The International Post-Exascale (InPEx) Collaboration

SC23, Birds of a Feather
November 15, 2023 – rooms 301-303

Thuc Hoang

National Nuclear Security Administration
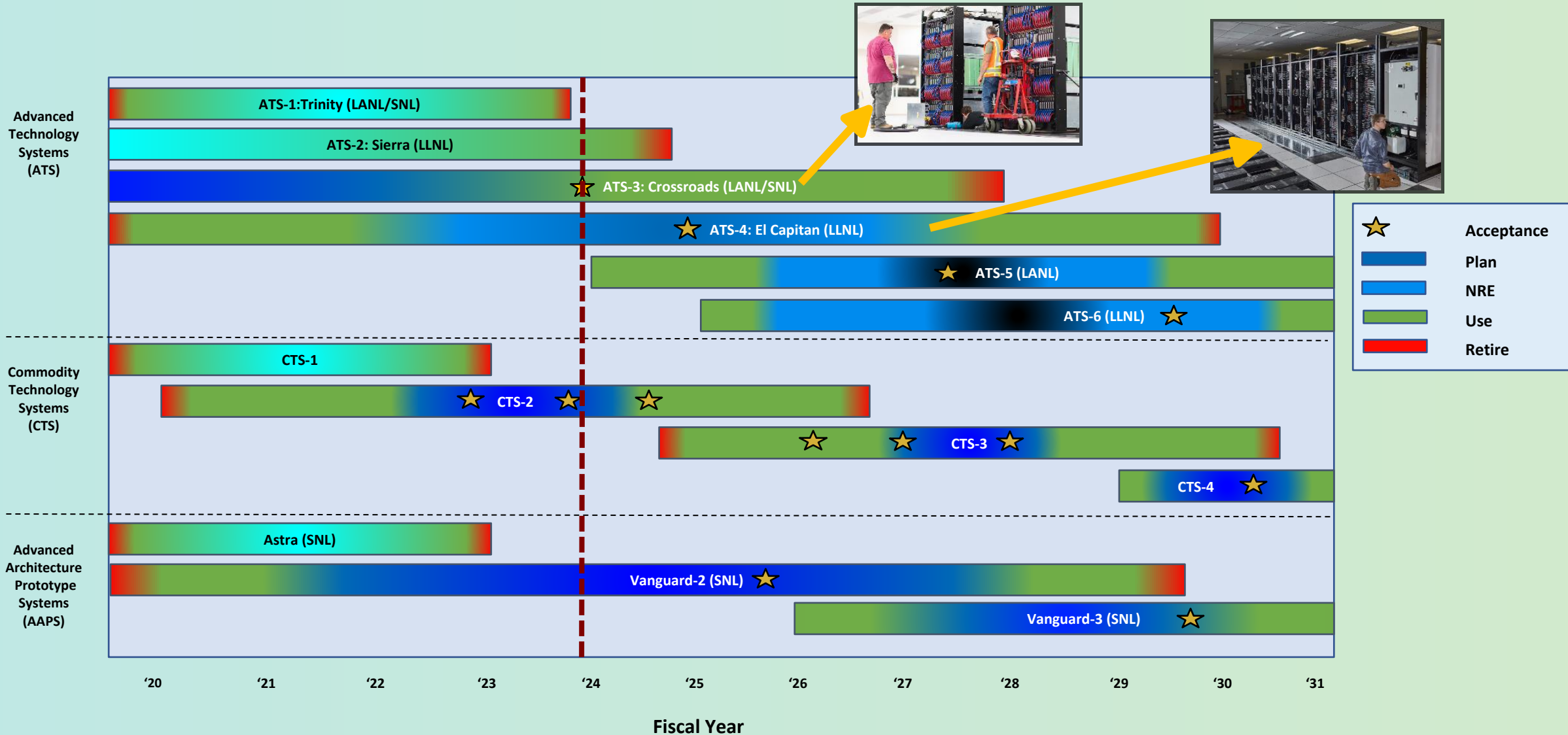
Department of Energy

Advanced Simulation and Computing (ASC) 10-year Strategic Guidance

- Deploy modeling and simulation capabilities for assessing the performance, safety, and security of an evolving stockpile

- Deliver modeling and simulation services for optimizing designs and addressing threats

- Develop simulation tools for an efficient production complex

- Provide a stable, production-level high-performance computing (HPC) capability for current and future NNSA nuclear deterrent missions

- Modernize and sustain the ASC tri-lab computing infrastructure (classified and unclassified)

- Collaborate with industry to keep pace with hardware advances, especially in artificial intelligence and quantum computing areas

