

THE FUTURE IS ENGINEERING

Summary of Summit #3

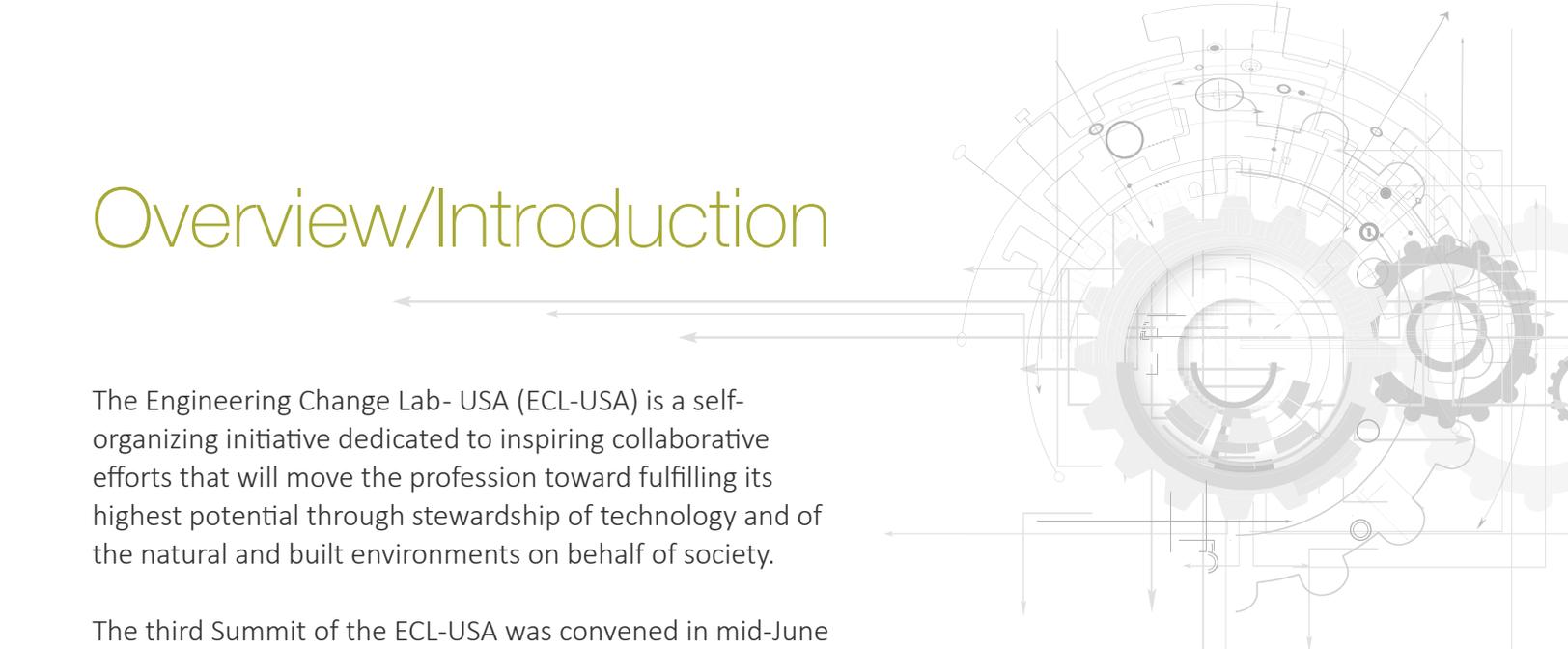
Engineering Change Lab, USA

June 12th - June 13th, 2018

Omaha, NE



Overview/Introduction



The Engineering Change Lab- USA (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 and of the natural and built environments on behalf of society.

The third Summit of the ECL-USA was convened in mid-June to continue its deep dive into the future of the engineering community. A group of forty leaders representing diverse stakeholders across the profession met in Omaha for a day and a half to reflect on the role that the engineering community ought to play in an emerging future and to expand the set of exploratory initiatives that the Change Lab community has chartered to pursue its mission.

- › Specific objectives for Summit #3 included:
- › Reflect on and test the draft ECL-USA Vision Statement.
- › Explore the Vision Statement’s imperative for the engineering community to serve as stewards of technology, the built and natural environments, and public health, safety and welfare (See following pages).
 - To develop a working definition of stewardship within the context of this imperative.
- › Expand our understanding of and commitment to the role that the ECL-USA can play helping the engineering community reach its highest potential.
- › Identify points of leverage and potential collaborators for taking action. (Engaging in “institutional acupuncture”.)
 - Recognize progress on current focused initiatives and charter new efforts to advance our learning.
- › Continue to evolve the ECL-USA as a social change lab.
 - Take next steps in designing and building a sustainable effort.
 - See the Summary Report for Summit #2 and the assigned reading for Summit #3, *The Social Labs Revolution* by Zaid Hassan, for additional perspective about social change labs.

VISION: Challenge, Imperative, Mission

CHALLENGE

The world is experiencing an unprecedented and growing wave of change. Accelerating technological progress, rapidly evolving societal needs and expectations, and growing environmental imperatives, including climate change, all present significant, fundamental challenges and opportunities.

IMPERATIVE

Maintaining the status quo of the engineering community and profession is no longer an option for delivering a resilient, thriving world. By engaging our robust technical knowledge and innate problem-solving skills with committed leadership, the engineering community can serve as stewards of technology, the natural and built environments, and the public health, safety and welfare as an uncertain future unfolds. The time is now to drive the system-wide changes that will support the engineering community in execution of this vital role.

MISSION

The Engineering Change Lab - USA is a catalyst for change within the engineering community (profession), helping it reach its highest potential on behalf of society.

To achieve our mission, we will:

- Bring together stakeholders, innovative thinkers, and change agents to explore and generate new knowledge about the role of engineering in an emerging future.
-
- Self-organize as an independent (non-aligned) entity – complementing existing stakeholder organizations (professional societies and associations), not attempting to duplicate their efforts.
-
- Become a communications hub, linking and sharing knowledge between stakeholders engaged in creating the future of the engineering community (profession).
-
- Engage in and lead collaborative initiatives designed to transform the engineering community (profession) to help it thrive in an evolving world.

Introductory Observations

What have you noticed leading up to this summit? What stands out?

