CANADA SCIENCE AND TECHNOLOGY MUSEUM

INTERPRETIVE CONCEPT MASTERPLAN

SEPT 2015

ALDRICHPEARS ASSOCIATES

CANADA SCIENCE AND TECHNOLOGY MUSEUM
MUSÉE DES SCIENCES ET DE LA TECHNOLOGIE DU CANADA

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INTRODUCTION

1.0 INTRODUCTION

The Interpretive Concept Masterplan is the Canada Science and Technology Museum's (CSTM) foundational document for development and design of the Museum's new visitor experience. Developed by CSTM staff in coordination with design, interpretation and facilities consultants, the Masterplan is an articulation of the new CSTM's project fundamentals and should be used as the start point for the design dialogue moving forward. The Masterplan is intended as a reference for all CSTM staff, project architects and designers who will be contributing to the upcoming design of exhibits and interpretation. It includes a high-level intellectual framework for organization of interpretation, as well as a strategies for implementation of digital and mobile technologies that will form an integral part of the CSTM experience. It concludes with a set of overarching exhibit design guidelines and architectural requirements; these itemized, technical requirements are provided to inform the architects and design teams who will be contributing to the design process moving forward. The Masterplan concludes with a high-level overview of this process, highlighting strategies for procurement and prototyping in the upcoming design phases.

1.1 Project History

The master planning exercise began on April 7, 2015, with discussion and review of project parameters and objectives, relevant resources CSTM had developed to date, and a preliminary assessment of the architectural requirements for the new Museum. This was followed by two focused multi-day workshops in May and June, as well as a public consultation process that is detailed in Appendix A of this document. CSTM staff and consultants collaborated with AldrichPears Associates (APA) to develop high-level conceptual categories of visitor experiences, an overarching thematic framework, loose interpretive hierarchy and a functional programme for the building. These were refined and elaborated upon through further research and consultation with CSTM. A draft version of the project foundations captured here were presented to CSTM stakeholders and staff in June, and subsequently revised according to stakeholder and staff feedback.

1.2 Masterplan Summary

This Masterplan consists of five sections supplemented by appendices. The sections are summarized as follows:

1.2.1 Situation Analysis

This section lists the project's principal underpinning considerations with analysis, where appropriate, of how these considerations factor into the development of the Masterplan. The section documents the Museum mandate, location and facility, and provides an audience analysis and overview of the collection in CSTM's thematic development and visitor experience.

1.2.2 A Defining Vision

The defining vision is the core of the Masterplan. It contains the big-picture conceptual statements upon which the building's functional programme and design guidelines are largely based. The vision provides a high-level intellectual framework that prescribes an interpretive arrangement of four Core Galleries (in addition to a Children's Gallery and Maker Space). The framework also includes a set of overarching interpretive principles that represent story categories and/or interpretive touchstones that may recur throughout the Museum. These principles will provide curators and interpretive planners with a start point in the development of the interpretive programme as research and conceptual design progresses.

The defining vision provides a preliminary articulation of interpretive goals and objectives. These interpretive goals and objectives were developed in coordination with CSTM's curatorial and interpretive planning staff, based on preliminary curatorial research of the institution's collection. These goals and objectives will be revised and expanded upon as curatorial research progresses in the next phase of work.

A visitor experience section within the defining vision illustrates how the thematic framework may manifest; the visitor experience is intended as a highly conceptual illustration, developed without the benefit of the galleries' exhibition subthemes that will follow as research, interpretive planning and design progresses.

Finally, the defining vision offers an overarching plan for implementation of digital media on the gallery floor as well as implementation of mobile technologies as part of the Museum's national outreach programme. It concludes with a high-level strategy for active interpretive engagement with cutting-edge science and technology developments, presented through case studies of two successful exhibitions in the Museum of Science and Industry in Chicago and the Cité des Sciences and de l'Industrie in Paris.

1.2.3 Functional Programme

This section presents a high-level functional organization of the Museum space, outlining all essential Museum functions and spatial designations. The functional programme includes early-stage schemes for public access, gallery adjacencies and visitor circulation. It also responds to functional requirements with respect to operations, presenting artefact and equipment access and circulation and facility rental opportunities. It concludes with a list of base-building requirements to be incorporated into the architectural plan as design progresses.

1.2.4 Design Guidelines

The design guidelines section is a tool for the design-build teams who will be designing the new Museum in coordination with CSTM. It represents a largely technical set of design and architectural recommendations that provide high-level guidance as work progresses and articulates a set of crucial design standards that teams must adhere to as well as a series of looser guidelines. These guidelines are the outcome of first-stage design discussions between CSTM and APA, based on the ideas captured in the Masterplan's defining vision.

1.2.5 Next Steps

This section captures key considerations moving forward into the project's next phase. It outlines an overarching procurement strategy, as well as the place of prototyping in design of the new CSTM.

1.3 Glossary of Terms

Common Spaces

Refers to areas of the Museum accessible to the public that are not a Core Gallery.

Contracted Design Team (Contractor)

Consultant contracted to design a specific gallery or other specific area.

Core Gallery

Refers to the four main galleries: Moving and Connecting Gallery, Transforming Resources Gallery, Creating and Using Knowledge Gallery, and Technology in Our Lives Gallery.

Design Overview Coordinator (DOC)

The Design Overview Coordinator (DOC) will provide overarching design direction to the Contracted Design Teams during the development of the Museum's Core Galleries and Common Spaces (Making Canada, Demo Stage, Artefact Alley, Circulation, and Wayfinding).

Exhibit

Exhibitions are composed of multiple exhibits. An exhibit is a three-dimensional installation designed to provide Museum visitors with opportunities to "see, feel, think and do". Exhibits may include, but are not limited to, objects (including artefacts), 2D images and artworks, printed texts, audio-visual units, built furnishings, digitized content, computer terminals, kiosks and interactive elements.

Exhibition

Exhibitions are collections of exhibits that work together to form a cohesive thematic installation in a designated gallery, providing an enriching and engaging Museum experience for visitors.

Gallery

A gallery is composed of multiple exhibitions all linked by one overarching theme. Galleries provide high-level direction to the exhibition development. They are supported by theme statements that identify a general interpretation for the exhibitions found within the space.

Science

A set of research practices (intellectual and practical) that use observation and experimentation to produce bodies of knowledge about the physical, natural, and social world.

Technology

The objects, techniques and knowledge we use to achieve some practical goal.

SITUATION ANALYSIS

2.0 SITUATION ANALYSIS

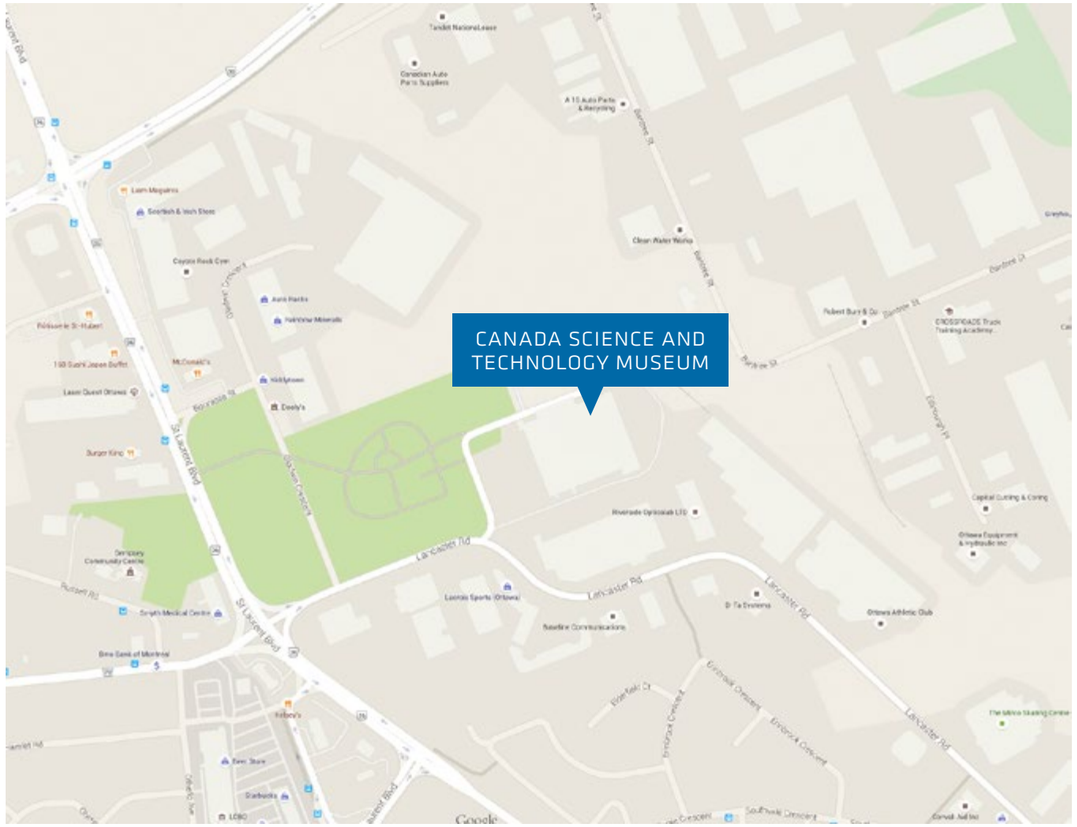
2.1 Mandate

The Canada Science and Technology Museum is mandated to foster scientific and technological literacy throughout Canada by establishing, maintaining and developing a collection of scientific and technological objects, with special but not exclusive reference to Canada, and by demonstrating the products and processes of science and technology and their economic, social and cultural relationships with society .

2.2 Location and Facility

The Canada Science and Technology Museum is a 17-minute drive from Parliament Hill, Ottawa's most recognizable icon, and a 20-minute drive from the Canadian Museum of History, Ottawa's most visited museum. It is located between the intersections of St-Laurent at Innes and St-Laurent at Walkley, two of the highest intersection volume points in the City of Ottawa, both of which feature an average daily volume of 40,000 to 50,000 passengers.

The CSTM is housed inside a building that is a repurposed bakery distribution center. It has served as a "temporary" facility for the past 48 years. The CSTM is now closed to the public while remediation is undertaken. The facilities team is working hand-in-hand with the exhibition team to make sure they address the serious access, circulation and environmental issues that have made it a challenging facility to operate. When it reopens in 2017, the new facility will be better suited to function as the home of our nation's Science and Technology Museum.



2.3 Audience

CSTM has a stable core of predominantly local members and repeat visitors. Conversely, CSTM has experienced a steady decline in visitation over the last decade, particularly among school groups and families. While a refreshed CSTM visitor experience will invigorate visitation, the exhibit programme will need to provide layered experiences that inspire a dialogue and continued engagement between the target audience and Museum. Additionally, the national mandate directs design to expand CSTM's presence beyond the National Capital region, which will entail a dramatic expansion of the Museum presence beyond its current local base audience.

Summary of Average Audience Statistics

- More than half of adult visitors have children under 18.
- More than half of adult visitors are motivated by their child's interest.
- More than half of adult visitors visit with family members.
- More than 2/3 of visitors are returning visitors.
- Almost 2/3 of visitors are from the National Capital Region.

Summary of Attendance Trends

- Attendance has declined an average of -2% per year for the past decade.
- Most notable declines have been in School Groups (-7%/yr) and Families (-6%/yr).
- Member Visits (+1%/yr) and Facility Rentals (±0%/yr) have been relatively stable.

Analysis of Trends

- Demographics are skewing older and school enrolment is declining in the National Capital Region but the rate of decline in Family and School Group attendance outpaces the trends.
- Children, either as part of a School Group or Family visit, have traditionally been a key segment of CSTM's Audience.
- The perception that the Museum exhibits do not change, is in disrepair, and doesn't keep up with advances in technology has contributed generally to declining attendance.
- There is a perception that the Museum does not have enough activities for children.

Target Audience

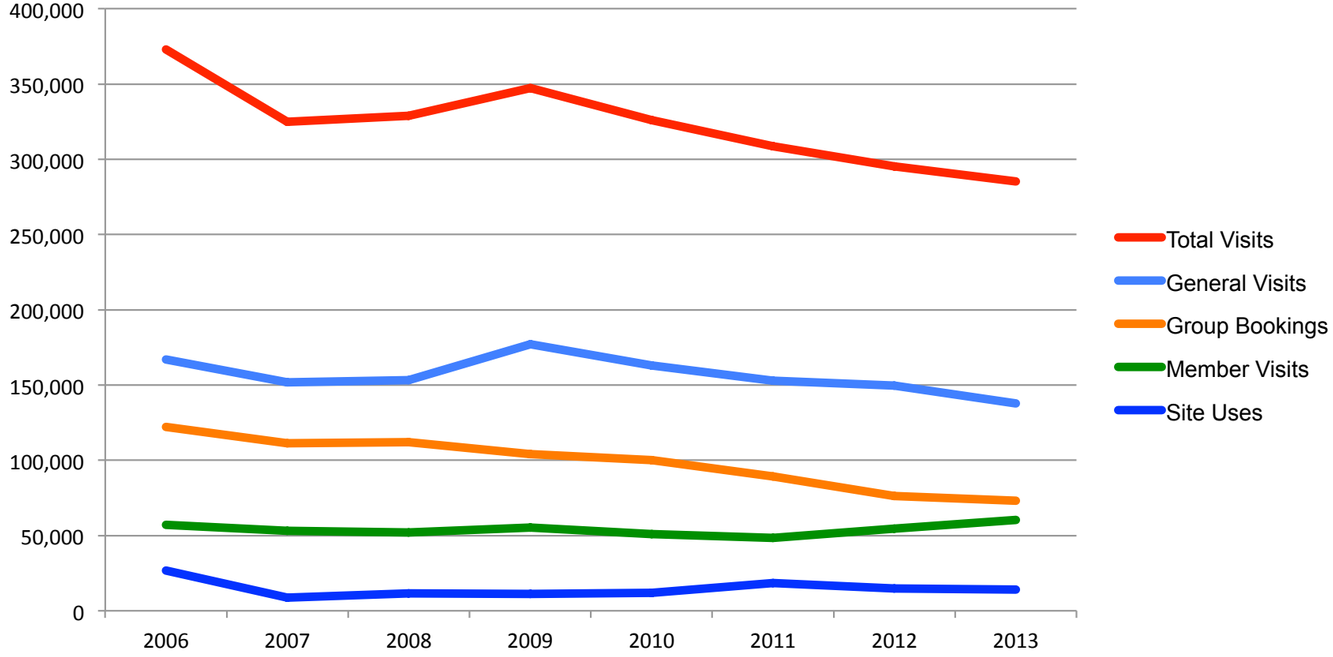
To ensure year round attendance the Museum must appeal to a local family market. These are the people who will visit outside of the peak tourist season.

Primary Audiences:

- Local families
  - Exhibitions are aimed at intergenerational groups (children, adults, seniors visiting as a unit).
  - The Children's Gallery targets children 2 to 10 and their parents/caregivers.

Secondary Audiences:

- Science and technology enthusiasts (all ages)
- Visitors to the Capital Region
- Teens are a primary target for the Maker Space



2.4 The Collection

The Canada Science and Technology Museum is home to the largest collection of scientific and technological artefacts in Canada. The collection is organized in the following categories:

- Communications
- Transportation (Land and Marine)
- Energy and Mining
- Industrial Technology
- Scientific Instruments
- Medical Technology
- Domestic Technologies
- Computing and Mathematics

It is a unique collection and a defining characteristic of the institution. At the time of closing, fewer than 3% of the artefacts were on display, and only props and reproductions could be handled by visitors. One of the goals of the renewed CSTM is to place many more artefacts on display and make them relevant to visitors. To that end, the curatorial team was tasked with identifying artefacts in the collection that could meet the following criteria.

Thematic Considerations

Canadian Context. Canadian scientific and technological endeavour is reflected in the challenges encountered and the choices made in the development of the country.

- What makes an artefact iconically Canadian?
  - Made in Canada
  - Representation of something distinct in Canadian culture
  - Technological response to a uniquely Canadian issue
  - Scientific phenomena and technological systems discovered or invented in Canada
  - Iconic to a moment in Canadian history
  - Technologies that have transformed the Canadian environment

Finding New Ways. Science and technology play key roles in efforts to find new ways of living, learning and working.

- Artefacts in the collection that represent dramatic turning points in human technological history.
- Consider connections with the Museum's mandate on interpreting the future. How can messaging use artefacts that represent technological pivot-points in human history to interpret the future?

How Things Work. Developing a knowledge of how "things" work can help people better understand the factors that have contributed to the making of Canada.

- Artefacts that lend themselves well to live demonstrations, or easy interpretation of the way they function.
  - Assess what artefacts can be disassembled and/or used for interpretive purposes.
- Artefacts that represent innovative processes/technologies that were invented in Canada.

People, Science and Technology. Our culture and lives are shaped and influenced by scientific and technological change. At the same time, individually and collectively, people shape the evolution of science and technology through their decisions and actions.

- What artefacts effectively represent the way technology has been a factor in massive social change?
- Is there a category for artefacts that evolve/are modified based on user interaction with them?

Experience Considerations

Hands-on Experiences

- What artefacts exist in the collection that visitors can always touch unsupervised?
- What artefacts exist in the collection that visitors can occasionally touch while supervised?

Interactive Experiences

- What artefacts exist in the collection that visitors can operate unsupervised?
- What artefacts exist in the collection that staff can operate as part of a demonstration?

Visually Impressive (aesthetic, scale, etc.)

- What artefacts exist in the collection that will be visually impressive to visitors?
  - Huge things
  - Smaller things en masse
  - Beautiful things
  - Weird things

Reveals Their Inner Workings

- What artefacts exist in the collection that display their function through their form?
- What artefacts can be disassembled and animated to demonstrate their function?
- What artefacts cannot be disassembled so would require virtual means to demonstrate their function?

A DEFINING VISION

3.0 A DEFINING VISION

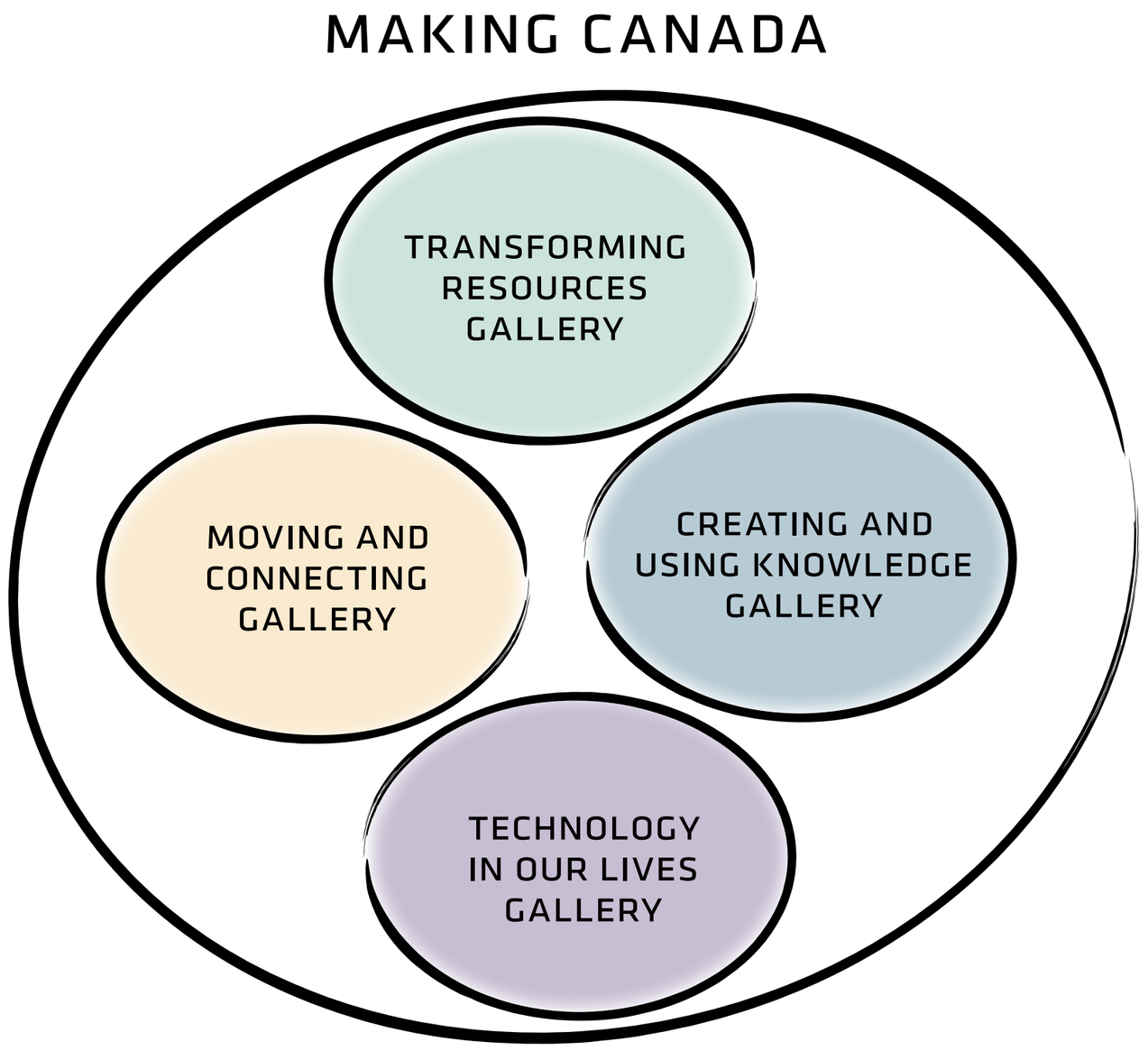
The following section contains the Masterplan's fundamental recommendations for design, based on an overarching intellectual framework that organizes CSTM's interpretation into four Core Galleries: Moving and Connecting, Transforming Resources, Creating and Using Knowledge and Technology in Our Lives, as well as a Children's Gallery and Maker Space. The basis for upcoming interpretive planning is also documented in the following pages, which include a preliminary set of interpretive principles, as well as goals and objectives that will inform exhibition narratives within the galleries. An articulated list of visitor experience categories serve as a start point for the development of the design concept along with strategies for digital and mobile media. The defining vision concludes with a high-level strategy for active interpretive engagement with cutting edge science and technology developments, presented through case studies of two successful exhibitions in the Museum of Science and Industry and the Cité des Sciences and de l'Industrie in Chicago and Paris, respectively.

3.1 The Intellectual Framework

This section provides the preliminary intellectual framework that marks the start point for the curatorial and design dialogue upon which CSTM's exhibitry will be built. The framework is captured by a principle "Making Canada" conceptual statement that provides high-level direction for overall exhibit development, supported by four theme statements that identify a general interpretive direction for four Core Galleries. The curatorial and interpretive team has tied these statements together with a set of overarching interpretive principle statements—a list of recurring story angles to be employed in exhibitions throughout the Museum. As content research and design progresses in the coming phases, the intellectual framework for these galleries will be refined to include visitor-oriented theme statements and subthemes that will encapsulate individual exhibitions within each of the galleries.

3.1.1 Thematic Organization

CSTM's preliminary thematic organization, pictured here, prescribes a four-gallery breakdown for the new Museum. Principle conceptual and thematic statements are described on the following page.



Making Canada Overarching Concept

Through scientific and technological endeavour people have made Canada and continue to shape its future.

This overarching conceptual statement provides a high-level start-point for development of CSTM's exhibitry. There are three key components of this statement that provide intriguing avenues for interpretation:

1. **"Through scientific and technological endeavour…"**
   Science is a set of research practices (intellectual and practical) that use observation and experimentation to produce bodies of knowledge about the physical, natural, and social world. Technology consists of the objects, techniques and knowledge we use to achieve some practical goal. Interpretation will explore scientific and technological endeavour as a set of social and material practices driven by curiosity, observation, creativity and innovation, with results that are surprising, fascinating, and often unpredictable.

2. **"…people have made Canada…"**
   Our science and technology processes and products have shaped perspectives, material/environmental realities and social dynamics, thereby "making" the Canada we know today in all its diversity and complexity. Interpretation will place people in the foreground of CSTM's stories, while embracing the Museum's national mandate by balancing Canadian context with broader universal narratives of human experiences with science and technology.

3. **"…and continue to shape its future."**
   The story of science and technology in Canada is a story of constant making and remaking. As the science and technology dialogue continues, new perspectives, material/environmental realities and social dynamics emerge. Sometimes the consequences of these changes are unforeseen.

Gallery Themes

Moving and Connecting

We use transportation and communication technologies to solve practical problems, in the process changing our sense of time and space and redefining our relationships with each other.

This gallery explores transportation and communication technologies on two levels. Practically, it focuses on the role of transportation and communication technologies in the movement of people, goods and information—in the context of individuals' day-to-day lives as well as global networks to which these technologies create and provide access. The gallery also explores what transportation and communication technologies represent: tools that allow us to transcend physical and temporal limits, mediums for creative expression and transmission of culture, symbols of personal identity and community, and key factors that shape how we view our physical and cultural landscapes.

Transforming Resources

Canadians have deployed knowledge, practical skill and technological tools to the ever-changing process of transforming the resources around us into energy forms and things that we consume. The choices we make in transforming energy and materials bring benefits as well as consequences.

Industry, energy, manufacturing, production: this gallery explores the creation of energy and materials by way of manifold resource transformations that make up Canada's constantly evolving economy. This includes processes of transformation of our natural resources as well as the way manufacturing processes create materials and other industrial products. The gallery will also explore the byproducts and consequences of industry—the planned as well as the unforeseen.

Creating and Using Knowledge

Scientific explorations have shaped and been shaped by our society, our perspectives, and our environment. These explorations continue to generate new knowledge and powerful new questions that are a fundamental part of the transformation of Canada.

Interpretation in this gallery focuses on the pursuit and use of knowledge. It looks at the intellectual, practical and material exploration of our surroundings, from the infinitely large (outward macro perspectives of the universe beyond Earth) to the infinitesimally small (micro perspectives of subatomic realms), and the way these explorations provide new perspectives from which to launch further inquiry.

Technology in Our Lives

Just as we transform technologies, our lives are shaped by day-to-day interactions with technology—interactions that have changed over time.

This gallery explores the way Canadians encounter and interact with technology in day-to-day life, focusing on the nature of these interactions in the context of the household, workplace, community, streets, etc. Exhibits may investigate what these daily interactions signify and how they have changed, underlining the way consumer manifestations of science and technology plug people into global cycles of production and consumption as well as obsolescence and waste.

3.1.2 Interpretive Goals and Objectives

The curatorial and interpretive planning team is in the process of advancing the thematic framework for each of the four identified galleries. This entails further research of the Museum's collections and identification of the interpretive goals, objectives and subthemes that will define the constituent exhibitions in each gallery. The tables documented in Appendix B of this document represent the first steps in this process. The documented interpretive goals and objectives are the outcome of a June 3 – 4, 2015 workshop, when the team gathered to develop and discuss a set of interpretive goals for each gallery, articulating key messages that the Museum will aspire to deliver to visitors. Development of related interpretive objectives, topics and possible objects for display for each of the galleries followed the June workshop, further detailing the thematic possibilities in each area. Note these tables are a snapshot of work in progress. Interpretive goals and objectives will shift as curatorial research progresses in the coming phase of work; at the time of writing, not all of the galleries have been documented to the same level of detail.

3.1.3 Interpretive Principles

The curatorial and interpretive planning team developed the following list of interpretive principles. These represent overarching story categories, or interpretive angles, that will recur throughout all four Core Galleries. As research progresses over the next phase of work, these principles may provide key interpretive touchstones in the development of gallery themes and subthemes; some of these principles may be formalized within the interpretive plan as recurring story nodes.

Process Behind Creation

Stories related to the creative motivations, processes, inspirations and innovations in science and technology will recur throughout the Museum. In exploring creation, interpretation may reference the links between the past and the future. How have science and technology-related motivations, processes and aspirations remained consistent throughout time? How have they changed?

- Current producers/innovators and design processes
- Human creativity and innovation and how they drive change
- Designs—of experiments, objects and systems—embody visions of the future
- Motivations behind creation
- Science as a human practice, with all the complexities that fact entails

Canadian Context

Science and technology are both products of the societies in which they are embedded and are implicated in social, economic and cultural change. They do not exist outside history. Understanding scientific and technological change requires an understanding also of the changing historical circumstances of Canadian society.

- Provide a sense of time and place
- Show connections to relevant social, economic and political events and trends
- Look for opportunities to highlight continuities and discontinuities between contemporary and historical phenomena
- Look for clues to the future in precedents from the past

The Human Experience

As indicated in the overarching conceptual statement, people are placed in the foreground of CSTM's science and technology narrative. There is rich opportunity to explore multiple aspects of human relationships with science and technology—personal emotional connections, functional dependencies, national and global networks, and many others.

- Experience science and technology on different levels (personal, national, global).
- Personal/local connections with science and technology
- How people work with science and technology

Functions and Uses of Technology

Technologies are closely associated with practical functions, which often act as enhancements of natural human capacities. Interpretation of the various kinds of work technologies perform will be a recurring interpretive theme throughout the Museum.

- Objects perform different kinds of work

Making Things

People's place in CSTM's science and technology story also manifests in exploration of how technological objects are made, how they work and how they can be adapted.

- Processes of making things and how things work
- Making and breaking (and modifying, fixing, adapting, etc.)
- Taking things apart/making things

Transformations

The impacts of science and technology applications are manifold and frequently unforeseen. Stories about social, environmental, economic and personal consequences of applied science and technology transformations will recur throughout the Museum. For everything that is gained, something is often lost.

- Change and consequent gains and losses
- Technology as a disruptive force
- Scientific and technological change can transform social and physical environments
- Change manifested in the objects we create and use

Appreciation of 'Things' [*not connoisseurship]

The CSTM collection provides an opportunity for visitors to appreciate the many dimensions of the things we make and use. These may manifest in various ways throughout the Museum.

- Materials
- Construction
- Design
- Function
- Aesthetics

3.1.4 Categories of Visitor Experience

The CSTM masterplan exercise began with a May 6, 2015 creative workshop that focused on establishing a set of visitor experience categories. The intent of these categories is to provide a foundational start point for conceptual development of exhibit design when work proceeds into the next phase. The full outcome of this workshop has been tabulated and included in Appendix C. The visitor experience categories that were developed are summarized below.

Engage with a Historical Narrative

History is a major element of the CSTM experience. This was underlined during the visitor experience workshop, where many of the proposed experiences involved different ways visitors might engage with CSTM's historical narratives. This includes exhibits that reference the place of popular sentiment and nostalgia in science and technology narratives. Exhibits should employ various methods of accessing science and technology histories, with emphasis on creative sensory interfaces that connect visitors with science and technology stories through touch, smell and sound-based artefact interactions.

Creative and Collaborative Use of Technology

The visitor experience should provide opportunities for exploration of technologies and the processes behind their creation, as well as different technologies' functions, interfaces and outputs. The clearest and most evocative way to put visitors in touch with technological objects is to allow visitors to use them as they were intended, to create a finished product or to engage with them through interactive exhibits that are designed to deliver a creative outcome. Suggested experiences illustrated different ways visitors might engage with real and/or recreated technological objects and/or processes in evocative and engaging ways.

Hands-On Exploration and Analysis

In addition to providing creative engagement with science and technology, exhibits should also provide analytical experiences with science and technology topics. This requirement was prescribed by a set of proposed experiences that focused on revealing or deconstructing objects, with the intent of discovering how an object works or what function it was designed to fulfill. Visitors might also handle real or recreated historical technologies from a set of designated demonstration artefacts within the collection, to experience and understand how and why they work as well as appreciate what made certain objects historically innovative.

Immersive Narratives

The idea of 'journey' figured prominently during the workshop, particularly full-body, immersive journeys that create an illusion of transportation to another place—back in time and across the country in a historic locomotive, across the cosmos from the perspective of the Hubble telescope, borne to another planet upon a futuristic rocket. Intellectual immersion is also included in this category, where visitors might explore user-generated content on a large-scale digital map of Canada, or use applications designed for mobile devices to experience alternate physical tours (or remote virtual tours) of the Museum.

Appreciation of Technological Forms and Functions

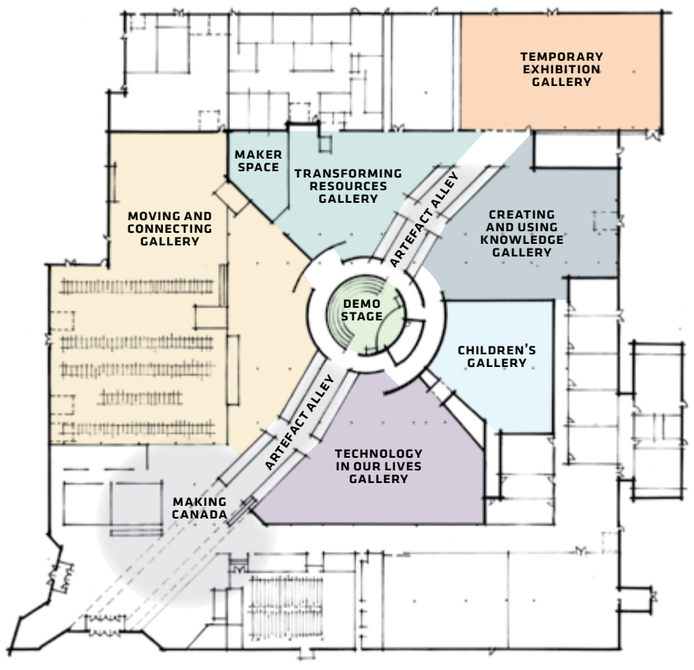
There is an intrinsic beauty to many technological forms and science-based patterns. Exhibitry should bring these forward through experiences that emphasize relevant objects, visuals and/or ideas that are exceptional in terms of complexity, beauty, scale and grace.

A Welcoming and Engaging Space

The importance of feeling welcome and comfortable was also identified as a key part of the visitor experience. This includes intuitive orientation and circulation, accessibility, a quality café experience, a comfortable interior space, and welcoming and knowledgeable staff.

3.2 Visitor Experience

This section provides a snapshot of how key areas inside the new Canada Science and Technology Museum work “on the ground”—that is, what visitors may be able to see and do when they visit. Each component is described as the visitor might experience it. Narrative descriptions, conceptual sketches, and reference imagery are called upon to highlight the significance of key components in the visitor experience (why it is special) and tease out proposed/sample visitor experience ideas. The descriptions that follow are highly conceptual, documented for the Masterplan in advance of in-depth curatorial research and subsequent interpretive planning that will define the subthemes and messages of the exhibitions within each of the galleries. The proposed location of each of these spaces within the Museum is illustrated in the plan view below.

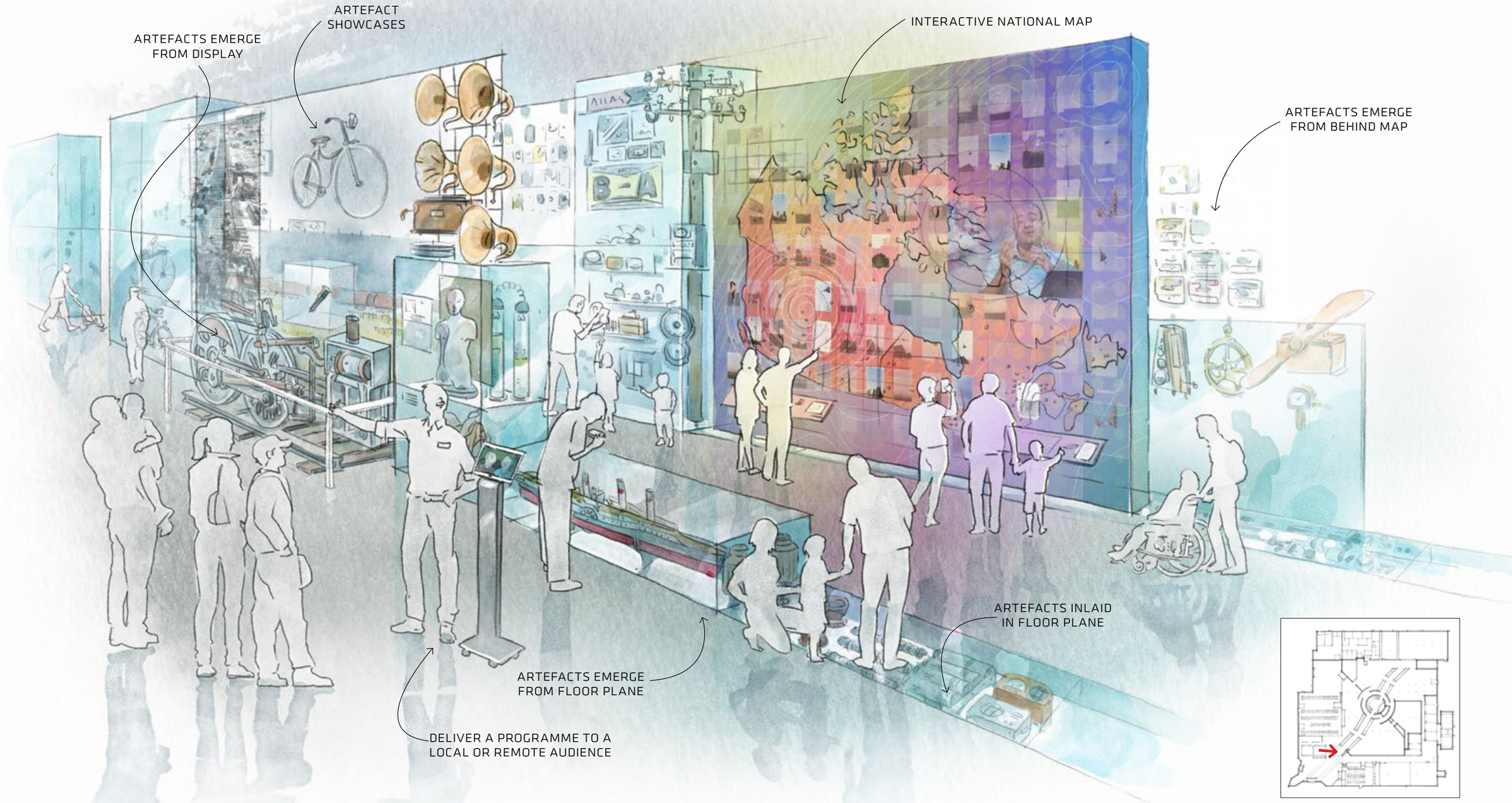


3.2.1 Making Canada

One step inside the new Museum entry, Making Canada, visitors to the new Canada Science and Technology Museum know this won’t be any ordinary museum visit. Doors close with a rush of excitement as visitors step into the bright, airy lobby and cast a gaze northward. It’s hard not to notice the dynamic mass of colour and shape high in the ceiling overhead: a fleet of vintage typewriters or perhaps an iconic carriage, never before seen from this angle, tell all who can’t help but look up that this is a place about objects and their untold stories—the things we make and use everyday. Here, architectural features, interpretation, and wayfinding are well-integrated, and visitors immediately understand where to go to purchase an admission ticket. Other simple questions (What can I see here? Where are the washrooms? How do I access the Boutique or Cafeteria without paying admission? How long is the Museum open? etc.) are addressed through visual cues, clear accessibility, wayfinding and other signage, as well as enthusiastic staff on hand at the ticket counter.

Ahead, two rows of cases house artefacts of all sizes, shapes, and textures. But it is a large map of Canada, the Interactive National Map, that beckons first, emerging like an artefact from between layers of glass: colourful, dynamic, and constantly changing as visitors here and beyond the Museum’s walls contribute to its ever-shifting image in real-time. Today, the Museum asked Canadians to share a snapshot of a technology they can’t live without and the results are instantaneous: photographs stream in by the second and the map evolves with each new contribution. It is a visual reminder that this is more than a museum about objects—it’s about how those objects connect to people through shared stories and experiences. Visitors quickly discover that they, too, can contribute to this photographic collage for all to view on the larger-than-life map, and feel encouraged to check in virtually once they return home to see what Canadians far and wide post next.

