

Advanced Scientific Computing Research (ASCR)

Computing Advancing Manufacturing Advancing Computing

24 February 2026

for HPC4Mfg Workshop and CMEI/AMMTO



U.S. DEPARTMENT OF
ENERGY

Office of
Science

[Energy.gov/science](https://www.energy.gov/science)

OFFICE OF SCIENCE BY THE NUMBERS

Delivering scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States

FY25

6 CORE SCIENCE PROGRAMS

- Advanced Scientific Computing Research
- Basic Energy Sciences
- Biological and Environmental Research
- Fusion Energy Sciences
- High Energy Physics
- Nuclear Physics

2 ENGINEERING AND TECHNOLOGY OFFICES

- Isotope Research and Development and Production
- Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)

5 NATIONAL QUANTUM INFORMATION SCIENCE RESEARCH CENTERS

ACROSS ITS 10 NATIONAL LABS, OFFICE OF SCIENCE MAINTAINS APPROXIMATELY

24 MILLION
SQUARE FEET OF SPACE

1,600
BUILDINGS

38,000
ACRES OF
LAND OWNED

SUPPORTS RESEARCH SPANNING

17
DOE NATIONAL LABS

50
STATES,
PUERTO RICO,
AND WASHINGTON, D.C.

>300
UNIVERSITIES AND
HIGHER-LEARNING INSTITUTIONS

STEWARDS

10
DOE NATIONAL LABORATORIES

ESTIMATED RESEARCHERS SUPPORTED

10,100 Permanent PhDs

3,100 Postdoctoral Associates

4,800 Graduate Students

9,900 Other Scientific Personnel

NEARLY
43,000

USERS AT

28
OFFICE OF SCIENCE FACILITIES

10
SITE OFFICES

1
CONSOLIDATED SERVICE CENTER

OVER
120
NOBEL PRIZES

\$8.2 BILLION

OVERALL OFFICE OF SCIENCE BUDGET

\$991 MILLION

USER FACILITY CONSTRUCTION

\$261 MILLION

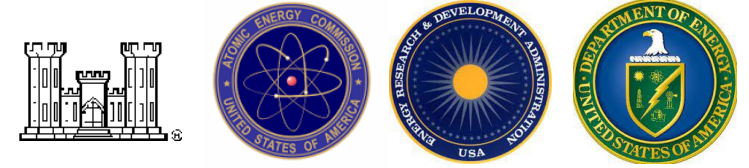
SCIENCE LABORATORIES INFRASTRUCTURE

3

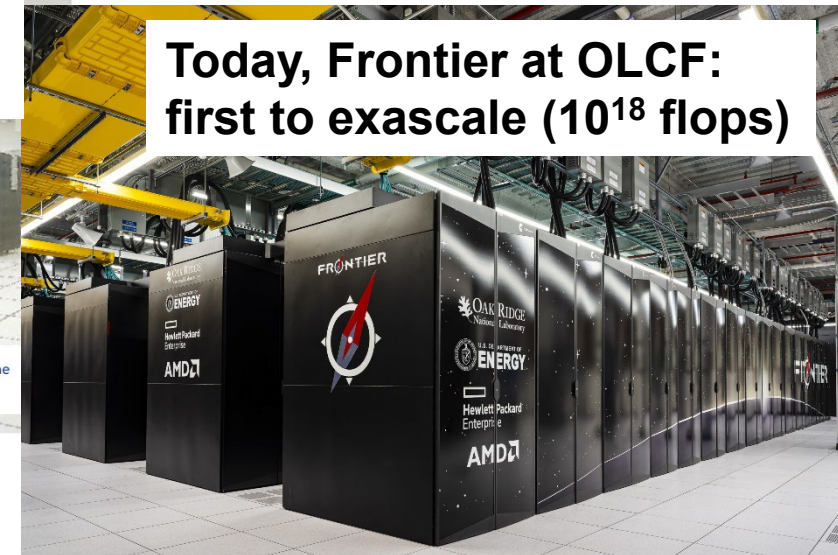
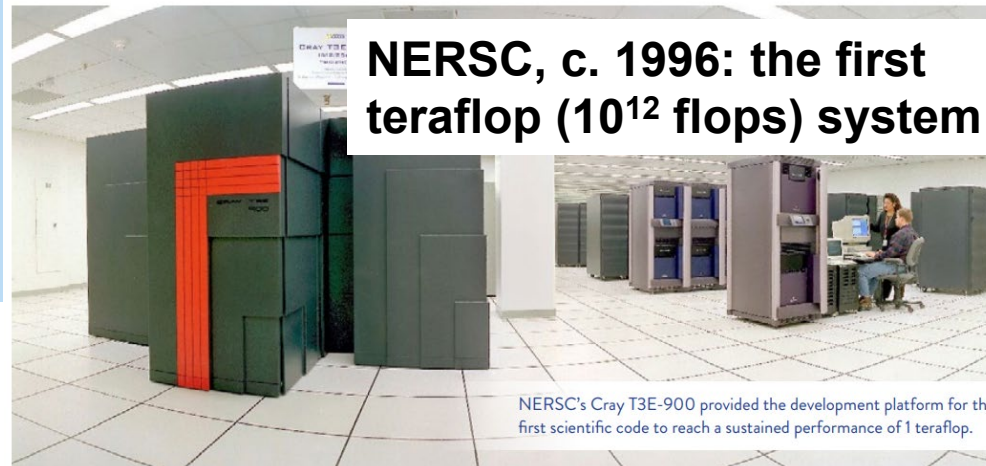
World-Leading Supercomputers