- › Fragmentation and disintegration – the engineering profession is fragmenting into smaller sub-disciplines and the connective tissue that traditionally united them is disintegrating.
- › Social interaction and working in teams is the future of many professions.
- › Keeping engineering students and new engineers engaged purposefully is becoming a challenge.
- › Public communication is essential to the success of engineering projects.
- › Past assumptions in engineering are no longer true. Engineering for extremes and increased resilience is now desirable.
- › Bridge building between senior engineers and entry level engineers is important. Mentorship is not what it used to be.
- › Interdisciplinary work will lead to innovation.
- › Stratification in engineering firms. Firms are consolidating – big firms are getting bigger. Do firms now considered small have a place in the world.
- › Are engineers constrained by the code of ethics?
- › There is a need to be able to engage in “courageous conversations.”
- › Different engineers may not “see each other” in that they (we) don’t understand what others value and aspire to.
- › The rapid integration of software into the design process. Disruption is coming soon.
- › The central role of technology and the need to get ahead of technological development.
- › More examples of people within the industry that are advancing the way they use technology in their companies and are advancing a collaborative view of research. However, this seems to be occurring only in the larger firms. Concern about the future of small firms.
- › Advancements in technology are making many things possible. Misuses of technology are alarming because people use it as black boxes.
- › Rapid change in technology is frightening.
- › Students are eager for hands-on learning.
- › Current students are asking different questions and thinking about different things than I did when I was in school.
- › Fragmentation is also happening in education.
- › Engineering students in their first year strongly believe that engineers’ purpose is to serve society; however, this belief wanes by their fourth year and into the work force (from sociological study).
- › Not all engineering curriculums are created equal. Many schools are making more effort to integrate soft skills into curriculum.
- › Diversity in engineering still leaves something to be desired. Only 20% of graduating engineers are being licensed and of those 80% are civil engineers.
- › Undercurrent of hostility towards four-year degrees. Engineering is not just the ability to use a calculator.
- › Many faculty have never worked in industry. Many international faculty do not understand the K-12 system.
- › “The complete engineer” - core skills, not soft skills!
- › People are able to circumvent licensing requirements.
- › Necessity to look creatively at changes in the licensure model.

- › Is licensure necessary for certain engineering sub-disciplines?
- › Engineering profession is not sufficiently engaged at a public policy level.
- › Engineering will be key to what comes next for Puerto Rico, not only in rebuilding infrastructure but for developing an economy.
- › Being a voice for public policy that supports inclusion will be important.
- › Engagement in public policy is critical.
- › There is a need for ECL-USA.

Progress To Date

Summit #1: August 2017

- Launched an "unaffiliated", self-organizing initiative.
 - › Patterned after, and learning from, ECL-Canada.
 - › Connected to, and collaborating with (not duplicating), other efforts exploring the future of the engineering profession.
- Commitment to engage a more diverse set of participants from across the engineering ecosystem.
- Chartered a small set of focused initiatives.
- Took first steps in creating a fledgling organization.
- Convened a second summit to occur within six months.

Summit #2: February 2018

- Adopted the "social change lab" model for the ECL-USA effort.
- Explored purpose and essence of the engineering profession.
- Developed 1st generation mission & principles for ECL-USA.
- Gained commitment to continued evolution of ECL-USA.
 - › 3x summits per year for core group (next in June 2018).
 - › Continue to work on increasing diversity of participants.
 - › Continued collaboration with ECL-Canada.
- Mapped next steps for three focused initiatives.

Exploring the Role of the Engineering Community As “Stewards of Technology and the Environment”

The first morning of the summit was spent in a set of exercises that explored the concept of stewardship that is a central element of the role of the engineering community expressed in the ECL-USA Vision statement.

Participants were asked to recall and reflect on specific cases or stories of best practices with respect to stewardship of technology and the environment. Insights and lessons learned included:

Willingness to act in times of crisis:

- › We need to honor times when engineers have acted voluntarily in times of crisis on behalf of society and their communities.
 - › 1900 Galveston hurricane. Instead of relocating, the community, led by engineers, decided to rebuild. Included elevating homes and building a sea wall.
 - › Hurricane Harvey. Engineers, working in real time during the event, created models of flooding in and around Houston to help coordinate responses to the unfolding crisis.

Seeing the larger picture -- whole system thinking:

- › Looking outside the boundary of projects to identify opportunities for improvements.
 - › Getting creative.
 - › Engaging a broader set of stakeholders.
 - › Being aware, and working at the level of the “whole system.”
- › Engineers can take a holistic approach to projects – viewing client needs from all angles and “doing what’s right.”
- › Stewardship is a value-add to the businesses of our clients. We act in ways that might be good for us or our clients, but that might cause damage to others or the environment. Examples:
 - › A flood control plan for a brownfield site included a storage pond instead of replacing pipes. This was an amenity to the community and could also be used for fire protection storage.
 - › Convincing a client to locate a project near existing rail and highway infrastructure, rather than in a location that would require new infrastructure.
- › Stewardship often requires partnership with non-engineers.
- › Communication, compromise, and the recognition that challenges are often bigger than technical – good stewardship needs a certain amount of passion and connection to the human condition (empathy).

Examples:

- › Maintenance of quality water source for a community – creating a culture and governance for a town to understand that everybody is a steward of this resource.
- › Academic institutions are stewards of their communities.
- › MEDLIFE – a student organization which does pop-up clinics in central/south America. Not an engineering organization but, participates in engineering projects in those areas. They understand that helping communities is much deeper than helping individuals.
- › Crowd funding of solutions and sharing the results with all contributors.

Sustainability, engineering with nature, and human-centered design:

- › Engineers are stewards of environment and society.
- › Human centered design (it isn't just for architects). Environment and quality of life should drive design for more sustainable projects and systems (triple bottom line).
 - › Example: Principles of ENVISION.
 - › Using adaptive traffic signals to reduce or control congestion. You can do things that not only solve a sustainability problem, but often also reduce costs.
 - › Reusing and recirculating gray water.
- › Considering all cultures-- being a bridge or voice present to help assure projects and technologies are done in the right way.
- › Stewardship of the "built environment" should include addressing digital infrastructure, regulatory space, human dignity, and economic constructs.
- › What is the difference between stewardship and sustainability or the triple bottom line?
- › The Corps of Engineers Post-Hurricane Katrina "Engineering with Nature" policy is a prime example of stewardship of the environment.

