information systems and science.

The chapters in this section discuss a selection of the core foundations that have been introduced to the literature through URISA, and to the real world of information systems experience in government, industry, interest groups, non-government organizations, associations, research institutes, and academic institutions on a daily basis.

And, perhaps even more importantly, they suggest many topical and visionary foundations that await thoughtful consideration and purposeful action.

Barry Wellar



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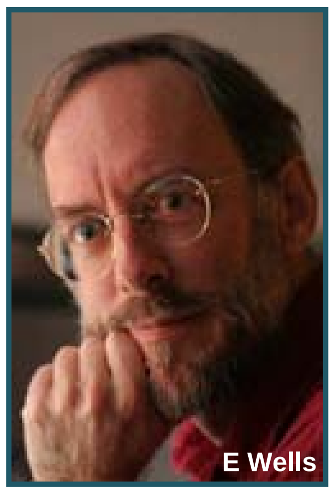
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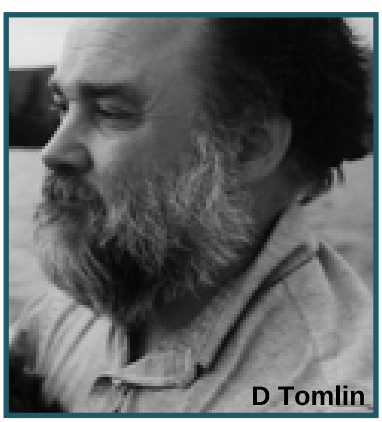
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CONNECTING RESEARCH METHODOLOGY AND THE REALITY-DATA-INFORMATION-KNOWLEDGE TRANSFORM PROCESS

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Abstract. Enhancing the reality-data-information-knowledge transform process is a primary objective of the field of urban and regional information systems and geographic information systems and science. In this chapter I discuss a selection of research methodology foundations that affect how well we succeed in each step of the transform process. The foundations discussed include: client-driven and curiosity-driven tasks; research output focus; the human factor; relating scientific frontiers and societal utility; implementing real-world research operations; moving beyond cataloguing to hypothesizing and theorizing; exploratory and confirmatory approaches; qualitative, quantitative, and visualization techniques; and, design-evaluation procedures.

1. Introduction

For the purposes of this paper, research methodology refers to the body of research methods, research techniques, and research operations used to undertake investigations, examinations, evaluations, and related inquiries about relationships between and among dependent and independent variables.

And, again for the purposes of this paper, the transform process is summarized to refer to the ways and means that reality is converted into data, data are converted into information, and information is converted into knowledge.

URISA's interest in research methodology began at its first meeting, and its public record on the topic began with the organization's first recorded publication of note, that is, its first conference proceedings in 1963.

The reason for the research methodology interest, in brief, is that a number of the participants in the early days of URISA were from universities, government agencies, and businesses, and it was in their "job descriptions" to learn all they could, and, truth be told, in some cases publish all they could about the newly-emerging topic of information systems.

Back in the day the phrase "research frontier" was used to refer to something that was new or different with regard to subject matter, methodology, technology, etc. As discussed in all the chapters in both Part I and Part II, there were a number of aspects to the information systems research frontier back in the 1950s, 1960s, and 1970s.

Further, and, as discussed in other chapters in Parts III, IV, and V, some of those research frontiers prevailed for decades, even through to today, and numerous others emerged during the unfolding of the field of urban and regional information systems and geographic information systems and science.

The point of import, however, is that some of the field's research foundations were put in place more than 50 years ago, and others are of more recent vintage. This paper refers to a selection of the research frontiers that were encountered in the formation of research foundations over the years, and invites other researchers to expand on this initial contribution to the foundations literature.

As for URISA's interest in the transform process, it had two equally important aspects that were discussed in detail in an earlier paper (Wellar, 1995).

First, there are various ways that the transforms can be achieved, and there was interest on the part of some researchers to engage in studies designed to improve the ways that the transforms were performed, but not necessarily in anything beyond the transform processes themselves. That situation may remind some readers of the saying, "They were interested in building a better mousetrap, but were not necessarily interested in catching any mice".

And, on the other hand, there were researchers with an applied orientation, whose interest was in those aspects of the transform process that were relevant or pertinent to their jobs, tasks, agencies, etc., "in the real world".

In short, these individuals were not seized by the notion of research for the sake of research. Rather, there needed to be a policy, program, plan, or other job-related or position-related purpose or mission that would be served by achieving the applied research objective.

Second, the phases of the transform process were also subject to different perceptions and attitudes. By way of illustration, discovering a new way to transform reality into data may have been perceived by some to be a good thing. Others could agree that transforming reality into data may be regarded as a critical first step in the transform process, but may also have been of a mind that the activity amounted to a waste of time, money, and effort if the data were not subsequently converted into information.

Similarly, producing new information about a relationship may signify an important research breakthrough. However, if knowledge is needed for decision purposes, stopping at the information phase is not sufficient, and the effort may be deemed to be wasteful of time, money, and effort.

And, of course, if time, money, and resources are spent on any of the transform phases, and the outputs are not used for their intended purposes, whatever they might be, then questions and/or challenges could arise about targeting, productivity, value-for-money, and so on.

Moreover, while the "I" of Information is at the centre of URISA and GIS, that is more a matter of convenience and coincidence in this paper than it is a design choice.

Rather, and as indicated by the title of the chapter, there is an intimate, interdependent relationship among data, information, and knowledge in the field of urban and regional information systems and geographic information systems and science. This paper is therefore designed to elaborate that relationship, with some guidance by the writings of Russell Ackoff, and communications with such eminent researchers as William L. Garrison and Wilbur Steger.

In his classic book, *The Design of Social Research*, Ackoff (1953) very succinctly sets out two primary objectives of methodologically designed research:

- Add to knowledge.
- Add to ways and means of continuing to add to knowledge.

Using the Ackoff argument as a model, the connection between research methodology and the reality-data-information-knowledge transform process may be indicatively outlined as activities that serve the following objectives:

- Add to data.
- Add to ways and means of continuing to add to data.
- Add to information.
- Add to ways and means of continuing to add to information.
- Add to knowledge.
- Add to ways and means of continuing to add to knowledge.

Table 1 in Chapter 1 lists many of the domains which have been discussed in URISA conference proceedings papers, journal articles, workshop workbooks, and other URISA productions. Some of the domains are in the body of data, body of information, or body of knowledge sphere, some are in the transform camp of adding to ways of continuing to add to data/information/knowledge, and some are used to refer to both transform processes and products.

The bottom line is that during the course of its 50 years, URISA has been a leading venue for identifying and elaborating many of the domains which comprise urban and regional information systems and geographic information systems and science.

However, and perhaps even more important than its contribution to identifying and elaborating domains, was and is URISA's contribution to the body of foundations – e.g., ideas, needs, motivations, philosophies, and catalysts – that serve and promote making the connection between research methodology and the reality-data-information-knowledge transform process.

In the remainder of this paper, I discuss several of the foundations that underlie or underpin the fundamentally important connection between research methodology and the reality-data-information-knowledge transform process. I hasten to add that this paper is merely a start on a topic that is seriously overdue for thoughtful consideration, and I encourage other researchers to expand on this initial, preliminary comment.

2. Foundations that Serve and Promote Connecting Research Methodology and the Reality-Data-Information-Knowledge Transform Process

I have written on this topic on previous occasions, and in this paper I draw on ideas developed in the earlier publications. Several references are included for readers who may wish to examine my earlier thinking on linkages and connections between science, research methods and techniques, GIS, and the reality-data-information-knowledge transform process. (Wellar, 1985, 1990; Wellar, *et al*, 1994; Wellar and Wilson, 1994; Wellar *et al*, 1996a, 1996b)

Six foundations are selected for detailed discussion, and three more are suggested for others to pursue. Bearing in mind that the language/terminology of the field has changed significantly over the past 50 years, there no doubt some readers may prefer phrases and terms other than those which I have chosen.

However, I am optimistic that the issue of "labels" will not detract from making the point that the foundations which are credited to URISA presentations, productions, communications, and discussions are significant contributors to building connections between research methodology and the reality-data-information-knowledge transform process.

2.1 Research Task Origin: Client-Driven or Curiosity-Driven?

Generally speaking, research tasks are either client-driven or they are curiosity-driven.

I outlined this distinction more than a decade ago while contributing to several publications and activities hosted by the Applied Geography Specialty Group, Association of American Geographers, and elaborated the differences and the connections between the two origins of research tasks for an Anderson Lecture that was subsequently published in the *International Journal of Applied Geospatial Research.* (Wellar, 2010)

In brief, a client-driven research task is one that is specified by a government agency, business, or other entity that has a research question, problem, issue, etc., for which it wants an answer. The person charged with providing the answer can be internal to the organization, or hired as a consultant, but in both cases the research project does not originate with the researcher, it is assigned to her/him.

And, a curiosity-driven research task is one wherein the research question, problem, issue, etc., is framed by the researcher herself or himself. Research projects of this nature can be represented by theses and dissertations, scanning of websites for matters of interest and, since they are the products of curiosity, they can also be undertakings that no one but the researcher may care about one way or another.

Examination of URISA conference proceedings reveals that beginning with the first production in 1964, this association has been a consistent and regular source of papers reporting on client-driven and curiosity-driven research projects.

Moreover, URISA was the first association in my experience whose conference papers demonstrated the thesis of my Anderson Lecture in 2005 and the *IJAGR* article. Namely, that the best research designs and associated research publications are those which combine methods and techniques from both research perspectives.

Evidence of URISA's scientific and societal impact in this regard is that over the past several decades a number of academic disciplines (e.g., geography, operations research, public administration, political science, urban studies, and environmental studies) have followed the URISA lead in two particular respects:

- Many of the domains listed in Table 1 of Chapter 1, which were introduced to the field of urban and regional information systems and geographic information systems and science through URISA, have been adopted by academic disciplines such as those listed above.

- The URISA approach of having due regard for both client-driven and curiosity-driven research tasks and their associated methods and techniques are increasingly represented in curricula, conference programs, and website pages.

And, a similar comment holds with professions such as planning, engineering, and law.

By demonstrating how both client-driven and curiosity-driven research perspectives contribute to the ways of conducting research, and enhancing research outcomes, URISA has been responsible for introducing and shaping a core foundation of the field of urban and regional information systems and geographic information systems and science.

2.2 Research Output Focus on Elements of Governance: Legislation, Policies, Programs, Plans, Projects, and Operations

From the onset of its conference programs and proceedings, URISA has provided a venue for reports on research initiatives dealing with the primary components of governance – legislation, policies, plans, and programs – as well as the primary elements – operations and projects – which implement the components.

Further, URISA has led the way in supporting and promoting research into linkages among and between the components and elements, and in designing and adopting an overall systems approach to the governance process.

As a result, there are many hundreds of articles in URISA proceedings, as well as workshop workbooks, journal articles, and other productions which discuss how and why urban and regional information systems and geographic information systems and science can be used in the processes of modifying government legislation, policies, plans, and programs (and associated operations and projects).

Examination of recent conference programs of a number of organizations, and numerous website pages, reveals that URISA's emphasis on having due regard for all components and elements of governance is increasingly being accepted as the appropriate way to proceed when undertaking public sector research into the reality-data-information-knowledge transform process.

I believe this finding is external confirmation that URISA's emphasis on ensuring that research outputs are generally pertinent to governance – legislation, policies, programs, plans, projects and operations – represents another foundation contribution to the field of urban and regional information systems and geographic information systems and science.

2.3 Adapting Research Methodology to the Human Factor

The field of urban and regional information systems and geographic information systems and science is intellectually, technically, and technologically fascinating to many of us, no question.

However, and as was recognized early on in the life of URISA, some elected officials, city managers, chief administrative officers, and department heads, as well as members of the professional staff and other local government staff, do not share in that fascination.

The approach taken by URISA to deal with the non-fascination factor was to promote designing research initiatives, and the outputs of research activities, so that they took into account the interests, needs, and capabilities of individuals throughout governments at all levels.

This was no easy task 40-50 years ago, and it is no easy task today in a number of jurisdictions. Put simply, some people do not easily embrace decision support tools such as statistics, mathematics, operations research, computer science, library science, econometrics, and research methods and techniques in general or in particular. Evidence in this regard includes findings from a recent study which confirmed the limited use of analytical methods and techniques by municipal government officials when making decisions about identifying, adopting, and implementing sustainable transport practices (Wellar, 2009).

Fortunately, however, progress is being made in representing the reality-data-information-knowledge transform process in ways that are more likely to be accepted by officials (and citizens), and that is a significant achievement.

Specifically, attendees at URISA conferences are provided numerous opportunities to learn about new "people-friendly" graphics-based approaches, products, and services, as well as about how to incorporate social networking as an integral element of data/information/knowledge networking. Credit goes to URISA for assisting researchers to modify their approaches so that their research initiatives and outputs are more likely to be broadly accepted.

2.4 Dual-Purpose Research Methodology: Regard for Advancing Science and Regard for Advancing Information Systems and Services Utility

Description, explanation and prediction are traditionally regarded as the fundamental classes of study in scientific inquiry, and as being integral to achieving two of the primary objectives of methodologically designed research, that is, adding to knowledge and adding to ways and means of continuing to add to knowledge.

Research methodology for advancing information systems and services utility also relies upon those three classes of study as means to achieve the reality-data-information-knowledge transform process.

In addition, however, evaluation and impact assessment studies are also conducted to ascertain, for example, if:

- GIS program goals have been met;
- Whether current IT systems performance can be improved;
- Whether new or different policies are needed to deal with data sharing issues;
- Whether current return on investment measures are appropriate for circumstances; and,
- Whether online access for citizens needs to be modified in favour of more graphics and fewer complex numerics.

As a result, the classes of research methods and techniques which are pertinent to the field of urban and regional information systems and geographic information systems and science are at least five in number:

1. Description
2. Explanation
3. Prediction
4. Evaluation
5. Impact assessment

In the early days of URISA, the occasional text such as *Urban Development Models* (Hemmens, 1968) included mention of the five classes of study.

However, it is my experience that URISA was the first professional or technical organization to tie the five classes to the information systems field. And, I hasten to add, URISA is still (in my opinion) the leading venue for reporting on and learning about new or different ways of employing research methodologies to advance information systems and services utility.

2.5 Implementing Research Operations that Connect Research Methodology and the Reality-Data-Information-Knowledge Transform Process

It is one thing for a textbook to identify the research operations that underpin research techniques or research methods, and quite something else to design and undertake those operations under real-world conditions of uncertain funding, limited expertise, threatened empire builders, media scrutiny, moving deadlines, and a host of unseens and unknowns.

As cases in point, I expect that many readers can quickly find more than a few research domains in Table 1, Chapter 1 that bring back “difficult” memories about research operations that did not go well.

Examination of URISA proceedings beginning in 1963 reveals deep thoughts and a huge “heads up”, along with substantial amounts of empirical evidence, on the hows of successfully engaging in fundamental research operations such as observation, measurement, analysis, and synthesis. Further, URISA was also an excellent “school of hard knocks” when it came to cautions and lessons learned about the pitfalls, blind alleys, dead ends, lost time, wasted effort, and other downsides that could be encountered during research operations.

Insofar as the expression “Reality-Data-Information-Knowledge Transform Process” is concerned, therefore, while it appears that the expression itself was not coined until some years later, various ways of implementing (and not implementing!) the steps in the process began to be a topic of discussion at initial URISA conferences.

2.6 Moving the Research Emphasis beyond Cataloguing to Hypothesizing and Theorizing

The call to move research beyond cataloguing to hypothesizing and theorizing in the field of urban and regional information systems was initially and informally issued back in the 1960s in URISA presentations and communications. It is my recollection that there was serious but limited interest in the topic, because the field itself was in the very early days of formation. The call was extended over the next decade to include geographic information systems and science, and again in a serious but limited way for the same reason: GIS was still in its early days of formation.

By the time of the 1977 URISA conference, however, Edgar Horwood was ready to take a major run at the topic, and his conference keynote paper (Horwood, 1977) was the basis of a number of follow-on presentations and publications, including the paper by Wellar and Harris (1992) for the URISA benchmarking project and several productions that had their origins in the URISA experience. (Wellar and Wilson, 1994, 1995)

To date, it appears fair to say, appeals for research that increasingly contributes to the hypothesizing and theorizing phases have not been heeded as well as one might wish, and there is no basis for surprise in that regard. As a general rule, compiling inventories, lists, arrays, files, and other assemblages of data, images, books, etc., is technically easier than framing, testing, assessing, and depicting hypotheses, and considerably easier than analysing and synthesizing the results of framing, testing, assessing, and depicting hypotheses to derive theories, which in turn go through their own creative and validation processes.

However, I believe that change is in the wind, pushed and/or pulled to a considerable extent by the reality-data-information-knowledge transform process.

That is, while cataloguing is part of each phase in the process, there are rapidly-reached limits as to the value, robustness, and utility of any of the transform results (data, information, knowledge) if relationships are not explored/confirmed and generalized through the hypothesizing and theorizing phases of research.

I therefore fully expect that for a very pragmatic reason, within the coming decade there will be a significant surge in hypothesizing and theorizing activity in the field of urban and regional information systems and geographic information systems and science.

Put simply, I believe there is an increasing appreciation that the field will suffer a serious loss in professional credibility if it does not move in the suggested direction, and that this may be the needed motivating factor to raise the research bar accordingly.

In terms of credit earned, then, URISA has garnered full marks for its efforts to elaborate the connection between research phases (cataloguing, hypothesizing, and theorizing) and the reality-data-information-knowledge transform process as a foundation of urban and regional information systems and geographic information systems and science. That said, a great deal of heavy, mental lifting remains.

2.7 Three More Foundations Affecting the Connection between Research Methodology and the Reality-Data-Information-Knowledge Transform Process

In addition to discussing foundations of urban and regional information systems and geographic information systems and science, contributors to this book are invited to identify foundations for others to elaborate in theses, dissertations, research proposals, etc.

I am pleased to follow my own "invitation" and offer three more foundation topics whose continuing elaboration could make an insightful contribution to better connecting research methodology and the reality-data-information-knowledge transform process.

2.7.1 Exploratory Research and Confirmatory Research

Discussion of the differences between, and the linkages between exploratory research and confirmatory research was deemed to be of major benefit in designing the study into the use of research methods and techniques for making decisions about sustainable transport practices. (Wellar, 2008)

It is my belief that a major literature search and review activity structured along similar lines could provide significant insights into the exploratory-confirmatory research relationship in urban and regional information systems and geographic information systems and science.

And, it is my expectation that the study findings would provide directions as to whether and to what extent adjustments are advisable in terms of better connecting research methodology and the reality-data-information-knowledge transform process.

2.7.2 Qualitative, Quantitative, and Visualization Procedures

The results of a brief but intensive investigation into the use of qualitative, quantitative, and visualization procedures of spatial logic were published about 15 years ago (Wellar *et al*, 1996a, 1996b). Bits and pieces of that topic had been discussed at URISA and GIS/LIS conferences over the years, but not as a total techniques package.

It has become clearer over the years since publishing the summary papers that, due largely to rapid changes in software, a sustained research program and associated publication program is needed in order to better understand how the three techniques can be more effectively used (separately and in combination) in each phase of the reality-data-information-knowledge transform process.

2.7.3 Research Project Phases: 'Pilot Study', 'Pre-Test', and 'Trial Run'

The terms 'pilot study', 'pre-test', and 'trial run' have been in the research methodology literature for more than fifty years, they or their proxies have been in the URISA literature for more than fifty years, they or their proxies have been in other bodies of literature for more than fifty years, and they or their proxies have been part of research methods courses in universities for more than fifty years.

There seems to be a general, accepted understanding within the scientific community as to what the terms mean, and how they combine to form a robust design-evaluation tool for guiding decisions about research project specifications and procedures.

Further, there appears to be an appreciation, in principle, among elected officials and other decision-makers that this design-evaluation tool could provide guidance during deliberations about proposed initiatives involving such complex matters as transportation systems and their components, waste disposal alternatives, construction of public facilities, major re-zonings, as well as computer/communications systems in general and geographic information systems in particular.

Unfortunately, when it comes to practice, that is, implementing this design-evaluation tool, comments from elected officials at all levels of government, appointed officials at all levels of government, and members of the media frequently reveal a serious misunderstanding (to put it politely) of what the terms are intended to construe separately, and what they are intended to achieve collectively.

Specifically, in many cases the term ‘pilot study’ is frequently used to refer to anything and everything that is done in the way of research before computer systems are changed, shovels are put in the ground to expand road networks, sport stadiums are constructed, bus routes are changed, waste handling procedures are changed, library hours are changed, etc. etc.

However, there are different kinds of pilot studies, different kinds of pre-tests are applicable to different kinds of pilot studies, and trial runs are a function of what was done at the pilot study and pre-test phases.

To perhaps disabuse any still-held misconceptions, the fact is that relative to some aspects of governance the design-evaluation process is a complicated business, and the situation is not helped by language from government officials which is “clear as mud but covers the ground”.

Based on my civil service experience, and my research experience inside and outside government, it is my opinion that lack of regard for the methodology behind design-evaluation procedures is a major cause of dis-connects in the linkage between research methods and the reality-data-information-knowledge transform process.

Accordingly, I suggest that design-evaluation methodology warrants immediate and sustained attention by the urban and regional information systems and geographic information systems and science community.

3. Conclusion

The motivation behind URISA’s origins included an interest in urban and regional research, and associated research interests in methods and techniques to perform urban and regional studies, data to support investigations, and computer hardware, software and peripherals to process the data and perform analyses.

Fifty years later, as demonstrated by conference programs and proceedings, workshops, and other productions, the Association is still pushing research frontiers in the field of urban and regional information systems and geographic information systems and science. From a general perspective, the research frontiers are neatly summarized by putting them within the purview of the reality-data-information-knowledge transform process.

In this paper I discuss some of the ways that URISA has significantly contributed to the body of foundations – e.g., ideas, needs, motivations, philosophies, and catalysts – that serve and promote making the connection between research methodology and the reality-data-information-knowledge transform process.

And, I suggest several other foundation topics that warrant immediate and sustained research attention.

As a closing comment about the challenges of connecting research methodology and the reality-data-information-knowledge transform process, if we have learned anything over the past fifty years I believe it is this: Fifty years from now someone will say, "This is complicated, very complicated, even after all these years."

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18

FUNDAMENTALS OF GEOSPATIAL ALGORITHM DESIGN

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Abstract**:** The content and the spirit of this chapter are both reflected in its original working title: *You Could Design a Geospatial Algorithm with Your Eyes Closed (and You Should)*. The chapter argues that tools and techniques associated with geographic information systems (GIS) are often also associated with "thinking on the right-hand side of the brain." It does so by directing a variety of casual quips and tips toward those who might not otherwise be likely to venture beyond the chapter's current title.

