Industry Insights - Cybersecurity for Additive Manufacturing

Additive Manufacturing for Reactor Materials & Components
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Agenda

- Introduction
- Threat Update - FUD
- Cybersecurity for Direct Digital Manufacturing (DDM)
- Cybersecurity Regulations
- Supply chain
- Recommendation

CTC - Leading Innovation through Engineering, Technology and Services

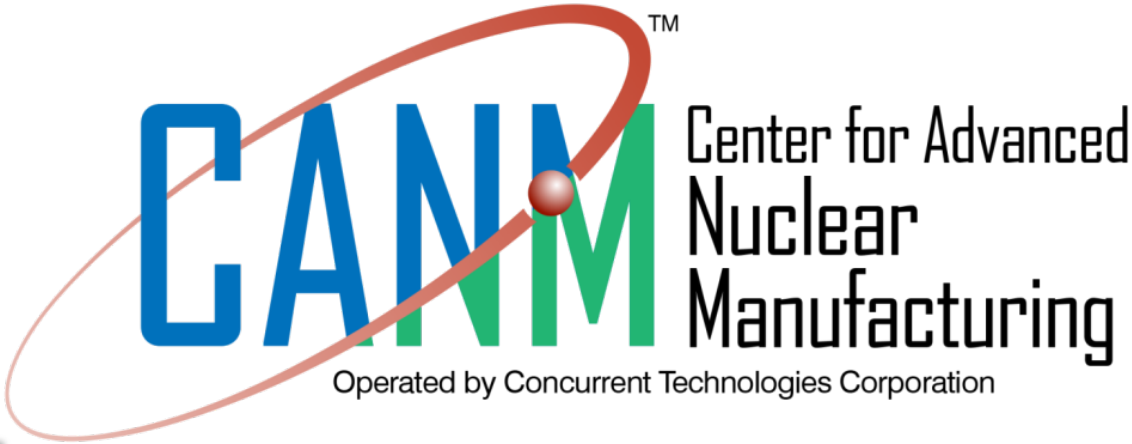
Concurrent Technologies Corporation (CTC) is an independent, nonprofit, applied scientific research and development professional services organization.

Enterprise Ventures Corporation (EVC) is CTC's technology commercialization arm and is organized as a wholly owned for-profit affiliate of CTC.

CTC and EVC provide full lifecycle support services to clients, from innovative concepts through production and deployment.

Center for Advanced Nuclear Manufacturing

- With the advent of the next generation of SMRs and AR's there is a clear need for advanced manufacturing technologies to support the efficient fabrication of complex modular systems
- In 2017 CTC made the decision in 2017 to establish the Center for Advanced Nuclear Manufacturing (CANM) with support from the US Nuclear Infrastructures Council's
- Leverages CTC's experience in operation of the Navy Metalworking Center (NMC) helps to facilitate an efficient start-up and operation of the Center

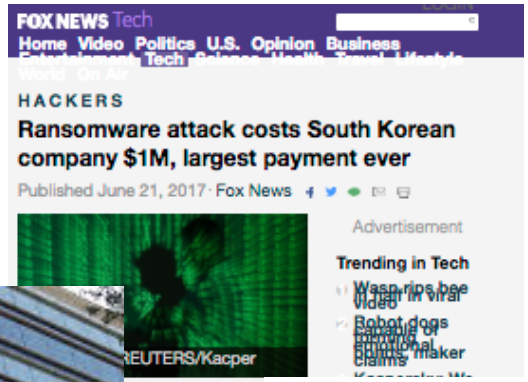


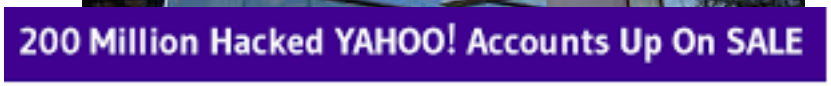
Cyber Threat Update

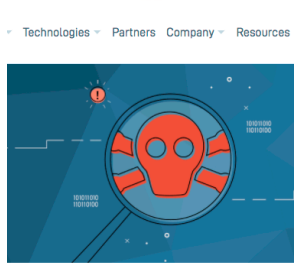
Threat update

- Verizon Breach Report (November 10, 2017)
  - 75% of breaches were from external actors, 25% involved internal actors
  - 62% featured hacking, 51% included malware, 81% were **stolen or weak passwords**
  - 66% of malware **installed via email**
  - 73% were financially motivated with **21% being espionage**
  - 61% of the victims were businesses **under 1,000 employees**
- Manufacturing specifics results
  - 90% of data stolen during a breach were considered **"secrets"** by the owner
  - **Strategic gains** were the number one motive
  - The majority were conducted by **state-affiliated sponsored actors**
  - Internal espionage was present as well

When were you compromised?