Engagement with public policy:

- › Being at the table with respect to the development of public policy.
 - › Around the country, there are hundreds of people with a STEM background that have decided to run for office in reaction to a lack of respect in current administrations.
 - › The website of "314 Action" (www.314action.org/) is helping to track these races.

Leadership beyond problem solving:

- › Leadership as a catalyst for stewardship.
 - › Pursuing common goals.
 - › Taking an active stance, though many engineers may be uncomfortable doing that.
 - › Many engineers pride themselves on being 'problem solvers,' however this is a reactive stance. A proactive model of engineering may be beneficial.
 - › We are trained as problem solvers, not innovators or creatives.
 - › Engineers need to be at the table throughout the lifecycle of a piece of infrastructure (e.g. security needs to be baked in from the beginning, not sprayed on afterward).

Innovation & risk:

- › Stewardship includes support for innovation.
 - › Can stewardship also stifle innovation?
 - › Stewardship is the generational passing down of history and values. Engineers need to understand why this important, not just that it is important.
 - › Sometimes stewardship is teaching people how to fail, and how to learn from the failure and be successful in the future.
- › Stewardship of a technology may lead to the explicit decision not to use it, or re-directing it.
 - › Balancing between what is possible and what ought to be done.
 - › Stewardship brings a "value system" into decision making.
- › Encouraging and supporting public officials to use new technologies.
 - › Supporting risk taking with respect to technological innovation.
 - › Dealing with inertia that can prevent necessary change and progress.
 - › Supporting government officials and helping them feel "safe to fail" ... and learn.

- › Helping clients communicate.
- › Dealing proactively with risk.
 - › Communicating and mitigating unintended consequences, knowing that you're not going to eliminate all risk-- there will have to be a decision on whether that risk is acceptable or not.
 - › Recognizing that some risks have to be accepted – and coming up with plans to deal with those risks in the likelihood that problematic outcomes occur.
 - › Understanding whether or not the outcomes of technology pass the “sniff test.”
- › Integration of engineering judgment with technology (e.g. understanding level of accuracy in field scanners).
- › Using technology as a communication tool to improve credibility and help stakeholders understand potential decisions and choices (e.g. Infoworks).

Skill development and learning:

- › Stewardship of our own skillsets.
 - › Imagining challenges outside of our traditional disciplinary boundaries.
 - › Extending ourselves as problems become more complex.
 - › Challenging ourselves to engage in multi-disciplinary projects.
 - › Re-imagining our skillsets as fast as technology changes.
 - › Skills should adapt to changing tools.
 - › Using technology to keep people engaged in learning.
 - › Focus should be less on becoming engineers but on developing skills.
 - › Recognize that large numbers of engineers coming out of higher education don't ultimately practice as engineers.
- › Stewardship includes the way young professionals are developed.
 - › Being “stewards of students” by training new engineers (students) in leading edge technologies.
 - › Stewardship in employee development – young engineers can be type cast as experts in technology when this might not be the case. Additionally, companies may put employees on either a management or a technical track with little opportunity to go in between.

The next exercise asked small groups to develop possible definitions for stewardship:

- › The careful and responsible management of the natural and built environments for the benefit of individuals and society through creation and application of technology.
- › Being entrusted to preserve, protect and advance _____ on behalf of society.
- › Stewardship honors humankind, the built environment and resources including energy, nature money and time. We must accept and embrace our social responsibility as individuals and as a professional community.
- › From Wikipedia: An ethic that embodies the responsible planning and management of resources.
- › Supervision (taking care of) the built and natural environment. Capacities include understanding the system and a passion to supervise the use of technology (being current).
- › Balancing competing priorities based on values for the advancement and sustainability for global prosperity.
- › Develop skills and provide empowerment to inspire responsible and active leadership for a cradle to cradle vision.
- › Proactively leading the building of resilient systems that balance interests and honor society.

Additional observations about stewardship, reflecting on these definitions:

- › Being entrusted to safeguard human dignity and the commons.
- › Does stewardship imply “stasis” and the maintenance of the status quo? No, stewardship also recognizes the need for change and to help evolve, and improve. Stewardship is not about mindlessly maintaining equilibrium (the status quo).
 - › Stewardship is a positive force in society.
- › Engineers make tough decisions and not all stakeholders will be pleased with every decision – the definition of steward may need to have a sharper edge.
 - › Balancing competing priorities.
- › Stewardship is about “advancing” and being aspirational (to the moon).
 - › Making sure aspirations are connected to creating a thriving world.
 - › Seeing opportunities and problems.
 - › Reaching for prosperity and a convivial, life-affirming/life giving future.
 - › More aspirational than a code of ethics.
- › “Curation” and looking for and celebrating what is special.
 - › Preservation of something, but also appreciating and sharing it.
- › Positive deviance-- instead of trying to solve a problem, look for examples where the problem doesn't exist and study why.
- › Connecting basics to current uses of technology (the algorithms).

Engineering Community & Engineering Profession

Should the primary focus for the ECL-USA be the engineering community or the engineering profession?

Observations:

- › The future of the engineering community or profession? Which is most relevant?
- › It's not important which to use – just use one consistently. (English major perspective)
- › Would this be an issue if we were lawyers?
- › The engineering community may include engineering graduates who don't practice as well as other groups who are imperative to what we do (scientists, medical professionals...). On the other hand, the engineering profession may include only licensed engineers and those who explicitly practice engineering.

Consensus of the Whole Group:

The primary focus should be “community” to be as inclusive as possible.

