

THE FUTURE IS ENGINEERING

Summary of Summit #2

Engineering Change Lab, USA

February 5th - February 6th, 2018

Omaha, NE



Overview/Introduction



Forty-five engineering leaders from the US and Canada, representing consulting firms, academic programs, associations and regulatory bodies flocked to the mid-winter mecca of Omaha, Nebraska, for two days of snow and sub-zero conditions- and an opportunity to strategize about the vital role engineers must play in an emerging future.

Building on the results of Summit #1 (August 2017), Engineering Change Lab- USA participants continued their “deep dive,” into the future of the profession of engineering. The ECL- USA is a self-organizing initiative dedicated to inspiring collaborative efforts that will move the profession toward fulfilling its highest potential through stewardship of technology on behalf of society.

In support of that mission, the group in Omaha worked to sense and make sense of current conditions, explore what the profession (and the larger engineering community within which it is nested) “ought to be” in the future, and surface potential strategies to make that future happen.

Specific objectives for Summit #2 included:

- › Explore the prospect of, and process for, moving the engineering profession toward fulfilling its highest potential in the emerging future.
- › Crystallize the intent of the ECL- USA and commit to using a social laboratory approach in taking on this work.
- › Recognize and make progress on focused initiatives begun at the first summit.
- › Organize ECL- USA, including structure, participation, communication protocols, and plans for future summits.
- › Identify next steps, including outreach to other stakeholders in the larger engineering eco-system.

Adopting A Social Laboratory Approach

Inspired by the approach followed by the Engineering Change Lab- Canada, the Engineering Change Lab- USA has adopted a “social laboratory” approach as the basic structure for our work¹. According to Zaid Hassan, social labs are a particular type of platform for addressing complex social challenges². They are:

SOCIAL: They start by bringing together diverse participants (drawn from different parts of the targeted social system) to work collectively as a team.

EXPERIMENTAL: They take an iterative approach using experiments to stimulate learning and generate innovations.

SYSTEMIC: They aspire to go beyond treating symptoms and dealing only with subsystems to address fundamental root causes and challenges driving systemic change within the whole.

Social labs follow a deep “U” master path. (*See sidebar Deep U diagram on the following page.*) To familiarize themselves with this approach to change, participants attending Summit #2 were asked to read the book *Presence* by Peter Senge and Otto Scharmer³. The deep “U” path emphasizes reflection and inquiry and avoids giving in to pressure to take quick action after only minimal analysis (the shallow “U” that characterizes many change initiatives). The process moves repeatedly through an exploratory cycle, from *sensing to presencing* to *realizing*, creating an iterative, emergent experience for participants as they journey toward a discovery of “what’s needed in the world ... our highest future possibility and destiny.”

A social lab *is not* a project. *Nor* is it a task force or strategic planning effort. Understanding the true nature of an adaptive challenge facing a social system, surfacing deeply held (often unconscious) assumptions and beliefs that drive current behaviors, discovering the highest potential possibilities for future change, and experimenting with possible interventions takes time and patience. It also demands a willingness to enter uncharted territory that can’t be easily demarcated at the beginning an effort with clear goals, plans, and performance benchmarks.

With the completion of its first two summits, ECL-USA has taken its first steps along this deep “U” path, digging beneath surface features to better understand the current state of engineering, exploring what the world really needs from the profession and the engineering community, and generating a first set of possible experiments for learning and change.

¹ To learn more about social labs, check out *The Social Labs Revolution* by Zaid Hassan.

² This approach has been used successfully over the last twenty-five years to catalyze change in a wide range of complex social systems. See *Labcraft: How social labs cultivate change through innovation and collaboration*, Edited by Hendrik Tiesinga and Remko Berrkhout.

³ *Presence: Human Purpose and the Field of the Future*, Peter Senge, C. Otto Scharmer, Joseph Jaworski, & Betty Sue Flowers, The Society for Organizational Learning, 2004.