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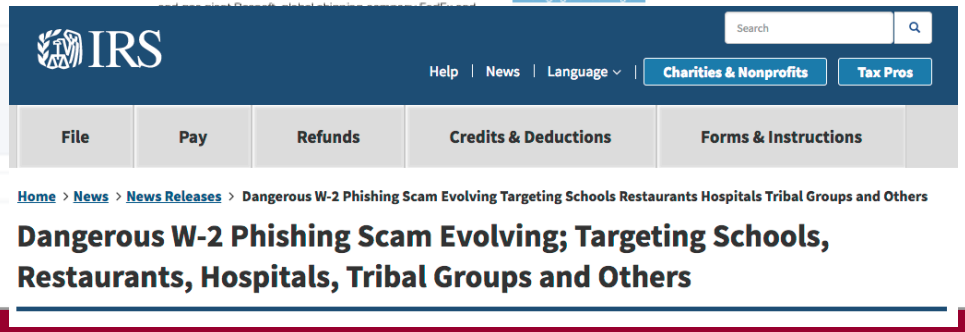


Why are we still failing?

- We have big budgets for security…
- We are focusing on the right things, I think…
- There is a shortage of talent but is that really the reason…
- Is the adversary that motivated or smarter…
- Are our workforce the issue…
- Do we not train enough or the right way…
- Is this just the new norm…

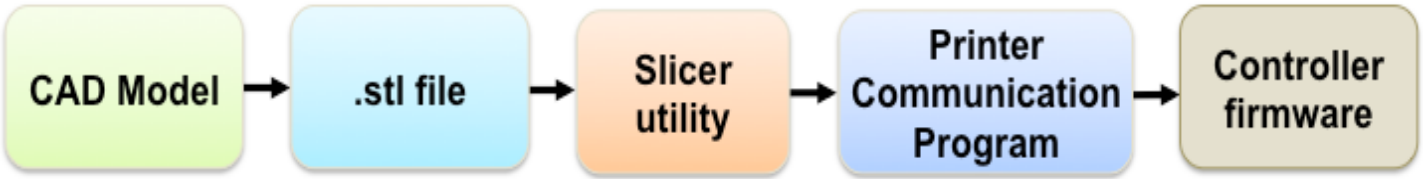
Cybersecurity for DDM

Cybersecurity: A Practical Perspective

Can you connect our new printer?

Direct Digital Manufacturing

- *"The fabrication of components in a seamless manner from computer design to actual part in hand"- Brookings Institute*
- A disruptive technology with similar communication challenges as with Control Systems and IOT sensors
- Air gapped cybersecurity approach cutting the "Digital Thread"



Industrial Control System Cyber Issues

- ICS-CERT 2016 Report ICS Findings
  - Boundary protection
  - Least functionally
  - Authenticator management
  - Identification and authentication 5. Least privilege
  - Allocation of resources

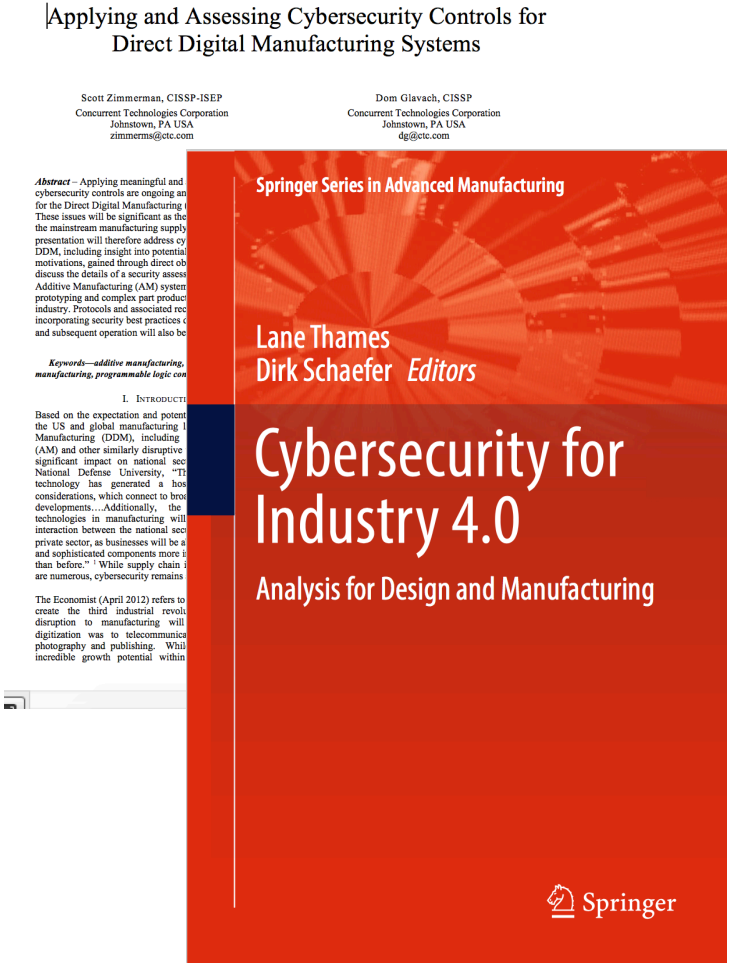
Advanced Manufacturing Security Challenges