Learning from "NICKEL"

National Initiative on Capacity Building and Knowledge Creation for Engineering Leadership
An Initiative of the University of Toronto Community of Practice on Engineering Leadership

Mike Klassen, the Assistant Director of the Institute for Leadership Education in Engineering at the University of Toronto shared the story of the "NICKEL" initiative that emerged within the context of the ECL-Canada effort. Key Points from Mike's presentation included:

- › Defining engineering leadership: Leadership is a process that begins with self and, guided by values, vision, and vitality, inspires, empowers and influences others, teams and organizations to make positive change.
- › In 2010, the Institute for Leadership Education in Engineering at the University of Toronto established the ILead program to do research and offer programs and outreach to the engineering community (universities and private companies) about leadership in engineering.
- › The value proposition of ILead: "Engineers leading change to build a better world."
- › Through its involvement with ECL-Canada, ILead helped launch the NICKEL initiative in 2015, whose mission is expressed in its name: capacity building and knowledge creation for engineering leadership.
"...where common challenges could be shared, where senior leadership could better understand the systemic problems that block their engineering teams from achieving their highest potential, where human resource professionals can learn techniques to better train and retain their engineering workforce, and where engineers themselves can articulate their lived experiences with their peers."
From NICKEL website: <http://www.engineeringleaders.ca/about/>
- › Change Lab conditions that contributed to the successful launch of NICKEL include:
 - › CONVENING POWER: Legitimacy to host at a national scale.
 - › CHALLENGE: Impact the whole profession beyond our university.
 - › ACCOUNTABILITY: Report on progress and learning, space to unpack failure.
- › Beginning in 2016, NICKEL has convened annual conferences bringing together faculty from engineering schools across Canada to accomplish its mission. This has resulted in the evolution of a vibrant community of practice in those university programs centered on engineering leadership.

Discussion Observations:

- › Often schools who create engineering leadership master's programs receive pushback from the business department who see it as a threat to the MBA program.
- › What is the metric of success for NICKEL?
 - › A metric such as how many engineers rise to the C-suite in business reinforces the idea that leadership is a title. Other metrics are difficult to quantify.
 - › One way would be to measure the effectiveness of teams.
- › Focus on both undergraduates and graduates. Recently have begun working with PhD students who are not planning on staying in academia.
- › The NICKEL story provides a very valuable case study in how to launch focused initiatives from within the context of a Change Lab.
 - › Strategic Doing provided a key process breakthrough for the initiative team.

What are we learning about the role that the ECL-USA can play helping the engineering community reach its highest potential?

A major portion of the afternoon on Day One was spent in a dialogue session engaging the whole group. That dialogue focused on the question shown above.

- › Changes in society are happening rapidly. This is contrasted with the time that is required to mount an organization like ECL-USA to be representative of a community and have an impact. This presents a troubling challenge.
- › Another role that ECL could play is to act as provocateurs for other organizations and within the organizations that we are part of. ECL can create linkages to other engineering organizations and provide a means for them to learn from each other about change.
 - › Being the “sand in the clam shell” for other organizations/associations.
 - › Engage the “Big 5” engineering associations.
 - › Become a clearinghouse and sharing space.
- › It’s difficult to be a change agent internally. This could also be characterized as comfort with how things are. ECL may help in the exchange of change agents between organizations by adding credibility.
- › Can ECL be a collection point for good and bad ideas in the context of our community? It is important to show people who are resistant to change that we aren’t going to hurt them – in fact maybe we can show them some actions that will help them.
- › Having a change lab can help remove personal bias.
- › It would be good to reflect on the desired end state for the Lab. What actions can be taken to reach this state? What is the deliverable?
- › The Lab should be about both threats and opportunities.
- › Young engineers are more open to change – the future can be scarier to them as it will impact their lives more fully.
- › Things are changing but young students understand the new state of technology and where technology is headed. Speaking to them will be useful in understanding the trajectory of the profession.
- › We need to build a coalition across generations and reflect a much higher degree of inclusion and diversity (closing gaps).
- › We can elevate conversations within our organizations to address the bigger picture.
- › It’s about knowledge transfer and communication – sharing best practices via storytelling.
 - › Getting our common message out through storytelling.
 - › What is our communication strategy?
- › There are so many priorities! How will we prioritize our responsibilities?
- › We need to be able to take advantage of quick wins and butterfly effects to build momentum.
- › When it comes to action, not everybody has to agree to get started. Individual actions can be taken by multiple people to experiment and learn. We can create a snowball effect using feedback from such efforts.
- › Individuals can gain credibility (and skills) through their association with the ECL – and then go off and act as change agents in their own spheres of influence.
- › Finding and engaging passionate people who occupy positions of influence.
- › Helping individuals connect and empowering people to try things out.

- › A role of the ECL is in its power to convene.
 - › For example, valuable insights could follow from convening engineers from the biotech industry. ECL location may have to move west for this.
 - › We can “lead without authority” inviting others to come think, learn, and experiment with us.
 - › Reflecting on the book *Orbiting the Giant Hairball* by Gordon MacKenzie: Even if an organization doesn’t have any formal power – if it gives people a reason to convene, it can make change. An engineering equivalent to his “office of creative paradox” could give people a reason to share ideas and grant those ideas some level of legitimacy just because they’ve been shared.
- › Experiments in maintaining the sense of stewardship in engineering students throughout their academic career. Universities can be a good place for industry to give some problems to-- providing students real problems to solve will maybe help to illuminate, inculcate, and maintain stewardship values and principles.
 - › Linking universities and industry.
- › More people in ECL-USA originate from industry (consulting engineering practice) than in ECL-Canada. Opportunities are there for collaboration in problem solving between the two.
- › Forming relationships between unexpected allies. E.g. partnering of K-12 educators with NICKEL to do leadership workshops and rethink bits of curriculum.
- › Creating connections with other organization and societies to spread the message and share knowledge about the emerging future. Build on similar initiatives.
- › Celebrating acts of stewardship.
 - › For example, “ShelterBox” (www.shelterbox.org) and Liz Nilsen’s experience taking strategic doing to post-hurricane Puerto Rico.
- › Don’t “over engineer” the ECL-USA.
- › We’ve only scratched the surface.
- › Creating a “book of great ideas.”
- › ECL as a “think tank” – or, ECL as a “think-do tank”? Remain open to all, and don’t become a membership organization.
- › Collaborate with five key organizations.

At the end of the dialogue session as the work of the day was wrapping up, the desire for a better picture of the “end game” for the ECL-USA was expressed by several participants. What does the ECL look like three to five years out? A more concrete sense of that destination would be helpful.

Consequently, the agenda for the morning of Day Two was adjusted to include work on “envisioning an aspirational future” for the ECL-USA. A set of prompts for people to reflect on overnight was offered as a means of setting up that visioning work.