1. What?

Shortly after Thanksgiving dinner, I had the opportunity
to spend some time with the only first cousin of the only child
of my mother's only brother, and there was little disagreement
that a fellow I had seen earlier could well have been my nephew.
So why is it that my wife has never spoken to my sister?

If you liked that one (and especially if you didn't), try this.

Count backwards from ten.

Too easy? I agree, so how about the following?

Recite the alphabet from Z to A.

Not so easy, huh? Okay, here's one more.

List the months of the year
in reverse chronological order
starting four months ago.

The common thread (and, for some, the key) to solving such problems is the ability and an inclination to rely on internal visualization, to see them in the mind's eye and pursue them by employing cognitive skills associated with the right hemisphere of the brain. While most can count backwards from ten by rote, and very few can easily make their way from Z to A without having already committed the trip to memory, that question about the months is one that almost always conjures up a mental image. Yet even those for whom this image is crystal clear are likely to put it aside when asked to recall which of those months have only 30 days.

These are skills that do indeed seem to vary from one person to another. Having now spent several decades teaching geospatial data-processing techniques to graduate students in schools of environmental planning and design, I can say with confidence that different people have different ways conceptualizing what, when, and where. Such differences are particularly pronounced between those who tend to think in terms of discrete objects or events and those who tend to do so in terms of continuous conditions or processes.

These are skills that have even been shown to relate to brain physiology. Check out the work of 1981 Nobel Prize winner, Roger Sperry. In my own experience, this became clear one day when I offered navigational directions to a colleague. It was only after this forest economist explained that he had undergone brain surgery years before (which had severely diminished his former ability to process mathematical data) that I could even begin to appreciate his description of the actual pain (let alone the frustration) he would feel in trying to interpret such instructions.

The recognition of hemispheric dominance has also given rise to plenty of popular, online tests. These tend to associate “right-brainedness” with things like creativity, spontaneity, innate senses of both space and time, and expression by way of body language.

So what does all this have to do with the design of algorithms? As one who is certainly not a neurobiologist and not even much of a computer programmer but one who has nonetheless been invited to comment, my own strong contention is that “spatial reasoning” has plenty to do with the design of algorithms. And for *geospatial* algorithms, even more. In fact, I am convinced that, among the ranks of those who would cast themselves as users of geospatial tools are many whose spatial reasoning skills could (and should) be put to use in designing those tools as well.

It is for this reason that what follows is presented not so much as a retrospective synopsis of the field but, rather, as a more prospective pitch directed toward those who are new(ish) to this field – particularly those who might not think of themselves as anything like software developers.

Of course, right-brain thinking isn’t the only way to approach the design of geospatial algorithms. Just as in writing, singing, knitting, or cooking, different creative minds may work in very different ways. And there is always a need to complement the creative vision with productive action. But even to those for whom this may not seem the way to go, that in itself may be reason enough to spend a few moments with one who really does.

2. Why?

Can spatial reasoning really help in the design of geospatial algorithms? If so, does it call for particular skills? And if that's the case, can those skills be developed? The purpose of this paper is simply to explore such questions. And yes, the term "explore" is used quite deliberately in that sentence in order to diminish expectations of crisp or definitive answers. What should be expected instead is an informal but deliberate sequence of observations, anecdotes, suggestions, and examples that have been chosen in order to make a case by pointing more or less in a common direction.

3. How?

What is happening in his head
Ooooh, I wish I knew
I wish I knew

The lines (from the song "Go To The Mirror!" by Peter Townshend of The Who as part of their 1969 rock opera, "Tommy") do indeed have to be heard in context in order to fully appreciate their relevance to the design of geospatial algorithms. So go ahead, take a few minutes right now. You'll have no problem finding it online.

When you do, you will also encounter four more lines that nicely reflect the progression of steps by which the problems addressed by such algorithms are 1) observed, 2) understood, 3) confronted, and 4) resolved. If you were around and you were listening soon after 1969, you already know what they are. Otherwise, you really must take those few minutes right now in order to fully appreciate what follows.

3.1 Seeing

The first and often the simplest (yet, just as often, the most significant) step toward solving any problem is to cast it in terms that facilitate its resolution. For the kinds of problem that call for algorithmic solutions, this is generally done by explicitly articulating objectives, constraints, and anticipated solutions. In some cases, that articulation may well be through algebraic equations. In others, it may be through words. Often, however, the most effective way of articulating a problem is to envision its components as pseudo-spatial objects or conditions.

Consider, for example, the following problem that was presented at the end of my own first class on computational complexity.

Given a duel in which one party gets to shoot first
with a gun that is deadly accurate only one third of the time,
while the other party goes second (if fortunate)
with a gun that hits its mark half the time,
which party enjoys the better odds?

Though the problem was issued as a homework assignment (by Dr. David Dobkin, then a junior professor at Yale and now Dean of Faculty at Princeton), several hands shot up immediately after the question was posed. Without exception, each of those hands belonged to a student who had resisted the temptation to think in terms of algebraic equations or dynamic simulations. Instead, these were all students who simply envisioned probabilities of success as geometric objects. They were "hunks of good fortune" repeatedly divisible into thirds (if shooting first) or halves (if shooting second) of whatever might remain after each shot.

Even this elementary example begins to suggest how mind's-eye visualization can help to register the multiple components of a problem and record relationships among them in a manner that facilitates their retrieval. This particular example also serves to introduce the element of time. Here, the spatial dimensions involved are virtual (occupied by hunks of good fortune), while the temporal dimension (one shot after another) is actual.

Consider another example, however, in which the reverse is true: the spatial construct involved is real, while a temporal framework is used to schedule events that occur in logical, but not necessarily chronological, sequence. Given a set of consumers within a region, the task is to place a specified number of producers in the same region such that the total distance between consumers and producers is minimized. To do so, start by placing the producers anywhere. If you will then move each producer to the geometric center of all consumers to which it is the nearest of all producers, and repeat until no more producer movement occurs, a pretty good solution will result. See it? More generally, this "*k*-means" technique is often used to cluster observations according to their values in far more than two dimensions, none of which may actually be spatial.

Here's one more (a favorite of Dr. David Mark, Professor of Geography at the University of Buffalo) that clearly involves no real spatial or temporal dimensions at all, but whose solution becomes apparent when the problem is visualized in those terms.

Given a list of cities identified by name and size,
find the largest of those cities for which
another of the same name is larger.

3.2 Feeling

After a problem has initially been "seen" but before its solution is yet ready to be attempted, it can often be helpful to arrange for the problem to be "felt" in ways that go beyond its initial portrayal. At this point, the intent is to gain insight, and there are several simple-but-effective ways to do so, each benefitting from a willingness to imagine entities, states, relationships, and processes in at least topological if not geometric terms.

One way is by adopting a conceptual metaphor: noting that the problem to be solved shares enough similarities with a familiar phenomenon to infer additional similarities that might shed light on its solution. Consider, for example, the problem of finding a path of minimum travel cost from a specified origin to a specified destination over an intervening terrain in which the cost of each step varies according to conditions under foot. Techniques for the solution of such problems most often start with the calculation of travel-cost "distance" from the destination. Those distances can be equated with elevations on a three-dimensional surface not unlike a physical surface of land heights above sea level. By doing so, the minimum-cost path from origin to destination can be envisioned as one that is comparable (though not identical) to the downstream path that water would follow from origin to destination over a physical model of that surface.

Now consider the problem of connecting multiple origins to a common destination while minimizing the overall cost of the network of paths required. By pursuing that hydrological metaphor and thinking in terms of channelization, the following strategy emerges. Trace the minimum-cost path from each origin, note how many of those origins "drain" over each location downstream, and use the resulting "flow volume" to reduce the cost of travel through that location. If travel cost from the destination is then recalculated and the whole process repeated several times, the dendritic network of paths generated with each new iteration will be one of fewer small branches, larger trunk lines, and therefore greater efficiency.

Another way to better wrap one's head around a problem is to blur the mind's eye just enough to see it at slightly higher levels of abstraction. It is Bill Miller (architect, engineer, planner, educator, and now geodesigner at Environmental Systems Research Institute) who comes to my own mind first in this regard for his eloquent description of the Lamé curve. This is a geometric figure that is able to take on the form of a point, a square, a rectangle, an ellipse, a circle, or a diamond by simply changing its parameters. Bill was able to completely reinvigorate a particular software-brainstorming session by using this example to argue, in effect, that black and white are both just shades of grey.

The power of abstraction can also be expressed by borrowing from what some will find to be a familiar joke.

A scientist, a priest, and geospatial algorithm designer see two people enter a house that is known to be empty. When three people soon emerge from the house, each observer is asked to explain. The scientist responds, "We have probably made an error in observation." Says the priest, "Not at all. What we have witnessed here is indeed a miracle!" The algorithm designer: "I can't be sure, but I do suspect that, if I were to enter that house right now, the house would again be empty.

Sometimes, the best way to keep a problem well within range of the mind's eye is to make sure it is not within sight of those other two eyes up front. (This is in fact why the current text has yet to make use of figures.) That point became very clear to me several minutes into an important lecture that seemed doomed from the start when a projector bulb failed, and no replacement was available. All I could do was to ramble on with feigned conviction from slide to invisible slide. After a while, however, my mind was put at ease when a voice from the back of the room called out, "Could you please go back to that slide before the last one?"

3.3 Touching

You can't always get what you want
You can't always get what you want
You can't always get what you want
But if you try sometimes you just might find
You just might find
You get what you need

Unless these lines (from the song "You Can't Always Get What You Want" by Mick Jagger and Keith Richards of The Rolling Stones on their 1969 album, "Let it Bleed") are already familiar, and even if they are, they too warrant a listen by anyone interested in the algorithmic design. Why? It's because the design of precise and reliable algorithms so often calls for the use of heuristics that are seldom precise and never fully reliable.

Whereas an algorithm is a finite sequence of well-defined instructions yielding a replicable result, a heuristic is a not-necessarily-finite set of not-always-well-defined steps that rely on experience, incremental progress, and lessons learned along the way to approach solutions that may not be replicable or even optimal but which often tend to suffice. Two examples of heuristics have already been offered: the *k*-means technique for clustering and the use of channelization to allocate a dendritic network.

As the designer of an algorithm becomes more engaged, and as that engagement begins to shift from more passive forms of observation and interpretation to more active forms of exploration and flirtation with solutions, it is very likely that this will involve a series of trial-and-error (or trial-without-error) attempts. Significantly, the expectation for each of these attempts is not necessarily to score a hole in one but merely to move the ball closer toward the target, to avoid major setbacks along the way, and – importantly – to learn a bit more about what lies ahead.

If "feeling" a problem is a matter of imagining its entities, states, relationships, and processes, then "touching" the problem implies that these components are now about to be juggled in hopes of conjuring up solutions or at least (and more likely) solution strategies that hold promise. And juggling is always easier when the mind's eye is wide open.

Often, the best way to open that eye is to start with a “naïve solution,” one that may not be at all efficient but which is nonetheless effective and which serves to articulate the problem’s essential challenge. Consider, for example, the problem of calculating distances to all pixels in a raster image from one particular pixel. According to Pythagoras, the distance between any two such pixels can be calculated as square root of the sum of the squares of the horizontal and vertical components of that distance. Thus, one naïve solution might be to proceed from pixel to pixel and work with Pythagoras at each step along the way. If nothing else, this solution will (eventually) generate a correct answer, keep Pythagoras busier than seems necessary, and begin to suggest that each new calculation might somehow be able to benefit from the one that was just completed.

Another way to train the mind’s eye is to direct it toward a simplified instance of the problem being pursued. If a straightforward solution to that simple case can be found, then more and more general cases can be considered in hopes of constructing more and more general solutions. To ease that burden on Pythagoras, for example, consider taking on just part of his task: calculating squared distances only to the immediate right of a designated pixel. The resulting values (in pixel widths) will be as shown below.

0 1 4 9 16 25 36 49 64 81

Now note the following differences between consecutive values.

1 3 5 7 9 11 13 15 17

If you’ll do that one again, the result will be as indicated here.

2 2 2 2 2 2 2 2

So the squares of consecutive integers can be generated by incrementing (each time adding two more than before) without any squaring at all. This feels like it ought to be significant even if not sure why. And indeed it is.

To see why, consider the following array of pixel values.

0	**1**	**4**	**9**	**16**	**25**	**36**	**49**	**64**	**81**
1	**2**	**5**	**10**	**17**	**26**	**37**	**50**	**65**	**82**
4	**5**	**8**	**13**	**20**	**29**	**40**	**53**	**68**	**85**
9	**10**	**13**	**18**	**25**	**34**	**45**	**58**	**73**	**90**
16	**17**	**20**	**25**	**32**	**41**	**52**	**65**	**80**	**97**
25	**26**	**29**	**34**	**41**	**50**	**61**	**74**	**91**	**106**

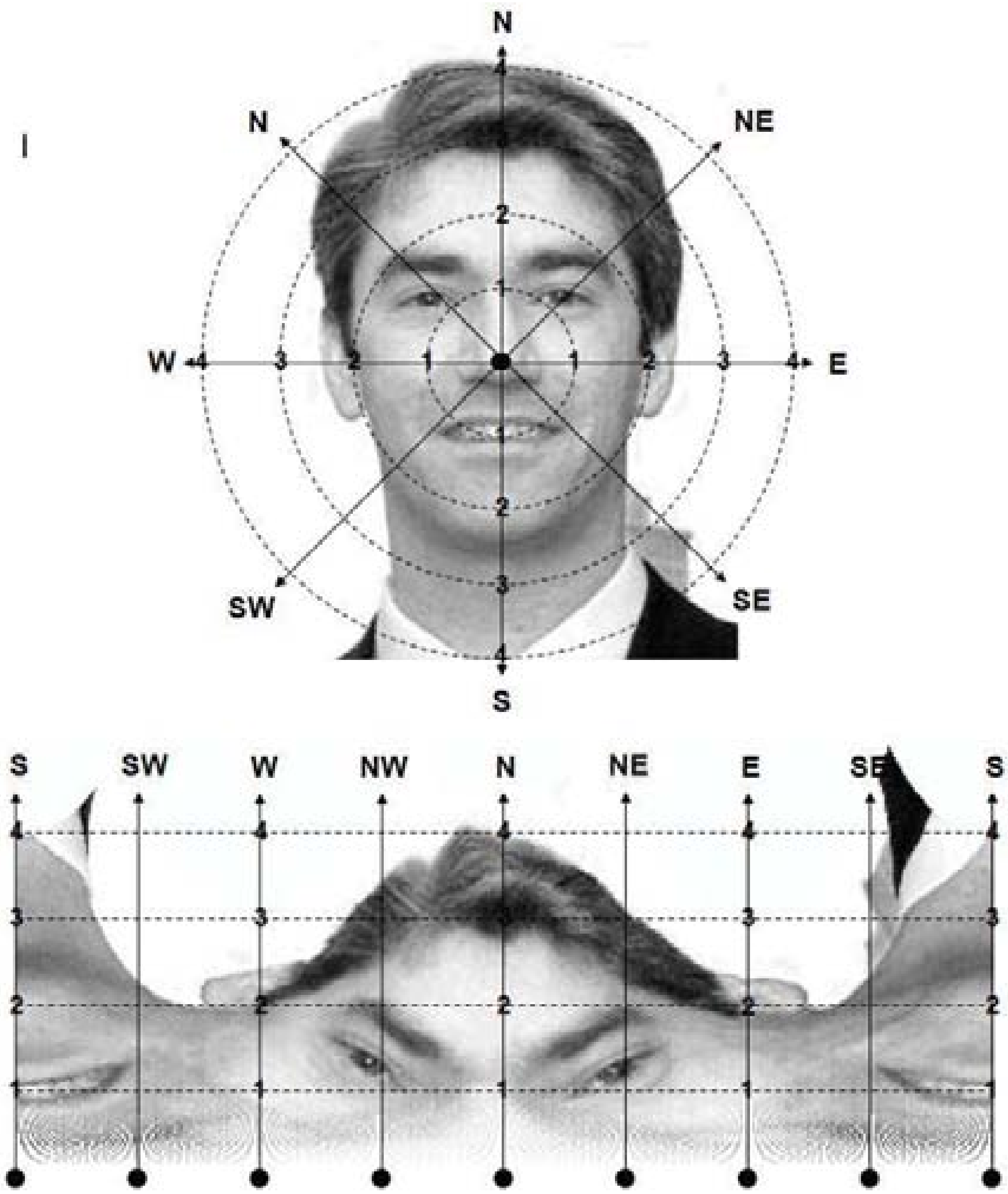
Here, the same sort of incrementation that was applied from left to right has now been applied from top to bottom. Thus, each value in the second row exceeds that of its upper neighbor by one, while those in subsequent rows do so by three, five, seven, nine, and so on. The punch line here is that each pixel's value now indicates the square of its distance from that pixel in the upper left corner. While some additional maneuvering will also be required when measuring distance from more than just one neighboring pixel, this technique has all but eliminated those repeated calls to Pythagoras. It has also done much of the work necessary to indicate the directions, the identities, and the interpolated influences (as opposed to merely the distances) of those neighbors.

The key insight that ultimately leads to problem's solution can sometimes simply arise from wishful thinking. Consider, for example, the task of generating viewsheds. Tracing radial lines-of-sight is challenging primarily because of the radial geometry involved. Things would be much easier if the lines radiating from a given viewpoint were parallel to one another. So why not just make it so? With apologies to Robert Cheetham (Founder and President of Azavea, a geospatial software firm in Philadelphia), Figure 1 demonstrates the process. First, the landscape around each viewpoint is warped such that radial directions become vertical and concentric distances horizontal. (Given the techniques described in the previous paragraph, this transformation is remarkably easy.) The parallel lines-of-sight that result can then be traversed by simply proceeding upward over each in order to generate a viewshed that can (just as easily) be reprojected back onto the original landscape.

Another way to catch that first glimpse of the inkling that might eventually solve a problem is to try to imagine that problem from the inside out: to invert the cause-and-effect perspective from which many problems tend to be considered into one that considers causes from the perspective of their effects. This is much like inverting a declarative sentence from the active to the passive voice. For geospatial problems, it often means replacing (or at least augmenting) a mental image in bird's-eye format with its worm's-eye counterpart. By focusing myopically on a typical location for which some sort of value is to be computed, it is often easier to keep track of the various inputs required to do so.

Notwithstanding several previous examples where this was not the case, the point can be illustrated by building on one of those examples. Suppose "the problem of finding a path of minimum travel cost from a specified origin to a specified destination over an intervening terrain in which the cost of each step varies according to conditions under foot" (as was introduced several pages ago) were to include a constraint requiring that this path be of a specified width. If your first inclination is to envision a "wide-load" vehicle trying to make its way through a field of travel costs, you are in good company; one recently-published algorithm has adopted just that approach.

Figure 1. Modeling Radiation



Consider, however, a much simpler and much faster alternative. Instead of attempting to allocate a path of specified width, just try to allocate the centerline for such a path. Once that's done, this centerline can easily be widened as necessary. But the centerline of a path that has width is not the same as a path that has no width. Whereas the latter can snake its way through tight spots between areas of higher travel cost, the former must take those nearby travel costs into account. How to do so? Simply replace the incremental cost of traversing each location with the maximum of all such costs that occur within a radius of half the desired path width.

3.4 Healing

If you've ever woken from a dream recalling just enough of it to know that you'd like to recall more, you will also know that doing this requires both conscious and subconscious faculties that can get in each other's way. Much about this process is similar to that of bringing what seems like a good idea into sufficient focus to translate it into a practical solution. We have shifted completely from description to prescription at this point, and the challenge is now to make it all work in the sober light of day. The ability to present intermediate results in evocative terms is essential, and the best way to do so is very often by way of suggestive visualization.

In my own experience, the most memorable example of this is one that becomes even more so as time goes by – probably because of the ancient computing environment involved. It was decades ago, when experimental work on what would later become a tool for propagating waves of travel cost through fields of varying impedance meant waiting overnight for output from a computer that was large and important enough to warrant a building of its own. As what seemed like reams of fanfold paper were laid out across the floor, it was both exasperating and exhilarating to see that floor covered with digital puddles, streams, and eddies that tended to dramatize logical errors but – precisely because of that – also tended to hasten their correction.

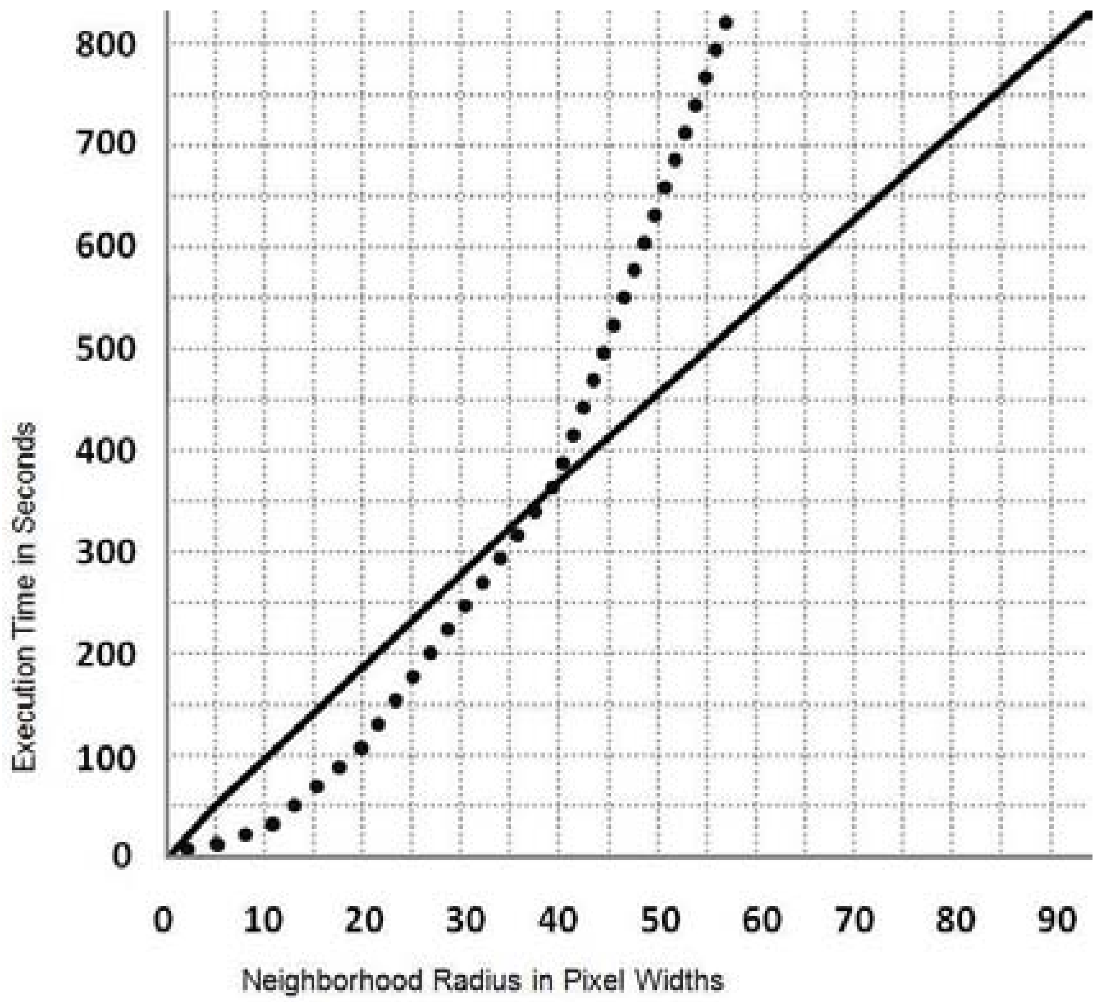
Okay, one final example. This one is intended to offer a glimpse at the overall process of geospatial algorithm design, from inception through implementation. To the best of my knowledge, the algorithm proposed is a new one. It is also one that addresses a fundamental problem: to efficiently calculate, for every pixel in a grid, the sum of all values from pixels lying within a specified radius. If that radius extends over no more than several pixels, any reasonable algorithm will generate reasonable results. If the radius extends over hundreds or thousands of pixels, however (as can be expected with the increasing availability and use of raster datasets at finer and finer levels of resolution), such calculations can very quickly become very slow.