ASCR – over 70 years of Advancing Computational Science

Beginnings: During the Manhattan Project, John Von Neumann advocated for the creation of a Mathematics program to support the continued development of applications of digital computing



Over 40+ years, ASCR has a rich history of investment in computational science and applied mathematics research, and revolutionary computational and network infrastructure.



WHY COMPUTATIONAL SCIENCE?

- Third pillar alongside theory and experiment
- Essential when experiments are too expensive, dangerous, time-consuming, or impossible
- Facilitates idea-to-discovery, equations to algorithms
- Virtually every discipline in science and engineering has benefited from DOE's sustained investments in computational science

Scientific Discovery through Advanced Computing

Office of Science
U.S. Department of Energy

March 24, 2000

March, 2000 report identified need for concerted, Office-of-Science-wide investment in **software infrastructure** for scientific computing.



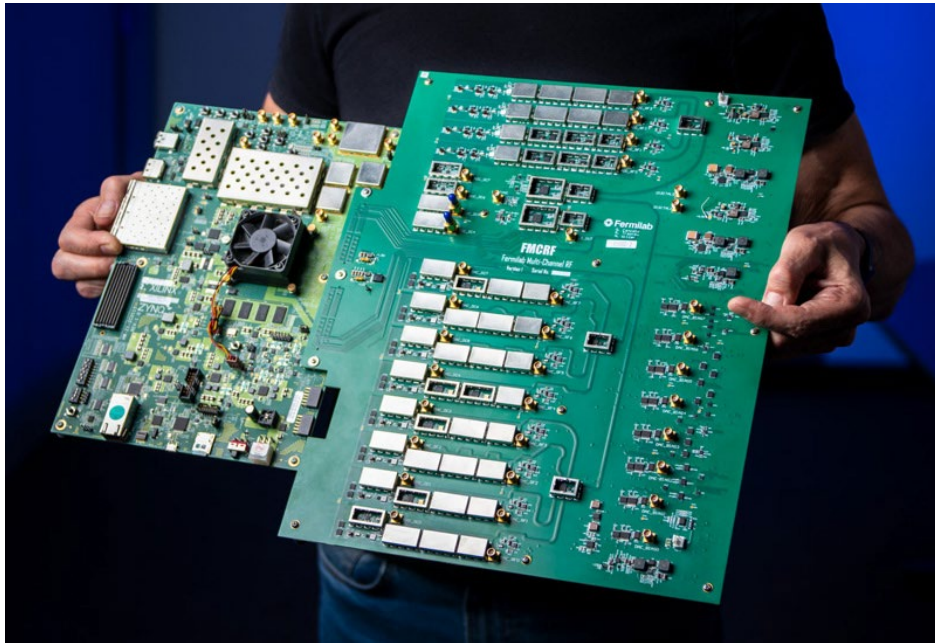
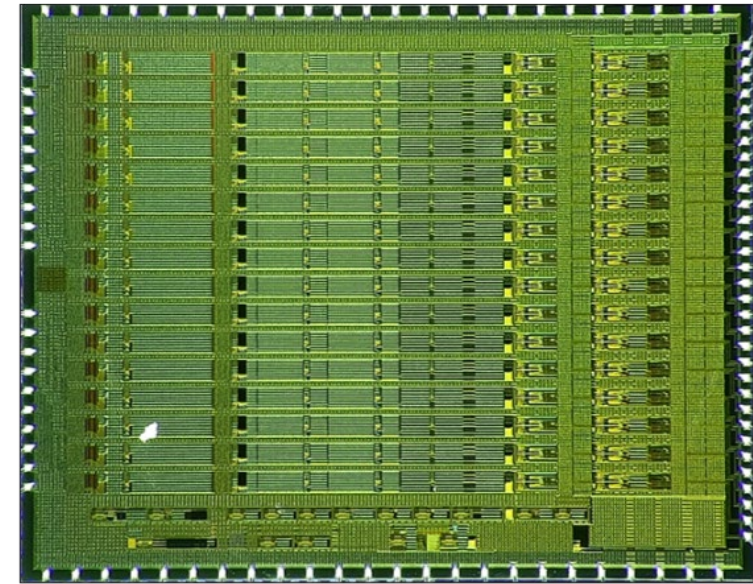
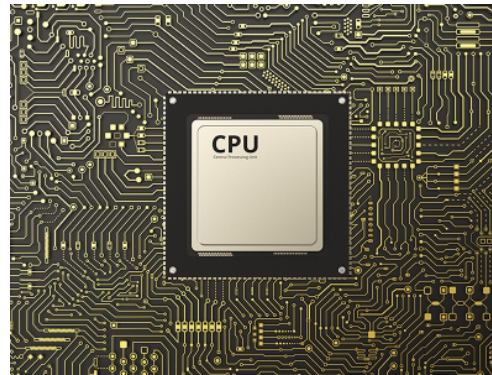
Previous generation,
vector machines: 40-50%
of peak performance

New, massively
parallel
architectures: only
5-10% of peak



Needed **new algorithms, codes** to take full advantage of the **new hardware**

Even more true today





EXASCALE
COMPUTING
PROJECT
2016-2024

two examples

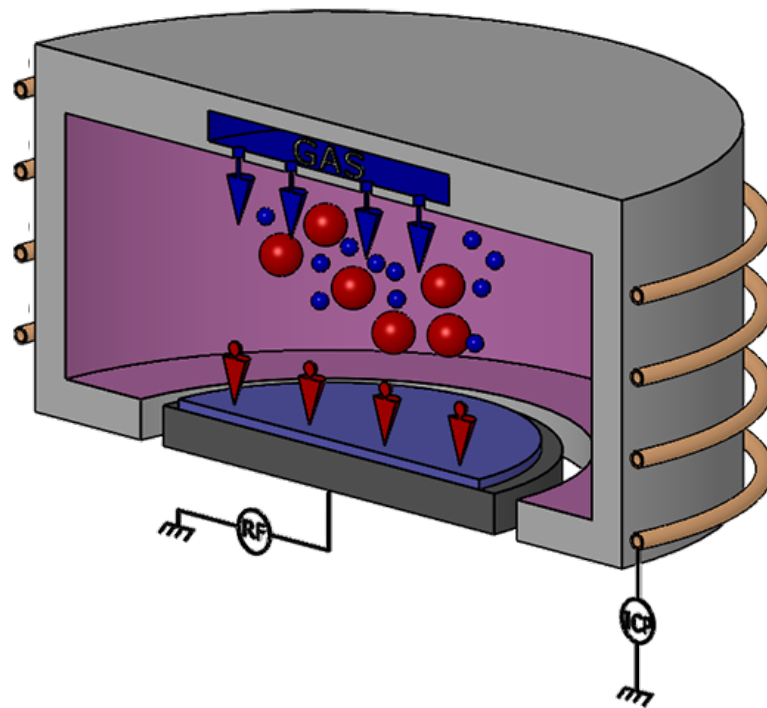


C++ linear algebra: write once, performant across vendors (Intel, AMD, NVIDIA)



