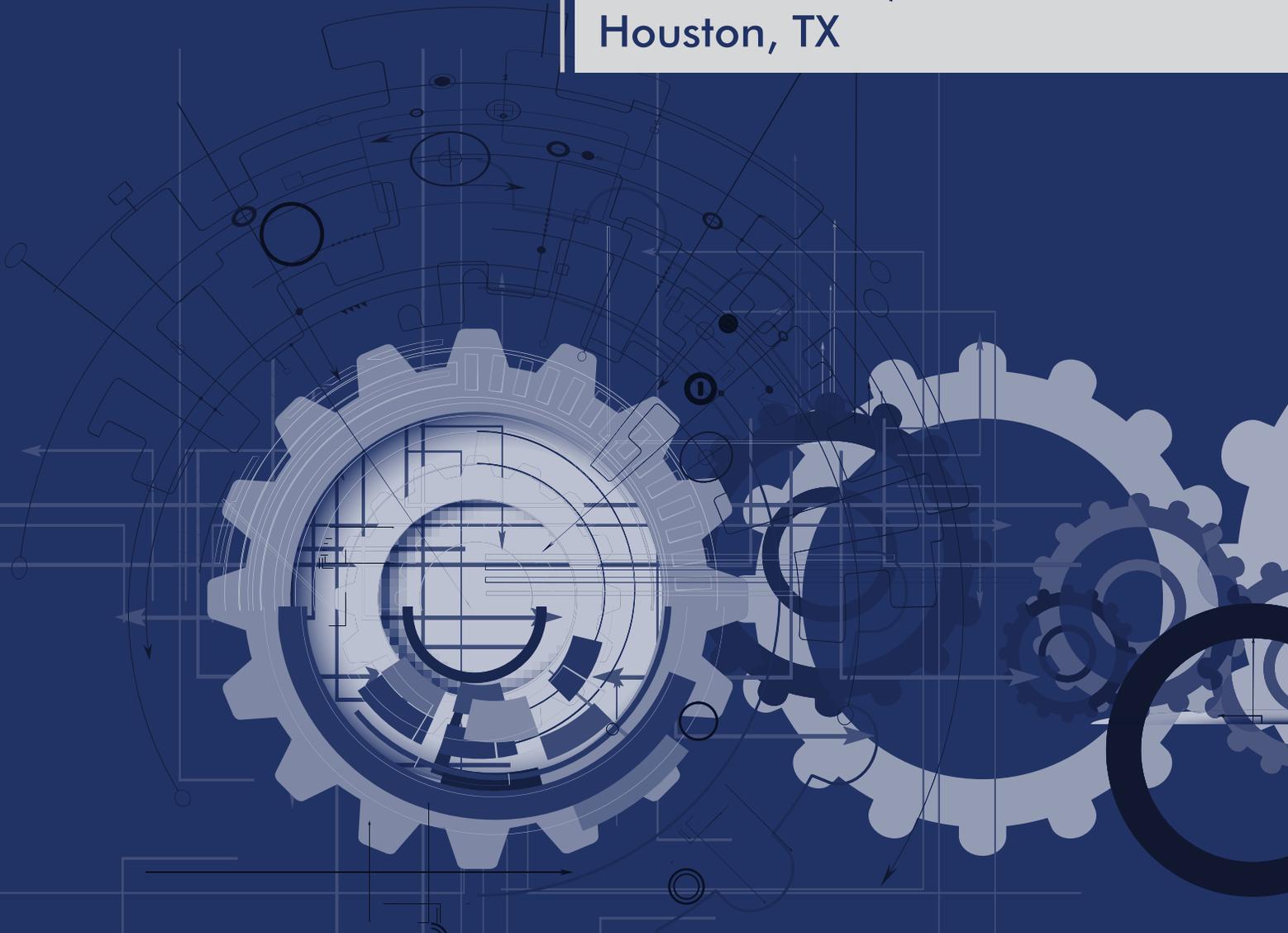




For more information on Engineering Change Lab-USA, contact Executive Director Mike McMeekin at mike.mcmeekin@lamprynearson.com and visit our website www.ecl-usa.org