Envisioning an Aspirational Future For the Engineering Change Lab - USA

Prompts for Reflection

When you envision the future for ECL-USA in the next _____ years, what does it look like? What is most important to you?

- › *How have we contributed to the evolution of the engineering profession?*
 - › *What big things have we accomplished?*
- › *Beyond the contributions and accomplishments, how are we living our vision / mission?*
- › *What characteristics of ECL-USA have enabled our initiative to thrive?*
- › *What are distinctive attributes of the ECL-USA?*
- › *What is it like to be engaged in ECL-USA's efforts?*
- › *Who is engaged in the initiative?*
 - › *Types of people:*
 - › *Connections to other organizations:*
 - › *What do leaders do?*
- › *How are we organized?*
- › *How does the ECL-USA fund itself?*
- › *What are the biggest changes to the ECL-USA that have happened since today?*

Small Group Reports

Group One: ECL 2021

- › Recognized, well-functioning, well-funded organization (including staff).
- › Respected by the engineering community and engineering organizations as a thought leader, convener, aggregator, and provocateur.
- › Undiluted voice embracing diverse views.
 - › Open to diverse opinions, but speaking with an undiluted voice.
- › Impacted the engineering community by increasing awareness of technological and environmental stewardship (fulfilling the ECL Mission).
- › Impacted public policy.

Group Two: 6 months to 3 years

- › Concrete experiments:
 - › Culture of doing experiments and harvesting learning.
 - › Influence faculty and shape curriculum (e.g. leadership).
 - › Cut across groups (e.g. mix industry and academia).
 - › Understanding how “practice” will change (the future of practice).
 - › Comparing what faculty and industry value in graduates (e.g. “I” shaped vs. “T” shaped).
- › Structure:
 - › Respected and valued by national associations.
 - › Be a “Think-Do Tank.”
 - › Balanced participants (across sectors, disciplines, etc.) with broad backgrounds and experience.
- › Value proposition:
 - › Inter-generational exchange (teaching the next generation).
 - › Identify and address threats.

Group Three: ECL-USA in 5 Years

- › Established website – “resourceful” (resource full) for us and the community.
- › Augment existing tools (education and learning) from kindergarten through the 65-year-old fulfilling certification requirements.
- › Bridging between K-12, University, and Practice.
- › Developing an entrepreneurial mindset among engineers so they don’t just wait for a project to be presented, but they go out and identify problems to be solved.
 - › Be the change agent.
- › E-society linkage (initiatives and implementation).
- › Publish position papers and statements of issues that go out to the engineering community.
- › Educate and engage political decision makers (be members of their “kitchen cabinets”).
- › Serve stakeholders and those stakeholders are aware that we exist (visibility).

Group Four: 5 to 7 Years

- › Descriptors / Accomplishments:
 - › Convener.
 - › Built relationships and connected other associations.
 - › Legitimately seen as an umbrella organization that recognizes the issue.
 - › Seen as a-political (we are a trusted source of unbiased information).
 - › Leadership (recognized and credible).
 - › Influencer (skills, tools, etc.).
 - › More of what we do day to day, how can we provide the training and the connection back down to lower education levels in order to prepare the next generation. We have to start asking them questions instead of just telling them the answers.
 - › Think tank + experiments (doing).
 - › Modeling ECL-Canada.
 - › Diverse (full spectrum).
 - › Sustainable (people, \$ (with no strings attached), methods).

Whole Group Discussion & Summary

What was common in all reports?

- › Lack of specificity. Should the goals of the Lab be more specific?
- › None of us have actually thought about what the problems of three / five years will be. Being less aspirational than maybe we were supposed to be.
 - › In the future, we might have a technology task force that sense possible disruptions and prompts actions to address them ... there are a million things that are changing so fast, we need to identify them and see how we can address them.
 - › Another issue is how do we get this information back to the universities to help develop better curriculum/standards.
- › Does this help us move forward and think about what the lab could be?
 - › The problem could be with implementation. Strategies are often where plans fail.
 - › Civil and consulting are disproportionate in ECL. Some seats will need to be emptied to invite more diverse members. Who else needs to be present to best achieve measurable actions?

What can we do to continue engaging industry?

- › What does the future look like, and will this group bring measurable outcomes? Is it a helper and enabler of change?
- › The group is looking to get ahead of the industry and help guide that change.
- › The “arrived” moment for me would be that we are invited to go to individual companies and tell them how their business model will be different and how their bottom line might be affected. That will be how we know this group has achieved its goal.
- › Would it be helpful to have someone from the financial industry or the insurance industry here?
- › How do we influence policy instead of being constrained by it?
 - › e.g. mandatory parking for new buildings limits an engineer’s ability to work on new parking systems.

Summary Ideas about the ECL-USA Value Proposition

- › Getting ahead of change in our industry and helping guide that change.
- › We’re invited to go to companies and advise them on how their model of practice / delivery should be changing.
- › We’re willing to “throw down” ideas and provoke members of the engineering community and our stakeholders.
- › Learning.
- › How to contribute more through stewardship and incorporating that philosophy into a firm/organization.
- › Have more owners participate in Lab efforts.
- › How do we influence and shape public policy, not just be influenced by it?
 - › Using our diverse group to tackle the problems being addressed by public policy.
- › Add additional stakeholder participants such as finance, insurance, medical (bio).

Focused Initiative

The group chartered a task force to put together a “next generation” statement of the ECL-USA’s aspirational future for review and comment before the next summit.

Aspirational Future Task Force

Liz Nilsen (Team Leader)

Michael Sullivan

Chris Walcutt

Elizabeth Stolfus

Johnny Shockley

John Eddy

Personal Leadership Opportunities With Respect to the Work of the ECL-USA

Individuals were asked to reflect on and share their responses to a set of prompts exploring how they could personally contribute to the work of the ECL-USA.

With respect to the work of the ECL-USA ...

- *What am I most passionate about with respect to the work of the ECL-USA?*
- *What leadership am I currently offering?*
- *What opportunities exist for me to offer additional or other types of leadership?*
- *What “works for me” as a change leader?*
- *What will I need to learn to be a more effective change leader?*
- *What support do I need to be more effective as a change leader?*

Progress Reports on Focused Initiatives

Education Initiative

Liz Nilsen and Clint Robinson presented a progress report on the work of the Education Initiative. The group adopted a “strategic doing” approach to their work starting with an “Imagine if” statement ...