Deep "U" & Presencing

SENSING

seeing & suspending

deep listening, willingness
to speak openly

reflection

observing from within the
whole system

experiencing the world "as it is"

COMMUNION

sharing & holding in common

letting go

REALIZING

bringing something new into
reality

surrendering into
commitment

crystallizing intent

experienceing the world
"as unfolding through us"

CO-CREATION

surfacing possibilities

letting come

PRESENCING

an inner knowing of what is emerging

discovering who you are as a steward or servant
for what's needed in the world...
our highest future possibility and destiny

experiencing the world
"from inside the living processes
underlying reality"

a profound opening
of the heart

From: *Presence: Human Purpose And The Field Of The Future*
Peter Senge, C. Otto Scharmer, Joseph Jaworski, & Betty Sue Flowers

Exploring the Emerging Future

Much of the first day of the summit was spent in a series of exercises designed sense what the highest potential for the profession of engineering (and larger engineering community) might be. Work included surfacing and suspending for examination assumptions and beliefs that drive behavior within the current social system and exploring what “we think we know about the ‘purpose’ or ‘essence’ of the profession of engineering in an emerging future.”

The first of those exercises used an **appreciative inquiry** process to learn from personal experiences recognizing that,

“What is most systemic is most local. The deepest systems we enact are woven into the fabric of everyday life ... paying attention to what’s right here within my awareness ...” can often provide essential clues for understanding the whole. From Presence, Senge & Scharmer

Participants interviewed each other, sharing personal stories of times when they felt particularly fulfilled, inspired, and excited about their work as professional engineers. They also traded personal perspectives about the core value or essence of the profession, including reflections on those times when they felt the best about their work as professionals. Finally, they were asked to make two wishes to heighten the health and strength of the profession of engineering in the US.

Key themes and implications for developing a new vision for the engineering profession/community drawn from this exercise and subsequent discussion include:

Lead through technological stewardship.

- › Maintain a sense of higher purpose.

Reduce commoditization.

To thrive the profession needs to increase diversity, in both participants and thought.

- › Mirror community diversity.
- › Embrace more complex identities (inclusiveness).

Practice whole system and long-term thinking.

- › The highest value comes from seeing the entire problem/system and opening up the range of potential solutions (whole systems awareness).
- › Go beyond reactive problem solving to proactive problem seeking (problem definition) and leadership.
- › Address self-limiting views.
- › Value critical thinking skills.

Practice collaboratively with a wide range of people and stakeholders, don’t work in a vacuum.

- › Practice as facilitator/advisors, not just technicians.

Enhance public awareness and understanding of the value of engineering and engineers (at both the individual and collective levels).

- › Restore the joy and creativity of the profession through a focus on the benefits to society of engineer's work.
- › Place more emphasis on the human impacts of engineering (water for example) to increase public understanding.
- › Recognize that we don't advertise the value of engineers and engineering, but our failures are readily known.

Evolve the underlying nature of engineering work to address disruptive changes in technology, the economy, and society.

- › Embrace tech and AI industries as partners.
- › Be involved in public discussions of societal/cultural trends.

Increase business innovation, willingness to take risks, and agility.

Increase participation in public policy at all levels.

Engage the full range of participants and stakeholders in the engineering community.

- › Address the proliferation of engineering disciplines, particularly at the boundary between science and engineering.
- › Bring associations and societies closer together to minimize (or eliminate) silos, fragmentation, and unnecessary overlaps.
- › Find peace with, and involve, non-traditional practitioners in industry and tech.
- › Speak with a unified voice – reverse the fragmentation of the profession

Address credentialing and licensure challenges.

- › Ensure new professionals gain the knowledge they need to ensure human health.
- › Reconstruct the licensure process.
 - Address timing of licensing, reciprocity issues, and the industrial exemption.
 - Encourage more engineers to pursue licensure.

Adapt engineering education to meet the future needs of engineers (whole system thinking).

- › Attract more people into engineering with an appetite for leadership.
- › Offer post bachelors professional degrees.