CLIMATE & EXTREME WEATHER CHALLENGES

Summit 8 Report
March 10 - 11, 2020
Houston, TX



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ECL-USA's vision for the future includes that the engineering community will serve a greater role as stewards of both the natural and the built environments. One of the themes of Summit 8 was to explore this stewardship role with respect to climate and extreme weather challenges, both of which are major issues for Houston and the Gulf Coast. This exploration was accomplished in alignment with our role as a connector of leaders and organizations and as a venue for sharing exemplary work being done throughout the engineering community and by other organizations. In Houston, we learned of an initiative intended to shift the paradigm of design in architecture, of a non-profit based in California that is working to develop leaders in addressing climate change within the educational system, and from a foundation leading a movement to incorporate the principles of environmentally responsible engineering into the higher education curriculum of all engineering programs. We also heard the story of a ground-breaking partnership working to address the threat of storm surge in the Houston area.

Summit 8 was held just as the full impacts of the COVID-19 coronavirus pandemic began to emerge in the United States. ECL-USA appreciates the commitment of the 45 stakeholders and provocateurs who were able to take part in Summit 8 at a time of concern and distraction.

Synopsis of Provocations

DESIGN EXCELLENCE IN THE ERA OF CLIMATE CHANGE

ARCHITECTURE RETHINKS ITS PURPOSE

Corey Squire is an architect and advocate for sustainable design. He is currently splitting his time between Positive Energy, a human-outcome focused mechanical engineering firm, and Dept. of Sustainability, his sustainability strategy consultancy. As a member of the AIA Committee on the Environment (COTE) Advisory Group, Corey is a lead author of the COTE Top Ten Toolkit, a resource that's helping to redefine design excellence for the built environment. He was also part of a group of leaders

within AIA who, at the 2019 AIA National Convention, pushed from the floor of the convention for the adoption of the “Resolution for Urgent and Sustained Climate Action,” an action that provided a “framework for the AIA to prioritize and support urgent climate action to exponentially accelerate the decarbonization of buildings, the building sector, and the built environment.”

Squire’s provocation at Summit 8 traced the deep-rooted history of commitment to the environment within AIA that began with the establishment of the Committee on the Environment (COTE) in the 1990s. Past environmental initiatives within AIA have included the 2030 Challenge, adopted in 2006, that sought to reduce greenhouse gas emissions from buildings through enhanced energy performance, and the adoption of sustainability provisions in the 2018 Code of Ethics.

For several years, COTE has managed an awards program for sustainable design. These awards are based on the COTE Top Ten Measures of Sustainable Design.



Corey Squire, Positive Energy / Department of Sustainability

COTE Top Ten Measures of Sustainable Design



Design for **Integration**



Design for **Energy**



Design for **Community**



Design for **Wellness**



Design for **Ecology**



Design for **Resources**



Design for **Water**



Design for **Change**



Design for **Economy**



Design for **Discovery**

The leaders of COTE recognized that the public conversation on the quality of architectural design has been dominated by style and visual aesthetics. Given the reality that we spend 90% of our time indoors and 99.99% of our time in the built environment, combined with the urgent societal challenges posed by climate change, they saw the need for a shift in the paradigm of architectural design.

Sensing that immediate action to address this need is imperative, these leaders proposed the “Resolution for Urgent and Sustained Climate Action” from the floor of the 2019 AIA Annual Convention. The resolution was overwhelmingly passed by the AIA membership, with 4,860 voting yes, 312 voting no, and 28 abstentions. The impacts of this action have been immediate.

- › AIA, as the representative of the architecture profession, has made a public declaration of an urgent, sustained climate imperative.
- › AIA now seeks to “align and utilize our external messaging to leverage support from our peers.”
- › Transformation of the day-to-day practice of architecture has begun with the adoption of the COTE Top 10 Measures as a new AIA framework for design excellence (see link below).
<https://www.aia.org/resources/6077668-framework-for-design-excellence>
- › AIA has begun working on a Climate Action Plan addressing adaptation, mitigation, and leadership.