MAKING CANADA



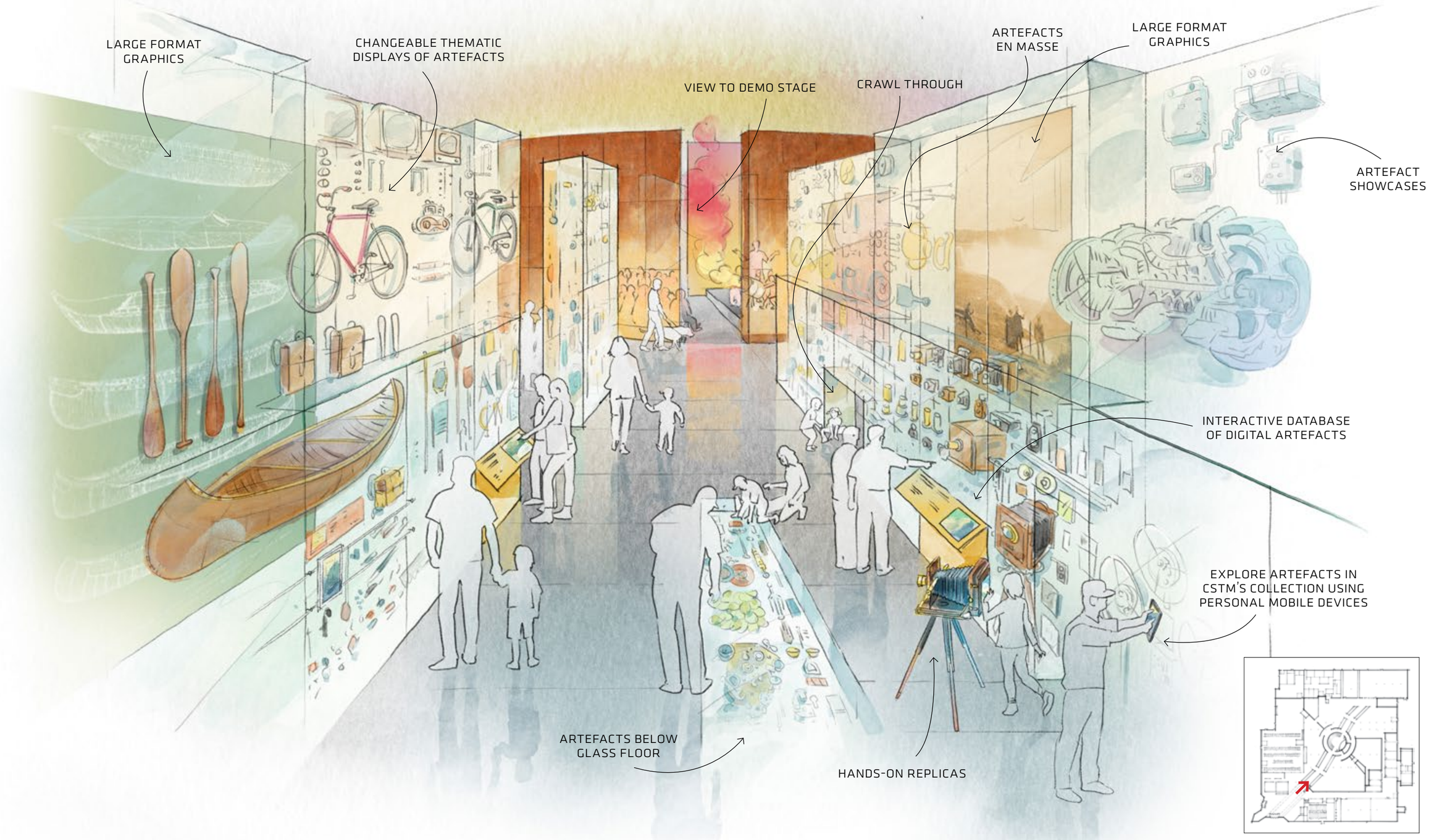
3.2.2 Artefact Alley

Rows of telephones and engines, a collection of player pianos, and even the famous last spike: this is Artefact Alley, and it's an impressive place to take a walk. Visitors are drawn down this lush, linear space by the sheer quantity of objects in view. Artefacts of all sizes flank the walls of the Alley, most in well-lit glass cases stacked one on top of another in ever-increasing heights. Many are grouped together; others suspended overhead; and some stand proudly on their own, finally enjoying a moment in the limelight. It's eye candy, yes, but the objects don't appear impulsively placed or out-of-bounds—they're dramatic, front and center, and best of all, accessible.

Here, artefacts tell the story, and each story calls out to someone different. One visitor heads to a wall of cameras, another to a chunk of telegraph cable beneath their feet, while a third stands quietly near a turn-of-the-century printing press, utterly fascinated by its wheels and cogs. Whatever their interest, they'll see it here in Artefact Alley—but it's about more than just visible storage, and as they meander visitors pause to engage with the objects around them. Interactive digital stations reveal untold stories behind key artefacts while others, partially exposed in their cases, invite passersby to take a closer hands-on look at how they work.

Despite this imposing display of objects on all sides, visitors have no problem getting around. Indeed, Artefact Alley becomes their compass for navigating through the Museum. It's a familiar route and easy to traverse, but there are still opportunities to veer off into one of the Museum's four Core Galleries. Every now and then, an unexpected break in the wall invites visitors to detour; crawl-throughs allow the adventurous to slip through, while larger pass-throughs offer a more noticeable gap that is accessible to everyone. Iconic artefacts positioned near these openings provide cues to the stories that wait in the gallery beyond, enticing visitors to explore. Others hightail it through this space to the Temporary Exhibition Gallery to take in that special exhibition they heard so much about, pausing only briefly en route to take note of a cool object that catches their eye. Some visitors hear the faint sound of chatter near the center of the Alley, and head toward it to see what's happening.

ARTEFACT ALLEY



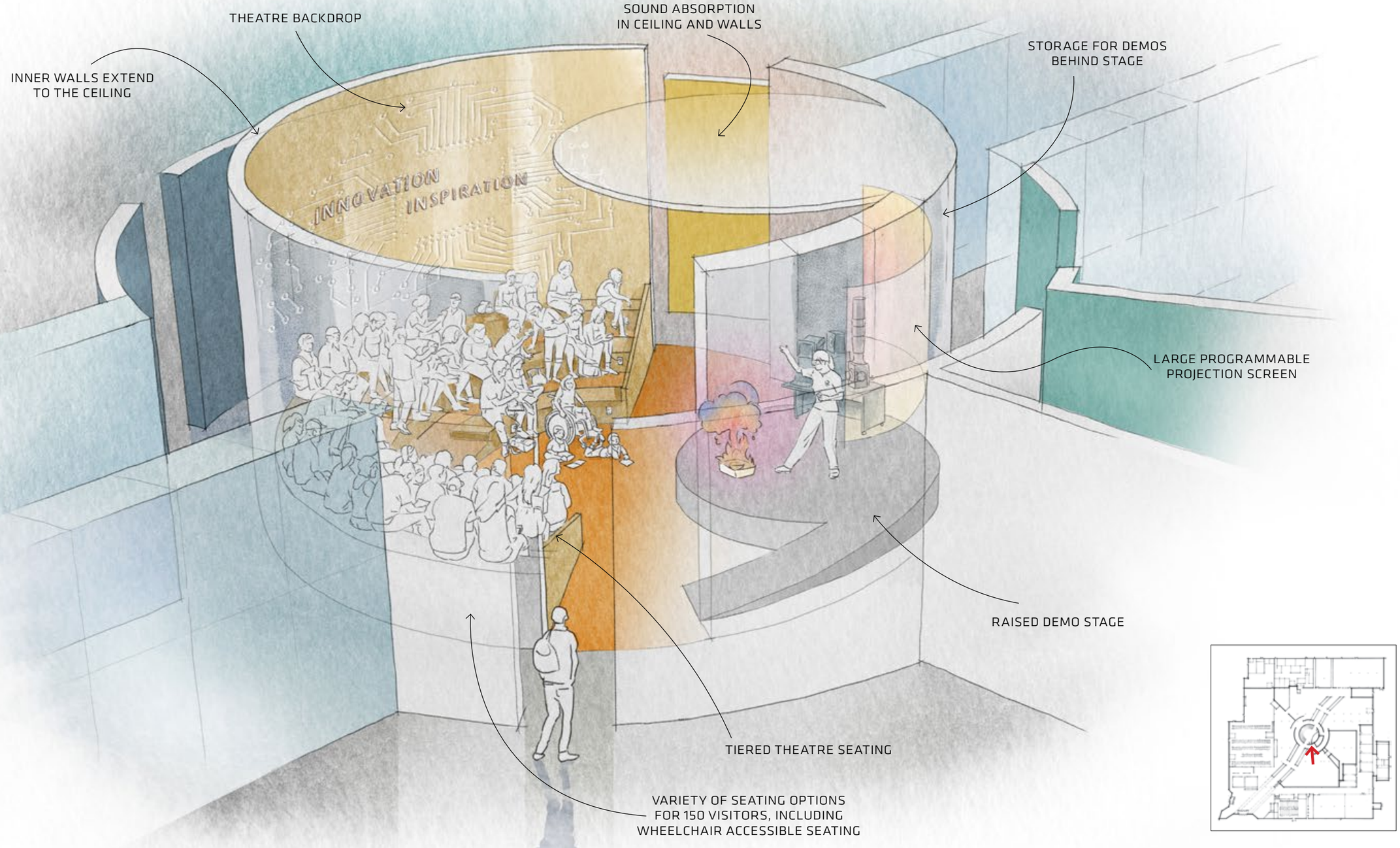
3.2.3 Demo Stage: Active

What happens when people, science, and technology mix? New ideas, cool conversations, and a whole lot of fun! From Artefact Alley, visitors can hear the faint chatter of people in the distance. There's something exciting going on, and they're eager to check it out. Those nearby in the galleries hear it too, and as they approach a gap in the wall reveals the source of the sound: a handful of visitors chat excitedly near a small stage, where a demonstration is about to begin. The new arrivals grab a seat and settle in for what promises to be a lively and interactive talk—made all the more exciting by the infectious enthusiasm of the presenter, a few cool artefacts, and some amazing images projected on a changeable screen behind the stage. There are a few groups inside, but the space is small enough for people to ask questions and engage with their seatmates in informal, often unexpected ways.

Visitors can also engage and interact with staff as they plan, develop, and rehearse new demonstrations. This could take place on a "Web 2.0 connected" multimedia stage, which may also offer online demonstrations and programmes for web audiences.

Before wandering back into one of the Museum's galleries, visitors pause in the corridor outside to take in a stunning display of vintage car advertisements and drawings by Jacques Ostiguy framed on the walls. It's a different display than the last time they were in, but as always it is well worth a look and they head back to the galleries with a deeper appreciation for the Museum's fascinating archival collection.

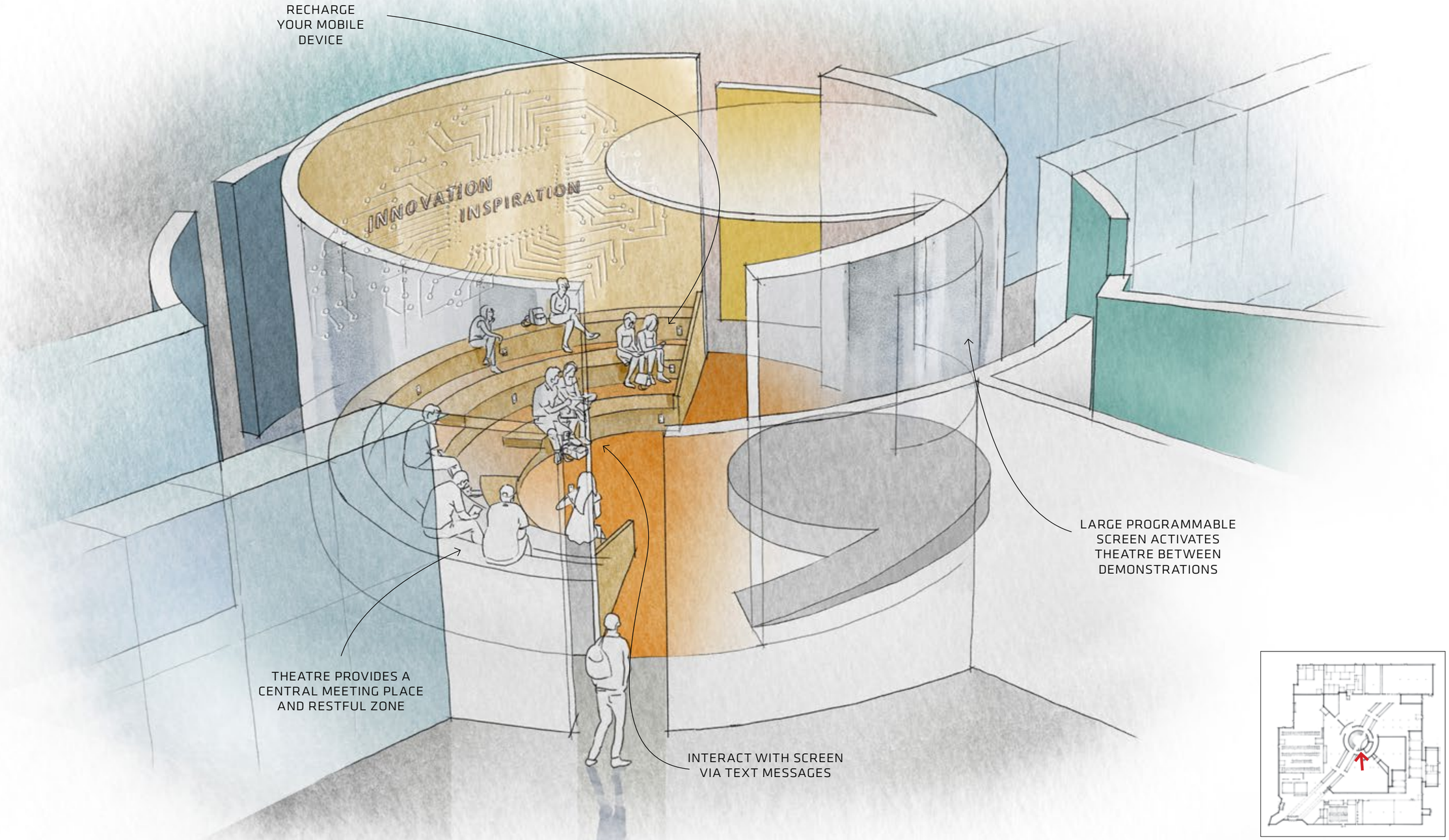
DEMO STAGE


INNER WALLS EXTEND TO THE CEILING
THEATRE BACKDROP
SOUND ABSORPTION IN CEILING AND WALLS
STORAGE FOR DEMOS BEHIND STAGE
INNOVATION
INSPIRATION
LARGE PROGRAMMABLE PROJECTION SCREEN
RAISED DEMO STAGE
TIERED THEATRE SEATING
VARIETY OF SEATING OPTIONS FOR 150 VISITORS, INCLUDING WHEELCHAIR ACCESSIBLE SEATING

3.2.4 Demo Stage: Gathering Space

At times visitors happen upon the Demo Stage in-between demos, drawn here by the chatter of others enjoying a brief reprieve from their museum visit. Some use this hub as an opportunity to recharge their mobile devices; others take a break and recharge their feet. Wherever they are in the Museum, visitors can quickly and easily access this gathering space to meet up, chill out or connect with others both within the space and beyond. For many, it's a comfy space to unplug while also plugging in, and they busy themselves posting images of their favourite artefacts on the screen behind the stage. Their posts catch on, and soon the screen is awash with some of the Museum's coolest objects for all to see. A vintage Indian motorcycle catches one visitor's eye and they chat with the person that posted it, eager to know where to find it in the Museum. Refreshed and now on the hunt for something new, they head back into the galleries to continue their visit.

DEMO STAGE – GATHERING SPACE



3.2.5 Moving and Connecting Gallery

Feel the power of the locomotive and hear the whirl of an engine as it hums to life! As visitors cross into the Moving and Connecting Gallery they are immediately struck by the sheer size of the locomotives in view, looming larger than ever over the entire space. Like a cross-country road, these imposing artefacts are joined by myriad other transport and communications-related objects Canadians use to move and connect—from telephones and satellites to bicycles, buses and the first electric car.

Behind the locomotives, the building of Canada seemingly comes to life through images of the construction of the railway on the gallery wall. As visitors approach this incredible backdrop, they realize it is floor-to-ceiling glass layered with images of the nation from east to west. Elegant yet highly personal, this mural speaks to time, change, and the use of technology to bridge distances and build communities. As visitors wade deeper into the rows, opportunities abound to see artefacts come to life and engage with the real thing. Some explore communication networks by operating a telephone switchboard, others collaborate to make a poster on a historic printing press. Within an enclosed recording studio, a group of friends produces an audio track using the sounds made by a number of communication artefacts on display. Nearby, a train's wheels churn forward on the rail past the wide eyes of a family engaged in an augmented reality experience unlike any other. Wherever visitors turn another object waits, amplified with interpretation in unexpected and surprising ways.

POSSIBLE EXHIBITION TOPICS

The Moving and Connecting Gallery brings CSTM's communications and transportation collections together under a single overarching theme, to be supplemented by artefacts from other collections as required by the interpretive schemes in the yet to be developed gallery exhibitions. The subthemes that will define the individual exhibitions within this gallery will be developed as curatorial research progresses and design proceeds. Potential topics for these exhibitions are as follows:

- **Steam Transportation**
- **Communication and Transportation Networks**
- **Sound and Music**

POSSIBLE VISITOR EXPERIENCES

The following is a preliminary list of possible visitor experiences for the Moving and Connecting Gallery. They have been organized according to the categories of visitor experiences documented in Section 3.1.4, illustrating the way these categories should be drawn upon as the basis for the design concept that will be developed during the next phase of work. A more extensive list of possible visitor experiences for this gallery is included in Appendix D of this document.

Engage with a Historical Narrative

- **Stories of Our Artefacts:** Listen to fascinating stories about the 6400 locomotive or the Ottawa Car electric sweeper (1926).
- **Identity Crisis:** Explore iconic Canadian modes of transportation in film, television, print, music, advertisements, etc.
- **Road Signs:** See displays of historical road signs. Design and print out your own sign and pick it up at the gift shop.

Creative and Collaborative Use of Technology

- **Printing Press:** Operate a printing press and take away the resulting copy.
- **Recording Studio:** Create your own recording using sounds of the collection. Mix your creation and share it with friends—and maybe even use the final sound as a personal ringtone!
- **Send a Message:** See how many different ways we communicate by sending messages using different modes of communication (e.g., sounds, codes, language, symbols, writing, telegraph, and digital means).

Hands-on Exploration and Analysis

- **Fire It Up:** Remove the outer layers of an electric engine, gas engine, and steam engine with digital media and learn how they work.
- **Networks at Work:** Build and follow a virtual network (digital, transportation) to understand its components.
- **Deconstruct a Car:** See a display of a car in the collection that has been disassembled. Using digital media, reassemble the car to appreciate the complexity of an everyday object.

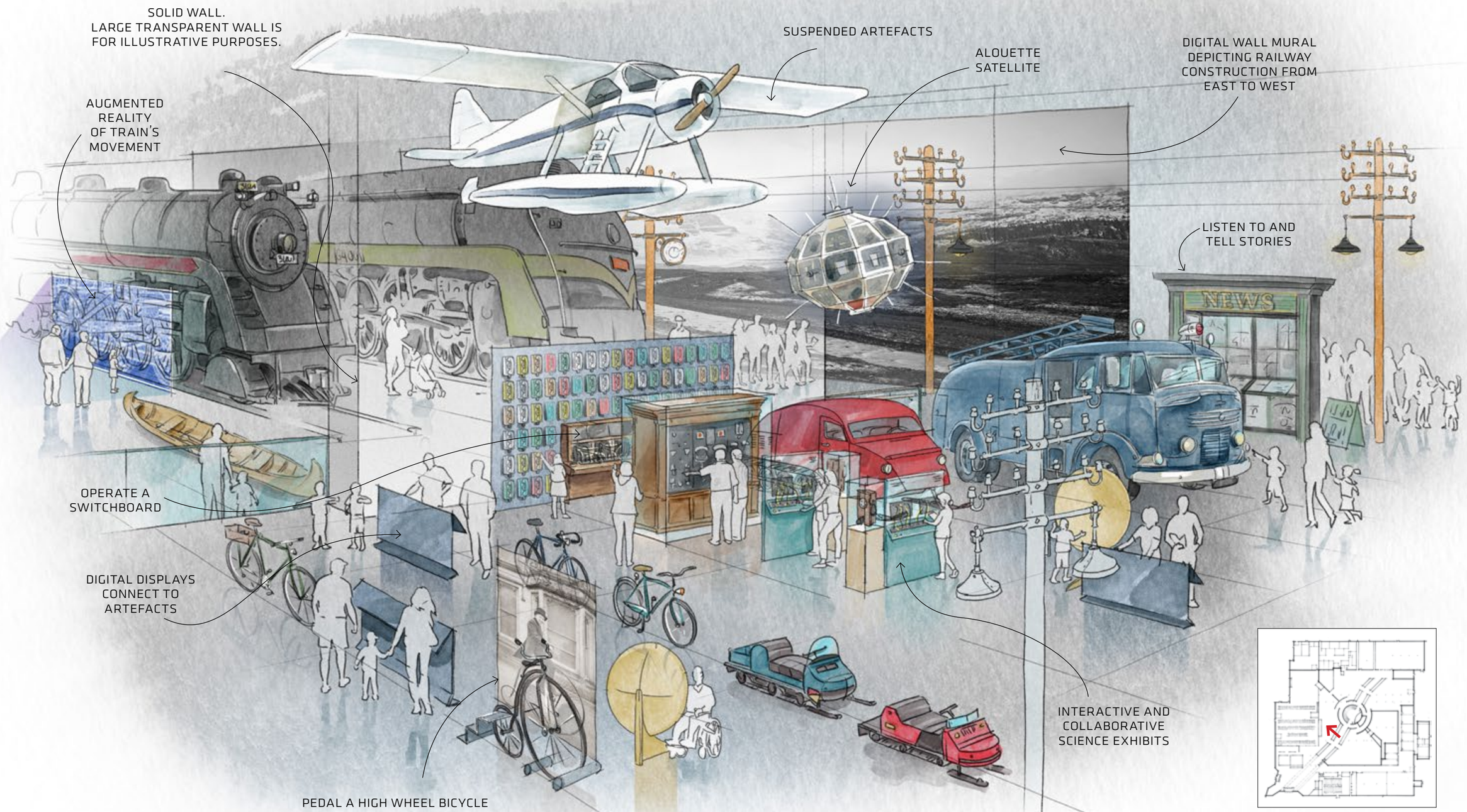
Immersive Narratives

- **Virtual Reality Train Trip:** Take an immersive train ride in the 6400 at the height of its appeal.
- **Journey Across Canada:** Using the CN gallery, travel across Canada or to specific Canadian landmarks.

Appreciation of Technological Forms and Functions

- **Streamlining Display:** Through artefacts and the Museum's 2D collection, see how the design of various modes of transportation were streamlined by corporations.
- **Big Wheel:** Sit on a high-wheel bicycle and discover how thrilling and dangerous it might have been to use this mode of transportation.

MOVING AND CONNECTING GALLERY



3.2.6 Transforming Resources Gallery

Extracting, mining, constructing, manufacturing: it's in our nature to transform the world around us, and nowhere is this more evident than inside the Transforming Resources Gallery. Here, a giant mining truck (2 ½ D) takes center stage, and as they enter visitors pause for a quick photo in front of its wheels. Others slip beneath the truck's giant undercarriage and climb the stairs (or take the lift) to explore from the platform above.

Back on the floor, visitors head to the materials wall to touch, smell, and interact with natural resources from all over Canada. Wood, oil, coal, ore, potash, and other raw materials are all within reach, and as they take part in a variety of immersive activities visitors begin to see just how much their lives are shaped by these precious materials. Some busy themselves "harvesting" resources from the landscape, while others pause to consider an art installation that quantifies the impact of their consumer choices through the waste they generate. Whatever activity they chose, visitors take on a participatory role in the transformation process and see first hand just how pervasive their relationship with natural resources can be. As they head back toward Artefact Alley, some pause near the gallery walls to take a closer look at objects they passed on the way in. Be it a household appliance made from Canadian steel or an artefact once used to mine for ore, each case speaks to resource extraction and use—only now the visitor's place in this process is as clear as the glass they peer into, and they exit the gallery with a newfound appreciation for the natural world.

POSSIBLE EXHIBITION TOPICS

The Transforming Resources Gallery is where CSTM's energy and mining and industrial technology collections will be focused. These will likely be supplemented by other collections categories as determined by yet to be developed exhibition subthemes. Potential topics for these exhibitions are as follows:

- **Materials**
- **Making and Building**
- **Energy Sources**

POSSIBLE VISITOR EXPERIENCES

The following is a preliminary list of possible visitor experiences for the Transforming Resources Gallery. They have been organized according to the categories of visitor experiences documented in Section 3.1.4, illustrating the way these categories should be drawn upon as the basis for the design concept that will be developed during the next phase of work. A more extensive list of possible visitor experiences for this gallery is included in Appendix D of this document.

Engage with a Historical Narrative

- **Energy Use "Time-Line":** See how energy demand has increased over the decades. Using visually effective and measurable units like "Energy Servants," learn how much our use/demand has increased (e.g., it would take 40 energy servants to power our lives today, how does this differ from 50 years ago? 100?).
- **Historical Perspective:** Explore the changes that transformation industries underwent over time.

Creative and Collaborative Use of Technology

- **Build It:** Play with plentiful building materials to build your own creation.
- **Collective Long Timeframe Interactive:** Collectively drill through a rock or saw a log. Using mechanical movement, visitors gradually drive a drill bit through a rock face or use a large saw to cut through a large log.
- **Renewable Resources:** Experiment with water, wind, and solar energy. Power your cell phone using hydroelectric energy, race solar powered toy cars or experiment with wind turbine design and configuration to maximize power generation.

Hands-on Exploration and Analysis

- **Manufacturing Mission Game:** Get tasked with building a product (e.g., a chair). Collect the natural resources required to build that product (e.g., wood, metal), and then visit stand-alone kiosks representing the different resources to "harvest" materials (punch cards). Once you have collected all required resources, return to the building station (central kiosk) to input your materials and see the product created before your eyes.
- **Gallery of Unexpected Materials:** Have your material perceptions challenged! See unexpected materials used in everyday objects. Cuddle a steel teddy bear, stand on a cardboard bridge, jump on a sheet of glass. See artefacts made of unexpected materials (e.g., Draisienne: a bicycle made out of wood).
- **Human Power:** See artefacts that require human power to run. Experiment with interactives that mimic the various mechanisms used to activate power (e.g., bicycles, recumbent bikes, hand-cranks, treadmills, etc.).

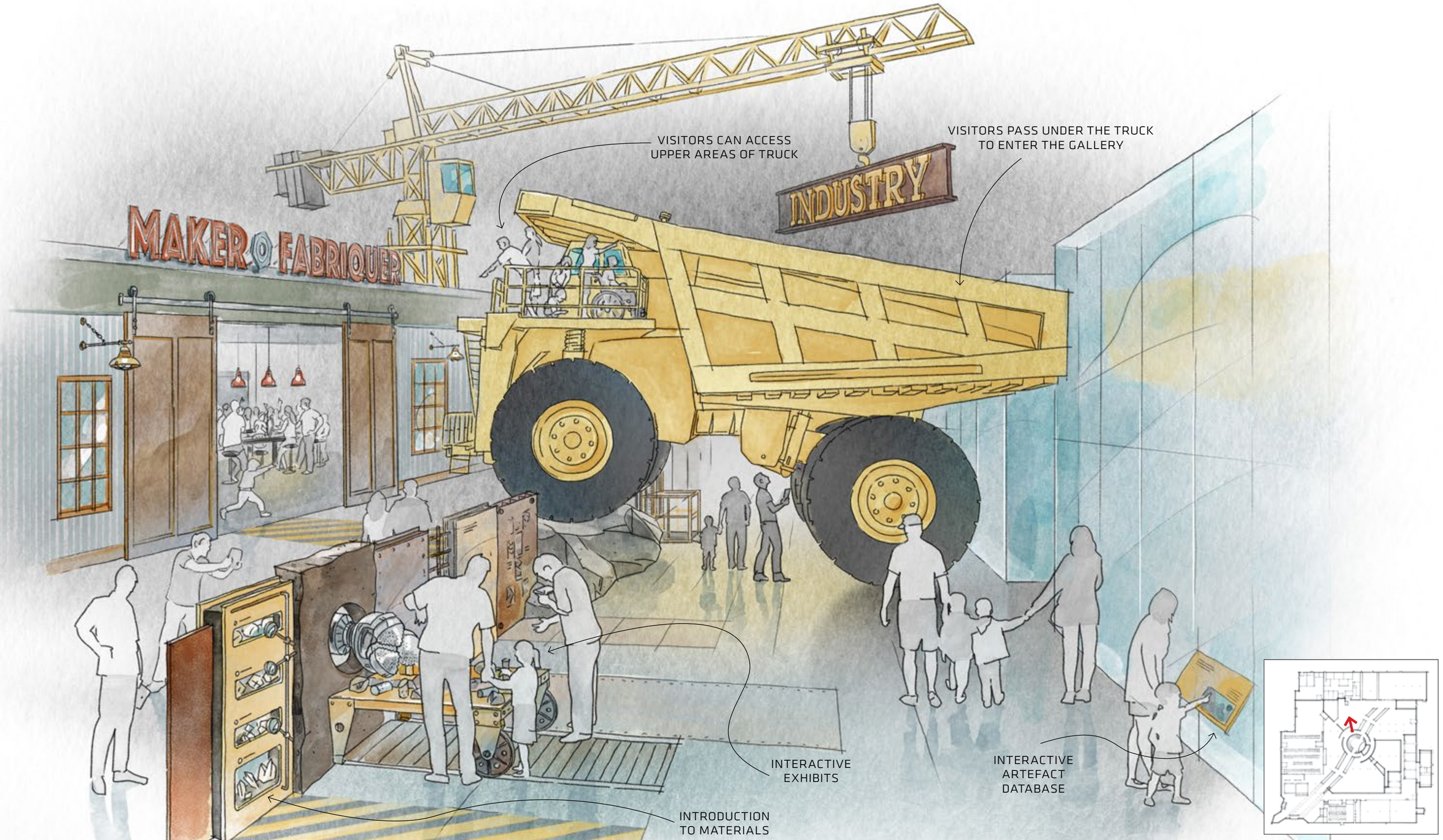
Immersive Narratives

- **Immersive Mine:** Immerse yourself in a working mine. Be transported virtually down a shaft and explore the surroundings.

Appreciation of Technological Forms and Functions

- **Material World:** See artefact groupings by material (wood, leather, plastics, metal, etc.).

TRANSFORMING RESOURCES GALLERY



3.2.7 Creating and Using Knowledge Gallery

Teeming with life, two large halves of a magnified lens flank the entrance as visitors approach the Creating and Using Knowledge Gallery. On the left, an oversized telescope lens magnifies the world beyond, while its microscopic counterpart on the right illuminates the invisible life under our very nose. This duality of looking in and out defines the gallery as visitors peer into a bustling laboratory space where old and new worlds collide. It appears historic yet familiar and also cutting edge, and visitors feel eager to explore as they head inside. To the right, a "micro" lab provides opportunities for visitors to explore how to look, through advancements in technology, further inward at the familiar in new ways. Those that veer left into the macro lab find opportunities to look further out at the world beyond. It's all about the process of discovery here, as visitors engage in scientific inquiry, observation, and measurement to understand how scientific and technological developments change our views of the world and begin to appreciate the role of those who investigate it.

Just beyond the walls of the lab, visitors are drawn to a large, multi-sided Rube Goldberg machine with balls already on the move. They add a new ball to the mix and follow its path, activating variables along the way. In the adjacent spaces, a variety of interactives await: many call upon iconic artefacts, like medical equipment and microscopes, to emphasize connections or illustrate cause and effect. At the back of the gallery, a presenter has just arrived with a few artefacts tucked inside his lab coat and a small group gathers to take a closer look. Changing microscopic and telescopic images on the walls behind make the perfect backdrop to this pop-up show, and some visitors pause to consider what, indeed, they are looking at before moving on to the next gallery.

"From this gallery visitors might also explore an exhibition related to perception, where young and old alike will encounter a range of experiences that challenge how they think about, and perceive, the world around them (e.g., black and white spinning discs, illusions, distorted room, mirror play, etc.).

POSSIBLE EXHIBITION TOPICS

Stories in the Creating and Using Knowledge Gallery will be informed largely by CSTM's scientific instruments and computing and mathematics collections, likely supplemented by artefacts from the medical technology and industrial technology collections (among others) as research proceeds and the gallery's exhibitions are developed. Potential topics for these exhibitions are as follows:

- **Measurement**
- **Unseen Worlds**
- **Science and Sense**
- **Northern Lights**

POSSIBLE VISITOR EXPERIENCES

The following is a preliminary list of possible visitor experiences for the Creating and Using Knowledge Gallery. They have been organized according to the categories of visitor experiences documented in Section 3.1.4, illustrating the way these categories should be drawn upon as the basis for the design concept that will be developed during the next phase of work. A more extensive list of possible visitor experiences for this gallery is included in Appendix D of this document.

Engage with a Historical Narrative

- **Expanding Perspectives:** Explore how human understanding of a set of natural phenomena has changed over time with new observations made possible by the invention of specific scientific instruments.

Creative and Collaborative Use of Technology

- **Measuring You:** Step on a scale that accurately records your vital statistics (height, weight, mass, temperature, etc.). Compare your measurements to common objects (e.g., how many nails, how many of 'you' add up to a locomotive, etc.), and email yourself a status report.
- **The Tinkering Lab:** Find a solution to a problem. Imagine, design, create, test, and try it out! Display your creation in the Tinkering Gallery to inspire others.

Hands-on Exploration and Analysis

- **My Birthday:** Explore ways of expressing time by determining your birth date in different time measurements (Gregorian calendar, Mayan calendar, seconds, minutes, geological time, etc.).
- **Near Misses:** Play out different scenarios that demonstrate why accuracy in measurement is important and see if you succeed or fail (missing the moon, navigation, sinking a battleship, etc.).
- **From the Infinitely Small to the Infinitely Large:** Use augmented reality to look into an object or use virtual reality to travel through the human body or the Earth's crust.

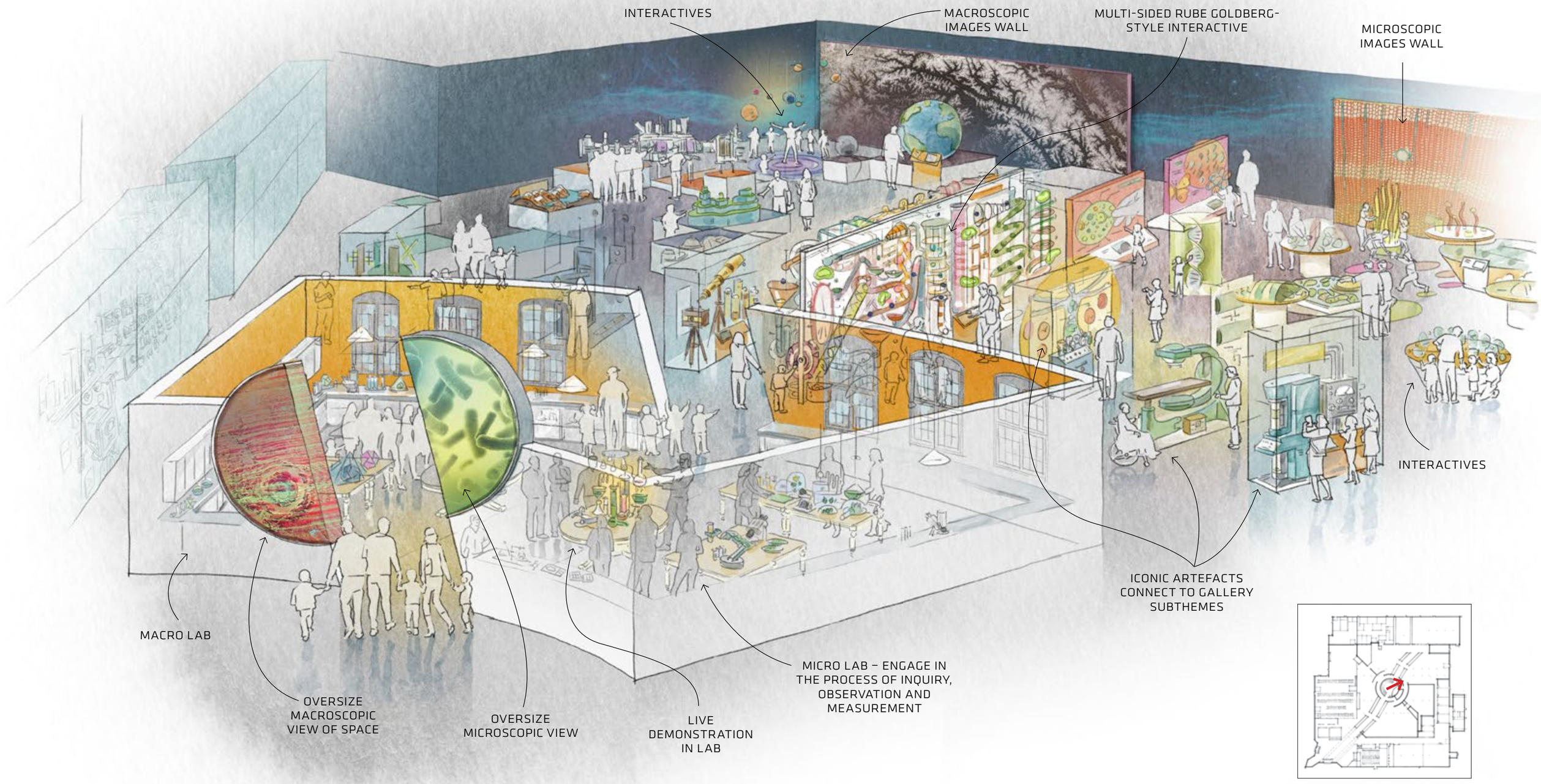
Immersive Narratives

- **Projection Dome:** Explore the night's sky, and hunt for constellations and other phenomena.

Appreciation of Technological Forms and Functions

- **Scientific Instruments:** See displays of different instruments of measurement and engage with various physical interactives that explain how they work.
- **Up Close:** See beauty in large blown-up images/projections of hidden phenomena (e.g., medical imaging, microbes, the Universe, etc.) or displays of artistic pieces in the collection (e.g., Percival slides in large size or DNA beads hanging) juxtaposed with smaller views of larger things (e.g., the galaxy).

CREATING AND USING KNOWLEDGE GALLERY



3.2.8 Technology in Our Lives Gallery

Welcome home! The exterior walls of a typical residential house greet visitors like a welcome mat as they approach the entrance to the Technology in Our Lives Gallery. At first glance, this projected changeable façade resembles a house not unlike their own, but upon closer inspection visitors realize it's a constantly morphing image of a typical dwelling through time. Stepping across the threshold, they enter an immersive room that explores the evolution of domestic technologies from televisions and light fixtures to furniture and refrigerators. This multi-screen object theatre continues to transform: First, it is a typical living room, then a kitchen or perhaps an office. Nostalgic for some, it showcases a variety of familiar environments that allow visitors to literally walk back into a bygone era.

In the spaces beyond, visitors are challenged to expand their understanding of familiar technologies. Rows upon rows of appliances and other domestic gadgets draw many a gaze to the walls at the back of the gallery, where stories of their use await at digital stations. Various tabletop interactives nearby provide opportunities to break apart and expose the inner workings of objects we use everyday, as visitors learn more about heating coils, cooling units, motors, and more. Visitors that head to the Design Studio start back at the drawing board, manipulating touchscreens to explore the design and engineering process behind the making of an object. Some set to work on their own creation, drawing inspiration from real prototypes like the Electronic Sackbut visible nearby.

POSSIBLE EXHIBITION TOPICS

Stories in the Technology in Our Lives Gallery will be informed largely by CSTM's domestic technology collections, with potential to be supplemented by artefacts from the transportation, communication, industrial technology, medical technology, and computing and mathematics collections. The extent of the collections housed in this gallery will be realized as research proceeds and the gallery's exhibitions are developed. Potential topics for these exhibitions are as follows:

- **Household Consumption**
- **Wearable Technology**
- **Science Fiction**

POSSIBLE VISITOR EXPERIENCES

The following is a preliminary list of possible visitor experiences for the Technology in Our Lives Gallery. They have been organized according to the categories of visitor experiences documented in Section 3.1.4, illustrating the way these categories should be drawn upon as the basis for the design concept that will be developed during the next phase of work.

Engage with a Historical Narrative

- **Christmas Consumables:** Compare how what's under the tree has changed dramatically over time. See how the type, amount, and cost of Christmas gifts have changed. Compare toys from the collection (numbers and cost) with toys today as a means to highlight what you would have received versus what you receive now.

Creative and Collaborative Use of Technology

- **Design Studio:** Design an object from inception to market. Choose from three generic/simple objects (e.g., toaster, pencil), then make your way through the steps involved in creating it. Once developed, launch your product in a virtual storefront where visitors can share and submit their designs/products and others can "buy" them through a voting process.
- **Assembly Lines:** Collectively make a product by following an assembly line.