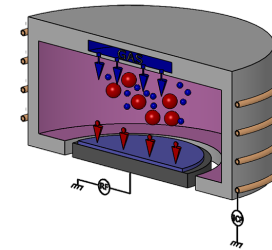
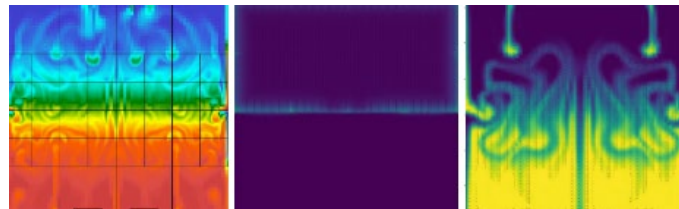
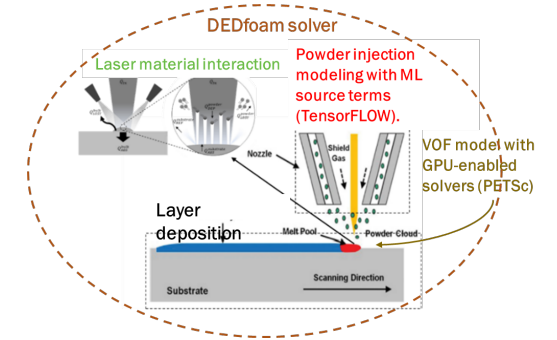
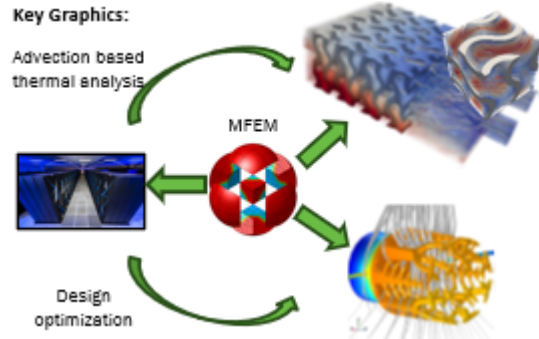
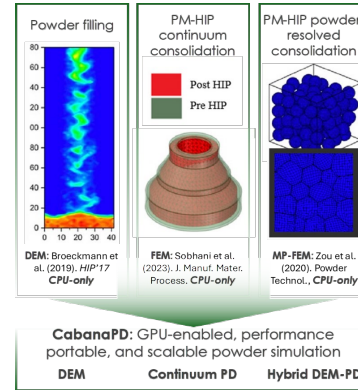
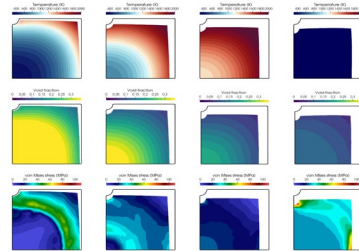
Electromagnetics/plasma package using particle-in-cell method

Revathi Jambunathan, LLNL PIC-MCC and ML-Enhanced HPC Code for Optimizing Plasma-Assisted Semiconductor Chip Manufacturing



spring 2024 EERE lab call HPC4Mfg

Topic 3, "Codes for HPC4Mfg"



