



# SERC 2014-2018 Strategic Technical Plan

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*and*

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**5<sup>th</sup> Annual SERC Sponsor Research Review**

**February 25, 2014**

**Georgetown University**

**Hotel and Conference Center**

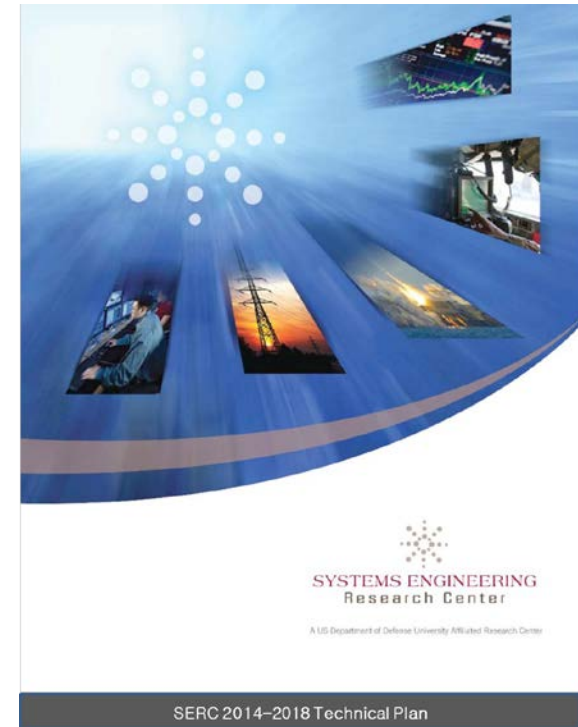
**Washington, DC**

**[www.sercuarc.org](http://www.sercuarc.org)**

# The Systems Research and Impact Network

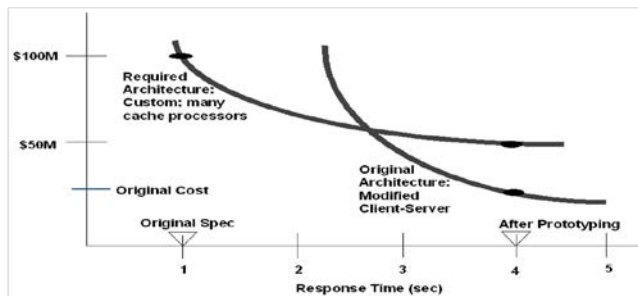


- Provide the vehicle to align the SERC Vision and Research Strategy with the Sponsor's Core funding priorities
- Describe the SERC Vision, the Sponsor's needs, and the SERC's response to these needs
- State DoD's SE research *grand* challenges and how the SERC will apply core and other funding during 2014-2018 to address them
- Provide a multi-year roadmap of research programs to support this strategy.



# SE and Management Transformation: Affordability and Value in Systems

- System ilities have systemwide impact
  - System elements generally just have local impact
- Ilities often exhibit asymptotic behavior
  - Watch out for the knee of the curve
- Best architecture is a discontinuous function of ility level
  - Large system example below
  - Highly risky to “Build it quickly, tune or fix it later”
    - Complementary RT-40 addresses quantitative risk assessment



## Status:

- Tradespace and affordability analysis foundations
  - More precise ility definitions and relationships
  - Stakeholder value-based, means-ends relationships
  - Iility strategy effects, synergies, conflicts
  - U. Virginia, MIT, USC
- Next-generation system cost-schedule estimation models
  - Initially for full-coverage space systems (COSATMO)
  - Extendable to other domains
  - USC, AFIT, GaTech, NPS
- Applied iTAP methods, processes, and tools (MPTs)
  - For concurrent cyber-physical-human systems
  - Experimental MPT piloting, evolution, improvement
  - Wayne State, AFIT, GaTech, NPS, Penn State, USC

**Summary:** Create, validate, and transition MPTs to make better decisions on affordability and value in systems, particularly for non-functional requirements or -ilities

## Impact:

- Engagements with NAVSEA, Army RDECOM on ility tradespace analysis in set-based design, use of GaTech FACT tradespace analysis capability
- Engagements with USAF/SMC, Aerospace Corp., and aerospace companies on definition and development of next-generation, full-coverage space system cost estimation model
- Development and iteration with DoD, industry of initial framework and quantification of ility definitions, stakeholder value-based, means-ends relationships, and Iility strategy synergies and conflicts with other ilities



**Stakeholders** propose challenging projects

- Require systems thinking across multiple disciplines



**Students** volunteer to participate

- Select their own projects
- Teams are self-organizing



**Faculty** provide guidance and academic assessment

- Advise stakeholders on expectations
- Advise students on plans and methods
- Assign grades to students

## Pilot 2012-2013 Academic Year

- **Humanitarian assistance and disaster recovery kit and Dual use ferry**

— Stevens Institute of Technology, University of Alabama in Huntsville



- **Satellite radiometer**

— Southern Methodist University, University of Hawaii at Manoa



- **Immersive training system**

— Missouri University of Science and Technology, University of Hawaii at Manoa



**Summary:** Building and piloting the infrastructure to affordably scale capstone projects nationwide between 2014 and 2018 and improve how thousands of students are taught engineering across the US.

## Status:

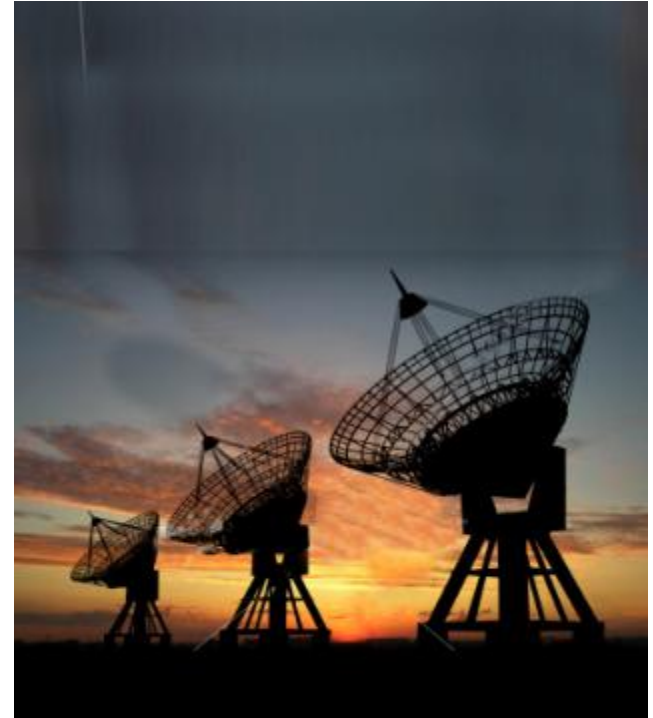
- Created registry website
- Matched schools and sponsors on 3 projects in pilot year
- Solicited 24 project proposals from sponsors in 2014-2014 academic year
- Identified successful capstone practices

## Impact:

- Create robust infrastructure to support large-scale involvement of universities, students and organizations
- Integration of systems engineering into engineering curricula



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National Resource  
to further  
systems research and  
its impact on  
issues of  
national and global significance



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