In Figure 2 is a graph comparing observed execution times for one crude version of this algorithm (solid line) and the most widely-used of its current counterparts (dotted line). Note that processing time for the new algorithm grows in near-linear (rather than exponential) proportion to the radii of the neighborhoods involved. That's good news.

So how does it work? And more to the point of the current discussion, how did it come about?

It started with a naïve solution: visit every pixel and, for each, visit all of that pixel's neighbors. If nothing else, this solution serves to make the underlying issue conspicuous. If each "neighboring" pixel must be visited repeatedly (once for each of the neighborhoods containing that pixel), then the total number of such visits can be enormous as neighborhoods grow.

Figure 2. Improving Performance



To envision an alternative approach to this problem was not a matter of inducing an abstraction or adopting a conceptual metaphor; it simply called for a different point of view. Rather than thinking in terms of overlapping neighborhoods, each to be fully processed before the next one was considered, the problem was instead "seen" (quite out of focus at first) in terms of incremental accumulations. This would mean starting with sums from adjacent pixels, then summing those sums, and repeating the process as necessary over larger and larger groups of pixels eventually forming neighborhoods. In that way, later calculations might be able to take advantage of earlier ones and thereby avoid redundant computation. All it would take is some careful bookkeeping.

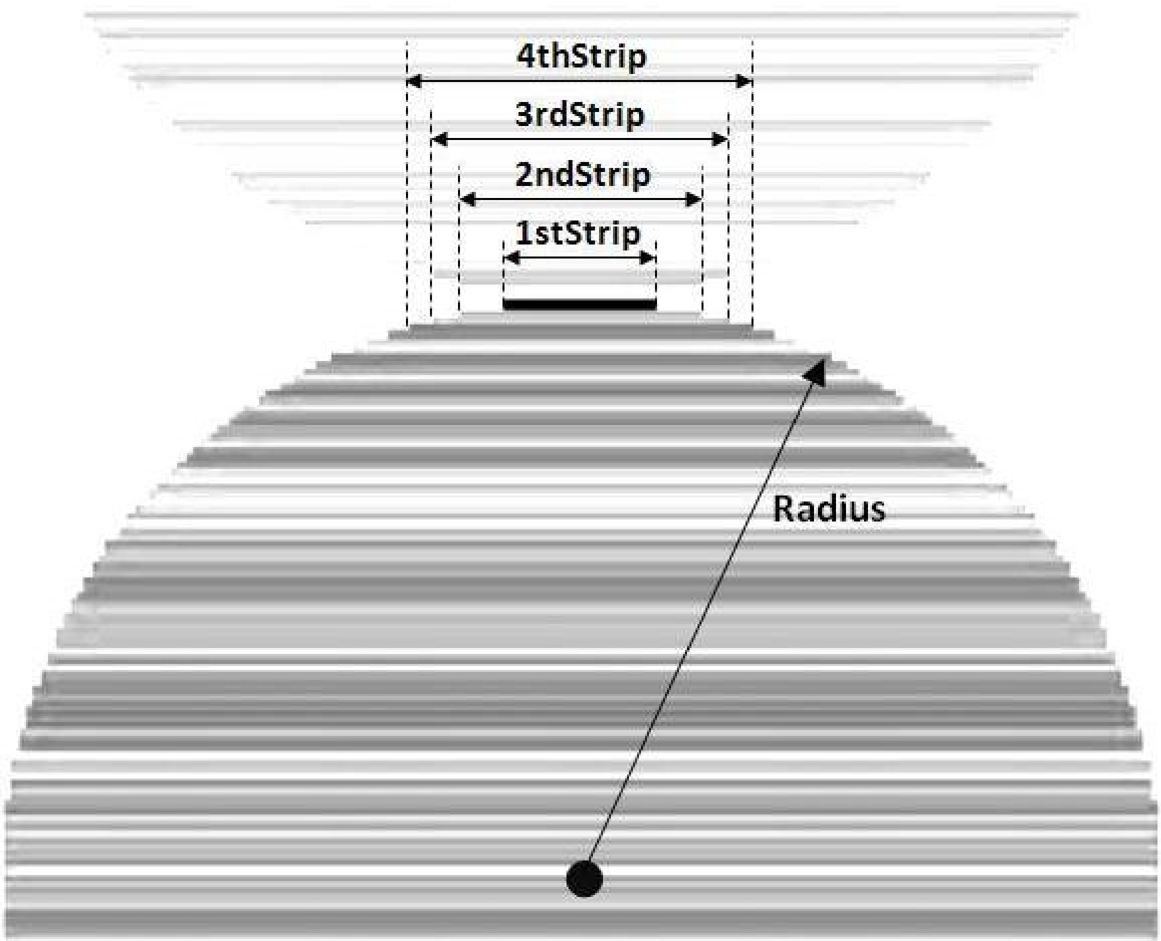
To explore this prospect, the next step was to consider a simplified case: one in which the neighborhood of a given pixel extended not in all directions to form a circle but, rather, only to the immediate left and right of that pixel. The lesson learned from this exercise was a simple one that can be envisioned as shown below, where each letter represents a pixel.

A B C D E F G H I J

Given a the sum of the values of all pixels within three pixel widths of pixel **E**, the sum of the sum of all pixels within three pixel widths of pixel **F** can be computed by simply subtracting the value of pixel **B** and adding that of pixel **I**.

Next, it was recognized (though probably anticipated long before, even if never consciously acknowledged) that lateral neighborhoods or "strips" like the one shown above could be used to construct circular neighborhoods as shown in Figure 3. Note here that the uppermost strip in each neighborhood is called its **1stStrip**, the one below it is called **2ndStrip**, and so on. Note too that the number of strips from top to the center of such a circular neighborhood will be equal to its radius in pixel widths. The horizontal width of any given strip can be calculated as twice the square root of the difference between the squared radius and the squared number of rows between that strip and the neighborhood center. (A little geometry was bound to show up sooner or later, but that's about all there is.)

Figure 3. Accumulating Neighborhood Sums



Given this, the algorithm can be roughly described in terms of tree steps.

Step 1:
For every pixel, calculate the sum of its **1stStrip** input values.

Step 2:
Add that sum to the current output values of two pixels:
the center of the neighborhood for which **1stStrip** is its top row, and
the center of the neighborhood for which **1stStrip** is its bottom row.

Step 3:
Repeat Steps 1 and 2 for each pixel's **2ndStrip**, **3rdStrip**, and so on until the number of strips processed is equal to the number of rows per neighborhood radius (keeping in mind that, for each new strip, the two neighborhood-center pixels to which Step 2 sums must be reported will each be one row closer to the pixel being processed).

Note here that, if Step 1 visits pixels from left to right across each row of a grid, then each new **1stStrip** sum for any given pixel can be calculated by adding the values of rightward neighbors and subtracting the values of leftward neighbors as described earlier. Similarly (but more significantly), each new **NthStrip** sum for any given pixel can be calculated in a manner that takes advantage of the **(N-1)thStrip** sum most recently calculated for that pixel. More than anything else, it is this which accounts for the algorithm's healthy performance.

4. So?

You're far too keen on where and how
But not so hot on why

Okay, this third musical reference may well be a bit gratuitous, but it seemed only fair to cite at least one line from something more recent than the sixties (the song "Gethsemane" by Andrew Lloyd Webber and Tim Rice on their album, "Jesus Christ Superstar," which came out in 1970). And a glimpse at just about any rendition of that song from the rock opera that would follow will convey the conviction with which I would argue the reasons for spatial reasoning.

So what about those questions posed at the beginning of this chapter? Can spatial reasoning really help in the design of geospatial algorithms? If so, does it call for particular skills? And if that's the case, can those skills be developed? While this paper has attempted to suggest an affirmative response to each of those three questions, it is the third that most warrants your own greatest attention. The very fact that you're still reading this chapter probably suggests one of two things.

On the one hand, the preceding pages may simply have confirmed the familiar. You are already the kind of person who is tolerant of uncertainty, comfortable with nascent ideas, confident in stochastic events, delighted by paradox, and amazed at the power of recursion: one for whom *À la Recherche du Temps Perdu* and *Where's Waldo?* hold comparable appeal.

On the other hand, those pages may have drawn your attention to notions that aren't quite as familiar as it seems they could or should be. Though your mind's eye did indeed project an image of those months a few moments ago, you still stand squarely among those (as do I) who found it easier to simply mutter "Thirty days hath September ..." and let it go at that. If so, the following pages are intended especially for you.

The structure of this chapter is due in large part to a colleague in Computer Science (Dr. Tim Richards at the University of Massachusetts), whose advice was sought not because of his considerable ability to generate computer software. Rather, it was because of Dr. Richards' considerable ability to (You guessed it.) … juggle. To be more precise, it was his ability to *teach* someone (not unlike myself) to juggle, and much of what Tim had to say is reflected in what you have already read – particularly the idea that you can't fully teach someone how to juggle any more than you can fully teach a child how to ride a bike. The best you can do is to set the stage, offer suggestions, try to instill some confidence, and perhaps be there to avoid catastrophe, but otherwise let the brain do exactly what the brain does best when (both sides of that brain are) given the opportunity.

So here are three final suggestions. Though none of the three is unique to the task of designing geospatial algorithms, each is still quite likely to be of use in that regard. All pertain to the nature and use of what amount to gifts: 1) gifts that may never actually arrive, 2) gifts you may want to return when they do, and 3) gifts that are likely to be delivered when you're not even there.

4.1 Expecting

First, come to terms with serendipity. Make yourself available to it, expect that it will find you, recognize it when that happens, and take advantage of whatever it has to offer. No, you can never fully predict serendipity any more that you can the weather. (If you could, it would no longer be serendipity; right?). But much like the weather, you can still rely on fortunate surprises with a fair degree of confidence, particularly if you are proactive, reactive, and resilient enough to enjoy the dance with uncertainty.

One way to do that, for example, is to dance with multiple partners. The technique illustrated in Figures 2 and 3 was actually developed "on the side" as an unexpected (and remarkably brief) diversion from a much more serious project on parallel computation. And even as I am drafting this text, I find my mind wandering among the several other projects currently occupying my desk: some non-Euclidean neighborhood functions, critical comments on my son's most recent film, an impending grant proposal, our cabin in the wilds of Maine... You get the idea; you probably do the same. But when do you find that your wandering eye is wandering the most? For me, it's not when progress on one of those projects begins to get bogged down. In fact, it's just the opposite. Right now, for example, as I start to feel better about how this paper is finally coming together, I find that ideas for work on that cabin are also beginning to compete for my attention. And frankly, right now they are winning.

4.2 Accepting

Okay, Maine was great, but (probably because of that) I'm ready to offer a second suggestion with even greater conviction. In short, beware of overwhelming the visceral with the cerebral. A promising idea can often be quite delicate in its infancy, requiring a good bit of suspended judgment before it is able to stand on its own under the weight of practical scrutiny. Though the instinctual and the intellectual will ultimately have to work together, the former is always more difficult to sustain.

This sentiment is nicely reflected in the work of Hughes Mearns, an early twentieth-century educator who had a major impact on attitudes toward childhood creativity and whose own attitude toward poetry was stated in almost Tao-like terms as follows.

Poetry is an outward expression of instinctive insight
that must be summoned from the vasty deep of our mysterious selves.
Therefore, it cannot be taught; indeed, it cannot even be summoned;
it can only be permitted.

It is several lines of his own poetry (from "Antigonish," published in 1922 but originally penned in 1899), however, for which Mearns is most widely recognized and for which he is cited here in the context of keeping ghosts alive.

Yesterday upon the stair,
I met a man who wasn't there
He wasn't there again today
Oh, how I wish he'd go away

4.3 Reflecting

The third and final suggestion also relates to frame of mind. Suffice it to say that what a psychologist might call "flow" and what almost any athlete would refer to as being "in the zone" is just as important in designing algorithms as it is in speed typing, video gaming, speech writing, or water skiing. It is a mental state of high concentration and self-reinforcement in which both conscious and subconscious perceptions of challenge, environment, and ability can result in extraordinary performance. It is also an elusive state, however, and one whose pursuit is largely a personal matter. Nonetheless, as a long-time designer of algorithms myself, I do feel comfortable offering at least the following three words of advice.

Sleep on it.

This advice is to be taken quite literally. When confronted with more complexity than can be handled at the moment, lay out the pieces where your mind's eye can see them, take them with you when you fall asleep, and then get out of your own way. Let the elves do their thing while you're not (quite) there, and rest assured that progress will be made – probably just before you open your eyes and let in all that blinding rationality.

Want to give it a try? Consider the drawing presented in Figure 4. It was created by applying familiar geospatial operations to a photograph. But how? If the answer isn't already apparent, put the drawing aside for now and return to it just before you go to bed. Tomorrow morning, I bet you'll either have the answer or at least be a lot closer to it. In any event, you will have a new appreciation for the words of comedian Stephen Wright.

Did you sleep well?
No, I made a couple of mistakes.

If sleep isn't possible, a daydream may do, or even some time with your own favorite four-legged companion. The trick is to do whatever is necessary to transcend the here and now in order to access mental faculties that (come to think of it) behave much like that cat. After all, they do exist, they reside with you, and they are very likely to satisfy, but they are also likely to be unavailable until the stage has been properly set and they themselves are ready to perform.

For some, it's music. For others, it's a shower, a walk in the woods, or conversation with a friend. For many, in fact, it may well be a mind-altering substance. I certainly wouldn't suggest anything illegal, but hey, let's talk over beers. I know of some non-Euclidean neighbors who may well want to join us.

5. Next?

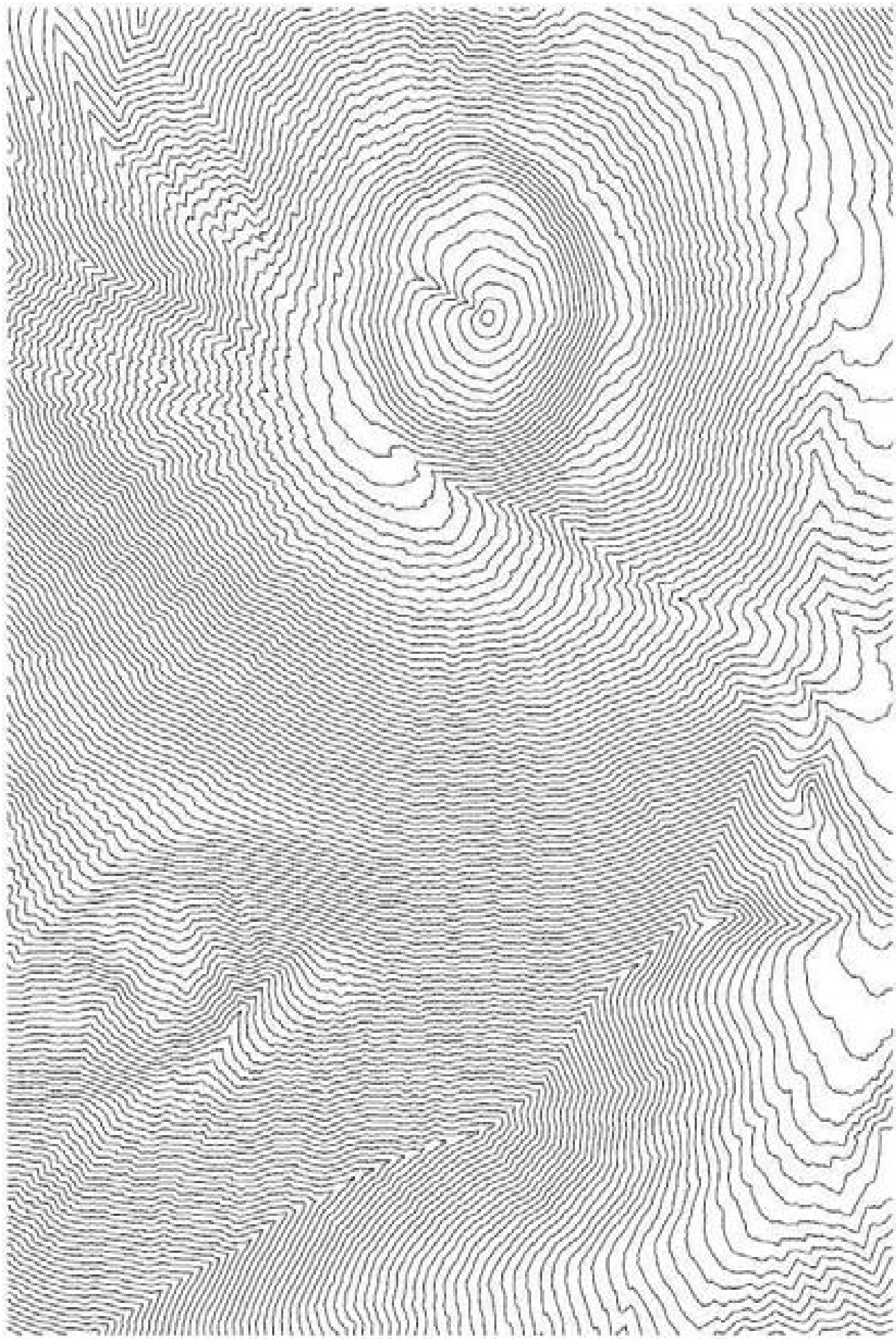
So there's the pitch, a pitch that was thrown for several different reasons.

For many of those in the stands, its intent was to celebrate the game.

For those sitting closer, its purpose was to demonstrate technique.

And for those inclined to take a swing, it was offered as encouragement. This is a field in which the challenges have never been more worthwhile, the prospects have never been more promising, and the gratification is just as it's always been.

Figure 4. Reading Between the Lines



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STREET ADDRESSING: FROM ADMATCH TO A NATIONAL STANDARD

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Abstract: URISA's long history has been deeply involved with the development of street addresses as a central geographic data element that permeates local, state and federal government activities. Much of the early work done by URISA was centered on the development of DIME and TIGER files which permitted the use of digital Census and other demographic data by GIS practitioners. Later contributions involved the development of address standards, and the systematic study of addresses and their functions in the landscape and in data schemas. URISA and its members have made significant and fundamental contributions to the development of systems that work with, standardize and manage address data.

1. Background and History of Addressing

While the naming of streets and the assignment of individual address numbers (and letters) to identify individual businesses, residences and other occupancies is not new, the use of addresses as a means of unifying, analyzing and managing urban information has been one of the most central contributions of URISA to the geospatial profession. From the earliest organizing meetings, the question of how to use addresses to locate information was central to the agendas.

Street addressing, here defined as the process of giving names to streets in some logical manner, and assigning numbers or other individual identifiers to buildings, has been used in some form in human settlements for centuries. Street names are found on Babylonian and Roman maps, helping travelers identify routes from place to place. Early towns often placed a stone with a map of the routes to surrounding towns in the central square, so that travelers could make copies of it, or memorize the directions to the next village. Numbering of individual buildings began in Europe in the 15th and 16th centuries as cities grew large enough that residents could not know all the other inhabitants, and often needed help to find others, or to locate goods or services.

In the United States, cities and towns followed European patterns of assigning names and numbers generally. Town planners in the colonial period had the advantage of laying out the street systems for many of the new towns and used a more regular grid and regular numbering pattern in doing so. The impact of the Public Land Survey System on land allocation patterns in the United States had profound impacts on the morphology of towns as they were started up in the mid-west and west as settlers moved across the continent. The addressing of cities and towns was largely in place by the late 19th century, but rural areas were not addressed until much later. Mail delivery was an initial driving force for addressing, and many rural areas were addressed for postal delivery through the Rural Free Delivery (RFD) program of the Post Office, using rural route and box numbers for these areas.

2. Where URISA came in: Geoprocessing, Geocoding, Census and the DIME Files, Topology and Address Matching

URISA's founders came together in the 1960's to discuss the development of information systems that could be utilized for urban and regional planning. This history has been thoroughly discussed in previous chapters, and will not be recounted here except as it applies to the understanding that street addressing has been a core data issue for URISA from the start of the Association.

In the beginning, information systems that were discussed for urban/regional planning included tabular databases as well as early digital mapping systems. One of the most prominent issues in the early years was finding ways to take the individual records collected by both municipal and other governments, as well as by the Census and other federal agencies, and aggregate them by various geographies so that choroplethic mapping could be done. Geocoding was seen as a way to deliberately aggregate individual records into mappable “blocks” for analysis and planning purposes. Over the years, this understanding of “geocoding” has changed significantly.

Reviews of the proceedings of URISA conferences from the 1960s and 1970s (chapters 8 and 9) provide a rich guide to the development of the DIME and GBF files, and the evolution from early mainframe-based computing to more agile mini and “micro” computers. Much of the focus was on the use of newly-digital data (in databases) and how it could be mapped. Significant time and effort were allotted to the creation of centerline files and address ranges on the road segments, as these served as the basis for geocoding algorithms.