Imagine if, guided by educators and mentors who understand emerging technologies, every student was prepared and excited to address challenges/problems by applying science and math concepts, using an engineering approach. What would that look like?”

The initiative’s first step was to develop and administer a survey of early career engineers to better understand attitudes and motivations behind their choices to become engineers. The initial survey drew over 750 responses (and the number continues to climb). Major takeaways from the initial survey were summarized ...

Ten Things We’ve Learned So Far:

1. They’ll answer a survey.
2. They have opinions about what the future will look like.
3. High school is decision time for them.
 - › We should probably know what other career fields these people considered before deciding on engineering.
4. “Real” engineering experiences are critical.
5. Men and women have had different experiences before college.
 - › “Tinkering” implies working with your hands, and that’s not what engineers do. It would be interesting to explore this more fully.
6. Men and women have different experience in college.
7. Men and women have different reasons for deciding to become an engineer.
8. Doubts are common, but some are more common than others.
 - › Contrasting “Doubts about DESIRE” and “Doubts about ABILITY.”
9. We’ve still got a lot to learn.
 - › What is behind the gender divide?
 - › What about the students that don’t become engineers?
 - › Is it really true that before high school, the most critical “levers” aren’t available?
 - › Do any of the many current K-12 engineering education initiatives respond to these findings?
 - › Do these results hold up across the field? Because...?
10. We need help to learn more.
 - › Expanding respondents by type of organization and area of practice.

Discussion with the whole group yielded the following thoughts/action items:

To expand the pool/cross section of responders:

- › Use licensure groups (Patty Mamola & Lance Kinney).
- › Tap university alumni (Libby Jones, Phillip Parker, Theresa Maldonado).

Questions and next steps to consider:

- › Why did people fall out of / or stay in programs/schools? Also, what course/experience kept them involved in engineering?
- › Consider the impact of community colleges?
- › What are possible experiments with faculty?
- › What does this suggest about outreach to girls in elementary school?
- › While conversations support the hypothesis that mentorship is important, this did not show up in the data. Why is this?
- › “Grey hairs” telling the “kids” what to do is not very helpful. Ask the younger people.
- › Consider selecting some responders and convening a panel (focus group) or try to have a more in-depth one-on-one phone conversation.

The Education Initiative group will continue to expand survey respondents and explore results. Next generation results can be shared at the next summit.

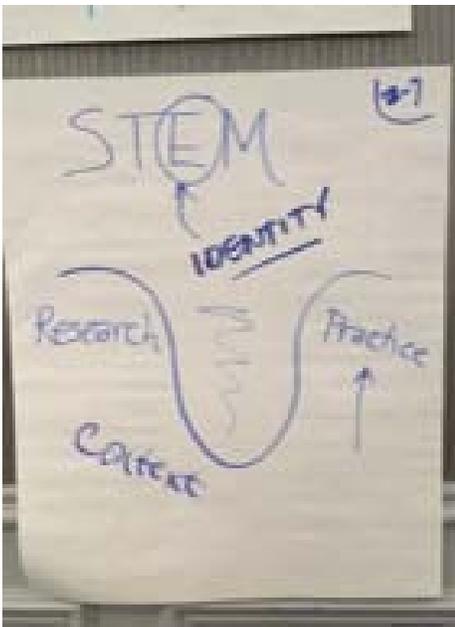
Reflections on STEM & Engineering Education

Theresa Maldonado

On STEM:

There is a real issue with respect to the "E" in STEM being recognized. Engineering doesn't have the same identity as Science, Technology, and Math in STEM preparedness programs.

- › Nobody is advocating the “E.” And, there's often not a specific engineering piece included in these programs. So, our unique profession gets lost, and K-12 kids don't really understand what engineering is.
- › There is little recognition of the diversity of practices within engineering in STEM programs, including the engineering of the built environment.



On Engineering Education:

There is a “Valley of Death,” or big gap, between academics who teach engineering and /or do research in engineering education – and – trying to implement engineering education research outcomes in practice.

- › Most faculty have never worked in industry and are surrounded by an academic cocoon. Yet they are preparing students to work primarily in industry.
- › There is also a high percentage of students (perhaps as much as 40%) who do not end up practicing engineering. Even though faculty should be aware of this trend, many are not.
- › Consequently, many faculty don't know how to have (nor do they recognize the need for) conversations with students to help guide these future engineers in making critical career choices.

The growth in the number of professional societies is another concern.

- › How do we get these disciplines all at the table to discuss the critical challenges facing engineering?

Focused Initiatives

ECL-USA Communication Strategy:

- › Get content on website and social media accounts.
Questions:
 - › Is there enough money to hire a web master?
 - › Would it be cheaper to find a work-study student to do it?
- › Develop standard Powerpoint slides.
- › Plan for a ECL-USA Ted Talk.

Team Members: Libby Jones (co-leader), Brittini Stephens-Yates (co-leader), Gregg Brown, Mike McMeekin, Kyle Davy (content provider)

Bringing NICKEL down to the USA for a workshop:

- › Goal is to have a workshop or generate a new class module, not to write a report.

Team Members: Phillip Parker (team leader), Lance Perez, Theresa Maldonado, Mike Klassen, Libby Jones.

Creating an experiment around licensure:

- › Explore the question: “If we had to do it all again, what would it look like?”
- › ACTION ITEM: The Nevada Board is hosting a continued education event for licensed practitioners and Patty will share about ECL. They are willing to try the experiment discussed above at this event.

Team Members: Patty Mamola and Lance Kinney. Kyle Davy offered to potentially facilitate.

Working group to explore technological driving forces:

- › Establish a working group to explore and pull together a map of technological driving forces as a means of fostering group foresight.

Task Group: Kyle Davy (team leader), Nancy Pridal, Marilen Reimer, Edwin Friedrichs (public policy)

Acquiring funding and gaining non-profit status:

- › The time is right for proceeding with these activities. Put this on the agenda for the Denver meeting.

