

Systems Engineering Research Center (SERC)

A unique DoD UARC developing a Systems Research Network



NDIA SE Division Meeting – February 2019

Dr. Dinesh Verma, Executive Director

This material is based upon work supported, in whole or in part, by the U.S. Department of Defense through the Systems Engineering Research Center (SERC) under Contract H98230-08-D-0171. The SERC is a federally funded University Affiliated Research Center (UARC) managed by Stevens Institute of Technology consisting of a collaborative network of over 20 universities. More information is available at www.SERCuarc.org

- UARCs are strategic US Department of Defense research centers associated with one or more universities. UARCs were established to ensure defense critical engineering and technology capabilities are maintained and advanced. Collaboration with university educational and research resources is essential to their mission. These not-for-profit organizations maintain long term strategic relationships with their DoD sponsors and operate in the public interest, free from real or perceived conflicts of interest.
- Although UARCs receive sole source funding, they may also, in some circumstances compete for science and technology work.

- UARCs are competitively awarded under the same FAR as FFRDCs and GOCOs
- UARCs are funding based vice STE/FTE (i.e. FFRDCs)
- UARCs have additional attributes such as
 - Accepting work from other DoD funding sources via the UARC Prime Sponsor (i.e. USD R&E for SERC)
 - Implementing non-Prime Sponsor UARC-based relationship for multiple DoD contracting activities (replication/slave) tailored to meet additional sponsors needs like Army has done for SERC in 2018
 - Ability to pursue competitively awarded contractual relationships
- SERC has ability to add additional academic collaborators as may be needed/deemed necessary

The Stevens/USC UARC - SERC: A Brief History

- In 2008, the DoD released a full and open competitive RFP for a University Affiliated Research Center (UARC) on systems engineering research
- Stevens Institute of Technology led a team that brought together much of the best systems engineering research talent in the nation to form a stable and enduring collaboration to the benefit of the DoD
- Stevens was awarded the SERC in September 2008
 - Vested through a 5-year, renewable, task order based IDIQ contract with DoD
 - Contract renewed in September 2013 (POP Sep 2013 – Sep 2018); Currently in the process of being renewed for the next five years (POP 2018-2023)
 - A second 5 year contract with ACC at Picatinny Arsenal was awarded in Summer of 2018 – this allows outreach of the SERC to the rest of the Federal Agencies
- SERC has been awarded over \$70M in research tasks (from 2008–2018)
- SERC is unique among UARCs
 - Only UARC funded at the DoD level – USD(R&E)
 - Only UARC consisting of a collaborative network of universities
 - Only UARC created to address the entire domain of systems engineering – education, research, and practice

SERC Government Executive Advisory Board

- Ms. Kristen Baldwin, OUSD (R&E) (Chair)
- Mr. Scott Lucero, OUSD (R&D) – Program Manager
- Representatives from DoD Service Components (Army, Navy, Air Force), NSA, DNI, NASA, FAA, NIST, DHS, and NOAA/NWS

SERC Advisory Board

- MG Curtis M. Bedke, USAF (Retired)
- LTG Ted Bowlds, USAF (Retired)
- Ms. Victoria Cox, Former Assistant Administrator for NextGen, FAA (Retired)
- Dr. Ruth David, President and CEO, ANSER
- Mr. Al Grasso, President and CEO, MITRE
- **Dr. Paul Kaminski, CEO, Technovation, Inc. (Chair)**
- MG Nick Justice, US Army (Retired)
- Mr. David Long, President, INCOSE
- Dr. Stephen Rottler, Vice-President, Sandia
- CAPT Bill Shepherd, US Navy (SEAL, Astronaut – Retired)
- **Mr. Mike Wynne, 21st AF Secretary (Chair Emeritus)**

SERC Management

- Dr. Dinesh Verma, Executive Director (Stevens Institute of Technology)
- Dr. Barry Boehm, Chief Scientist (University of Southern California)
- Mr. Thomas McDermott, Deputy Director (Stevens Institute of Technology)
- Dr. Jon Wade, Chief Technology Officer (Stevens Institute of Technology)

The Systems Research and Impact Network



Carnegie Mellon



STEVENS
INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY

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

- **Catalyze** SE researchers and end users
- **Accelerate** SE competency development
- **Transform** SE practice



PENNSTATE



UMASS
AMHERST



UNIVERSITY OF
MARYLAND



GEORGETOWN UNIVERSITY



VIRGINIA TECH.



UNIVERSITY
of VIRGINIA



OLD DOMINION
UNIVERSITY



NAVAL
POSTGRADUATE
SCHOOL



THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE



TEXAS A&M
UNIVERSITY



AUBURN
UNIVERSITY



NORTH CAROLINA AGRICULTURAL
AND TECHNICAL STATE UNIVERSITY



Ability to conduct long-term, comprehensive SE research focused on DoD acquisition, including:

- Enable integrated development and management
- New ways to link requirements to design
- Leverage modeling and simulation
- Link technical baselines to architectures
- Apply SE to acquisition of services

Ability to leverage developments in systems architecting, complex systems theory, systems thinking, systems science, knowledge management and SwE to perform research to advance the design and development of complex systems across all DoD domains, including:

- System and open systems architecture/analysis
- SE in complex SoS and FoS environments
- Enterprise SE
- SW-unique extensions and modern SW-development technology
- Flexible SE environment
- Knowledge management
- Undergraduate/Graduate SE education needs

Ability to leverage developments in open systems standards, organizational theory, program management, SE management, and IT to provide needed integration of program/technical management MPTs, including:

- Integrate TPMs with EVM
- Maturity reviews
- SE team structures, etc. for improvement
- Improved SE information sharing
- Rationale and way ahead for standards
- Toolsets throughout the life cycle
- Analyzing SE costs, accounts, and ROI
- SE metrics and leading indicators



