

## Proposed National Science Foundation Engineering Research Center for Gigatechnology



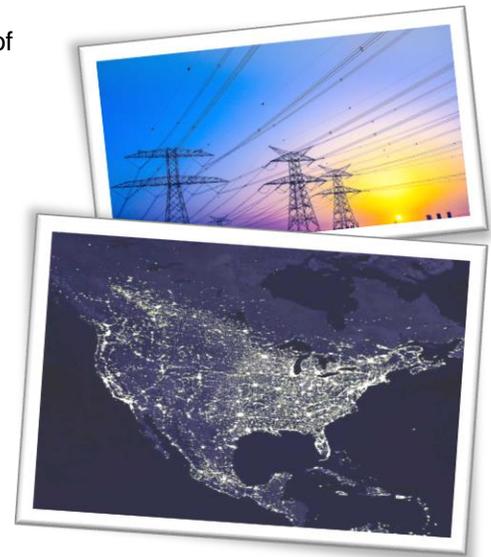
Syracuse University



Stanford University



**G**igatechnologies are the largest engineered structures with which humans manipulate mass and energy. They include electric power grids; networks of roadways; municipal water systems; mazes of pipelines; global supply chains; webs of connected communications, sensors, and computing devices; and clusters of buildings that aggregate to form blocks, neighborhoods, and cities. Problems arise because these systems are designed, built, and maintained within silos. Failure to recognize the interconnections among infrastructure systems, and with the social, economic, and environmental systems in which they reside, results in sub-optimal or unintended outcomes. The ERC for Gigatechnology (Te9) will create a newly convergent and use-inspired science and engineering transdiscipline committed to the study of the interconnections and interdependencies among very large engineered systems of energy, water, transportation, and buildings, and the emergent properties that result from these interactions. Furthermore, a new platform for integrating gigatechnologies and a diverse workforce produced by Te9 will lay the foundation for a transcendent approach to infrastructure engineering that results in cities that generate more equitable wealth and health at reduced costs, with less waste, and lower resource investments.



**Te9** has three research thrusts, and three crosscutting initiatives. **Research Thrust 1** will empirically establish the basis for a common science – infrastructure ecology – and the methods for quantifying and qualifying the impacts, interconnections, and interdependencies among gigatechnologies and their interactions with social, economic, and natural systems. In **Research Thrust 2**, researchers and practitioners will partner to build a platform that allows investigators, developers, and planners, to connect large and complex infrastructure, environmental, economic, and social systems models and datasets and to quickly analyze their interactions and impacts across a holistic community at multiple temporal and spatial scales. **Research Thrust 3** looks at new means for engaging large numbers

of people in complex infrastructure decision making, and ensuring that infrastructure decisions reflect communities' shared values, preferences, and interests. The goal of **Cross-cutting Initiative 1** – workforce development – is to recruit, retain, and educate the first generation of “gigatechnologists” to work in interdisciplinary teams that reflect the diversity of the cities they serve, and to address complex infrastructure issues that cannot be solved through traditional reductive and non-convergent approaches. In **Cross-cutting Initiative 2**, Te9 will build a culture of inclusion that increases diversity and participation of female, underrepresented minority, disabled, and LGBTQIA individuals in STEM at all K-12 and university levels, and in leadership positions within academia, industry, government, and NGOs. In **Cross-cutting Initiative 3**, investigators will collaborate with practitioners in the public, private, and non-profit sectors to build an innovation ecosystem and serve as translational agents of change for creating more sustainable and resilient infrastructure.

**Outcomes:** Te9 will 1) create the world's leading center of research, education, and practice in sustainable infrastructure systems; 2) develop a diverse and broadly representative workforce, trained in a transdisciplinary environment, that can address complex problems of societal importance, and can communicate their work and its relevance to diverse audiences; 3) test and validate pathways for improving the sustainability, resilience, costs, and benefits of infrastructure systems; 4) integrate scientific research and engineering solutions into public and private decision making processes; and 5) partner with the public and private sectors to expeditiously transfer knowledge and technology into the marketplace of policies, products, and services.



**Key Dates** Preliminary Proposal: Submitted January 16, 2019  
Full Proposal: Due **July 12, 2019**

Contacts: **Georgia Tech**, John Crittenden, [john.crittenden@ce.gatech.edu](mailto:john.crittenden@ce.gatech.edu)  
**Syracuse University**, Cliff Davidson, [davidson@syr.edu](mailto:davidson@syr.edu)  
**The University of Texas at El Paso**, Miguel Velez-Reyes, [mvelezreyes@utep.edu](mailto:mvelezreyes@utep.edu)  
**Stanford University**, Michael Lepech, [mlepech@stanford.edu](mailto:mlepech@stanford.edu)