Archetypal ASCR partnership

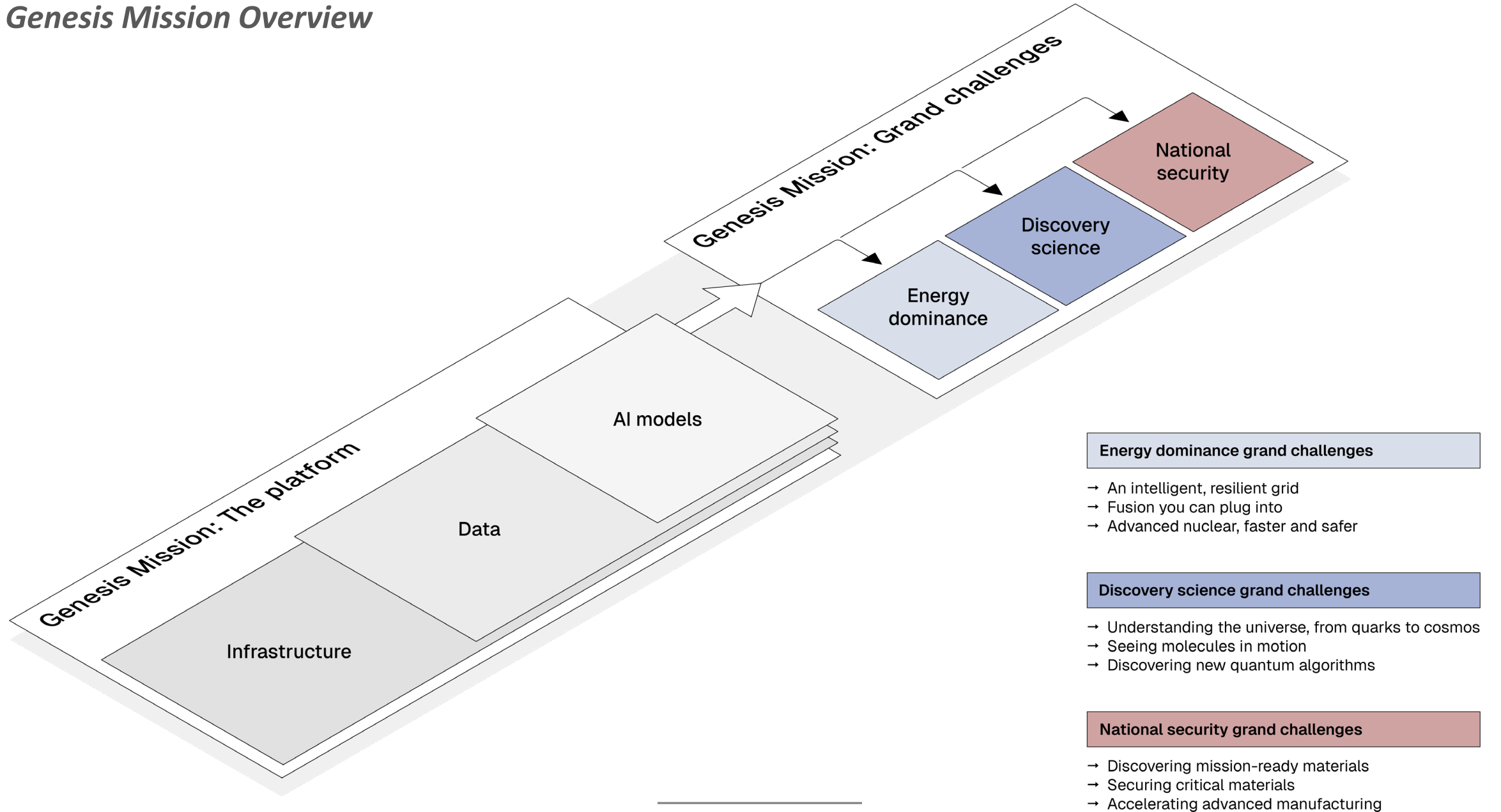
Scientist/engineer: "Wow! I had no idea this capability existed. Now I can run much bigger/longer and get new results I never thought I'd see."

Mathematician/computer scientist: "Wow! I had no idea problems like this existed. I've had to rethink my whole strategy and come up with new algorithms/codes."



Genesis Mission

Genesis Mission Overview



Grand Challenges



Energy

AI will be used to accelerate sustainable fusion power, optimize advanced nuclear reactor design and operation, and enable a more intelligent and resilient electrical grid.



Discovery Science

AI will be used to illuminate molecular dynamics, unify data to understand the universe from quarks to cosmos, and generate new quantum algorithms.



National Security

AI will be used to secure critical materials, accelerate advanced manufacturing, and discover mission-ready materials for defense and industry.

Some other ASCR partnerships

- SciDAC: Scientific Discovery through Advanced Computing
- NAIRR (interagency)
- code correctness (NSF/CISE/CCF)
- graduate fellowships (SC/WDTS and NNSA/ASC)
- ML in Citadel secure environment (NIH/NCI)
- ...