Enterprises and SoS

- *Comprehensive Enterprise/SoS Modeling and Analysis*

Trusted Systems

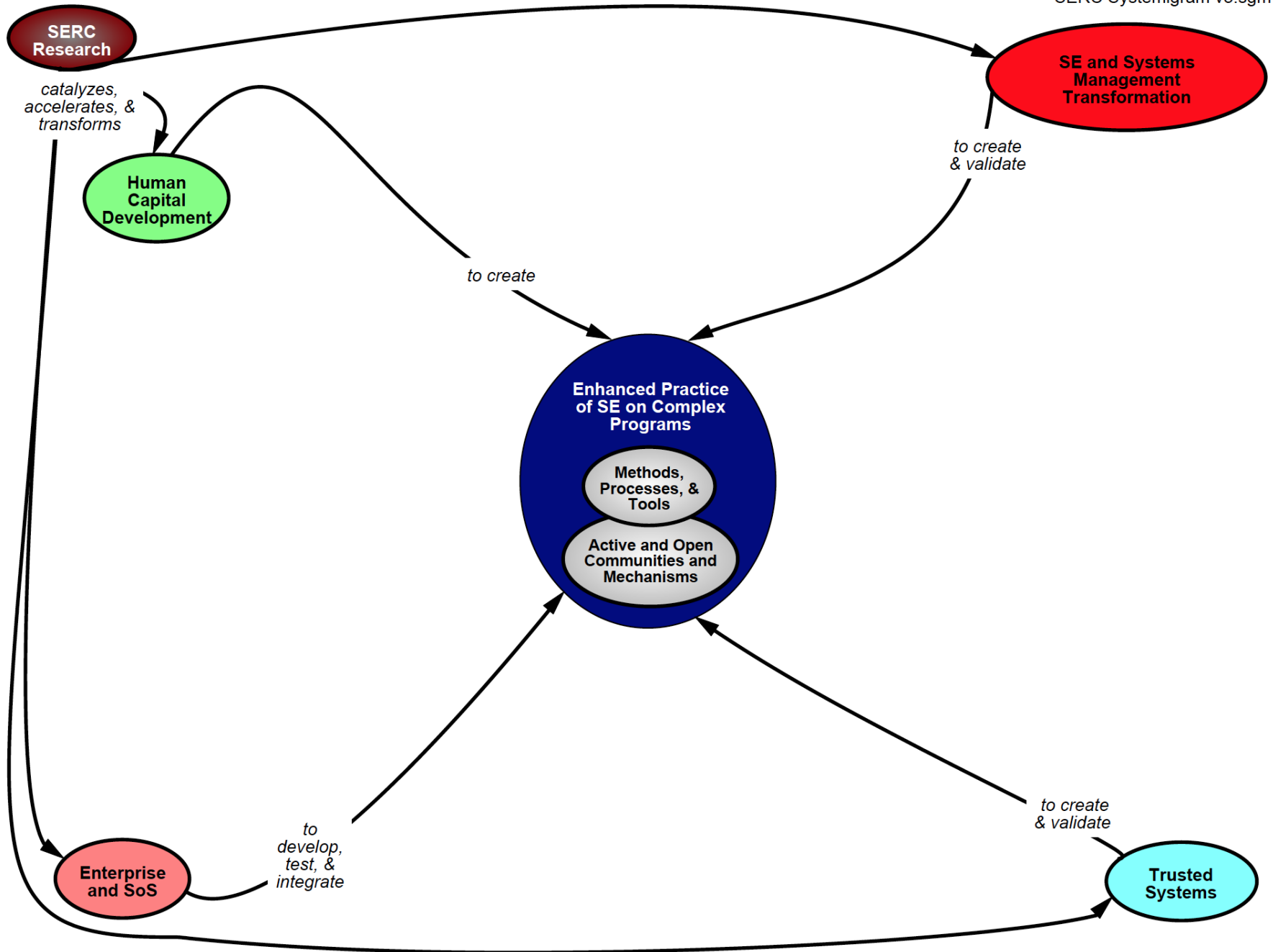
- *Systemic Security*
- *Systemic Assurance*

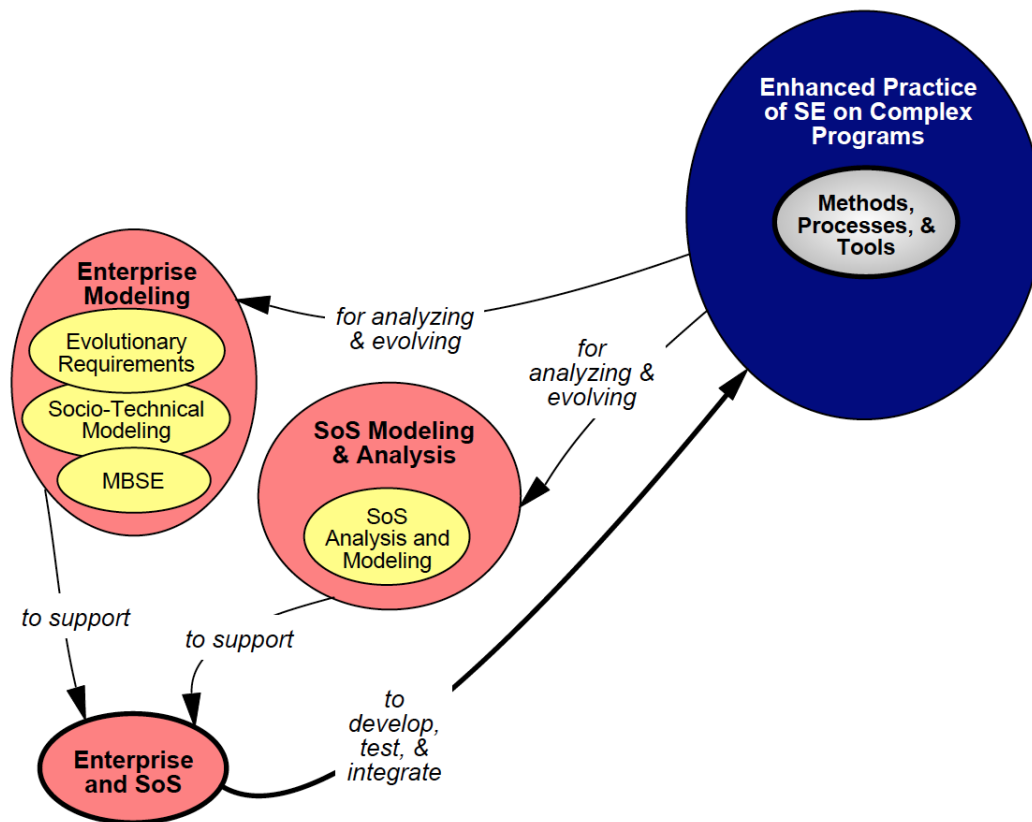
Human Capital Development

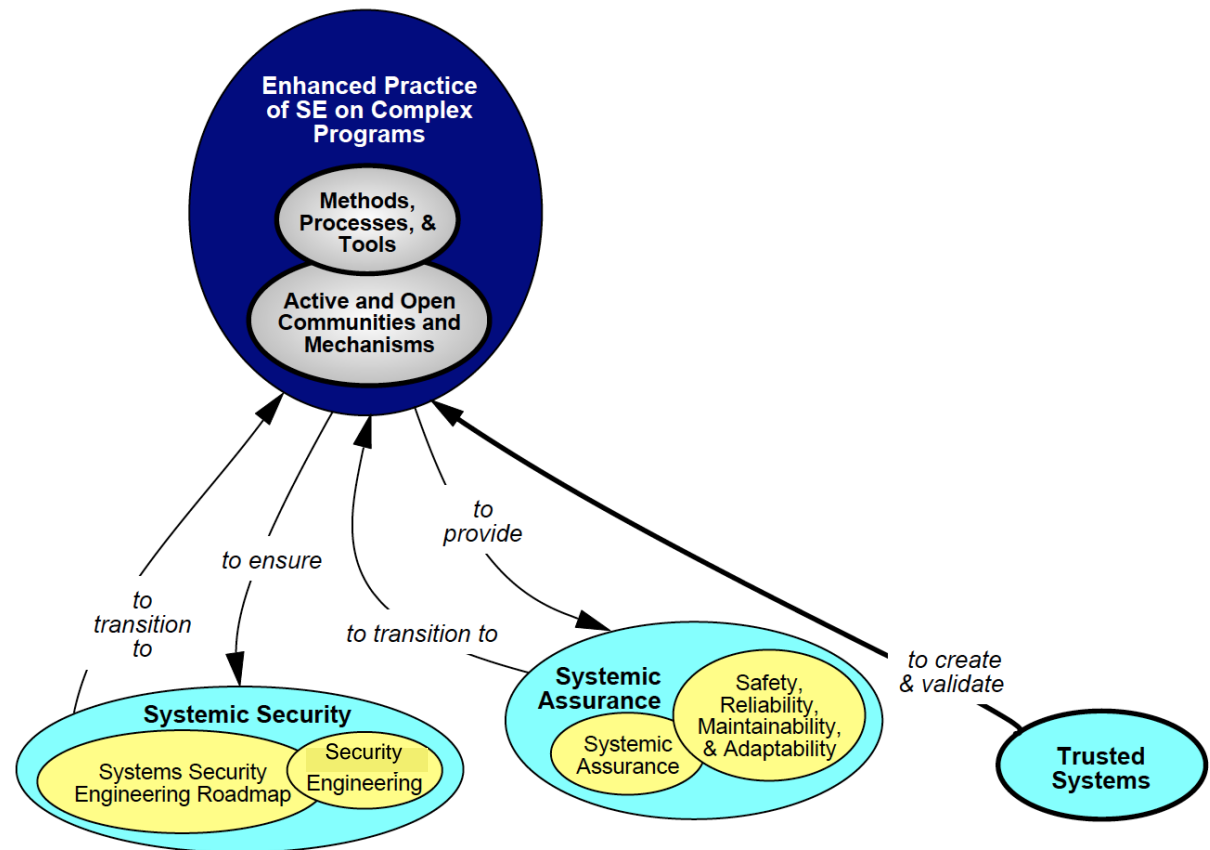
- *Evolving Body of Knowledge*
- *Experience Acceleration*
- *SE and Technical Leadership Education*

