



# CREATE

## Software Program Management for Productivity Computational Research Engineering Acquisition Tools and Environments

Dr. Douglass Post  
SEI Senior Technical Staff

Computational Science & Engineering  
Software Sustainability and Productivity  
Challenges

Software Engineering Institute  
Carnegie Mellon University  
Pittsburgh, PA 15213



Software Engineering Institute

Carnegie Mellon University

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# Software Program Management Recommendations

- Based on Lessons-Learned developing Engineering Design Software at:
  - Princeton Plasma Physics Laboratory (PPPL-23 years)
  - LLNL and LANL (10 years)
  - DoD High Performance Computing Modernization Program as an IPA from the Software Engineering Institute (10 years)



# Computational Research and Engineering Acquisition Tools and Environments (CREATE)

**CREATE is a multi-phase program that started in 2008, to develop and deploy four (now five) computational engineering tool sets for acquisition engineers**

- **Aircraft (AV) Design Tools:** Fixed-wing aircraft, rotorcraft, conceptual design, trade-space exploration and operational testing and transition
- **Ship Design Tools:** Shock/damage, hydrodynamics, early-stage design & trade-space exploration, and operational testing and transition
- **Radio Frequency (RF) Antenna Design and Integration Tools:** Conceptual design and detailed analysis tools relevant to virtually all DOD platforms
- **Ground Vehicles (GV) Tools:** End-to-end mobility solver, provide rapid, physics-based data for design and trade-space analysis
- **Meshing and Geometry (MG) Support:** The geometry and meshing project improves the ease, speed, flexibility, and quality of geometry and mesh generation, and enables the generation of CAD-neutral digital representations and product models of weapons systems & platforms and operational terrains and environments



**CREATE**  
Computational Research and Engineering Acquisition Tools and Environments

## CREATE-AV

Aircraft (AV) Design Tools

## CREATE-SHIPS

Ship Design Tools

## CREATE-RF

Radio Frequency (RF) Antenna Design and Integration Tools

## CREATE-GV

Ground Vehicle Design Tools

## CREATE-MG

Meshing and Geometry (MG) Support



# CREATE Tools: used by over 110 DoD organizations to assess more than 70 DoD Weapon Systems



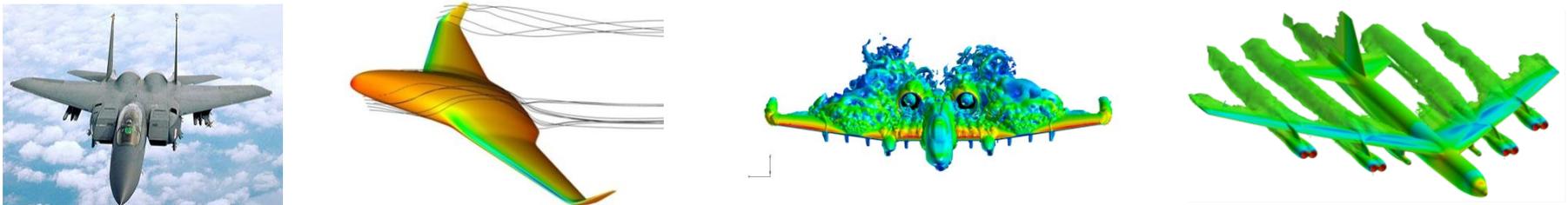
NAVSEA: DDG-1000 Destroyer, the CVN 78 and 79 Aircraft Carriers, the Ohio Submarine Replacement and the LX(R) programs.