Peter Senge, in his book *The Fifth Discipline*, emphasized the importance of surfacing and suspending (for examination) assumptions and mental models present within a social system as a critical discipline to be practiced when engaged in transformational change efforts. Existing beliefs and mindsets are often primary drivers of personal and/or organizational behavior. Left unexamined and unchanged, they will work to maintain the status quo and often confound and defeat the most ambitious and well-meaning of change efforts.

Following Senge's imperative, the next exercise attempted to surface and begin exploring **assumptions and mental models** that may be driving the behavior of professionals and the engineering profession today. The generation of this list was used to seed a subsequent afternoon dialogue exercise at the summit. Assumptions and mental models identified included:

- › Only good engineers are licensed; only licensed engineers can provide services society needs.

- › You must have an engineering degree in one of the traditional disciplines to practice engineering.
- › Regulation is needed to protect the public.
- › We don't need to be intentional about our relationship with technology; someone else, or the free market, will take care of it.
- › There is plenty of time for engineers to evolve. Incremental change leading to evolution will be sufficient.
- › Engineers don't need to compare themselves to non-traditional entrants.
- › Engineers have exclusive knowledge that others can't or don't have.
- › Engineering is fundamentally about technical problem solving.
- › The public understands and values what engineers do; or if they don't, they need to.
- › Engineers will continue to get paid for what we do today.
- › Commoditization is a bad thing.
- › That the existing engineering community can/should evolve itself to play a critical and unique role in helping steward society's continued evolution.
- › That society needs engineers to the same degree that engineers think society does.
- › Mathematics is the central foundation on which engineering is built.

An afternoon exercise then engaged the whole group in a **dialogue** that started with the prompt: "What do we think we know about the purpose or essence of the profession of engineering in an emerging future?"

Reflections offered by the group during the dialogue included:

- › Engineering operates at the interface between science and society.
- › Engineers have a duty of care.
- › Engineers protect the health & safety of public – particularly in the built environment. This needs to be preserved while other things may change.
- › We know that we will continue to build things and we will use technology to get there – the space in the middle is the question.
- › The future is always unfolding and the pace of change is accelerating.
- › Thomas Friedman notes that the pace of technology change has exceeded human's capacity to change.
- › If we are resistant to change and protect the present, we may be left behind in the future.
- › From the book, *What Technology Wants* by Kevin Kelley: Technology is on an evolutionary path, just like a living system, and will evolve regardless of what humans want. Is one of the roles of engineering in the future to protect the human-ness (conviviality) of the world? Is this part of health and safety?
- › Do we need to separate the "role we serve" vs. the "way we do it"?
- › There is a need for a whole system view.
- › Does engineering still have a purpose in an emerging future?
- › Dee Hock, the founder of VISA, reflecting on the future of organizations from a living systems perspective, framed four questions to consider.
 - How it was?
 - How it is?
 - How it will be?
 - How it ought to be? (From Hock's perspective, this is the most critical question on the list)
- › What does the engineering profession add?
- › Leaders stand up and lead. If we want engineers to be viewed as leaders, we need to make it happen. If we sit and wait to be recognized by others we will be waiting a long time.
- › We've allowed "engineer" to be pushed into a soulless space.
- › Why worry about the future of engineering? Are we hung up on semantics and on the perspectives and needs of our current organizations?
- › There was engineering before engineers (and the profession of engineering). Are we even a profession?