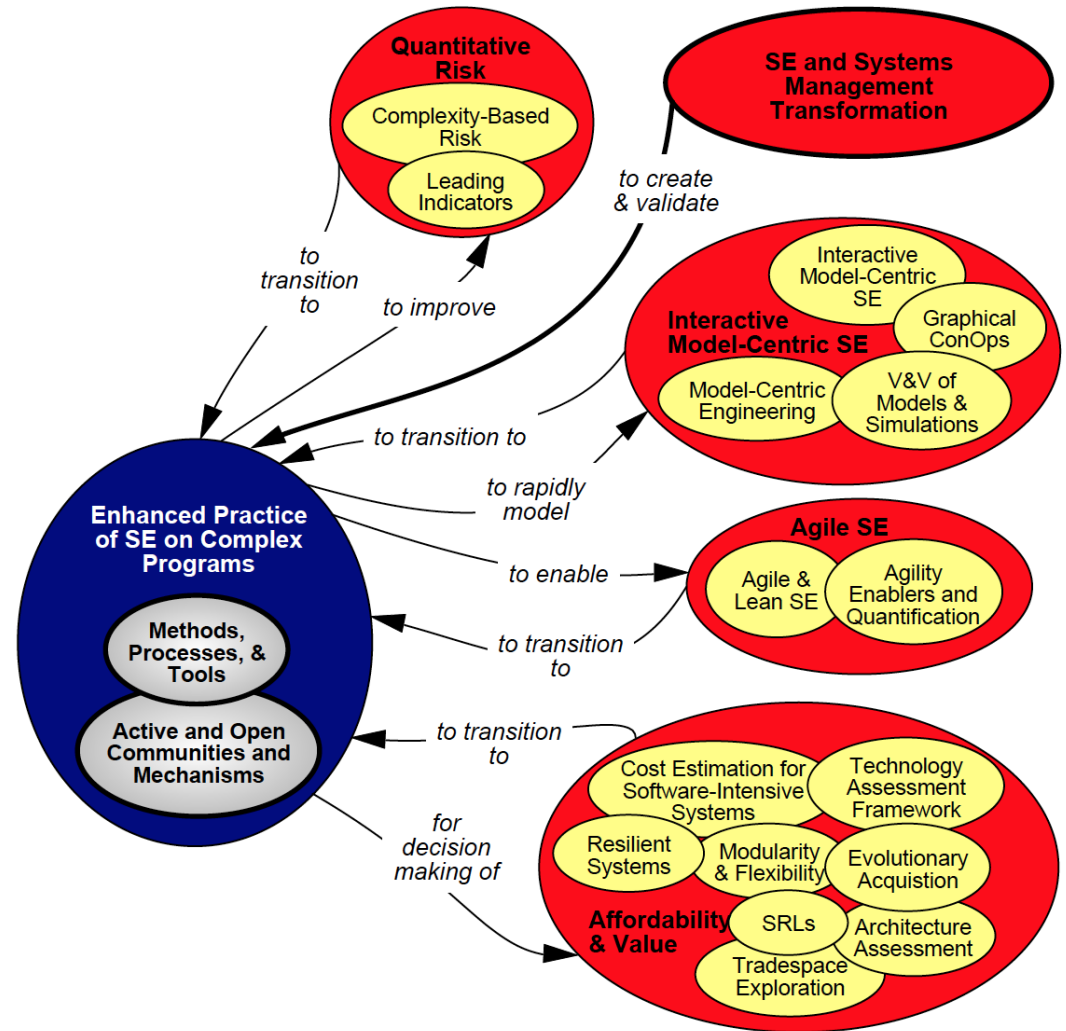
SE & Systems Mgmt Transformation

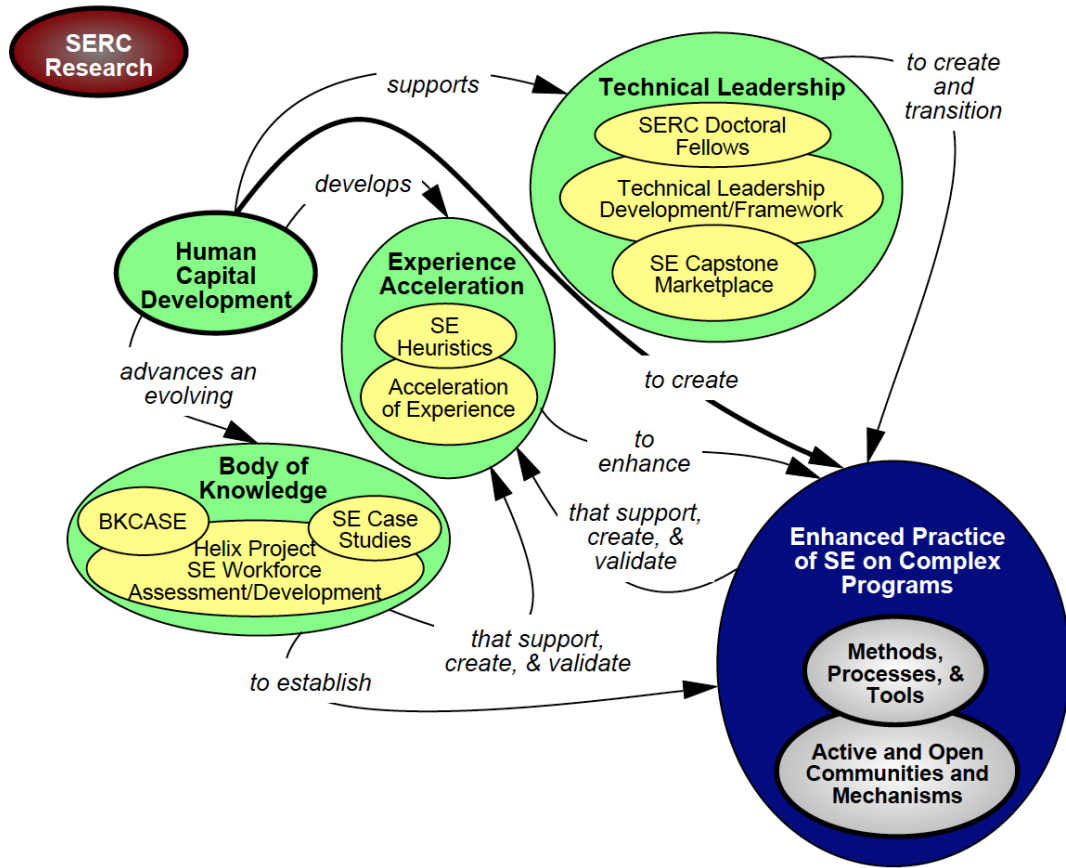
- *Digital Engineering*
- *SE Methods for AI and Autonomous Systems*
- *Systems Engineering for Velocity and Agility*
- *Mission Engineering*