The development and implementation of topology was the topic of numerous presentations, especially with regard to developing geocoding algorithms which were required to place a given record “within” or “outside” of a polygon, so that the data could be analyzed and mapped. This represented a major change in the way planners were able to view urban planning issues, and greatly improved the ability to base decisions about where and how to spend money within the urban fabric to create the greatest benefits. While individual data records were available, URISA's founders were looking for ways to portray this data in an aggregated form by geocoding it to Census blocks, tracts, and other geometries for analysis.

Storage of address information in digital form was also a matter of discussion. Most data was entered in the early years via punch cards which contained 80 spaces. The reduction of a street address, along with other information to a string of 80 characters was often daunting, and required some level of standardization of the information. A number of papers were presented on data standardization for address data used by Census, and by other users.

By the mid- to late 1980s many cities and counties had commenced development of geographic information systems, using minicomputers. With the advent of the personal computer (initially termed "microcomputer"), software developers began creating mapping software that was more accessible to urban and regional planners, and others. Census had perfected the DIME files in this time, and by the run-up to the 1990 Census, the TIGER files were in preparation. Local governments were asked to review and edit paper copies of these maps, and to attribute the street centerlines with address ranges where possible.

URISA was at the center of the discussions on how to improve the quality of TIGER, and how to develop good address data, how to geocode it into blocks and smaller areas for use, and display it via GIS systems. URISA's broad perspective on urban and regional issues, as opposed to simply cartographic ones, allowed practitioners, academics, software developers and others to think about, study, and report on ways to map all manner of municipal and regional data, ranging from the more obvious planning data (demographics, socio-economic factors, transportation, etc.) to finance, law enforcement, social services, education, etc.

Initially URISA did not focus on a need for creating addresses, nor were there specific papers presented on how to assign or manage addresses at the local level. Early work on developing data models for address data included the Horwood and Somers papers at the 1980 conference. By 1981, the use of addresses in GIS system had become a consistent topic at URISA, and no less than 5 papers on modeling and incorporation of address data into municipal and other governmental systems, as well as on new libraries and programming routines for address data, were presented. And at the 1981 conference, a workshop was presented on Geoprocessing which included a section on addressing.

1982 saw the first workshop with explicit address data modeling included as a topic. The workshop, Introduction to Urban Management: Geoprocessing and Data Base Management, included "Geographic Referencing and Addresses" among its major topics. The workshop was developed by Steve Kinzy, Peirce Eichelberger and Charles Barb. Additional papers were presented, mainly on Census data from the 1980 Census.

After this workshop, no addressing workshop was taught for the next several years. During the few years before and after the 1990 Census, URISA's Annual Conference program had several sessions each year focused on the improvement of geographic coding of street and address data. As more and more municipalities and counties began to complete base layers of their GIS systems, address location became a topic of a number of papers. For those in urban areas, with digital parcels, centerlines and other planimetrics, connecting addresses to specific coordinate locations became possible, and there were a number of papers that discussed various approaches. 1986 brought Peirce Eichelberger's paper on the Orange County Land/Structure/Occupancy data model for addressing, along with five other papers on various aspects of digital street networks, address coding and use.

Addresses began to be seen as a central dataset for government use outside of the Census. URISA's expansion of interest in addressing at the local level was informed by the long history of Census use of address data. The broader, more local-government focused studies presented at the conferences from 1985 through 1990 represented URISA's membership base as well as a long history of collaboration with the Census in geocoding and analyzing data identified by street addresses. In 1987, a 20-year retrospective of work with addresses at the Census was presented at the URISA Conference. In just 20 short years, Census and URISA members had shared the development of digital address geocoding and analysis systems from the New Haven study proto-type, to the DIME file, and by 1987 the soon-to-be-released TIGER files.

Still, for the most part, throughout the 1980s and early 1990s, the focus was on the Census, and on aggregating individual data held by local governments and others into small area units (such as tracts and blocks) for analysis. Privacy, especially when data was displayed on maps, became an important consideration.

In the early 1990s, with the TIGER files a part of Census, and more and more local governments turning to computer-aided dispatch, addressing again became a focus for URISA's membership. For much of the United States' history, addressing was confined to towns and cities. Rural areas did not receive house-to-house mail delivery, and addresses were not used. But with improvements in the caller ID and caller location technologies related to dispatching for emergencies, rural areas were increasingly addressed to assist first responders in locating citizens in distress.

Local governments, always at the core of URISA's membership, began to be aware of addresses. Rural addressing came about because of the need to locate residences, businesses, and other features outside of cities and towns. E-911 required a physical street address for every house and building in order to provide a location that could receive emergency services. GIS was used to support CAD with routable street centerlines, street names, and address ranges.

Focusing on addressing in local government, URISA's involvement in working for better addressing came about in the mid-1990s, with the advent of a new workshop centered on addressing at the local level. The workshop was developed by Peirce Eichelberger and Jim Guthrie, and it focused on parcel-based addressing, and use of computers. It discussed the methods of assigning addresses, and how to handle “difficult” address assignment issues.

By 1997, URISA felt there was a need for a specialty conference on the subject of addressing. URISA solicited USPS, Census and NENA as partners in this conference, initially named “Street Smart and Address Savvy”. It was held first in 1998 in San Antonio. About 200 people attended. The Addressing Conference (held under a variety of names) continues as a specialty conference. In 1999-2001 and 2009-2011, the conference focused on decennial Census issues.

Since 2004, NENA and URISA have jointly offered the conference, and there has been a focus on the use of addressing in emergency response and disaster recovery, as well as address assignment and the uses of address data in various environments. The development of a national address data standard, through the auspices of the Federal Geographic Data Committee (FGDC) became a hot topic in 2003 with the circulation of a draft standard just prior to the conference.

URISA's strong history of expertise in the area of addressing took a much larger role in the national development of an address data standard beginning in 2003. By the late 1990s there were a number of single-purpose address standards being developed or in use. These standards were discussed at many URISA meetings, conferences, and workshops.

The earliest address-centric standard was USPS Publication 28 (first published in the 1960s) which standardized the way an address is to be formatted on a mail piece. NENA's first version of an address standard, based on USPS standard, was published in 1991, and it has been updated several times over the years. The NENA standard is designed for the recording and transmitting of call records containing addresses as quickly as possible within and between dispatching systems. NENA is currently working on a new version of their address standard in their Next Generation 911 standards program.

Census and EPA had also attempted to write a standard for addresses, but neither had gained much support outside of the agencies themselves. Both were based on the USPS address formatting standard, and did not recognize many of the issues surrounding the differences between physical and mailing (postal) addresses, nor many of the business needs of local governments, states, or private address data vendors. Census was designated by FGDC as the maintenance authority for an address standard.

3. The Federal Geographic Data Committee (FGDC) Address Data Standard: URISA's Role in Creating a National Standard

In 2003, the FGDC published a draft address data standard for public review and comment. The draft focused primarily on mailing addresses, following the USPS's Publication 28 which defines the manner in which an address is to be written for mail pieces (envelopes and packages).

A number of URISA members who were working with addresses believed that the proposed standard was not sufficient for general use, especially not for local governments. As addressing in the United States is done at the local government level (cities and counties), URISA's members wanted a standard that reflected their business environment and processes.

The FGDC draft standard led URISA to propose, with the support of the National Emergency Number Association (NENA) and the U.S. Census Bureau, the convening of an Address Standard Working Group (ASWG) to include representatives from a range of interested federal, state, regional, and local government agencies, the private sector, and professional associations. The proposal was accepted by the FGDC Standards Working Group on April 13, 2005.

The ASWG was chaired by Martha Wells, Carl Anderson, Hilary Perkins, Ed Wells, and Sara Yurman, all representing URISA. The ASWG worked under the authority of the Census Bureau, which chairs the FGDC Subcommittee on Cultural and Demographic Data (SCDD). Two drafts were circulated for public comment in 2005-2006, and the ASWG continued its revisions through the endorsement of the standard in 2011.

The development of the Address Standard was done using a different process than had been used by FGDC for the development of its other standards, and as such, represents a new framework for future standards development, one which, like URISA, is collaborative, participatory, and transparent.

Because addresses are created by such decentralized processes, and because the standard must satisfy such a wide range of requirements, the ASWG sought by a variety of means to make the development process as open and broad-based as possible. This involved:

- **Fostering Broad Awareness and Participation.** The ASWG sought by various means to make the geospatial and addressing communities aware of the development of the standard and to involve as many as possible in the effort. The ASWG invited participation from and via professional associations representing geospatial professionals, local government officials, and emergency responders, including the National Association of Counties (NACO), GITA (Geospatial Information Technology Association), the American Association of Geographers (AAG), URISA, NSGIC (National States Geographic Information Council), and NENA (National Emergency Number Association).

  The draft standard, when posted, was widely announced in the geospatial and standard online media. ASWG members made numerous presentations on the standard at conferences and meetings. In addition, the ASWG regularly briefed various federal groups, especially the FGDC and Census, about progress on the standard.

- **Using a Wiki Collaborative Website.** To encourage wide participation, the ASWG set up an interactive wiki web-site using free and open-source software. Wiki software posts a draft document (in this case, the working draft of the standard) on a server and enables anyone to edit or comment on it via an internet browser. Comments and changes, once saved, are immediately visible to all. Anyone can add comments and ideas, or join in discussions of various aspects of the standard.

  The ASWG wiki site was open to anyone providing a name and a valid email to which to send a password. Over 500 individuals signed up to view the site, provide comments, enter discussions and participate in the development of the standard. The wiki site fostered discussion among widely scattered individuals, and proved useful in obtaining information and debating points of concept, practice, and actual address conditions.

- **Posting Drafts for Public Comment via Webform.** The ASWG posted a first draft of the standard two months after starting work, in the summer of 2005. It was posted on the URISA website, with copies available for download, and all comments were submitted via webform so that as many people as possible had access. Over 125 comments were received on this draft. A second draft was posted in December 2005, which received over 180 comments. The Committee made significant revisions to incorporate these comments, and to respond to issues that they raised.

  In 2010 a final draft of the Standard was delivered to FGDC, and was circulated for comments by FGDC. The ASWG continued its work, responding to all of the comments, and in some places adding significant additional materials and revising the standard to respond to those comments. On February 10, 2011, the Standard was endorsed by the FGDC Steering Committee. Since that time, a number of states and local governments have begun implementing it, and several have officially adopted it.

- **Focusing on Practical Needs and Usefulness.** The ASWG's purpose was to create a standard that will be useful and used. To be useful, the standard must reflect and build on the processes of address creation, management, and use. The standard must be developed by people who understand the local business work flows that utilize addresses in a real-time environment. Therefore the ASWG has sought advice and comment from a wide range of practitioners, including, among others, local government GIS managers, planners, assessors, emergency responders, school district officials, election officials, software developers, data aggregators, postal officials, census geographers, and a newspaper delivery manager, to name a few.

The development of the Address Standard by URISA volunteers represents a major contribution to the profession. URISA's institutional knowledge of addressing practices and issues was brought to the project. The project was conducted by volunteers from URISA who wrote, edited, discussed, and researched addressing best practices throughout the United States and its territories.

The Standard was designed to systematically identify addresses by classification, elements and attributes, and to incorporate data quality tests, and a protocol for data exchange. It is the only FGDC Standard to incorporate these four components fully. In addition the Standard contains a profile to maintain compatibility and data cross-walks with the USPS Standard (Publication 28), and will contain a profile for the new NENA Next Generation 911 Address Standard (known as the CLDXF).

These profiles broaden the range of applicability of the Standard, and also assist in implementation of the Standard throughout the geospatial data community. Further profiles to link the Address Standard to other standards, both FGDC and others, is underway. Meanwhile numerous states and local governments have adopted the standard and are implementing it within their organizations.

4. Beyond the Standard: Implementation and New Roles

Since the endorsement of the Address Standard in February of 2011, several states have adopted the Standard as policy for address data held in state agency repositories and databases. Several more states are considering adoption, and a number of local governments have implemented Standard-compliant repositories. The Census also utilized much of the then-draft standard in updating its Master Address File (MAF) database in advance of the 2010 Census. Census is also working to enhance its interactions with local address authorities and States in maintaining comprehensive address data repositories.

Census held an Address Summit in Sept, 2011 to work with federal, state, local and tribal governments and standards developers in discussing how to implement the standard, especially with regard to the exchange of information between units of government.

Numerous URISA members, including Martha Wells, Co-Chair of the Address Standard Working Group, were invited to participate in this event to begin development of a number of pilot projects to assess how better address data could be delivered to Census by local and state entities. URISA continues to lead and be involved in the implementation of the Standard, and in national and international discussions on addresses.

In addition, a new initiative has begun through the International Standards Organization (ISO) to develop an international address standard.

5. URISA's Leadership in Addressing

From the beginning, URISA has seen addresses as a basic building block of geospatial information. The early years focused on aggregation of individual data through the Census and numerous urban communities for use in planning, forecasting and analysis. The development of the DIME and TIGER files by Census provided a way for demographers, geographers, planners and others to view population, housing, and economic data in a digital mapping environment. Many of URISA's founding members were among those who invented these technologies and promoted them actively.

Over the years, as GIS became a more widespread and universally used technology, with the advent of web-based mapping systems, URISA's attention focused on the addresses themselves that are the building blocks of our demographic data. Many conference presentations over the years led to workshops and ultimately a conference devoted to addressing issues.

URISA's response to a nationally recognized need for a standard for address data produced a working group and a strong and numerous force of GIS and addressing professionals who worked voluntarily to create the United States Thoroughfare, Landmark, and Postal Address Data Standard, as a fitting capstone to 50 years of leadership in building strong geographic data resources.

6. Source Materials (Editor's Note)

A bibliography of pertinent references is being assembled, and viewers with an interest in discussing the bibliography are invited to contact Martha Wells at mwells@spatialfocus.com.

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PUBLIC ACCESS, PRIVACY AND SECURITY PROTECTIONS, AND COST RECOVERY POLICIES FOR GOVERNMENT GEOGRAPHIC DATA

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Abstract: URISA began with a request for government records. For fifty years, URISA has provided a key forum for discussion of public access, privacy and security protections, and cost recovery policies for government geographic data, especially as they apply to local and state governments. Those debates have occurred in three phases:

1. 1966-75: Privacy vs. disclosure of government information
2. 1985-95: Pricing, and the protection and liabilities of data ownership
3. 2000-present: Balancing access, privacy and security

This chapter sets forth URISA's leading role in fostering these discussions, and the resulting wealth of material to be found in URISA's literature.

1. Introduction

In 1961, when Edgar Horwood made the first request for digital census data (see Chapter 3), computers were a new and unexplored technology. By the end of that decade, computer systems were in wide use among large federal, state, and local agencies. As their use spread, their benefits and threats came under intense debate, then and in the decades to come.

Horwood directed his request to Jack Beresford of the Census Bureau. Beresford's two-sentence reply to Horwood –"Well, there is nothing I know of that tells me I can't [send a copy of the data tape]. Providing there is appropriate suppression to avoid disclosure on small entries I'll send it on out to you at cost."– anticipated the key themes of those debates:

1. What government information should be open to the public?
2. When and how should personal privacy be protected by withholding personal records from public disclosure?
3. When government information is provided, how should it be priced?

Those debates have occurred in three phases:

1. 1966-75: Privacy vs. disclosure of government information
2. 1985-95: Public access, cost-recovery, data sales, copyright, licensing, and liability

3. 2000-present: Balancing access, privacy and security

During each phase, URISA, with its uniquely multidisciplinary membership, has provided a key forum for these discussions, especially as they apply to local and state governments.

2. 1966-75: Privacy vs. Disclosure of Government Information

In the 1960's, advances in general-purpose computer systems brought them into increasing use in large federal, state, and local government agencies. Very early it was realized that computer systems raised new possibilities for effective government, and new issues about public access to government data:

1. How should public access rights and public disclosure obligations be administered in the context of large-scale computer data banks?
2. How should personal privacy be safeguarded to prevent disclosure of personal information held in government files?
3. How should individual freedoms be secured against the threat of a government with files on every citizen?

The issue came into national prominence in 1965, when the Social Science Research Council (SSRC) recommended that twenty U.S. federal statistical agencies consolidate their separate data files into one central data center. The U.S. Bureau of the Budget endorsed the recommendation the following year. Immediate controversy ensued within Congress, the executive branch, academic research communities, and the popular press. Proponents argued a National Data Center would save money, improve data access for researchers and policymakers, support better policy-making, and preserve data for posterity. Critics raised Orwellian fears of citizen surveillance, loss of privacy, and the erosion of democratic freedoms.

Between 1965 and 1974, Congress debated and enacted the framework for federal U.S. public access and privacy law that remains in place today. The states were also active in and around that decade — between 1950 and 1983 all fifty states and the District of Columbia either enacted or substantially revised their open records laws — and all were influenced by the national debates and federal actions:

- 1965 - The Supreme Court recognized the Constitutional basis for the right to privacy in *Griswold v. Connecticut.*
- 1965-67 – The National Data Center was proposed, debated, and eventually dropped.
- 1966 – Congress passed the U.S. Freedom of Information Act (FOIA).
- 1967 – Alan Westin, professor at Columbia University Law School, defined “informational privacy”, which applied the concept of privacy rights to the context of information systems.
- 1971-74 – Publication of the Pentagon papers, and the Watergate scandal,

created public support for strong open records laws and privacy protections.

- 1973 – The Department of Health Education and Welfare promulgated the Code of Fair Information Practices, which defined the basic principles of informational privacy.
- 1974 – Congress passed the Privacy Act, which strengthened the FOIA and enacted individual rights concerning their personal information held in government record systems.
- Canada wrote similar privacy protections into its Human Rights Law in 1977. (The provinces adopted similar statutes between 1990 and 2007.)

After passage of the Privacy Act, Congress moved on to other issues. The U.S. federal FOIA law (amended in certain details over the years) has stood the test of time, and it remains the central definition of public access and personal information privacy rights in U.S. federal law.

During these years, URISA played a central role in transmitting national and federal issues into the local government arena, and synthesizing a coherent set of public access, privacy, and security policies and practices, both administrative and technical, to guide local governments in implementing large-scale computer systems.

Discussions within URISA began with Ken Dueker's paper, given in 1967, on the issues raised by the National Data Center proposal. They continued through 1975, driven by a series of papers and projects carried out within the Urban Information Systems Inter-agency Committee (USAC) Integrated Municipal Information System projects (especially with the City of Charlotte NC), which were a focal point of URISA's conferences from 1969-1975. The papers covered:

1. Privacy protections within a National Data Center.
2. Privacy and security in criminal justice systems.
3. Census protections of confidentiality; and
4. The balance between public access, privacy, and security in government information systems.

The results were synthesized in C. Wayne Stallings 1972 conference paper; Dial and Goldberg's *Privacy, Security, and Computers: Guidelines for Municipal and Other Public Information Systems* (1975); and in Part V of Kraemer and King's *Computers and Local Government* (1977). These sources provided municipal and other government officials with a coherent legal and technical framework of disclosure, privacy, and security policies covering:

1. Review of applicable FOIA and privacy protection laws.
2. Balancing disclosure and privacy protection obligations.
3. The creation, empowerment, and administrative operations of a local data control board.

4. Establishing data access controls for products and processes.
5. Maintaining the physical security of the data and computing facility.
6. Auditing compliance with established procedures.

These references provided definitive guidance for local officials until desktop computers raised a whole new set of issues in the mid-1980s.

3. 1984-95: Public Access, Cost-recovery, Data Sales, Copyright, Licensing, and Liability

During the interim, between 1975 and 1985, both technology and political attitudes changed substantially. By the mid-1980s, privatization and adoption by government of business models of operation generally were seen by many as keys to increased government efficiency and responsiveness. Personal computers were coming into widespread use, and client-server systems were rapidly displacing the mainframe and minicomputer systems of the 1970's.

By 1984, GIS was on the verge of becoming a mainstream technology for large cities, counties, and state and federal agencies. As pioneer agencies brought early systems into production, their value — and cost — became clear. It was unusual, if not unprecedented, for local and state government agencies to be creating administrative records that had so much value outside of government.

In this context, other jurisdictions and agencies sought to follow the pioneers' examples, and to find the funding to do so. Members of the public wanted to use GIS data, for personal, research, and commercial purposes, and had FOIA rights to demand the data. What were the powers and duties of public officials in responding to public requests, charging fees commensurate with the cost of developing and operating the system, and incurring liability for possible errors in the data?

These questions touched off a wide-ranging debate that ran for ten years; cut across several related matters of law, technology, and public administration; involved researchers, administrators, and technologists from the academic, public, and private sectors; and extended into several professional associations and their conferences. From the beginning, URISA, with its diverse membership, provided a key forum for these discussions.

In the December 1984 issue of *URISA News*, then-president Bill Huxhold posted a page of questions raised by public officials in the information systems community. The article may have betrayed unfamiliarity with the lessons learned during the 1970s, but six months later Roger Hurlbert responded in *URISA News* with a summary of the prevailing principles of FOIA and privacy law across the fifty states, DC, and the federal government. In summary, he advised that:

1. These questions were not new, but were governed by the state or federal FOIA law applicable to the agency.

2. Government records had to be provided to any requestor, unless the records fell into a category of non-public records under the applicable law.
3. The records had to be provided for the cost of copying them, as “cost” may be specified under the applicable law. “Costs” did not include system development and operations costs, only the costs incidental to meeting the request.
4. The cost of the system, the value of the records, the administrative burden on staff, the purpose of the requestor, whether the records would be used for commercial purposes, whether they were digital or paper — none of this mattered under any U.S. FOIA law. Presumably the system had been created with public funds to carry out the public function of the agency, not to create a marketable commodity, so the value of the data assets belonged to the public, not to the agency.
5. Agencies were required only to provide copies of records. Custom analyses, data conversions, print-outs and plots — these were services, not copies, and therefore outside the scope of FOIA.
6. Absent reckless negligence, liability was not a significant issue. The law did not require perfection.

These established principles did not diminish the desire to realize a stream of revenue from the sales of valuable government GIS data, and use that potential revenue to justify the initial capital investment in GIS, or to offset some of its operating costs.

