



RESEARCH REVIEW 2024

Carnegie
Mellon
University
Software
Engineering
Institute

Crafting Connections

Building Pathways from Innovation to Impact

NOVEMBER 13, 2024

Tom Longstaff
Chief Technology Officer

[DISTRIBUTION STATEMENT A] Approved for public release and unlimited distribution.

©2024 Carnegie Mellon University



Document Markings



Copyright 2024 Carnegie Mellon University.

The view, opinions, and/or findings contained in this material are those of the author(s) and should not be construed as an official Government position, policy, or decision, unless designated by other documentation.

NO WARRANTY. THIS CARNEGIE MELLON UNIVERSITY AND SOFTWARE ENGINEERING INSTITUTE MATERIAL IS FURNISHED ON AN "AS-IS" BASIS. CARNEGIE MELLON UNIVERSITY MAKES NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, AS TO ANY MATTER INCLUDING, BUT NOT LIMITED TO, WARRANTY OF FITNESS FOR PURPOSE OR MERCHANTABILITY, EXCLUSIVITY, OR RESULTS OBTAINED FROM USE OF THE MATERIAL. CARNEGIE MELLON UNIVERSITY DOES NOT MAKE ANY WARRANTY OF ANY KIND WITH RESPECT TO FREEDOM FROM PATENT, TRADEMARK, OR COPYRIGHT INFRINGEMENT.

[DISTRIBUTION STATEMENT A] This material has been approved for public release and unlimited distribution. Please see Copyright notice for non-US Government use and distribution.

This material may be reproduced in its entirety, without modification, and freely distributed in written or electronic form without requesting formal permission. Permission is required for any other use. Requests for permission should be directed to the Software Engineering Institute at permission@sei.cmu.edu.

Carnegie Mellon® is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

DM24-1528

CMU SEI is a DoD R&D Federally Funded Research and Development Center



Established in 1984 at Carnegie Mellon University

Charged to improve the state of the practice of software engineering and cybersecurity

Added AI Engineering in 2018

Collaborates with CMU and broadly in academia, government, and industry

Capable of conducting both fundamental research and classified work

~650 staff members

Offices in Pittsburgh and DC, with locations near customer facilities in MA, TX, and CA

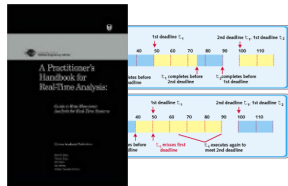
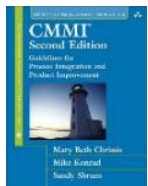
What does it mean to craft connections?



Our researchers

- build authentic relationships with collaborators and customers
- apply broad expertise and experience in software, cybersecurity, and AI to meet DoD needs
- transition our research innovations into operation to make a real-world impact

CMU SEI: Celebrating 40 Years of Innovation

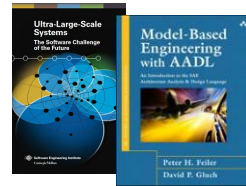


Repeatable delivery of platforms

Verification and validation of real-time scheduling



Strategic design; reuse and evolution; measurement and analysis



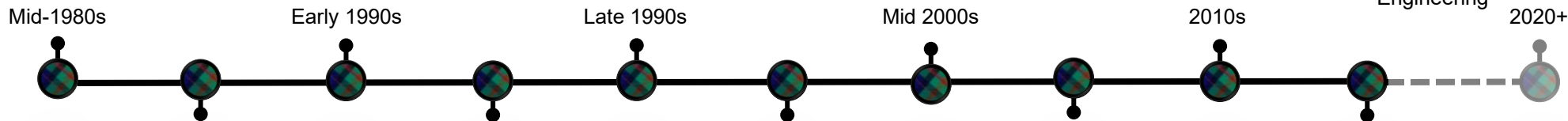
Ultra large-scale systems research; AADL



Adopting iterative development and acquisition practices



AI Engineering and AI-Enabled Software Engineering



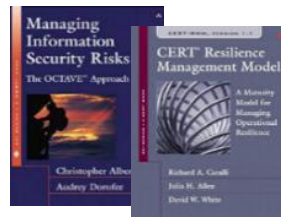
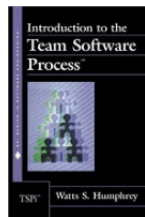
Late 1980s
Establishing a basis for software reuse

Mid 1990s
Evidence-based developer output

Early 2000s
Managing the operational risk of fielded systems

Late 2000s
SOA; secure design patterns; framework for architectural decisions

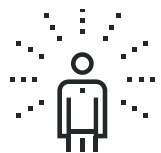
Today
Lifecycle automation, Agile/DevOps; assuring complex systems; continuous integration/continuous deployment



Today's Takeaway: How Our Work Advances the State of the Art



Now, Let's Dive Into Our Research...



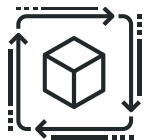
Communication

Engage with the DoD and USG to identify tough problems



Research/Development

We conduct our research/development



Integration

We work with customer to transition research results, leading to impact

Today

- Listen to learn about what we're working on
- Take notes about things that interest you
- Ask questions about the things you're curious about

Tomorrow,

stay informed about our work by

- writing to us at info@sei.cmu.edu
- visiting our website, <https://www.sei.cmu.edu>
- subscribing to the SEI's podcasts and webcasts on Apple or Google
- subscribing to the SEI Blog
- subscribing to the SEI | CMU channel on YouTube
- following us on Facebook, Twitter, or LinkedIn

Today's Program

Time	Presenter	Topic
9:30 – 10:30	Dr. Alexis Bonnell	Keynote
10:30 – 11:00	Break	Demo & Poster Session
11:00 – 11:30	Linda Parker Gates, Dr. Nicholas Testa	AI Robustness (AIR)
11:30 – 12:00	John Wohlbier	Co-Design for Edge Artificial Intelligence: Application-Specific System on Chip
12:00 – 1:30	Lunch Break	Demo & Poster Session
1:30 – 2:00	Dr. Will Klieber	Techniques for Detection of Information Flows Indicative of Inserted Malicious Code
2:00 – 2:30	Bjorn Andersson	Explainable Verification for Rapid Certification
2:30 – 2:45	Break	Demo & Poster Session
2:45 – 3:15	Kevin Pitstick	Vessel: Modeling Container Reproducibility Failures
3:15 – 3:45	Dr. Gabriel Moreno	Towards Compositional Assurance of Large-Scale Systems
3:45 – 5:30pm	Reception	Reception with Demo & Poster Session

Keynote Speaker Dr. Alexis Bonnell



Dr. Alexis Bonnell

Chief Information Officer & Director of the Digital Capabilities
Directorate of the Air Force Research Laboratory

Alexis Bonnell is the Chief Information Officer and Director of the Digital Capabilities Directorate of the Air Force Research Laboratory, the primary scientific research and development center for the Department of the Air Force.

She is responsible for developing and executing the AFRL Information Technology strategy, leading the strategic development of highly advanced next generation technologies and platforms for AFRL.

Her focus includes catalyzing the discovery, development, and integration of warfighting technologies for air, space, and cyberspace forces via digital capabilities, IT infrastructure, and technological innovation across the lab's operations and culture.

Contact



Tom Longstaff
SEI Chief Technology Officer

Email: info@sei.cmu.edu