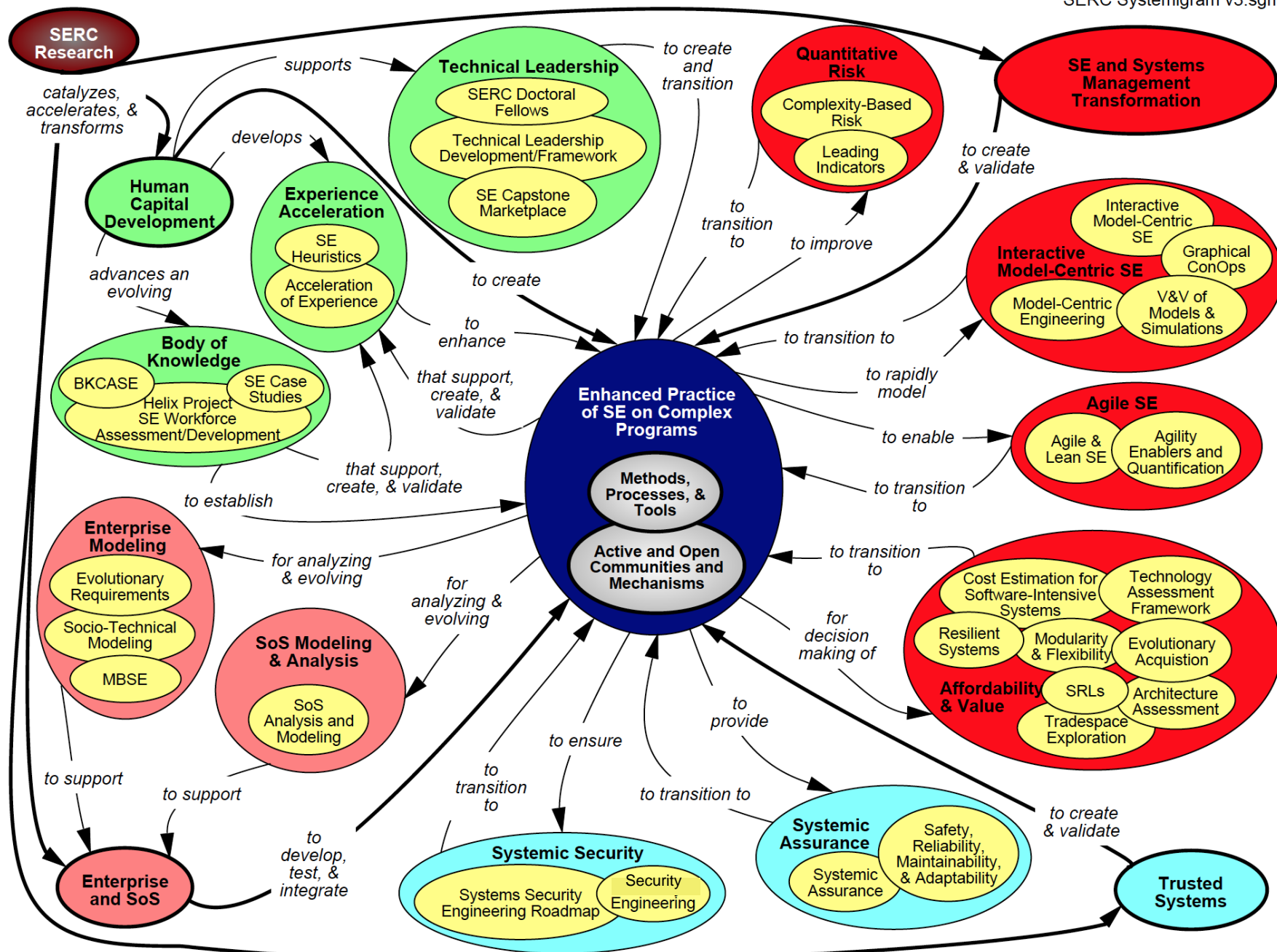






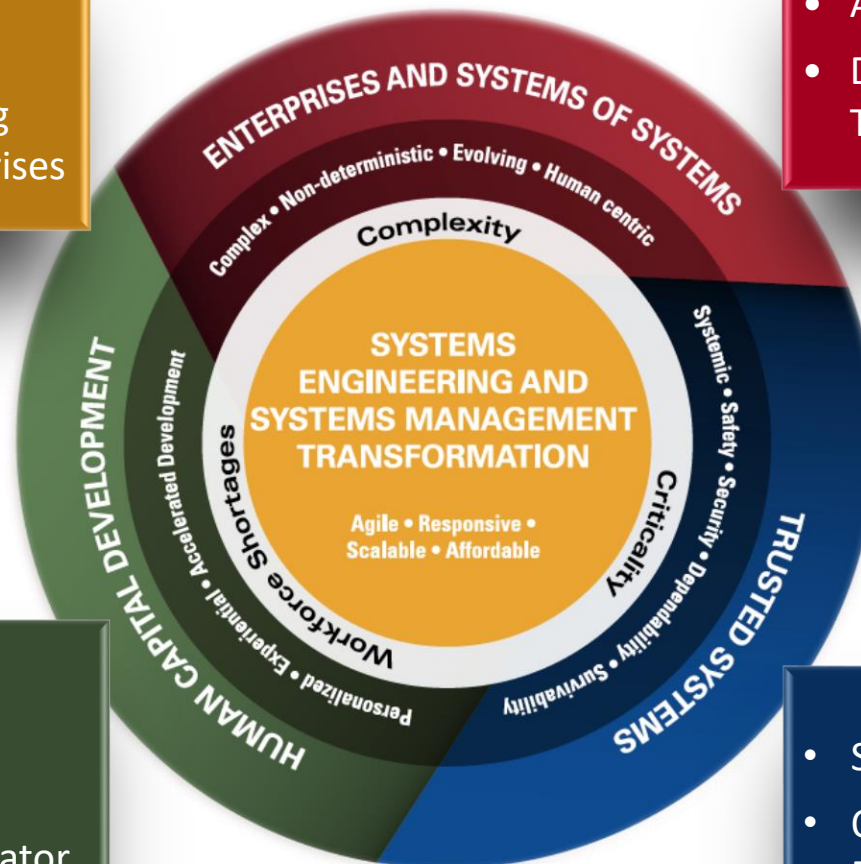






- COSYSMO
- ERS Tradebuilder
- Multi-Level Modeling Paradigm for Enterprises

- Analysts Workbench
- Digital Engineering Transformation

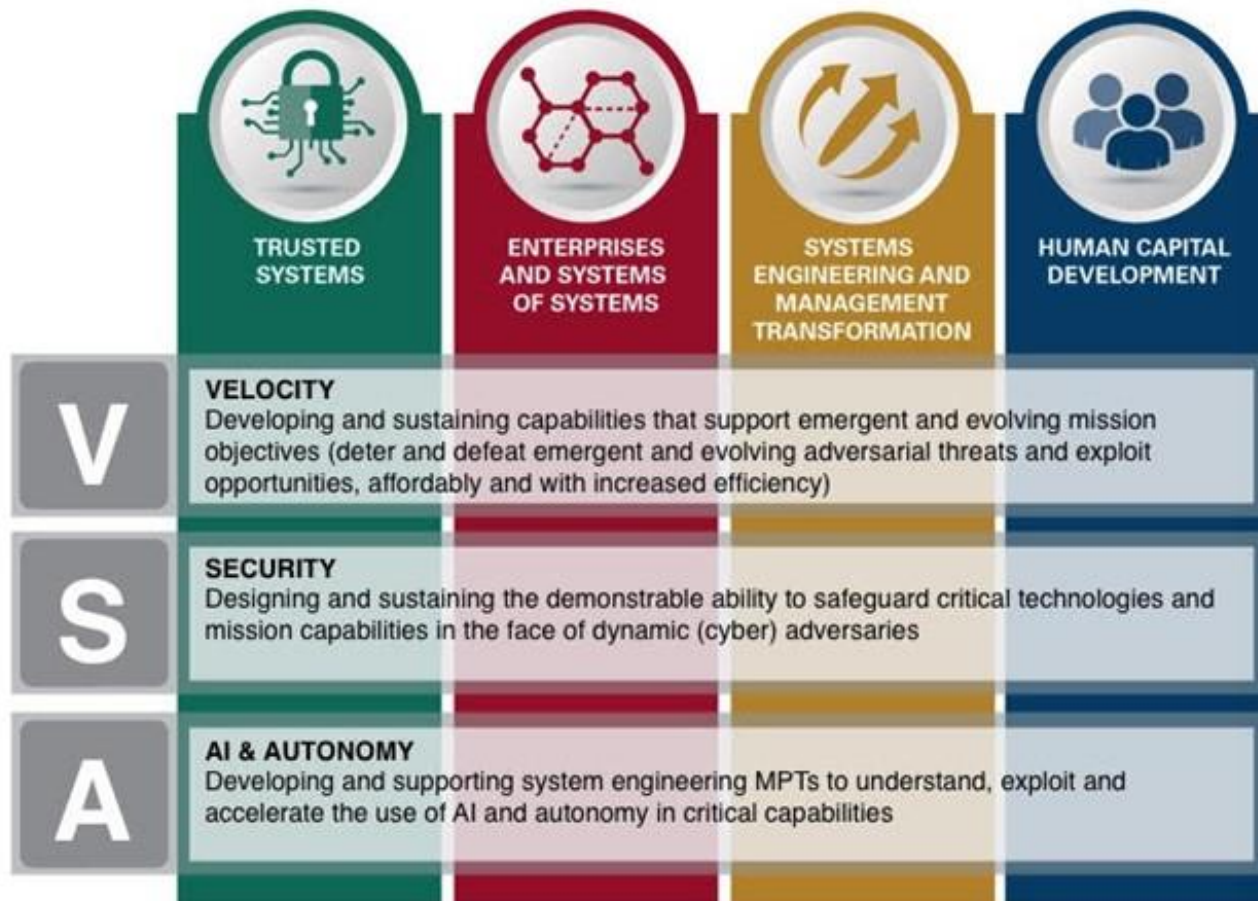


- BkCASE and SEBOK
- HELIX ATLAS 1.1
- SE Leadership
- SE Experience Accelerator
- Capstone Marketplace

- System-Aware Security
- ODNI Sensemaking Research Roadmap

SERC Research Areas and Missions

Mission Engineering



- Improve **Speed** to the Fight
- Increase SE **Reach** and **Rigor**
- **Assure** safety and security
- Be at the forefront of integrating **Emerging Tech**
- Lead Enterprise **Transformation**
- Meet the challenge of **Complexity**
- **Educate** the future workforce

Digital Engineering

Research Council Members



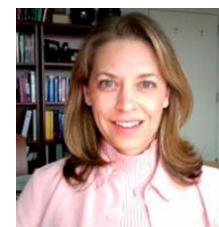
- **Enterprise Systems and Systems of Systems**

- *Dan DeLaurentis, Purdue*
- *Bill Rouse, Stevens (NAE)*



- **Human Capital Development**

- *Jon Wade, Stevens*



- **Trusted Systems**

- *Barry Horowitz, UVA (NAE)*
- *Kevin Sullivan, UVA*
- *John Colombi, AFIT*
- *Val Sitterle, Georgia Tech*



- **Systems Engineering and Systems Management Transformation**

- *Mark Blackburn, Stevens*
- *Barry Boehm, USC (NAE)*
- *Paul Collopy, UAH*

- **2016**

- Model Centric Engineering (May 26, 2016)
- Cyber-Social Learning Systems (September 26, 2016)
- Modular Open Systems Approaches (October 5, 2016)

- **2017**

- Model Based System Assurance (December 6, 7, 2017)
- Risk (December 13, 2017)

- **2018**

- Cyber Resilient Weapon Systems Engineering (July-August, 2018)
- Continuous Development and Deployment (November 2018)

The Pathfinder Project