A number of attorneys, technologists, and public officials advanced proposals to provide a legal and administrative basis for cost-recovery policies, on the premise that GIS were uniquely valuable and expensive, and that their benefits would not be realized without data sales revenues to justify and defray capital and operating expenses. The ensuing discussion in turn touched off a wider debate of the implications of turning public agencies into GIS quasi-businesses. The debate extended to six complex and interrelated issues, and for several years formed a major theme of URISA conferences, URISA Journal articles, as well as the URISA and NCGIA research agendas (see Chapters 13 and 15):

1. **FOIA Reinterpretations and Amendments.** The debates began with proposals, presented at URISA conferences and published in the proceedings, to reinterpret or amend FOIA laws to permit sales of GIS data products for fees that covered some portion of system development and operating costs. They included, among other arguments, suggestions that FOIA cost-of-copying restrictions should not apply to GIS data; that commercially valuable data should be protected from use at non-commercial prices; and that data bases might be distinct from records, and therefore not subject to FOIA cost-of-copying restrictions. Key advocates included John Antenucci, Howard Roitman, Hugh Archer, Alma Puissegur, Jerome Anderson, and Pete Croswell, all of Plangraphics Inc.; and Jack Dangermond, Lori Dando, and Dale Friedley, among others.
2. **Public Value vs. Proprietary Value.** Some commentators, notably Earl Epstein and Harlan Onsrud, argued that cost-recovery policies were fundamentally

unsound, that public agency data should be treated as a civic asset, to be held in common and used by anyone. Because the data and the system are paid for with public funds to perform public business, the value created should benefit the public, not the agency.

3. **Pricing Policies.** If agencies are to raise funds from data sales, what products should they sell, and how should they price their products? Should prices be set by costs of production or market demand? How do businesses define markets and price private-sector products? What FOIA amendments would provide a legal basis for pricing and sales that would allow for capital cost recovery while serving the purposes of public access requirements? URISA's literature includes papers on pricing theory, private-sector pricing strategies, and public-agency case studies.
4. **Management Structure.** What management structure would maximize the strengths of both public and private sector actions required? URISA's literature includes proposals and case studies of entrepreneurial public agencies, public-private partnerships, public-agency consortia contracting to third-party service bureaus, non-profit corporate subsidiaries of public agencies, and direct contracting with private firms. Key case studies among many included LRIS in Alberta, Teranet in Ontario, SANDAG's Sourcepoint in San Diego, IMAGIS in Indianapolis, and Ada County, Idaho.
5. **Protecting Data Assets: Copyright and Licensing.** How, if at all, could a public agency prevent customers from reselling data purchased from a public agency? Can public agencies assert copyright over public records? Can databases be treated differently from individual records? Would license agreements offer more effective and enforceable protection? URISA's literature includes the two definitive papers on these issues, both by Lori Peterson Dando, and papers on licensing arrangements and their effectiveness.
6. **Minimizing Liability.** What liabilities does an agency incur if it distributes erroneous data? Does risk of liability increase if the agency is acting in a quasi-commercial rather than a governmental capacity? URISA's literature includes practical synopses of the applicable legal theories of liability and how they might apply to data products, how cost-recovery policies might affect sovereign immunity protections, and the observation that higher prices increase the risk of legal liability.

In 1994, the National Center for Geographic Information and Analysis convened a group of 38 experts on the different aspects of law and information policy for spatial databases. Almost 30% of them had been prominent in URISA's sessions. That conference, without resolving underlying philosophical differences in the approach to pricing, showed consensus on a variety of other issues. With the key viewpoints and resolutions established, public access, privacy, and pricing issues ceased to be topics of debate by 1996, and URISA moved on to other issues.

In the end, the prevailing principles and practices remained pretty much as summarized by Roger Hurlbert in 1984. Twelve states amended their FOIA to allow cost-recovery pricing for GIS data, but cost-recovery policies turned out generally to be unnecessary and unsuccessful. First, public agencies were able to fund GIS from within public budgets. Second, from all the reports I have seen, no agency has realized enough revenue from data sales to cover even a significant portion of operating costs, much less to repay capital investment. Instances of public-private partnerships and non-profit service bureaus exist, but they are the rare exceptions to the general rule of public agency ownership of data, and public agency provision of access in accordance with FOIA provisions. Four factors contributed to this outcome:

1. Geographic information systems — both hardware and software — became substantially less expensive.
2. Federal geographic data products became freely available as nationwide data sets, providing an alternative source to local government GIS data for several key data themes. Data resellers realized efficiencies of scale with national data sets, and so were less inclined to work with local data sets.
3. In 1991, the Supreme Court ruled that facts cannot be copyrighted. A GIS is fundamentally a compilation of facts. Copyright therefore did not protect data assets. Without copyright protection, agencies had no practical way to restrict third-party use of data while meeting their public-access obligations.
4. Most state legislatures were not persuaded that GIS records merited special treatment with their FOIA laws. Those that were persuaded kept the exceptions narrowly focused on additional costs that could be incorporated into prices. None of the amendments exempted GIS data from public access requirements. This, plus the low cost of federal products, kept prices and revenues low.

4. 2000-12: Balancing Access, Privacy and Security

Less than a decade later, the context of public access and privacy issues had transformed again. The internet transformed the technical mechanisms of data access and distribution, but it raised new problems of viruses, malware, and information security.

After the destruction of September 11, 2001, security replaced openness and data sharing as the basic values guiding data access policies. State and local governments have removed formerly open information — especially infrastructure information — from the public domain.

Geographic information is now big business. First Mapquest, and more recently Google Maps and Bing, have made GIS products ubiquitous and widely familiar. The value of GIS is understood by all, and much of the value is based on public assets created by public investments, readily available to all.

The debate over cost-recovery vs. cost-of-copying pricing, being at the bottom a philosophical debate, remains unresolved, and continues to provide food for discussion within URISA and elsewhere.

URISA continues to foster an active interest in the interrelated policy issues of government data access rights, privacy rights, data security, and pricing. In two recent California court cases of national importance, URISA members have taken an active role in drafting amicus briefs for the court.

During the last decade, discussions of public access issues shifted from debate to synthesis. URISA's Law and Public Information workshop, which until 2002 covered general philosophical and policy issues, and referred primarily to U.S. federal law, was rewritten completely. The workshop now synthesizes a legal and policy framework from all 52 U.S. FOIA laws (federal, states, and DC) as they cover public access, privacy, security, and pricing, with briefer looks at copyright, licensing, data-sharing, and policy implementation issues. No other resource is so thoroughly grounded in the state laws, and therefore so directly relevant to local and state officials. The workshop itself could not have been started without URISA's rich and remarkable heritage, a 50-year span that covers the entire history of public access to computer data. As Pete Croswell notes in Chapter 16, a knowledge of these issues is essential for GIS program managers, and URISA has "written the book" on legal and policy impacts and requirements for GIS programs.

A Concluding Irony. In 1967, in the first URISA paper on public access and privacy, Ken Dueker summarized the views of those who opposed the National Data Center proposal: "According to this viewpoint, the centralization of records will make it possible for the government to have a personal history of each citizen on file. The threat they say is that the government can check up on people and that their past mistakes will follow them for life."

As we now know, this fear proved unfounded. The government did not do this (well, except for whatever the NSA is doing). It was done much more efficiently and cheerfully, first by the large credit-reference and market research firms, and later by the people themselves, on the internet.

5. Source Materials (Editor's Note)

A list of references is being assembled, and viewers with an interest in the references are invited to contact Ed Wells at ed.wells@gmail.com.

6. Author's Note*

This paper expresses the personal views of the author and has not been reviewed or endorsed by the Washington Metropolitan Area Transit Authority.

7. Acknowledgement

This chapter owes much to nearly a decade of collaboration with Mary Tsui, co-author with me of the URISA workshop "Public Data, Public Access, Privacy, and Security: US Law and Policy."

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GIS AND THE CITY 2.0

Jack Dangermond
President, Esri

***Abstract*:** The growth of global population has been accompanied by a migration of population to cities. We need to start thinking about cities in a different way, and this was emphasized by the award of the 2012 TED prize to the concept of "The City 2.0." Cities are the new man-made ecosystem where humans spend the majority of their time, and geospatial technologies will play a vital role in changing the way we think about, manage, and design them.

1. Our Urban Destiny

7 billion. That number has received a lot of attention recently as global population has grown past this mark. But lost in the media coverage of this milestone was another, perhaps even more fascinating global statistic: more than 50% of those 7 billion people now live in cities, a number projected to grow to more than 75% during this century (UNFPA, 2007). In fact there will be at least 19 cities in the world with a population greater than 20 million people by the end of the 21st century (Wurman, 2008). Cities are human destiny.

This growing recognition of cities as the center of the human world was further highlighted when "The City 2.0" was awarded the 2012 TED Prize. "For the first time in the history of the prize, it is being awarded not to an individual, but to an idea," the TED committee stated. "It is an idea upon which our planet's future depends." (TED, 2011)

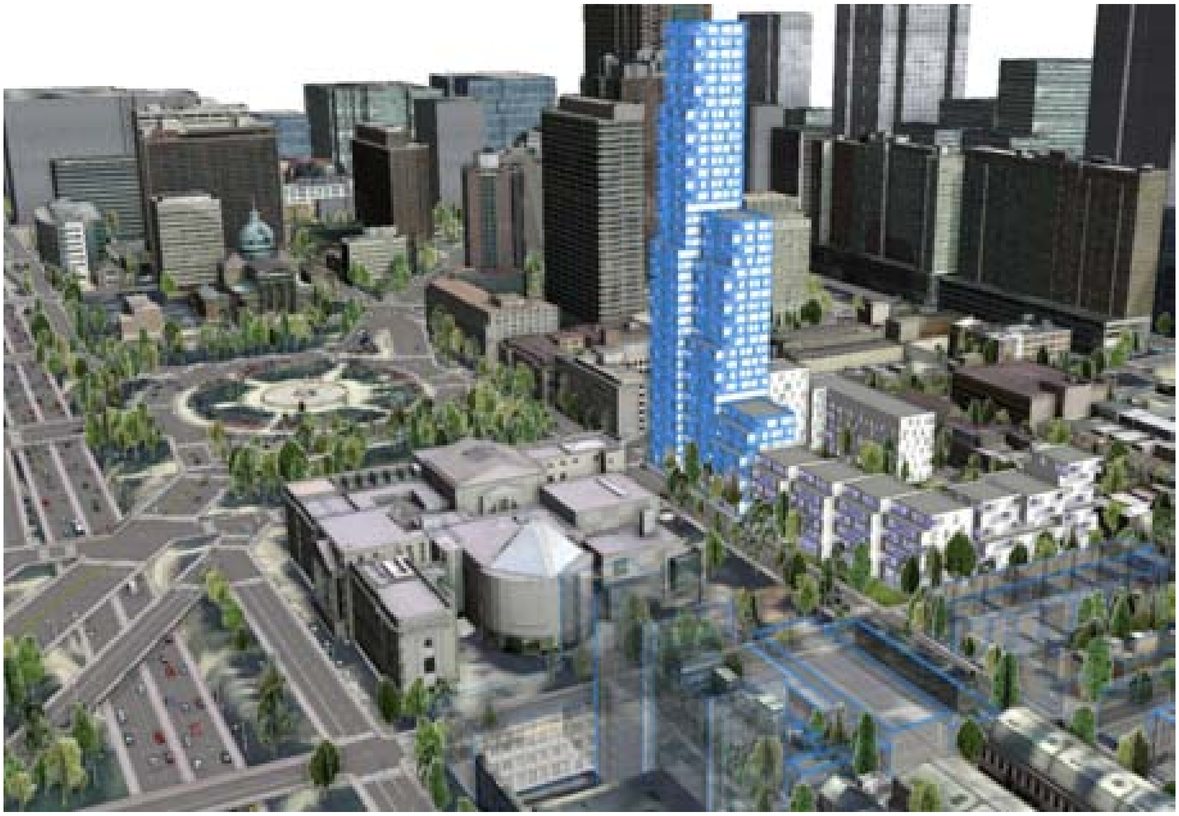
Clearly cities will play an increasingly important role in our future survival. Cities offer easier access to services, and urban dwellers are more efficient consumers of limited resources. But as our cities become more populated and more numerous, how do we best manage this complexity?

We need to start thinking about cities in a different way.

2. Reimagining the Canvas

Fundamental to changing the way we think about cities is a reimagining of the way we abstract them. Maps are abstractions of geography, and have proven to be particularly useful throughout our history. But traditional maps have limited our ability to manage and design in a holistic, comprehensive manner.

Geographic information system (GIS) technology has given us a powerful new context for extending our traditional methods of abstracting geography — a new canvas that includes everything that lies below, on, above, and around the city, including what exists inside and outside buildings, as well as how things connect to the city and how all of these things change through time.



Cities are dynamic, complex human ecosystems

3. Cities as Ecosystems

Cities are the places where most of us now spend the vast majority of our lives. They have in fact becomes man-made ecosystems — vast assemblages of interdependent living and non-living components — the primary habitat for the human species.

The recognition of cities as habitat for modern man is leading to new approaches to their management and design. GIS technology has long been used to map, study, analyze, and manage "natural" ecosystems. It only seems logical to manage, model, and design our new man-made ecosystem with the same tried and true tools used to manage, model, and design traditional ecosystems.

4. Buildings as Micro Cities

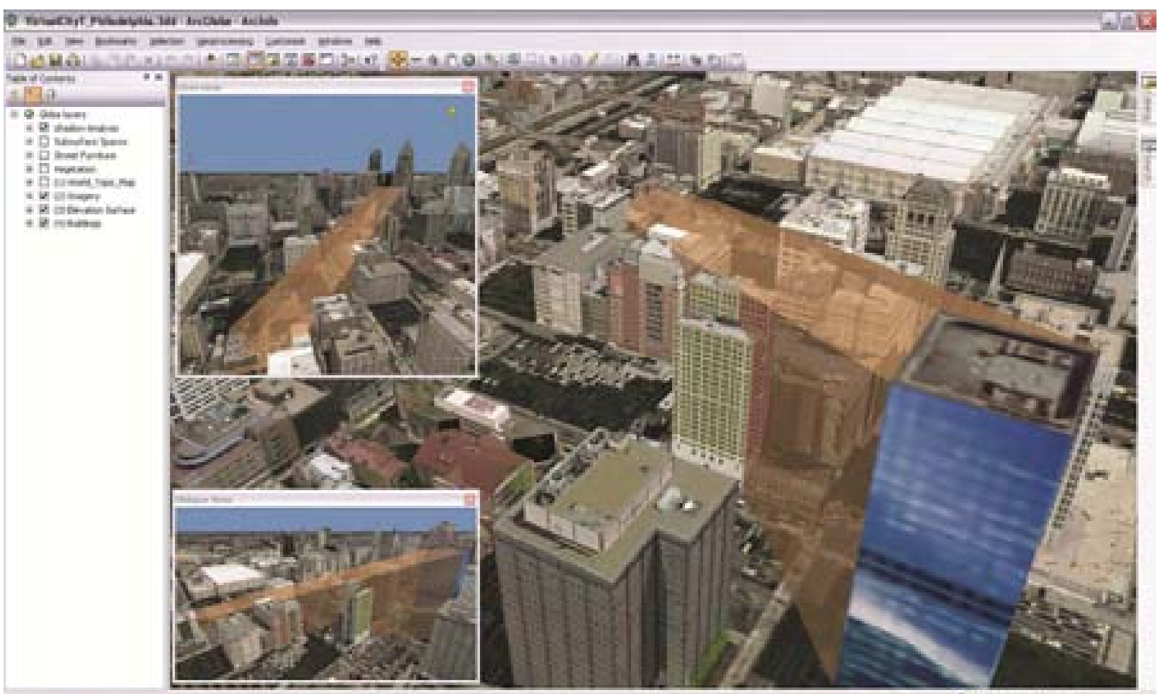
As our cities are growing in size and complexity, so too are the buildings which form much of the fabric of the city. In effect, many buildings and facilities are becoming small cities themselves, and they need to be designed and managed as such.

GIS tools, used successfully for many years in fields such as environmental analysis and landscape planning, also support a broad range of applications inside and outside of buildings and facilities. In fact, GIS can be used throughout the lifecycle of a facility — from siting, design, and construction through ongoing use, maintenance, and adaptation, and ultimately through closing, repurposing, and reclamation.

5. An Engaged Citizenry

Smart cities of the future will be those where the citizenry is engaged in their design and evolution, where we fully leverage the collective intelligence of the masses and allow *everyone* to actively participate in shaping our communities. Today, social media and mobile citizen engagement applications are enhancing a variety of government-citizen interactions involving public information, requests for service, public reporting, citizen-as-a-sensor, unsolicited public comment, and even volunteerism.

Geospatial technologies have already proven to be effective tools in supporting citizen engagement. Intelligent web maps are acknowledged as a catalyst for solving key challenges in creating a dialog through informed citizens. As web and cloud-based GIS continue to evolve and social media and mobile devices become more pervasive, governments will continue to deliver innovative forums through interactive information and participatory citizens applications.



GIS helps us think about cities in a different way

6. Designing the City 2.0

Geography is constantly changing — from wind and water erosion, natural climate shifts, tectonic and volcanic activity, and the dominance and extinction of species and ecosystems. But recent changes to geography as a direct result of human activities are threatening the survival of many species, including our own. And while the actions causing these monumental changes are often deliberate, much of the change to geography has been an unintentional by-product of poor planning and unsustainable actions — change that I call “accidental geography.”

In my talk at TED2010 (Dangermond, 2010), I introduced the idea of “geodesign”— a concept which enables architects, urban planners, and others to harness the power of GIS to design with nature and geography in mind. Geodesign results in more open participation through visualization, better evaluation of proposed scenarios, and a deeper understanding of the implications of one design over another (Dangermond, 2009). Combining the strengths of data management and analysis with a strong design and automation component is fundamental to designing The City 2.0.

7. A New Direction

Cities are intricate collections of materials, infrastructure, machinery, and people, with countless spatial and temporal relationships and dependencies, which require progressively more sophisticated tools to help us design and manage them. They are complex systems where we humans spend an increasing amount of our lives.

“This idea is capable of inspiring millions of people around the world to contribute to one of the biggest challenges and opportunities humanity faces,” the TED committee stated when announcing the award of the 2012 TED Prize. “The City 2.0 is not a sterile utopian dream, but a real-world upgrade tapping into humanity’s collective wisdom.”

Our challenge is to design our man-made ecosystems to achieve the maximum benefit to society while minimizing short- and long-term impacts on the natural environment. As an integrative platform for management and analysis of all things spatial, I believe that GIS technology can help meet this challenge.

Cities are our new man-made ecosystems, and it’s time we start to think about them, manage them, and design them as such.

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GIS IN AUSTRALIA AND NEW ZEALAND

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***Abstract*:** GIS and Industry bodies in Australia and New Zealand have been both founded by, and the foundation of, wider trends in the spatial industry. This chapter provides a potted history of professional associations in Australia and New Zealand, from the Australasian Urban and Regional Information System Association (AURISA) to the Spatial Sciences Institute (SSI) and more recently in 2009, the Surveying and Spatial Sciences Institute (SSSI). In this chapter we discuss the development of these organizations in the context of wider industry trends, highlighting areas in which the professional associations have influenced industry. In conclusion, we discuss the key trends which will influence the professional association, and the profession, into the future.

1. AURISA

The Australasian Urban and Regional Information Systems Association (AURISA) was originally founded informally as the Urban Regional Information System Association and later changed its name to become more synonymous with Australia and then again to Australasia to reflect linkages with New Zealand. The organization was officially formed in 1975 at a meeting held in conjunction with the conference in Newcastle, New South Wales.

In the early days, the organization was predominantly made up of statisticians and librarians, and predominantly focused on land related information systems concerned with spatial and/or attribute databases applied across all levels of government, including utilities and government agencies. As the organization progressed, the information systems with which the Association concerned itself came to be collectively described in a number of different ways, as Land Information Systems (LIS), Geographic Information Systems (GIS), Spatial Information Systems (SIS) and Geomatics. The true strength of the Association was in its interdisciplinary nature and in the very wide interpretation of both ‘Urban Regional’ and ‘Information Systems’.

The Association was governed by a Council, with members organized into Chapters in the various states of Australia and New Zealand. The task of the Chapters was to present seminars, meetings and conferences at a local regional level, and to host the annual AURISA Conference following a successful bid. Other than member education, the Association had a role representing the private sector on the Standards Association of Australia committee for Geographical Information Systems, and with the academic sector through recommending guidelines for curriculum development.

Membership of the Association remained around the 800 mark, including a number of corporate members. The corporate membership category was initially incorporated in the Spatial Sciences Institute (SSI), and has been adapted in the Surveying and Spatial Sciences Institute (SSSI) as the Sustaining Partner Program.

2. AURISA and URISA Relationship

The link between AURISA and URISA began informally in the mid-1970s when Dr. Bob Aangeenbrug and Dr. Barry Wellar, both then on the URISA Board of Directors, and both of whom became URISA presidents (Aangeenbrug, 1977, Wellar, 1978), engaged in discussions about the USAC project (Chapter 5 and Chapter 8) with government officials and academics in Australia. By the end of the 1970s and early 1980s a number of information systems people from the U.S. and Canada, almost all of whom were URISA members, had been invited to Australia to give conference presentations, report on research projects, and discuss joint interests such as the USAC project and OECD programs investigating information technology applications in government. Dr. Wellar made presentations at the 1981 and 1983 conferences, and was instrumental in promoting the idea of an exchange arrangement among AURISA and URISA officers.

Closer ties between AURISA and URISA took root in the early 1980s as a small but steady stream of AURISA members travelled to North America annually for the URISA conference, people such as Merv Sedunary, Bob Eddington, Tony Hart, Bob Fowler, and Ian Williamson amongst others. At the time, the URISA conference was seen as the key international event in urban and regional information systems (gradually becoming known as GIS) with a strong focus on municipal government applications. The North American systems were well known and a number of them had already been in place for a decade, so the major attraction of attending the URISA conferences in those early days was to learn about these maturing systems and, taking advantage of being in North America, to fit in as many site visits to cities in Canada and the U.S. as time permitted.

By the mid-1980s, a number of URISA members had started to attend the annual AURISA conferences to learn about the Australian experience with Land Information

Systems (LIS) and State-wide land records automation projects. This was something the URISA counterparts had long wanted to achieve, and while excellent work in this area was being done in Canada, the county-based approach to land records in the US was causing integration difficulties. They were also keenly interested in efforts to establish coordination bodies, such as the Australian Land Information Council (ALIC) formed in 1984, which subsequently became the Australia New Zealand Land Information Council (ANZLIC) a few years later.

One of the early people from URISA to start attending AURISA conferences was Dr. William Craig of Minnesota, a member of the URISA GIS Hall of Fame. Will attended his first AURISA conference in Adelaide in 1985 and thereafter travelled 'south' many times to hear about the Australian and New Zealand experiences with LIS/GIS. He became president of URISA in 1986-87 and was clearly an influence on other senior URISA members attending the AURISA conferences to hear a range of perspectives different from those they had been used to in North America.