Resources



LINK TO COREY SQUIRE’S PRESENTATION

<https://ecl-usa.org/wp-content/uploads/2020/03/Summit-8-Corey-Squire.pdf>



LINK TO AUDIO INTERVIEW WITH COREY SQUIRE

<https://ecl-usa.org/wp-content/uploads/2020/04/Summit-8-Interview-Squire.mp4>

As a key takeaway, Corey Squire stressed the need to re-frame what is perceived as good design and to overcome the tyranny of the minimum threshold. Building codes do not require beauty in buildings, yet architects have always strived for beautiful buildings. The same aspirational view of design can apply to sustainable design.

When they proposed the climate change resolution at the AIA convention, Squire and the other leaders were concerned that the measure may not pass. Instead, the resolution was approved by an overwhelming majority. The engineering community can learn from this experience. It is likely that there is a “quiet majority” within the engineering community that would support a similar bold action and lead the engineering community to increase its role as stewards of our earth.

The Tyranny of the Minimum Threshold



ENGINEERING FOR ONE PLANET

The aspiration for The Lemelson Foundation’s “Engineering for One Planet Initiative” is to ensure that all engineering professionals are equipped with fundamental competencies and skills in environmentally responsible engineering



Cindy Cooper, VentureWell

by transforming engineering education. The initiative aligns with the inspiration for The Lemelson Foundation – Improving Lives Through Invention. The initiative is a joint project between Lemelson and VentureWell.

One of the tools developed by Lemelson and VentureWell is the “Inventing Green” toolkit. The toolkit was developed in recognition of a major gap between the personal values of engineering student innovators and their ideas. VentureWell identified that sustainability was an important personal value for 70% of students, but only 60% had considered the environmental impacts of their design. The Inventing

Green toolkit assists student innovators in...

- › Developing sustainability goals.
- › Incorporating systems thinking that considers impacts on people and planet.
- › Measuring environmental impacts throughout the product or project life cycle.
- › Developing business models that align with sustainable design.

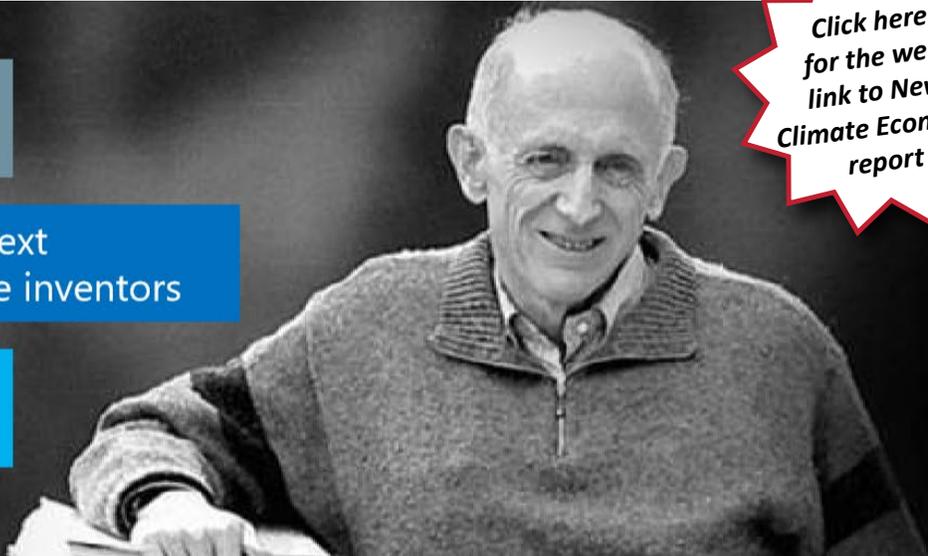
The “Engineering for One Planet” initiative is being developed in recognition of the close ties between invention, entrepreneurship, and engineering. Evidence shows that the supply of next generation engineers with a strong interest in environmentally responsible thinking is increasing and that the demand from society for this type of thinking is also increasing. This demand is reflected in commitments to sustainability from major businesses (Black Rock, Starbucks, Microsoft, etc.) to the Department of Defense. According to a report from “The New Climate Economy,” the economic potential for a shift to a more sustainable world represents a \$28 trillion increase in economic growth through 2030 compared to business-as-usual.