Visit a number of warfare centers, R&D centers, National Laboratories, and FFRDCs, with the objective of talking to senior technical leaders – with a view to identify systems engineering “pain points”, research priorities, and any strategic workforce considerations

**Almost 20 visits
were completed...**

Primary Questions and Research Priorities

- **Modeling System Security, Risk, Reliability, and Resilience**
 - Particular reference to Distributed Systems (IoT; Cyber-Physical Systems; Mission Threads)
- **Agility at the scale of the Enterprise**
- **Mission Engineering -**
 - Collaboration and Competition – Computational Policy Framework
- **Knowledge Management**
 - Legacy and into the future with changing demographics
- **Model Based Engineering – Digital Engineering**
 - Various sub-themes
- **Analytics and Enhanced Quantification to all aspects of Systems Engineering**
- **Systems Engineering Aspects of Autonomy, AI, and ML, especially V&V**
- **Understanding and managing complexity**

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- **“other topics”**

- **We need better models for complex, sensor-intensive cyber-physical weapon systems;**
- How do we assess the risk/reliability of a mission? In particular, when we have an array of heterogeneous systems – some manned and some unmanned systems;
- We need models to better assess and estimate the reliability of heterogeneous network centric systems;
- How do we do a vulnerability analysis for the prioritization of risk in a system of systems?
- **How to assess and model system security?**
- How do we model and assess system security at scale?
- **How do we model system resilience?**
- **How do we model system trust?**
- There is a need for a holistic approach to assess and model system security, offensive cyber warfare, cyber-defense, and information security;
- How do we measure the security and resilience of a weapon systems?