Team Members: Patty Mamola and Kyle Davy to look into potential donors.

Diversity and Inclusion:

By bringing in new members for the sake of diversity, we may lose steam. Everyone here now is invested and motivated. Maybe the way to increase diversity is through initiatives and experiments. Reach out to EWB, Bridges To Prosperity, Water for People, etc., to get students involved and increase diversity. Use connections in Denver for next summit.

- › Steps for diversifying – maybe diversify in smaller groups and workshops.
- › Smaller group first, smaller workshops and more people coming in later, staying for bits and pieces. Similar to how they did it at ECL-Canada.

Planning for Future Summits: 2018 & 2019

Time - Location	Possible Focus / Theme	Notes
Fall 2018: Denver October 25 & 26, 2018 › Denver Natural History Museum	Students & Young Professionals Technology & Natural Systems	Engage Engineers Without Borders, Bridges To Prosperity. Invite leaders of student org's. and your professional groups within associations.
Winter/Spring 2019: Kansas City March 4 & 5, 2019	K-12 Education Public Policy & Governance	Engage educators and public officials in charrette processes. › What should schools do? How should engineers engage? › What should gov't. do? How should engineers engage?
Summer 2019: SF Bay Area › Berkeley › Joint Summit with ECL Canada	Advanced Technology (Tech) • Digital • Biotech • Neurotech	Explore the tech engineering community view of the future. Ethics Global perspectives and stewardship.
Fall 201: Omaha	Consulting Engineering (?) Higher Education (?)	New models of practice. New curricula & teaching approaches.

Closing Comments

“What stood out/seems particularly important over the summit?”

“How are you feeling about our efforts?”

- › I’m still kind of an “edge person” but I am learning a whole bunch and loving it.
- › I’m excited about the momentum. It’s fascinating to me how much progress has been gained from last meeting to this meeting. How quickly we got to work this time.
- › We didn’t wait six months. I think that helped with that connection. I continue to be enthused about it. It’s an important topic that we need to address.
- › This is good, I think it’s important. It’s a little more aligned, it’s starting to come together. ECL is starting to coalesce.
- › Feeling reflective about what we’ve discussed here and the future.
- › I wonder if there could be opportunities or ways we can put things out there that we read that will affect the future of the profession.
- › We want to be connected to your industry. It looks like we can take a lot of your needs and incorporate them into what we’re doing.
- › I’m excited, almost too excited. I feel glad and good about the engineering community is really interested in trying to make things better.
- › As a first timer, there’s a lot here to unpack. I’m always impressed when you get a group of people like this together, with disparate views and experiences.
- › Big thank you. Very welcome and very heard. Hearing Patty and Lance say, “let’s imagine a whole new licensure” – never would happen in Canada. Very good.
- › Feel very grateful to be included. Expanded my idea of what’s possible. One of the huge benefits something like this can contribute to society. Very inspired by Patty and Lance.
- › Still wrapping head around policy issues, but excited to be a part of this.
- › I’m glad I was able to come to this summit and the last one. I enjoy seeing it start to focus a bit more than the last time.
- › Very interested in the role of our community as stewards. Very personally motivating to me. I continue to be attracted to this group because of the focus on stewardship. The discussion yesterday was very good. Going even beyond technology and environment stewardship. Surprised and amazed at the initiatives we will be working on between summits. That will continue to drive this.
- › I think we do need to start to coalesce around certain tracks that we need to advance the cause and push the envelope. The tasks we came up with between now and the next summit are good steps.
- › I’m pleased with where we are at today. The stewardship discussion really re-engaged me.
- › Onboarding- I really appreciated being give the past summit material. That was helpful as someone who is attending for the first time.
- › I think we are at a tipping point. There is so much fragmentation. I think we need to talk about the future and figure out what is going on. We are such an interpretive group. We’ll have to really stretch to reach such a goal.

- › I see the opportunity this group creates. There is so much going on, the volume makes it difficult to focus. This is very exciting and really energizing. The challenge is how do you really exercise that action piece without creating duplication or conflict? Honestly, it is getting difficult to find time/money to commit to four more meetings, but it's worth it.
- › I'm wondering if ECL is ready to have a session with ASEE (Engineering school deans). Will talk more off line about this.
- › We have to keep in mind that there is an audience who will be in receipt of whatever we come up with, otherwise we are just talking to ourselves.
- › What can we do to increase the mobility of licensure between states?
- › I do believe we have made some forward progress.
- › This group creates an opportunity to fill Teresa's "valley of death." It's good for professionals to get a chance to talk about topics outside of their work specialization.
- › Appreciation of the continued narrative supported by individuals who have been here all along as well as the new voices being added to the conversation.
- › Committee reports are important and should be an important part of meetings.
- › Appreciative of small group discussion from second day. A lot of work to be done in faculty training. We'd like graduates to be all around engineers who value stewardship but how many faculty are like that?

In Summary

Summit 3 of the Engineering Change Lab – USA (ECL-USA) was held on the campus of the University of Nebraska – Omaha on June 12 & 13, 2018. The summit was attended by 40 engineering community leaders from across the country. The summit was a success, with continued support expressed by attendees for the importance of the ECL–USA initiative.

The group of attendees explored the role of the engineering community as stewards of technology and the environment, which is an important element of the vision for ECL-USA; heard from the University of Toronto’s Mike Klassen regarding the ECL-Canada initiative to incorporate leadership into the curriculum for engineering; explored the role of ECL-USA in helping the engineering community reach its highest potential; discussed the organizational structure of ECL-USA; listened to a report from ECL-USA’s Education Task Force; and chartered additional focused initiatives.

