

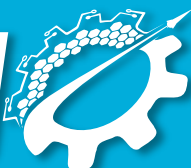


Exceptional service in the national interest

Advanced Manufacturing Lessons from National Security

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Center for Advanced Manufacturing & Innovation
DREA²M LDRD Mission Campaign

CAMIN 

Center for Advanced Manufacturing & Innovation



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Introduction

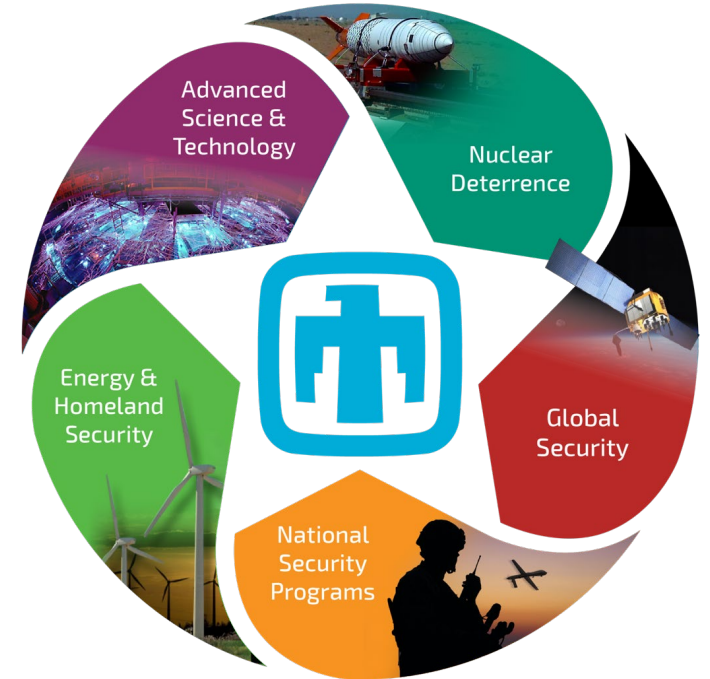


Not a shipbuilder

Our World:

- High-consequence national-security applications
- Complex, interdependent relationships
- Risk averse by nature

Advanced Manufacturing (AdvM) is not solved...



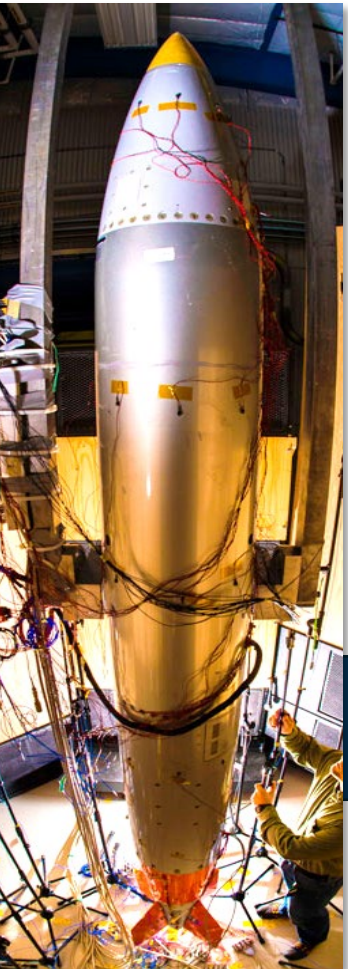
... but we have seen the patterns of modernization — where it struggles, where it sticks, and how new technology becomes trusted.



The Adoption Paradox



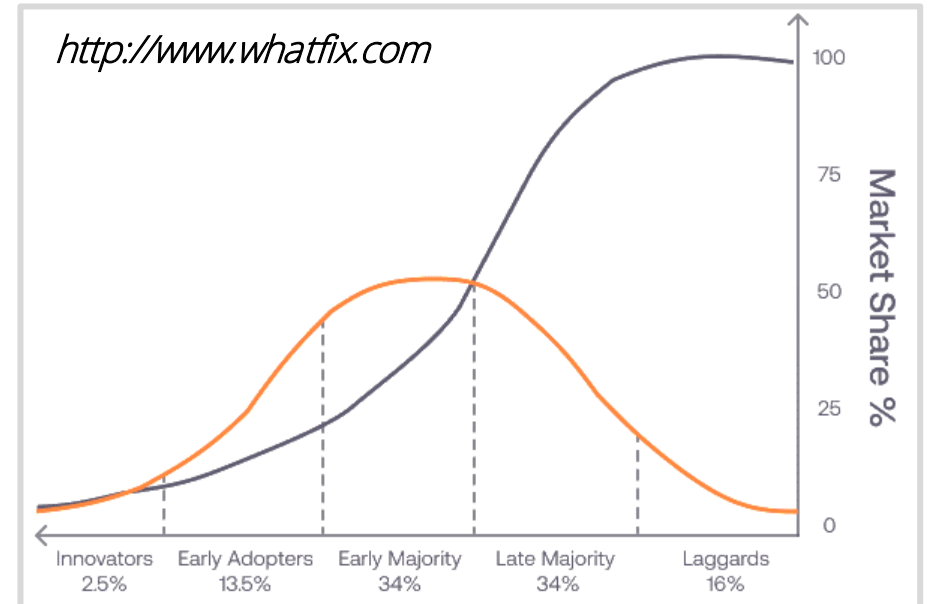
*Technology is advancing faster than we are advancing **trust**.*



- Additive • Automation • Autonomy • Smart Factory • Digital Twin
- AI/ML • OMI

Defense missions need **mission grade** trust → **Assurance**

<http://www.whatfix.com>



Not unique
to defense:



XEROX



BUT ...