Hands-on Exploration and Analysis

- **Skin Deep:** Learn the science behind cosmetics. Play with cosmetics on a virtual face and see the large lists of ingredients found in many products we apply to our skin. Discover historical cosmetics and learn how they've been around for longer than you might think. Explore the processes that people use to permanently alter their appearance like tattoos, piercings, and plastic surgery.
- **Gender in Ads (and Technology):** Explore the Museum's advertisement collection. See ads for various consumable products, and perhaps even the real objects they feature. Experiment and play with the advertisements by swapping out genders in ads, changing eras of ads, changing advertisement slogans, etc. Post your creation and share with friends.

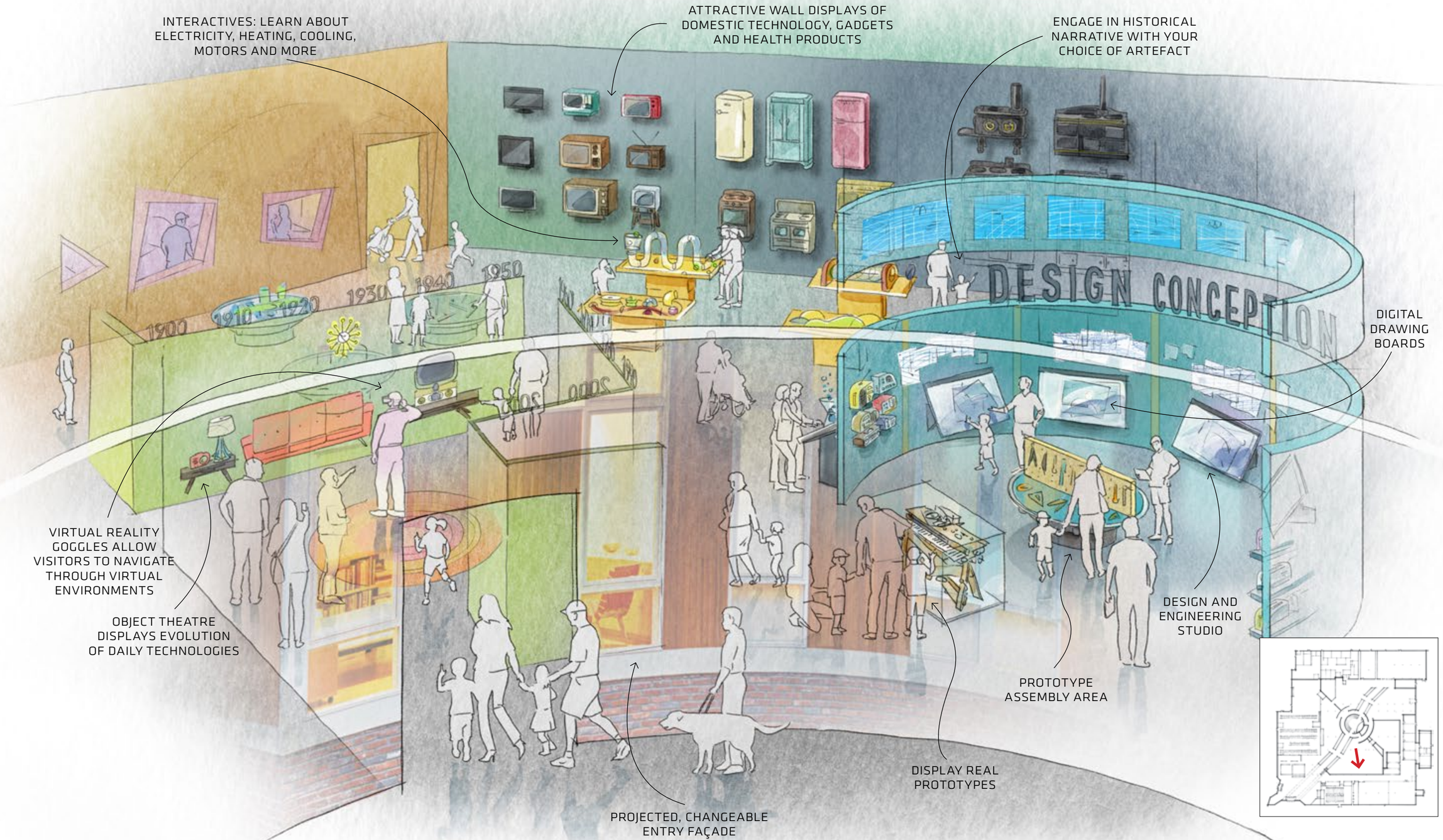
Immersive Narratives

- **Household Contents:** Through digital projection, compare the contents and design of rooms in a house. See how appliances, furniture, technology, and decor have evolved.

Appreciation of Technological Forms and Functions

- **You…Only Better:** See groupings of artefacts that enhance our bodies—from helping prolong life to improving our physical abilities or altering our physical appearance.

TECHNOLOGY IN OUR LIVES GALLERY



3.2.9 Children's Gallery

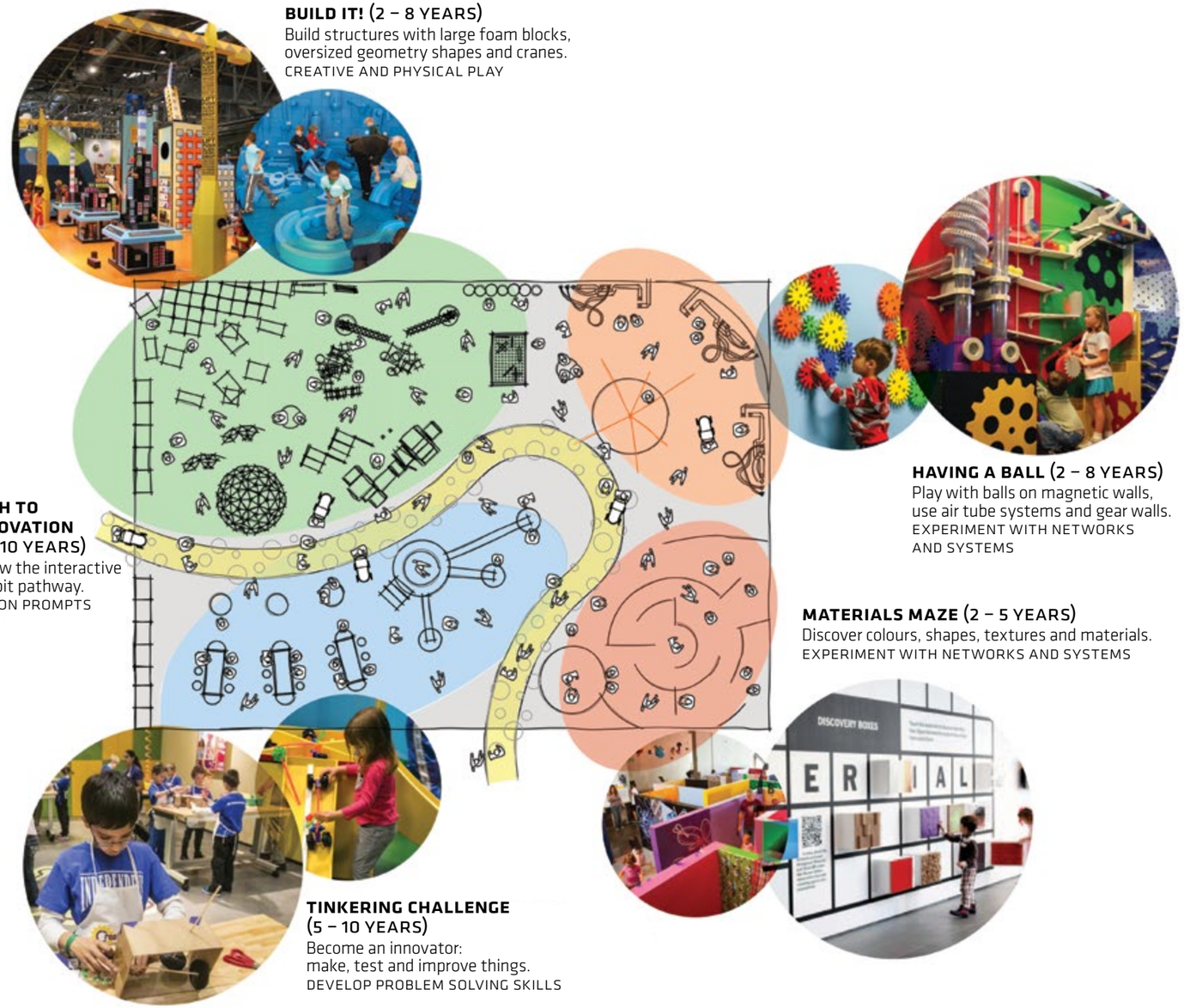
It's time to play! Children ages two to ten (and their families) are drawn to the multi-sensory environment inside the Children's Gallery, where opportunities to investigate, experiment, and exercise creativity abound. It's a colourful, interactive space peppered with large objects that entice from afar, and once inside parents and guardians immediately know it is a safe and secure environment for youngsters to touch, create, and engage in full-bodied play. Sightlines allow children to be supervised at all times as they engage in a range of activities, both solo and collaborative.

Stations throughout the space explore and experiment with the concepts of innovation through play. At one, a small group experiments with light and shadows, while at another a family uses large cranes and building blocks to construct bridges and other fun structures. Nearby, a young family encourages their curious toddler to explore textures and materials. Children are encouraged to engage with family, friends, and other visitors, allowing multiple users to participate in cooperative experiences regardless of ability or skill.

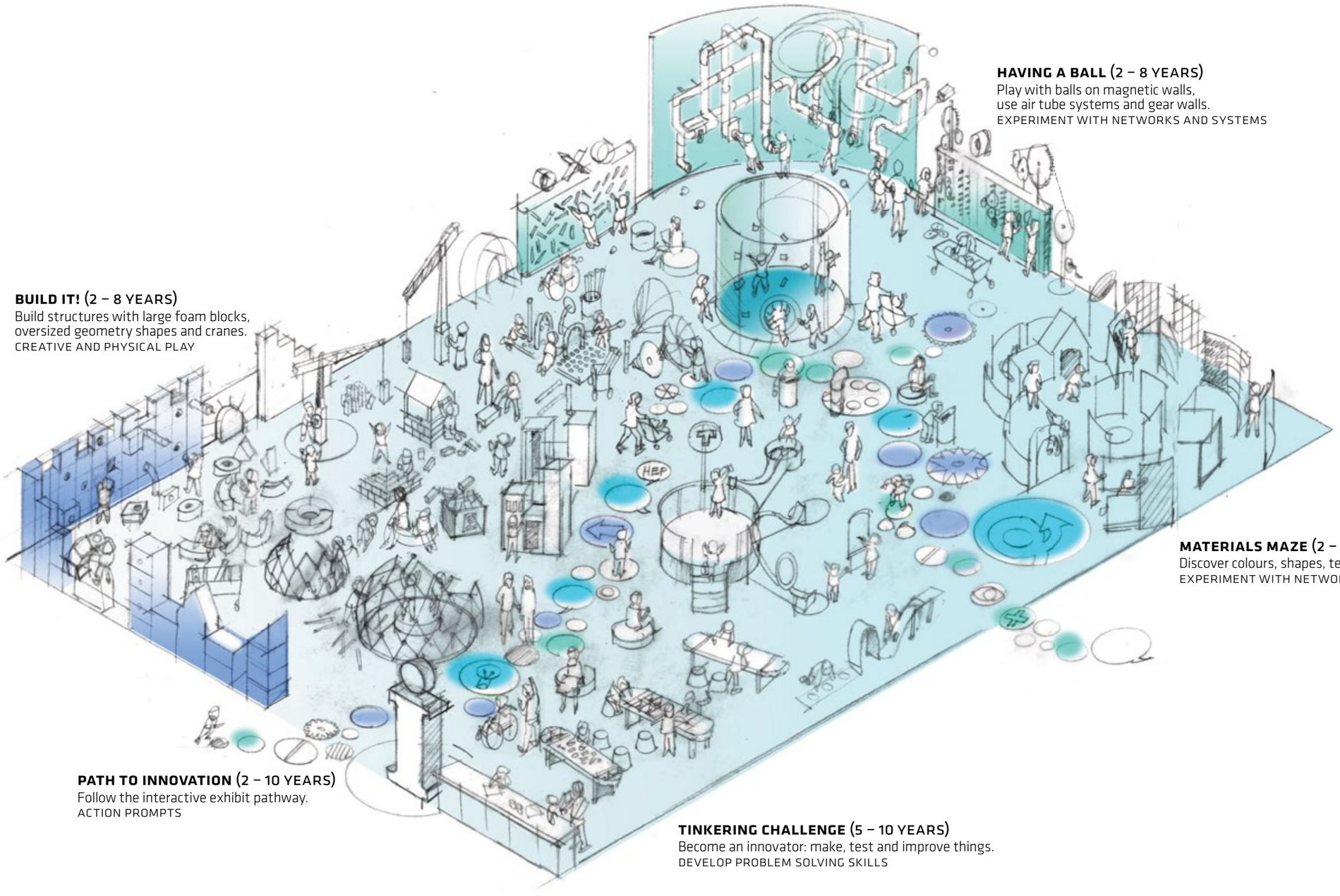
Kinesthetic experiences with large objects and opportunities for role-playing encourage children to imagine, question, create, test, and try again. This is a self-directed space where there is no right answer: open-ended experiences allow children to exercise their imagination and make their own choices, inspiring a new generation to be innovative and creative.

POSSIBLE VISITOR EXPERIENCES

- **Off to the Races:** Build a car and race it down a ramp, make skyscraper which must reach a certain height, build a bridge that must support a fixed weight, assemble a system of gears and pulleys to lift a mass.
- **The Wind Tunnel:** Experiment with a wind tunnel, placing objects of different materials inside a large cylinder to see what happens.
- **Ball Machine:** Experiment with a multi-interactive ball track with lifts, spirals, elevators and loops to activate a wow experience (launch a shuttle, activate a toy train, etc.). Use simple machines to move balls around the system.



CHILDREN'S GALLERY



BUILD IT! (2 – 8 YEARS)
Build structures with large foam blocks, oversized geometry shapes and cranes.
CREATIVE AND PHYSICAL PLAY

HAVING A BALL (2 – 8 YEARS)
Play with balls on magnetic walls, use air tube systems and gear walls.
EXPERIMENT WITH NETWORKS AND SYSTEMS

MATERIALS MAZE (2 – 5 YEARS)
Discover colours, shapes, textures and materials.
EXPERIMENT WITH NETWORKS AND SYSTEMS

PATH TO INNOVATION (2 – 10 YEARS)
Follow the interactive exhibit pathway.
ACTION PROMPTS

TINKERING CHALLENGE (5 – 10 YEARS)
Become an innovator: make, test and improve things.
DEVELOP PROBLEM SOLVING SKILLS

3.2.10 Maker Space

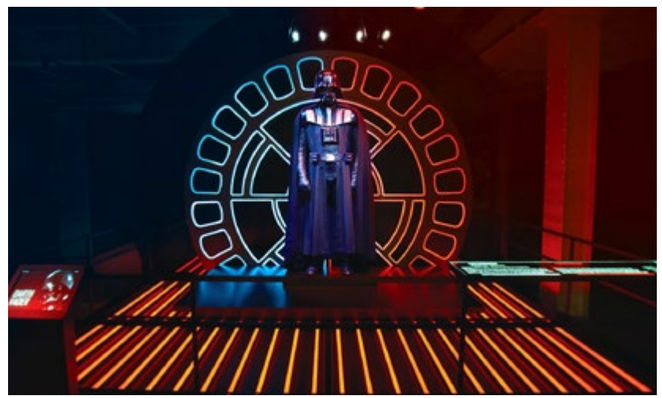
The Maker Space is a fun and dynamic workshop environment. Visitors are invited and encouraged to roll up their sleeves and put their hands and minds to work tackling challenges that require creativity and innovation. At the entrance to the Maker Space visitors catch a glimpse of a group of people gathered around a table for a hands-on workshop on the art of upcycling old industrial parts. At another table, a few visitors work independently with an assortment of materials and tools, inspired to tinker, take apart or build something new. Activity, hands-on engagement, exploration, discovery—the Maker Space is animated by dialogue, interaction and creativity.

3.2.11 Temporary Exhibition Gallery

There's a new exhibition at the Canada Science and Technology Museum, and the buzz around town is that it's worth checking out. Some visitors come to the Museum specifically for this special experience, others learn about it upon arrival and immediately add it to their list of things to see during their visit.

Ticket in hand, some visitors head straight for the exhibition and it isn't hard to find: Artefact Alley, and its long corridor, provides a clear path to the space. The Alley's glass "walls" rise up around visitors as they make their way toward the Temporary Exhibition Gallery, filled with unique objects of all shapes and sizes that both intrigue and excite. Some visitors stop to admire a cool artefact and get lost for a moment in its form or function, but clear signage for the exhibition provides all who pause en route with an unmistakable sense of where to go.

Just outside the Temporary Exhibition Gallery, visitors possibly encounter a large object, images, and a few simple interactives that together serve as a pre-show or preview of what's to come. Some have been to a temporary exhibition here before (the last one, an immersive walk-through human body, was curated by the Museum), but even repeat visitors are in for a treat. A travelling exhibition is visiting from Seattle and the space is completely different, almost unrecognizable, this time around. The exhibition is well worth the wait, and those who visit are excited to tell others about it. Many make a point of checking the Museum's website and social media feeds to see what's coming next in this dynamic and ever-changing gallery space.



3.3 Digital Media Strategy

The goal of the digital media strategy is to integrate technology seamlessly into the galleries so that it feels like an extension of the surrounding environment rather than isolated bits of technology. The design team has also included several digital concepts to get stakeholders excited about what is possible, and to ultimately help fundraising efforts that will make these concepts a reality. Ideas were inspired by the APA Visitor Experience Workshop, existing artefacts in CSTM's collection, conceptual renderings of the new galleries, current technologies and digital trends. The concepts detailed in this section represent how digital media might be integrated into a visitor experience that layers artefacts, graphics, digital media and visitor interaction and engagement. A Digital Media Producer working closely with CSTM's team, their subcontracted design teams and the DOC will develop these experiences.

Ultimately, the digital strategy outlined in this document is based on several guiding principles designed to offer flexibility in developing a series of digital exhibits that will enhance the overall visitor experience. A more extensive list of sample digital media experiences is included in Appendix D of this document.

THE DIGITAL STRATEGY FOR CSTM'S EXHIBITS IS BASED ON THE FOLLOWING PRINCIPLES:

Make the most of the social setting of the Museum

Technology-based exhibits at their best immerse visitors in an experience that is hands-on, interactive, and social. A museum is not a place for visitors to walk through while staring at their phones, oblivious to their surroundings. Technology should be used to encourage families, friends or strangers to engage in learning together. Digital media presents a unique opportunity to engage users, encourage interactivity, and solicit participation and conversation. Experiences should be designed to capture the visitor's imagination through creative use of digital media that blurs the line between physical and digital. This can be enabled through effective use of audio, light, projection, screens, mobile devices, physical interaction, and multi-user experiences.

Enhance understanding through game-based experiences

Experiences can be designed to establish a challenge for the visitor and provide reward for effort and achievement towards overcoming that challenge. Gamification can include single and multiplayer experiences, points-based rewards, and the use of leader boards to encourage competition. Well-designed games focus on visitors' inherent desire to explore, play, socialize and use the game experience to enhance social learning.

Enable visitors to drive their own experience

Giving visitors control of their experience via digital interactive exhibits allows them to personalize their experience, making it more meaningful, fun, and memorable. This can be achieved through 'choose your own adventure' games, storytelling experiences where the visitor reveals layered content as they progress, digital content that is unlocked by visitors' mobile devices, and open-ended digital exploration where the visitor can create something virtually. With complex stories, technology-based exhibits can provide tiers in the information hierarchy such that visitors can enjoy the surface story or dig into more detail at will.

Link experiences to the collection

The collection of artefacts at CSTM includes more than 48,000 objects. Currently less than 3% of those objects are on display, and only props or reproductions can be handled by visitors. This situation is an ideal opportunity for digital media to bring the collection to life. Through touch screen interactives, dynamic projections, and graphic overlays of augmented reality over a real-world view of the Museum, visitors can discover the collection and explore it in ways that are not possible without technology. This opportunity allows for the experience to blend the physical collection and digital storytelling in a way that captures the imagination. An overview plan for integration of digital media into the interpretive graphics is presented in Section 5.7 Graphics Guidelines.

Change focus from content delivery to engagement

CSTM has an opportunity to shift from the traditional didactic approach to engage the public in scientific discussion. The Museum then becomes the facilitator of the experience, rather than the only content authority. Thus, digital experiences can be designed to be less focused on static one-way delivery of content, and instead become a platform for dialogue. With this platform, visitors can engage with the Museum, share their ideas with fellow visitors, and enhance their learning through scientific engagement.

Align technological approach with technology focus of museum

As a museum of science and technology, CSTM's digital exhibits must showcase innovation, originality, and ingenuity. That said, exhibits also need to be robust and durable for museum visitors, thus 'leading edge' rather than 'bleeding edge'. The approach should balance quality over quantity, creating a museum with clever use of technology, rather than one with 'so many screens!' The focus of the experience should be technology that encourages visitors to delight in the experience of learning, rather than the latest gadget.

Provide a variety of experiences

The proposed digital experiences present a variety of experiences to appeal to different audience types, varied learning styles, options for technology solutions, and alternate approaches. By providing a wide range of experiences, exhibits can be educational and fun, while at the same time approachable to a diverse audience.

3.3.1 Samples of Digital Media Experiences

The following section contains several examples of digital media experiences for the new CSTM, informed by discussions during the May 2015 Visioning Workshop and subsequent conceptual development. Many of these ideas could work in a number of different galleries, calling upon overarching themes carried throughout. Furthermore, any of these ideas could be redeveloped to incorporate a specific artefact or to meet specific learning objectives. All concepts can be scaled up or down depending on available resources and the desired relationship to adjacent exhibitions.

3.3.2 Making Canada: Interactive National Map

The Interactive National Map extends CSTM's reach across Canada, an onsite manifestation of the Museum's engagement with audiences across the nation, which is further expanded upon in Section 3.4.1 Facilitating a National Dialogue. A massive digital video wall displays a dynamic map of Canada, capturing the eyes of all who visit this area. This experience comes to life with animated photographs and media mosaics, all to be shared and even controlled by visitors to the Museum and other users across Canada via mobile applications referenced in Section 3.4 Mobile Strategy and National Outreach. In addition to selected images supplied by CSTM, the content on the map can be user generated to bring visitors even closer to the experience. Using a range of interface options—including the large wall, neighbouring touch screens, visitor gestures, or mobile devices—users can interact with images of interest within the mosaic experience and contribute their own. Selected images would enlarge and hold, allowing for interaction options, and then fade back to the animating mosaic once not in use. To extend the reach of this experience with Canadians far and wide, the system will allow visitors from other science centres and museums to share images with the video wall. Users can upload and view their own images from anywhere via mobile devices and share them using the video wall at the CSTM.

With the use of powerful meta data options, images contributed can be separated into themed mosaics to celebrate special events, scientifically historical dates, or big ideas in technology. Examples could include: Canadian discoveries at use, weather across Canada (blossoms in Victoria and a blizzard in Halifax), the routes of migrating birds, Canadian's celebrating 'Pi Day', or special events at other science centres and museums across Canada. The mechanism for contributing these images to the Museum could be diverse, including a website, a mobile app, and onsite kiosks. User-generated content could be images, videos, or image captions such as personal stories or ideas to share.

To enhance the experience visitors could tag and save content while they explore the video wall and thus create a personal legacy tour of their visit. This experience can also be shared across Canada through onsite locations with partners and mobile devices. This digital take-away could be made available via the web after their visit allowing visitors to explore further at their leisure. It could also be shared onsite with future visitors either via the video wall or mobile device, or shared via the web and with friends and family via social media. A custom takeaway could also be available at the Boutique (e.g., t-shirts, 3D prints, badges, etc.).

CSTM staff could moderate all contributions and publish a new theme at intervals to keep the mosaic fresh. When no visitors are interacting with the display, it could be set to auto-rotate through a selection of preferred images. CSTM-supplied wristbands containing RFID tags could personalize the experience even more by presenting on-screen content tailored to user preferences.

3.3.3 Artefact Alley: Augmented Reality Artefacts

Augmented Reality (AR) is a technology-based solution to bring digital interactive media content to life in an unobtrusive way by layering digital content over a real-world view of an exhibit. By introducing AR into Artefact Alley, visitors will be able to use their smart phones or museum-provided tablets to animate iconic artefacts within the Museum. Viewing an artefact through the device camera via an augmented reality application will overlay additional information including but not limited to: old newspaper clippings, a timeline of Canadian discoveries, 3D models of the inner workings of artefacts, videos of historical footage, photos and explanatory text.

Through virtual means, visitors will be able to manipulate artefacts in many ways, including: rotate in 3D, peel back layers, break apart, reveal the inner workings, show in use, animate complex concepts, demonstrate the scientific principles and highlight important Canadian innovations. Through digital exploration, the visitor has control over their experience to explore the objects that are most meaningful to them, to see those objects in the context of their use and application, and to discover additional layers of content according to their interests. This approach could be applied to large, small, iconic, and obscure artefacts in the collection, including computers, car engines, trains, stoves, switchboards, printing presses, and old fashioned cameras.

Augmented Reality can also be used to capture visitors' imaginations. For example, as a visitor walks by a wall of old TVs, the televisions could appear to turn on and play a clip of a TV show from the era that corresponds to the age of the television. Similarly, for a wall of old computers, the augmented reality app could overlay old video games onto each screen. Additionally AR could place an object within a 3D virtual environment.

There is also an opportunity to allow visitors to discover some of the more obscure artefacts in the CSTM collection that might not be on display. This can be achieved by including a "link to similar artefacts" button with the AR application. The default view of the related artefacts section could be a list of related categories such as era, field (transportation, communication etc), inventor, etc. The visitor could touch on any category filter to see a list of artefacts that are related to the initial artefact. Selecting a particular artefact could reveal a description of the item as well as supplementary photos, videos or audio files. This approach offers an opportunity to highlight many of the artefacts in the collection that cannot easily be displayed due to size or space limitations.

Museum visitors accesses deeper content pertaining to a physical artefact in the space.

The British Museum incorporates Augmented Reality as a game for visitors
http://www.whattodowiththekids.co.uk/news/new-augemented-reality-app-launched-at-the-british-museum

Augmented reality offers an opportunity to show parts of artefacts that are not visible in the physical world such as the 3-D exploded view of this motorcycle.
http://www.slrlounge.com/cool-bts-on-an-exploded-view-of-a-motobike/

Museum of Vancouver's 'The Visible City' Augmented Reality app for Neon Stories
http://www.museumofvancouver.ca/exhibitions/exhibit/visible-city

3.3.4 Moving and Connecting Gallery: Animated Newspapers

At a newspaper stand, visitors could explore historic newspapers through digital means. As visitors flip through the newspapers, they could use a mobile device to access additional layers of content. Visual cues on the newspapers would prompt visitors to use their mobile device (or museum supplied tablet) to active the new layers.

Using the mobile app, visitors would see the static photos from the newspaper come to life as animations. Through these animations, visitors can step back in time to see history come to life. In addition to the animations, visitors would be presented with a navigation menu to reveal additional video, photos, and content.

While engaging with the experience, a visitor could “favourite” the articles, animations, videos, and images. The visitor could also share this content via social media. Based on these interactions, the visitor could be prompted to “subscribe” to receive new content on a regular basis from the Museum, pushed through the app.

Visitors could also activate a selfie feature to put themselves within a historic photo or article. These newspaper selfies could be shared on social media through their mobile device. When friends view the selfie newspaper, they would also gain insider access to unlock a related interactive exhibit available online.

At the Boutique, there could be an option to purchase a replica newspaper as a souvenir. This souvenir could be designed to activate the virtual content, keeping visitors engaged once they leave the Museum.

The Museum of London’s iPhone app uses AR and location based features to activate historic content. http://www.museumoflondon.org.uk/Resources/app/you-are-here-app/home.html

Gramophone is augmented with an animated 3D character telling the story about Belgrade’s development at the beginning of 20th century. A map of Europe is brought to life overlaid with 3D animations of battles in 1914. https://www.youtube.com/watch?v=sQ3FlGDulBs

Digital exploration of archival newspapers from the Hillcrest Mine Disaster at the Frank Slide Interpretive Center. http://www.ngxinteractive.com/#work/Hillcrest

The Srbija 1914/Augmented Reality Catalogue enhances printed materials with supporting audio effects, video and animations. https://www.youtube.com/watch?v=veCSJgPp8rw

3.3.5 Transforming Resources Gallery: Virtual Reality Mine Excavation Simulator

This interactive station is a first-person game experience that allows visitors to 'transform resources' by taking ore from the ground and hauling it to a mill for processing while learning how ore is than transformed into everyday objects. Visitors will be drawn in by the challenge to move as much ore as possible in a race against the clock.

Visitors will literally put themselves in the driver's seat as they step into a mock-up of an underground mining haul truck. An underground mining scene is displayed on a large projection surface made to look like a windshield. Placed in front and facing the screen is the cab of the underground haul truck from where the visitor operates the vehicle using a steering wheel, a forward/reverse shifter, and a dump lever. The user is provided with simple instructions, objectives and basic, high-level information about the ore they are mining before the simulation begins.

The driver is shown a split screen view: the main view is their first person vantage of the mining environment as they sit waiting in the underground excavator as the last bucket gets loaded. There is also an inset that shows a plan view of the truck and mine routes. As the last bucket is loaded they hear the horn from the shovel operator indicating they are loaded and they are now in control! They carefully navigate their vehicle down the haul-road avoiding obstacles such as loose boulders, potholes, hairpin turns, and oncoming traffic. When they arrive at the mill crusher they back their vehicle in and dump their precious cargo. When completed they are notified of their success; "That was a rough ride but you made it!" "Your load contained enough 'ore' to create 'x' number of everyday items: 'x' smart phones, or 'x' hubcaps, or 'x' car engine components". The objects are then displayed on screen by way of an intelligent info-graphic. The amounts of ore per load will vary, simulating a real-world experience and thus different results can be experienced for each driver.

To complement the mining game experience, touch screens could be used to present additional learning opportunities. These touch screens will also provide the visitors with something to do while waiting their turn in the simulator. The content will help the visitor understand that the resource is used for so many items that we take for granted and that our world would be a very different place without this precious resource.

A mobile application or museum-supplied tablet will present the visitor with an opportunity to extend the reach of this interactive to the rest of the museum via a virtual scavenger hunt. Visitors will be presented with a number of other objects found elsewhere in the museum containing this resource; they will need to find the objects and read the associated content to determine the amount of resource contained within the object.

There could be a daily leader board as well as overall standings, to encourage friendly competition and collaboration between visitors. Furthermore changing the scavenger hunt objects or themes could refresh the scavenger hunt and encourage repeat visits by increasing one's standing.

Alternatively this experience could be turned into a multi-player experience played on smart phones or museum supplied tablets, rather than a single-user simulator, with game play displayed on a large screen for all to see. This option would allow multiple users to virtually drive their haul trucks at the same time, in a race not only against the clock but also against each other! Within the physical space, a large screen would show a bird's eye view of the competitors in the Museum as well as a leader board. Other visitors can join the experience by cheering on the competitors, encouraging real-world interactions between visitors (not just virtual interactions).

The physical exhibit can include elements from a real mining truck including a steering wheel, seat, shifter and levers for a realistic experience.

The mining experience from a variety of lenses.

A visitor uses a mobile application to explore the museum. This type of technology could be used in the scavenger hunt. http://www.nj.com/entertainment/index.ssf/2010/08/digital_directions_help_explor.html

3.3.6 Creating and Using Knowledge Gallery: Macro and Micro Visualizations and Scavenger Hunt

Macro and Micro Visualizations

The entrance to the gallery and the back wall could both feature large scale imagery of macro and micro scale content. The back wall could be a digital display for a dynamic cycling of these images through a variety of themes (human body, ocean biology, rock formations, forestry).

Visitors could interact with this display using either gesture technology or their mobile device to control the content. For example, visitors could 'be the virus' within the micro view of the human body. Here, visitors could use gestures or their mobile devices to control the movement of the virus or microorganism through the body. A group might form to help fight off viruses and other microorganisms; thus, the more "anti bodies" present would impact the content, animations or outcomes. In another example, a group might collectively identify constellations in the night sky on the large display using their devices.

Visitors could also use their device to zoom in and out of images to experience the transition between the macro and micro views. They could also reveal additional content on their mobile device. For example, the mobile display could include impressive statistics that relate to both the topic, at the macro and micro level. Additional layers will not interrupt the large visual aesthetic of the images on the wall—only on the visitor's mobile device, where they have decided to view this additional content, is a change perceived. Visual cues on screen could indicate which images are 'enhanced' with these additional layers. Bluetooth beacons might also push content to devices nearby.

Macro and Micro Scavenger Hunt

A scavenger hunt could challenge visitors to collect objects (digital samples) via their mobile device or museum-supplied tablet. The experience would be designed to encourage curiosity, inquiry, and observation. Visitors could choose from a variety of scientific-themed challenges where they can 'be the scientist'. Challenges can be designed for topics at the macro or micro level.

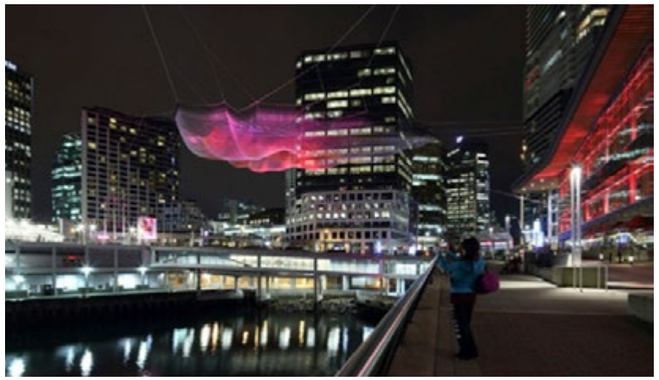
Visitors use a mobile device to find and collect "samples" from different exhibits or artefacts inside the gallery. The samples would be pushed to the device from a Bluetooth beacon or through near field communication. Once they capture the sample, visitors receive confirmation via an audio jingle, caption or message. Additional content about the object they collected could be revealed, and the visitor prompted to continue their hunt for more.

Additionally, the scavenger hunt could be designed to challenge visitors to answer questions about their collected sample before they move on to the next one. This added complexity would reward visitors for their observation skills and would enhance learning.

Results from the scavenger hunts could be posted onto a "leader" or "contributor" board that encourages other visitors to participate. Visitors could also use the app to boast about their accomplishment via social media. For example "I just completed the young scientist sample challenge at CSTM!"

This concept could be enhanced to include samples that the visitor could find at locations across Canada. This option would reinforce engagement with the Museum beyond the initial visit.

The Digital IO Brush enables users to capture a "color sample" from the environment and "paint" with it on a digital display. https://www.youtube.com/watch?v=04v_v1gnyO8



At night, an interactive light-show is projected onto the net. Visitors are able to choreograph the lighting with physical gestures in real time using their mobile devices. The number of visitors present or connected to the display determines/influences the content or experiences that can be unlocked and controlled.

Students use a mobile app at the Getty Center to participate in a photo-based scavenger hunt.

3.3.7 Technology in our Lives Gallery: Engine Simulator

This potential exhibit could teach visitors about mechanical systems by allowing the visitor to control four systems of an engine: electrical, ignition, cooling and fuel. The physical exhibit could feature four table-mounted touch screens surrounding a vertically-mounted glass surface with a projection that is visible on both sides. This exhibit could accommodate up to four independent users or could be used in multi-player mode where all four visitors collaborate to achieve a common goal.

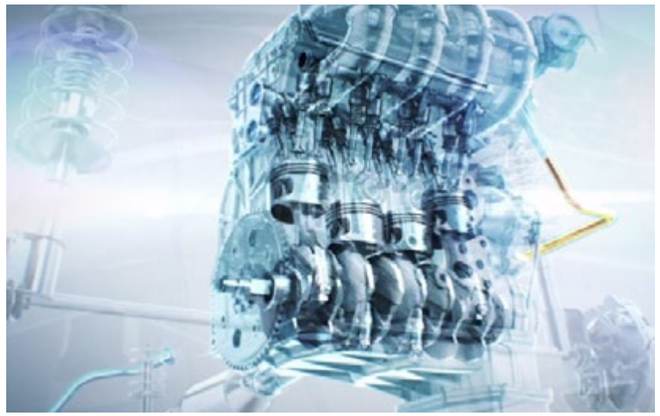
In independent mode, each visitor could choose one of four systems to control: electrical, ignition, cooling and fuel. Each system contains a dashboard with common elements for that system. The visitor will learn what each of the elements does and will be able to touch and drag to change parameters and explore the end result. For example, the visitor could change the wiring layout, voltage, resistance or amperage in the electrical system to turn on a light or fan. If they overload the system, the circuit could break and the visitor would be provided with an explanation of what went wrong. In this mode the glass projection acts as an attract screen displaying an animation of the various subsystems.

In multi-player mode, all four people could work together to get an engine up and running. The experience could begin with each visitor choosing a different subsystem. Like the independent mode, the experience features a tutorial on how to control their subsystem. Once the tutorial is complete, the four users could make adjustments to their subsystems to optimize engine performance; they would need to collaborate in order to understand how changes to each subsystem impact the overall engine performance. In this mode, an animation of the engine as well as the engine diagnostics would be displayed on the glass projection.

The Manitoba Museum Watersheds of the Future exhibit is an example of a multi-player interactive game.

Animation and text can be projected onto a glass surface so that the surrounding environment is visible through the projection. The overall effect is futuristic and playful.

This is an example of a two-sided glass projection in well-lit area.



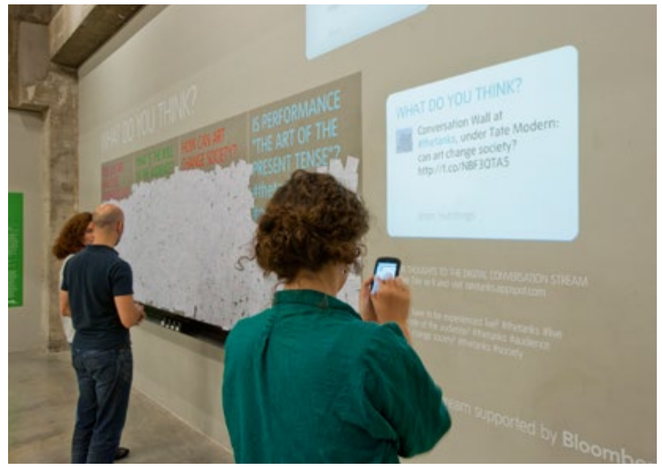
An animated 3D model of the engine can be used to provide visual feedback on whether or not the multi-player team is optimizing engine performance. https://www.behance.net/gallery/1143717/TNK-Pulsar

3.3.8 Demo Stage: Active

The Demo Stage is a natural gathering place for visitors and presents an excellent opportunity to enhance the visitor experience. When not in use for demonstrations, this space could become a playful, gesture-based exhibit through which visitors can explore science and tech content while also creating opportunities for visitors to engage with each other. Programming possibilities are limitless. For example, images could be presented on screen that visitors can control using full-body gestures; perhaps visitors “interact” with the northern lights or with the fireworks at Parliament Hill, controlling their colours or movement. As users interact with the screen, infographics explain the science behind the image (what are the northern lights? how do fireworks work?). Alternatively, visitors could be encouraged to share, via their mobile device, images of favourite artefacts seen while touring the facility. When posted on screen, these “favourites” encourage others to share also and spark dialogue between visitors.

3.3.9 Demo Stage: Gathering Space

When not in use for demonstrations and presentations, the Demo Stage can be used by visitors to recharge their bodies, minds and their devices. This is a brilliant opportunity to engage them in a little trivia! Imagine the big screen being taken over by trivia game that visitors can play using their mobile devices. Visitors could be questioned on science and tech subjects and gain valuable points as they compete with other visitors or against the clock. Points could be scored just for fun. Alternatively, visitors could earn prizes or collect points for redemption in the Boutique (or other important sponsor venues). This type of gamification stimulates collaboration and socially-connected learning, and allows CSTM to share more of their collection with visitors.



3.4 Mobile Strategy and National Outreach

The mobile strategy is designed to fulfill two key roles: as an engagement channel for the National Outreach programme and as a personal exploration tool that is part of the digital media experience at the CSTM. These would be realized through one or more downloadable applications available to the public for installation on their mobile devices (smart phones and tablets). The intent is to leverage the ubiquity of mobile devices to enable meaningful engagement of audiences across Canada in their homes, educational institutions, other science centres and the CSTM.