**Click here
for the web
link to New
Climate Economy
report**

Jerry Lemelson
envisioned a program

that would foster the next
generation of collegiate inventors

and help them bring
their ideas to impact



According to Cooper, history also demonstrates our ability to create major change in reaction to great needs. Consider our progress in reducing deaths from disasters, child mortality, hunger, ozone depletion, plane crash deaths, and the cost of solar energy.

Cooper described the “Engineering for One Planet” roadmap to transforming engineering education curriculum to incorporate the principles of environmentally responsible engineering for all engineering disciplines. The process has involved input from across the entire engineering community – academia, businesses, NGO’s, and government. The major deliverable to date is the framework for “Environmentally Responsible Engineering: Core Student Learning Outcomes” that outlines outcomes in the core areas of...

- › Environmental Literacy
- › Responsible Business & Economy
- › Social Responsibility
- › Environmental Impact Measurement
- › Materials Choice
- › Design
- › Critical Thinking
- › Communication & Teamwork

Next steps in the process are to...

- › Connect to engineering professionals and engineering educators for feedback on the draft ERE Framework.
- › Initiate pilot grants with a handful of higher education institutions to use the ERE Framework to generate changes in engineering curricula.
- › Share the Engineering for One Planet initiative more broadly and build the global network of individuals and organizations that are supportive of the initiative.

Cooper concluded by inviting everyone in the engineering community to consider that we are all part of “engineering for one planet” through...

- › What we say and do.
- › Who we hire.
- › How we support and catalyze changes in education.

ENVIRONMENTALLY RESPONSIBLE ENGINEERING: CORE STUDENT LEARNING OUTCOMES



Resources



LEARN MORE ABOUT THE LEMELSON/
VENTURE WELL “ENGINEERING FOR ONE
PLANET”

<https://venturewell.org/environmentally-responsible-engineering/>



LINK TO CINDY COOPER’S PRESENTATION

<https://ecl-usa.org/wp-content/uploads/2020/03/Summit-8-Lemelson.pdf>

Building Leaders to Drive Climate Solutions

Strategic Energy Innovations (SEI) is a nonprofit, based on the West Coast, that builds leaders to drive climate solutions. In founding SEI, Cyane Dandridge sought to utilize her engineering background to generate bottom-up action to address climate change and create sustainable communities.

Dandridge began her provocation by reminding the Summit 8 attendees of the world that we are designing for. She presented several key elements of this world.

- › Population Growth – global population projected to increase to 10 billion by 2050.
- › Plastic Waste – only about nine percent of all plastic produced has been recycled.
- › Extreme Weather Events – resulting in economic losses of \$653 billion over the last two years.

Echoing key points that stakeholders of ECL-USA have heard from multiple provocateurs and thought leaders, she described engineering as a high leverage point for change in the world through our ability to impact REMEDIATION, ADAPTATION, MITIGATION AND REGENERATION. She reminded us again that the degree of engineering’s future impact will depend on the ability to adopt systems thinking, understanding

the connections of engineering to other technologies, social systems, and natural systems.

In its over 20 years of operation, SEI has focused on building leadership capacity through K-12 curriculum, career technical education, college internships and early workforce training. SEI’s flagship programs, which are described below, seek to integrate climate education with training for valuable careers in the workforce.



Cindy Cooper, Founder and Executive Director, Strategic Energy Innovations

- › Energize Schools. Engaging, inspiring, and empowering K-12 students to become environmental leaders through hands-on learning.
- › Energize Colleges. Partnerships with colleges and universities that provide opportunities for student sustainability career exploration and skills development.