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- **How do we balance risk, safety, and security on the one hand, and getting capability to the field in an accelerated manner on the other?**
- How do we address our acquisition culture, tradition, processes, governance, and procedure?
- **How do we move from a policy and compliance culture to an incentive and outcome oriented culture?**
- Error and fault monitoring are not able to keep up with the “speed of operations” – how do we fix this?
- Within an environment of extremely mission critical systems, how do we get better at trying new and different approaches?
- Tension between safety and agility – a paradox. How best to rationalize this?
- How do we bring multiple disciplines, multiple doctrines, and multiple organizational cultures together to get through complex system and solution development faster?
- How do we fix an environment that lacks trust – between acquisition and contractors; between different organizations on the government side?
- We should question the relevance and value of ALL CDRLs, and make this lean.
- Can we do a risk and reward assessment of ALL SE steps – to allow more rapid development?
- Should we allow a more stream-lined and direct interplay between operators and users on the one hand; and developers and doctrine writers on the other?
- **How do we evolve to bring greater agility in system development at the level of the enterprise?**
- **Modularity and Rapid Development:**
 - **Impact of Modularity on test and integration speed; and the need for comprehensive re-certification; Impact of modularity - multiple case studies are necessary to understand cost and benefits, and impact of agile development, integration and test, and innovation.**

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- **Tension between “owners” of systems and programs; and the “owners” of mission threads – we need to figure out a way to put incentives to align these two perspectives;**
- **What is the true cost of system integration? For standalone systems; and for the integration of a system into an enterprise.**
- Mission analysis and engineering for complex system of systems – modeling and risk assessment;
- A mission thread cuts across multiple “lego pieces” in diverse geographical instances. How do we manage this enterprise when resources are allocated to the “lego pieces” and not to the mission threads?
- How do you characterize the “boundary of a system” when dealing with a system of multiple cloud based services? Furthermore, how do we develop a reference baseline for a “system in the field” when there are often local level variants to the designed or implemented baselines? This drives the integration of new services in the context of mission engineering.
- Integrated decision making and portfolio management:
 - How do we prioritize funding across multiple systems and programs for maximum impact on orthogonal mission threads?
 - Need an integrated decision framework (Space War-fighting Concept) spanning languages, cultures, doctrine across multiple organizations in a landscape that involves a diverse customer set (cultural inertia).
- **Fleet level interoperability remains a challenge – particularly when dealing with concurrent and overlapping networks with conflicting information – this can and has compromised missions.**
- Sometimes our requirements seem to go in one direction – from mission to system to sub-system – leading to a significantly reduced design space at the sub-system level and ultimately an underperforming system, and hence an underperforming mission. We need a better way.

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- **How do we capture our “design journey” on legacy systems and today’s systems; our architecture; and our domain knowledge and heuristics in an actionable way for the future; This is a real issue.**
- One significant challenge is that we are using our systems way beyond their design life – how do we certify that what we have there is still good and will operate as intended? This sometimes requires us to revisit a set of design and configuration decisions made 10-30 years ago. How well do we know why the designs are the way they are? While a number of our employees from 10-30 years ago are still with us – they are quickly retiring – and furthermore, today’s generation is not that stable in the workplace.
- **It is very easy to collect design and architecture information – but it is very hard to find it when you need it. Our workforce is becoming very mobile, so there is a real need for us to figure this out soon.**
- We need to develop a modern knowledge management and transfer system – we are truly in danger of losing significant domain knowledge.

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- **We need help with translating natural language processing and design documents into MBE;**
- Wish there was a practical notion of a roadmap; Further, how do we decide when should one begin modeling, when have we done enough modeling, and how much fidelity do we need and at what level and when?
- I wish we better understood the vast landscape of possible activities and scenarios and investments – and to identify the vector of maximum ROI when investing in MBE. We do not have the resources to do everything.
- **I wish there was a decision framework for deciding where to go high fidelity and where to go low fidelity – otherwise we are just boiling the ocean.**
- Has someone done an assessment of the skills and capabilities that we need to develop in support of digital engineering? This would be helpful.
- **Model Based Testing:**
 - How do we establish test boundaries for cyber-physical systems? Testing is too late for some system aspects. We need to get better at Simulation based Testing in support of mission engineering and interoperability; We need to better understand robustness and V&V associated with additive manufacturing. How do we do V&V and testing for learning systems?
- **Validation, verification and accreditation of models:**
 - What is sufficient? This is a rather labor intensive process. A key issue is model validation with sparse data. What tests are worth doing?
 - One challenge is model verification in the presence of small data sets;
 - Uncertainty quantification in multi-level modeling is a challenge for us.

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Analytics and Enhanced Quantification to all aspects of Systems Engineering

- We need to cope with vast amounts of field data – such as condition based maintenance data from the fleet – our challenges are data science application to the stakeholder domain - data structuring, visualization, and analytics;
- **How to we bring instrumentation and enhanced quantification to all aspects of systems engineering?**
- Stockpile/Legacy systems have collected tons of data – it would be nice to have applications of machine learning to find trends and patterns that the SMEs have not noticed and to even combine data from different weapon systems that share similar components and finding insights through machine learning;
- **How do we compose and make consistent data from diverse sources?**
- Can we instrument our infrastructure systems and development systems to provide real time data monitoring to increased insight into efficiency and effectiveness gains?
- **Can we use system analytics and system instrumentation to develop the concept of a unique system DNA (wing number level)?**
- Can we used machine learning applications focused on colleting and creating test metrics?

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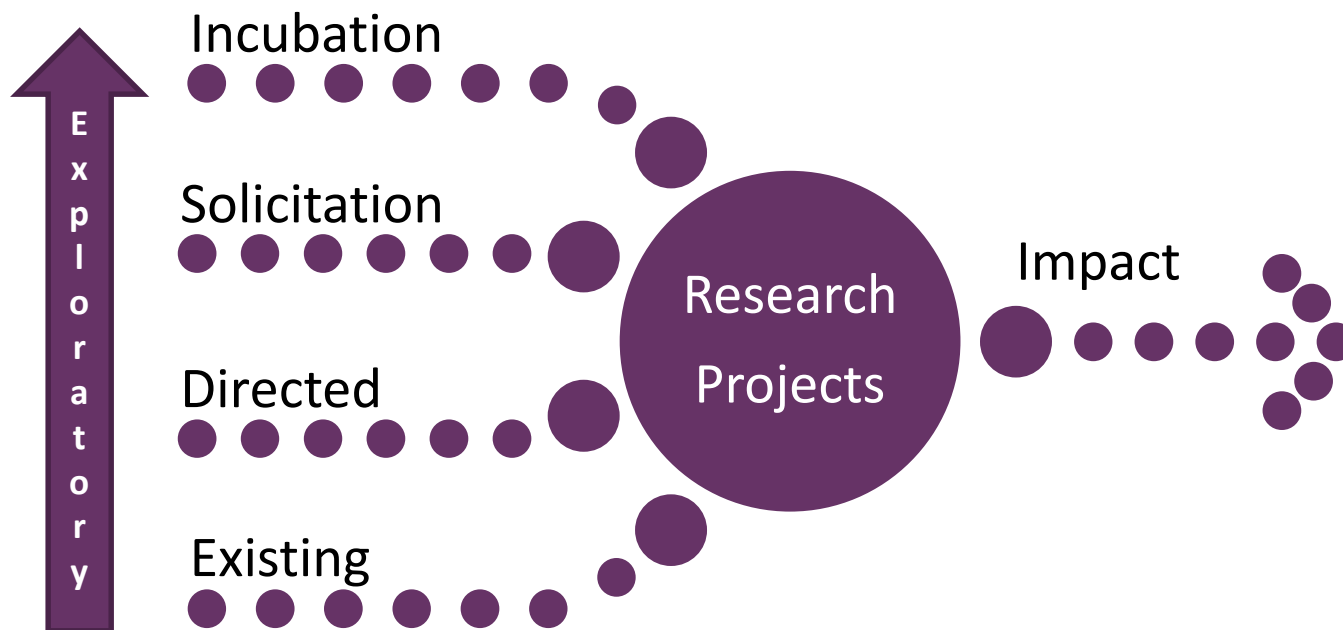
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- **We need to think about leveraging ML to collect and create metrics in support of Integration and Test;**
- We need to develop applications such as Autonomous Topological Predictor-Corrector (UAS Testing);
- How do we setup boundary conditions between humans and machines? Pattern recognition is just scratching the surface; We need to focus more on algorithm development for decision processes – making decisions or advising decision makers; When we are wallowing in data, it would be good for AI/ML based systems to help us filter the wheat from the chaff. We need a research horizon that exceeds 3 to 4 years.
- AI in support of systems engineering and design: Explore the concept of developing cognitive agents to support designers and engineers. In particular, applying these agents to the notion of verification and validation.
- How do we do V&V for learning systems and self governing systems?
- Can ML help us bring quantification and analytics to all aspects of systems engineering?