Engagement would manifest through the two-way communication and documentation capabilities of mobile devices by allowing people to download and upload relevant content to CSTM, engage in dialogue and document their participation in the sciences. The role of the mobile device as a personal exploration tool would also come into play within the Museum; devices would augment the on-site user experience. In both instances, the CSTM could potentially provide the technology to other science centres across Canada through sharing or revenue generation models.

It is important to think of the CSTM mobile strategy as a conversation between Canadians rather than a one-way delivery of information. Users will be able to consume content, but also contribute their own. They will be able to ask questions of experts, document science in their community, and suggest new topics for coverage. Social media integration will allow users to share content to their networks (for example, share a science experiment on Facebook).

3.4.1 Facilitating a National Dialogue

Mobile technology provides an unprecedented ability to engage with Canadians of all ages, economic backgrounds, ethnicities and locations. Mobile devices are increasingly capable of rich, immersive experiences and are viewed as essential personal tools usually within arm's reach 24 hours a day. Mobile is also the preferred method by which content is accessed online. The shift from desktop to mobile is now decidedly in favour of mobile: research for the 2016 Olympic Games indicates 85% of expected web traffic for the Olympics will come from mobile devices.

Mobile devices are well suited for two-way communication and ideal for facilitating a national dialogue on science and technology as part of outreach. Pervasive, personal and trusted, these devices provide a communication platform that most Canadians possess with a relatively low barrier to entry for the user and at no cost for CSTM. In many ways, mobile devices represent the forefront of the intersection of current technological and sociological progress. This provides many opportunities for CSTM to use mobile devices to frame science and technology as part of a far-reaching collaboration. CSTM need only frame the conversations and provide the structure to engage the young, curious and knowledgeable into using mobile devices as personal laboratories, tutors, and measurement and recording devices.

These conversations can become part of the fabric of the CSTM experience through the Interactive National Map, outlined in Section 3.3.1 of this document. The Map provides structure to a visual collage representing the national interest in science and the specific topics discussed regionally; it is the onsite manifestation of the national dialogue, featuring curated user inputs from across the country.

3.4.1.1 Schools Across Canada

Using new, affordable, rapidly improving technologies, the CSTM will be able to make all its accessioned content available to classrooms across the country in ways never before possible. Immersive technology such as Google Cardboard and Expeditions will allow group multimedia experiences led by teachers. As Google said of the technology, it will allow for “field trips to anywhere.”

The CSTM platform will allow interactive lesson plans with rich media modules to be distributed to teachers. These lessons can include images, video, and workbooks.

The CSTM mobile outreach can also include science experiments that can be conducted in class. Classes will be able to submit photos and comments of their completed experiments back to CSTM so that they can share their experiences and findings to the Interactive National Map display. This would provide students with the thrill of perhaps seeing their work during a visit to CSTM while providing the Map with much needed, ever evolving content.

When live programming such as presentations or demonstrations are given on the Demo Stage, CSTM can offer live and archived streaming to and from locations across the country.

3.4.1.2 Homes Across Canada

The CSTM mobile offering will enable families across Canada to learn about science and technology in an interactive, collaborative manner. Mobile devices are becoming more capable each year and provide an unprecedented opportunity to engage with the audience near and far.

Rainy Day Science will provide ideas on science experiments that can take place in the home along with the findings and science behind the experiments.

The mobile Citizen Science will afford users the ability to contribute content en masse. For example, users could report on migrating birds in their community or science experiments conducted at home.

3.4.1.3 Ask a Scientist and Topics of Interest

Inquiring young minds will be able to submit questions in an “Ask a Scientist” feature. These questions and answers can subsequently be viewed in a searchable public archive.

Analytics on these information requests would also be tracked and available for the CSTM to use for gauging interest in structuring future topics of exploration.

3.4.1.4 Discover Local Canadian Narratives

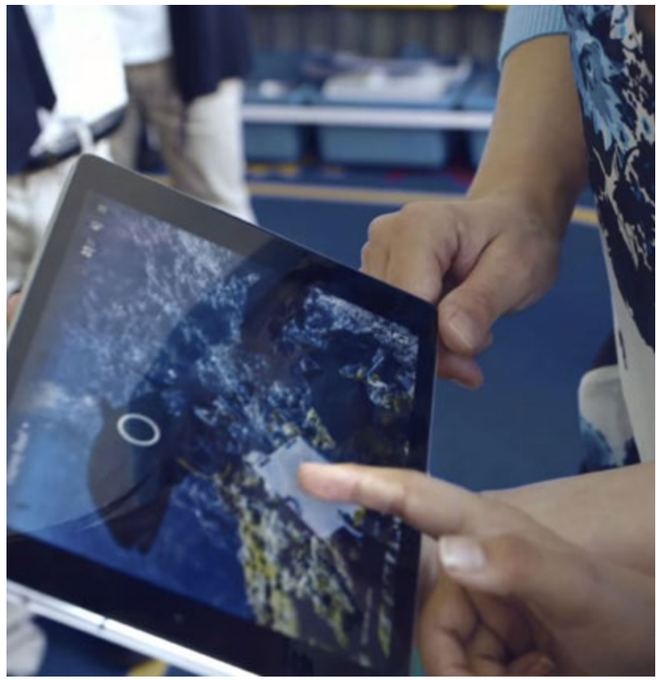
Augmented reality (AR) and geo-location services will allow for exploration of science and technology in communities. Mobile devices can overlay meta data on buildings, natural features, or even historical areas. AR will also allow printed content to come to life using overlaid images and animations (for example, scan a CSTM print piece and see the cutaway of the spiral tunnels or the parts of a rocket engine, and watch the rocket take off from your hands).

3.4.1.5 Relevant to Local Communities and Current Events

It is important to remember that just because you build it does not mean they will come. The CSTM mobile platform will use targeted push notifications to alert users to CSTM mobile content that is relevant to current events. For example, if an oil spill happens in Vancouver, or a comet is visible in the night sky, a push notification can easily be sent to all users of the app that lets them know there is a CSTM module explaining the phenomenon in detail.

Augmented reality will allow text, imagery, and videos to be overlaid on physical objects to help better explain processes or theories. For example, how containment booms and surfactants work to clean up the oil spill or solar wind creates the comet tail.

As with all aspects of the CSTM mobile platform, analytics will be generated to understand which content and items are being accessed most frequently.



3.4.2 Collection Access

Although visiting the CSTM will provide the ultimate way to experience the collection, for those that cannot make the journey mobile will provide another form of access. Part of the mobile strategy will be to make available all accessioned content through a searchable database. Patrons will have the ability to learn about the artefact, related artefacts, the stories of discovery and see the artefact with the option to view select items using Virtual Reality devices such as Google Cardboard or more expensive purpose-built platforms.

3.4.3 Mobile Applications at Work within the Museum

Visitors to the CSTM will be able to use their CSTM mobile platform in the facility to enhance their visit through the availability of supplementary information or to help navigate to topics of interest.

3.4.3.1 Enhanced Content Within the Museum

Mobile technology at the CSTM facility will introduce a viewable meta layer of content that is contextual to the visitor's location and collection item being viewed. This layer of content will allow for interactivity, greater understanding, and a deeper level of information available with the limited space allowed by physical printing constraints. Examples of the way this may be applied are explored in Section 3.3 Digital Media Strategy. The content can also be tailored depending on the visitor; for example, a module could be presented in either an adult or kid-friendly mode, or the content could be provided in alternate languages or audio for the visually impaired.

3.4.3.2 Bringing Content Within Reach

CSTM wishes to make as much as possible of their collection physically available on display inside their updated facility. This will mean placing artefacts in the collection in unique configurations that may make it difficult to provide proximal information for some objects. Combining location awareness, optical place/pattern recognition and Augmented Reality, the mobile platform will enable visitors to use their device's camera to "see" the environment and on-screen overlay information about items in the collection. For example, a replica of the Alouette satellite may hang from the ceiling of the Museum with no placard immediately visible; the visitor lines up their mobile device camera and onscreen identifying information about the satellite is superimposed along with a detailed view.

3.4.3.3 Wayfinding

Mobile devices can also act as way finding tools so that users can quickly find the appropriate route for a certain learning path, or go directly to a specific item. This experience could even start while the user plans their visit to CSTM, with past topics of interest or favourited subjects suggesting areas of exploration and routes in the facility.

Beacon infrastructure will allow for indoor location even when a GPS signal is not available.

3.4.3.4 Favouriting and Sharing

As visitors navigate through CSTM, the mobile platform would allow for "favouriting" of specific displays. The information would be available to the visitor for subsequent recall and social media sharing. The Demo Stage provides another opportunity for visitor dialogue with the Museum via mobile apps, as explained in Sections 3.3.7 and 3.3.8 of the Digital Media Strategy.

3.4.3.5 Objects Not on Display

Mobile devices will also allow for exploration of CSTM artefacts not currently on display. For example, the 3D models and specifications for all CSTM snowmobiles could be called up when viewing a snowmobile on display.

3.4.4 Selecting a Suitable Platform

There are pros and cons for using mobile web vs. native apps and the final selection will largely be dictated by analysis of the requirements of CSTM. Mobile web offers the advantage of supporting many different types of devices due to the standardization of coding for web browsers, resulting in effort and cost savings. However, the underlying assumption of Mobile Web is that a persistent, low latency, high bandwidth data connection is present. Conversely, native application development can be more costly, but uses less data and can provide enhanced functionality using “on device” capabilities that currently cannot be delivered via the web. Fortunately, the two are not mutually exclusive.

One component of the CSTM Mobile vision includes targeted push notifications to alert users to new or relevant content—for example, notifications that there is content available on lunar eclipses when a lunar eclipse will be happening in the users’ area. Push notifications currently rely on a native application with opt-in permissions. Augmented reality experiences are also limited if relying on current web technologies, although this is rapidly changing with the introduction of offerings from Google and Mozilla. Ultimately, a hybrid approach may be used to provide the benefits of both mobile web and native app development.

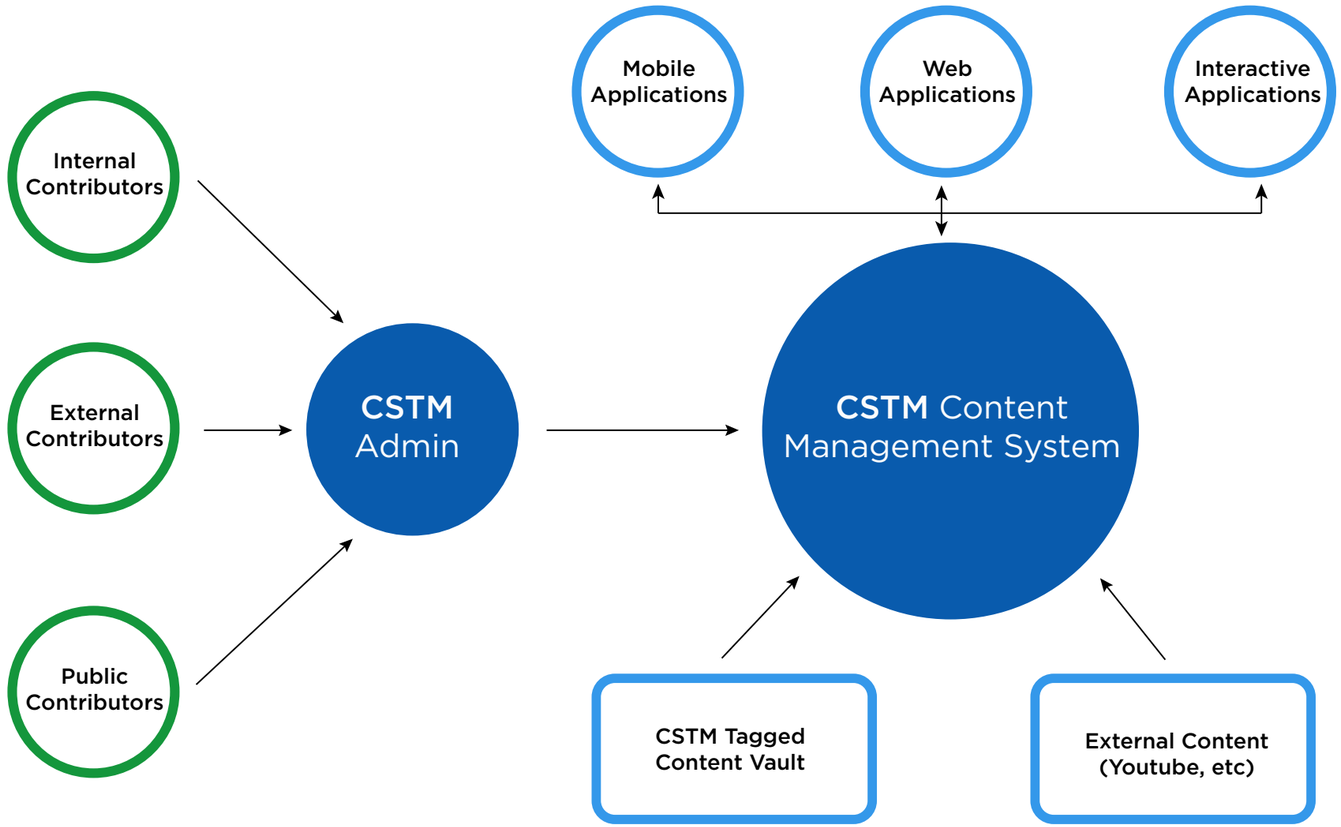
CSTM mobile should be predicated on a strong central content management system that can be accessed in a variety of ways including mobile web, native applications, and other future interactive concepts.

3.4.5 Content Management System

The mobile strategy is predicated on a robust content management system (CMS) that will allow internal and external contributors to easily build a database of text, image, and video items.

All content will be verbosely tagged with meta tags such as “telecommunications”, “Alberta” and “wireless”. In doing so, the system will be future-proofed by allowing mobile applications to access the information through dynamic queries, such as those used to match content to users.

The CMS will allow for an administrator to easily add new users or to create editors that can approve externally provided content. The CMS will have an analytics dashboard so that CSTM staff can easily see which content items, objects, or lessons are accessed most frequently.



3.4.6 Science Centres and Museums Across Canada

One of CSTM's metrics for success is to effectively extend its reach beyond the Museum. This is the basis of the following Travelling Exhibition, which would form a part of its national outreach strategy. It takes advantage of the Museum's collection to establish institutional presence and partnerships with science centres and museums across the country, engaging a national audience with the CSTM's collections and interpretive messaging while encouraging visitation to CSTM when visitors are in Ottawa.

3.4.3.1 The Travelling Exhibition

The proposed Travelling Exhibition will circulate real objects from the CSTM collection to science centres and museums across Canada. Exhibit components will accompany these artefacts, providing visitors with opportunities for interaction. These components may be custom-developed, defined by a variety of themes and artefacts, or determined by curatorial research, interpretive planning and/or host institutions' thematic requirements.

3.4.3.2 Exhibition Components

The Travelling Exhibition will be composed of the following:

Feature Artefacts from CSTM Collection

Artefacts would be relatively small, and may not have great monetary value but they should be of historical significance. They should be selected for their ability to be attention-getters: unique, rare, unusual, controversial and representational of the CSTM's overall collection. When displayed, these objects are contained within a secure case; however, selected objects would not have special conservation requirements that necessitate environmentally-controlled casework.

Support Artefacts

Smaller artefacts that may provide additional content support and/or that directly relate to the featured artefact will be displayed according to their place in the exhibition's thematic structure. Similar requirements for security and conservation as the Feature Artefact will be upheld, although these smaller objects may be drawn from CSTM's touchable collection and may be handled with staff present.

Artefact Database

Visitors may use a kiosk for online access to the entire CSTM collection, thus encouraging exploration of the database from home. The Travelling Exhibition would provide a CPU, monitor and keyboard, with restricted access to a CSTM site. The database could promote download of CSTM's dedicated app for more in-depth dialogue with the Museum.

3D Printer

The printer will be used to replicate any number of objects from the CSTM collection; these may be full size or scaled versions. Where visitors cannot physically interact with the real artefact, printed full-scale reproductions are made so they can have a tactile experience, while the simple viewing of objects being 'created' on the spot will be a great attractor. Printed objects may be kept on display in the exhibition, accruing over the duration of the exhibition for all visitors to see and interact with. The printer can be used by the visitor (with staff assistance) to replicate an artefact from CSTM's collection database.

The Travelling Exhibition provides the printer, software and link to the CSTM site, as well as selected artefacts that are suitable for modeling. The host institution would supply consumables and be responsible for the operation and maintenance of the printer.

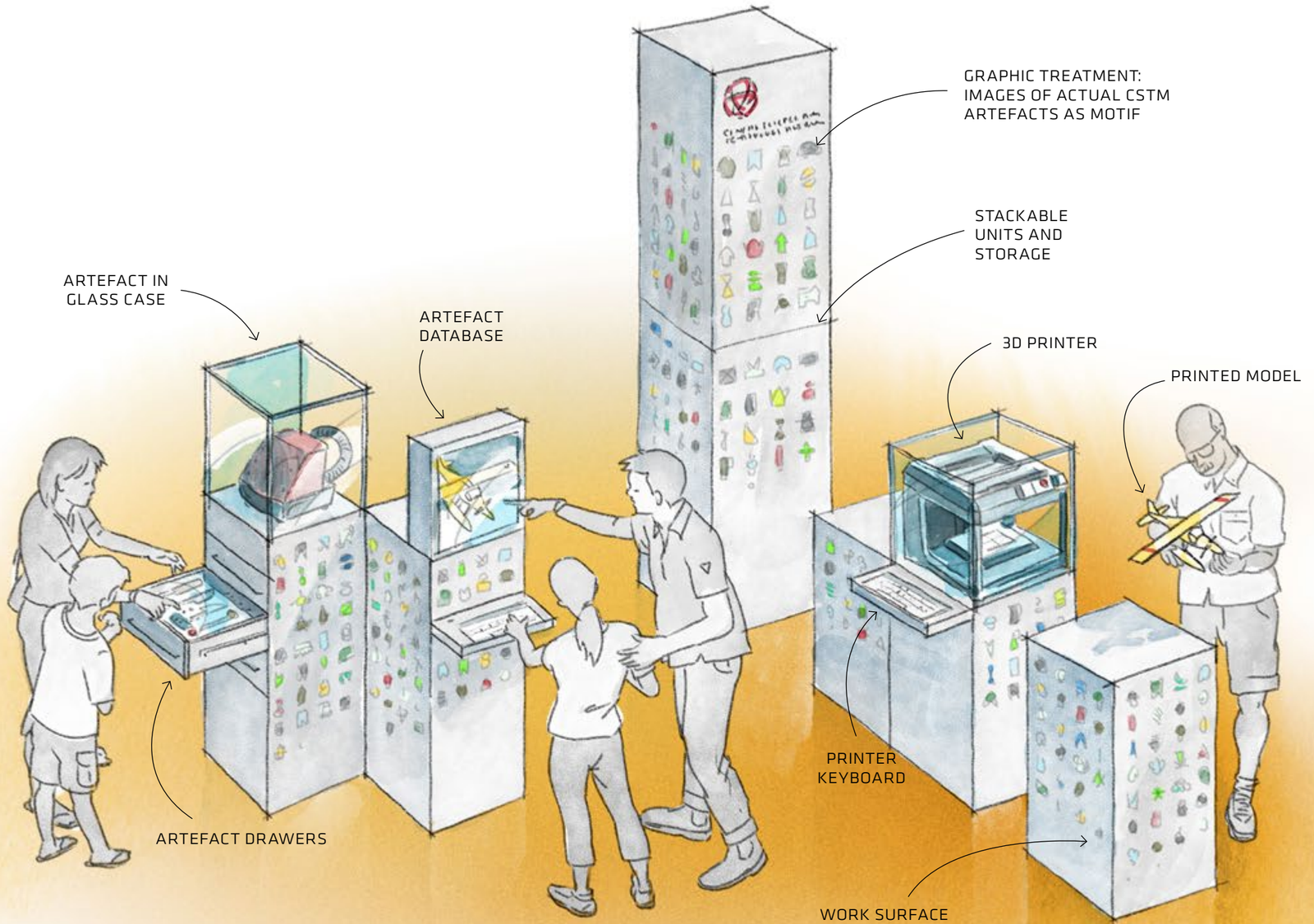
Graphic Support

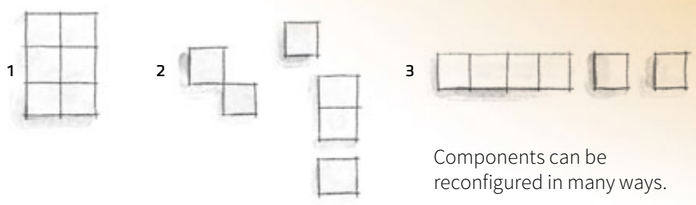
The graphic approach would reinforce the exhibition focus of "accessing the CSTM collection." This might manifest as line drawings along the exhibit bases, representing the wide variety of artefacts in the CSTM collection. Interpretive graphics would be provided, telling the story of the CSTM, its role as a national institution and its collection.

Design of Components

Exhibition components are designed to be arranged in any number of layout options to accommodate different spatial requirements for individual host institutions. The bases provide storage space and secure environments for hardware. Component bases are designed to fit into as few shipping crates as possible (some are collapsible to create less volume), while assembly of the bases is straightforward and electronic components are a simple 'plug and play' approach. Materials are lightweight, but extremely durable to resist normal exhibition wear and tear and requirements of shipping and constant assembly and disassembly. Host institutions are free to use all or some of the components included with the Travelling Exhibition.

NATIONAL OUTREACH – THE TRAVELLING EXHIBITION





Components can be reconfigured in many ways.

3.5 Interpreting Current Trends in Science and Technology

A central facet of successful science and technology museums is the presentation of science and technology topics so that visitors can see the relevance of these topics to their lives today, while prompting questions about where current trends will take us tomorrow.

Cutting-edge developments in science and technology tend to be inherently future-focused, insofar as the consequences of many current ideas and inventions have not yet been resolved or actualized in a yet-to-be-determined future tense. How will continuing research and advancements in artificial intelligence technologies affect society? Will gene therapy provide the cure for cancer? And so on.

Many museum attempts at interpreting the future soon end up dated and irrelevant. When exhibitions successfully capture the "right now" on the gallery floor, however, interpretation that delves into questions of the future becomes not only a possibility, but a natural (and even expected) component of the exhibition narrative. In this regard, interpretation of the future is best delivered via interpretive programmes and demonstrations that use cutting-edge exhibition as a thematic resource. This is a key strategic point to consider in response to CSTM's desire to bring the future onto the gallery floor.

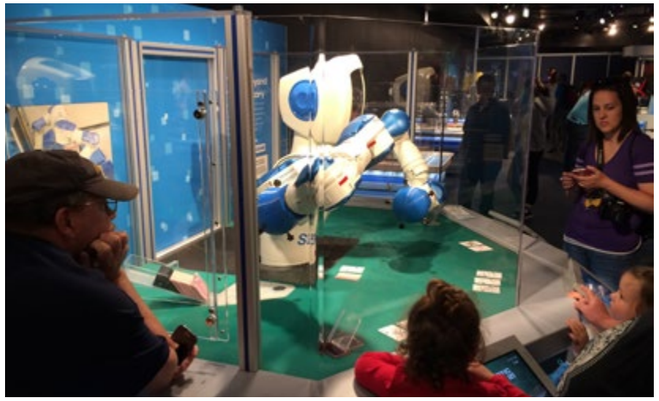
3.5.1 The Central Role of Partnerships

It is crucial to interpret what is happening 'right now' in a way that is authentic and that will resonate with visitors. The importance of partnerships with research institutions and industry in delivering cutting-edge science and technology exhibits cannot be stressed enough. A renewed CSTM has an opportunity to position itself within mission-appropriate industry and academic networks as public communication/education conduit. In turn, CSTM could optimize on such partnerships by accessing leading-edge content and artefact resources for display, while elevating its public identity as an institutional participant in a professional science and technology dialogue. What follows are two case studies for how two other science and technology institutions have successfully tackled the exhibition of the "cutting-edge" in science and technology.

Outcome of a Longterm Network: "Robot Revolution," Museum of Science and Industry – Chicago

The "Robot Revolution" exhibition at Chicago's Museum of Science and Industry (MSI) provides a relevant case study for how a long-term international network of industry and research institutions made possible a successful exhibit that brings cutting-edge robotics technologies onto the gallery floor for museum visitors. This entailed MSI fostering relationship with various institutions over several years while establishing an identity as a location for informal robotics education through regular hosting of robotics lab programming.

Today, "Robot Revolution" features the latest robotics technology by featuring dozens of prototypes and commercial robots for display and interaction. Interpretation presents the various robot prototypes by way of the basic functions for which they were designed, such as "Cooperation," Skills," "Smarts," and so on. MSI's exhibit contributors, a combination of commercial and academic partners are committed to multi-year agreements to iterate robot design within the exhibit as technology advances. Successfully presenting cutting-edge technologies with a clear "futuristic" angle, the evolving "Robot Revolution" has been designed as a travelling exhibit, and will be generating revenue for MSI after it concludes its opening run at its mother institution in Chicago.



Joining a Dialogue: “L’Observeur du Design,” Cité des Sciences et de l’industrie – Paris

Cité des Sciences has interfaced with France’s national Agency for the Promotion of Industrial Creation (APCI) to become a part of the Agency’s annual L’Observeur du Design event. Since its founding in 1999, L’Observeur du Design has highlighted the nature of the relationship between industrial designers and their public or corporate partners in innovation processes. The exhibit is a competition format event, where APCI selects a number of prototype designs chosen from a yearly call for submissions. The selected pre-market prototypes are displayed in a temporary exhibition situated within the Cité’s Innovations Gallery. The most remarkable creations are awarded “Etoiles” by a jury of international experts. Another set of awards are bestowed by various corporations in their respective areas of expertise, while the visiting public also votes to choose winners of the event’s Public Awards. The event has been consistently well attended, with partners that include major French industries and design institutions. As of 2015, 2731 designs have been submitted for exhibition.

L’Observeur du Design is a temporary exhibit that runs in the Cité three months of the year. It is an unqualified success in the way it positions the institution within the country’s design community and contributes to the public perception of the Cité as an authentic technology and design authority. In terms of the visitor experience, the Cité provides APCI with an attractive exhibit space within the topically relevant context of the Cité’s Innovation Gallery. In return, L’Observeur du Design provides annually updated content and objects for a section of the Cité’s Innovation Gallery. L’Observeur du Design has a decidedly ‘products of the future showcase’ look and feel, which is becoming crucial within a larger Innovations Gallery that is starting to look slightly long in the tooth.

FUNCTIONAL PROGRAM

4.0 FUNCTIONAL PROGRAMME

The Canada Science and Technology Museum renewal presents an opportunity to improve the building with the goal of allowing staff and visitors more efficient access to and circulation through the various functions of the Museum. To this end, APA has analyzed the existing building, reviewed previous studies, interviewed staff and met with the facilities and architectural and engineering teams to develop a preliminary functional plan for public areas.

4.1 Functions and Areas

The following schedule lists the desired functions of the publicly accessible components of the Museum and the areas required to accommodate those functions. This was developed in close collaboration with the CSTM exhibitions and facilities teams as well as the architectural and engineering team. Previous reports that were consulted include the GBCA Functional Plan dated March 3, 2015 and the CSTM Functional Program Priorities dated April 6, 2015.

This schedule of functions and areas informed a workshop held at the Museum to determine optimal agencies and circulation. That exercise and subsequent iterative reviews resulted in the preliminary museum floorplan and accompanying access, adjacencies, and circulation diagrams found on the following pages.

VISITOR SERVICES		
Main Entrance and Lobby	535	m^2
Group Entrance and Lobby	200	m^2
Boutique	500	m^2
Washrooms		
Lobby	120	m^2
Children's Gallery	60	m^2
Classrooms	60	m^2
Cafeteria	60	m^2
Exhibitions	60	m^2
Coat Room	120	m^2
Conference Hall	500	m^2
Auditorium	500	m^2
Cafeteria	500	m^2
Classrooms	390	m^2
EXHIBITIONS		
Moving and Connecting Gallery		
Upper Gallery	550	m^2
Lower Gallery	540	m^2
Locomotive Hall	1,065	m^2
Transforming Resources Gallery	550	m^2
Maker Space	150	m^2
Creating and Using Knowledge Gallery	700	m^2
Technology in Our Lives Gallery	550	m^2
Crazy Kitchen	150	m^2
Children's Gallery	600	m^2
Living Lab	70	m^2
Family Room	30	m^2
Temporary Exhibition Gallery	800	m^2
Queueing Area	100	m^2
Artefact Alley	480	m^2
Demo Stage	200	m^2
Storage	25	m^2
TOTAL	**10,165**	**m^2**

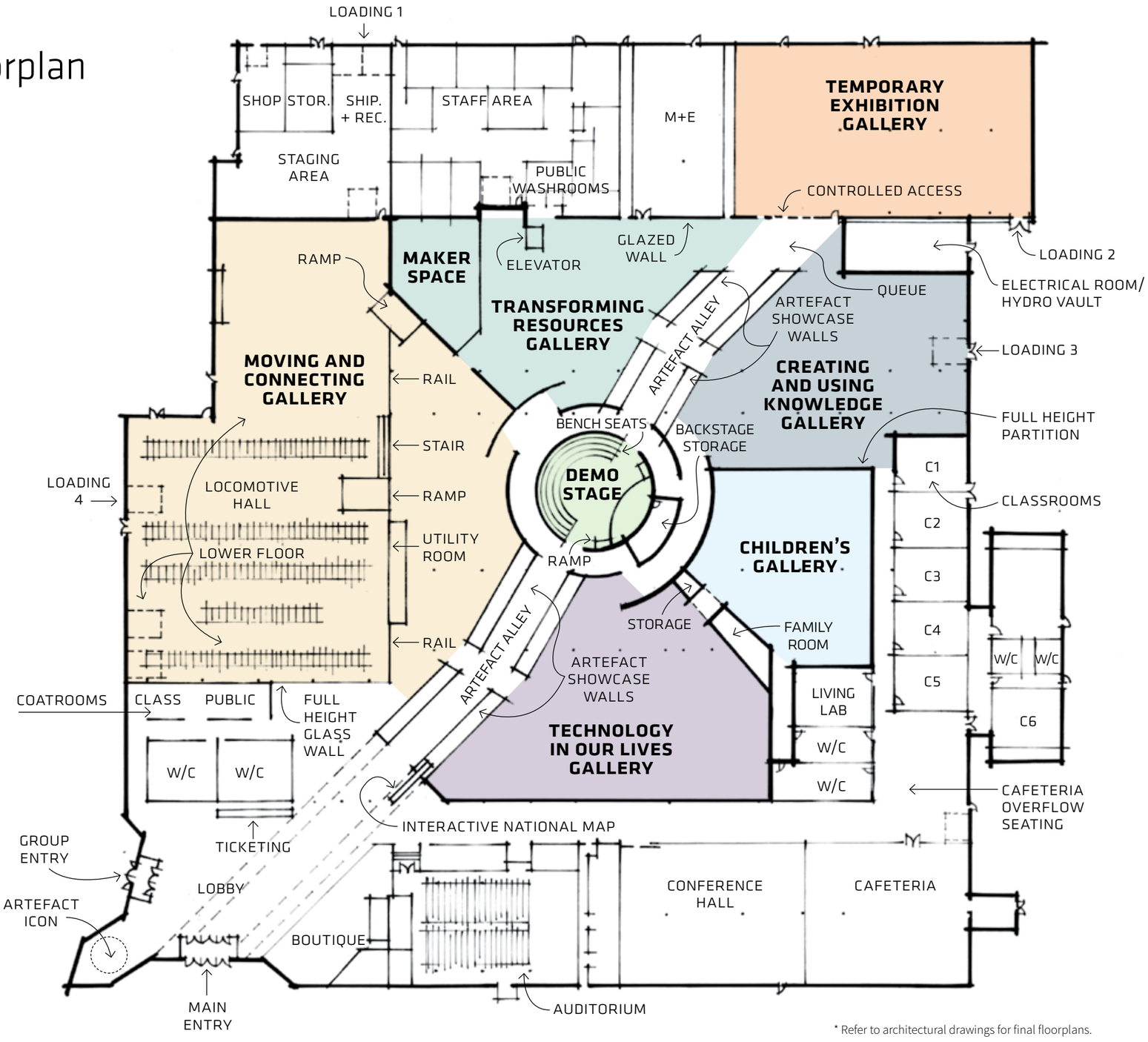
4.2 Preliminary Museum Floorplan

The preliminary floorplan is designed to optimize access to CSTM's extensive collection by increasing the visibility and quantity of artefacts on display and, where possible, by enhancing opportunities for artefact interpretation and interaction. Visitors intuitively understand that the artefacts serve as the foundation for science, technology and human related stories.

The architecturally integrated exterior digital panels are programmed to highlight the collection inside, connect to the large, changeable and iconic artefact featured in the lobby, and serve as an introduction to the overall Museum experience. Artefact Alley functions as a diagonal spine through the Museum, offers clear wayfinding and entry experiences that connect to all major galleries, and provides a direct route to the Demo Stage and Temporary Exhibition Gallery.

The Demo Stage bisects Artefact Alley and acts as a hub to the surrounding Museum, allowing visitors to quickly and easily move from the adjacent galleries to the central space when a show is about to start.

The Temporary Exhibition Gallery is located at the far southwest corner encouraging visitors to meander through Artefact Alley before arriving at the new exhibition. The gallery has direct loading/unloading access and can be closed off to the main Museum during installs/strike or when not in use.



* Refer to architectural drawings for final floorplans.

4.2.1 Access, Adjacencies and Circulation

Access and accessibility are key considerations in the preliminary floorplan for both visitors and staff. There is a main entry and a group entry located at the front of the lobby, in close proximity to the washrooms, coatrooms, boutique and ticket counter. The large wall located directly behind the ticket counter provides both orientation, and clear information outlining the featured exhibitions, daily highlights, shows and admission costs. The spacious lobby allows groups and families to gather prior to entering the Museum.

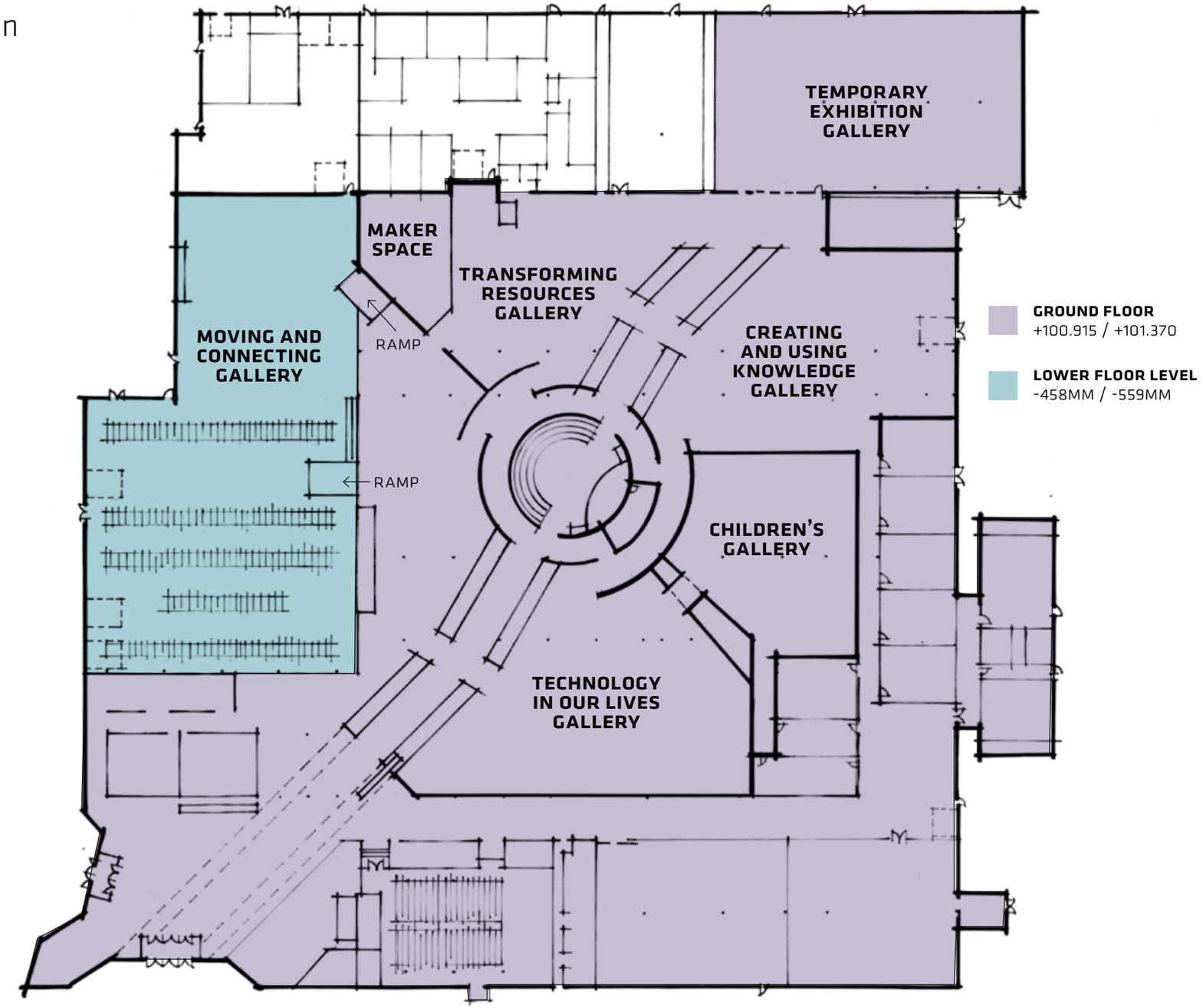
Visitors wishing to explore the Museum's galleries take a clear path down Artefact Alley, branching off to any of the four Core Galleries or heading directly to the Demo Stage. Visitors can move from gallery to gallery in either a clockwise or counterclockwise direction, passing through Artefact Alley or they can return to the central Demo Stage and move from the center to the outer perimeter of any gallery.

The Children's Gallery is located off the Technology in Our Lives Gallery, providing more security with a single, main entry/exit. The Family Room spans a central section of wall, allowing parents privacy while nursing and the ability to watch another child from a safe distance. A short hallway provides direct access to public washrooms. In addition, the Learning Lab is adjacent to the Children's Gallery providing opportunities for CSTM and partner institutions to work collaboratively in the area of child development through research.

With the exception of the Moving and Connecting Gallery, all other galleries are now on the same level making navigation through the Museum seamless. Two ramps connect to the lower level of the Moving and Connecting Gallery, allowing the large locomotives to stay in their former location. The Demo Stage, central to the entire museum and circular in plan, maximizes its footprint by creating amphitheater-style seating surrounding a central stage. Staff has direct access to backstage storage from the stage platform. Two of the four Core Galleries and the Temporary Exhibition Gallery have direct loading bay access.

The final location for Maker Space is still to be determined. Ideally, it will be located between two galleries, providing staff with flexibility in designing programmes and activities related thematically to the adjacent galleries but not limited to. Staff have requested that Maker Space have direct access to loading and staging areas.

All back-of-house functions are nestled together in the northeast corner of the building, including workshop, storage, shipping and receiving, staging area and a staff area. There is a direct route from the lobby to the Auditorium, Conference Hall, Cafeteria and Classrooms. There are plenty of washrooms located close to the Classrooms and Cafeteria, and an overflow area beside the Cafeteria for school children to eat lunch.