- › Engineering is a verb, not a noun.
- › Engineer of engineering?
- › How will engineering be delivered and by whom?
- › Problem solving vs. problem definition.
- › Creativity is the essence of engineering, but engineers have a strange relationship with creativity (perhaps because of conservatism that has its roots in the mandate to protect health and safety).
 - Technical capacity may limit us, but our creativity will allow us to learn.
 - Engineers seem uncomfortable with creativity and/or design. They don't acknowledge/honor creative classes, even though innovation depends on it.
 - The school took "engineering" out of the names of their first-year courses and replaced the class titles with "design" and wound up with a much more diverse group of people in their engineering program. Twenty-five percent of a recent Dartmouth engineering graduate class didn't start as engineering majors.
 - We've contributed to the marginalization and confusion by associating designer with design and technologist with technology. This has muddled the relationship between engineering and design and technology.
 - Creative people aren't hung up by professional boundaries. They follow the challenge/opportunity.
 - Senior engineering students are less innovative than freshmen (based on a study from Dan Linzel at UNL).
- › How does a profession maintain meaning when it is embedded in organizations and mixed with other professions?
- › A profession is equal to a subset of people with certain knowledge, skills, and attributes who have a willingness and ability to play a certain role on behalf of society.
- › Society has always compartmentalized in order to demonstrate, optimize, and organize expertise.
- › The engineering business structure operates on the basis of experience, older people lead. Tech companies turn that on its head.
- › Many younger people don't care about defining engineering and whether they fit into a particular box.
- › Technology is great at conferring explicit knowledge, not as good at translating tacit knowledge.
- › ME, ChE, EE have evolved much further than CE. Have we constrained ourselves too much by focusing on credentialing vs. goals of engineering?
- › Other industries go from research to execution. Engineering goes from research to processing/codifying to execution.
- › Focus on an opportunity discussion, not a protectionist discussion.
- › Are we the right people to answer this question? If not us, who?

An Initial Articulation of a Mission and Principles for ECL-USA

The next exercise shifted the focus of summit participants from the future of the engineering profession to the mission of the ECL-USA initiative and how we should organize our efforts. Two key questions were explored:

What should the mission (or role) of the ECL-USA be in helping the engineering profession engage its emerging future and move toward fulfilling its highest potential?

- › Thought leadership in engaging the industry through provocation, reflection, and action
- › Facilitator/convenor of the whole system
- › Facilitate bringing together stakeholders and disruptive thinkers
- › Communication hub that is agnostic to any professional society, association, or organization
 - Connecting with and facilitating exchanges and flows within the larger professional ecosystem
- › Active exploration of the profession without bias
- › Catalyst for change
 - Facilitating discussion of engineering future
 - Taking action – sharing information, engaging stakeholders, available to society
 - Acting as an enabler
- › Catalyst for action, but not always the source of answers
- › Catalyst for new perspectives
- › Catalyst for change
- › Humanism and stewardship
- › Champion opportunities to minimize risk
- › View non-traditional disciplines as an opportunity, not a threat
 - Include non-traditional disciplines in future sessions as force multipliers
- › Think tank
- › Goal oriented
- › Reach out to engage younger people that currently aren't represented in the ECL-USA effort
- › Engage in institutional acupuncture to create change
- › Integration of the larger living system and the human element

What principles should guide the Lab and its members in this work?

(According to Dee Hock, principles can be thought of as behavioral aspirations of a community, how the whole and the parts will conduct themselves in pursuit of the mission.)

- › Stewards of technology and the public interest
 - Advocacy through action – represent the profession and what we offer society
 - Work on behalf of the next generation(s)
- › Treat one another in ways that promote trust and mutual respect
 - Explicit rules of civility
 - Safe space for discussion including constructive conflict
 - Be comfortable with tension

- › Open source
 - Open to and actively seeking outside info
 - Transparent and collaborative
- › Have a clear vision and value proposition
 - Offer leadership – take the initiative
 - Long term perspective
 - Bias for action, resulting in impact
 - Wiki for best practices
- › Blank page approach to membership (to achieve true diversity)
 - Start w/list of who/what we want represented and engage/invite from there
 - Embrace diversity in the broadest sense
- › Apolitical and “non-partisan,” no agenda, open-minded
 - Respect for others doing “good work” in this realm
 - Openly embrace and encourage all opinions
 - Open to challenging the status quo
 - Be fact-based
 - No sacred cows
- › Interface with education at all levels
- › Forward looking and agile
 - Don’t engage topics from the past that haven’t been resolved
- › Our predictions of the future won’t be correct!
- › Have a timeline in mind
 - Milestones and open space for making pivots
 - But, be patient with the process
- › Be “organizationally lite” and agile
 - Build only what we need
 - Don’t create another “organization” for its own sake
- › Make ECL self-sustaining & flexible to future change