Nuclear Deterrence can't use
market share to build trust.

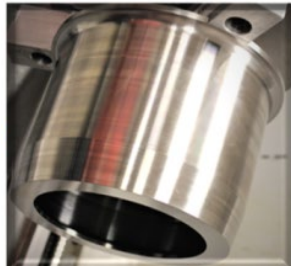
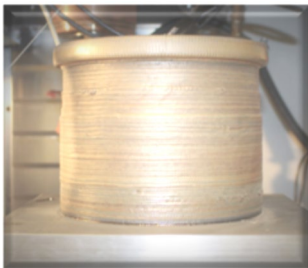
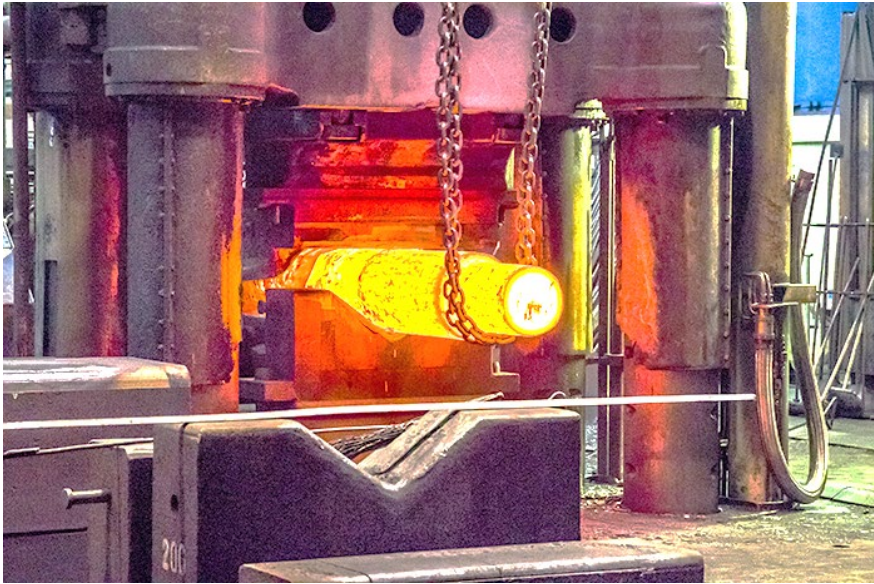
*Adoption isn't limited by what our machines can do; it's limited by what our institutions are ready to **believe**.*



The Stakes Are High



Advanced Manufacturing addresses our most pressing problems.



Sims et al, Sandia National Labs, 2024

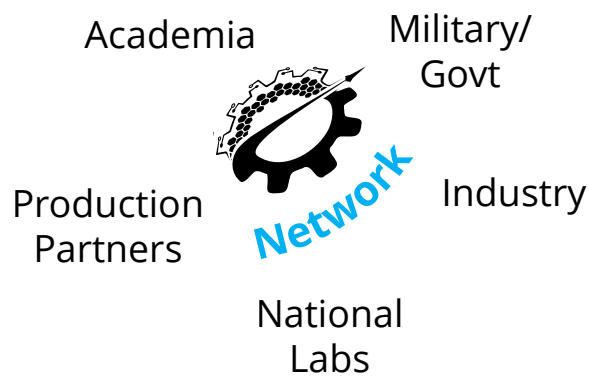
- Supply chain risk, from commodity to specialty materials.
 - Up to a year for large castings and forgings
 - 6 months for specialty machining
 - 4 months for simple machining
 - Limited design space from slow prototyping
 - Lack of verification digital tools
 - Complex production and assembly
- 
- Prototypes in weeks
 - Alternate AM supply chain
 - Piece part reduction
 - Instrumented production for digital twin/thread
 - Deployed AM for on-demand field manufacturing

*National security demands **mission-grade trust.***

CAMINO *Center for Advanced Manufacturing & Innovation*

CAMINO Resources

- Equipment
- Space
- Digital Tools
- **Network**
- Funding



CAMINO Thrusts

- Materials
- Processes
- Integration
- Mod/Sim & AI
- Urgent Exemplars
(Cables, Connectors, Electronics)