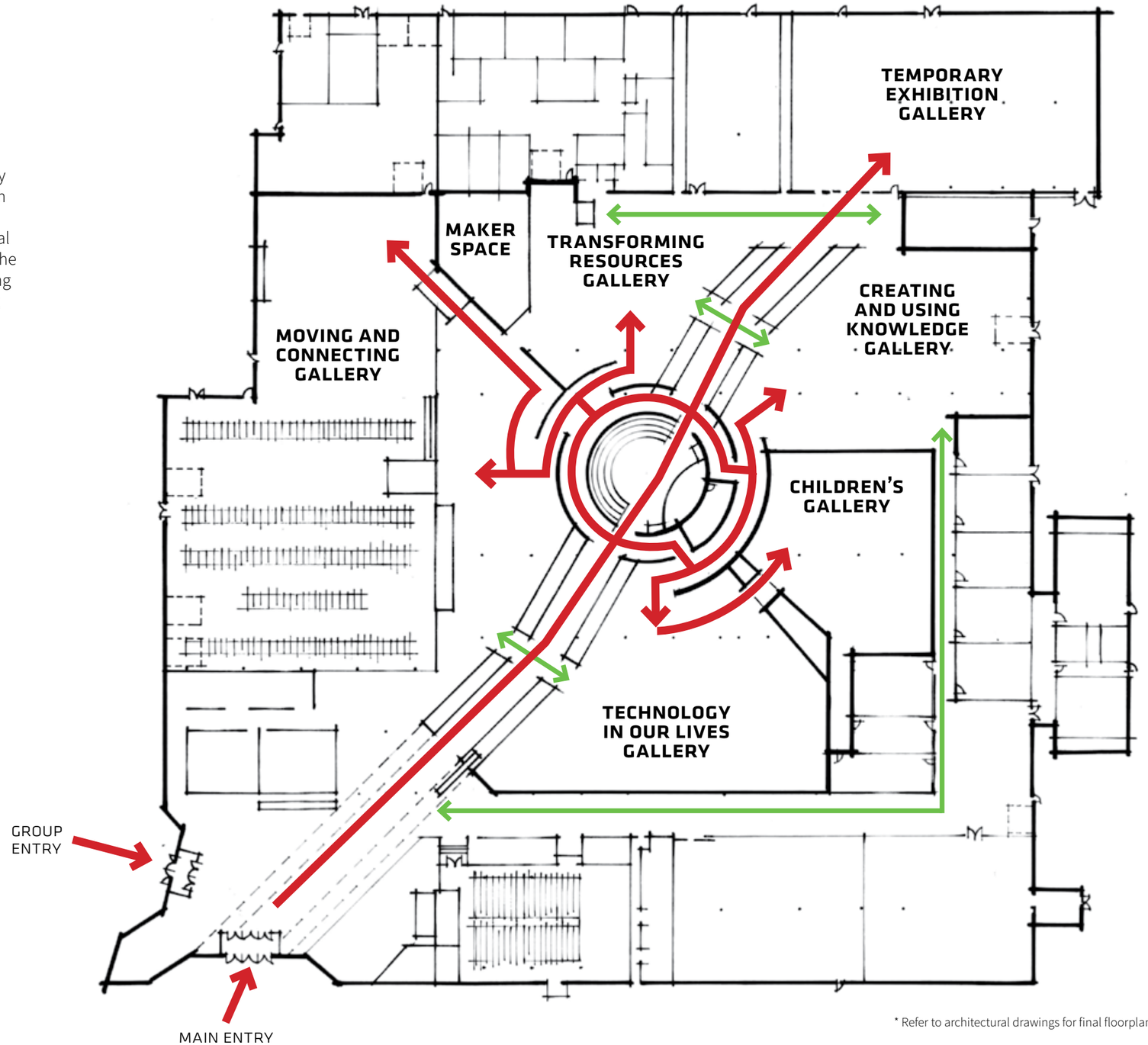
* Refer to architectural drawings for final floorplans.

4.2.2 Visitor Access and Circulation

Primary access through the Museum starts at the Lobby, and runs down the length of Artefact Alley, with branches to the major galleries. It is important to note that the central circulation path that wraps around the outer wall of the Demo Stage also serves as primary circulation, whereby visitors radiate outward to the perimeter galleries and back again to the center. Alternatively, they can radiate outward and then choose a secondary circulation path by moving clockwise or counterclockwise to the galleries, cutting through the passageways of Artefact Alley. There are two additional secondary circulation routes that provide a bypass to the core of the Museum; one that runs east/west from the Cafeteria to the Creating and Using Knowledge Gallery, and a second long corridor running north/south from the Lobby to the Auditorium, Conference Hall, Cafeteria, Classrooms and Learning Lab.

PRIMARY CIRCULATION

SECONDARY CIRCULATION

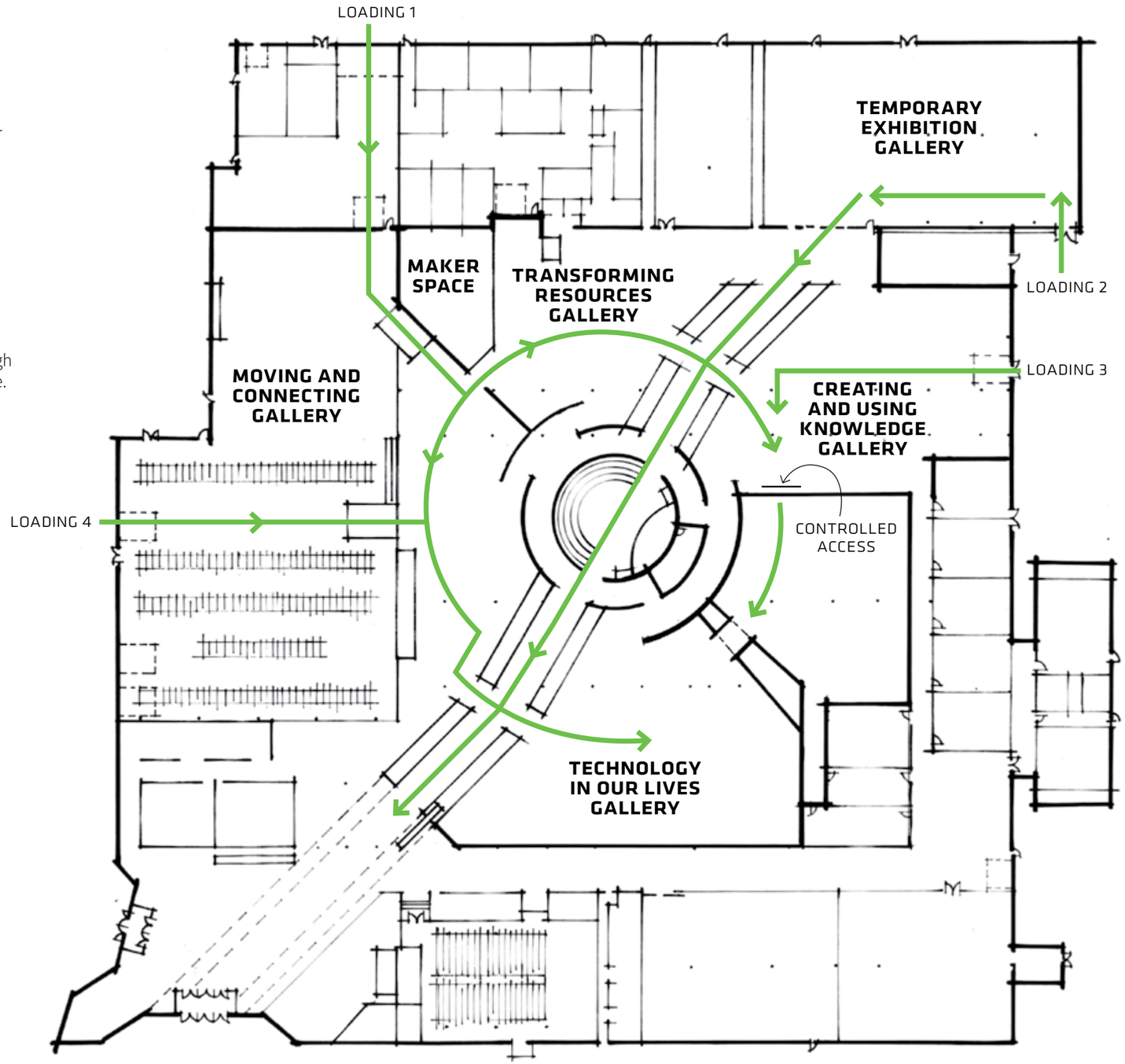


* Refer to architectural drawings for final floorplans.

4.2.3 Artefact and Equipment Access and Circulation

It is essential that CSTM staff have clear transport routes not only for moving heavy equipment and/or large artefacts in and out of the Museum, but also throughout the Museum. These transport routes should be kept clear or exhibits that are located within a transport route should be moveable. All access routes provide clearance for large artefacts.

There are four primary loading bay doors located around the perimeter of the building, three that lead directly to the Moving and Connecting Gallery, Temporary Exhibition Gallery and the Creating and Using Knowledge Gallery. Objects and/or rental equipment intended for display or use in Artefact Alley should be moved through the loading bay door at the Temporary Exhibition Gallery, if possible.

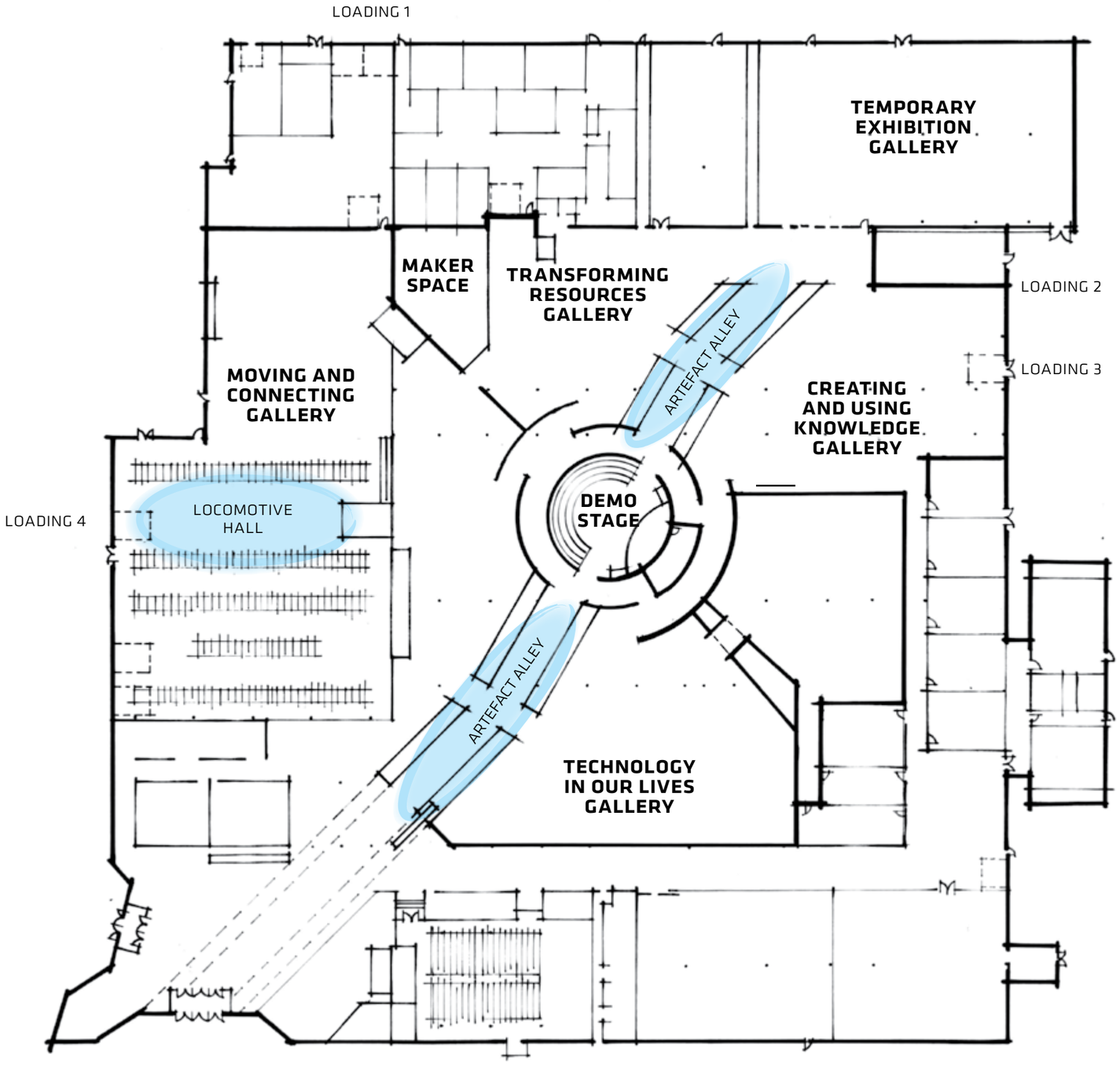


* Refer to architectural drawings for final floorplans.

4.2.4 Potential Facility Rental Locations

Facility rentals provide CSTM with opportunities to rent the facility for a variety of daytime or evening events. Although an important aspect of the rentals is revenue generation, rentals also provide CSTM with a chance to connect with the community, increasing visibility within Ottawa and the surrounding rental markets. Historically, CSTM has rented a variety of spaces within the Museum including the Auditorium, Conference Hall and Classrooms for a variety of events including banquets, conferences, receptions and weddings to lectures, meetings and workshops. CSTM also hosts evening events such as the popular sleepovers in Locomotive Hall and picnic events outdoors on their expansive, green lawn sprinkled with large sculptural iconic elements that provide a unique setting.

In addition to rental opportunities of the past, CSTM has identified the need for new rental opportunities providing new streams of revenue generation. The floorplan highlights the area within the Locomotive Hall, and two new areas within the glass walls of Artefact Alley. A plan study will be provided in the next phase of design to determine how many seats can be accommodated in the new areas. The Demo Stage should also be considered, as a central “theatre in the round” for groups of 150 or less.



* Refer to architectural drawings for final floorplans.

4.3 Base-building Requirements

The base-building requirements provide a general summary of building system requirements that are necessary to support exhibits and galleries for the Canada Science and Technology Museum. They are intended to identify the physical, environmental and control interfaces between the building and exhibition elements, and define the boundary between exhibit scope and architecture scope at these interfaces. Exhibition related requirements that will be provided within the base-building construction works are identified, with a description of the performance and technical parameters that will influence the interfaces between base-building and exhibits.

4.3.1 Summary of Base Building System Requirements

These recommendations apply to the following areas within CSTM:

- Temporary Exhibition Gallery
- Core Galleries
- Demo Stage

4.3.1.1 Power and Data

Exhibit Power

Estimated power requirements are 70 W/m² in exhibit galleries, as follows:

- Exhibit and Theatrical Lighting Power..... 15 W/m²
- Exhibit AV Power..... 35 W/m²
- Exhibit Small Power..... 20 W/m²
- AV Control Rooms..... 250 W/m²
- Additional power in temporary galleries for existing theatrical fixtures—approx. 100,000 watts.

Power and Data Distribution

General:

- The base building contractor will distribute power and data cable to all floor and ceiling boxes.
- The exhibit contractor will connect the exhibits to the floor boxes as necessary.

Power and data on floor and wall:

- Power and data floor boxes to be distributed on either a uniform grid of 3 m x 3 m or as specified by exhibit designer to clarify preferred scheme.

Power and data for overhead exhibit lighting:

- Power and data points to be distributed at ceiling coordinated with exhibit designer's lighting plan.

Typical Floor Box Requirements:

- One 120 V power receptacle, circuit A (nominally for AV). Circuit A shared between 3 floor boxes.
- One 120 V power receptacle, circuit B (nominally for case lighting). Circuit B shared between 3 floor boxes.
- Two RJ45 data connectors, each with a CAT6 cable home run to AV patch bay in closest AV data room. AV data can be separate from building data system but should have a connection to building data to facilitate remote access.

Lighting and Show Control Systems:

- All exhibit lighting circuits to be provided with central dimming and programmable control.
- A programmable lighting control system to be provided to allow for beginning/end of day control and for the selection of preset scenes for normal visitor experience, cleaning, and special events.
- Dimming systems, where provided, must be fully compatible with LED sources and provide smooth dimming from 5% to 100%.

4.3.1.2 AV/IT Room

- Base-building to provide dedicated secure room(s) that is/are ventilated and temperature controlled.

4.3.2 Exhibit Lighting

Exhibit lighting will be provided for the areas that correspond to the exhibit area delineation plans.

The primary exhibit lighting to be provided by a museum grade track lighting system, which will provide flexibility, durability and provision for a wide range of accessories including filters, louvers, barn-doors, and light blocking screens.

LED lamp technology will be utilized where possible to reduce maintenance and energy costs.

4.3.2.1 Exhibition Gallery Lighting Scope Inclusions

- Feature lighting and general circulation lighting within galleries, which will be supported from the exhibition structures or perimeter ceilings and gallery walls.
- Lighting fixed to or within exhibition display structures.
- Exhibit cases will be fitted with internal LED lighting and/or an internal fibre-optic lighting system as appropriate for accenting artefacts.
- Colour wash lighting may be considered to enhance the experience in certain areas as appropriate.
- Pattern projection and theatrical effects projectors may be used if appropriate in selected areas. HID or LED lamp technology will be utilized in these devices to reduce maintenance and energy costs.
- Other lighting sources will be provided as required to suit specific needs.
- A dimming system will be provided with controls for each exhibit area for fine-tuning of the overall lighting, reduction of illuminance levels to meet conservation requirements and the custom programming of special effects.

4.3.2.2 Artefact Conservation

- In the event that light-sensitive materials are introduced, light levels can be adjusted via the dimming system. The proposed LED lamps do not emit ultra-violet radiation so UV filters will not be required.

4.3.2.3 Exclusions

- Emergency, maintenance and house lighting is to be supplied through the base-building contract.
- Power distribution to the exhibit lighting system to be provided from the dimmer/electrical panels to exhibit lighting backboxes in the gallery ceilings, walls, and/or floors.
- Conduit and control wiring for exhibit lighting systems to be provided from the exhibit lighting control rack to backboxes in the gallery ceilings, walls, and/or floors.

4.3.2.4 Integration with Building Management System

- Base-building to provide links between the building system and both the exhibit lighting system and the exhibit AV system so that, in the event of fire detection or other emergency, the exhibit systems are automatically switched off and the emergency lighting and evacuation turn on, etc.

4.3.3 Exhibit AV Systems

Exhibit AV systems will be provided for the areas that correspond to the exhibit area delineation plans.

The exhibit AV systems will be a decentralized system with components located inside the millwork of the same exhibits as their screen or interactive element. AV systems will be CPU based playback units capable of hosting a dynamic range of content including websites, videos, custom software and capable of supporting hardware such as multiple displays, touch screens, projectors and other display and input devices.

4.3.3.1 General Notes

- All AV systems CPUs will have remote access capability for management and troubleshooting.
- Projectors, displays, projectors and touch screens will be commercial models with a minimum rating of 16 hours per day operating time.
- Projectors, displays, projectors, amplifiers and touch screens will have the ability to be powered on and off remotely.
- Projectors, displays, amplifiers and touch screens will have LAN control wherever possible.
- Micro-controllers may be used for interactive exhibits. Source code for any micro-controllers used on the project will be made available to the client for re-installation purposes.
- All CPUs and accessories will be hard wired for power and communications.
- Local Area Network will be Gigabit. Any small switches provided in exhibits will be capable of Gigabit communication.
- Video and audio signal conversion should be kept to a minimum and used only when necessary.

4.3.3.2 Control System

- AV system will have a central server to provide an interface with the BMS system for scheduled power on/power off commands.
- All CPUs, Projectors, displays, touch screens, amplifiers will be connected to a local area exhibition network and switchable by a centralized control system.
- Computers will enter a low power mode when requested by centralized control system.
- Centralized control system will use IP based control out to devices wherever possible eliminating the need for IP to serial converter boxes.
- IR Control of equipment is not permitted.

4.3.3.3 Exclusions

- Power distribution to the exhibit AV system to be provided from the electrical panels to exhibit AV backboxes in the gallery ceilings, walls, and/or floors.
- Conduit and control wiring for exhibit AV systems to be provided from the exhibit lighting control rack to backboxes in the gallery ceilings, walls, and/or floors.

4.4.3.4 Integration with Building Management System

- Base building to provide links between the building system and both the exhibit lighting system and the exhibit AV system so that, in the event of fire detection or other emergency, the exhibit systems are automatically switched off and the emergency lighting and evacuation come on, etc.

DESIGN GUIDELINES

5.0 DESIGN GUIDELINES

Design Guidelines presented at the Masterplan stage are intended as high level approaches to the CSTM's technical requirements identified at the project start. The conceptual approach for gallery arrangements within the Museum is to encourage gallery designs that are distinct from each other and from common areas inside the Museum. Further, each gallery will contain a yet to be determined number of exhibitions defined by a set of related subthemes. The look and feel of these exhibitions may likewise be distinct, but related.

The Guidelines listed herein are intended to give direction, rather than be prescriptive. They are to be followed to ensure a level of consistency within the overall Museum. They are not intended to restrict the creative design process for individual galleries, but to maintain a certain level of consistency in design throughout the CSTM. Contracted Design Teams (Contractors) for individual exhibit areas within the Museum will work with the Design Overview Coordinator (DOC) in the Concept Design Phase to ensure the Guidelines are followed and to encourage distinct approaches to individual galleries. The DOC will also act as the design coordinator between gallery Contractors and the CSTM.

CSTM Exhibition Project Managers will coordinate design reviews between Contractors and the DOC.

5.1 Relationship to Base Building

a. Design of Core Galleries and Common Spaces will be coordinated with the design approach developed by the architects for the base building. This includes the selection of materials, a colour palette and miscellaneous building details. It is anticipated that the base building design approach will call for a neutral colour and materials palette, allowing for a broader range of options for complementary palettes within the galleries.

b. Exhibit design for individual galleries should respect the Artefact Alley structure that runs through the Museum as a display technique and an organizing element for the entire Museum. Visitors in the Core Galleries should have full physical and visual access to the Artefact Alley for viewing the objects within it, as well as access to the interactive components that are integral to the structure.

c. The demising wall separating galleries or common areas are not full height (to the underside of the existing truss system). Design of individual galleries should take into consideration potential for acoustic and light spill that may affect adjacent spaces. Specifically, audio-visual programmes should be self-contained within the gallery to mitigate sound and/or light spill.

d. Objects or structures within individual galleries should consider demising wall heights and openings between adjacent spaces. Objects visible from other spaces will be considered and perhaps even encouraged, in coordination with the DOC.

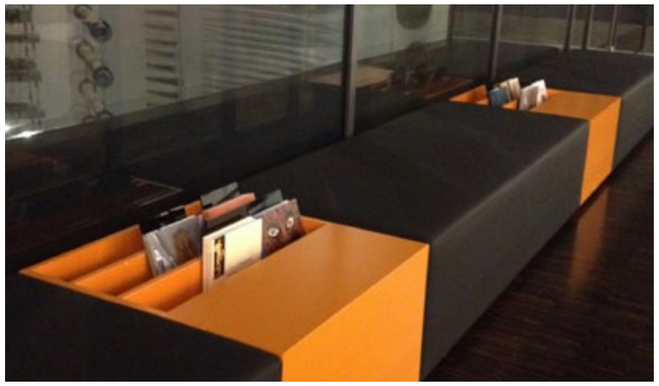
e. Layouts for exhibits within individual galleries should respect the designated footprint and consider the visitor flow between the gallery, other galleries and Common Spaces within the CSTM. Visitor flow, especially when affected by programmed events within a gallery, should be carefully coordinated with overall flow inside the Museum.

f. Seating should be provided within each gallery or common space, providing an opportunity for visitors to rest, but also to observe the activity of the gallery. A variety of seating styles and configurations are encouraged as long as accessibility guidelines are met.

g. A lighting grid will be provided as part of the base building and will be consistent throughout the Museum. Sufficient power will be provided overhead for theatrical lighting fixtures. Theatrical lighting and lighting integral to individual exhibit components will be part of the design approach proposed by Contractors.

h. Power and data lines will be provided in a floor grid with an approximate 3 m x 3 m grid and equipped with 110 V, flush mounted receptacles. 220 V will be provided at power panels only. Exhibit layouts will have to respond to this grid.

i. A sealed concrete floor finish will be provided as part of the base building and will be consistent throughout the Museum including the Core Galleries. This floor finish will be left exposed except in special circumstances. Contractors should consider this factor when considering acoustics within individual galleries and Common Spaces.



5.2 Flexibility in Design

a. The design approach for all areas, but specifically for Core Galleries, should allow for flexibility in individual exhibitions and exhibits.

b. Individual exhibits should be designed to accommodate ease of removal or replacement with minimal disruption to adjacent exhibitions and exhibits. This will allow for maintenance of exhibits or replacement as part of updating the gallery. Exhibitions should also be designed to allow for complete removal and replacement to accommodate a more extensive revitalization or update of the gallery.

c. Contractors should give consideration for the use of exhibit support systems that can be reconfigured and/or moved to other galleries or common spaces within the building. Such systems may allow for the desired flexibility in the reconfiguration of individual exhibits or exhibitions mentioned above. When not in use these systems should not create a large storage burden for the CSTM.

5.3 Accommodating Different Categories of Visitor Experience

a. The foundation for the design guidelines contained in this section is informed by the recognition of the different categories of visitor experience. Each exhibit, exhibition and gallery should be designed with these categories in mind. Refer to Section 3.1.4 for an overview.

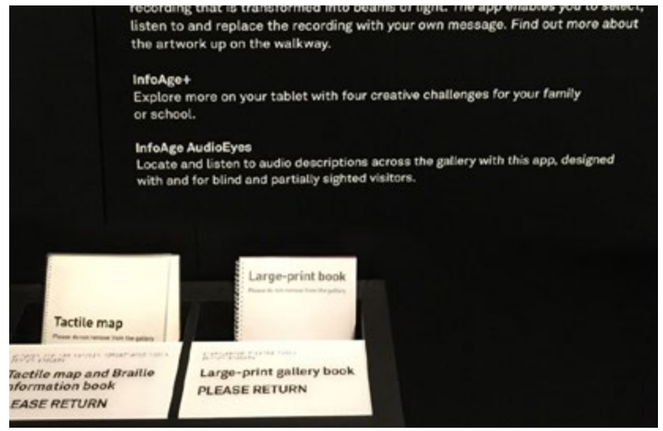
b. The first step in the design process will be the development of a strong conceptual approach for each gallery and common space. The categories of visitor experience will be used as a resource for the development of this concept. The Contractor will work closely with the CSTM and the DOC during the Concept Development phase to help translate stories into real experiences at the Museum.

c. Using the category of “Creative and Collaborative Use of Technology” as an example, the Concept Development phase might focus on ways to enable visitors to interface directly with artefacts and what that means in terms of design. How can visitors have sensory contact with real artefacts? Which artefacts (including duplicates, replicas and/or props) might be available for tactile experiences? What other exhibit techniques are used to support that experience and effectively tell the stories that accompany that artefact?

5.4 Accessibility

a. Accessibility refers to a broad range of goals for providing successful levels of visitor access to exhibitry. The designer’s goal is to respond to different learning styles.

b. The CSTM has established standards for accessibility. Refer to Appendix F for CSTMC Accessibility Standards for a detailed description. The Contractor should strive to not just meet, but exceed, these standards.



5.5 Integrating Artefacts

a. The mandate of the CSTM calls for providing the closest possible visitor approach to the collection. Although the majority of the artefacts will be protected from handling by visitors, visual access must be provided. Additionally, visitors must be able to have close proximity to artefacts while not infringing on security protocol.

b. The goal of Artefact Alley is to make as much as possible the CSTM collection available to visitors. This approach should be continued through the Core Galleries and other spaces that provide such opportunities.

c. Comprehensive direction exists regarding the procedures and processes for artefact conservation and exhibition at the CSTM, through two important documents; the Conservation Management Plan Directive #101 (January 2014) and the Conservation and Operation of Artefacts Guideline #100-C (January 2014). Both documents are appended to this document (Appendix G and H, respectively). In keeping with the procedures outlined in this documentation, the following general guidelines for artefact integration are provided:

- Introduce artefact “icons” that speak to the content of a specific gallery (e.g., locomotives in the Moving and Connecting Gallery), preferably located near the main entry to a gallery or positioned along its sightline.
- Introduce a “featured” artefact or grouping of artefacts that speak to a specific exhibition (thematically appropriate).
- Integrate artefacts wherever possible, connecting them to a specific exhibit (typically interactive experiences) to enhance the story of science and technology.
- Utilize the height of perimeter walls for display purposes; showcasing artefacts that do not require climate control and that can be displayed with minimal rail treatment.
- Suspend artefacts from the ceiling to help populate spaces with interesting objects that have the potential to provide contextual interest and lend visual texture. Seeing the underside of an artefact offers another, perhaps under-explored, way for visitors to look at and engage with objects in the collection, and might also provide clues about function or use. A proposed 500-pound point load at a three-metre grid will suffice for most applications; heavier items should hang from two or more points.

d. There are number of approaches to the presentation of objects in order to provide context and animate the objects. Key guidelines are:

- Artefacts assembled in thematic groups, or shown individually, should be displayed with minimal, light supports.
- Presentation of artefacts should allow for flexibility in relocating, rotating objects, and changing layout within the thematic groupings.
- Objects should be visible from at least three sides.
- Showcases should appear light with objects evenly illuminated.
- Select artefacts can be displayed outside of the cases, when possible, connected to interactive exhibits.
- In some cases, artefacts will benefit from contextual backgrounds; however, great care should be taken to not visually overwhelm, conflict with or obscure the artefact.

5.6 Interpretive Text Guidelines

a. CSTM has developed extensive guidelines for development and use of interpretive and non-interpretive exhibit text. See the “Text Production Process” document in Appendix E. Thorough and well thought out, these guidelines provide a useful set of rules.

b. The grid included in Appendix E is a guiding principle. Text strategies will be specifically designed to meet the unique requirements of each exhibition.

c. There may be conceptual opportunities in specific exhibitions that necessitate breaking the established grid (for instance a concept might prescribe printed quotations writ large, a space with no interpretive text at all, or an expansive object theatre environment where digital projections and audiovisual effects animate artefacts labels). In such cases, Contractors should be flexible in their interpretation of the current interpretive text guidelines.

d. Presentation of all text should have a well-defined and obvious hierarchy; However, there is flexibility in the final design approach for both text and graphics. They should be an extension of the conceptual approach for the individual gallery.

e. The amount of text is not a given, nor is the medium used to present that text and/or the content it represents.

f. All text (and audio visual programmes) will be presented following the CSTM’s requirements for bilingualism.

g. For guidelines on text comprehension levels as well as requirements for font size, contrast, word counts, hierarchy, etc. refer to the CSTMC Accessibility Standards included as Appendix F.

5.7 Graphics Guidelines

a. Graphics are a major component of any exhibition, contributing largely to the voice and character of any given space. As such, it is crucial that a visual communications approach be integrated into the early stages of a design concept, along with the interpretive themes, messages and content, approaches to artefact display, physical materials and forms, audiovisual components, user interfaces and the interpretive voice. Development of a visual communications approach for CSTM will require consideration of the way digital media will be integrated into the graphics concept. The sample graphics hierarchy documented below outlines the way digital media may be integrated into the graphics programme. The start point for CSTM's visual communications approach are the Accessibility Standards documented in Appendix F. These requirements must be adhered to, but the design guidelines allow for graphic approaches that express the qualities of the overall gallery design.

b. Prior to the work of Contractors, a design approach for the common spaces of the Museum, including a colour palette, material selection and a graphic approach, will be provided by the DOC. Distinctive graphic design approaches for individual galleries are encouraged but should be complementary to, and not conflict with, the overall design approach for the Museum. The DOC will work with Contractors to ensure this compatibility.

c. A graphics hierarchy should be visually defined during the next phase of work. This hierarchy, composed of a seamless integration of printed (or dimensional) and digital graphic elements, will be structured around the content requirements of the galleries and exhibitions. Preliminary layers of the hierarchy have been identified as follows:

1. **Gallery and Exhibition Identification.** These graphic elements provide visual cues to identify galleries and their constituent exhibitions while delivering high-level introductory content.

- ***Gallery Heading (Printed or Dimensional Graphic, if necessary)***
  - Name of gallery
- ***Exhibition Introduction (Printed or Dimensional Graphic)***
  - Name of exhibition
  - Main message of exhibition

2. **Exhibition Thematic Reference.** These panels carry overarching exhibition interpretation that contextualize artefact groupings (as well as individual artefacts) within larger historical, cultural or other thematic groupings as determined by the individual exhibitions' interpretive organization.

- ***Thematic Zone Introduction (Printed or Dimensional Graphic)***
  - Name of a thematic zone within an exhibition (if appropriate to the exhibition's interpretive organization)
  - Main message of the thematic zone
- ***Story Panel (Printed or Digital Graphic)***
  - Story that contextualizes a key artefact (or group of artefacts) within the main message of a thematic zone. Use of digital media in this tier of the hierarchy would allow for Museum revision and/or visitor interaction within this tier of the hierarchy, providing avenues for exhibit flexibility and interactivity.

3. **Instruction (Printed, Dimensional or Digital Graphic).** Instructional graphics provide step-by-step instructions for how visitors use interactive exhibits. For example, "Try to hit the bull's eye," "Aim the cylinder," "Pull the lever," etc. These graphics may be printed or delivered via digital media, depending on whether the exhibit they are attached to is mechanical or digital.

4. **Identification.** Panels in this tier of the hierarchy may serve to identify artefacts, images and AV media on display and provide avenues of exploration through digital interface.

- ***Key Artefact Identification (Printed or Dimensional Graphic)***
  - Name of the artefact
  - Age of the artefact
  - Description of its function, provenance or other relevant information
- ***Interactive Artefact Labels (Digital Graphic)***
  - Touchscreen depicting all artefacts on display and visible in the immediate vicinity
  - Touch the artefact to get an interactive 360 degree scan as well as the following information:
    - *Name of the artefact*
    - *Age of the artefact*
    - *Description of its function, provenance or other relevant information*
- ***Key image identification***
  - Image caption
  - Image credit
- ***Key AV media identification***
  - Media title
  - Media credit

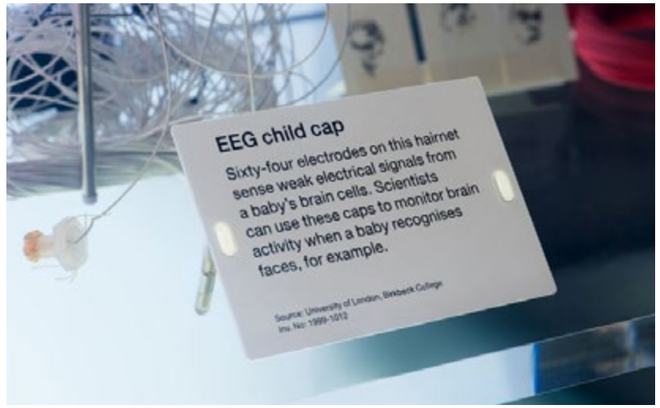
5. **Scientific Principle.** This tier within the graphic hierarchy serves to demonstrate how artefacts operate and interpret related scientific principles.

- ***Key Artefact Operation (Digital Graphic)***
  - Touchscreen or projection with a digital representation of the key artefact in operation would allow for animated and interactive interpretation of the artefact in use and how it works.
- ***Scientific Principle Description (Printed or Dimensional Graphic)***
  - Name of related scientific principle (where applicable)
  - Illustrated description of the related scientific principle (where applicable)
- ***Innovators (Printed or Dimensional Graphic)***
  - Name of scientist who discovered or popularized the related scientific principle (where applicable)

6. **Parent Points (Printed Graphic).** This layer of graphics illustrates ways to engage a pre-literate audience with content. Content in this tier is directed at parents visiting with children, providing content and/or behaviours that interpretation intends to deliver to younger visitors.

d. Some 'typical' exhibits may be developed as a system for use throughout the Museum. These exhibits may utilize a standard aesthetic, media type, graphic design approach an/or material selection. The DOC will work with Contractors to ensure, wherever possible, that the graphic design approach for individual galleries does not conflict with this system.

e. For guidelines related to text presentation on graphic panels and screen-based displays, refer to CSTMC Accessibility Standards in Appendix F.



5.8 Digital Media Design Guidelines

Media

- Provide accessible alternatives to significant audio and video.

Audio

- All content that contains speech or other audio information necessary for the comprehension of the content will be open or closed captioned and bilingual.
- Manage acoustics to minimize sound pollution.

Video

- Key experiences that contain visual information necessary for the comprehension of the content will be audio described.

Digital Interactives

- Consider approach, reach range, access to controls, accessible heights and/or adjustable heights for interaction, viewing and listening.

Controls

- Make every effort to provide alternate methods of operation and information retrieval for digital interactives, accessible touchscreens or touch-operated controls, non-slip controls. Specify standard industry parts.

Vision Support Features

- Ensure high contrast for all user interface controls and system settings.
- Strive to use large buttons, incorporate tactility and consider alternates to colour-coding.

Audio Support Features

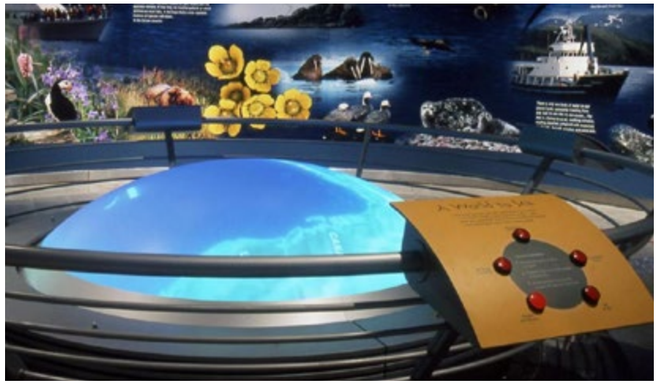
- Provide visual cues for all audio alerts, accessible volume control, standard signal levels and consider ambient noise level of the adjacent environments.
- The product must provide the ability to interrupt, pause, and restart the audio at anytime.

Screens

- Eliminate glare on screens. Evaluate multiple angles for those who would be seated or standing, centered or off to the side and for variable visitor heights.

Guidelines

- For guidelines related to digital media design on screen-based displays, refer to CSTMC Accessibility Standards in Appendix F.



5.9 The Wayfinding System

a. A design approach for a building-wide wayfinding system will be developed and applied to the entire CSTM. The graphic design approach for individual galleries should take into consideration this system and not conflict with its design.

b. The wayfinding system is an important design element for the Museum. It provides clear and consistent direction for visitors through a design approach that is applied throughout the building. Its design is consistent throughout the building exterior and Making Canada, and through all circulation routes, including the Artefact Alley. Its design approach is distinct from that of the graphic design within the Core Galleries, and vice versa.

c. The wayfinding system will enable visitors to easily find out what Museum features (specific exhibits, galleries or facilities) they want to see, where they are located and how best to get to them. This can be an immediate need or may involve longer term planning, perhaps for an entire day's visit.

d. Random exploration is also facilitated by the wayfinding system. Many visitors simply want to wander through the Museum with no set programme or agenda. The wayfinding system should ensure that they can easily find out where they are within the CSTM.

e. The primary goal of a wayfinding system is to help visitors find their way around a Museum with many route options. It is not considered an interpretive tool. Components should stand out from other competing signage and graphics.

f. The design of the wayfinding system will be:

- Stylistically appropriate: compliments the building design, yet is easily distinguished from the background clutter of materials, graphics and signage.
- Designed to not become stylistically out-of-date.
- Be applied consistently throughout the system.
- Legible in all normal viewing conditions.
- Designed to aide visitor and staff navigation.
- Conforming to CSTMC Accessibility Standards (refer to Appendix F).
- Designed to be easily modified to accommodate changes in Museum layout and/or facility function.

g. The scope for such a wayfinding system will include:

- Support for visitor orientation and trip planning, including Museum maps and directories at the entrance to the Museum and throughout the main circulation routes.
- Exterior building identification.
- Signage to support wayfinding to all major public and administrative areas of the building.
- Area and room identification in major public and administrative areas.

h. The wayfinding system will identify:

- Main exhibit spaces such as the Core Galleries and Temporary Exhibition Gallery.
- Major landmarks such as the Demo Stage, Artefact Alley or Maker Space.
- Iconic exhibits such as the locomotives and Interactive National Map.
- Non-interpretive display spaces such as the Conference Hall, Classrooms and Auditorium.
- Museum services such as the Cafeteria, Emergency, Information Services and washrooms.

5.10 Sustainable Design

Consider environmentally superior choices, products or services that are:

- Made from renewable, recycled or reclaimed materials.
- Environmentally certified with third party verification (e.g. Certified Organic, Energy Star, Green Seal, etc).
- Durable in nature.
- Supportive of environmental conservation initiatives.
- Recyclable and/or compostable.
- Recyclable at the end of the exhibit life cycle.
- Low VOC (paints etc.).

5.11 Serviceability and Durability of Exhibits

a. All exhibits will be designed to provide ease of maintenance and service access for CSTM staff. Exhibits that cannot be quickly serviced on the floor should be easily removable from the gallery, leaving minimal evidence of a missing exhibit. A high level of serviceability should be maintained at the lowest achievable maintenance cost.

b. Rigorous fabrication standards for computers and related electronics, audio-visual hardware and software, lighting, mechanical interactives, materials and finishes will be upheld during the design, fabrication and installation phases.

c. The design of all exhibit components, including mechanical, electrical, audio-visual hardware and software and all materials and finishes should be built for ten (10) years of heavy-duty interaction, while being easily maintained and providing very little down time.

