APPLIED RESEARCH LABORATORY FOR
INTELLIGENCE
AND SECURITY

Future of Research

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Disclaimer

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“Resilient, diverse, and secure supply chains are going to help revitalize our domestic manufacturing capacity and create good-paying jobs…

It’s about resilience, identifying possible points of vulnerabilities in our supply chains, and making sure we have the backup alternatives or workarounds in place.”

-- Remarks by President Biden at 24 FEB 2021
Signing of an Executive Order on Supply Chains

https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/02/24/remarks-by-president-biden-at-signing-of-an-executive-order-on-supply-chains/

But we've been saying it for years…

- DoD Digital Engineering Strategy says digital transformation will address challenges associated with complexity, uncertainty, and rapid change in deploying and using systems
- McKinsey recommends using a holistic and systematic analysis in making decisions on how and where to best deploy and maintain technologies and capabilities
- MITRE says DoD needs better use of its existing resources to identify, protect, detect, respond to, and recover from network and supply chain threats – we must protect systems as much as we try to deploy them.

It's all about Integrated Logistics!

"You will not find it difficult to prove that battles, campaigns, and even wars have been won or lost primarily because of logistics."
-- General Dwight D. Eisenhower

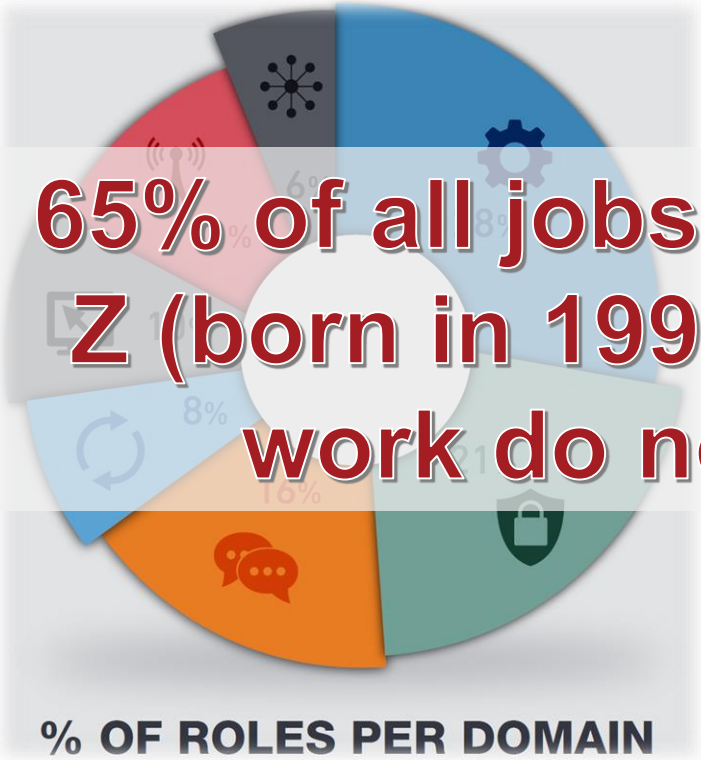
“Logistics is the bridge between the economy of the Nation and the tactical operations of its combat forces. Obviously then, the logistics system must be in harmony, both with the economic system of the Nation and with the tactical concepts and environment of the combat forces.”

-- Rear Admiral Henry E. Eccles

Supply Chains require uncompromisable systems, services, workforces, and workforce environments!

Joint Chiefs of Staff. (2019). *Joint Logistics* (Joint Publication 4-0). United States Department of Defense. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp4_0ch1.pdf?ver=2020-07-20-083800-823

Need to Educate / Train People Differently!