Education



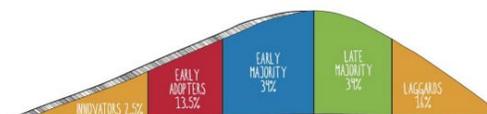
ENERGIZE SCHOOLS



SCHOOL OF ENVIRONMENTAL LEADERSHIP



DIFFUSION OF INNOVATION



Workforce Development



David Leibman,
Climate Corps Fellow
& now Energy and
Sustainability Manager



Alondra Santarriaga-Meza,
Climate Corps Fellow,
Jr. Project Designer



Ashley Manning,
Energize Colleges Fellow,
Energy Master Planning

- › School of Environmental Leadership. Comprehensive high school program designed to develop environmental leaders through development of skills in communication, collaboration, critical thinking, and creativity.
- › Climate Corps. Fellowship program that recruits and places climate professionals with local governments, non-profits, educational institutions and businesses to implement climate change mitigation and resiliency projects.

Dandridge encouraged the engineering community to reflect and commit to a set “audacious goals” and find the “engineering equivalents” to the path followed by the legendary Ray Anderson of Interface Carpets. She invited all to join in the work of SEI.

- › Sponsor schools for climate education.
- › Invest in the development of climate curriculum for engineering colleges.
- › Hire a climate intern in our organizations.

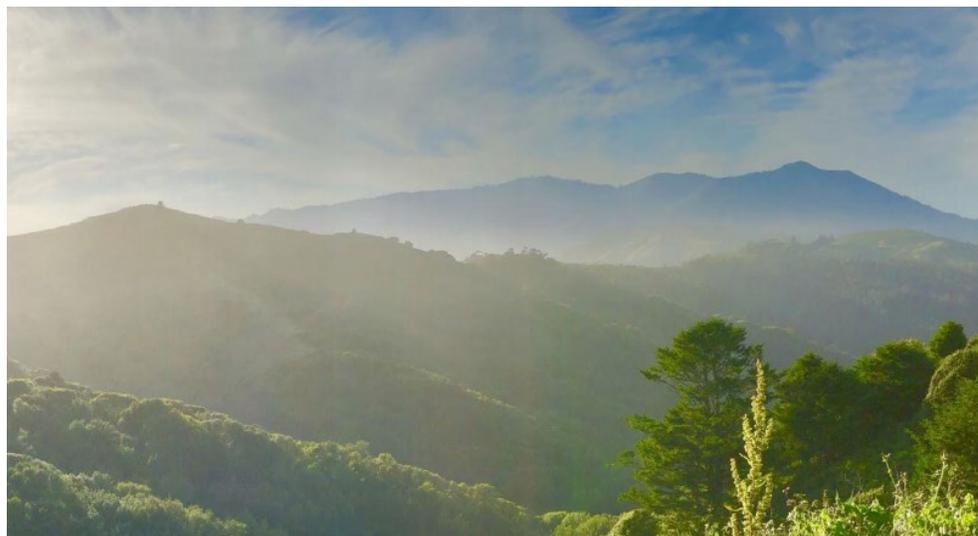
These programs are all described in more detail on SEI’s website <https://www.seiinc.org/>.

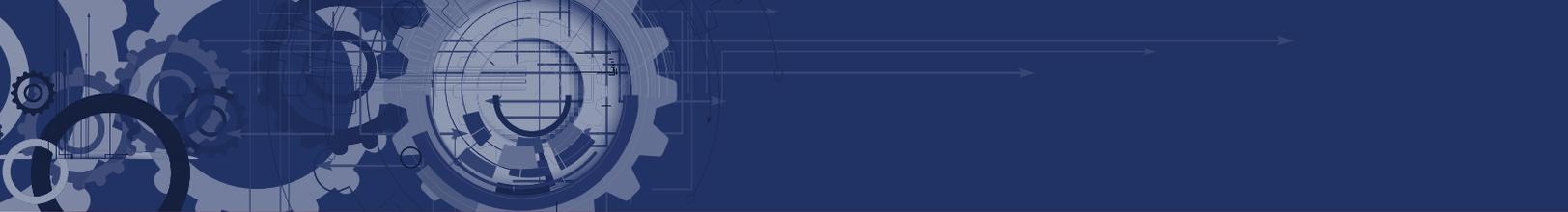
Resources



LINK TO CYANE DANDRIDGE’S PRESENTATION

<https://ecl-usa.org/wp-content/uploads/2020/03/Summit-8-Cyane-Dandridge.pdf>





Group Dialogue – What do we think we know about leading the adaptive work required for our communities and society to respond to climate and extreme weather challenges?