Focused initiatives developed at the summit included the following:

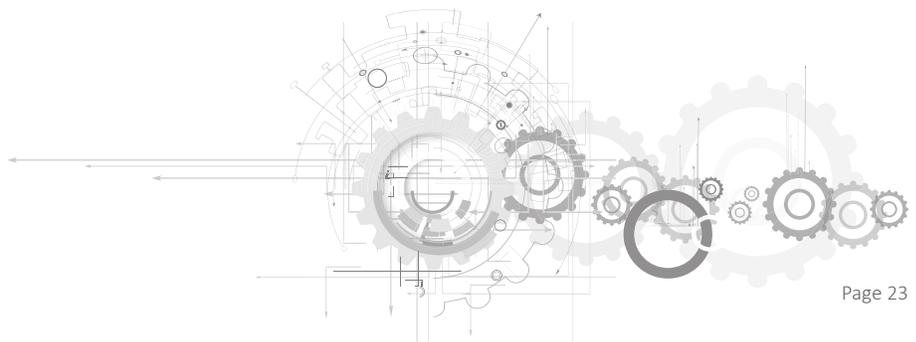
- › Developing the Aspirational Future of ECL-USA
- › Developing a Communication Strategy for ECL-USA
- › Incorporating Leadership into Engineering Curriculum
- › Imagining a New Model for Engineering Licensure
- › Mapping Technological Driving Forces Impacting the Engineering Community
- › Exploring Non-Profit Status & Funding for ECL-USA

In order to provide for more advanced scheduling, the dates and locations for the next two summits have also been established.

Summit 4 – October 25 and 26, 2018, Denver

Summit 5 – March 4 and 5, 2019, Kansas City

Summit 6 will likely be held in the San Francisco area in the summer of 2019, and the potential for this being a joint summit with ECL-CA is being explored.



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, Regenis, Wiley, 2016.

The State of Professions

8. *The Future of the Professions*, Richard Susskind & Daniel Susskind, Oxford University Press, March 2017.
9. *Shaping the Fourth Industrial Revolution*, Klaus Schwab, World Economic Forum, January, 2018.
10. *The Fourth Industrial Revolution*, Klaus Schwab, Crown Business, January 2017.
11. *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

12. *America By Design: Science, Technology, and the Rise of Corporate Capitalism*, David F. Noble, Oxford University Press, 1977.
13. *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession*, Edwin T. Layton Jr., The John’s Hopkins University Press, 1986.
14. *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.
15. *The Engineer of 2020: Visions of Engineering in the New Century*, National Academy of Engineering, 2004.
16. *A Whole New Engineer: The Coming Revolution in Engineering Education*, David E. Goldberg and Mark Somerville, Threejoy Associates, 2013.

FUTURE OF THE ENGINEERING PROFESSION SUMMER SUMMIT

2018

OMAHA, NE



**ENGINEERING
CHANGE LAB USA**



FUTURE OF THE ENGINEERING PROFESSION 2018 SUMMER SUMMIT

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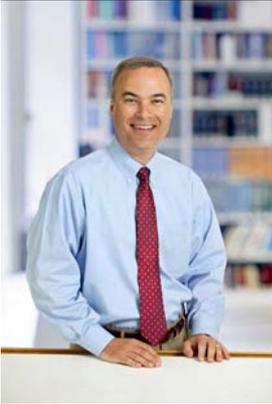
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(Missing Info) Adam Stodola is employed as a Project Manager at Garver, an engineering and architecture firm in Wichita, Kansas, where he is the Kansas Transportation Team Leader. He has held officer positions on both the Kansas Society of Professional Engineers (KSPE) Eastern Chapter and State Boards, serving as President on the KSPE Executive Committee in 2015-2016. Adam currently serves as NSPE House of Delegates representative for Kansas and is the Chairman of the NSPE Future Professional Engineering Task Force. He was named KSPE State and Chapter Engineer of the Year in 2013, and NSPE Fellow in 2017.

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Elizabeth Stolfus is President of Stolfus & Associates, Inc., a Colorado transportation engineering and planning consulting firm. Her professional interests include linking transportation systems with community planning, building multi-disciplinary programs and teams to improve highway safety, and implementing thoughtful engineering designs that accommodate every mode of travel. Elizabeth focuses on developing solid transportation decisions, projects, and processes by establishing inclusive participant settings, asking the right questions, and sharing information.



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Bill Stout is a Principal Consultant with Gannett Fleming Valuation and Rate Consultants, LLC, a subsidiary of Gannett Fleming, Inc. Bill provides internal training to staff and assistance in client studies related to public utility depreciation and cost of service, fields of practice that occupied much of his career. Early in 2017, he retired as Chairman of the Board and CEO of Gannett Fleming, Inc. In 2016, Bill received the American Council of Engineering Companies (ACEC) Chairmen Emeritus Award.



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Gayle Sturdivant has 26 years of experience that includes four years of providing military construction services overseas, and transportation and water projects primarily for domestic municipalities. Prior to joining the City of Omaha she was the Program Manager for the Southern Delivery System Program in Colorado Springs. Gayle now serves the City of Omaha as the Design Manager. She is also a member of ASCE (American Society of Civil Engineers), PMI (Project Management Institute) and APWA (American Public Works Association).

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Michael “Sully” Sullivan serves on the State Board of the Technical College System of Georgia, Georgia Chamber of Commerce Board of Governors & Board of Directors and as Chairman of the Gwinnett County Water & Sewer Authority. Sully was named to Georgia Trend Magazine’s annual list of Notable Georgians, a Georgia Super Lawyer ‘Rising Star’ by Law and Politics and Atlanta Magazine and has twice been named to James Magazine’s annual list of ‘Georgia Super Lawyers.’



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As the current president of the American Society of Civil Engineers (ASCE), Kristina Swallow is a civil engineering leader with more than 20 years of professional practice in water resources, transportation, and land development. Among her many past roles, she served as Region 8 Director, Region 8 Governor, Chair of the Education Activities and the Diversity and Women in Civil Engineering committees, and ASCE’s 150th Anniversary Steering Committee.

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Markus Weidner serves as the Chief Innovation Officer for Pennoni, a 1300-person Engineering Design and Consulting Firm with offices across the Eastern United States. His role focuses on bringing the spirit of innovation to operational systems and processes, the creative direction around the modification and modernization of existing services, and inventiveness in the creation of new solutions and service lines. Markus has 20 years of experience in the AEC industry and has served in a number of operations and technical roles – most recently as Director of Technology for NELSON, a national Architecture firm of 1200 people.



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Kylie Wilmes is a Civil Engineer and a Project Manager at HDR Engineering, Inc. She has spent her career working on diverse infrastructure projects for both the public and private sector, and enjoys working with others to solve problems. Kylie is currently on the Membership Committee for NWEA, and a past-president of the Engineers Club of Omaha.