By the late 1980s, the URISA conference had grown to 3000 participants and the links between the two organizations were starting to be formalized – although it was always the case that any similarities between them, apart from their common interests, were in name only and there were no official organizational ties. Indeed, there had also existed a 'British URISA' known as BURISA for several years, but it had ceased to operate by the early 1990s.

However, the links between AURISA and URISA became formalized around 1987-89 when it was agreed there should be an exchange of presidents each year. Each president would be provided with a complementary registration to attend the other association's conference, plus accommodation and a return airfare. The URISA presidents were usually promoted as keynote speakers at the AURISA conferences, and after the event they would be invited to speak at one or more AURISA Chapter events in Australia and New Zealand. This also gave them the chance to gain a wider experience of both countries, and the Chapters would fund their airfares and accommodation.

By the early 1990s these exchanges between AURISA and URISA were very well-established, and it is fair to say that the presidents of both associations always looked forward to the trips and have many fond memories of the hospitality that was generously extended to them. There were also several other ties established between the two associations, which included:

- The offer to members of each association to attend the other association's annual conference at their discounted member registration rate;
- The offer to members of each association to purchase books, proceedings, videos and other such items from the other association at their discounted member discount rate.

Finally, during the exchange visits the presidents would be invited to attend the Board meetings of each other's association held during the annual conferences, and hear and discuss a range of mutually beneficial topics including the different approaches to finance and fund-raising, membership, chapters, sponsorships, marketing and promotion, and new initiatives. As is detailed in future sections of this chapter, the exchange visits have been an enduring feature of the relationship between URISA and the Australasian Institute in all its incarnations. There is no doubt that the program has produced many benefits to both societies over the past 20+ years, and is a model to be strongly recommended for any professional society looking to build ties with other associations.

3. Consolidation and the Spatial Action Agenda

The year 2000 ushered in a decade of change for the Spatial Industry in Australia. Increasing recognition of the value of the spatial industry, and spatial information, to the economy drove a series of initiatives aimed at strengthening and consolidating institutional and policy frameworks.

The Spatial Information Industry Action Agenda, “Positioning for Growth” was released in Parliament in September 2001 (Department of Industry, Science and Resources, 2001). The report estimated the Australian spatial information industry to have a turnover in excess of $1 billion per year, with the surveying services part of the industry growing at 11% a year, and the ‘New Economy’ sector of the spatial sciences the big mover, growing at 40% per year. The report delivered five goals and 45 recommendations in support of its vision that ‘Australia will be a global leader in the innovative provision and use of spatial information’. The goals set out the means for private business, academic and government sectors to work together to achieve the Vision. The goals of the Action Agenda were to:

- Develop a Joint Policy Framework: to encourage a mutually beneficial relationship between business and government,
- Improve Data Access and Pricing: to increase the net benefit to industry by maximising the use, distribution and creation of publicly funded spatial information products and services,
- Increase Effective Research and Development: to create an innovative, strong and high value-added industry,
- Evaluate and Reform Education and Skills Formation: to maintain a highly skilled, relevant and innovative workforce,
- Develop Domestic and Global Markets: to expand the domestic market and provide a base to create a highly competitive export industry.

While the focus of the Action Agenda was on promoting the private sector, it set a strong direction in establishing the three pillars of industry, education and profession under unified and collaborative bodies. For the first time the spatial industry in Australia was coming together to speak with one voice to government and the public.

The formation of ASIBA, the Australian Spatial Information Business Association was closely aligned to the recommendations of the Action Agenda. The new organization brought together the allied disciplines trading in spatial information products and services, representing spatial information as a discreet sector in the Australia economy. The Action Agenda charged ASIBA with responsibility for driving many of the recommendations set out in the report.

The trend towards consolidation was also mirrored in the education industry, with Federal support for specialised collaborative research centres (CRC's). The first CRC for Spatial Information (CRCSI-1) commenced operation in July 2003. An Australian Government Initiative, this first CRC was a further attempt to position government to adapt to the changing community and private sector demands for spatial information. With 55 partners, and $78 million to invest, CRCSI-1 conducted user-driven research in emerging areas of spatial information addressing issues of national importance.

Already established on publication of the Action Agenda, the Spatial Sciences Coalition (SSC) was the first move towards consolidation of the bodies representing professionals across the spatial sciences, and laid the groundwork for the formation of the Spatial Sciences Institute (SSI). As the Action Agenda noted, the implementation of the agenda needed to be driven primarily by the industry, stating that 'The member organizations of the Spatial Sciences Coalition (SSC) are expected to make a major contribution to a number of actions under the Education and Skill Formation and Research and Development goals'.

The Organizations constituting the SSC were:

- The Australasian Urban and Regional Information Systems Association Incorporated (AURISA)
- The Institution of Engineering and Mining Surveyors Australia Incorporated (IEMSA)
- The Institution of Surveyors Australia (ISA)
- The Mapping Sciences Institute, Australia (MSIA)
- The Remote Sensing and Photogrammetry Association of Australasia (RSPAA)

4. SSI – Formation of an Industry Association

The Spatial Science Coalition laid the foundations for a move towards full integration of the previously disparate professional associations. In 2003, following a vote of members, the Spatial Sciences Institute was formed. SSI constituted the fully amalgamated memberships and finances of AURISA and RSPAA, and an MOU with the Divisions of the ISA such that professional surveyors in most regions of Australia were represented by the new SSI.

The SSI was governed by a Board of Directors representing the geographical regions of the newly formed Institute,

- Western Australia
- Northern Territory
- South Australia
- Victoria
- New South Wales
- Australian Capital Territory
- Tasmania
- Queensland
- New Zealand (formed in 2004)

and the Professional interest groups of the Founding organizations, known as Commissions,

- Spatial Information
- Cartography
- Engineering and Mining Surveying
- Land Surveying
- Remote Sensing and Photogrammetry
- Land Surveying and Hydrography

The Commissions were a constitutional arrangement which reassured the Founding organizations that their professional interests and members would be represented in the new organization, and aligned member voting with their most active area of participation in the Institute. However, the Commissions were always intended to be flexible enough to respond to changes in the profession, such that new areas of interest could be formed and represented in the Institute, and areas that became inactive could be dissolved. To a certain extent this did happen in SSI, however the original Commissions have proven to be a more solid governance structure than originally envisaged, and for the most part have persisted, even with the merger of SSSI. It is interesting to note this trend in member behavior, which is not consistent with the original concept promoted by SSI of an open membership structure and a unified 'Commissionless' organization. Clearly, while spatial professionals acknowledge the value of a unified organization representing all streams of professional interest, they still prefer their professional development activities to be more tightly focused on the applications on which they work.

The new Institute set ambitious membership targets, and by June 2005 had recruited nearly 650 new members. While the retention of members from the Founding organizations was calculated at 66%, not the projected 80%, total membership of the Institute had grown to 3100 by 2005. SSI had an open membership structure in keeping with the unified philosophy of its foundation, such that all users and interested participants, from academically qualified spatial professionals to casual users of the technology were welcomed to join. The Institute also initially had a corporate membership category, which was a feature of the Founding body AURISA. This relationship with corporate entities later developed into the successful Sustaining Partner Program, which provides mutual financial and corporate benefits, and which has been developed further under SSSI.

The SSI provided a range of professional development activities for members, primarily based within its regions of operation. National biennial conferences were planned, with the inaugural conference held in Melbourne in 2005. Successful conferences followed in Hobart in 2007 and Adelaide in 2009. In the years between national conferences, Commissions held smaller events tailored to their specific areas of professional interest.

SSI began to develop national and international relationships, and to take on an advocacy role as the unified voice of spatial professionals with such bodies as the peak Spatial Information Council, ANZLIC. Many intra-organizational relationships were well established under the SSI founding bodies, and continued under SSI, including membership of ISPRS and AARS in the remote sensing and photogrammetry area, a continued relationship with URISA, and support of FIG in the land surveying Commission.

SSI also had a strong working relationship with the newly formed ASIBA. One of the most successful activities implemented under this joint relationship were the Australasian Pacific Spatial Excellence Awards (APSEA), a biennial event which recognized the excellent achievements of industry and the profession. The APSEA were a direct response to a recommendation from the Spatial Action Agenda. Regionally based awards also grew around this structure, again reinforcing a close working relationship between ASIBA and SSI at all levels. It is disappointing to note that, as organizational priorities have diverged in recent years, and in particular the priorities of the Business Association, the APSEA will no longer be a joint event. SSSI continues to recognize the importance of celebrating excellence in the industry, and the value of doing this at a jointly held event.

The SSI employed a range of communication channels, providing the popular magazine Position to members six times per year, as well as the refereed Journal of Spatial Science published by Taylor Francis (http://www.tandfonline.com/toc/tjss20/current) twice per year. In addition the Institute had an electronic newsletter, Spatial Voice, as well as a range of regional and commission based newsletters, some electronic, some printed.

5. Young Professionals

One of the most exciting activities in the SSI was the formation of the Young Professionals in 2005. The ‘YPs’ as they were, and still are known, were a special interest group formed to represent the interests of young people under 36 already working in the profession, and students. Their inception by a leadership group formed by Paul Barnett, Renee Bartolo and James Moody was in response to a clear need to create a more vibrant youth culture in the Institute, in order to combat a perception, justified or not, that it was a place predominantly for older established professionals.

The launch of the YPs in each region created huge energy and interest, and it is now acknowledged that the Young Professionals contributed significantly to the high number of new members engaging with SSI and now SSSI.

6. Women in Spatial

Women in Spatial was another group to grow out of an obvious need to widen the reach of the Institute to incorporate the professional needs of women in the spatial sciences. A membership survey conducted by Renee Bartolo and Penny Baldock in 2006 revealed that only 8% of the Institute membership were female, a statistic clearly not representative of the wider spatial profession. The Board endorsed a new special interest group to examine ways in which to make the activities of the SSI more relevant to women. Women in Spatial, or WIS, now has active groups established in all regions of the SSSI, and has conducted two industry surveys collecting important information on female employment in the spatial industry.

7. Spatial Information and Cartography in SSI

In the newly established SSI the interests of those working in spatial information and cartographic areas was represented by two separate Commissions, Spatial Information, and Cartography. The Cartography Commission was lead by Peter Bowen, with Tim Barker heading up the Spatial Information Commission. The newly formed Spatial Information Commission maintained the close ties which were built between AURISA and URISA, including the annual exchange. In addition, the Commission was working on laying the foundations for professional certification, described in a separate section of this chapter, and on other activities, such as the Spatial Technology in Schools Competition, another program which originated from AURISA.

Despite a positive vote from its members, the Mapping Sciences Institute Australia (MSIA) did not join the newly formed SSI, and efforts to formulate an MOU between the two organizations were initially not successful. This left the Cartography Commission with reduced funds, and a split membership. In 2007, following a recommendation from its Chair, Peter Bowen, members of the Cartography Commission voted in favour of amalgamating their Commission with the Spatial Information Commission, to form the Spatial Information and Cartography Commission. With a reduction in cartographic course content across the board at tertiary institutions, a trend which continues in Australia into 2012, and the blurring of cartographic professional identity with GIS practitioners, membership numbers did not provide justification to maintain a separate Commission. In addition, the MSIA continued to maintain separate membership, and to deliver services to cartographic professionals. In many ways, the amalgamation was to the detriment of cartographic representation in the SSI, and to some extent the industry as a whole. In 2011 an MOU was signed between SSSI and MSIA to work together to the betterment of the cartographic profession in Australia. More recently in 2012 the SIC Commission of the SSSI prioritized the expansion of its cartographic representation, education and advocacy role in order to redress this balance.

8. Delivering the Vision – Formation of SSSI

The SSI was the first step towards a unified professional body in Australia, however much hard work was yet to be done in order to deliver the full vision of the Spatial Action Agenda.

The Surveying and Spatial Sciences Institute (SSSI) was formed in July 2009, merging the two former organizations, the Institution of Surveyors Australia (ISA) and the Spatial Sciences Institute (SSI). The vote of members, conducted in early 2009, dissolved the existing organizations, and formed SSSI, representing the interests of all surveying and spatial sciences professionals in Australia. The merger was the result of much hard work by the Boards of both SSI and ISA in incorporating the best of both organizations into a new entity. In particular, the vision of SSI Presidents Renee Bartolo and Marnie Leybourne, as well as Jonathan Saxon, inaugural President of SSSI, must be mentioned in achieving this result.

The SSSI is a member based not-for-profit professional organization with its Head Office located in Canberra Australia. Most regions in Australia have a Regional Office and Regional Executive Officers who support the work of the volunteer committees.

The Institute is governed by a Board of Directors, with the Consultative Council providing a second tier oversight of the Institute's operations. Representation on the Consultative Council encompasses the Commissions, a structure carried through to the new organization from SSI, Regional Representatives and Young Professionals. Member services are predominantly delivered by regional committees and working groups. As with SSI, the Commissions cover the breadth of the surveying and spatial science professional disciplines: Land Surveying, Spatial Information & Cartography, Remote Sensing & Photogrammetry, Hydrographic Surveying, and Engineering & Mining Surveying. Additionally, two national Special Interest Groups, the SSSI Young Professionals and Women in Spatial, represent these growing sub-groups in the profession.

Unlike SSI, which had an open membership structure, the SSSI incorporates the concept of the professional institute as a learned environment, an approach adopted from ISA. In order to maintain membership, members must complete 15 points of validated Continuing Professional Development (CPD) per year, roughly equivalent to 15 hours of training, presentations, networking or other contributions to the profession. This has proven to be a challenging modus operandi for many of the non-surveying Commissions. The SIC Commission has had greater success with the Geographical Information Systems Professional – Asia Pacific (GISP-AP) professional certification program. This certification provides a pathway for CPD points and importantly is gaining prestige as recognition of professional skill in GIS and Cartography.

The Institute delivers a diverse range of membership services throughout the regions and nationally, including a large national conference, and a continuation of the professional recognition Awards program.

Due to its more centralized structure, SSSI has been able to utilize communication technologies to full effect. From its website redeveloped in 2012 the Institute delivers a monthly newsletter and regional and national committees centralize information in a shared online environment. (http://www.sssi.org.au/)

9. Spatial Information and Cartography in SSSI

The Spatial Information and Cartography Commission in SSSI continues as the second largest Commission of the Institute, with nearly 800 members in 2012. The Commission has a focus on providing relevant professional activities to members working in the GIS and cartographic areas, through specialized CPD activities in regions, and through participation in the national conference. The Commission has continued a strong relationship with URISA, including the annual exchange program. In 2010 the Commission worked on behalf of SSSI to develop a MOU to formalize the relationship between SSSI and URISA.

Under SICC Chair Chris Pettit the Commission extended these collaborative activities into a new area, licensing the URISA certified workshop ‘GIS Program Management’. This program was delivered with great success to groups across Australia, and as part of the 2011 Conference in Wellington, New Zealand. As of 2012 there is a clear lack of non-vendor training focused on GIS program and project development, and the Commission is hopeful that this workshop program can continue to satisfy this need.

10. GISP-AP Professional Certification

A key activity for the SIC Commission has been the development of Certification for GIS professionals.

The establishment of the SSI brought surveyors and GIS professionals into the same community. Although the two groups had many things in common, one difference that stood out was that surveyors had the opportunity to achieve high-level recognition of their professional skills via a process of registration, and this highlighted the need for GIS professionals to establish their own form of certification.

Cliff Bacon took on this challenge, making contact with the GIS Certification Institute which had already developed a mature and robust certification program for GIS professionals in North America. An MOU was negotiated between the GISCI and SSI allowing the GISCI's intellectual property to be used to develop a similar and equivalent program in Australia and New Zealand, to be promoted and administered by SSI. Cliff developed a charter, a manual on policies and procedures and in May 2007 became chair of the inaugural GISP-AP certification panel at the Institute Conference in Hobart.

SSSI is the first organization to establish an MOU with GISCI for the purposes of extending their certification program to another geographic region. The Institute maintains contact with the GISCI and also regularly forwards applications to the GISCI for validation, to help ensure the programs are aligned.

To date, nearly 90 people have successfully achieved recognition as GISP-APs. Five years have passed since the program started, and many of the inaugural GISP-APs will become eligible for renewal of their certification. In order to help promote certification the Commission has been running a series of interviews with successful applicants, asking about their motivation for attaining certification and their experience of the process. A GISP-AP pin has also been commissioned, and is being distributed to new and current certificants.

Each of the five commissions within SSSI has or is developing a specialist certification program, roughly equivalent to GISP-AP. GISP-AP is held in high regard within the institute for the rigour of the process, the high standards maintained, the dedication of the assessment panel and the steady success in attracting new applications.

11. A Strategic Approach to the Future

SSSI Strategy 2015 (Surveying and Spatial Sciences Institute, 2012) describes the operation of the Institute and its program of work for the following three years. The SIC Commission aligns its strategic priorities to those of the Institute as a whole. The following six Strategic Priorities provide the framework for achieving the vision of the Institute 2012-2015.

- ***Certification***
  The SIC Commission will continue to provide leadership in developing and promoting the GISP-AP program.
- ***Continuing Professional Development (CPD)***
  The SIC Commission will develop professionally relevant CPD programs to fulfill training needs for GIS and cartographic professionals. This will include a continuation of the GIS Program Management program, and development of future workshops, such as Cartography and Map Production.
- ***Education***
  The education and employment climate continues to change in Australia and New Zealand. Universities are moving further towards a 3+2 formula, similar to that in the United States, where students undertake a 3 year generalist undergraduate degree follow by a specialist masters degree. This presents challenges to the industry, which will have to think carefully about the skill set and professional abilities it will require in its future workforce, and how it will measure these skills in a rapidly changing technical environment.

  The SSSI, and the SIC Commission, has a role in educating its members and the industry as both employers and employees, and in coordinating Education activities across the nation. In 2012 the National Spatial Education Leadership Group was initiated by SSSI, bringing together key players to discuss career promotion strategies and it has been acknowledged that a concerted effort is required in both secondary school and tertiary educational facilities in order to promote the industry.

- ***Coordination of the Profession***
  The Institute aims to be widely recognized as the voice of surveying and spatial professionals through coordinated initiatives and approaches. For the SIC Commission, this represents many opportunities to build further on national and international relationships with groups such as URISA and the International Cartographic Association (ICA). It also represents a challenge to find new and better ways of working with areas of the profession, and with organizations which do not necessarily share the same professional ideology as GIS professionals, such as the surveying professions, and the Australian Mapping Sciences Institute.

- ***Advocacy and Community Engagement***
  Following from a strong tradition in AURISA and SSI, the SIC Commission will continue to Provide quality and informed advice and positions on issues of importance for the benefit of decision makers.

- ***Connecting and Empowering***
  The SSSI will provide an environment where members, partners, staff and stakeholders are empowered, connected, supported and operate in a professional and ethical manner.

12. Lessons Learned and a Glimpse at the Future

So where has our historical journey brought us to in 2012? And what will our journey look like in another 50 years?

The future for the Geospatial Professional is limitless as business, government and citizens demand richer and more timely information to value add to the decision making process at work, or in their private lives. The thirst for knowledge and information is endless and will not slow down in our consumer style world. Consumers want their information to be instant, but they also want the flexibility to choose as new app’s, data, or integrated systems appear. This is where the Geospatial Professional will become the most valued, as enablers of complex ‘big’ data into usable, understandable information using visualization techniques that are simple, flexible, appropriate, and enhance daily life.

Over the past 20 years the GIS community has seen many changes. In many cases, spatial data has moved from behind the walls of government to freely accessible cloud environments. Systems have moved from inflexible mainframe environments to personal computers, and now to apps on mobile devices. The pace of technology is truly inspiring, but in recent times it has become evident that in Australia the real challenge will be the maintenance of a skilled and knowledgeable geospatial workforce for the next 20 years. People are the glue between all things technology, people are the x-factor in innovation, people make technology come to life; however, not all sectors of the industry see people as critical to their success. With many competing pressures in the marketplace and increasing pressure to 'do more with less', business and government find it much easier to justify investment in infrastructure, systems or data than investment in a knowledgeable workforce for the future. If the geospatial sector wants to lead and become an enabler of society, if it wants to become pervasive in every part of business and government, it needs to invest in the people who can make this happen by up-skilling the current workforce, developing leaders who can see over the horizon, and defining a vision of what the geospatial professional will look like in 5, 10 or 20 years.

One of the immediate challenges in Australia is to make some sectors of the industry appealing to the next generation of students, who have grown up with location based apps on a phone or Google maps on a tablet. The industry needs to understand how to engage with the future workforce, how to demonstrate that location is important to everybody on this planet and show the importance of spatial professionals in enabling business, government and citizens to use geospatial technology for everyday decision making. The other important aspect is to promote how diverse our industry is, how a student can learn the principles of spatial science and translate that into a career with almost limitless opportunities.

Another related and emerging challenge to the industry in Australia is the convergence between traditional GIScience, Cyber (e)-Infrastructure and social media. In 2009 Michael Goodchild gave a keynote address at the Spatial Sciences Conference in Adelaide, concluding that some GIS applications are aligning with mainstream IT. Since that time there has been further convergence between GIS and IT with the emergence of e-infrastructure investments across Australia where large infrastructure initiatives such as AUSCOPE (http://www.auscope.org.au/site/) and AURIN (http://aurin.org.au/) are moving towards a CyberGIS. This emergence of CyberGIS and convergence of GIS and social media (Sui & Goodchild, 2011) offers both challenges and opportunities to the industry both in Australia and internationally.

Finally, for professionals in our workforce today, Institutions like URISA and SSSI play a pivotal role in providing continuous learning opportunities. In order to do this it is everybody's responsibility to step up to the challenge, support their peers, advocate the importance of personal development, and recognize geospatial professionals through international certification programs like GISP and GISP-AP.

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Acknowledgements

The authors acknowledge the contributions of Cliff Bacon in providing content and editorial comments to the chapter.

Part VI

CONCLUDING REMARKS

It has long been my contention, implemented through university course reading lists, thesis and dissertation supervision, references in agency and learned literature publications, advisories given as part of consulting assignments, citations used in expert witness statements, and examples and case studies called upon in many local, national, and international conference presentations, that URISA publications are a core contribution to the body of foundations upon which the field of urban and regional information systems and geographic information systems and science is based.

Upon reflection, the chapters in *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science* confirm my long-held contention that URISA is indeed a core contributor to the foundations of urban and regional information systems and geographic information systems and science.