A tradition of the ECL-USA summits is to engage in dialogue about the learning that we experience from our provocateurs. Dialogue allows participants to reflect and inquire and to learn from others' reflections and inquiries. At Summit 8 our dialogue centered on the question, "What do we think we know about leading the adaptive work required for our communities and society to respond to climate and extreme weather challenges?" The perspectives from this dialogue are captured below.

PERSPECTIVES OF CONCERN

- › There is reluctance to engage on climate action that is influenced by a fierce, persistent, vocal minority opposition to acknowledging the reality of climate change.
- › We are fighting against the perception that the work of engineers has been evil and damaging.
- › The issue of climate change has become political and people's positions are based on tribalism rather than fact or science.
- › There is fear and reluctance of the need for lifestyle change.
- › There are financial costs to making individual decisions that minimize impacts on the environment, and inequity in the ability to afford making these decisions.
- › Are we arrogant in thinking we can "educate?"
- › Timing is a concern – can we afford to wait for young people to take action?
- › Climate change is not the only problem that needs to be addressed, and others place a higher value on other needs.

HOPEFUL PERSPECTIVES

- › The AIA Climate Change Resolution was approved by 93% of the membership.
- › Engineering has contributed to the protection of the environment, and we should capture these contributions through story-telling in common language.
- › We have a history of successful pivots – ozone, etc.
- › The best time to act is now – society has shifted in their viewpoint more than we realize.
- › The potential for taking action can be improved by de-emphasizing the discussion of the causes of climate change.
- › There is a need to navigate the value tensions with a clear view of reality.
- › There is a \$26 trillion economic opportunity.

Galveston Bay Coastal Surge Protection Study

Few areas face the increased threats from climate change and severe weather being faced by the Houston area. One of these threats is the potential for storm surge from hurricanes in the Gulf of Mexico. A ground-breaking, multi-disciplinary partnership between the private sector and academia is working to plan a massive project that would greatly increase the area's resilience to storm surge. At Summit 8, we learned more about the "Galveston Bay Coastal Surge Protection Study" from two of the project's leaders, Dr. Phil Bedient, Director of the Rice University Severe Storm Prediction, Education and Evacuation from Disaster (SSPEED) Center and Charlie Penland, Director of Civil Engineering Services for Walter P. Moore.

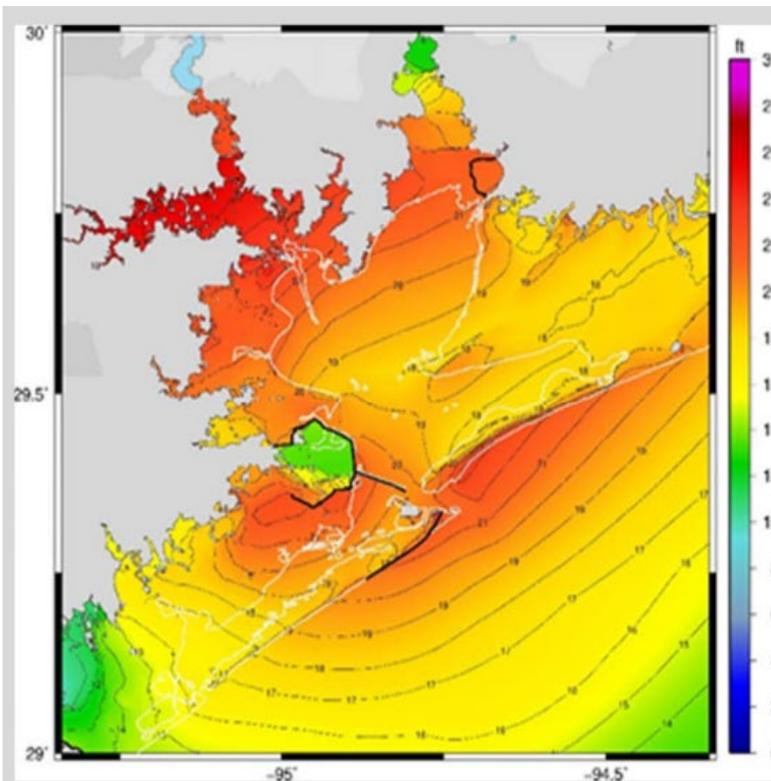
The Houston region faces massive potential risks from storm surge from a Category 3 or Category 4 hurricane and unimaginable risk from a Category 5 storm. Experience from recent storms and storm surge modeling have demonstrated the potential for overtopping and failure of existing seawalls that could result in human, environmental, and economic disaster beyond belief. Modeling of design storms based on historical precedents indicate the potential for over 25 feet of storm surge in the Houston Ship Channel.