On the second day, an opening whole group discussion addressed the need to organize the ECL-USA. In this discussion, the following points were explored:

- › A fear of over-structuring the Change Lab was raised. The sense of the group was to build structure only as it is needed.
- › Consider an organizational structure that is formed around a core team of 40 to 50 participants who are actively involved in summits as well as outreach and information gathering, a larger community of practice that is engaged in focused initiatives, and a small steering committee to guide the overall effort.
- › The summits provide a forum to generate perspectives and ideas. It is the role of the steering committee to take away those ideas and propose a path forward – the group will need to trust the steering committee.
- › Do we want to bring in those who are going to disrupt us (participants in the lab)?
- › There is a need to clarify the value proposition of the ECL-USA.
- › The strong consensus of the group was that the work of the ECL-USA needs to continue.

After the opening discussion participants split into four small groups. Three groups formed around a set of focused initiatives – moving forward with the beginnings of ECL-USA’s first set of experiments. The three focused initiatives include:

EDUCATION: Developing a superior future workforce by impacting the entire educational pipeline, from K-12 through higher education to continuing education for practicing professionals. The group adopted a Liz Nilsson’s strategic doing approach in articulating its approach to this focus area.

PUBLIC POLICY: Increasing engineer participation with, and leadership of, efforts to proactively shape public policy

THE FUTURE OF CONSULTING ENGINEERING: Evolving the current model of practice in response to a rapidly changing world.

Prior to the small groups starting work, Liz Nilsen of the Purdue Agile Strategy Lab offered to help initiative teams use a “strategic doing” process to take action. This process asks groups taking on a new challenge to answer four key questions:

1. What could we do?
2. What should we do?
3. What will we do?
4. What’s our 30 / 30? (What will we do in the next 30 days and when will we next meet (in about 30 days)?)

The fourth group focused on clarifying the work on mission and principles and developing a draft statement for the ECL-USA. The ideas generated on the first day were explored and compared with mission statements from other organizations, including the AIA Technology in Architectural Practice Knowledge Committee (TAP). Mark Abbott shared ECL-Canada’s vision/mission statement that addresses four levels of strategic thinking and offered an overview of the process used by the Canadian Lab to generate that statement.

Engineering Change Lab - Canada Vision & Mission

<p>Society</p>	<p>Challenge:</p> <p>Never in human history has technological change caused such a fundamental shift in the world's systems. The speed, scope and complexity of this change is opening previously unimaginable risks and opportunities.</p>
<p>Engineering Community</p>	<p>Imperative & ECL Vision:</p> <p>The engineering community must adapt to these massive technological changes. As the people who create, employ and perfect technology, we also have the unique capacity and obligation to help steward those changes in a positive direction to address the challenges of our time. To do this – and do it well – our community must evolve.</p>
<p>Engineering Change Lab – Canada</p>	<p>ECL Mission:</p> <p>We envision Canada's engineering community reaching its full potential by helping steward the application of science and technology to address the challenges of our time.</p>
<p>Lab Supported Initiatives</p>	<p>Initiatives:</p> <p>The Engineering Change Lab is a catalyst for evolving Canada's engineering community – ensuring it is diverse, forward-looking and collaborative so that it can address the challenges of our time.</p> <p>To achieve this mission, we will:</p> <ul style="list-style-type: none"> › Act as a platform for ongoing collaboration within the engineering community and with other disciplines and fields › Deepen understanding and raise awareness for the engineering community's higher potential to contribute to society › Identify, test, and progress initiatives to address barriers and advance the community's ability to achieve its higher potential

The discussion of the mission/principles statement was framed within the context of the social lab approach adopted by ECL-USA; assembling a microcosm of the social system and working systemically, collaboratively, and experimentally with potential changes and new ways of working in the form of focused initiatives.

A small team of individuals drawn from this group, led by Elizabeth Stolfus, agreed to generate a draft statement to be brought back to both the steering committee and the whole group for continued evolution.