However, the chapters also inform us that retaining this pre-eminent position will require building on the intellectual capital that URISA has accumulated over the past 50 years. The chapters are guideposts to direct this journey and prompt the exhortation, *Oblatum occasionem tene.*

Barry Wellar

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REFLECTING UPON THE *FOUNDATIONS* PROJECT AND ITS IMPLICATIONS

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Abstract. This concluding chapter briefly comments on "foundations" as the book theme, the topics considered and not considered, the parallel activity of nominating a selection of federal agencies for induction into the GIS Hall of Fame, and the implications of ***Foundations*** for research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science. Summary reflections are that designing the book around the theme of "foundations" provides a challenge that is fully met by authors, this project provides a significant start on elaborating foundations topics but many remain in need of attention and, as is demonstrated repeatedly throughout the book, the importance of making URISA proceedings accessible online as soon as resources permit cannot be over-emphasized.

1. Introduction

A number of ideas were "floated" over the past several years about how URISA past presidents could contribute to celebrating URISA's 50th anniversary conference at its 2012 GIS-Pro meeting in Portland, Oregon.

One of the adopted proposals was for the past presidents to sponsor this 50th anniversary book, and in that regard I am pleased to be able to say, "Mission accomplished". On behalf of URISA, as well as current and future readers of the book, a much-deserved "Thank You" is extended to all the authors of chapters in ***Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science***.

And, a second proposal adopted by the past presidents in November, 2011 was to give consideration to nominating a selection of federal agencies for induction into the GIS Hall of Fame. Now, some six months after launching the commemorative book and the Hall of Fame initiatives, it is clear that "Reflections on the ***Foundations*** Experience" needs to include a comment on the foundations connection between the nomination statements and the chapters in this book.

In the next several pages I briefly reflect upon the ***Foundations*** experience. Matters of interest include "foundations" as the book theme, the topics considered and not considered, the connection between the book and the 2012 Hall of Fame nominees, and the implications of ***Foundations*** for research, education, training, and applications activities in the field of urban and regional information systems and geographic information systems and science.

2. "Foundations" as the Book Theme

Use of the term "foundations" in the title of this book represents my professional conviction that URISA is to be taken very seriously as a professional organization. Consequently, it is appropriate that this 50-year book of celebration be characterized by a theme with a leading edge ring to it. Foundations as a theme serves that purpose, because it gives notice that the bar has been set very high in terms of content.

Further, and beyond bringing an element of *gravitas* to the book project, foundations also brings to mind concepts such as building blocks, pillars, basics, principles, and fundamentals, all of which are logically associated with research, education, training, and applications activities involving urban and regional information systems and geographic information systems and science.

However, I am well aware of the old saw that "Talk is cheap" and, as a result, the book is designed to ascertain whether the claim about foundations is supported by empirical evidence.

Table 1 in Chapter 1 sets the stage by identifying more than 200 information system domains which originated with URISA, were refined through URISA, were elaborated in URISA workshops and workbooks, were technically advanced through URISA publications, were tested in presentations at URISA conferences, were featured in URISA keynote and plenary addresses, and so on.

The listed domains were obtained from searches of URISA productions, and by soliciting inputs from URISA past presidents and contributors to the book, as well as URISA members in government, academe, and business. Based on the feedback received from informal surveys, it appears fair to say that the entries in Table 1 are generally considered to be among the domains which have been and are at the core of the field of urban and regional information systems and geographic information systems and science as it evolved over the past 10, 20, 30, 40, and up to 50 years for some domains.

Many of the domains represent foundations of urban and regional information systems and geographic information systems and science and, as a result, it is not a stretch for a URISA-sponsored 50-year anniversary book to be designed around the theme of foundations. That said, it is one thing to design a book around the theme of foundations, and quite something else to compile a body of evidence which supports such a choice.

Fortunately, since being proven wrong would have been very embarrassing to say the least, the choice of foundations as the book theme is repeatedly confirmed by the chapter authors. That is, each of the chapters makes a significant contribution to documenting the body of foundations which represent research, education, training, and applications and other activities in the field of urban and regional information systems and geographic information systems and science.

However, the past 50 years was "then", and this is now, and a question arises. That is,

> Since foundations appears to be an appropriate, informative, and instructive theme for a 50-year celebration book, will others add to the foundations work which is represented by the design and content of these pages?

A potential next anniversary celebration is in 2022, ten years away, but I suggest that the task of foundations updating is not one that improves or gets easier with time.

Rather, and based on prior experience, I believe that the time to begin extending what has already been written, and adding new materials to the foundations base that is provided by these pages, is now. This matter is simply too important to the future of URISA, and that of urban and regional information systems and geographic information systems and science, to let slide.

3. Topics Considered and Not Considered

By design, and having due regard for resource constraints, ***Foundations*** is indicative and illustrative rather than comprehensive and definitive.

Moreover, and again having due regard for resource constraints, the content of ***Foundations*** is limited to topics which URISA past presidents, GIS Hall of Fame inductees, Horwood Award recipients, and URISA-related association leaders agreed to discuss from the perspective of foundations.

The topics considered, therefore, are those which the authors previously discussed, or which they agreed to discuss for inclusion in this book. In either event, topics considered include dozens of the domains listed in Table 1, Chapter 1, as well as many hundreds of initiatives, issues, challenges, achievements, etc., associated with research, education, training, and applications and other activities in the field of urban and regional information systems and geographic information systems and science.

As for including topics "Not Considered" in heading 3.0, it is done for a reason.

In brief, examination of numerous Google search results reveals that many of the results include the term "foundations"' in the titles of university courses, journal articles, and even books. However, many of the entries appear to be little more than variations on sections of URISA workbooks, including the ***Introduction to Geographic Information Systems*** workbook that URISA used in workshops beginning about two decades ago!

One objective of this book is to go far beyond what is currently "out there" in terms of purported foundations of urban and regional information systems and geographic information systems and science, and it appears fair to say that the chapters fully succeed in that regard.

That said, much remains to be done when it comes to more completely elaborating the foundations of our field, and it is appropriate to flag the fact that many *bona fide* foundations were not considered due to resource and organizational constraints.

I am therefore inviting researchers to expand the foundations sphere beyond what is covered in these pages, and I am sure that the other contributors to this book join me in looking forward to learning about these advances.

4. Connecting 2012 Hall of Fame Nominees and *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science*

Readers of preceding chapters will be aware that a number of federal agencies in Canada and the United States made and continue to make major contributions to education, teaching, research, and applications in the field of urban and regional information systems and geographic information systems and science.

In recognition of their contributions, URISA past presidents agreed that federal agencies would be the focus of attention for possible induction into the GIS Hall of Fame in 2012.

The purpose of this section in the Reflections chapter is to emphasize what has already been noted in preceding chapters, and what is elaborated in the GIS Hall of Fame nomination statements which will be posted on the URISA website (urisa.org) and very possibly on the websites of 2012 Hall of Fame inductees.

That is, each of the agencies has played and continues to play a significant role in conceptualizing, designing, implementing, and maintaining the institutional, organizational, operational, technical, and technological foundations of urban and regional information systems and geographic information systems and science.

And, in that same vein, my involvement with and/or exposure to the agencies strongly influenced my ideas about creating and undertaking the ***Foundations*** book as a means to celebrate URISA's 50th anniversary conference.

So, giving credit where credit is due, it is acknowledged that ***Foundations*** is the product of a number of forces and influences, including the following federal agencies which have been nominated as 2012 inductees into the GIS Hall of Fame.

From Canada:

Natural Resources Canada
Statistics Canada

From the United States:

U.S. Bureau of the Census
U.S. Department of Housing and Urban Development

U.S. Geological Survey
U.S. Library of Congress
U.S. National Aeronautics and Space Administration
U.S. National Geodetic Survey
U.S. National Science Foundation

Each of the named organizations has been making outstanding contributions to information system foundations for more than 50 years. In combination, however, they represent an overwhelmingly impressive testimonial to the central role that federal agencies in Canada and the United States have played, are playing, and doubtless will continue to play in the evolution of foundations underpinning urban and regional information systems and geographic information systems and science.

It is my belief, therefore, that reading this book in conjunction with reading the nomination statements of the agencies named for induction in 2012 could be an excellent learning experience for anyone who wishes to better understand why, how, and by what means towards what ends the field of urban and regional information systems and geographic information systems and science has evolved.

5. Implications of *Foundations* for Research, Education, Training, and Applications Activities in the Field of Urban and Regional Information Systems and Geographic Information Systems and Science

Statements about the implications of ***Foundations*** for research, education, training, and applications activities are included in each chapter. I therefore advise readers who are interested in implications associated with a particular topic to examine the pertinent chapter.

Specifically, and recalling earlier comments about original and derivative research, this book appears to be one of a very limited set in which information system foundations are expertly examined from a mix of perspectives. As such it is appropriate, and prudent, to consult the original documentation.

At a broader scale, it is my expectation that the ***Foundations*** project and book will lead to a surge of interest in all URISA proceedings published since 1964, as well as in other URISA productions. As demonstrated by each of the chapters, URISA has been at the leading edge of research, education, training, and applications in urban and regional information systems and geographic information systems and science for 50 years.

This is a record of unmatched achievement, and it seems most likely that serious students of urban and regional information systems and geographic information systems and science from academia, government, and business will want to know more about how and why and by whose efforts the field's foundations came to be in the first instance, and evolved over time and space and circumstance.

Finally, the preparation of ***Foundations*** underlines the need to make URISA proceedings accessible online as soon as resources permit.

As illustrated by various chapters in ***Foundations,*** URISA proceedings represent a rich body of ideas, evidence, test results, research proposals, comparative analyses, etc. However, this resource is relatively untapped in its current paper form.

Making the proceedings accessible electronically would significantly and dramatically increase the quality and quantity of information and knowledge available to everyone – elected officials, agency and department administrators, planners, engineers, researchers, first responders, GISPs, scientists, professors, teachers, students, and so on – with a professional, personal, or other interest in urban and regional information systems and geographic information systems and science.

Contributors’ Bio-Notes

The bio-notes section provides outlines of the careers of contributors to *Foundations.* The following subject headings were suggested for all authors, with the rider that authors were invited to vary from the suggestions if there is another topic which is important to mention in setting out credentials:

> Education: Employment: Professional Accreditation(s): Professional, Academic or Technical Association Service: Professional, Academic, or Technical Association Memberships Held: Awards and Recognition: Publications: Website Postings.

Since all contributors are widely known, it may seem at first glance that they need little introduction to most readers who have been or are engaged in research, education, training, and applications activities in urban and regional information systems and geographic information systems and science. However, I wish to assure that these bio-notes serve a much higher purpose than merely padding the contributors’ public profiles.

That is, this book is published under the title *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science*, and is designed to celebrate many aspects of URISA’s 50 years as an international leader in the field.

I am confident in suggesting that the bio-notes which follow confirm that the contributors are eminently qualified to work at the level of *Foundations*, and to review and overview many of the fundamental components of the URISA record of achievement, 1963-2012, as well as to preview its impending challenges and opportunities.

Barry Wellar

A Brief Comment about the Bio-Notes of Contributors to *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science*

Examination of the bio-notes reveals that the authors of chapters in *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science* have individually and collectively made numerous, significant contributions to education, research, training, and applications in many domains and aspects of the information systems field.

Further, the bio-notes demonstrate that individually and collectively, the authors are very capable of representing the government, academic, and private sector interests in urban and regional information systems and geographic systems and science.

I hasten to emphasize, however, that the bio-notes are included for the important but nevertheless limited purpose of illustrating the competency which each author brings to the mission of writing about **foundations** of urban and regional information systems and geographic systems and science.

Readers are therefore urged to construe the bio-notes as intended, and to look to the authors' c.v.s for details about the entries in the bio-notes, as well as for more detailed information about the authors.

Barry Wellar

Bio-notes of authors are presented in alphabetical order of surnames, as follows:

Penny BALDOCK

Education: Adelaide University, Bachelor of Arts (Honours), 1997 (Geography).
Employment: Department of Primary Industries and Resources South Australia 1999 – 2008 (Senior GIS Specialist); Department of Families and Communities South Australia 2008 – 2011 (GIS Service Delivery Manager); Department of Communities and Social Inclusion 2011 – present (Chief GIS Project Officer, Evidence Based Management Project), coordinating GIS and policy approach of the Evidence Based Management project, in order to provide better information for funds based decision making and service provision to government clients.
Professional Accreditation(s): Geographic Information System Professional Asia Pacific (GISP-AP).
Professional/Academic/Technical Association Service: Member Spatial Information Committee (SICOM), Regional South Australian Chair Spatial Sciences Institute, Member of the National Spatial Sciences Conference 2009 committee, Director, Spatial Sciences Institute, National Chair Young Professionals Committee, Spatial Sciences Institute, National Chair Spatial Information and Cartography Commission, Surveying and Spatial Sciences Institute, Convenor South Australian Spatial Conference.
Professional/Academic/Technical Association Memberships Held: Fellow Surveying and Spatial Sciences Institute.
Awards and Recognition: Young Spatial Professional of the Year, Australia and New Zealand 2004.

William J. CRAIG

Education: University of Minnesota, B.A. 1965, Mathematics; University of Minnesota, M.A. 1972, Geography; University of Minnesota, Ph.D., 1980 Geography with supporting fields of Economics and Statistics.
Employment: University of Minnesota: 1967-70, Director of Social Science Research Facilities Center; 1968-70, Director of West Bank Computer Center; 1970-1998, Assistant Director of CURA (Center for Urban & Regional Affairs); 1983, Visiting Professor, University of Hawaii; 1984, Visiting Scholar, South Australian Department of Environment and Planning; 1986-91, Director of Minnesota Center for Survey Research; 1999-present, Associate Director of CURA.
Professional Accreditation: Geographic Information System Professional.
Professional/Academic/Technical Association Service: President of the following professional associations: Urban & Regional Information Systems Association (URISA, 1986-87), International Geographic Information Foundation (IGIF, 1994 & 1995), University Consortium for Geographic Information Science (UCGIS, 1995-96), National States Geographic Information Foundation (NSGIC, 2009-10). Chair of the Minneapolis Complete Count Committee for the 2000 Census. Member of the Mapping Science Committee, National Research Council (2000-05) and a member of several study panels.
Professional/Academic/Technical Association Memberships Held: American Association of Public Opinion Research, Association of American Geographers, Minnesota GIS/LIS Consortium; Urban & Regional Information Systems Association.
Awards and Recognition: Fellow, University Consortium for Geographic Information Science (2011), GIS Hall of Fame, Urban & Regional Information Systems Association (2009), Outstanding Service Award, National States Geographic Information Council (2007); Lifetime Achievement Award, Minnesota GIS/LIS Consortium (1995).
Selected Publications:

- Craig, William J, 2009. Governance of the NSDI, *ArcNews* Magazine, Fall.
- Craig, William J, 2005. White Knights of Spatial Data Infrastructure: The Role and Motivation of Key Individuals, *URISA Journal,* Vol. 16, No. 2. 5-13.
- Craig, William J., Trevor M. Harris, and Daniel Weiner (editors), 2002. *Community Participation and Geographic Information Systems.* London: Taylor and Francis.
- Craig, William J, 1995. Why We Can't Share Data: Institutional Inertia. In *Sharing Geographic Information*, Harlan J. Onsrud and Gerard Rushton, eds., Center for Urban Policy Research, Rutgers University, pp. 107-118.

Website: See http://www.cura.umn.edu/about/staff/Craig

Peter L. CROSWELL

Education: Mr. Croswell received a bachelor's degree in geography and mathematics from the State University at Albany NY graduating magna cum laude and Phi Beta Kappa and Master's degree in geography and geology from Western Illinois University. In 2007, he completed a training program at the University of Louisville in IT management, Web development, and systems/database administration. Over the past 30 years, he has had extensive post-graduate education and training in GIS, IT, and public administration.

Employment: Mr Croswell has over 30 years experience as a GIS and IT practitioner, program manager, and consultant. His professional history is summarized below:

- President and lead consultant, Croswell-Schulte IT Consultants (2008-Present)
- Executive Consultant and Vice President, PlanGraphics, Inc. (1985-2007)
- Manager, Kentucky Natural Resources Information System, Kentucky Natural Resources Cabinet (1981-1985)
- GIS Analyst, Kentucky Natural Resources Cabinet (1979-1981)
- Cartographer, New York State Sea Grant Institute (1975-1979)

Professional/Academic/Technical Association Memberships and Service: Member of URISA, Geospatial Information Technologies Association (GITA), American Society of Photogrammetry and Remote Sensing (ASPRS), Project Management Institute (PMI). Past URISA Board member and President and leader and participant on many committees, and special programs.

Awards and Recognition:

- <u>Professional Certifications include</u>: Project Management Professional (PMP), ASPRS Certified Mapping Scientist (MS-GIS/LIS), GIS Professional (GISP), Microsoft Certified Professional (MCP), Master CIW Web Site Designer.
- <u>Awards on honors include</u>: Former Board member and President of URISA; URISA Horwood Distinguished Service Award (2008); URISA Service Award (1999); ASPRS President's Award for Practical Paper (1990); URISA Horwood Award for Best Paper (1990).

Publications: Author of over 40 special publications and professional papers published by URISA and other organizations. He is also the lead author and instructor for URISA's GIS Program Management Workshop. His is the author of the 2009 book, *The GIS Management Handbook* (Kessey Dewitt Publications, 2009), a co-author of, *Geographic Information Systems: A Guide to the Technology* (Van Nostrand Reinhold, 1991), and contributing author for *Profiting from a Geographic Information System* (GIS World, Inc.,1993), and *GeoSpatial Data Infrastructure: Concepts, Cases, and Good Practice* (Oxford Univ. Press, 2000).

Jack DANGERMOND

Education: B.S., Landscape Architecture, California Polytechnic College–Pomona, 1967; M.S., Urban Planning, Institute of Technology, University of Minnesota, 1968; M.S., Landscape Architecture, Graduate School of Design, Harvard University, 1969.
Employment: Jack Dangermond founded Environmental Systems Research Institute, Inc. (Esri) in 1969 with a vision that computer mapping and analysis could help us design a better future. Under Dangermond's leadership, that vision has continued to guide Esri in creating cutting-edge GIS and GeoDesign technologies used in every industry to make a difference worldwide. Dangermond fostered the growth of Esri from a small research group to an organization recognized as the world leader in GIS software development. Esri employs 2,700 people in the U.S.; many who shared his passion for GIS in the early days are still with the company and remain dedicated to helping our users be successful.
Professional/Academic/Technical Association Service: The Jane Goodall Institute (JGI), Board Member; National Geospatial Advisory Committee, NGAC; National Geographic Education Foundation, NGS; Earth System Science and Applications Advisory Committee, NASA; Science and Technology Advisory Committee, NASA; National Geospatial Advisory Committee, NGAC; National Center for Geographic Information and Analysis (NCGIA), Executive Board; National Advisory Council for Environmental Policy and Technology (NACEPT); U.S. Environmental Protection Agency, Information Impacts Committee; National Academy of Sciences, Committee on Geography; University of California, Berkeley, President's Engineering Advisory Council.
Awards and Recognition: Hon. Ph.D., Clark University, 2011; Alexander Graham Bell Medal, National Geographic Society, 2010; Patron's Medal, Royal Geographical Society, 2010; Public-Private Partnership Award, National Governors Association, 2009; Hon. Ph.D., University of Minnesota, Minneapolis, 2008; International Cartographic Association, Carl Mannerfelt Medal, 2008; American Society for Photogrammetry and Remote Sensing (ASPRS), Outstanding Service Award, 2007; Hon. Ph.D., Loma Linda University, 2006; Hon. Ph.D., University of Arizona, Tucson, 2006; Missouri Botanical Garden, Henry Shaw Medal, 2006; Hon. Ph.D., State University of New York, Buffalo, 2005; Hon. Ph.D., California State Polytechnic University, Pomona, 2005; Hon. Ph.D., Technical University for Civil Engineering of Bucharest, 2005; Inductee, GIS Hall of Fame, Urban and Regional Information Systems Association, 2005; Geospatial Information & Technology Association (GITA), Lifetime Achievement Award, 2004; Hon. Ph.D., University of West Hungary, 2003; Hon. Ph.D., City University London, 2002; U.S. Department of State, The Secretary's Open Forum, Distinguished Public Service Award for Outstanding Contributions to National and International Affairs, 2002; Hon. Ph.D., University of Redlands, 1999; John Wesley Powell Award, U.S. Geological Survey, 1996; Hon. Ph.D., Ferris State University, 1993.

Kenneth J. DUEKER

Education: BS (1960), MS (1963), and PhD (1967) in Civil Engineering, University of Washington.

Employment: Emeritus professor of urban studies and planning, is an experienced educator and researcher in transportation, land use, and geographic information systems. He directed the Center for Urban Studies from 1979 to 1998 and the Transportation Studies Center from 1997 to 2002 at Portland State University. His areas of interest include: transportation and land use interactions, travel and parking behavior, and Geographic Information Systems - Transportation.

Professor of urban and regional planning and geography, University of Iowa, 1969-79. Assistant professor of civil engineering and urban and regional planning, University of Wisconsin-Madison, 1966-69.

Professional/Academic/Technical Association Service: Dueker chaired the Transportation Research Board Subcommittee on Geographic Information Systems - Transportation. He is a past-president of the Urban and Regional Information Systems Association (URISA) and was a co-editor of the URISA Journal from 1989 to 1999. He was also the 1999 - 2000 president of Oregon URISA chapter. Dueker was an original member of URISA and served as its first Treasurer, 1967 – 1970. His major professor was Edgar Horwood, URISA's founder.

Awards and Recognition: In 1997 URISA awarded Dr. Dueker the Horwood Service Award and in 2000 the Transportation Research Board appointed him as emeritus member of the Spatial Data and Information Sciences Committee. In 200l Portland State University honored him with the Millar Award for a distinguished research record. In 2002 the Oregon Chapter of URISA awarded him its first Distinguished Service Award.

Publications: Dueker has published in the URISA proceedings, the URISA Journal, the Journal of the American Planning Association, and Transportation Research Record.

Shoreh ELHAMI

Education: 1978-1982, Architectural Engineering (minor in Urban Planning) from National University of Iran; 1987-1989, Masters in City and Regional Planning from the Ohio State University; 1998-2009, Esri Authorized Instructor.
Employment: 1989-1994, GIS Coordinator at Delaware County Regional Planning Commission; 1998-1999, Adjunct Instructor at Ohio Wesleyan University; 1999-2009, Adjunct Instructor at the Ohio State University; 1994-Present, GIS Director at Delaware County Auditor's GIS Office.
Professional Accreditation(s): GISP
Professional/Academic/Technical Association Service: URISA memberships: 2000-Present, GISCorps, Board of Directors, Leadership Academy, Chapter Relations, ESIG, and Nominating committee.
Professional/Academic/Technical Association Memberships Held: 2003-2008, Member of National Academy of Sciences Mapping Science Committee, 1999-2011, several Census related committees, 1989-Present, member of many Ohio geo spatial technology related committees.
Awards and Recognition: 2000 & 2006 Esri's SAG award (for work and for GISCorps); 2003, URISA Leadership award; 2005, ESIG award (for work) & Esri GIS Health Service award (for GISCorps); 2007, NaCO award; 2008, Barbara Hirsch special achievement award; 2012, Presidential Volunteer Service Award and Daily Point of Light (for GISCorps).
Publications: Numerous slide presentations for work, GISCorps, and Census related publications and research.
Website Postings: Results of work and volunteer efforts can be viewed at these web sites: www.dalisproject.org & www.giscorps.org.