Dr. Phil Bedient



Charlie Penland



Storm 36 Surge Modeling

Landfall - San Luis Pass

25 Feet impact in
Houston Ship Channel

Smaller Than Irma and Maria

Does Not Include
Sea Level Rise of 3-4 ft

From: Dr. Clint Dawson – UT Austin

The goal of the study is to develop a regional, comprehensive approach to storm surge risk management that includes multiple lines of defense.

- › Higher and more extensive levees.
- › Navigation channel gates.
- › Raising roads.
- › Enclosed dredge containment berms.
- › Restoration of oyster reefs.

The multi-disciplinary team is seeking to “Break the Frame” of traditional approaches to flood protection.

Factors contributing to the project’s “frame-breaking” include these...

- › Private funding of the study as opposed to traditional public-sector funding.
- › Vision and motivation to create a project with long-term value.
- › Ability to assemble the project team outside of typical procurement processes.

“ **PROBLEMS CANNOT BE SOLVED BY THINKING WITHIN THE FRAMEWORK IN WHICH THE PROBLEMS WERE CREATED.** ”
– **Albert Einstein**

- › Ability to define and structure the problem as the team felt was appropriate.
- › Freedom from the bounds of normal rules and standards.
- › Freedom from the influences of the political process that enabled the team to...
 - o Talk about climate change as a factor in the need for the project.
 - o Design for the level of storm felt to be appropriate for a project that would exist for many decades.

Elements of the Galveston Bay Park Plan

- 1 Houston-Galveston industrial complex & West-side Protection to 25 Feet
- 2 Texas City Levee Raised to 25 Feet
- 3 Backside Levee around Galveston
- 4 Elevated FM 3005 and Highway 87 for Evacuation
- 5 Sand Nourishment for Beach
- 6 Possible Extension of Galveston Levee to Pelican Island



As the work on the project has progressed, the team has identified other factors contributing to its early success.

- › Early step of a small number of leaders that “read the situation and acted” by convening a dinner of like-minded stakeholders that was used to motivate people and mobilize first steps.
- › Importance of a compelling vision – in this case focused on the magnitude of the potential disaster to the region.
- › Listening to feedback from the public and being flexible and willing to change.
- › Seizing the opportunities to incorporate multiple purposes into the project.
 - o Ship channel widening.
 - o Public access and park.
- › Collaborating with the perceived competition, i.e. USACE.
- › Building consensus throughout the region.
- › Pro bono work provided by Walter P. Moore.
- › Non-traditional, multiple funding sources.

Bedient and Penland both emphasized that the Galveston Bay Project is an example of taking advantage of an opportunity to convene people to take action. Engineers have the contacts to initiate these types of action.

You can learn more about the work of the SSPEED Center at the following link <https://www.sspeed.rice.edu/>.