Next Steps/Call to Action

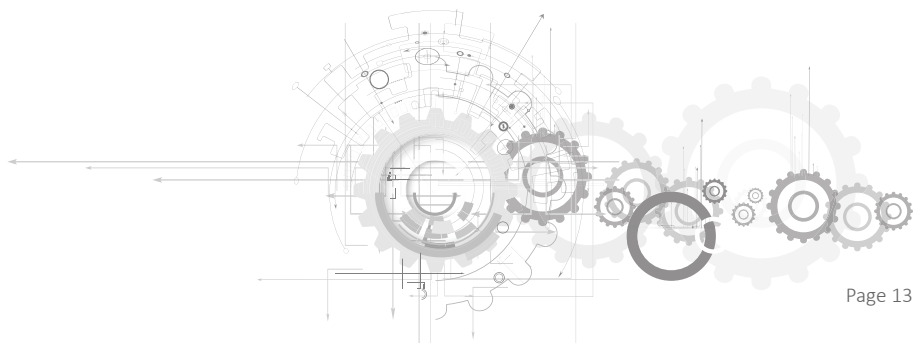
- › Adopt a schedule of three summits per year (four months between summits). The next summit will be held in June 2018 and will once again be held in Omaha.
- › The group discussed the possibility of a future summit in the San Francisco Bay Area as a means of reaching out to the tech community was raised. There is also the potential of staging a joint summit & workshop with the ECL-Canada in that location.
- › Summits will continue to be 1-1/2 days long, though a pair of hours will be appended to the agenda on the afternoon of the second day to allow initiative groups to work face-to-face on their efforts outside the main summit agenda.
- › Include participation and presentations by “provocateurs” to offer disruptive views and stimulate outside the box thinking at the summits.
- › Develop an on-boarding process for new participants.
- › Continue efforts to expand the diversity of participants, including the development of a strong value proposition that can be used to recruit them.
- › The existing steering committee will be expanded to include several additional members.

In Summary

The ECL-USA met in February to work toward a future in which the engineering profession and larger engineering community fulfills its highest potential on behalf of society. As expected, the conversations in Omaha generated more questions than immediate answers. Often when people talk about the future, they are apprehensive, protective, and quick to make broad generalization. At the summit, however, participants were open-minded, thoughtful, and really listened to each other. The work was extremely challenging individually and collectively.

In the end, there was broad consensus around the value of the Change Lab effort and strong commitment to continue to be engaged with the process.

Stay tuned.



Suggested Readings

Deep “U” Change Processes

1. *Presence: Human Purpose And The Field Of The Future*, Peter Senge, C. Otto Scharmer, Joseph Jaworski, & Betty Sue Flowers, 2004.
2. *Leading from the Emerging Future: From Ego-System to Eco-System Economies*, Otto Scharmer and Katrin Kaufer, Berrett-Koehler Publishers, 2013.

Change Lab Theory and Practice

3. *Labcraft: How Social Labs Cultivate Change Through Innovation and Collaboration*, Edited by Hendrik Tiesinga and Remko Berkhout, Labcraft Publishing, 2014.
4. *The Social Labs Revolution: A New Approach to Solving Our Most Complex Problems*, Zaid Hassan, Berrett-Koehler Publishers, 2014.

Related Readings on Leading Change and Adaptive Work

5. *The Fifth Discipline: The Art & Practice of The Learning Organization*, Peter Senge, Doubleday/Currency, New York, 1990
Also by Peter Senge:
The Fifth Discipline Fieldbook; Peter Senge, Doubleday, New York, 1994
The Dance of Change, Peter Senge et al., Currency, New York, 1999
6. *Birth Of The Chaordic Age*, Dee Hock, Berrett-Koehler, San Francisco, 1999.
7. *Regenerative Development and Design: A Framework for Evolving Sustainability*, Pamela Mang, Ben Haggard, Regenisis, Wiley, 2016.