Michael F. GOODCHILD

Education: B.A., Physics, University of Cambridge, 1965; Ph.D., McMaster University, Geography, 1969.
Employment: Mike Goodchild joined the University of Western Ontario as Assistant Professor of Geography in 1969, advancing to Associate Professor in 1971 and Professor in 1978. In 1988 he moved to the University of California, Santa Barbara, as Professor of Geography, where he was appointed to the Jack and Laura Dangermond Chair of Geography in 2010. He has taught courses in quantitative methods, spatial analysis, and geographic information systems, and conducted research in each of these topics. In 1988 he became co-Director of the National Center for Geographic Information and Analysis, and Director in 1991. Since then he has directed many projects and centers, most recently the Center for Spatial Studies. He has published over 500 papers and 15 books, acted as principal advisor for over 25 Ph.D. students, received over $55 million in research grants as principal investigator, and taught thousands of undergraduate students, as well as giving keynote addresses at conferences around the world.
Professional/Academic/Technical Association Service: Chair, Mapping Science Committee, National Research Council; Chair, Advisory Committee, Social, Behavioral, and Economic Sciences Directorate, National Science Foundation; Chair, Committee on Planning for Catastrophe, National Research Council; member of 15 editorial advisory boards for journals and book series; chair or member of program committees for many conferences; Editor, *Geographical Analysis* and the Methods, Models, and Geographic Information Sciences section of the *Annals of the Association of American Geographers*.
Awards and Recognition: Peter A. Burrough Medal, International Spatial Accuracy Research Association, 2012; Fellow, University Consortium for Geographic Information Science, 2010; Corresponding Fellow, the British Academy, 2010; Foreign Member, the Royal Society, 2010; UCGIS Prix Vautrin Lud, St Dié-des-Vosges, France, 2007; Inducted into the GIS Hall of Fame, Urban and Regional Information Systems Association, 2007; Lifetime Achievement Award, Geospatial Information and Technology Association, 2007; Member, American Academy of Arts and Sciences, 2006; Honorary Doctor of Laws, Ryerson University, 2004; Honorary Doctor of Science, McMaster University, 2004; Founder's Medal, Royal Geographical Society, 2003; Foreign Fellow, Royal Society of Canada, 2002; Member, National Academy of Sciences, 2002; Lifetime Achievement Award, Environmental Systems Research Institute, 2001; Honorary Doctor of Science, Keele University, 2001; Honorary Doctor of Science, Laval University, 1999.

Dianne HALEY

Education: BSc 1975, Queen's University, Canada; Certificate in Information Systems Management 1992, University of Calgary, Canada; Postgraduate Certificate in Theoretical and Applied GIS 2000, Simon Fraser University, Canada; MScGIS 2001, University of Huddersfield, UK.
Employment: 1975-1980, Computer Operator/Supervisor Editing, Programmer, Geoterrex Ltd.; 1980-1981, Programmer Analyst, Trans Canada Truss; 1981-1982, Technical Systems Analyst, Suncor Inc.; 1982–2003, Various positions related to automated mapping and GIS, The City of Calgary; 2003-2011, GIS Program Coordinator/Enterprise GIS Services Lead, Alberta Energy Resources Conservation Board; 2012–Present, CEO DMH GIS Consulting, President Haley-Comben Services Inc.
Professional Accreditation(s): GISP
Professional/Academic/Technical Association Service: URISA memberships: GISCorps, Board of Directors (1999-2002, 2003-2006), Past President (President 2004-2005), URISA Leadership Academy, Chapter Relations, ESIG, and Leadership Development committees. URISA Alberta Executive member since 1990: Treasurer, VP South, President, Past President, Publicity Chair.
Professional/Academic/Technical Association Memberships Held: Member of URISA International; Member of URISA Alberta; Member of the GeoAlberta Conference Organizing Committee.
Awards and Recognition: URISA Service Award 1999; URISA Leadership Award 2007; Presidential Volunteer Award and Daily Point of Light (for GISCorps).
Publications:

- Numerous slide presentations for employment work, GISCorps activities and GIS certification.
- Co-author of chapter titled *Environmental and Regulatory Compliance* in Pipeline Geomatics: Practice & Innovation, ASME 2009

Gary J. HUNTER

Education: Bachelor of Surveying 1982, University of Melbourne, Australia; Master of Surveying Science 1987, University of Melbourne, Australia; PhD 1994, University of Melbourne, Australia.
Employment: 1971-1977, Surveyor, Australian Regular Army; 1982-1987, Licensed land surveyor, Victorian State Government; 1987-2009, Associate Professor in GIS, University of Melbourne, Australia; 2009-present, self-employed international development aid advisor.
Professional Accreditation: Licensed Land Surveyor, Victoria, Australia.
Professional/Academic/Technical Association Service: 1992-1998, Secretary, FIG Commission 7 (Cadastre and Land Management); 1996, President, AURISA; 1996-1999, Member, Surveyors Board of Victoria; 1997-present, Member, URISA ESIG Awards Committee; 2005-2008, Member Surveyors Registration Board of Victoria.
Professional/Academic/Technical Association Memberships Held: Honorary Fellow, Surveying and Spatial Sciences Institute (SSSI).
Awards and Recognition: 1993, 1995, 1999, URISA Horwood Critique Prize; 2005, inducted into the URISA GIS Hall of Fame; 2011, Thornton-Smith Medal, University of Melbourne, Australia.

Michael KEVANY

Education: B.S., Business Administration (Transportation), University of California at Los Angeles (UCLA) 1962; Certificate in City and Regional Planning, University of California at Los Angeles. 1965.
Employment: Los Angeles County Regional Planning Commission 1962-1967 (Regional Planner); System Development Corp. 1967-1971 & 1975-1978 (Project Manager); Datum, Institute for Urban and Regional Planning Bonn, Germany 1971-1972 (Research consultant); University of Tennessee 1972-1975 (Research Assistant Professor, Graduate School of Planning); Independent Consultant 1978-1987 (geographic information, automated mapping, and land records systems services); PlanGraphics, Inc., Silver Spring, Maryland 1987-2009 (Senior Vice President); Independent Consultant 2009-Present (GIS & Emergency Management services).
Professional/Academic/Technical Association Service: URISA Board of Directors, Industry Advisory Board, International Coordinator, Executive Program Chair, Co-chairperson of the Annual Conference Program Committee, Chairperson of SIG GEO, Steering Committee GIS-LIS Conference, Co-Chairperson multiple annual Addressing Conferences, Program Committee GIS-CAMA Conference; Urban Data Management Society UDMS (EU) Board of Directors, National Representative (USA), Society Planning Committee; PlaNET 2005 Global GIS Conference (Portugal), Chair, International Scientific Committee; National Computer Graphics Association, National Director of State Activities and Maryland State Director; ACSM and the American Cartographic Association, Liaison to URISA; National Defense Executive Reservist; PlanGraphics, Inc. Member of the Board of Directors; PlaNET '98 Global GIS Conference Committee (Portugal).
Professional/Academic/Technical Association Memberships Held: Urban and Regional Information Systems Association (URISA), Urban Data Management Society (Europe), National Computer Graphics Association, Spatially Oriented Referencing Systems Association (SORSA), ACSM, American Cartographic Association.
Awards and Recognition: Horwood Distinguished Service Award URISA, 2002, URISA Leadership Award, 1986.
Publications: Information Support for Collaboration in Emergency Response *Urban and Regional Data Management*, Taylor & Francis Group, London, 2009; Improving Geospatial Information in Disaster Management Through Action on Lessons Learned from Major Events, *Geospatial Information Technology for Emergency Response*,Taylor & Francis Group, London, 2008; Geo-Information For Disaster Management: Lessons from 9/11, *Geo-Information for Disaster Management*, Springer Science+Business Media, 2005; GIS in the World Trade Center Attack, *Computers, Environment and Urban Systems*, Elsevier, 2003; A Proposed Structure for Observing Data Sharing, *Sharing Geographic Information*,Center for Urban Policy Research, Rutgers, The State University, 1995; *Geographic Information Systems: A Guide to the Technology*, Chapman & Hall 1991.
Prepared papers for several publications, presented papers at numerous national and international conferences, including URISA, GIS/LIS, NCGA, Auto-Carto, SORSA, UDMS and others.

Gary MAGUIRE

Education: TAFESA, Ass. Dip. Survey Drafting (1989), Adv. Cert. Architectural Drafting (1993), Dip. Geographic Information Systems (2001); Leaders Institute of South Australia, FGLF (2008).
Employment: Government of SA, Department for Lands 1984-86 (Survey Drafter), Digital Cadastral Database 1986-2000 (Land Information Analyst), Department for Environment and Heritage 2000-2002 (Senior GIS Analyst), South Australian Housing Trust 2002-2005 (Senior Spatial Planner), Department for Families & Communities 2005-2007 (GIS Manager), Department for Communities and Social Inclusion 2007-present (Manager Business & Location Intelligence Services), Provide leadership and strategic direction for the delivery of Business and Location Intelligence services and solutions to operational divisions of the Department for Communities & Social Inclusion and the citizens of South Australia. Through guidance and management of staff, Business and Location Intelligence Service delivers business strategies and solutions using the latest BI and LI technologies, with the aim to continuously improve business information acquisition, data management, knowledge distribution and evidence based reporting services.
Professional Accreditation(s): Fellow Governors Leadership Foundation (FGLF), Geographic Information System Professional Asia Pacific (GISP-AP).
Professional/Academic/Technical Association Service: Member Spatial Information Committee (SICOM), Regional Chair Surveying & Spatial Sciences Institute, Member of the National Spatial Sciences Conference 2009 committee, Director, Surveying & Spatial Sciences Institute, President Surveying & Spatial Sciences Institute.
Professional/Academic/Technical Association Memberships Held: Surveying and Spatial Sciences Institute, Leadership Institute South Australia
Awards and Recognition: South Australian Spatial Professional of the Year, DFC Australia Day Award – Innovation, Service to the Spatial Community (South Australia).
Website Postings: Presentations and documents can be viewed at SlideShare.

Nick LAWRENCE

Education: University of Queensland, Bachelor of Science (Geography) 1993, University of Queensland, Post Graduate Diploma GIS, 1994.
Employment: Queensland Department of Main Roads 1996 – present, procuring and distributing spatial data, deploying desktop GIS software, spatial systems development and providing training and support for GIS.
Professional Accreditation(s): Geographic Information System Professional Asia Pacific (GISP-AP).
Professional/Academic/Technical Association Service: National Chair Spatial Information and Cartography Commission, Chair GISP-AP certification panel, Member of the Queensland Regional Committee Surveying and Spatial Sciences Institute.
Professional/Academic/Technical Association Memberships Held: Member Surveying and Spatial Sciences Institute.

Christopher J. PETTIT

Education: University of Queensland, Bachelor of Regional and Town Planning Hon 1995, University of Queensland, Postgraduate Diploma in Geographical Information Systems 1996, University of Queensland, Master of Regional and Town Planning, 1998, University of Queensland, Doctor of Philosophy in the Field of Planning, 2003.
Employment: The University of Melbourne 2011-current (Associate Professor & Strategic Implementation Coordinator AURIN), Victorian State Government Department of Primary Industries, 2004-2011 (Research Manager – Spatial Information Sciences), RMIT University 2002-2004 (Post-Doctoral Research Fellow), University of Queensland 1998-2002 (PhD Student and Casual Lecturer), Commonwealth Government of Australia - Australian Surveying Land Information Group 1998 (Professional Officer – GIS) Queensland State Government Department of Natural Resources 1997 (Technical Assistant – Spatial Information and Mapping).
Professional Accreditation: Member, Surveying and Spatial Sciences Institute (SSSI), Planning Institute of Australia (PIA); Geographic Information System Professional - Asia Pacific (GISP-AP).
Professional/Academic/Technical Association Service: Chair of the ISPRS II/6 - Geographical Visualisation and Virtual Reality 2008-current, SSSI Victorian Committee member 2008-current, SSSI Spatial Information and Cartography Commission member, 2008- current, member of the ICA Commission on Cognitive Visualization 2011- current, member of the ICA Commission on Geovisualisation 2011- current, Director of SSSI 2009-2010, Chair of the SSSI Spatial Information and Cartography Commission 2008-2010, Scientific Secretrary ISPRS Working group – Spatial Planning and Decision Support Systems 2006-2008.
Awards and Recognition: Planning Institute of Australia – Winner Rural and Regional Planning Achievement National Award 2010, Modelling Software Society of Australia and New Zealand MSSANZ Bi-annual Award – Winner of the Early Career Research Excellence 2009, Sendai Prize for outstanding paper, 8th International Conference on Computers in Urban Planning and Urban Management, 2003.
Publications: More than 100 documents (books, chapters, papers, reports. postings) in spatial planning and decision support systems, geographical visualisation, landscape planning, natural resource management and GIS applications.
Website Postings: Presentations, documents and postings can be access online at:
http://www.casa.ucl.ac.uk/geoviz/
http://scholar.google.com.au/citations?hl=en&user=b1WpKn0AAAAJ
http://vro.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/geovisat

Dana TOMLIN

Education: University of Virginia, B.S. 1973; Harvard University, M.L.A. 1975; Yale University, Ph.D. (Forestry and Environmental Studies) 1983.
Employment: Environmental Research and Technology, Inc., 1978-81 (Environmental Planner); Harvard Graduate School of Design, 1975-88 (Visiting Critic, Instructor, Assistant Professor of Landscape Architecture, Associate Professor of Landscape Architecture, Associate Chairman of Landscape Architecture, Assistant Director of the Laboratory of Computer Graphics and Spatial Analysis; The Ohio State University, 1988-91 (Associate Professor of Natural Resources, Associate Director of the Center for Mapping, Director of the Natural Resource Information Systems Laboratory); Harvard Faculty of Arts and Sciences, 1983-94 (Associate of the Harvard Forest); Private Practice, 1975-present (Consultant in Geographic Information Systems); Yale School of Forestry and Environmental Studies, 1989-present (Lecturer, Visiting Professor, Professor Adjunct); University of Pennsylvania School of Design, 1991-present (Associate Professor of Landscape Architecture, Professor of Landscape Architecture, Director of the Regional Planning Program, Founder and Co-director of the Cartographic Modeling Laboratory).
Professional/Academic/Technical Association Service: National Science Foundation (Science and Technology Committee on Long-Term Ecological Research); National Academy of Sciences (National Research Council Mapping Science Advisory Committee; University of Texas – Dallas (Research Advisory Board).
Awards and Recognition: University of Pennsylvania, 1997 (Perkins Award for Excellence in Teaching); University of Pennsylvania, 2002 (Lindback Award for Distinguished Teaching); Urban and Regional Information Systems Association, 2010 (GIS Hall of Fame).
Yale University, 2012 (Graduating Class Award for Teaching Excellence)
Publications: Modeling radial propagation in a grid, 2010 (International Journal of Geographic Information Science, Taylor & Francis); Mapping what isn't quite there, 2011 (Perspecta 44: The Yale Architectural Journal, MIT Press); Gedanken zum geodesign, 2012 (GIS.Science, Wichmann); GIS and cartographic modeling, 2012 (ESRI Press).

Peter H. VAN DEMARK

Education: B.A., 1970, Dartmouth College; M.S., 1973, University of Wisconsin – Madison; Advanced to Ph.D. Candidacy, 1977, University of Wisconsin – Madison
Employment: 1978-1994, Senior Research Analyst/Cartographer, Center for Governmental Research Inc. 1994-present, Director of GIS Products and Training, Caliper Corporation.
Professional/Academic/Technical Association Service: 1987-1990, Member, URISA Board of Directors; 1989-2000, Member, URISA Journal Editorial Board
1996-1998, President, New England Chapter of URISA; 1998-2009, Board Member, New England Chapter of URISA; 2001-2002, Member, Horwood Critique Committee; 2002-2004, Member, Workshop Committee.
Professional/Academic/Technical Association Memberships Held: Association of American Geographers; Canadian Cartographic Association.
Awards and Recognition: 1997, Leadership Award, URISA.

Barry WELLAR

Education: Queen's University, B.A. 1964, Hon. B.A.1965 (Economics, Commerce, Geography); Northwestern University, MS 1967 (Geography), Ph.D. 1969 (Geography).
Employment: University of Kansas 1969-1972 Assistant Professor and Research Associate, Department of Geography, Institute for Social and Environmental Studies, Space Technology Laboratory; Government of Canada, 1972-1979 Senior Research Officer, Assistant Director, Director, Senior Policy Advisor; University of Ottawa, 1979-2005 Professor of Urban and Regional Planning, and Geography and Environmental Studies; 2005-present, Principal, Wellar Consulting Inc., President, Information Research Board (IRB) Inc. Consulting in transportation and land use planning, sustainable transportation, geographic information systems and science, pedestrians' safety, standard of care analysis, decision support methods, index design, testing, and application, expert planner and expert witness opinions.
Professional Accreditation: Member, Canadian Institute of Planners (MCIP), Ontario Professional Planners Institute (OPPI), and Registered Professional Planner RPP); Geographic Information System Professional (GISP).
Professional/Academic/Technical Association Service: Director, Vice-President and President, Urban and Regional Information Systems Association; Chair, Applied Geography Specialty Group, and Anderson Medal Committee, Association of American Geographers; Director and Annual Conference Program Chair, Small Town and Rural Division, Annual Conference Program organizer Economic Development Division and Information Technology Division, American Planning Association; Director, Geography Awareness Week, Canadian Association of Geographers; Research Fellow, Transport Action Canada; Policy and Research Advisor, Federation of Urban Neighbourhoods.
Professional/Academic/Technical Association Memberships Held: American Planning Association, Canadian Institute of Planners, Regional Science Association, Transportation Research Board, Urban and Regional Information Systems Association, Canadian Association of Geographers, American Association of Geographers, Government Technology, GISWorld, Small Town Institute, Ontario Professional Planners Institute, Transportation Research Board, Transport Action Canada.
Awards and Recognition: National Association of Towns and Townships (U.S.), Canadian Association of Geographers, Urban and Regional Information Systems Association, American Institute of Planners, Association of American Geographers, Mid-America GIS Conference, The White House (Carter Administration); Canadian Parliament, University of Ottawa, Temiskaming District Secondary School.
Publications: More than 600 documents (books, chapters, papers, reports. postings) in information systems, GIS, planning, development, transportation, indexes, housing, indicators, policy analysis, road safety, pedestrians' standard of care, research methods, sustainability, environmental assessment, decision techniques, urban analysis, interdependent infrastructures, transit, governance, and standard of care.
Website Postings: Presentations and documents can be viewed at various websites including slideshare.net, transportaction.ca, urbanneighbourhoods.ca, cag.org, wellarconsulting.ca, geomatics.uottawa.ca, and urisa.org.

Ed WELLS

Education: Stanford University, B.A., Human Biology, 1972; Cornell University Department of City and Regional Planning, 1976-1980; Carnegie Mellon University Heinz School, Master of Public Administration, 1999.
Employment: Ed Wells is employed as the GIS Manager for the Washington (DC) Metropolitan Area Transit Authority. He has over twenty-five years' experience as a GIS manager and consultant in the public and private sectors. He managed the implementation of Pittsburgh's GIS from 1984-1995.
Professional Accreditation(s): GISP, PMP.
Professional/Academic/Technical Association Service: Ed has been a URISA member since 1984, has served on URISA's board of directors, and is a Past President of the URISA Board.
He is the co-author of the URISA workshop "Public Data, Public Access, Privacy, and Security: US Law and Policy."
He is also co-chair of the URISA Address Standard Working Group (ASWG), which developed the FGDC's *United States Thoroughfare, Landmark, and Postal Address Data Standard.*
He has chaired the URISA Chapter Relations Committee and the URISA Workshop Development Committee, and was a founding member of GISCorps.
He was the founding president of the URISA Central Appalachian Chapter.
Awards and Recognition: URISA Service Award, 2004; Barbara Hirsch Special Service Award, 2005 (as ASWG co-chair).

Martha McCart WELLS

Education: B.A., Geography/History, San Francisco State University, 1969, M.S. Resource and Regional Planning, University of Massachusetts, 1970.
Employment: Co-founder and President of Spatial Focus, Inc., GIS/Addressing consultancy, 1998-present; Director of International Marketing, American Cadastre, 1995-1998; GIS Manager, Gwinnett County (GA), 1988-1994, President, Lombard-McCart Associates, Sausalito, CA, 1980-1988; Executive Officer, Coastal Zone Management, Government of the Northern Mariana Islands, 1978-1980; Director of Community Development, Town of Tiburon (CA), 1976-1978, Associate Planner, Town of Tiburon (CA), 1974-1976; Associate, Jones and Stokes Associates, Sacramento, CA, 1972-1974; Associate, Harry Halatyn, ASLA, AICP, Sacramento, CA, 1970-1972.
Professional Accreditation(s): GISP (2008-present)
Professional/Academic/Technical Association Service: URISA President (2003), URISA Board of Directors, 1995-1998, 2001-2004, URISA National Conference Chair 2003; URISA National Conference Program Chair, 2001-2002, URISA National Conference Committee, 1995-2004, URISA Workshop Committee, 1993-1995, URISA Workshop Author and Instructor (GIS Project Management, Addressing), 1993-2012, URISA Leadership Academy Author, Coordinator and Instructor, 2006-2012, URISA Address Standard Working Group Co-chair, Author, 2005-2012.
Professional/Academic/Technical Association Memberships Held: URISA (1986-present)
Awards and Recognition: Horwood Award (2011), URISA Leadership Award, 1999, URISA Barbara Hirsch Special Service Award (2006, 2010).
Publications: United States Thoroughfare, Landmark and Postal Address Data Standard, co-author with Carl Anderson, Hilary Perkins, Ed Wells and Sara Yurman, FGDC, 2011.
Website Postings: Presentations and documents can be viewed at www.spatialfocus.com (presentations), www.fgdc.gov (Address Standard), www.urisa.org (presentations, webinars and FGDC Address Standard).