ASC Post-Exascale Platform Timeline

Advanced Technology Systems (ATS)
- ATS-1:Trinity (LANL/SNL)
- ATS-2: Sierra (LLNL)
- ATS-3: Crossroads (LANL/SNL)
- ATS-4: El Capitan (LLNL)
- ATS-5 (LANL)
- ATS-6 (LLNL)

Commodity Technology Systems (CTS)
- CTS-1
- CTS-2
- CTS-3
- CTS-4

Advanced Architecture Prototype Systems (AAPS)
- Astra (SNL)
- Vanguard-2 (SNL)
- Vanguard-3 (SNL)

Legend:
- ⭐ Acceptance
- Plan
- NRE
- Use
- Retire

Fiscal Year: '20 '21 '22 '23 '24 '25 '26 '27 '28 '29 '30 '31

ASC Post-Exascale Software Plan

- ASC is transitioning its Exascale software products into its portfolio of production applications

  - This process will continue for several years due to vast catalog of software

  - Model accuracy and correctness remains a priority to ensure continued mission support. This requires considerable testing and change review.

- Starting FY 2024, ASC will support the "Flang" (Fortran-Language) compiler project

  - Dedicated investment to ensure Fortran-based applications continue to work on ASC platforms for the coming decade

  - Part of the platform strategy to ensure vibrant vendor options and competition

- ASC is investing in a component-based user environment for Exascale platforms

  - Builds on ECP and ASC investments in software

  - Allows for innovation in individual software products and use of vendor/academic products where compatible variants exist

  - Works across multiple vendor hardware and systems to reduce application porting and debugging

HPSF (hpsfoundation.github.io)
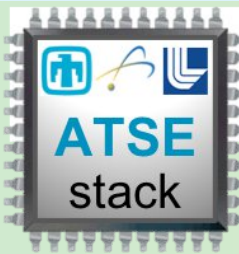
NASEM Post-Exascale Study – Recommendations

Recommendations are grouped into three main categories:

HPC Procurements & Roadmaps for the NNSA
Hardware, procurement models, software and mission workflows
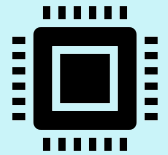
Investment in foundational and applied R&D
Including specific call-outs for inter-disciplinary R&D and focus on AI/ML

Workforce, partnerships and training
Inter-government, inter-agency, University and international partnership programs

U.S. Executive Order on Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence

Policy and Principles:

a) Artificial Intelligence must be safe and secure

b) Promoting responsible innovation, competition, and collaboration

c) Responsible development and use of AI require a commitment to supporting American workers

d) Artificial Intelligence policies must be consistent with advancing equity and civil rights

e) Protect interests of Americans who increasingly use, interact with, or purchase AI and AI-enabled products in their daily lives

f) Americans' privacy and civil liberties must be protected as AI continues advancing

g) Manage risks from the Federal Government's own use of AI and increase its internal capacity to regulate, govern, and support responsible use of AI

h) U.S. should lead the way to global societal, economic, and technological progress

OCTOBER 30, 2023

FACT SHEET: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence

BRIEFING ROOM   STATEMENTS AND RELEASES

Today, President Biden is issuing a landmark Executive Order to ensure that America leads the way in seizing the promise and managing the risks of artificial intelligence (AI). The Executive Order establishes new standards for AI safety and security, protects Americans' privacy, advances equity and civil rights, stands up for consumers and workers, promotes innovation and competition, advances American leadership around the world, and more.

Agencies: DOE, DHS, DOC, NSF, HHS, DOS, ODNI, OMB, OSTP, USAID, CDO

Opportunities for International Collaborations and Coordination

- HPC
  - Software stewardship – advancement and sustainment
  - Hardware codesign
  - Hackathons
  - Benchmark apps

- AI/ML R&D
  - Hardware codesign
  - Credibility & trustworthiness
  - Data science & management
  - Benchmark apps

ECP EXASCALE COMPUTING PROJECT

ECP-U-ST-RPT_2022_00285

ECP Software Technology Capability Assessment Report V3.0

Michael A. Heroux, Director ECP ST
Lois Curfman McInnes, Deputy Director ECP ST
Rajeev Thakur, Programming Models & Runtimes Lead
Jeffrey S. Vetter, Development Tools Lead
Sherry Li, Mathematical Libraries Lead
James Ahrens, Data & Visualization Lead
Todd Munson, Software Ecosystem & Delivery Lead
Kathryn Mohror, NNSA ST Lead
Terece L. Turton, Integration Lead

June 1, 2022

ORNL/TM-2022/2651

U.S. DEPARTMENT OF ENERGY | Office of Science   NNSA National Nuclear Security Administration

https://www.exascaleproject.org/reports/#software