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- **Set Based Design has a lot of potential – we just need better tooling to allow its robust implementation at scale;**
- Requirements are written at the system and sub-system level, not at the mission level; optimization is done at the system and sub-system level, not at the mission level. This is a problem;
- We have to contend with Security Stovepipes – versus Security at the Mission Level (rather than a discrete system level) – particularly in Space;
- A pragmatic framework for the assessment, management, and leveraging of complexity – our complexity comes not just from the technical systems and associated dynamics, but also the dynamic regulatory environment. At an institutional level, another source of complexity is the diversity of our development and process frameworks, driven by the diversity of our customers.
- **Requirements are getting out of hand – we are dealing with tens of thousands of requirements and it is only getting worse. Wish there was a better way.**
- We need to better understand the SE related to integrating focused applications into a legacy enterprise; or integrating already built components – there is a need to build rigorous processes for integrating existing components into systems.



SERC's four Operational Principles:

- Conduct innovative, high-impact research
- Translate proof-of-principle prototypes to impactful applications
- Strengthen and leverage the research network
- Prepare the next generation

- Current contract is managed by WHS in Washington DC, renewed in October 2018
 - Numerous DoD components have leveraged this via MIPR (MDA, DAU, AF, Army, Navy, and Marine Corps)
 - IDIQ - \$60m over 5 years
- A second contract established – managed by ACC at Picatinny Arsenal, NJ
 - They are willing to share all their sole source justification and other competition sensitive documentation with SMC directly.
 - IDIQ - \$50m over 5 years
 - This took about 6 to 8 months to establish, and provides the Army with a direct contract with the SERC
- SERC can currently accept contracts to a “DoD Secret” level
 - With sufficient incentive, we would explore going higher

SERC Systems Research Review (SSRR-2018)

8:30a–8:35a	Welcome from the SERC Executive Director and Chief Scientist Dr. Dinesh Verma, Executive Director, SERC and Dr. Barry Boehm, Chief Scientist and Chair, Research Council, SERC			
8:35a–8:40a	Kickoff and Welcome Dr. Yehia Massoud, Dean, School of Systems and Enterprises Stevens Institute of Technology			
8:40a–9:00a	Systems Engineering Perspectives for Today's Environment Dr. Paul Kaminski, CEO and President, Technovation, Inc.			
Sponsor Perspective and Challenges				
9:00a–9:10a	Introductory Remarks Ms. Kristen Baldwin, Acting Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE))			
State of the SERC				
9:10a–10:00a	Morning Keynote Address by Mr. Paul Scharre, Senior Fellow and Director, Technology and National Security Program, Center for New American Security. Author of Army of None: Autonomous Weapons and the Future of War			
10:00a–10:15a	Transition Break			
Research Reviews: Four parallel tracks with 40-minute sessions providing in-depth discussions on SERC research projects				
	Track 1: SE and Management Transformation (SEMT) (Vista Room)	Track 2: Model-Centric Systems Engineering (Angle Room)	Track 3: Trusted, Critical, Resilient Systems (Balcony Room D)	Track 4: Human Capital Development (Balcony Room E)
10:15a–10:55a	Identifying and Measuring Modularity/Violations in Cyber-Physical Systems Lu Xiao, Stevens	PEO Missiles & Space Systems Engineering Methods Brock Birdsong, Auburn	Human Machine Teaming Concepts for Resilient Cyber-Physical Systems Inky Kim, USC	SE Research Needs and Workforce Development Assessment (Pathfinder) Dinesh Verma, Stevens
11:00a–11:40a	Verification and Validation (V&V) of System Behavior Specifications Kristin Giammarco, MPS	Transforming Systems Engineering through Model-Centric Engineering (NAVAIR & ARDEC) Mark Blackburn, Stevens	Systemic Security and the Role of Hierarchical Design in Cyber-Physical Systems Val Sitterle, Georgia Tech	Mission Engineering Competencies Gregg Vesonder, Stevens
11:45a–12:30p	Framework for Analyzing Versioning and Technical Debt Ye Yang, Stevens	Interactive Model-Centric Systems Engineering (IMCSE) Donna Rhodes, MIT	Data Science Approaches to Prevent Failures in Systems Engineering Karen Marais, Purdue	SE Experience Accelerator John Wade, Stevens
12:30p–1:00p	Lunch (Catered) and Opportunity to View SERC Project Posters			
1:00p–1:30p	Lunchtime Keynote Panel by AWG Leadership Panel, Moderated by Ms. Kristen Baldwin			
1:30p–1:45p	Transition Break			
	Track 1: SEMT (Conference Room B)	Track 2: Model-Centric SE (Boardroom)	Track 3: Trusted Systems (Videoconference Room)	Track 5: Enterprise and Systems of Systems (Conference Room A)
1:45p–2:25p	Formal Methods in Resilient Systems Design using a Flexible Contract Approach Azad Madni, USC	Meshing Capability & Threat-Based S&T Resource Allocation Carlo Lipizzi, Stevens	Security Engineering 2018 Barry Horowitz, Peter Beling, UVA	ESoS Model for Digital Thread Enabled Acquisition Tom McDermott, Stevens
	Next Gen. Adaptive Cyber-Physical Human Systems Azad Madni, USC			
2:30p–3:10p	System Qualities (SQs) Tradespace and Affordability Barry Boehm, USC	ODNI Sensemaking Suba Subbalakshmi, Stevens	Game-Theoretic Risk Assessment for Distributed Systems (GRADS) Paul Grogan, Stevens	Approaches to Achieve Modularity Benefits in the Acquisition Ecosystem Dan DeLaurentis, Navin Davendralingam, Purdue
		SERC Workshops 2018 Tom McDermott, Stevens		
3:15p–3:55p	Electronics Survivability and Product Assurance in Harsh Environments Pradeep Lal, Auburn	MDA V&A and Simulation Research Mikel Petty, UAH	Tools and Methods Framework for Shipboard Power & Energy Systems John Dzielski, Stevens	Systems Engineering Approaches for Interagency Space Michael Drosz, USC
4:00p–5:00p	Poster and Networking Session		Executive Advisory Board Meeting (Invitation Only)	

SERC Doctoral Fellows Program



The Aerospace Corporation

The Doctoral Fellows Program: Primary Tenants

- No exchange of funds from the partners to the SERC in support of this program
- Industry/National Lab/FFRDC/Warfare and R&D Centers engage via sponsoring employees for doctoral studies
 - Minimum number of students sponsored as a function of organizational size
 - Best form of technology transfer
 - Development of focused technical leadership within the national security ecosystem
- ***Current state of this program:***
 - 5 Boeing-SERC Fellows;
 - 3 Raytheon-SERC Fellows;
 - 3 ARDEC – SERC Fellows;
 - 1 Aerospace – SERC Fellow.