5.12 Specific Design Guidelines: Making Canada

a. The main entry, Making Canada, the revitalized CSTM is a major architectural feature for the building. It is an opportunity to change the public face of the building and the perception of the entire Museum.

b. The Making Canada entry is bright, comfortable, open and welcoming. An uncluttered space with a clear and accessible designation of facilities (such as ticketing, washrooms, queuing space) and an intuitive orientation scheme provide a friendly area for the visitor. At the same time, Making Canada serves to communicate the Museum's institutional purpose by dramatic placement of a large-scale sculptural icon that is visible from the exterior and an impressive user-generated digital display map of Canada, the Interactive National Map.

c. Making Canada provides a careful presentation of the CSTM's mandate and the extent of the Museum collection. This is achieved through a series of transitional steps for visitors in the entry experience:

- A 'wow'-level sculptural element that is large scale and visually arresting. It is highly visible (especially at night when illuminated) in the façade of the building. The artefact itself could be changed regularly to promote new exhibitions and encourage repeat visits. Interpretation of the artefact within the lobby will be provided.
- Artefact Alley is the major interior feature of the CSTM. The strength of its size and geometry is carried out into Making Canada through the use of metal graphic panels flush-mounted in the floor and fragments of the artefact wall structure within the space. From the lobby, visitors are able to see deep into the Museum along the stretch of the Alley. Immediately, the visitor is aware that this is a place filled to capacity with an impressive collection.
- Visual access through large windows into the Locomotive Hall builds anticipation, telling visitors that their experience will be well worth the price of admission. These views into the Hall may be partially obscured to further heighten visitor anticipation.

d. The Interactive National Map is highly visible to both ticketed and non-ticketed visitors. It serves as a transition and introductory experience to the Museum and to Artefact Alley. Its design is fully integrated into that of the Artefact Alley so that it appears as if it had been pulled from the walls to welcome visitors. It serves as an icon for the CSTM's mandate as a national institution.

e. Although a busy visitor circulation point, Making Canada is also a place for decompression; stepping away from the outside world and preparing for a unique immersion experience within the Museum. To aid in this decompression Making Canada should:

- Maintain clarity of functions by providing clear visual and physical access to them, especially ticketing and information.
- Provide ample seating, both as a place to rest and as a natural meeting or waiting area.
- Keep group entry activities separate from public entry (separate coatrooms).
- Maintain clear visual and physical access to the Boutique, which should have a high profile and be seen as an attractive, welcoming space.
- Provide clear signage that identifies the Boutique and washrooms which can be visited without the purchase of tickets.
- Provide clear access to the Auditorium, Conference Hall, Cafeteria, Living Lab and Classrooms.

f. Ensure any signage or graphics are complementary to the design approach for colours, materials and graphics including the wayfinding system.

5.13 Specific Design Guidelines: Artefact Alley

a. Artefact Alley runs the length of the Museum. It is the building's principle circulation conduit and also brings the Museum's conceptual foundation as a collections-based institution to the foreground of the visitor experience.

b. Artefact Alley creates an opportunity to showcase artefacts as isolated exhibitions (cases on alley side) or to connect to content in adjacent galleries (cases on gallery side). Meaningful integration of artefacts into the overall approach to interpretation is critical. Highlight single, special artefacts with unique stories; mass artefacts with similar stories; and/or assemble artefacts artistically as eye candy to create a visually interesting or attractive display.

c. The Alley is bound by a set of large-scale, parallel display cases designed for easily updateable, meaningful artefact display. A highly flexible artefact mounting scheme allows for regular curatorial reworking and revision to thematically-linked showcases within the display cases. The cases are primarily two-sided, incorporating a variety of dividers and a variety of techniques that can be used for display; mass objects artfully or highlighting a singular element.

d. These showcases may feature interpretation of artefacts organized by any number of criteria (story, historical context, connections, function, color, manufacturer, etc.), as determined by the latest curatorial research of any given area within the collection. Interpretation for these showcases might be provided by printed labels and touchscreens governed by an accessible content-management system. The Alley's impressive aesthetic and substantial footprint will make it a unique and desirable venue for special events.

e. Exhibit design for individual galleries should respect the Artefact Alley structure that runs through the Museum as a display technique and an organizing element for the entire Museum. Visitors in the Core Galleries should have full physical and visual access to the Alley for viewing the objects within it, as well as access to the interactive components that are integral to the structure.

f. Artefact Alley displays will be developed and curated by CSTM in partnership with the Contracted Design Team.

g. Some specific guidelines for the design of the Artefact Alley include the provision of:

- Flexible arrangements of artefacts, changeable content — objects and contextual elements.
- Possibility to change visual context of the same group of artefacts with Museum's visual resources and update touchscreen content to tell a different story with same set of objects.
- Maximum interchange of layers, media to tell various stories.
- Multi-dimensional (multi-directional) displays to create immersive look and feel. Parallel running large-scale cases, walk-on-floor displays, and suspended objects all contribute to the immersive character of this space.
- Breaking the barrier (touchable exhibits), selected objects, or artefact replicas can be displayed outside of the cases. Some objects can act as a touchstone for a group of artefacts in cases. Selected objects could be incorporated into interactive exhibits.
- "Conversation for design" (blue prints of objects, as well as objects themselves).
- Connection to the "people" part of the story: scientists, inventors, designers, engineers, owners, users, etc.
- Spaces and infrastructure for special events (weddings, social gatherings and celebrations).

5.14 Specific Design Guidelines: Demo Stage

a. The Demo Stage is the Museum's central venue for interpretive presentation, demonstrations, performances, discussions, and gatherings. A semi-circular stage and tiered seating area provide a comfortable, intimate setting encouraging interaction amongst the audience and between the audience and the demonstrator.

b. Presentations may utilize audiovisuals, projected elements, animation or sound effects. When not in use for presentations, the Demo Stage serves as a gathering and resting area with recharge outlets and complimentary WiFi access, meant to attract an adolescent demographic looking for time away from visiting family groups; easy access to social-media platforms coupled with engaging teen-oriented questions projected on the stage screen. This may provide a new, internet-based access point to the Museum for this demographic.

c. The design and materials will allow for visual continuity between the Demo Stage and Artefact Alley. They will share a similar design approach to reinforce their role as prime architectural features within the Museum. Glass or any other transparent materials will create sightlines into the Demo Stage area and open up the Stage to the Museum.

d. Some specific guidelines for the design of the Demo Stage include the provision of:

- A dual mode for live demonstrations assisted by media as well as a rest-hub with internet and casual engagement.
- Comfortable and accessible seating and ramps to stage.
- A variety of accessible seating including back rests, supports and areas for wheelchairs.
- Surfaces and materials that are easy to clean and maintain.
- A changeable backdrop.
- Wireless capacity.
- Plentiful storage located directly behind stage, with easy access to stage.
- Programme schedules at points of entry.
- Multifunctional sound systems.
- High, sound absorptive walls to contain sound.

5.15 Specific Design Guidelines: Core Galleries

a. The Museum's four Core Galleries will present distinct functional challenges as design progresses. These will become apparent as the exhibition focus and character of experience within the galleries expands and evolves. What follows is a preliminary set of Guidelines that relate to those functional requirements identified at this time.

b. The Guidelines are to be followed to ensure a level of consistency within the overall Museum. These Guidelines are not intended to restrict the creative design process for individual galleries, but to maintain a certain level of consistency in design throughout the Museum. They are intended to give direction, rather than be prescriptive.

c. Contractors of individual exhibit areas within the Museum will work with the DOC in the Concept Design phase to ensure guidelines are followed and to encourage distinctive approaches to individual galleries. CSTM Exhibition Project Managers will coordinate design reviews between Contractors and the DOC.

d. Provision of strong gateway experiences that act as thresholds for visitors leaving one gallery and entering another or a common space. The adjacency of these transition points will require high levels of coordination between Contracted Design Team, CSTM's Exhibit Team and the DOC.

e. Major artefacts and/or fabricated structures should be used as strong landmark experiences in each gallery. These serve as identifiers for the content and as memorable images for visitors to take away.

f. New exhibits should provide multiple layers of engagement with large-scale artefacts and exhibits.

g. Overall, each gallery should have a distinctive 'look and feel', with a strong conceptual design approach that is consistent throughout the gallery.

h. Exhibit design for individual galleries should respect the Artefact Alley structure that runs through the Museum as a display technique and an organizing element for the entire Museum. Visitors in the Core Galleries should have full physical and visual access to the Alley for viewing the objects within it, as well as access to the interactive components that are integral to the structure.

i. Circulation and visitor flow within the gallery should be clear and simple, not requiring directional signage.

j. As stated elsewhere in this document, a range of media and experiences should be provided to reach visitors with different learning styles and abilities. For each gallery consider a rich selection of media. Sophisticated digital technologies should be interspaced with simple tactile and mechanical interactives, and one-on-one exhibits should be interspaced with exhibits designed for group interaction.

k. The Core Galleries provide opportunities to exploit many media types including large-scale immersive environments. Within the galleries there will be smaller themed spaces/immersive environments. Create hints of environments, use iconographic elements, leave room for imagination.

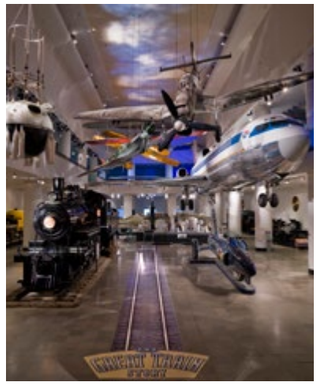
l. Immersive environments can be kinetic, sets should be lightweight, and easy to move. Projected large-scale images could create kinetic, evocative immersive environments.

m. Consideration should be given to suspending artefacts from the base building's overhead structure. A proposed 500-pound point load at a three-metre grid will suffice for most applications; heavier items should hang from two or more points.

n. A gathering and demonstration space should be provided. In addition to the dedicated Demo Stage, there are opportunities to create programmes and exhibits for group interaction. Each Core Gallery should have a gathering and demonstration space for up to 30 visitors. Seating should be provided for at least some of those viewers. A raised platform and integrated storage for props should be provided.

o. Each Core Gallery should provide a 'quiet' zone; a space, equipped with seating, to sit, rest, relax, re-charge and reflect. It should also serve as a waiting and meeting place.

p. Power and data lines will be provided in a floor grid with an approximate 3 m x 3 m grid and equipped with 110 V, flush mounted receptacles. 220 V will be provided at power panels only. In addition, natural gas, pneumatic air lines and a water supply will be provided to points within each Core Gallery.



5.16 Specific Design Guidelines: Children's Gallery

a. The Children's Gallery serves a unique visitor group with unique requirements. Its goal is to stimulate creativity and encourage collaboration through play inspiring a new generation to be creative and innovative.

b. The gallery is intended for visitors ages two to ten. Specific exhibits should be designed for ages within this age range. For example, exhibits specifically designed for, and only accessible to, toddlers aged two to three years should be provided.

c. The gallery must be safe and secure, with a particular focus on sight-lines to ensure children can be supervised at all times. Visitor flow into and out of the gallery should be easily monitored by staff and/or parents. Protective barriers should be used to control access points.

d. Immersive environments for children are encouraged, but children must be visible at all times and if necessary, easily retrieved.

e. Material selection is especially important in the Children's Gallery. Materials should meet requirements for protective surfacing in zones designed for groups 18 months to 10 years of age. Flooring is particularly important, especially around climbable structures. No sharp points, sharp edges, protrusions and or sharp surfaces should be permitted.

f. To best teach the principles of innovation through play, the gallery should:

- Be self-directed; providing open-ended experiences instead of dictating how things should be use. Create an environment that provides multiple outcomes, where children can exercise his or her imagination and make choices.
- Be inclusive; providing experiences with multiple entry levels allowing children of different abilities and skills/knowledge to take part in the exhibition. The exhibition should be comfortably used by children and parents.
- Be creative; the space should be simultaneously fun and educational, as well as interactive, to stimulate curiosity. Design a space where children can investigate, experiment and explore.
- Be collaborative; the space is designed so that children can participate with the other visitors, family and friends. Stations should be designed to allow multiple users to participate in cooperative experiences.
- Create opportunities for role-playing.
- Develop kinesthetic experiences with large-scale objects (large building blocks, large balls, etc.).

g. Experiment with the concepts of innovation. Identify a problem and find a solution. Question, imagine, create, test, revise and try again. For example:

- Build a car and race it down a ramp, make a skyscraper which must reach a certain height, build a bridge that must support a fixed weight, assemble a system of gears and pulleys to lift a mass.
- Experiment with a wind tunnel, place objects of different materials inside a large cylinder to see what happens.
- Experiment with light and shadows.
- See a multi-interactive ball track with lifts, spirals, elevators and loops to activate a wow experience (launch a shuttle, activate a toy train, etc.). Use simple machines to move balls around the system.
- Use large cranes, building blocks to construct bridges and large structures.

h. Encourage children to make connections between the activities in the gallery and the "grown-up" science and technology in the rest of the museum.

- Use artefacts in the galleries as models and inspirations for experiences (e.g. locomotives, cars, telephones, turbines, balances).
- Build groups of experiences around the main gallery themes (e.g. transportation, sound and music, natural resources, measurement).

5.17 Specific Design Guidelines: Temporary Exhibition Gallery

a. The Temporary Exhibition Gallery is intended to accommodate a wide range of exhibitions, both travelling shows and those developed in-house at CSTM. This 930 m^2 space is designed to be truly flexible, in that it may be used as a single, undivided floor area or subdivided into smaller presentation or meeting spaces. Nominally, these spaces should be multiples of 232 m^2.

b. A movable divider system should be provided that allows for up to three separate spaces, each with independent access points. This system will provide minimal interruption to floor area when not in use. It has the ability to be quickly and easily put into place, yet still provide complete acoustic and light separation between spaces. The gallery has a number of columns within the existing space. These will remain and should be taken into account when the divider system is determined.

c. The primary point for loading and unloading exhibits will occur through the main Museum space via the existing shipping and receiving and staging area (labeled “Loading 1” on plans). An alternative loading point is directly from the building exterior (labeled “Loading 2” on the plans). Options for dividing the gallery space should take into account loading/unloading scenarios. Crate storage will be off site.

d. A queue space has been designated on the floor plan. Its size and related functions, such as ticketing, are to be determined.

e. A controlled access line will separate the entire gallery from the rest of the Museum. This line runs along the end of Artefact Alley. When the gallery is completely closed off, provision will be made to provide a dramatic backdrop viewed from the Artefact Alley, rather than a blank façade. This backdrop may be a large sliding panel with graphic treatment (perhaps promoting the upcoming blockbuster show) or some other method of achieving this requirement.

f. A permanent lighting grid will be provided overhead throughout the gallery. This grid may have the option of being raised or lowered beyond the 4.5 m standard height. Sufficient power will be provided overhead for theatrical lighting fixtures. The gallery has no natural light.

g. Power and data lines will be provided in a floor grid with an approximate 3 m x 3 m grid and equipped with flush mounted receptacles. 240 V and 110 V will be provided. In addition, natural gas, pneumatic air lines and a water supply will be provided to a central point within the gallery.

h. Neutral colour palette and finishes should not conflict with any possible design approach for a travelling show. Wall surfaces must be easily painted to change the base building colour to accommodate the requirements of ‘blockbuster’ shows. Wall materials and the number and placement of wall-mounted fixtures should be conducive to the ease and speed of repainting base building walls.

NEXT STEPS

6.0 NEXT STEPS

This Masterplan is an articulation of the new CSTM's project fundamentals. It represents the start point for the design dialogue moving forward. It is intended as a reference for CSTM staff, project architects and designers who will be contributing to the next phases of the project. It includes a framework for the organization of interpretation, strategies for implementation of digital and mobile technologies, as well as a set of overarching exhibit design guidelines and architectural requirements.

The next important step in the project timeline is the creation of a design team comprised of the CSTM, the DOC and the Contracted Design Teams (Contractors). The procurement process to select these Contractors will begin immediately upon the issuance of the Masterplan document.

6.1 Procurement Strategy

a. Museum areas will be designed and developed as separate design and fabrication contracts based on the following areas. Contract structure will be determined by CSTM. The Contract Packages will include the following (but are subject to change):

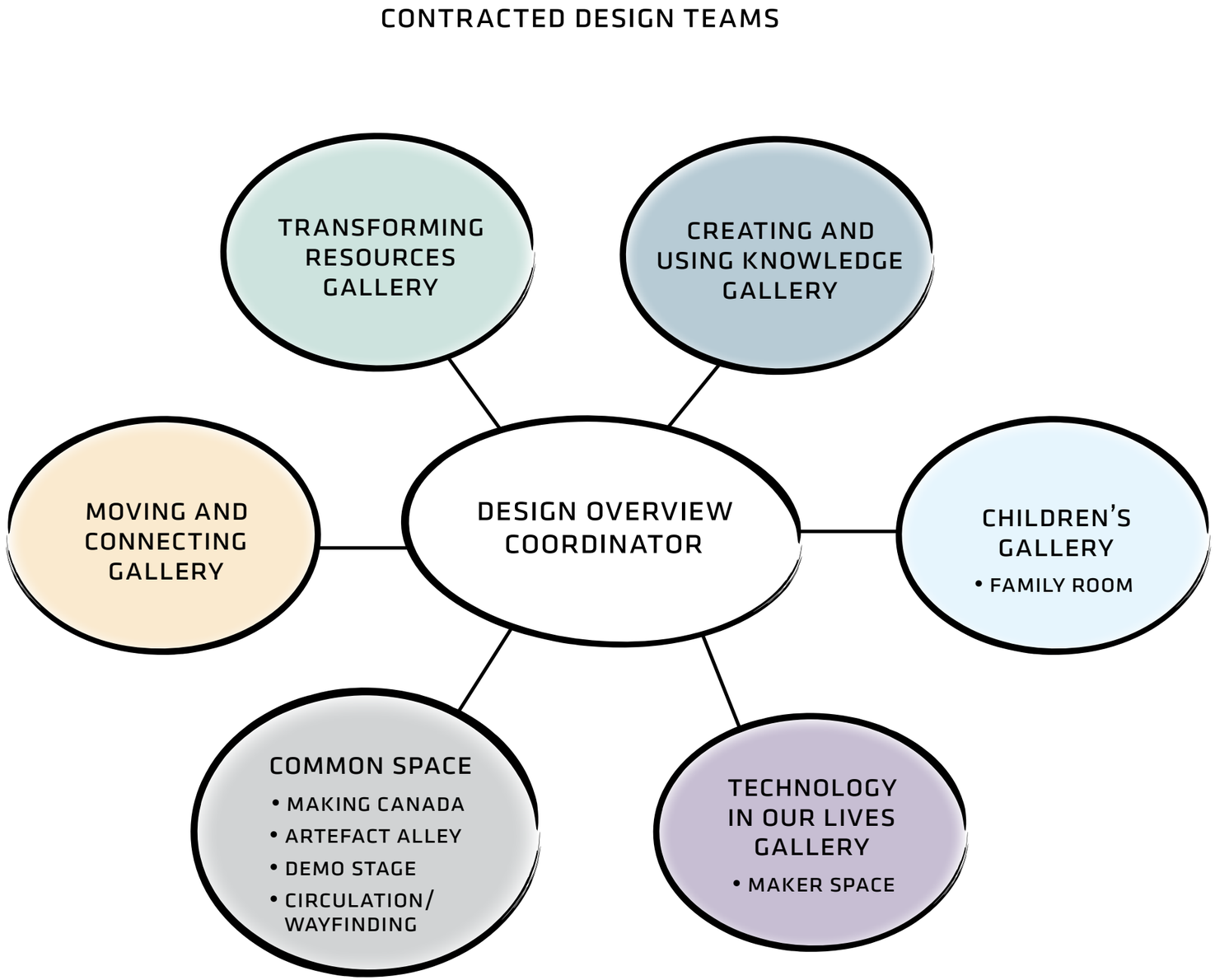
- Common Space: Making Canada, Artefact Alley, Demo Stage, Circulation and Wayfinding
- Moving and Connecting – Core Gallery
- Transforming Resources – Core Gallery
- Creating and Using Knowledge – Core Gallery
- Technology in Our Lives (includes Maker Space) – Core Gallery
- Children's Gallery

b. As an outcome of the master planning phase, an RFP (Request for Proposal) will be issued to CSTMC's suppliers. CSTM will create a short list of firms to undertake one or more of the Contract Packages. It is anticipated that the scope of work for each Contract Package will include:

- Full design and contract documentation services.
- Pilot testing and prototyping of specified exhibit elements.
- Fabrication and supply of all exhibit components including audio-visual programmes.
- Provision of all equipment including audio-visual hardware.
- Testing and installation.
- Staff training as required.

c. RFPs will be issued for each of the contract packages (as per the bubble diagram shown on this page). Each RFP will solicit responses containing two components; a Price Proposal and a Technical Proposal. Respondents may respond to one or more of the RFPs for contract packages.

d. Once successful Contracted Design Teams (Contractors) are selected for each of the Contract Packages, agreements will be negotiated and finalized.



6.2 Prototyping

a. Upon finalizing of the agreement, the project will immediately transition into the Concept Design Phase. At this time Contractors will work closely with the DOC and one (or more) of the CSTM teams to develop a strong design direction. Two key strategies will be implemented as part of this phase:

- **Phase One:** Rapid Idea Generation workshops. These workshops will involve the entire design team (CSTM Exhibit Team, Contracted Design Team and possibly the DOC) to ideate and then fabricate exhibits from easily manipulated materials. Over the course of the week-long workshop, numerous ideas will be built, documented and dismantled.

- **Phase Two:** Pilot Testing workshops. These workshops see the design team rapidly build, test and iterate exhibit or programme ideas with an audience. Conducted over a full week, in a semi-facilitated setting, they are intended to assess audience interest and engagement with different exhibits. At the same time, they ensure exhibits are robust enough to be used by the target audience.

b. After the Design Development Phase, prototyping of specific exhibit elements will occur at the selected fabrication facility/ies. These will be fully functioning, full-scale models and/or prototypes to finalize design details.

c. As design progresses, the DOC will work directly with Contractors to assist with interpretation of the Masterplan and specifically, the Design Guidelines. Contractors will be kept informed about the work of the other Contractors to both learn through their experience and to encourage the development of a distinctive design approach for each Contract Package.

APPENDICES

APPENDIX A:
PUBLIC AND STAKEHOLDER CONSULTATION PROCESS

Public and Stakeholder Engagement

The design team collaborated with Museum staff and management to create an engagement action plan for the CSTM renewal. The plan was carried out largely by Museum staff with input and guidance from the design team's engagement consultant.

Between mid-May and late June 2015, over 3000 people provided feedback on the renewal project and draft designs. Many more were informed of the project through news media (with significant coverage in the Ottawa Citizen, Metro News, and Radio-Canada/CBC TV), through social media and CSTM's website, and through exposure to exhibits in public venues.

Member Consultations

The Museum reaches out regularly to obtain input and feedback from Members regarding the Museum's directions. This continued during the design phase of the CSTM renewal project.

As part of the Masterplan development, Members were sent a survey containing preliminary drawings from May planning workshop. About 100 people completed the survey.

The Members survey included the first draft conceptual drawings from the planning workshop and emphasized open ended questions. Responses to the drawings were varied.

Given the very preliminary nature of the drawings, respondents often found it difficult to interpret and understand the concepts. Similarly, the drawings on their own couldn't communicate the sensory or interactive experiences that were at the early stages of development. Understandably, many of the Members responding to the first survey were therefore somewhat critical.

That said, Members liked the open entrance way, the interactive map of Canada, the Artefact Alley, ride-able early bikes and other concepts.

These responses from the Members were reviewed by the design team and considered in the development of the full concept proposal.

Members were also invited to participate in other elements of the stakeholder engagement, including the public survey, an Open House at St. Laurent Centre, and displays at Canada Agriculture and Food Museum, and Canada Aviation and Space Museum.

Public Survey

After the draft exhibit concept was presented to the CSTM Board and staff in early June, the concepts were shared with the public in an online survey. The survey link was sent out to Museum Members, stakeholder groups, in a news release, and via social media. As of this date, over 2500 people have responded.

Due to the limitations of the survey, it's not possible to give respondents the full context of the visuals that is available in a workshop environment. However, people were keen to participate—evidence of the strong interest in CSTM and its future.

The feedback was a blend of critical responses, constructive suggestions for tweaks to exhibit elements, and strong enthusiasm. Criticisms tended to fall in areas that were outside the scope of the renewal project, including the museum location, size of the building and broader concerns about the role of science and technology in our society.

A strong current of enthusiasm for the renewal project and the new exhibits ran through the survey responses. There were many positive statements about the designs for the entrance hall, Artefact Alley, the Demonstration Stage and each of the main galleries.

Community Engagement

To offer more interactive engagement opportunities, Open House style displays were organized for St. Laurent Centre (retail mall) near the CSTM site on June 6 and 7. Similar opportunities were provided at Canada Agriculture and Food Museum on June 13 and Canada Aviation and Space Museum on June 14.

Display panels featuring the draft exhibit concepts were set up, and staff from CSTM and APA were available to explain the concepts, answer questions, and discuss ideas.

Adults and children attending the events were quite positive about the visuals of the concepts. People took time to look at specific elements and offer suggestions. Most of all, there was a high degree of anticipation for the Museum's reopening.

Stakeholder Interviews

A series of telephone and in-person interviews with Museum stakeholders, including sponsors, partners, elected officials and interest groups, are underway. Responses to date are similar to those from the survey and public engagement events.

A full report on all engagement activities will be submitted as an Addendum to the Masterplan.

General Themes

The public engagement activities were designed to be formative, so public comments were provided back to the design team.

In their written and verbal comments, people were enthusiastic about the CSTM renewal project. There was some frustration with the location not changing. Overall, there was a clear desire to see the renewal project completed and anticipation for the new CSTM experience.

There appeared to be no clear consensus on the CSTM mission and the extent to which it should emphasize history or science, Canadian or international innovation, or what constitutes technology.

The building floor plan met with approval. People like the central axis of the Artefact Alley and the Demonstration Stage 'at the heart' of the Museum.

All of the exhibit concepts were well received. Many people were intrigued with the Artefact Alley and shared questions or concerns about how it would be executed. There were some concerns that it might seem static, 'cold,' or forbidding, and that people might not be able to see and appreciate items in the higher spaces. Even so, there was a strong interest in it as a design element.

People want the exhibits to be interactive, but not dependent on technology. Among some respondents there is frustration or fatigue with 'interacting with screens,' and those people want a high proportion of the exhibits to be unmediated.

As expected from earlier CSTM research findings, there was strong support for retaining popular elements like the locomotives and the Krazy Kitchen.

The designs for the Children's Innovation Space were well received and people look forward to the amount of hands-on discovery play that will be available to children.

All of the themed galleries met with a positive response. The integration of bicycles with snow machines and the much-loved locomotives was a hit in the Moving and Connecting Gallery. Respondents agreed with the importance of the Transforming Resources Gallery, with the accessible mining truck drawing a lot of positive attention. The science exploration and discovery elements of the Creating and Using Knowledge Gallery are expected to be a real draw for teaching purposes. The Technology in Our Lives Gallery resonated with many respondents due to the way that it allows exploration of different eras and shows technology's influence in everyday lives. It will serve as a great inter-generational conversation starter.

The Maker Space and temporary exhibit space were also seen as valuable elements of the Museum. While the majority of the respondents live in the Ottawa area, most agreed that a National Outreach capability would be a positive feature.

The public feedback provided the design team with excellent input regarding the content and design of the exhibits. This iterative and formative process also served to keep the public engaged during this challenging phase when the Museum is closed.

The high number of participants in the public engagement activities indicate a keen public interest in the Canada Science and Technology Museum—and its future.

CSTM Renewal Public Consultation– Preliminary Results

This report is intended as an early overview of the feedback received via the CSTM renewal survey (still live as of writing, with 2583 responses). More detailed information on the ideas presented to the public will follow. It is important to recognize that this survey is not a representative sample of the views of Canadians, but an open consultation. As such, most of the respondents indicated that they are regular museum-goers, and at least somewhat familiar with the CSTM. Demographic information is provided at the end of this document.

Entrance and Artefact Alley

Feedback about the entrance is generally positive, however there is a sizable proportion of negative feedback. Issues include a perceived lack of interactivity, a cold and sterile feel to the space, and an apparent dislike of screens for interpreting this kind of content.

"*Great entry set-up. Having the presentation area in a central area is perfect.*"
"A bit like a garage sale for really cool stuff you can't buy. I like it!"
"Beautiful. A modern 'cabinet of curiosities'."

"I find it disappointing to go to a museum to find myself looking at a computer screen, this aspect should be delivered by the website, use the museum to take better advantage of the real life exhibit, engaging with a different experience."
"I like the display of artifacts, but please, let's not just go for screens and iPads - we need real interactivity: hands on activities."

"This much behind glass and information on screens makes me feel like I'm at home browsing on my computer... there is no added value to being in the museum."

Demo Stage

The concept of the demo stage, as well as its placement, is viewed positively. Questions tend to focus on practical issues of access, crowding, and making sure the schedule of demos is easy to find. Some respondents also felt the space looked constrained or boxed in.

"*I like how you have interactivity and demonstrations at the heart of the museum. Those aspects were always my favorite parts of the science museum as a kid."*

"The demonstration stage is another good idea. Flow of visitors is my concern here again. If it is all wide-open, the flow of visitors may be disruptive to the presentation and visitors may feel that this is a private space rather than a public one."

The Core Galleries

The proposed galleries were also well received. Given the Museum's traditional audience base, both the Children's Gallery and the Moving and Connecting Gallery are quite popular. The Transforming Resources Gallery seems to be draw the most comments related to climate change, sustainability, and the Museum's ties to the energy sector. All of the exhibitions proposed draw comments about the importance of interactives and unique experiences that 'belong' to the Museum.

"I like these concepts. I wish I could play in the Children's space! I like how the transportation gallery seems really open - like you can explore each bike, car and truck. The Transforming Gallery looks really interesting - I want to get up on that big truck! And I like how you mention how our choices have benefits and challenges."

"*As for the kids zone, I am so happy to finally see an organized space meant for children instead of science zone or the digital network*."

"I like these. Interaction is important and fun for all ages. Transportation is such a vital part of this museum's history, it will always be a big draw"

Given the range of topics that fall under the banner of science and technology, and the museum/science centre approach that has characterised CSTM, it is not surprising that there is considerable range in opinions about the themes and experiences that should be offered.

"A lot of technology, not enough science"

"Would like to see where diverse scientific phenomena is explained through interactive experiment / activities"

"A lot of artefacts with regards to transportation are not on display. Will there be an interactive platform (photos, videos or computer) for visitors to search, see and/or obtain additional information with regards to all the artefacts that are not on display (cars, trains, fire trucks)"

"Every day technology - could appeal to nostalgia. Will the content look to the future?"

In terms of controversial topics it's interesting that there are no mentions of vaccination and one mention of genetic modification. Debates over the place of science, the interpretation of climate change, and ties to energy producers are mentioned.

"*In the industry section, you should also include something about climate change in order for it to give a complete picture. So long as that's a part of the exhibit, I think this would be quite nice."*

"Appears to be much more technology than science. Based on what's shown here I'd like to see more science exhibits/galleries. I hope the transforming resources exhibit includes a significant portion on sustainability, and doesn't just reflect the current government's obsession with energy exploitation. Despite current federal attitudes, pure scientific research without immediate application/products is an important endeavour."

Lastly, echoing the comments on the entry experience and Artefact Alley, when touch screens are mentioned it is typically to express a preference for mechanical or otherwise tactile experiences.

"Make it as interactive as possible! It's boring for all ages to read off a computer screen. I didn't like to do that as a kid, nor do I like to do that as an adult."

Broad Themes and Moving Forward

As a whole, the results suggest that the broad themes and ideas represented by the concept sketches are of interest to museum visitors, and will be a distinct improvement over the previous situation. This has been apparent in the survey results, but is also echoed in the feedback from community consultations as well as stakeholder interviews to date. A desire for high quality interactivity and unique experience are the most common themes, with a strong emphasis on multiple media and ways of interacting with content, both traditional and cutting edge.

Do you visit museums, science centres, art galleries, and/or historic sites in your free time?

Response	Chart	Percentage	Count
Yes		85.2%	2066
Rarely		14.8%	358
No, never		0.0%	1
		Total Responses	**2425**

In the past 12 months, how many times have you visited a museum, science centre, art gallery, or historical site?

Response	Chart	Percentage	Count
None in the past 12 months		4.4%	107
Once or twice		26.9%	655
Three to five times		40.4%	984
Six or more times		28.3%	690
		Total Responses	**2436**

Have you ever visited the Canada Science and Technology Museum?

Response	Chart	Percentage	Count
Yes		93.0%	2268
No		6.6%	161
Unsure		0.4%	10
		Total Responses	**2439**

You are:

Response	Chart	Percentage	Count
Male		49.8%	1207
Female		50.2%	1217
		Total Responses	**2424**

Where do you live?

Response	Chart	Percentage	Count
Canada's Capital Region — Ontario		79.4%	1929
Canada's Capital Region — Quebec		5.5%	133
Other region in Ontario		8.1%	198
Other region in Quebec		1.4%	34
Other province or territory in Canada		4.8%	117
Other Country		0.8%	20
		Total Responses	**2431**

Which province or territory?

Response	Chart	Percentage	Count
Alberta		1.1%	24
Colombie Britannique		1.6%	36
Isle du Prince Edward		0.0%	1
Manitoba		0.2%	5
Nouveau Brunswick		0.2%	4
Terre-Neuve		0.4%	8
Territoires du Nord-Ouest		0.0%	0
Nouvelle Écosse		1.1%	24
Nunavut		0.0%	0
Ontario		87.4%	1914
Québec		7.1%	155
Saskatchewan		0.6%	13
Yukon		0.3%	7
		Total Responses	**2191**

APPENDIX B:
INTERPRETIVE GOALS AND OBJECTIVES

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
<u>Moving and Connecting</u>—*We use transportation and communication technologies to solve practical problems, in the process changing our sense of time and space and redefining our relationships with each other.*			
Transportation and communications are about moving people, goods and information.	Visitors will appreciate the fundamental role that transport systems play in all aspects of their lives from international trade to personal recreation	Globalization	Clipper ship model, *Great Eastern* model, submarine cable sample and telegraph equipment, shipping container, locomotive, Drummondville transmitter, examples of consumer electronics, personal computers, and networking equipment
	Visitors will make the connection between their personal lives and the globalized economy and cultural environment made possible by global communication networks		
	Visitors will learn about the different types of transportation technologies that Canadians and others use to move goods and people.	The Power of Steam	Locomotives, CP Edwards engine, ship model *Turbinia*, stoker model, gauges, controls in locomotive cabs, working steam machinery models CN 6400, CP 2858
Transportation and communications are about human aspirations to transcend physical and temporal limits.	Visitors will identify technologies that allow them to transcend physical and temporal constraints and think about what they have gained and/or lost as a result of these.		Volkswagen beetle, 1950s Indian motorcycle, Brantford travel trailer, Collingwood skiff *Nahma*
	Visitors will explore the human desire to transcend space and time and identify some of its products and its consequences	Recording: it's about stopping time (not bridging distance)	Cameras, printing presses, recording devices
	Visitors will explore the idea of physical space as a common resource that, if over-used, quickly becomes unusable for all.		Traffic control computer, radar, traffic signs

*Note the number of rows listed for the Interpretive Goals and Interpretive Objectives under each theme statement are not meant to indicate any ideal number of goals and objectives for each theme statement.

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
Transportation appeals to our collective imagination because it embodies our fascination with speed, power and mobility.	Visitors will think about what users actually require from transportation systems and devices and what they have come to expect and desire.	Who needs speed? When slower is better.	Porter racing shell, Laser sailboat, 6400 model, ship model of trireme, CCM Flyer, Lotus race car Birchbark canoe, salmon skiff, model of Egyptian royal barge, Coventry lever tricycle
	Visitors will compare transport technologies and will question the different cultural meanings they attach to them.	You are what you drive or ride. . . or are you?	Cariole (sleigh), brougham (carriage), Montreal trolley bus or TTC omnibus, Columbia high-wheel bicycle, Cheetah bicycle, Eaton Rolls Royce, Plymouth Voyager minivan
We use communication technologies to make, share and preserve images, sounds, information and stories.	Visitors will experience how communication technologies are tools of creativity.	Music and sound	Electronic Sackbut synthesizer, recording devices, Koenig analyzer, Theremin, Minimoog demo, Robb Wave organ interactive
	Visitors will explore different communication technologies and their relationship to our senses.	Communication technologies and the senses – text, still image, moving Image, sound, touch	Printing presses, engraving tools, signs, cameras, film and TV cameras, TV set, microphones, disk and tape recorders, phonographs, telephones, radios, braille typewriter
Transportation shapes our perception of physical and cultural landscapes, our sense of proximity and distance and our sense of place and community.	Visitors will sense of the vastness of Canada and get a sense of how technology has mediated our understanding of our physical and cultural environment.	Obstacle or destination: transportation in the wilderness	The park murals, sleeping car berth stained glass, Brantford trailer, railway trade literature, Gidley launch, Klein snow kit, model of ice ship *St. Roch* or *Arctic*, survey equipment (land and water)
We use communications to explore and shape our personal identity and our membership in communities.	Visitors will explore how communications technologies have been used to create a sense of community at all levels from the personal to the national to the global.	Constructing identity through communications: personal, national, global	CBC and NFB equipment; Blackberry; radios, TVs, film projectors; snapshot cameras; mobile phones; telephone switchboard (demo)
	New communications technologies can be socially disruptive, and the design of new devices can be shaped by our desire to incorporate them into our lives and our homes in ways that “feel right”.	Domesticating communication technology: Radio in the 1920s; mobile phones from bricks to iPhones	1920s radios, a selection of mobile phones, transistor radios, Walkman, headphones

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
Transforming Resources—*Canadians have deployed scientific knowledge, practical skill and technological tools to the ever-changing process of transforming the resources around us into energy forms and things that we consume. The choices we make in transforming energy and materials bring benefits as well as unintended consequences.*			
It is in our nature to transform the world around us, altering the environment and resources to make simple tools, build cities and explore our planet.	Visitors will participate in making, breaking, and modifying the space around them.	Tools, technologies, and materials; Transforming landscapes, creating infrastructure.	Antony collection of woodworking tools, Builders' tools, a plough, maps
	Visitors will appreciate that by an on-going, always evolving process of transforming resources, we discover the world around us; make mistakes and learn; create new knowledge; make necessary and desirable things; and produce waste.	How do we learn by transforming resources? What mistakes did we make in the past? The things we learn from the world around us.	
	Visitors will appreciate how we've taken our practice of transformation to the Moon and Mars, where missions of exploration have necessitated creation, excavation and extraction.		Prototypes of drills used by Curiosity
Energy that we use every day is harnessed from natural sources.	Visitors will identify four categories of energy use in our lives.	Lighting; Heating and cooling; Appliances;	Light bulbs, heaters and fans, selection of domestic appliances such as ranges & fridges, toasters, coffee makers & electric kettles, vacuum cleaners, washers, leaf blower and lawn mower, radio, TV, etc.
	Visitors will learn what technologies we develop to acquire energy from various sources.	Transportation	
	Visitors will experience how difficult it is to generate power.	Generation; Transmission; Distribution; Storage	Generators, Cross-sections of cables, insulators, model of a transmission tower, transformers, energy storage devices such as batteries, springs, flywheel.
	Visitors will discover research on surprising ways in which we can generate electricity.	Human and animal power Piezoelectrics; Electricity in nature	Sault St. Marie control panel and generator, Motor-generator set + governor from Adams Power

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
	Visitors will name sources of energy in Canada's energy mix.	Hydro; Fossil fuels; Nuclear; Wind; Solar; Ocean; Biomass; Geothermal	House at Niagara, AC Tesla Westinghouse generator, oil pumps and drill bits, ZEEP and Tokamak, VAWT and HAWT, solar tile and a solar panel, tidal turbine, biomass samples
We transform resources to produce all things around us.	Visitors will name materials in everyday things.	Materials (wood, plastics\synthetics, metals, non-metals); Material science and properties of materials (Why do we choose specific materials? How do we test materials? What do we need to know about them before we make things? What are the mistakes that we made and what have we learn?) Smart materials Prospecting and Exploration science and technologies; Extraction technologies; Where do we look for and find resources (national and international context; earth, ocean floor, and space)	Examples of various materials; strength testing equipment, ornamental lathe, industrial press, prospecting artefacts, exploration and surveying equipment
	Visitors will discover what we need to know to select the best material for specific functions.		
	Visitors will appreciate technologies that we create and use to make resources available to Canadians.		
There is a direct link between our consumption and the environment.	Visitors will experience how we extract resources from the environment, which we transform into energy and things.	Soft rock and hard rock mining; How do we harness energy from natural sources? Forestry Changes in landscape and lifestyle; Impacts of elements and compounds on natural environment; GHG emissions Mining cycle; Land reclamation; Conservation and efficiency	Drills, mining lamps, Lunabot rover, mine rescue equipment, mine communication equipment, personal gear such as helmets and coveralls, saws, forest fire-fighting equipment, water and soil testing equipment
	Visitors will explore the consequences of the ways in which we choose to extract and process materials.		
	Visitors will appreciate the developments and the limitations of mitigation technologies.		