Resources



LINK TO PHIL BEDIENT AND CHARLIE PENLAND'S PRESENTATION

<https://ecl-usa.org/wp-content/uploads/2020/03/Summit-8-Galveston-Bay.pdf>



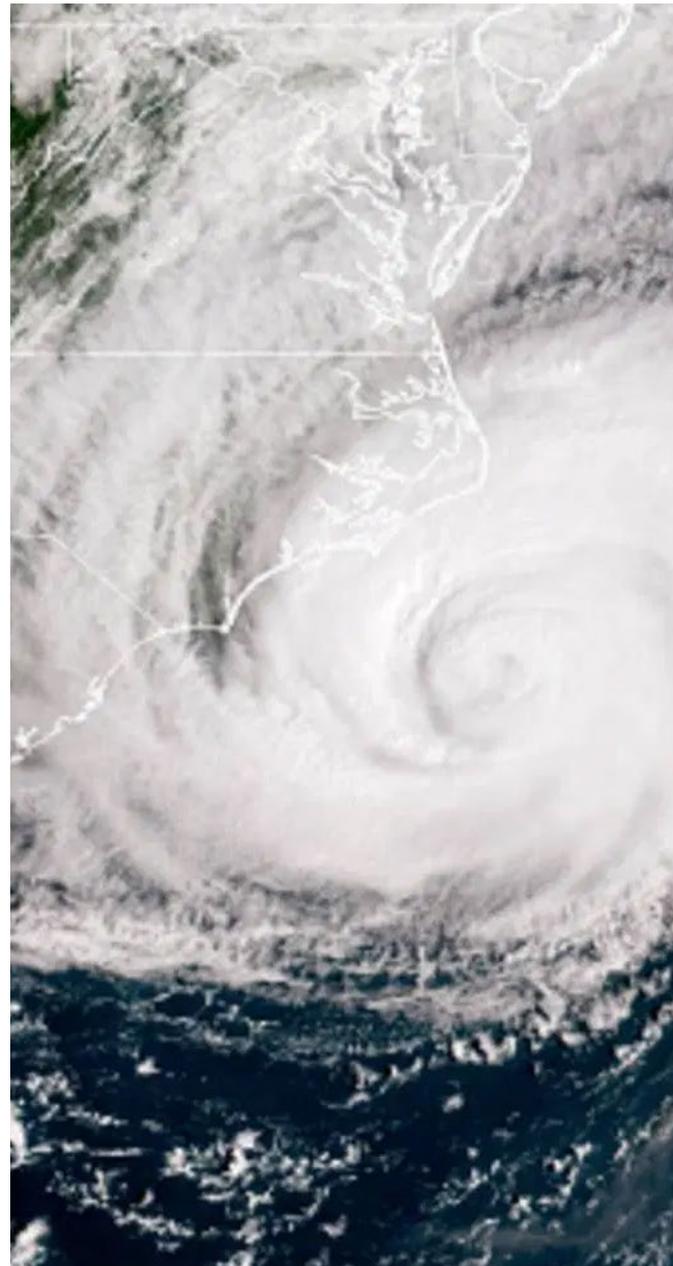
Group Discussion Takeaways

What roles can engineers play to address climate and extreme weather challenges? What are the responsibilities associated with those roles? What are best practice examples of engineers fulfilling these roles? What are the implications for the future of engineering? Attendees concluded Summit 8 by reflecting on and discussing these important questions. Key learnings and take-aways are described below.

Roles Engineers Can Play to Address Climate and Extreme Weather Challenges

- › Lead Convener of and Collaborator with Stakeholders.
- › Lead Collaborator / Connector of Non-Traditional Teams.
- › Proactive Generator of Solutions, Alternatives, Scenarios.
- › Lead Communicator- Humanizing Problems and Influencing Using Traditional and New Communication and Data Visualization Tools.
- › Steward of Information.
- › Challenger of Standard Processes and Status Quo / Driver of Change in Standards.
- › Elevator of Priority.
- › Risk Identifier – through use of understandable language and story-telling.
- › Traditional Role as Technical Expert – including new types of expertise such as life-cycle cost and impact analysis.
- › Strategic Investor of Expertise – even through pro bono work.

Climate and extreme weather challenges of the 21st Century present many opportunities for the engineering community to serve in a leadership and stewardship role on behalf of society. These opportunities exist through our contributions to the education of new engineers and through the work we do in practice. ECL–USA will explore these issues further at our next summit, The Engineering Ideas Institute in the summer of 2020. We welcome your participation.



If you are interested in learning more about Engineering Change Lab – USA, contact Mike McMeekin, Executive Director (mike.mcmeekin@lamprynearson.com).