NAVAIR: Aerostar & Raven UAVs, F/A-18E, E-2D



Army: UH-60, CH-47 (ACRB), Guided Airdrop (RDECOM), V-22

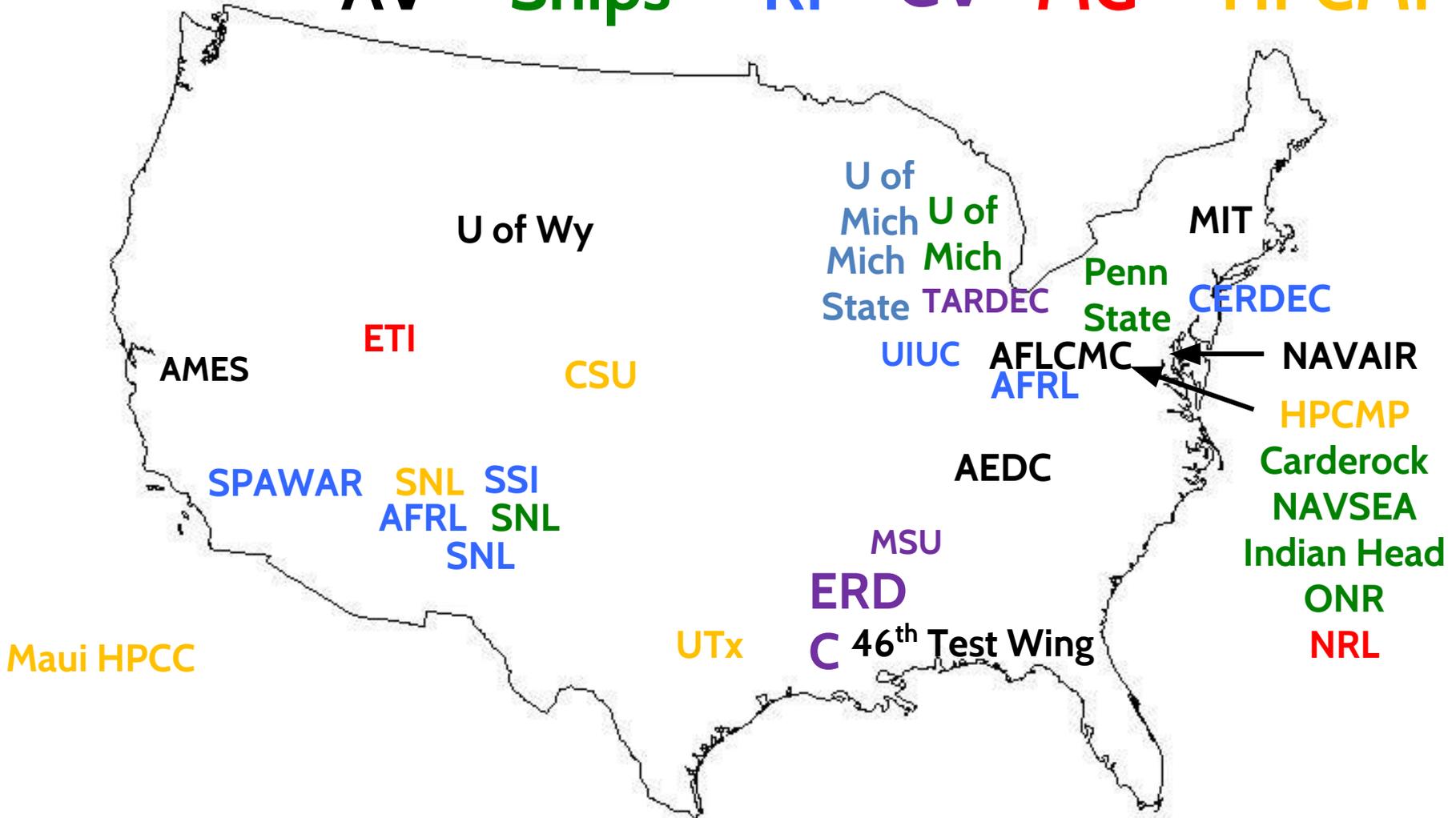


AF LCMC: F-15 SA/DB-110, Strategic Airlift CP&A, A-10, B-52

# Distributed Teams Can Work Very Well

→ But at the cost of financial and contractual complexity

**AV**   **Ships**   **RF**   **GV**   **MG**   **HPCMP**



# Software Project Management Principles (Lessons-Learned)

- Develop a compelling and credible vision and be able to communicate it.
- Develop a long term strategic plan and define the essential processes required to execute it
- Balance the need for an agile development process that empowers the development team with the need for accountability and an organized development process
- Recognize that the role of program management is to provide:
  - Program Leadership beyond merely Program Management
  - Stable funding, hosting, and stakeholder support and a constructive development and deployment environment,
  - Guidance for solving organizational and technical problems, and
  - Support to solve institutional problems the development team is unable to solve
  - The Program Leadership needs to shield the development team from institutional turmoil and other distractions as much as possible
- Recognize that the role of the development team is to provide high quality software applications within schedule and budget
- Emphasize the central and essential roles of the development team and its leadership
- Implement a rigorous verification and validation program
- Identify the challenges for developing and deploying the software within your organization and customer base



# Five Complexities Specific to the DoD

- Complex program management challenges
  - Development of new, innovative, risky, state-of-the-art (and beyond) computational technologies in DoD organizations that rigorously adhere to DoD program and project management processes).
- Complex development environment
  - Distributed, multi-disciplinary teams across multiple sites and embedded in Army, Navy, and Air Force organizations)
- Complex engineering applications
  - Integrated multi-scale, multi-physics—e.g., computational fluid dynamics, structural dynamics, turbo-machinery, electromagnetics, etc.
- Complex computing environments
  - Networks; cyber security; rapidly evolving computer architectures,...
- Complex customer organizations:
  - Army, Navy, Air Force, and defense industry acquisition engineering organizations;
  - DoD research, development, testing and evaluation [RDT&E] communities; and



# Ten Core Program-level Risks for CREATE

1. Inability to meet the challenge of creating and inventing new, innovative software technologies within the existing DoD program and project management structure.
2. Loss of Credibility and Effectiveness due to defects or insufficiently accurate models in the software that would result in inaccurate results
3. Inability to build and manage software development teams because the CREATE program relies on sponsoring development teams embedded in and part of the relevant DoD customer organizations.