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
Technology in Our Lives – *Just as we transform technologies, our lives are shaped by day-to-day interactions with technology—interactions that have changed dramatically over time.*			
We merge human body and technologies to express our identity, enhance our senses, heal our bodies, and better function in our environment and society.	Visitors will recognize that we have been enhancing our bodies with technologies for centuries.	Hearing aids and glasses Cosmetics	Queen cosmetics Jewellery (Business) sewing machine Designer Perfume bottle
	Visitors will understand the reasons for wearing technologies	Technology and "Disability" Working in difficult environments, Wearable technologies and identity Wearable media	Wearable technologies: 2013.0024 LED T-shirt CuteCircuit 2013.0022 Fibre optic scarf 2013.0023 Fibre optic blouse Sterilet?
	Visitors will explore technologies that facilitate intimacy and, in the process, are increasingly perceived as personal (e.g. smartphone).	Intimate Technologies – Technologies for Intimacy	Telephone; fountain pen; smart phone
Our domestic and public spaces are centres of consumption and disposal.	Visitors will differentiate between needs, consumer desires and aspirations.	The evolution of consumer culture Industrial design, advertising Income, gender, culture	*Consumer culture:* Ordinary range vs Tappan Gurney range (style) Ice box- GE fridge-today fridge with water and ice dispenser, see through door (not yet acquired) Beauty apparatus: hair dryers, curling irons, rasors *Factors of influence:* *Examples for Consumer Culture:* Sumeet culinary robot (Indian community) Other Indian kitchen utensils Italian kitchen utensils Canada's provincial differences in appliances selection

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
	Visitors will recognize the factors that affect our choices in consumer technologies.		*Examples for Gender:* Razors *Examples for Design:* Raymond Loewy appliances Boat shape blender Nice toasters
	Visitors will better understand the link between manufacturing, marketing, consumers and users.		
Everyday technologies connect us to global cycles of production, consumption, obsolescence and waste.	Visitors will learn that almost all that we have and use in our homes is produced somewhere else.	Historical change in housework; Production and supply chain From consumerism to throw away culture; Built-in obsolescence	*Production*: Made in China appliances: Made in Malaysia appliances: Dyson vacuum cleaners Made in US: several like dishwashers, fridges, *Design*: B&D kettles forms for market evaluation *Historical change in housework:* Roomba vacuum cleaning robot Cooking from scratch to ready meals-freezers Labor saving- more time to do other tasks-homemaking-sewing machine, tools for crafts Energy efficient appliances with steam/ convection/induction (not yet in collection) Hired help (no artefact yet)

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
	Visitors will see a link between consumption, disposal and the environment.		*Abundance and obsolescence:* Small and large appliances that no more last long by engineered planned obsolescence Old and newer refrigerators Old and newer range Old and newer washer and dryer Old and new toasters, coffee makers, kettles, etc. BBQ Battery-operated tools, garden tools and lawn mowers, body care appliances Major appliances with designer style-planned obsolescence with design: Frigidaire range and refrigerator designed by Raymond Loewy Decorative refrigerator Or appliances we buy-change to have a new experience: coffee makers, bread maker, gadgets, pasta maker, ice-cream maker, etc. Collingwood fishing skiff Clothing, shoes

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
Creating and Using Knowledge—*Scientific and technological explorations have shaped our society, our perspectives, and our environment. These explorations continue to generate unique questions and uncover new ways to investigate, understand and transform our surroundings.*			
Understand the crucial role of ***measurement*** in Canadian life.	Visitors will learn the importance of measurement in Canadian life and culture.	Time Surveying Canada Error Math Measuring people (also psychology)	Standard weights New Kilo instruments Mettler balances together NRC balance Giant slide rule Solar Compass McLatchie surveying collection Atomic time Slide rules Theodolites Ancient Ottoman math instruments and standards Babbage and Pascal calculators
	Visitors will learn about how measurement can be very local to place, people and culture in Canadian life.		
	Visitors will get a sense of the sheer variety of instruments for measuring, and things/entities/places/phenomena/people being measured.	Really, really small Really, really far away Standards (weight, length, height, time…)	
	Visitors will get a sense of the challenges of measurement in practice (error, intangibles, scale, human factors, instrument factors).	Measurement and conflict	
	Visitors will learn about the many areas of Canadian science and tech that depend on measurement.	Canadian journeys (e.g, the travels of survey instruments across Canada) Calculating Computers	
	(Northern Lights - topic) • Visitors will learn about the importance of Northern Lights in the history of Canadian Science and Technology. • Visitors will learn about the sheer variety of scientific fields that connect to Northern Lights. • Visitors will learn the many different interpretations of Northern Lights in many different cultures. • Visitors will learn about the sheer variety of experience with Northern Lights from people across Canada.	Northern Lights	

Interpretive Goals	Interpretive Objectives	Topics	Preliminary Objects List
Appreciate the highly creative role of making, breaking, adapting, modifying, "cannibalizing" instruments, material and things of science **(materiality of science)**	Visitors will experience science as a process of adapting, modifying and improvising in the material world.	Precision making Makers	Hugh Le Caine and the 1947 Cyclotron (compared to Sackbut) Bristol sci instrument payload with masking tape (Black Brant) Medical wax models 1938 Electron microscope 15" observatory telescope Metocean buoy Rand McNally Earth and Moon Space Age Blue computers and instruments
	Visitors will learn about making as an activity strongly shaped by local conditions and resources.	Making and place (mapping innovation)	
	Visitors will learn about experimentation and testing as a fundamental part of creating knowledge.	Skills and learning how to make (training) Making and controlling effects Models or all sorts Experiments and testing instruments and aesthetics (making them look good)	
Understand the importance of making ***hidden worlds*** comprehensible/accessible. **(observation)**	Visitors will learn about the importance of observation and the five senses as fundamental aspect of scientific activity.	Science, medicine and five senses	Historic microscope slides (Percival slides, diverse specimens, aesthetics) Live Cosmic ray detector demo Astronomical glass plates of galaxies Geiger counters (sound) Stethoscopes (sound to observe) Anatomical models MRI machine or CT machine or x-rays Classic optical, electrical and acoustical demonstration instruments
	Visitors will experience a large variety and scale of micro and macro worlds as an inspiration for scientific inquiry.	Beyond sensations: Micro and macro worlds	
	Visitors will explore scientific instruments as extensions (and modifiers) of the senses.	Extending the senses	
	Visitors will experience beauty as an inspiration for science.	Meteorology Astronomy Geometry, symmetry, order Magnetism Gravity Light, sound electricity Exploration History of demonstration and teaching in the sciences	

APPENDIX C:
CSTM WORKSHOP OUTCOMES

May 6, 2015 Visitor Experience Workshop Outcome

Engage With a Historical Narrative			Creative and Collaborative Use of Technology			Hands-On Exploration and Analysis		Immersive Narratives	Appreciation of Technological Forms and Functions	Welcoming and Engaging Space
Nostalgia	**Stories**	**Sense the Real Thing**	**Make & Take**	**Creative Collaboration**	**Create & Play**	**Break-in / Deconstruct**	**Use Historic Technology**	**Interpretive Journeys ("Trippin'")**	**"Eye Candy"**	**"Creature Comforts"**
Use obsolete technology	Hear the life stories of iconic artefacts	Smell something real	Print something and take it home	Contribute creatively to a collaborative visual project	Interactive light bulb display controlled with the body	Break apart a car engine	Crank a Model T	Take a journey through the human body	See beautiful things	Be able to see outside the museum
Remembered things from when I was younger	Listen to stories	Smellscapes relating to exhibit programs	Print a newspaper with a historic printing press	Super-large kinetic sculpture- many scientific principles	Dance to generate electricity	Remove the outer layers of artefacts with digital media	Operate robotic surgery arm	Take an immersive trip in a historic train across a historic Canadian landscape	Color themed artifact galleries	Eat and drink in a great cafe
	Read "tweets" written by historic innovators/ artefacts	Feel the power of a locomotive	DJ sound booth with sounds of obsolete tech	Build a Rube Goldberg machine	Make music	Deconstruct blackbox objects virtually	Experiment with unlikely materials	Toy train going around the perimeter with technology stops	Compare shell to a cathedral	See large 'wow' object in lobby
	Hear voices that haven't been historically represented	Hear the sounds of artefacts	Make something with a sewing machine	Record audio captions for historic photographs	Make new sounds	Guess an object's function	Exploration with gears: interactive artefacts	Remotely navigate and onsite robot	Be overwhelmed/humbled by artifact displays	Talk to a really knowledgeable guide
	Hear Bombardier tell a story of the snow mobile	Listen to sounds of computers from the 1980s	Operate printing press with takeaway		Play "Fur Elise" on world's first synthesizer	Match abstract close-up images with real artefacts	Lift heavy equipment	Use cell phone to take different tours	See a wall of irons arranged as art	Find my way around with ease
		See, feel and hear a locomotive rush by	Use old fashioned camera		Make my own cartoon	Thematically explore a non-linear photo gallery	Pedal a Penny Farthing	Journey to another planet	See weird, quirky, creative things	
					Build a simple machine		Operate vintage machinery	Be the Hubble Telescope	See objects as inspiration for maker space	
							Listen to heartbeat	Touch large interactive wall map of Canada	See cars	
							through vintage stethoscope			
							Please touch zone	Animate the locomotive digital hall with a wall mural, visually depicting railway construction from East to West		
								Live stream field institutional research backed by artefacts		

Other Experience Suggestions

- See prototypes of latest tech design innovations
- Dress-up in historic costumes
- See augmented reality of CSTM's history
- See evolution of technological objects
- Drawing program tour
- See and talk to Hadfield in space hologram
- Tag photos of Family
- See artefacts in action
- Sit in the driver's seat of car
- Play on a rock-climbing wall
- Use a wind tunnel
- Paddle a canoe
- Help catalogue an artefact
- Collaborate with mom and dad
- Do citizen science
- Make my own album
- See behind the scenes at the Museum
- Take apart an object like an engine
- Take pictures of my kids
- Had my perceptions challenged
- Laughed
- Experimented
- Was in a real OR

Additional Ideas Discussed After the Workshop

- Importance of exhibiting the real thing (power of authenticity)
- Space for quiet contemplation
- Importance of providing intellectual analysis of collections/ideas
  - Cerebral engagement
- Leave your mark (within the Museum)
- Basic science
- Importance of providing immersive spaces

APPENDIX D:
SUPPLEMENTARY IDEAS

Visitor Experience

Moving and Connecting Gallery

- **Assembly Line:** Follow the construction of a car as it makes its way through an assembly line.
- **Goods on the Move:** Track one of three Canadian commodities as it moves from farm/forest/mine to rails to port to you.
- **The Transatlantic Cable:** Follow the Great Eastern ship as she lays the transatlantic cable. Touch a large cross-section of the cable, and lay the cable with grappling hooks through an interactive medium.
- **Switchboard Experience:** Put yourself in the shoes of a telephone operator. See that there is more to a phone call than a direct path between two devices, and come face to face with a large projection of women operating a switchboard.
- **What Transportation Means to Me:** Using an oversized chalkboard, fill in the blanks to various statements (e.g., My car allows me to _____. My favourite thing about public transportation is _____.). Have fun contributing to the list or read other visitors' responses.
- **Telephone Display:** View a large wall of phones (from early rotary to smart phones) and eavesdrop on historic telephone conversations.
- **Historical Selfie:** View a wall of cameras and choose a device. Upload your own picture and see how it would have looked had it been taken with that device.
- **Paint-by-Number:** Use digital media to paint a Parks Canada mural like those that once adorned CN railway cars.
- **Map of Canada Bead Maze:** Move different modes of transportation across a large map of Canada using beads shapes like artefacts in the collection (e.g., canoe by waterway, airplane overland, automobile on road, locomotive on rail, etc.).
- **Stories of the Road:** Share your stories of Canadian travel and read other submissions.

Transforming Resources Gallery

- **CSTM's Power Generation:** Track the amount of energy the new museum building is generating. How much energy is being produced and saved?
- **Virtual Mining:** Dig for minerals in a virtual mine using a "sandbox" smart table interactive.
- **What's Yours is Mined:** Explore the overwhelming amount of minerals that contribute to the production of ubiquitous objects (e.g., cell phone, computer).
- **Interactive Periodic Table:** Play with a giant floor projected periodic table. Combine elements to make chemical reactions, explosions, and compounds.
- **Surveying:** Virtually fly a drone over remote landscapes as you search for natural resources (geological surveys).
- **Wasted:** Through visually shocking installations, see the impact of our consumer choices in the form of the waste we generate (e.g., a large transparent container filled with technological waste).
- **Land Reclamation:** Using a dial, explore the process of land reclamation from land surveying and exploitation to closing up a mine and regrowth.

Creating and Using Knowledge Gallery

- **What Time Is It:** Answer philosophical questions about time and our sense of time (survey of what time is, how people use it, how people perceive it).
- **Micro/Macro Labs:** Explore the hidden worlds of micro and macro. Play a guessing game and determine if an image is from the macro or micro world. Use digital media to zoom into the powers of 10.
- **Creative Pairings/Odd Couples:** Guess the link between seemingly disparate objects (e.g., Sackbut and Cyclotron, where the common link is the developer) and see what other people guessed.
- **Northern Lights:** Explore scientific principles related to the Northern Lights via interactive stations that experiment with magnetism, light, sound, and chemistry. Create and project your own Northern Lights by inputting ingredients (the various conditions, the elements present in the atmosphere).

Digital Media

Moving and Connecting Gallery

1. Virtual Reality Train

A virtual reality experience near the trains would allow visitors to put the collection of the Museum in the context of the Canadian landscape. As a 'choose your own adventure' exhibit, visitors would create a personalized tour based on their interests:

- Choose your train
- Pick your start and end points
- Select your historic period
- Decide what places you want to see along the way

Once they have made their choices, the journey would to life in a dynamic fly through. Visitors could share their virtual journey—or save as a souvenir of their visit. The experience could be done simply on one touch screen, more impressively on a large scale glass wall projection, or as a full immersive experience (step into a virtual train and put yourself in the story of how trains move and connect people, complete with vibrations and steam). The virtual journey could be narrated by a character from an era with background sounds reflective of the time. The experience could be first person from within the train, or as an observer seeing the artefact within the virtual reality scene that has come to life. A variation on this theme could be used to allow other non-accessible transportation devices (such as the Penny Farthing) to be accessible to all visitors through a virtual experience.

2. Immersive Gallery Takeover

A digital override would take over the gallery floor at pre-determined times (or on command by staff). The experience would use projection mapping, sound, and immersive effects to animate the large and small scale items in the collection. The locomotive would begin steaming as the whistle blows and the pistons begin to pump. The penny farthing bike would ride away to the sound of a bike bell dinging. The snow cat would rev to life and ski away. The canoe would be picked up and portaged out of the scene.

Transforming Resources Gallery

1. Resource Management Simulator

A multi-user simulator would challenge visitors to make real-world decisions on resource management—and would visualize the impact of these decisions on a large digital wall. Visitors would engage with the simulator with their smart phone or a museum provided tablet. On screen graphics would include a map of the world, with filters for emissions, global warming, forestation, as well as non-environmental factors such as population growth, natural disasters, and economic influences. The experience could be designed around a particular topic such as forestry management, mining, hydroelectricity, solar, or wind power—or could be a macro experience that brings together all the resources into one experience. For example, visitors within one game might decide to close a coal mine, invest in solar technology, de-prioritize research on wind power—and the impacts of those decisions would be played out visually: how do these choices affect global emissions? How does that impact the economy? Do those variables change if there is a natural disaster? What does that mean for the world's population?

2. Day in the Life Videos

This exhibit would allow visitors to explore the visual variety of resource management through captivating videos.

- **Option 1:** Short POV videos allow visitors to imagine a day in the life of someone working in the natural resources sector. The experience would be a sped-up 1st first person POV video shot with a GoPro camera.
- **Option 2:** Real time CCTV or streamed video from different "sites" across Canada.

3. What Did You Bring Today?

At this exhibit, visitors would connect their personal items with the theme of the gallery. The exhibit could detect what the object is (or something that is similar to it)—and then display information related to that object. For example, visitors may have a watch, gold ring, smart phone, a plastic water bottle, keys, etc. By connecting the theme with these objects, the message is relatable to all visitors, and visitors are encouraged to explore deeper.

4. Canadian Resources Animation

Visitors could watch a dynamic animation of natural resources in Canada. Starting from a map of Canada, the animation could highlight dynamic overlays of natural resource deposits (energy, forest, minerals, metals)—and how those resources have changed over the last 100 years—and possibly show how these deposits are expected to evolve in the future. The experience would be user controlled by a spin browser. Other options include an auto-cycle on a large display or user controlled via a touch screen.

5. Innovation in Resources

This exhibit would highlight the research and development of new resources. This would be an opportunity to feature important research, innovative Canadian start ups, and how these game changers might alter Canadian society of the future. The content would be presented on a touch screen for visitors to drill into areas of interest—and watch videos, interact with data, and sign up to stay connected to these stories as they unfold in the future. Visitors could be encouraged to imagine the future of resources by leaving behind a 'science fiction' solution.

Creating and Using Knowledge Gallery

1. Inquiry Booth

At the inquiry booth, visitors could ask questions, make a hypothesis, and explore how questions and answers are linked to the scientific method. User generated content could be mixed with questions and hypotheses of scientists, both historical and modern day. Visitors could leave their questions and hypotheses via an audio recording, a video, or a text message. Other visitors could explore this user generated content, start their own thread, or participate in a crowd sourced response. User generated content could be linked to existing solutions, ongoing research and/or shared with scientific community for feedback and review. There could also be a 'ping an expert' option—or a way to incorporate Artificial Intelligence. The experience could be tied to a timely theme, a special event topic, or be open-ended.

2. Virtual Science Fair

A touch screen display could be designed to mimic the classic 3-sided façade of a science fair presentation. The content on the display would include the latest innovations in science and tech from Canadians. The display could include an option to select stories from a Canadian timeline of innovation, to connect discoveries of the past with the innovation of the future. The display could also include user generated content to allow visitors to see their own research and experiments within the walls of the Museum. This approach would allow the Museum to highlight amazing achievements at any level. For example, the Victoria-based teenager who won the Google Science Fair project for her human powered flashlight: *http://globalnews.ca/news/860793/victoria-teen-wins-top-honours-at-google-science-fair-for-hollow-flashlight/*

3. Macro and Micro Gesture Play

Visitors could engage in full body play on dynamic animations at the macro and micro scale projected onto the floor. One moment they can leap across oceans and the next they are moving between plankton. Later, they are floating in the circulatory system of the human body, or avoid volcanic eruptions among the mountain peaks. The focus of this experience is physical play that complements the theme of the gallery.

4. Transparent Overlay – M and E Room

The mechanical and electrical room will be accessible for visitors to view through a glass wall. A transparent overlay on the glass wall could present an interactive diagram of what visitors can see of the equipment. Visitors could touch on the interactive diagram to reveal additional content, or to animate the inner working of the equipment. The systems of a 'Science and Technology' museum would get to be an exhibit of their own, including heating, cooling, venting, electrical, and plumbing!

Technology in our Lives Gallery

1. Virtual Room: Interactive Challenge

As described by APA, the gallery will feature a virtual room created by multiple screens lining the walls. This virtual room will allow visitors to step back in time to visualize a variety of rooms during various decades in Canadian history. For example, featured rooms could include the supermarket, the doctor's office, the living room, etc. This room will capture visitor's imaginations, as it will feature art, interior design, sound, and pop culture of the era, not just the technology devices of the time. The experience could also include an imagined future era—what will these rooms look like in 20 years? 100 years? To enhance this virtual room idea, the experience could be designed to ask visitors to complete a challenge within each era. For example: doing the laundry, changing the channel on the TV, make a phone call with a rotary phone, surfing the web with dial up internet, writing a letter with a typewriter, etc. This would allow younger visitors to really engage with what they are seeing—and also allow older visitors an opportunity for a nostalgic interaction.

2. Social Media Data Visualization

This experience would present interactive infographics on social media via a large interactive touch wall. Visitors could interact with the data to view the information that is most meaningful to them. For each social network, stats could include age, gender, frequency of use, global reach, trends, etc. The message beyond the stats would be thought provoking for visitors to reflect 'what does the future hold?' The display would include social networks relevant to different visitors (E.g. Facebook and Twitter vs Snapchat and Yikyak). Visitors could also engage with the wall by sharing their own content via their preferred network and seeing it shared in real time on the wall.

3. Physical Prototype/Digital Takeaway

Within the technology in our lives gallery, visitors would be encouraged to create a physical prototype to explore design thinking. Once their 3D object is created, they could use a 3D scanner to create a virtual 3D model of their creation. This virtual model can then be placed within a virtual scene, to create a digital experience. This digital experience could be a 'leave behind' or a 'take away'. For example, a visitor could create a model of the 'house of the future'. Once scanned, the visitor could placed the house in a 3D world of a futuristic city!

4. Digital Prototype/Physical Takeaway

Visitors could also be presented with digital 3D modeling tools to create a 3D model. This idea could be extended for younger visitors to allow them to draw a 2D design that the program then extrudes to create a 3D object. Their virtual 3D object could then be placed in the 3D environment of their choosing, or they could print a 3D model as a takeaway souvenir of their experience. Visitors could leave their 3D printed objects with the Museum for temporary displays. They could also create a stop motion film of the 3D object as a digital takeaway. For example, a visitor could draw a car of the future. The program could then extrude it to a 3D model. The car could then be printed with a 3D model and the visitor could use the object for a stop motion animation film. The best user generated content could be displays for inspiration for future visits.

APPENDIX E:
TEXT PRODUCTION PROCESS

CSTM TEXT PRODUCTION PROCESS

RESPONSIBILITIES – TEXT PRODUCTION[1]

The responsibility for establishing and maintaining the interpretive parameters of all exhibition texts (level of language, lengths, style) rests with the EPE division. This responsibility is exercised by the E&I rep in collaboration with the Director of exhibitions.

It is important that all team members agree as early as possible on the types of texts to be included in the exhibition, the maximum number of words for each type as well as on the text production schedule. These points should be part of the minutes of one of the team meetings.

Education and Interpretation Representative

Within an exhibition team, the E&I rep coordinates the development and production of all exhibition texts. All contacts with the external writer, translator and editor are done through the E&I rep. At the request of the team or a team member, the E&I rep will arrange a meeting with the team and the writer to discuss issues of content or style.

Curator

The curatorial representative verifies the content accuracy of all exhibition texts. The curator is also responsible for writing the artefact captions.

Director General of CSTM

The Director General reviews the texts at pre-determined points in the process, respecting the text production schedule, and provides comments and feedback.

The Director General provides the final approval of all exhibition texts.

TEXT SCHEDULE

The E&I rep is responsible for the development and monitoring of a schedule for the production of all texts.

The text schedule should include:

- IP development
- First Draft – Text Writing Period
- First Draft – Team Review Period
- Second Draft – Text Writing Period
- Second Draft – Team Review Period
- First Language Editing Period
- Director of exhibitions Text Review
- Second Language Translation Period
- Comparison Editing Period
- Director of exhibitions Final Text Review
- Production Editing

[1] Adapted from: The Exhibition Text Production Process, Originator: C. Faubert (1998)

STEPS IN THE TEXT PROCESS[2]

1. Developing the Interpretive Plan

The interpretive plan is a key tool in the development of text, primarily because it identifies and assigns priority to all messages present in the exhibition. It also identifies exhibition elements, such as artefacts, photos and interactives that will require accompanying texts. Every single piece of text must be identified and defined (as to type) in the interpretive plan, in a text column adjacent to the message column, and must be coded following the coding used for the messages (see Template for Exhibition Text Coding). This allows team members to keep track of all the texts, along with the message or exhibition element that each text relates to. In the text column, text can be either in the form of a draft not exceeding the maximum word count or in point form.

It should then be possible for an external writer to write the first text draft using only the text information contained in the interpretive plan and the additional background material. The background material is put together by the curator and usually consists of a relatively small number of photocopied pages. The background material will be used by the writer to familiarize her / him with the subject matter of the exhibition and of each section as a source of relevant and interesting information.

2. First Draft Text– External Writer

The English (usually) writer produces a first version using the messages presented in the interpretive plan, draft texts written by the curator (respecting the maximum word count) and supported by the background information supplied by the curator (respecting the maximum word count). This version is sent from the writer to the E&I rep who in turn circulates it to those team members involved in the text process for comments. In order to expedite this process, text is usually broken down into section packages, all text relating to one section contained in one package. The number of text sections depends on the size of the exhibit.

3. Team Review / Second Draft of Text

Comments are collected by the rep and, if necessary, forwarded to the writer for a second version. In many cases, the changes to the text will be small and can be done by the interpretive rep in consultation with the curator and other team members without involving the writer a second time. In cases where a second version is necessary, it is again circulated by the rep to team members for final corrections.

4. Editing

The English (usually) texts are then sent for editing by the E&I rep.

[2] Adapted from:: The Exhibition Text Production Process, Originator: C. Faubert (1998)

5. Director General Approval / Team Sign-Off

The edited texts are then sent to the DG for comments. Once the latter's comments have been reviewed and addressed by the interpretive rep in consultation with the curator and other team members, the texts are then approved by the team.

6. Translation / Comparison Editing

This final approved version is then sent to translation. The E&I rep coordinates the translation process. The translated text is then sent to editing and comparison editing is completed, in consultation with the E&I rep.

The edited, translated version with the edited source language is circulated to team members for comments. Small changes, if necessary, can then be made to the texts by the Education & Interpretation rep in consultation with the curator and other team members.

7. Final Approval: Director General

Once the texts have been agreed upon by the team, they are submitted to the Director of exhibitions for comments. Once the latter's comments have been reviewed and addressed, the texts are then signed-off by the E&I Rep and the Curator. This version becomes the final approved version and is sent to graphic design.

8. Production Editing

Before fabrication, a Production Editor* will edit all exhibition galleys in English and French. Changes at this stage must be approved by the Education and Interpretation rep and verified for content and accuracy by the curator. Galleys of all text panels must be signed-off by the Production Editor, the Education and Interpretation, the Curator and the DG before the panels can be produced.

(See Production Editing Process)

Text packages

Since most text graphic panels are now produced in an integrated way, with the graphic designer placing photos, graphics, titles and texts on one panel on the computer, it is essential that all these elements be given to the designer at the same time, in a Apackage@. A package therefore contains all the photos, graphic elements as well as all the interpretive texts — titles, main and secondary texts, tombstone data, photo captions, artefacts captions, and credits— relating to a particular part of the exhibition. Early on in the exhibition process, the team in consultation with the Manager, will define the various "packages" that will comprise the exhibition. As the work progresses, complete packages will be put together and "fed" into the system.

PRODUCTION EDITING PROCESS:

Depending on the size of the exhibition, the production editing process can take many days, even weeks to complete. As production editing is often completed in a time restricted period it is important for the E&I Rep to communicate a production editing schedule with the other members involved in advance insuring everyone's availability.

Steps

1. **Printing Galley Packages**

   - The exhibition designer prints out each exhibition galley in colour including the separate text component found on the galley to ensure that all exhibition text is legible and is revised properly. Pay close attention to photo captions, artefact labels and tombstone data as well as instructional texts as they are often forgotten. (Some packages may have up to 10 pages!)
   - Each package should be stapled together with the full galley as the cover page.
   - Each package should be labelled with the date and section/galley number on the cover page.
   - This first step should be completed before the production editor is brought on-site.

2. **Editing- First Revision**

   - During this step, the production editor (PE) and E&I Rep will verify:

     - grammar, spelling and style of text
     - text alignment
     - legibility of text (certain colours or fonts can be more difficult to read)
     - length of text lines
     - sentence breaks / word breaks
     - apostrophes (curly or slanted, not straight)
     - size of text
     - colour of text
     - type face
     - what's behind the text?
     -ease of read
     -ligatures

   - The PE will suggest modifications to text to the E&I Rep, who must approve any text modifications.
   - The E&I Rep's role during this stage is to ensure that all text sent to the designer in the text package is present on the appropriate galley. Pay close attention to the credits and captions which can often be left out or be shuffled around and placed on another galley.
   - Any modifications are communicated to the designer who makes the changes and prints out a second package of print-outs.

3. **Editing – Second Revision**

   - The PE and E&I Rep review the second package of text and communicate any changes to the designer who makes the modifications.
   - This process repeats itself until the PE and E&I Rep are content with the final galley. Some galleys can be more challenging to review and will require 3 or more revisions.
   - All print-out packages should be attached together, with the most recent revision as the cover package. Never throw away previous packages as they document the changes that were done in the production editing process.
   - The PE and E&I Rep sign-off each galley package (A signature and date is required on **EACH** print-out of the final revised package, including the cover page)

4. **Curatorial/Director General Approval**

   - Once the E&I Rep and PE have signed-off the galleys, the curator must review the packages to ensure that the changes proposed by the E&I Rep and PE have not altered the content. It also offers the curator one last revision of the exhibition text. The curator signs-off each print-out of the final revised package.
   - The last person to revise the packages is the DG who gives final approval on all galleys. As did the other three members, the latter signs-off each print-out of the final revised package.
   - The final signed-off galleys are archived at the end of the exhibition development.

EXHIBITION TEXT: INTERPRETIVE AND NON INTEPRETIVE

There are two main types of exhibition texts: interpretive and non interpretive.[3]

NON INTERPRETIVE TEXT

Non interpretive texts are:

Tombstone data

The Tombstone data is the functional information of an artefact. It includes: the name/title, fabricator, where it was found, date and artefact number. The tombstone data does not include any descriptions or stories concerning the object. This text is reserved for the artefact caption. (See text editing process for the tombstone data template)

Examples:

"DeLaval" Milker and Claw
DeLaval Manufacturing Company, Peterborough, Ontario
ca. 1960
Artefact no. 1974.0553

Trayeur et griffe « DeLaval »
DeLaval Manufacturing Company, Peterborough (Ontario)
vers 1960
N° d'artefact : 1974.0553

[3] Exhibit Labels. B. Serell (1996)

Directions / Instructions

Instructional text is associated with an interactive or audio-visual experience. It gives title, purpose, explanation and running time. It is invitational in tone. This text should be as short as possible.

Examples:

(AV Instructional text)

Discover more about the technology used to keep food free from bacterial contamination.

(Interactive Instructional text)

These six bacteria are the most common causes of food-borne illness.
Look at them under the microscope.
These consumers need your help.
Look at their personal requirements then decide which products they should buy, based on the information provided on the food labels.

Credits:

Credit information acknowledges the source of photographs, props or artefacts. Many sources will supply the Museum with their own credit information while others are indifferent of how their credit information is displayed as long as they are acknowledged in some way.

In many cases when the Museum obtains the right to use historical photos, the supplier will require that the credit information be accompanied by the photo's identification number. (See text editing process for credit templates)

Examples:

Courtesy of Canada Food Inspection Agency
Avec la permission de l'agence canadienne d'inspection des aliments

Examples of Archival Photo Credit Information:

Archives of Ontario SCH-43
Archives publiques de l'Ontario SHC-43

INTERPRETIVE TEXT[4] - General Rules

Interpretive Text	Description / Purpose	Word Count
Exhibition Title	• Snapshot of the exhibition subject and scope, designed to be taken in at a glance. • A tool to be used in marketing the exhibition • Should have impact and meaning	As short as possible
Advanced Organizer	• Serves as an orientation to an exhibition section	**15–20 words**
Section Titles	• Should be catchy and short • Communicates principal themes or topics	**Usually 1–7 words**
Subtitle	• Should be very short, to elaborate on title • Can also communicate sub-themes within a topic	**Usually 7-15 words**
First Level Text	• There should only be a few main texts in an exhibition. • Ideally, one main text should have one idea / message. • Links to the major communication objectives of the exhibition.	**80 words max.** (excluding title and subtitle)
Second Level Text	• Communicates the sub-themes of each section. • Highlights specific ideas of the exhibition	**40–60 words** (including title and subtitle)
Artefact Caption	• Should relate directly to the artefact being presented, as a whole or focusing on one specific aspect of it and making it clear why the artefact is presented there. • Use active voice and direct address.	**25–30 words max.** (excluding tombstone data and credit)
Photo or Prop Caption	• Storytelling or informative label • Sets the photograph or prop within context of exhibition narrative or argument.	**20 words max.** (excluding credit)

[4] Adapted from: The Exhibition Text Production Process, Originator: C. Faubert (1998)

TEMPLATE FOR CODING EXHIBITION TEXTS[5]

The coding presented here should be used in the preparation of the interpretive plan and by all the people who are involved in the development and production of exhibition texts, at NMST and at the AG Museum.

The most common exhibition elements should be abbreviated as follows:

Artefact	A
Photo	P
Graphic	G
Facsimile	Fac
Video	V
Audio	Aud
Interactive	IA
Manual (Flip Book)	Man
Title	T1
Subtitle	T2
Main body of text	T3,T4, etc.
Text Caption	Tcap
Text Credit	Tcred
Props	Pr
Decorative Element	D

Note: Exhibition elements specific to an exhibition will require their own abbreviation.

Here are some examples of text coding:

2.0	This number identifies the section to which the text belongs
2.0T1	main title of the section
2.0T2	sub title for the section
2.0T3	general text about the main idea of the section
2.0A1Tcap 2.0A2Tcap 2.0A3Tcap	for the artefact captions , artefacts 1,2,3 in section 2.0 (The actual artefacts are 2.0A1, 2.0A2, 2.0A3)
2.0 P1Tcap 2.0 P2Tcap	for the photo captions for photos 1 and 2 belonging to section 2.0 (The actual photos are 2.0P1, 2.0P2)
2.0P1Tcred 2.0P2Tcred	for the credits for photos 1 and 2 belonging to section 2.0 (This is often incorporated into the photo caption and may not need a separate coding designation)
2.0IA5T1	Title for interactive number 5 in section 2.0
2.0IA5T2	Subtitle for interactive number 5 in section 2.0
2.0IA5T3	Text for interactive number 5 in section 2.

[5] Source: Mitzi Hauser (2007)

APPENDIX F:
CSTMC ACCESSIBILITY STANDARDS

CSTMC ACCESSIBILITY STANDARDS

Disability is the result of a mismatch between a person's ability and the form and function of the environment created by people. Environments are changing, and technology for people with disabilities has made exciting leaps in recent decades. Many innovations average consumers enjoy today can be traced back to technology designed to make information and communication accessible for people with disabilities.

The best way to achieve accessibility is preventing new barriers from being created. When procuring a product, CSTMC is recommended to procure products which comply with Exhibition Accessibility Standards when such products are available in the commercial marketplace or when such products are developed in response to an RFP solicitation.

The following technical requirements will enable museum exhibition designers to follow general guidelines to be used on all projects. The requirements are selected from a variety of accessibility standards to provide a reference document with the most commonly needed specifications. The aim is to support exhibition designers and contractors to prevent accessibility barriers. The original standards quoted in the final section "Reference Sources" are strongly recommended for additional context, more accessible design recommendations, and illustrations.

Should designers have questions about the interpretation or implementation of accessibility requirements, consult with the project's Exhibition Interpretation Officer to seek advice and identify alternatives, or approve any variance requests. Integrating requirements at the beginning of a project prevents delays in approval stages and time lost and possible materials costs for redesigning, or remediating inaccessible conditions.

Please note that this is a living document and will be updated as new solutions and clarifications are required.

6.1. Core Principles

Standards provide minimum requirements for accessibility. **Strive to exceed minimums whenever possible.**

Content that is essential to an exhibition theme[1] will be made accessible in alternate formats which may include: tactile models, reproduction models, audio description, closed captions, simple language, and large font, as appropriate.

6.2. Built Environment Accessibility

Paths

- Strive to achieve a width of 1830 mm for circulation paths (this represents the width for two mobility devices passing each other). For children specific areas, widen the width to 2235 mm.
- The minimum width shall be 1370 mm (which represents the width of a wheelchair and one person standing). Make every effort to exceed the minimum width especially near key experiences.

Corridor

- The minimum corridor width for travel in a **single** direction shall be 920 mm. Make every effort to exceed the minimum width.

Turning Space

- Key museum experiences should allow a 2440 mm width / diameter best for U-turns and 360° turns. This accommodates longer mobility devices such as scooters and reclining wheelchairs.
- The minimum width to enable 360° turns for wheelchairs is 1525 mm by 1525 mm.
- 1220 mm by 1220 minimum space for turning radius, such as turning a 90° corner using a mobility device.

Protrusions or Obstructions

- Avoid placing obstacles (items placed lower than 305 mm) in the middle of routes or manoeuvring spaces. If obstacles are unavoidable, use lighting, high contrast colour, a barrier or raised platform to reduce hazards.
- The minimum clearance from the floor to any overhead obstructions (such as signage) will be 2100 mm.

[1] Essential content and key experiences will be determined by the Museum's exhibition team.

- Wall mounted obstructions may be any size if they start below 680 mm, making their bottom edge cane detectable
- Prefer display cases that reach the floor to ensure detection with a white cane. If impossible, use floor to wall colour contrast of 70% and lighting to reduce hazards.

Colour

- The floor and wall colour will respect a contrast of 70%

Doorways

- The minimum clear opening will be 950 mm for one individual at a time.
- For open doorways use "Paths and Corridors" requirements
- The doorway and its surroundings will respect a colour contrast of 70%.

Doors

- Independent use of doors is desirable. For non-power operated doors, additional requirements are applicable[2]
- Hardware will be 900 mm to 1000 mm from the floor and operable with a closed fist
- Revolving doors, turnstiles and frameless glass doors are not acceptable.
- Avoid thresholds over 13 mm high; thresholds over 6mm must have a 1:2 bevel on both sides

Display Cases and Vitrines

In addition to following requirements for Protrusions and Obstructions, display cases and vitrines shall meet the following requirements:

- Use anti-glare, anti-reflective glass or acrylic
- Where display cases have a counter or reading rail it will provide clear knee space of 610 mm high, 610 mm deep, and 760 mm wide. Tables and work surfaces require additional clearance.

Accessible viewing heights:

- Table cases will be shallow and respect a maximum height of 915 mm. A low bottom is hard to see in.
- Horizontal visual barriers (e.g. railings, frames) will respect a maximum height of 915 mm

[2] Additional requirements for Accessible Doors and Doorways is available in Section 3.8.3.3, of the Ontario Building Code http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_120332_e.htm, or Section 4.1.6 of London Facility Accessibility Design Standards https://www.london.ca/city-hall/accessibility/Documents/FADS_2007_final.pdf

- The accessible viewing height shall be between 1090 mm and 1700 mm when at a distance of 1830 mm from the object. When located closer to an object, height must be reduced to maintain line of sight for people seated in a mobility device or of short stature.

Up close viewing height:

- Vitrines shall be placed at a viewing level of 1090 mm and 1295 mm from the floor. For children specific spaces, the average viewing height shall be 1036 mm above the floor.

Seating and Tables

Seating:

- Seating must be provided in each exhibition.
- Seating and rest areas will include accessible locations that do not encroach on circulation routes.
- Locations will have clear approach not less than 920 mm wide by 1525 mm long.
- Seats should be firm and between 430 mm and 510 mm above the floor. Children's seat heights should respect a height of 203 mm to 305 mm (5 years and less), and 305 mm to 432 mm (5 years +).
- Strive to incorporate chairs or benches that have both arm and back support. Near key areas where visitors might spend more time (near children interactive zones, display walls of artifacts, AV presentations) seating shall have back and arm support.
- Chairs should have a colour contrast with their environment of 70%

Provide the following clearance for tables and work surfaces:

- Clear floor space shall not be less than 760 mm by 1370 mm
- Clear knee space shall be 685 mm high, 480 mm deep, 760 mm wide, for children 610 mm high, 610 mm deep, 760 mm wide
- Work surfaces will be located between 710 mm to 865 mm from floor.
- Wherever possible, provide adjustable-height work surfaces.

Reach Range

Forward reach range for a person using a scooter depends on the design of the front of the scooter. Dimensions for reach range are based on research for average-size people sitting in wheelchairs.