- **Topic: Reliability of Mobile Ad-hoc Wireless Networks**

- **Key publications, prior to the public defense:**

- Cook, J.L. and Ramirez-Marquez, J.E. (2007) “On Reliability of Mobile Ad-hoc Wireless Networks”, in Chapter 6 of Wireless Communications Research Trends , Nova Publishers, 1-60021-674-9, pp. 191-227.
- Cook, J.L. and Ramirez-Marquez, J. E. (2009) “Mobility and Reliability Modeling for a Mobile Ad-hoc Network”, IIE Transactions on Quality and Reliability Engineering, Special Issue in Honor of Richard H. Barlow, Vol. 41, No. 1, pp. 23-41. Paper Highlighted in IE Magazine January 2009.
- Cook, J.L. and Ramirez-Marquez, J.E. (2009) “Optimal Design of Cluster Based Ad-hoc Networks using Probabilistic Solution Discovery”, Reliability Engineering & System Safety , Vol. 94, No, 2, pp. 218-228.
- Cook, J.L. and Ramirez-Marquez, J.E. (2008) “Recent Research on the Reliability Analysis Methods for Mobile Ad-hoc Networks”, Systems Research Forum , Vol. 2, pp. 35- 41.
- Cook, J.L. and Ramirez-Marquez, J.E. (2008) “On the Reliability of Capacitated Mobile Ad-hoc Network”, Journal of Risk and Reliability , Vol. 221, No. 4, pp. 307-318.
- Cook, J.L. and Ramirez-Marquez, J.E. (2008) “A Reliability Analysis of Cluster-Based Ad-hoc Networks”, Reliability Engineering & System Safety , Vol. 93, No. 10, pp. 1512-1522. No. 19 of Top 25 Hottest Article in Reliability Engineering & System Safety during January - March 2008
- Cook, J.L. and Ramirez-Marquez, J.E. (2007) “Two-Terminal Reliability Analyses for a Mobile Ad-hoc Wireless Network”, Reliability Engineering and System Safety , Vol. 92, No. 2, pp. 821-829.
- Cook, Jason L. and Ramirez-Marquez, J. E. (2008) Reliability for Cluster-based Ad-hoc Networks; Proceedings Annual Reliability and Maintainability Symposium; Las Vegas, NV, January 2008.
- Cook, Jason L. and Ramirez-Marquez, J. E. (2008) Optimization of Multi-tier Ad-hoc Networks; Proceedings of Institute of Industrial Engineers Annual Conference. Invited Paper. Vancouver, Canada, May 2008.
- Cook, J. L. and Ramirez-Marquez, J. E. (2007) “Capacitated Reliability for Ad-Hoc Networks”. Proceedings of the Annual Reliability, & Maintainability Symposium, Orlando, Florida, January, 2007.
- Cook, J. L. and Ramirez-Marquez, J. E. (2006) “Reliability Method for Ad-Hoc Networks”. Proceedings of IIE Annual Conference, Orlando, Florida, May 2006.

- **Current position:**

- Division Chief, Systems Engineering, ARDEC, US Army

- **Topic: Mechanisms and Dynamics of Cooperation and Trust in Evolving Networked Systems**
- **Key publications, prior to the public defense:**
 - 1) Gianetto, D., Heydari B. (2016) "Sparse cliques trump scale-free networks in coordination and competition." ***Nature Scientific reports*** 6 (2016): 21870.
 - 2) Gianetto D., Heydari B. (2015) Assessing federal insurance exchange competition through network structure properties, **INFORMS Healthcare** 2015, Nashville TN.
 - 3) Gianetto D., Heydari B. (2015), Modularity is essential for evolution of cooperation under uncertainty, ***Nature Scientific reports*** 5 (2015)
 - 4) Gianetto D., Heydari B. (2014), Fear Not, Be Modular: How Network Structure Impacts Prosocial Norm Emergence, **CESUN 2014**, Hoboken NJ.
 - 5) Gianetto D., Heydari B. (2013), Catalysts Of Cooperation In System Of Systems: The role of diversity and network structure, **IEEE Systems Journal**, DOI: 10.1109/jsyst.2013.2284959.
 - 6) Polacek, G., Gianetto D., Khashanah K., and Verma D. (2012), On Principles and Rules in Complex Adaptive Systems: A Financial System Case Study, **Systems Engineering**, doi:10.1002/sys.21213.
- **Current position:**
 - Engineering Fellow at Raytheon SAS

SERC CAPSTONE MARKETPLACE INITIATIVE

1. 28 Senior design teams being sponsored this year, approximately 150 UG engineering students across 10 universities
2. Students interact directly with the operators and users, and work on interesting problems within a DoD context
3. Current sponsor include: RRTO, SOCOM, AFRL, USD (R&E)
4. Intent is to scale this significantly over the next two years
5. Being led by Capt. Bill Shepherd (Retd.)

THURSDAY, FEBRUARY 28, 2019 | 9AM - 2PM

SERC Capstone Marketplace Summit

FHI 360 Conference Center
1825 Connecticut Ave. NW, 8th Floor
Washington DC 20009

ATTENDANCE

the Capstone Summit is open to:

- SERC Collaborators
- Capstone Universities
- Other Interested Universities and Academics
- Military and Government Organizations
- Industry Representatives

REGISTRATION AND FEES

All Attendees will be required to register NLT 18 Feb 2019.

Capstone Summit Information is available online at:

<https://sercuarc.org/event/serc-capstone-marketplace-summit/>

Register for this event at:

<https://www.eventbrite.com/e/serc-capstone-marketplace-summit-tickets-53593540723>

Any questions on Capstone Summit Registration 2019 please bring to the attention of:

Ms. Monica Brito

mbrito@stevens.edu or 201 216 8065

Attendance is free for Government and Academic Summit Attendees

Meal contributions will be accepted onsite for Industry attendees for the working lunch

AGENDA

9:00 AM	Summit Open and Introductions	Bill Shepherd
9:05 AM	Capstone Marketplace - A Vision for Impact	Kristen Baldwin
9:25 AM	Sponsors' Opening Remarks	Lucero, Strahan
9:30 AM	Notes on Capstone Marketplace Organization and Administration	Verma, Shepherd
9:45 AM	Voice of Students & Academics	Various
10:35 AM	Voice of the Customer	Military and Govt Reps
11:05 AM	Break and Posters	All
11:25 AM	Streamlined SE Syllabus for Capstones	TBD
12:00 PM	Working lunch, Discussions, Posters	All
12:30 PM	Forecasts for Academic Year 2019-2020: Scaling up Capstones	Shepherd
12:50 PM	"Rudder Corrections" for Next Capstones: Expanding to "Whole of Government," Introduction of Graduate Capstones. Bringing in Industry	Discussion
1:30 PM	Review and Discussion of Submitted Comments and Forward Actions	Shepherd



VOICE OF STUDENTS & ACADEMICS

The moderator will offer each Capstone University and their teams the opportunity to discuss their work, the most effective processes used, and details on problems, shortfalls, process improvements which are needed. Open discussion with the group will be encouraged.

VOICE OF THE CUSTOMER

Members of various military organizations, staff, and other government "customers" will present their views on Capstone processes and effectiveness.

POSTER SESSION

The Capstone Summit will be a voluntary opportunity for Universities to showcase their ongoing Capstone work directly with key Government sponsors and leaders. SERC will provide easels and floor space for these presentations. More details on the organization of the poster session to follow.

ONE-ON-ONE CONFERENCES

At the conclusion of the Summit. Capstone Mangers and selected government reps will be available for individual discussions. A sign-up board will be on an announced website before the Summit and available at the outset of the meeting.

Summit Leader - CAPT (ret) Shepherd

Questions and Discussion