Digital Manufacturing | 28%
Traditionally known as the "shop floor"

Digital Thread | 21%
Management of an asset's data across its product lifecycle

Supply Network | 11%
Technologies and capabilities that support the supply and delivery of resources and products

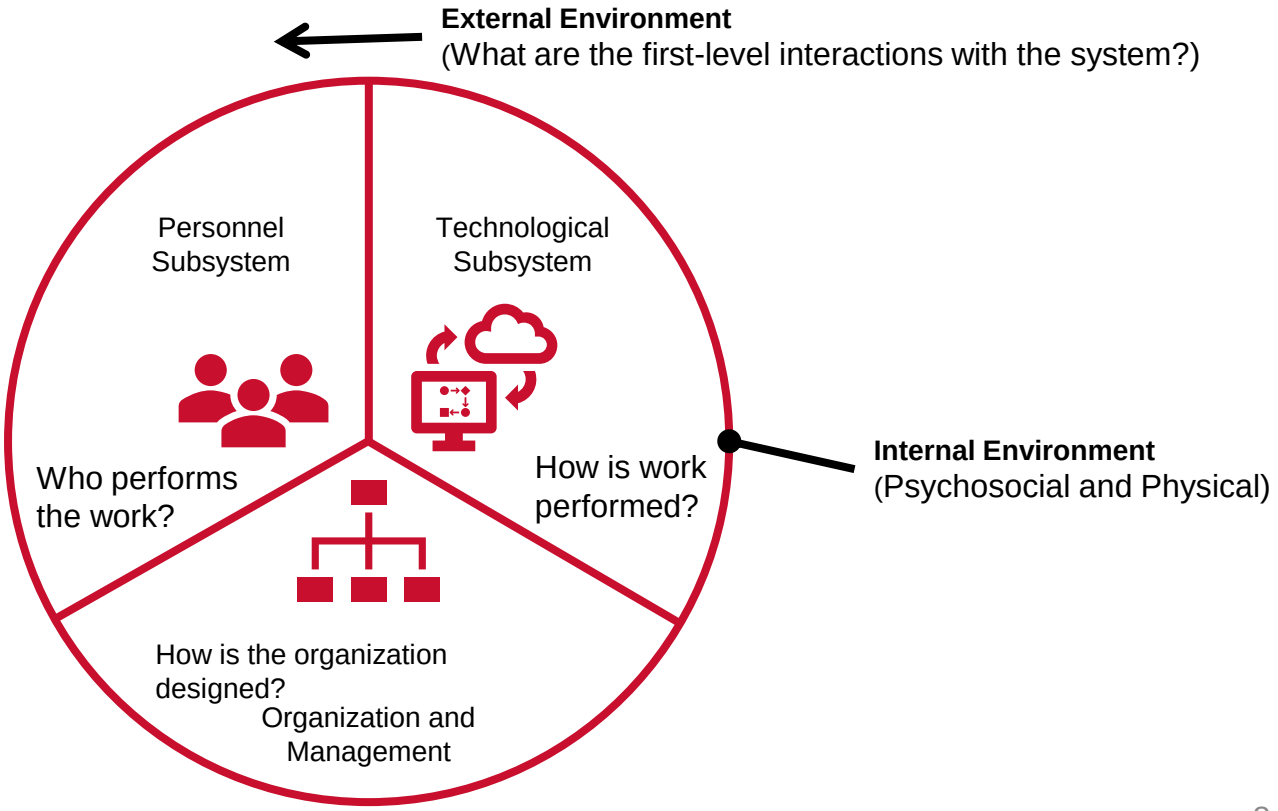
Omni | 6%
Wider, external cross-domain areas of work

65% of all jobs that Generation Z (born in 1996 and after) will work do not exist yet!

Kowalski, R., & Brown, C. (2019). *The Future Factory: Mapping the Skills that will Power Manufacturing*. Chicago IL.

The Future of Jobs Report 2018. (2018). *Centre for the New Economy and Society*. Geneva. Retrieved from https://www.weforum.org/reports/the-future-of-jobs-report-2018