4. Significant losses of core development staff and their corporate knowledge due to severe funding reductions and other institutional turmoil
5. Inability to ensure program coordination within the diverse management cultures—including security management—within different DoD organizations.
6. Inability to manage requirements creep and relevancy over the major development phases of the project
7. Inability to anticipate and respond to the impact of rapidly changing computational and computer technologies (especially rapidly changing computer architectures and environments).
8. Loss of DoD stakeholder and sponsor support due to frequent turnover of senior DoD personnel.
9. Loss of Control of Intellectual Property Rights.
10. Inability to support CREATE software users



# Follow-up

Preprints of papers describing:

- The CREATE Program and
- The CREATE Program Management Approach

Will be available on DTIC ([www.dtic.mil](http://www.dtic.mil)) in a month or so

And a limited number of copies are in the back of the room.



# Software Project Management Principles (Lessons-Learned)

Develop a compelling and credible vision and be able to communicate it.

- *Without a compelling, credible vision, it won't be possible to obtain initial funding or to defend the program*

Develop a long term strategic plan and define the essential processes required to execute it

- *A long term plan is essential for guiding the development of shorter-term, more detailed plans, and processes are required to execute the program*

Balance the need for an agile development process that empowers the development team with the need for accountability and an organized development process

- *The development teams need to have the freedom to exercise their technical judgment, but also need to produce a product*

Recognize that the role of program management is to provide:

- Program Leadership beyond merely Program Management
- Stable funding, hosting, and stakeholder support and a constructive development and deployment environment,
- Guidance for solving organizational and technical problems, and
- Support to solve institutional problems the development team is unable to solve
- *The Program Leadership needs to shield the development team from institutional turmoil and other distractions as much as possible*

Recognize that the role of the development team is to provide high quality software applications within schedule and budget

- *The development team needs to understand its responsibility to develop and deploy the software*

Emphasize the central and essential roles of the development team and its leadership

- *Teams develop software. Organizations and processes don't develop software*

Implement a rigorous verification and validation program

- *Without a good V&V program, your codes won't be credible*

Identify the challenges for developing and deploying the software within your organization and customer base

- *The Program management must help the team meet those challenges*