*What we need to be
good at when mission
teams seek help!*



Shortened Learning Cycles



Faster Prototyping



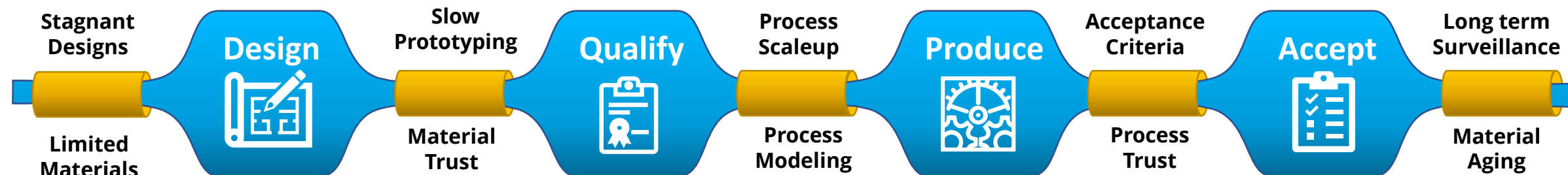
Piece Part Reduction



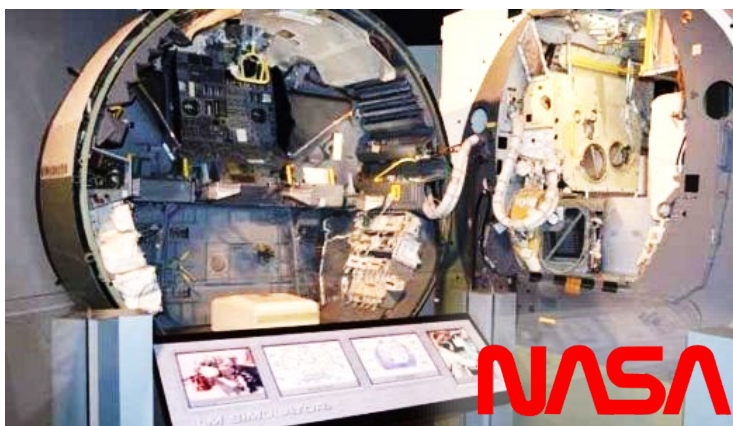
Supply Chain Resiliency

*CAMINO isn't just a facility; **it's infrastructure for trust** — tools, space, expertise, and funding to build assurance in advanced manufacturing.*

*CAMINO finds and smooths **friction points** early.*



A “machine shop” for the Mission: *Tools • Prototypes • Demonstrators • Data • Expertise • R&D • Support • Collaboration*



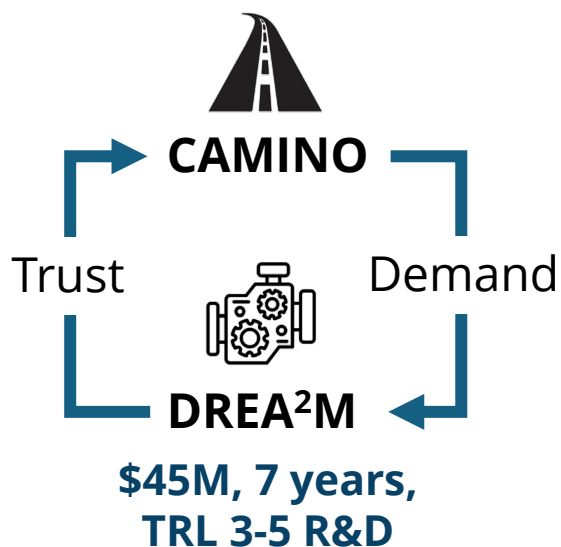
NASA Digital Twin Initiative: Real-time virtual replicas of physical objects, systems, and processes. Like with CAMINO, they **find friction and rehearse failure before it happens**, at data scale, not production scale.

*We use CAMINO to identify where data, tools, and trust diverge — **while the cost of learning is still low.***

 **DREAM²** Digitally Realized and Enabled
Agile Advanced Manufacturing



An **execution engine** to build trust
through AdvM R&D.



*DREA²M is one engine.
We need more!*

DREA²M's **8 R&D challenges** are created from **mission demand signals**

Design Phase



Process



Structure

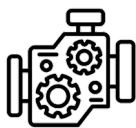


Properties



Performance

1. Rapidly Expand Material Choices
2. Improve Experimental Processes
3. Develop Predictive Models
4. Establish Correlations



Production Phase



Detect



Prognose



Adapt

5. Develop Real-Time Inspection
6. Create Decisional Models
7. Achieve Data Efficiency
8. Supplement the Artisan

21 projects to date: • Al, Ta, Ceramic, Inconel, SS • LPBF, Wire DED, DLP, Thin Films, energetics
• Automated assembly, qualification, autonomous testing, high throughput fabrication, joining • AI
inspection, PSPP surface mapping, multimaterial top-op, simulated data, feedforward control

*CAMINO is the road, DREA²M is the engine. **We need more of both.***



Partnerships that Make It Real



Collaboration in Action (not an exhaustive list!)



Joint R&D • Internships • Print Demonstrators • CRADAs • Residencies • Training • CAMINO Council

This isn't a Sandia show. It's a team sport — national labs, production agencies, universities, and companies all have a lane here.