The State of Professions

8. *The Future of the Professions*, Richard Susskind & Daniel Susskind, Oxford University Press, March 2017.
9. *The Fourth Industrial Revolution*, Klaus Schwab, Crown Business, January 2017.
10. *Good Work: When Excellence and Ethics Meet*, Howard Gardner, Mihaly Csikszentmihalyi, and William Damon, Perseus Books, New York, 2001

The Engineering Profession: Past, Present & Future

11. *America By Design: Science, Technology, and the Rise of Corporate Capitalism*, David F. Noble, Oxford University Press, 1977.
12. *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession*, Edwin T. Layton Jr., The John's Hopkins University Press, 1986.
13. *The Enigma of Engineering's Industrial Exemption to Licensure: The Exception that Swallowed a Profession*, Paul M. Spinden, Faculty Publication at Liberty University (DigitalCommons@LibertyUniversity), 2015.
14. *The Engineer of 2020: Visions of Engineering in the New Century*, National Academy of Engineering, 2004.
15. *A Whole New Engineer: The Coming Revolution in Engineering Education*, David E. Goldberg and Mark Somerville, Threejoy Associates, 2013.

FUTURE OF THE ENGINEERING PROFESSION WINTER SUMMIT

2018

OMAHA, NE



***ENGINEERING
CHANGE LAB USA***



FUTURE OF THE ENGINEERING PROFESSION 2018 WINTER SUMMIT

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Mark Abbott spent 15 years working in heavy industrial consulting engineering in Vancouver, Canada, before leaving to join the executive team of Engineers Without Borders Canada in Toronto seven years ago. Four years ago, Mark transitioned to help launch and become the founding director (animator) of the Engineering Change Lab, which is a collaborative platform comprised of senior leaders representing 40 + organizations from across the engineering community in Canada who are working together to understand and unlock the higher potential of engineering contributions to society.

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Stacy Bartoletti is CEO of Degenkolb Engineers and is active in organizations and community programs including the American Council of Engineering Companies (ACEC), the Council of American Structural Engineers (CASE), the Washington Seismic Safety Committee, and the United States Resiliency Council (USRC). Stacy is a leader in Washington's policy initiatives to improve seismic safety of critical lifelines, has testified before Congress on seismic safety, and has actively participated in the development of the CREW Cascadia Subduction Zone Earthquake and EERI Seattle Fault scenarios.

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Robert Brigham is the CEO of JEO Consulting Group, Inc., a 200-person full-service engineering and architecture firm with offices in Nebraska and Iowa. Unlike most CEOs in our industry, Rob is not an engineer. He has degrees in finance and law, and thanks to a summer job working on a survey crew, has had the opportunity for an amazing career.

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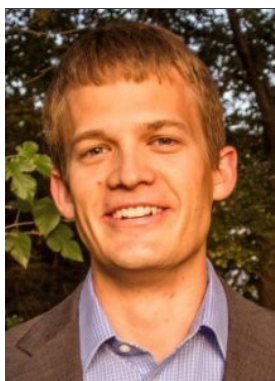
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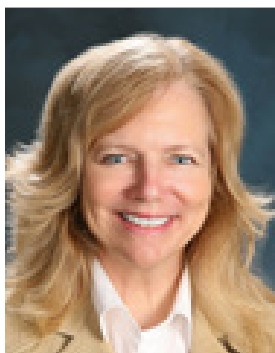
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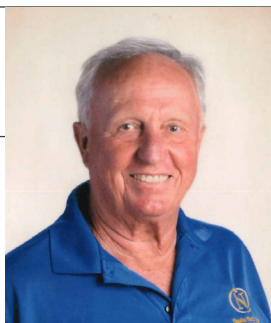
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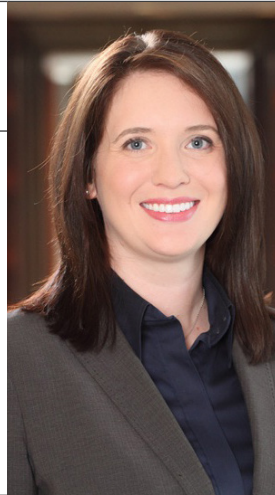
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