STS Analysis and Design

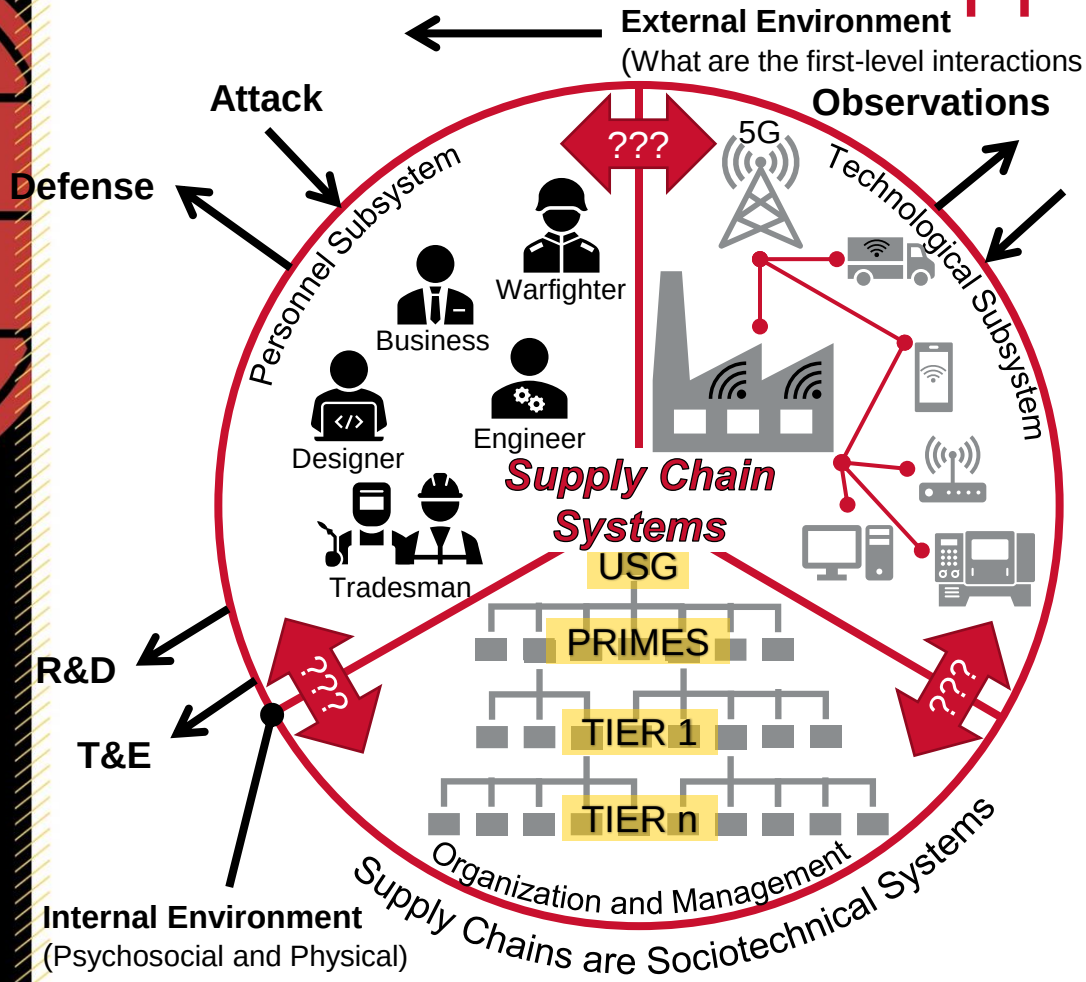


Kleiner, B. M. (2008). Macroergonomics: Work System Analysis and Design. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *50*(3), 461–467. https://doi.org/10.1518/001872008X288501

Interdependence Abound!

- Theory of Joint Causation
  - Subsystems are affected by causal events in the external environment and change in one subsystem causes changes in the others
- Theory of Joint Optimization
  - Maximization of overall work effectiveness requires joint design of subsystems toward the development of the best possible fit
- Theory of Joint Design
  - Be proactive, instead of reactive. Must consider subsystems jointly during design while considering objectives and requirements of subsystems

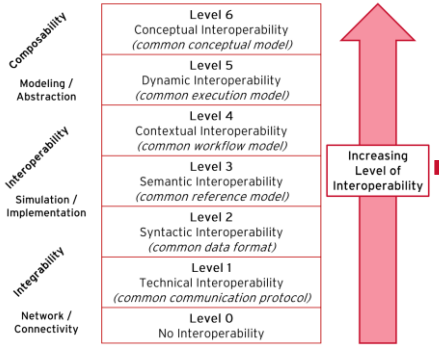
CONOPS of STS Supply Chains



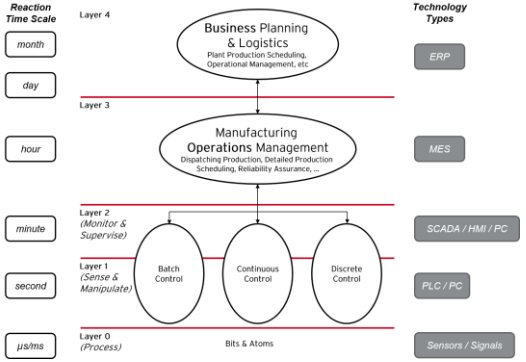
Must Respect the Theories:

- Joint Causation
- Joint Optimization
- Joint Design

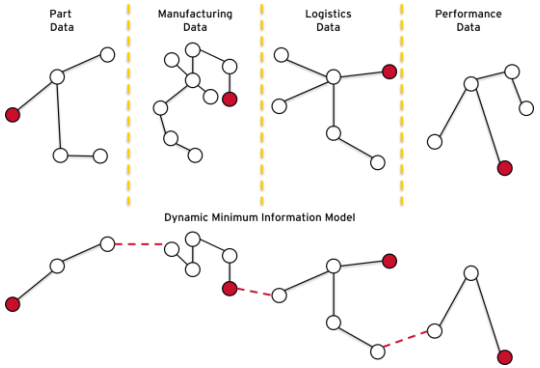
Model-Based Intelligence and Security



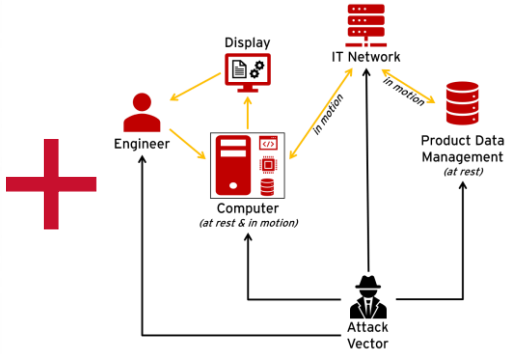
Conceptual Interoperability



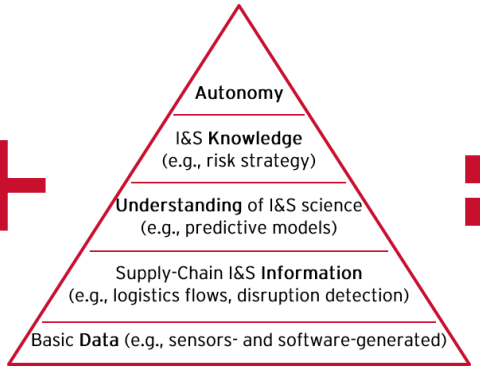
Enterprise Connectivity



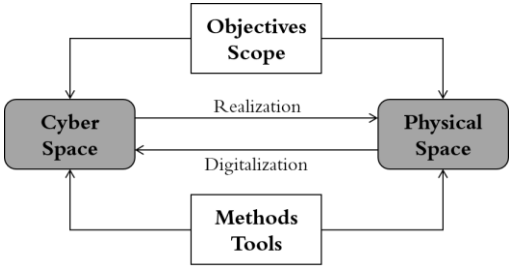
Linked Data



Trust and Traceability



Autonomous Knowledge Generation



Distributed A&IS
Digital Twins

Last words…To maintain dominance,

the US needs open architectures and policies to support the "brownfield" realities of manufacturing and allow interconnectivity across decentralized supply chains.

"This is about making sure the United States can meet every challenge we face in this new era — pandemics, but also in defense, cybersecurity, climate change, and so much more. And the best way to do that is by protecting and sharpening America's competitive edge by investing here at home."

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Thank you!
Questions?

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Snapshot About Me

Education

Ph.D., Industrial and Systems Engineering
from Virginia Polytechnic Institute and State University, Blacksburg VA

M.Eng., Engineering Management
from The Pennsylvania State University, University Park PA

B.S., Aeronautical & Astronautical Engineering
Minor in Political Science focused on Science and Technology policy
from Purdue University, West Lafayette IN

Professional Experience

- Current: Mission Dir., UMD ARLIS
- 2014-2020: Program Manager, NIST
- 2005 to 2014, Aerospace Sector, Phoenix, Arizona
- Model-Based Enterprise (MBE) Evangelist

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