Forward reach:

- Always strive for forward reach.
- The forward reach range shall be between 380 mm to 1220 mm from the floor.
- For children specific areas, the range shall be between 508 mm to 915 mm above the floor.
- Over an obstacle such as a table top, the maximum forward reach height shall be 1120 mm.

Side reach:

- The range shall be between 230 mm to 1370 mm from the floor.
- For children specific areas, the range shall be between 508 mm to 915 mm above the floor.
- Over obstacles such as a table top, the maximum forward reach height shall be 1170 mm.

Some people who are of short stature may not be able to reach controls above 915 mm from the floor.

Floors

- Use firm, level, non-slip, non-glare materials; low pile if carpeted
- The floor and walls shall respect 70% colour contrast.
- Avoid strong patterns.

6.3. Lighting[3]

For artefacts and text to be visible to people with low vision, lighting levels should be between 100 lux and 300 lux. (For purpose of comparison, full unobstructed sunlight has an intensity of approximately 100,000 lux.)

- Ensure lighting does not cause bright pools of light or shadows.
- Ensure lighting does not create shadows of the visitor over content being viewed.
- Ensure lighting does not create glare on glass, or acrylic including video screens or interactives.
- Balance lighting inside displays with ambient lighting to reduce reflections. Brighter interior conditions cuts reflection.
- Use soft upward ambient lighting to cut shadows.
- The angle of overhead lighting contributes to reflections and glare.
- Design lighting to prevent glare and reflections from multiple viewing angles including the perspective of people of short stature and people seated in a mobility device.
- Ensure that there is sufficient light on labels to make them readable by all visitors.
- Provide sufficient light to accommodate speechreading and sign language conversation in locations throughout the exhibition

[3] Additional resources: Interior Lighting Modeling, produced by IBPSA. Part of Building Energy Modelling (BEMBook) http://www.bembook.ibpsa.us/index.php?title=Interior_Lighting_Modeling
Light Guides (includes a section on Controlling Glare
http://www.lightsearch.com/resources/lightguides/index.html

Accessible Lighting Levels for Different Environments

Lighting Levels

Purpose	**Lux**	**Foot Candles**
Ambient Lighting	50 – 300 lx	5 – 30 fc
Text Panels	100 – 300 lx	10 – 30 fc
Controls	100 lx	10 fc
Directional Signage	200 – 300 lx	20 – 30 fc
Artefacts, Objects	50 – 300 lx	5 – 30 fc
Ramps, Stairs	100 – 300 lx	10 – 30 fc
Visitor Pathways	100 – 300 lx	10 – 30 fc

Light Sensitive artefacts

The maximum intensity of lighting for light sensitive artifacts is often 50 lux. Some strategies can help some people with low vision to see in lowered light levels, such as:

- Use consistent even lighting on the object
- Ensure the highest possible contrast background
- Ensure the closest possible visitor approach
- Avoid spotlighting the object
- Maintain ambient lighting in the gallery
- Use anti-glare glass or acrylic to prevent reflections

For objects that require high mounting or low light:

- Supplement comprehensive audio descriptions, and in brighter locations include photos, large printed formats, reproductions, and touchable models or materials. Tactile access is of interest to all visitors.

6.4. Graphics and Displays

Efforts will be made to ensure that print is developed in accessible formats that are conversion ready[4]. Alternate formats may include Braille, audio, or large print.

[4] conversion ready" means an electronic or digital format that facilitates conversion into an accessible format;

Colour Contrast

People with vision loss can benefit from strong colour contrasts between light and dark. Use high contrast colours to make objects and text more visible against background colours.

Colour contrast is expressed as differences in light reflectance values (LRV). The formula is expressed as:

Contrast = [(B1-B2)/B1] x 100

B1 = light reflectance value (LRV) of the lighter area whereas, B2 = light reflectance value (LRV) of the darker area.

Online colour contrast tools are available such as Web Aim Contrast Checker[9]. Be sure to check prototypes or samples under actual lighting conditions. Colours that may appear high contrast on a back-lit computer screen, may deliver poor results in low lighting.

Accessible Viewing Heights

- Accessible viewing height of body text shall be between 1090mm and 1700 mm when at a distance of 1830 mm from the text. When located closer to text, height must be reduced to maintain line of sight for people seated in a mobility device or of short stature.
- Labels mounted with a centreline at 1370 mm are ideal for most standing and seated (adult) viewers
- Mount small items (to center line) at no higher than 1015 mm above floor

Artefact Presentation

- Provide closest possible visitor approach
- Provide 70% colour contrast between objects and background
- No not mount objects against complex backgrounds
- Ensure objects to not compete; no overlapping objects, or excessive density of exhibit elements (distance apart and total number of elements)
- Place small items up front, larger items farther back
- Do not place items or text in shadows
- Place artifact labels in close proximity to objects (Ease of processing information)

Text Presentation

- Ensure text provides a 70% colour contrast to background
- Dark on light is marginally better than light on dark. When font is light on dark, use lighter type weight and greater space between letters to enhance legibility

- No backprinting (text on printed backgrounds) and no printing on textured surfaces
- Use sans serif fonts with clear extension for lowercase b, d, g, h, j, k, l, p, q, t, and y, and easily legible numbers
- Do not use all upper case letters; exceptions are permitted for headings and titles.
- No script or italic type. Oblique type is generally legible. Using bold face, quotation marks and alternate colours are other techniques to emphasize text.
- Provide leading (space between lines) 20% of font size
- Use consistent letter spacing and word spacing. Prevent letters from touching (e.g. no ligatures).
- Align to left margin.
- Avoid justified lines and limit centred text to 3 lines
- Print on non-glare, non-glossy surface
- No printing on clear glass or acrylic
- Light text panels and labels between 100 lux and 300 lux
- Avoid shadows on text panels and labels
- Avoid backlit panels as much as possible.

Text Height and Viewing Distance

Use parameters provided in "Accessible Viewing Heights" above for the range within which text can be placed for labels and text panels.

Visibility and legibility of text is also affected by the size of the text at different viewing distances. Text must be larger when viewed at greater distances. When calculating distance, consider how crowds will impact viewing distances. Here are some basic guidelines. Strive to achieve these guidelines as much as possible.

Viewing Distance	Minimum "x-height" Type Size
75 mm	5 mm (credit info)
1 m	10 mm
2 m	19 mm
3 m	28 mm

At a distance of 1830 mm from the object, minimum text height should be 19mm, for the smallest font such as photo captions.

Create a semantic structure hierarchy of text size and weight for Title, Headings, Body Text, and Secondary Text where the smallest font (such as photo captions) is not smaller than the minimum x-height for that viewing distance.

Note that design elevations should include average viewing distances.

Additional Resources

The following resources are produced for the United States marketplace using requirements from the Americans with Disabilities Act (ADA). In spite of minor discrepancies with Smithsonian Guidelines, these tools offer very strong support for graphic designers in selecting accessible font types, colour contrast, and font sizes.

Signage and the 2010 ADA Standards for Accessible Design, produced by Luminant Design

http://www.etikk.hu/wp-content/uploads/2013/05/ADA_informacios_tablak.pdf

Signage Requirements in the 2010 Standards for Accessible Design. A white paper produced by the Society for Environmental Graphic Design

https://segd.org/sites/default/files/SEGD_2012_ADA_White_Paper_Update.pdf

Text Comprehension

People with reading difficulties as well as those with low vision tire easily from the effort of seeing and reading a great number of printed words. When possible, offer an overview sentence or two --set in clear, large print—to allow these visitors to gather key information without having to read all of the text.

- Text shall be written for language skill of about Grade 6 level reading comprehension[5]
- Content will be provided at multiple intellectual levels and through more than one sensory channel.
- Obvious story line, theme, or repeated element offers landmarks, repetition, and a connecting thread
- Use short sentences (subject – verb – object) average 15 words, and labels using a maximum 60 to 80 words (English language) for body text and 35 words for artifact and photo labels.
- Use short lines with columns averaging 50 characters.
- Avoid words that represent complex concepts. When technical terms are used offer a definition or explanation.
- Use the active voice.

[5] Readability analysis tools are available in Microsoft Word, or using free online tools such as https://readability-score.com/

- Provide line drawings, silhouettes, and photographs that complement label text to aid comprehension for those with reading difficulties.
- Place label text in close proximity to artefacts to provide greater ease at processing information.

6.5. Media

Provide accessible alternatives to significant audio and video.

Audio

- Volume control that automatically resets to default level after every use
- All content that contains speech or other audio information necessary for the comprehension of the content, shall be open or closed captioned (and bilingual)
- Embedded American Sign Language (ASL) video is appreciated by culturally Deaf people[6]
- The least preferred audio accommodation is a transcript
- Manage acoustics to minimize sound pollution

Video

- Key experiences that contain visual information necessary for the comprehension of the content, shall be audio described.
- Display or presentation of alternate text presentation or audio descriptions could be user-selectable unless permanent
- Closed captions must be time stamped
- Television screens shall be placed at a viewing level of 1090 mm and 1295 mm from the floor. Note: the viewing distance and size of screen may affect the final placement of the screen. Testing is always recommended.

6.6. Digital Interactives

Approach and Reach Range

Approach to interactives must provide access to controls such as levers, buttons, and track balls. Use the Reach Range specifications listed in the Section "Built Environment Accessibility" above.

[6] For tips on embedding ASL videos in a video stream http://www.w3.org/TR/WCAG20-TECHS/G54.html

Interactives must not have permanent seating that blocks the approach and participation of a person seated in a mobility device.

- Microphones shall be placed at a maximum height of 1015 mm from the floor, or adjustable height
- Listening devices shall be placed at a maximum height of 1015 mm from floor, or adjustable height
- Viewing devices (such as a microscope) shall be placed at a maximum 915 mm from floor, or adjustable in height.

Controls

- Make every effort to provide alternate methods of operation and information retrieval for digital interactives.
- Provide industry standard ports for alternative input and output devices (such as personal headsets for private listening)
- Strive to develop accessible touchscreens or touch-operated controls that convey sufficient information about a user interface element (including the identity, operation and state of the element) and gesture-based controls, or provide alternative methods such as additional physical controls for operation and information retrieval.
- Where a product utilizes touchscreens or contact-sensitive controls that are not accessible, strive to provide an input method that:
    - Provides keys which are tactilely discernible without activating them.
    - Controls will be operable with one hand and minimal strength and dexterity
    - Provide the status of all locking or toggle keys visually and either through touch or sound
    - If key repeat is supported, the delay before repeat shall be adjustable to at least 2 seconds
- Controls will be non-slip
- If biometric forms of user identification or control are used, an alternative form of identification or activation, which does not require the user to possess particular biological characteristics, shall also be provided.

Vision Support Features

- Controls require 70% colour contrast to background
- Strive to use the largest buttons obtainable. Buttons that are 75 mm square, or 75 mm in diameter are the most accessible.
- If the interactive represents a tactile experience, provide tactile characters or Braille below knobs to indicate function controls.
- Color coding shall not be used as the only means of conveying information, indicating an action, prompting a response, or distinguishing a visual element. (example, French-blue and English-red buttons, Start-green and Stop-red buttons) Labels buttons appropriately.
- Provide system settings for high contrast for all user interface controls and content
- If color customization is supported, provide a variety of color selections capable of producing a range of contrast levels
- When a product permits a user to adjust color and contrast settings, a range of color selections capable of producing a variety of contrast levels could be provided

Audio Support Features

- Visual cues will be provided for all audio alerts.
- When possible, provide a physical volume control or provide an interface so that volume can be controlled with software.
- When products provide auditory output, the audio signal shall be provided at a standard signal level through an industry standard connector that will allow for private listening. The product must provide the ability to interrupt, pause, and restart the audio at anytime.
- When products deliver voice output in a public area, incremental volume control shall be provided with output amplification up to a level of at least 65 dB. Where the ambient noise level of the environment is above 45 dB, a volume gain of at least 20 dB above the ambient level shall be user selectable. A function could be provided to automatically reset the volume to the default level after every use.

Timing Features

- When a timed response is required, efforts will be made to provide an option to indicate more time is required, or allow the instructions to persist.
- Software shall not use flashing or blinking text, objects, or other elements having a flash or blink frequency greater than 2 Hz and lower than 55 Hz.

Screens

- Eliminate glare on screens. Evaluate multiple angles for those who would be seated or standing, centred or off to the side.

NOTE: Anti-glare coatings on screens are designed for viewing at either 0° angle or 45° angle. Specify the correct screen for the viewing angle or image colours will appear distorted. Ideal viewing angles are provided where screen height can be adjusted up or down to suit viewers seated or standing, short or tall.

6.7. Reference Sources

Smithsonian Guidelines for Accessible Design

http://accessible.si.edu/pdf/Smithsonian%20Guidelines%20for%20accessible%20design.pdf

City of London, Facility Accessibility Design Standards (FADS)
Note: City of Ottawa also has municipal accessibility design standards. However, London FADS are regarded as providing more accessible requirements, is easy to navigate and is supported by well depicted line drawings.

https://www.london.ca/city-hall/accessibility/Documents/FADS_2007_final.pdf

Ontario Building Code (Section 3.8 Barrier Free Requirements)

http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_120332_e.htm

Section 508 of the Rehabilitation Act (Americans with Disabilities Act)

http://www.uspto.gov/about/offices/cio/section508/

Section 508 Reference Guide

http://www.uspto.gov/about/offices/cio/section508/guide_index.jsp

IBM Accessibility, Developer Guides

http://www-03.ibm.com/able/guidelines/

APPENDIX G:
CONSERVATION MANAGEMENT PLAN

Canada Science and Technology Museums Corporation

Canada Agriculture Museum
Canada Aviation and Space Museum
Canada Science and Technology Museum

CONSERVATION MANAGEMENT PLAN
DIRECTIVE #101

January 2014

1.0 OBJECTIVES

The purpose of the Conservation Management Plan is to provide comprehensive direction for the responsibilities, procedures and processes of Conservation Services, Canada Science and Technology Museums Corporation. All actions are guided by the principle that preservation of an artefact's physical, historic, and aesthetic integrity is the prime consideration.

2.0 DEFINITIONS*

Cultural Property: Objects that are judged by society, or by some of its members, to be of historical, artistic, social or scientific importance, Cultural property will herein be referred to as artefacts.

Conservation: All actions aimed at the safeguarding of artefacts for the future. The purpose of conservation is to study, record, retain and restore the culturally significant qualities of artefacts as embodied in its physical and chemical nature, with the least possible intervention. Conservation includes the following: documentation, examination, preservation, preventive conservation, restoration and reconstruction.

Documentation: All records, written, pictorial, audio or other media, accumulated during the examination and treatment of artefacts. Where applicable, documentation includes the examination records and report, treatment proposal, curatorial consent and treatment records and report, the recommendations for subsequent care, samples taken from the artefact and relevant correspondence.

Examination: All activities carried out to determine the structure, materials, relevant history and condition of artefacts, including the extent of deterioration, alteration and loss. Examination also includes analyses and study of relevant material, as well as the study of relevant historical and contemporary information.

Preservation: All actions taken to retard deterioration of, or to prevent damage to, artefacts. Preservation involves management of the environment and of the conditions of use, and may include treatment in order to maintain the artefact, as nearly as possible, in a stable physical condition. With respect to material valued exclusively for its information content, for example some archival material, preservation may include reformatting.

Preventive Conservation: All actions taken to mitigate [minimise] deterioration and damage to artefacts. This is achieved through the formulation and implementation of policies, directives, guidelines and procedures in areas such as lighting, environmental

conditions, air quality, integrated pest management, handling, packing and transport, exhibition, storage, maintenance, use, security, fire protection, and emergency preparedness and response.

Restoration: All actions taken to modify the existing materials and structure of an artefact to represent a known earlier state. The aim of restoration is to reveal the culturally significant qualities of the artefact. Restoration is based on respect for the remaining original material and clear evidence of the earlier state.

Treatment: All direct interventions carried out on artefacts with the aim of retarding further deterioration or aiding in the interpretation of the artefact. A treatment may range from minimal stabilisation to extensive restoration or reconstruction.

* All definitions are taken from “Code of Ethics and Guidance for Practice” of the Canadian Association for Conservation of Cultural Property and of the Canadian association of Professional Conservators. Third Edition 2000”.

3.0 RESPONSIBILITIES

The **Director, Conservation and Collection Services** is responsible for policy and procedures related to the conservation of artefacts.

Conservation services shall be initiated by Collection and Research, Collection Services or Conservation Services through the use of a service request.

The **Manager, Conservation Services** shall be the primary authority on the preservation of all artefacts in the collection and shall have the final responsibility for all remedial treatments. The Manager also approves service requests for conservation or restoration of an artefact.

The **Manager, Conservation Services** is responsible for:

- Approving the use or treatment of any artefact for any purpose;
- Documentation of all artefact intervention: condition reports, treatment proposals (in consultation with subject curator) and treatment records, and ensuring that all documentation is entered into the KE EMu database;
- Establishing standards for storage and handling of artefacts;
- Developing and approving operating procedures for artefacts or amendments to them, in consultation with the subject curator; selecting suitable/qualified operators, and including a risk assessment where warranted;
- Conservation research into best treatment methods and practices; and research into materials identification and deterioration;
- Ensuring ethical conservation treatments are carried out;
- Ensuring historical accuracy of any restoration activity in consultation with the subject curator;
- Preparation and maintenance of artefacts selected for operation, according to the established process for selecting and approving operation of artefacts (see section 6.2); and,
- Providing advice and expertise to outside organisations, as time and resources permit.

4.0 PREVENTIVE CONSERVATION

Conservation Services is responsible for specifying acceptable storage environments and materials for the collection. This may include risk assessments of specific collections or materials, with recommendations for re-housing or long-term storage conditions.

Conservation Services is responsible for the monitoring of collection environments, and for generating Storage Environment Standards Worksheets annually, to monitor compliance with our Corporate CSTMC Collection Environment and Housing Standards and Performance Indicators, 2005.

Conservation Services is responsible for the identification of risk factors including hazardous materials, and for the identification of these factors physically on the artefacts, and digitally in the database; and for managing these risks as required by law and the Canada Labour Code.

5.0 CONSERVATION PROCEDURES

Conservation Services is responsible for the care and treatment of the collection of the CSTMC. This is carried out following established procedures of documentation which include:

- Examination of the artefact including analysis where applicable;
- Condition reporting of the state of the artefact to include research about materials and technology where applicable, that shall include any and all original information inherent in the artefact, and observations on potential risk;
- Treatment proposal outlining recommended treatment, including methods of treatment and materials to be used;
- Treatment record detailing work, with photographs, as well as all techniques and materials used; and,
- Research into the materials of composition, methods of construction, treatments, deterioration factors etc., at the discretion of the subject curator and the Manager,

Conservation Services. Conservation staff may be required to liaise with other museums and research facilities such as the Canadian Conservation Institute.

All treatment proposals and subsequent documentation must be approved by the subject curator and the Manager, Conservation Services. Any changes to the treatment proposal may be approved verbally, though the changes must be made in the database, and the treatment record must reflect the reasons for the change.

All treatments will be carried out using appropriate methods and materials, approved by the Manager, Conservation Services. These techniques and materials shall, to the best of current knowledge, be stable and not endanger the true nature of the object nor impede future treatment or retrieval of information through scientific examination. All treatments shall be carried out to the highest and most exacting standards of treatment; quality must never be compromised even if circumstances may limit the extent of treatment.

Restoration shall be carried out by, or under the strict supervision of, Conservation Services, after consultation with the subject curator, and after extensive historical research. Restoration shall be carried out only on artefacts which have been selected through the screening process outlined in Section 6.0 of Guideline #100-C Conservation and Operation of Artefacts.

All techniques and materials for restoration shall meet the same standards of techniques and materials as required for conservation treatments.

6.0 EXHIBITION OF ARTEFACTS

All artefacts proposed for exhibition or loan will be assessed as to their condition in order to ensure stability and determine requirements for exhibition and/or shipment purposes. Environmental standards for display shall be determined by Conservation Services, and these must be respected in any plans for exhibition in the CSTMC or in other institutions. The standards will include light levels, temperature and humidity, support and security.

The **Manager, Conservation Services** shall be the primary authority on the preservation of all objects in the collection and shall have the final responsibility for all remedial treatments.

Conservation Services shall be initiated by curatorial, or Conservation and Collection Services, through the use of a service request which will identify the artefact, the intended use, desired treatment and requested completion date. This request shall be initiated with advance notice of a minimum of 4 weeks.

The **Manager, Conservation Services**, shall assess each request to determine if:

- The work requested is consistent with the Corporation's priorities;
- The work requested is consistent with the Collection Development and Management Policy #100;
- The work requested is consistent with Directive #101: Conservation Management Plan;
- The work requested is consistent with Guideline #100-C Conservation and Operation of Artefacts; and
- Resources and facilities are available to complete the work as requested.

The Manager, Conservation Services and Director, Conservation and Collection Services must be informed immediately by the appropriate authority (Security, Public Programmes) in the event an artefact is compromised, damaged or threatened.

Removal of an artefact from exhibition will be recommended when its physical integrity is in jeopardy.

7.0 ARTEFACT STORAGE

Conservation Services uses established environmental storage standards, and is responsible for monitoring compliance with these standards on an annual basis. Furthermore, Conservation Services, at the request of the Director, Conservation and Collection Services; shall provide advice to Collection and Research and to managers in the CSTMC, to aid in care, safe handling and warehousing activities as far as resources allow.

8.0 RISK MANAGEMENT

Procedures for handling and treatment of hazardous materials identified in the collection of the CSTMC are outlined in Conservation Procedures – Risk Management 2009 (Appendix I). This document identifies possible sources of the material and protocols for handling, treatment and disposal of these materials. It should be consulted whenever there is suspected or actual risk to staff or artefacts.

A separate policy exists for management of asbestos in the collection (see Appendix II).

9.0 EMERGENCY RESPONSE

Conservation Services has created an Emergency Response Plan for the Collection (Appendix II), which consists of contact telephone numbers, response team organisation, salvage procedures and recovery techniques.

Primary contact personnel in the event of an emergency are the Director, Conservation and Collection Services, Director, Knowledge and Information Management Services, and Manager, Conservation Services.

10.0 AUTHORITIES

Museums Act 1990

CMSTC Policy #100, Collection Development and Management

11.0 REFERENCES

Canadian Association for Conservation of Cultural Property, Code of Ethics and Guidance for Practice, 2000.

APPENDIX H:
CONSERVATION AND OPERATION OF ARTEFACTS GUIDELINE

Canada Science and Technology Museums Corporation

CONSERVATION AND OPERATION OF ARTEFACTS
GUIDELINE # 100-C
January 2014

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1.0 ARTEFACTS

This Guideline, in keeping with the CSTMC Collection Management Plan Directive #100, governs the decision making process regarding conservation and operation of artefacts in the collection. It includes procedures to be followed in providing conservation services.

In all instances the treatment of artefacts shall be guided by the principle that intervention will be undertaken only with the support of adequate historical, scientific and technological information.

Conservation treatment will be guided by the principle that preservation of an artefact's physical, historic and aesthetic integrity is a prime consideration.

The conservation priorities of the Corporation are:

- to retard deterioration and prevent damage through the provision of proper storage, use and handling of its artefacts;

- to chemically and physically stabilize artefacts

- to clean, repair and provide restoration when required;

- to conduct research into deterioration of artefact materials, develop environmental standards and conservation methodology;

- to develop information and publications concerned with basic care of collections, environmental standards and control, and conservation treatment and research.

2.0 DEFINITIONS*

Cultural Property: Artefacts that are judged by society, or by some of its members, to be of historical, artistic, social or scientific importance, Cultural property will herein be referred to as artefacts.

Conservation: All actions aimed at the safeguarding of artefacts for the future. The purpose of conservation is to study, record, retain and restore the culturally significant qualities of artefacts as embodied in its physical and chemical nature, with the least possible intervention. Conservation includes the following: documentation, examination, preservation, preventive conservation, restoration and reconstruction.

Documentation: All records, written, pictorial, audio or other media, accumulated during the examination and treatment of artefacts. Where applicable, documentation includes the examination records and report, treatment proposal, curatorial consent and

treatment records and report, the recommendations for subsequent care, samples taken from the artefact and relevant correspondence.

Examination: All activities carried out to determine the structure, materials, relevant history and condition of artefacts, including the extent of deterioration, alteration and loss. Examination also includes analyses and study of relevant material, as well as the study of relevant historical and contemporary information.

Preservation: All actions taken to retard deterioration of, or to prevent damage to, artefacts. Preservation involves management of the environment and of the conditions of use, and may include treatment in order to maintain the artefact, as nearly as possible, in a stable physical condition. With respect to material valued exclusively for its information content, for example some archival material, preservation may include reformatting.

Preventive Conservation: All actions taken to mitigate [minimise] deterioration and damage to artefacts. This is achieved through the formulation and implementation of policies, directives, guidelines and procedures in areas such as lighting, environmental conditions, air quality, integrated pest management, handling, packing and transport, exhibition, storage, maintenance, use, security, fire protection, and emergency preparedness and response.

Restoration: All actions taken to modify the existing materials and structure of an artefact to represent a known earlier state. The aim of restoration is to reveal the culturally significant qualities of the artefact. Restoration is based on respect for the remaining original material and clear evidence of the earlier state.

Treatment: All direct interventions carried out on artefacts with the aim of retarding further deterioration or aiding in the interpretation of the artefact. A treatment may range from minimal stabilisation to extensive restoration or reconstruction.

* All definitions are taken from “Code of Ethics and Guidance for Practice” of the Canadian Association for Conservation of Cultural Property and of the Canadian association of Professional Conservators. Third Edition 2000”.

3.0 RESPONSIBILITIES

The **Director, Conservation and Collection Services** is responsible for policy and procedures related to the conservation of artefacts.

Conservation services shall be initiated by Collection and Research, or Conservation and Collection Services, through the use of a service request.

The **Manager, Conservation Services** shall be the primary authority on the preservation of all artefacts in the collection and shall have the final responsibility for all remedial treatments. The Manager shall also approve services requested for conservation or restoration of an artefact.

The **Manager, Conservation Services** is responsible for:

- Approving the use or treatment of any artefact for any purpose;
- Documentation of all artefact intervention: condition reports, treatment proposals (in consultation with subject curator) and treatment records, and ensuring that all documentation is entered into the KE EMu database;
- Establishing standards for storage and handling;
- Developing and approving operating procedures for artefacts or amendments to them, in consultation with the subject curator, selection of suitable/qualified operators, and a risk assessment where warranted.
- Conservation research into best treatment methods and practices; and research into materials identification and deterioration;
- Ensuring ethical conservation treatments are carried out;
- Ensuring historical accuracy of any restoration activity in consultation with the subject curator;
- Preparing and maintaining artefacts selected for operation, according to the established process for selecting and approving operation of artefacts (see section 6.2); and
- Providing advice and expertise to outside organisations, as time and resources permit.

Subject curators are responsible for:

- Initiating Service Requests which will identify the artefact, intended use, desired treatment and requested completion date. This request shall be initiated with advance notice of a minimum of 4 weeks.
- Approval for use and treatment of artefacts;
- The authenticity of the operation of any artefacts; and
- Ensuring the historical accuracy of restoration projects.

4.0 CONSERVATION PROCESS AND PROCEDURES

Conservation Services must be notified of all intended uses or movements of artefacts for any purpose.

4.1 Conservation Treatment

When a conservation /restoration service is required, it will be initiated through the use of a service request for conservation / restoration treatment, which will identify the artefact, state the intended use, desired treatment and requested completion date. Treatment shall be carried out by Conservation Services or by volunteers or contractors under the direct supervision of Conservation Services.

The Manager, Conservation Services will assess each service request to determine if:

- The work requested is consistent with Conservation Management Plan Directive #101; and
- Resources and facilities are available to complete the work as requested.

4.1.1 Treatment Proposal

Upon approval of a service request by the Vice-President, Collection and Research, the Director, Conservation and Collection Services, and the Manager, Conservation Services; a Condition Report and, if required, a Treatment Proposal, is completed which outlines the current condition and work proposed to be done on the artefact.

The Treatment Proposal and any amendments to it must have the approval of the Manager, Conservation Services and the subject curator. No work shall be performed on the artefact until the approval for either the treatment proposal or amendments thereto, have been obtained.

4.1.2 Treatment Record

A Treatment Record will be maintained, both in written and photographic form, that documents the actual treatment performed on the artefact. A complete conservation file should include: a condition report, treatment proposal, treatment record, diagrams, photographs, samples and any other material generated during treatment. These records will be compiled at the conclusion of the project and submitted to the Manager, Conservation Services.

Treatment reports will be included in the artefact supplemental information file and will be made available through the office of the Registrar, Conservation and Collection Services.

This procedure will be followed in all cases where changes to the artefact record are concerned.

4.2 Restoration Treatment

Restoration shall be carried out by Conservation Services only, or by volunteers or contractors, under the direct supervision of Conservation Services. All work will be carried out after consultation with the subject curator, and after extensive historical research; and only on artefacts which have been selected through the screening process outlined in section 6.0.

The subject curator will submit a service request to be approved by the signing authorities outlined in 4.1.1. The service request will provide a Restoration Proposal (outlined in 6.1.1) and all available information regarding the known state to which the artefact should be restored.

The curator will make available to the Manager, Conservation Services, all information that could influence the final decision on the restoration of an artefact.

Criteria for approval will include: availability and/or access to adequate documentation to support the restoration goals; safety of public and personnel; integrity of the artefact; appropriateness in light of existing priorities and artefacts; and adherence to the Conservation and Collection policies and directives.

Restoration may demand substantial physical intervention and may jeopardize the artefact's integrity as a study resource. Because such intervention may be irreversible, it is undertaken only when all the reasonable alternatives are exhausted.

Restoration must not impede future conservation treatment, and the retrieval of information through scientific examination. Restoration requires very rigorous documentation standards.

The documentation procedures outlined under Conservation Treatment also apply to restoration projects.

5.0 EXHIBITION OF ARTEFACTS

All artefacts proposed for exhibition or loan will be assessed as to their condition in order to ensure stability and determine requirements for exhibit and shipment purposes. Records will be kept as described under Conservation Treatment.

Conservation Services will advise on environmental requirements and care and handling requirements as appropriate, for exhibition at CSTMC or other institutions.

Conservation Services will, in cooperation with Exhibition Services, install artefacts in the CSTMC exhibits.

The Manager, Conservation Services and the Director , Conservation and Collection Services, must be informed immediately by the appropriate authority (eg Security, Public Programmes) in the event an artefact is compromised, damaged or threatened.

Removal of an artefact from exhibition will be recommended when its physical integrity or safety is in jeopardy.

6.0 RESTORATION and/or OPERATION OF HISTORIC WORKING ARTEFACTS: PROCESS

This process provides a systematic and rigorous method for managing the restoration and/or operation of historic working artefacts. At all stages, collaboration between curators, Conservation, engineers, trades people (e.g. welders, electricians) and craftspeople (e.g. upholsterers) should be maintained.

The operation of artefacts must be in accordance with all current safety regulations and permit requirements. These will be considered minimum standards, and further restrictions and safety requirements may be applied.

It is the responsibility of the subject curator to ensure the authenticity of operation and the historical accuracy of restoration projects.

The planning may be different for operation and restoration, since objects may not require restoration in order to operate, nor be required to operate after restoration. The process is similar, but will be addressed separately in this section of the Guideline. In some cases an object may be restored and operated; in which case all of the steps in both processes will apply.

6.1 Restoration Planning Phase

6.1.1 Curatorial, Conservation and Museum Planning

The first step in the restoration of historic artefacts is the Restoration Proposal, which shall be completed by the Curator. This proposal should include:

1. The artefact, its provenance, significance and function.
2. Information to include but not be limited to: previous owners, previous users, manufacturing information, photographs of artefact in use, and general history and context.
3. Further research into similar artefacts in historical collections, to allow for comparison and rating of rarity, condition, integrity and interpretive potential.
4. A Statement of Significance and Known Former State. Five measures of significance have been identified to assist in assessing suitability of restoration:
    - I Aesthetic significance: form, scale, colour, texture, materials, smells and sounds, as well as technical achievement;
    - ii Historic significance: age, association with important people, places or events;
    - iii Scientific significance: rarity, presence of original materials or technology, condition, is it operable or potentially so;
    - iv Social significance: whether the artefact has spiritual, political or cultural meaning for a particular group in society; and
    - v Future significance: with respect to potential loss of information which may not be accessible using current technology.

Significance can also apply to alterations, repairs and modifications, as these are evidence of use of the artefact and may provide important historic information about the life of the artefact.

The second step is the Conservation Assessment, which shall be undertaken by Conservation Services. This will determine:

1. The physical condition of the materials and structure of the artefact, including a clear description of its physical fabric
2. Whether there have been any historical alterations in the lifetime of the artefact; the alterations must be noted and their history determined if possible, particularly whether they were pre or post acquisition. Decisions to change to any of these alterations must be assessed individually.
3. Exhibition and/or storage restrictions such as space, and ease of access (as appropriate).

A Risk Assessment shall be completed as part of the Conservation Assessment, for each restoration project; to identify risks to the object and staff, including hazardous materials, and recommend mitigation.

The final step for restoration planning, is curatorial preparation of a Restoration Brief to be approved by the Vice President, Collection and Research and Vice President, Conservation and Collection Services. Where significant funding or operational impacts are anticipated, the approval of the Director General of the Museum will also be required. It will include:

1. The Restoration Proposal
2. The Conservation Assessment and Risk Assessment
3. A business plan describing resources required, including funds for initial treatment, for display, and ongoing maintenance (as appropriate).

6.1.2 Preparation of a Restoration Treatment Proposal

Once approval has been given above, a full treatment proposal will be created by Conservation Services, and submitted for curatorial approval.

6.1.3. Implementation Phase of Restoration

The implementation of treatment recommendations shall be done in accordance with established conservation policies and procedures of the CSTMC. All replaced parts shall be identified and retained, and where appropriate, samples shall be taken of fluids, lubricants etc. All documentation shall be entered in the database, including extensive photographs of the work in progress.

6.2. Operation Planning Phase

6.2.1 Curatorial, Conservation and Museum Planning

The first step in the proposal to operate historic working artefacts and is the Curatorial Service request which shall identify the artefact, intended use, and requested date of completion.

The second step is the Conservation Assessment, which shall be undertaken by Conservation Services. This will determine:

1 The physical condition of the materials and structure of the artefact, including a clear description of its physical fabric and a comprehensive understanding of its operation.
2 Whether there have been any historical alterations in the lifetime of the artefact; the alterations must be noted and their history determined if possible, particularly whether they were pre or post acquisition. Decisions to change to any of these alterations must be assessed individually.
3 The condition of the various functions of the artefact, with consideration that not all functions may be required or possible.
4. Exhibition and/or storage restrictions such as space, and ease of access (as appropriate).
5. Movement of the artefact to operating location (as appropriate).

A Risk Assessment shall be completed as part of the Conservation Assessment, for each operating artefact; which shall identify risks to the object, staff and visitors; and recommend mitigation. Included in this is the identification of wear through operation; whether it is initial wear, normal wear or accelerated wear. These are assumed to be linked to a "breaking in" period, continued and repetitive wear, such as an engine running normally, and catastrophic wear as a result of malfunction.

The final step for operation is approval by the Vice President, Collection and Research, Vice President, Conservation and Collection Services, and Director General of the Museum. It will include:

1. The initial service request and justification for operation
2. The Conservation Assessment and Risk Assessment.
3. A business plan describing resources required, including funds for initial treatment, for display, and ongoing maintenance (as appropriate).
4. Plan for operating schedule, training of staff, maintenance, and security for health and safety requirements.

6.2.2. Preparation of Operational Plan

The operation of the artefact must not in any way compromise the integrity or safety of the object. The Operational Plan will be prepared by Conservation Services in consultation with relevant stakeholders. It must include maintenance requirements such as tasks, schedule, costs, skills and materials required for ongoing maintenance such as lubricants, fuels, and spare parts. Costs should also be identified for storage, as well as for operation.

Specifically, the Operational Plan must include:

1. A description of an acceptable level of operation , duration and conditions of operation which may include limits on times, loads, speeds etc. In addition, a "final point" should be identified and agreed upon, after which the artefact will no longer be operated.

   A guide for establishing levels of operation is given here:
   Level I: no operation
   Level II: mothball, shutdown or freeze
   Level III: minimal operation: for maintenance purposes only and under controlled conditions.
   Level IV: low levels of operation, rare operation under controlled conditions (indoors)
   Level V: medium levels of operation – infrequent operation, medium controls.
   Level VI: high levels of operation – regular use, can be outdoors, replacement of parts is not a concern, and the physical integrity of the artefact is not significant.

2. An Operation Guideline which will define the conditions of use:
   1. Parameters and limits of operation;
   2. Operating methods which may include original manuals etc.;
   3. Requirements for authorized operators;
   4. Template for the operation log;
   5. Handling guidelines; and
   6. Inspection and maintenance plan and schedule.

Where there is some doubt regarding the operation of the artefact, the safest policy is to advise against it. All operation should balance significance against condition and vulnerability of the artefact; and this should be assessed regularly as both these factors can change: for instance an artefact may become more rare (by the loss of similar artefacts in collections), or the materials may become more vulnerable with age or use. A risk assessment can quantify risk levels and make this decision more objective.

The plan will provide a range of options to achieve the conservation objectives, bearing in mind that ideal treatments may not be possible or achievable due to possible resource constraints. For instance, if not all functions are possible for operation, mothballing of some functions may be an option.

Options may also include choice of materials, whether traditional skills or modern ones will be used to carry out the work, and whether original finishes can be conserved or will be restored.

The Operational Plan shall be agreed upon by the curator, and Manager, Conservation Services.

6.2.3. Implementation Phase of Operations

The implementation of treatment recommendations shall be done in accordance with established conservation policies and procedures of the CSTMC. All replaced parts shall be identified and retained, and where appropriate, samples shall be taken of fluids, lubricants etc. All documentation shall be entered in the database, including extensive photographs of the work in progress.

6.2.4. Lifecycle Preservation Program

The execution of the Lifecycle Preservation Program is the implementation of the Operation Guidelines outlined above (Section 6.2.2). The following documentation must be maintained and entered in the KE Emu database:

- Operating Log
- Inspection Record
- Maintenance Record

6.2.5. Operation

Artefacts will be operated in a manner consistent with the original design and with a minimum of changes or modifications necessary to meet current health and safety regulations. If, at any time, the safety of the artefact or staff member is in doubt, operation shall cease and the artefact will be re-evaluated for repair or retirement.

6.2.6 Licences, Certification and Training

The Manager, Conservation Services, in consultation with the subject curator, will determine what appropriate certification or licences are required by federal and/or provincial regulations. They will also develop and provide operator training programmes for all operated/demonstrated artefacts.

The Manager, Conservation Services shall ensure that all operators have been adequately trained, and/or certified to operate the artefact(s), and that the training fulfils any and all legal requirements.

7.0 ARTEFACT STORAGE

Conservation Services will establish environmental standards, care and handling requirements for artefacts to ensure preservation.

Conservation Services will provide aid in warehousing activities, as far as resources allow.

8.0 CONSERVATION RESEARCH

Conservation Services will undertake research into the materials of composition, methods of construction, treatments, deterioration factors, etc., at the request of the curator and/or the discretion of the Manager, Conservation Services.

Activities are limited to those that can be undertaken by routine methods, or in cooperation with other institutions such as the Canadian Conservation Institute.

Conservation Services will act as liaison between the respective museums and research facilities such as the Canadian Conservation Institute and other conservation agencies.

9.0 EMERGENCY/DISASTER RESPONSE

Conservation Services has created an Emergency Response Plan for the Collection (Appendix II), which consists of contact telephone numbers, response team organisation, salvage procedures and recovery techniques. Special emergency response procedures may be in place for operating artefacts.

Primary contact personnel in the event of an emergency are the Director, Conservation and Collection Services, the Director Knowledge and Information Management Services, and the Manager, Conservation Services.

10.0 AUTHORITIES

Museum Act
CMSTC Policy #100 Collection Development and Management

11.0 REFERENCES

Canadian Association for Conservation of Cultural Property, Code of Ethics and Guidance for Practice 2000.

Barr, Joanna. "Conservation of Working Objects: Development of a Conservation Management Tool". Artlab Australia, 2008.

National Museum of Science and Industry UK "Policy and Procedures for selecting and Operating Historic Objects" 2007

CSTMC Guideline #100-A Acquisition and Incoming Loans

12.0 AGREEMENTS

Memorandum of Understanding with the Canadian Conservation Institute

ALDRICHPEARS ASSOCIATES

CANADA SCIENCE AND TECHNOLOGY MUSEUM

MUSÉE DES SCIENCES ET DE LA TECHNOLOGIE DU CANADA