RISK

- Loss or theft of intellectual property
- Compromised process and/or product integrity
- Productivity disruption
- Damage to reputation

Additional Research

- CTC cyber risk assessment
- NIST Symposium on DDM
  - https://www.nist.gov/publications/proceedings-cybersecurity-direct-digital-manufacturing-ddm-symposium
- Textbook chapter
  - “Cybersecurity for Industry 4.0”
  - http://www.springer.com/us/book/9783319506593

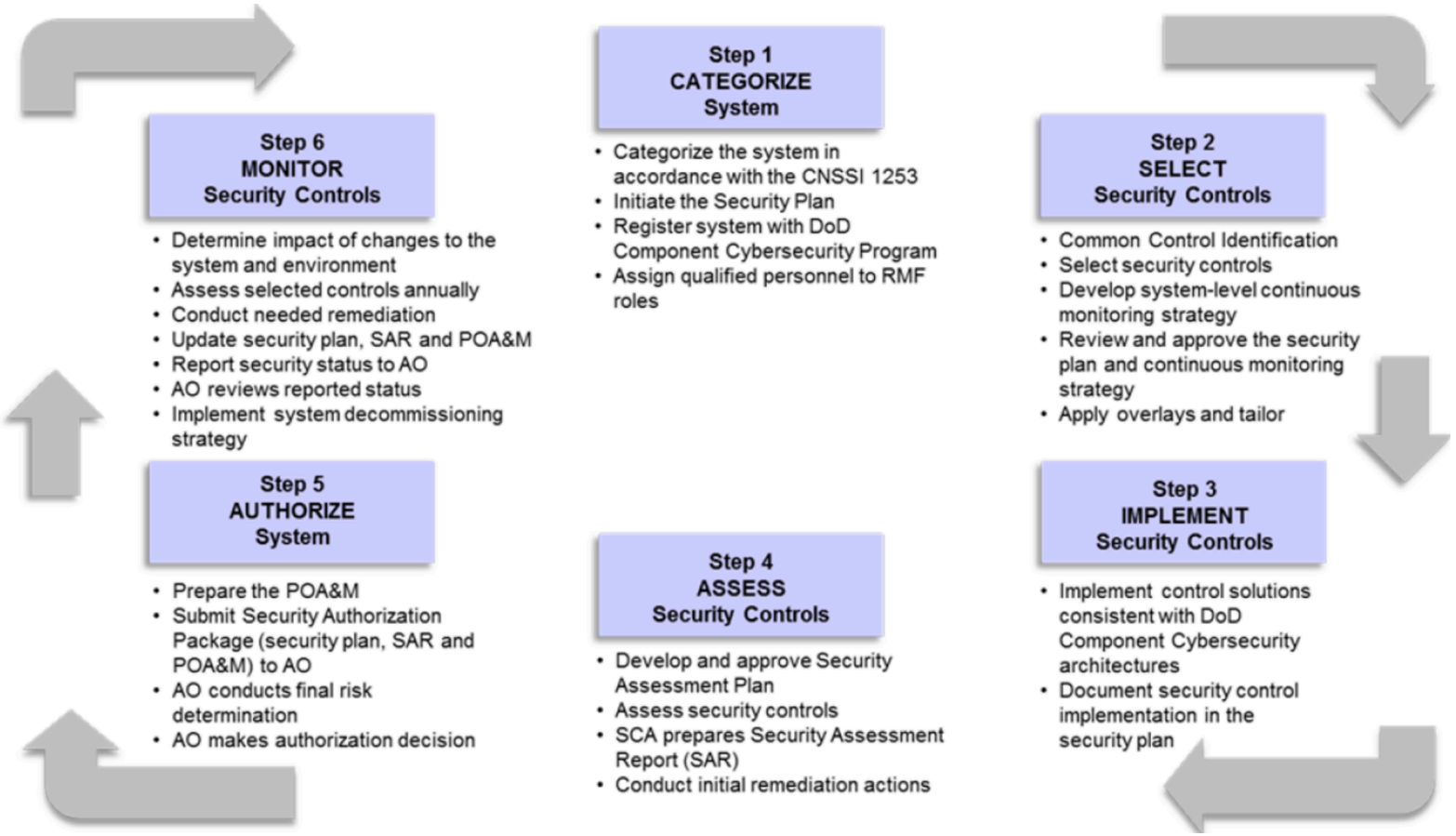


DoD Cybersecurity Requirements

DoD Information Assurance Framework Evolution

- DoD Information Technology Security Certification and Accreditation Process (DITSCAP), mid 1990s
  - Standardized approach, did not take into account evolving threat landscape
- DoD information Assurance Certification and Accreditation Process (DIACAP), 2006
  - Recognized an acceptable operational risk level to support mission
- DoD Information Assurance Risk Management Framework (DoD RMF), 2013
  - Risk based approached to managing cybersecurity

DoD Risk Management Framework

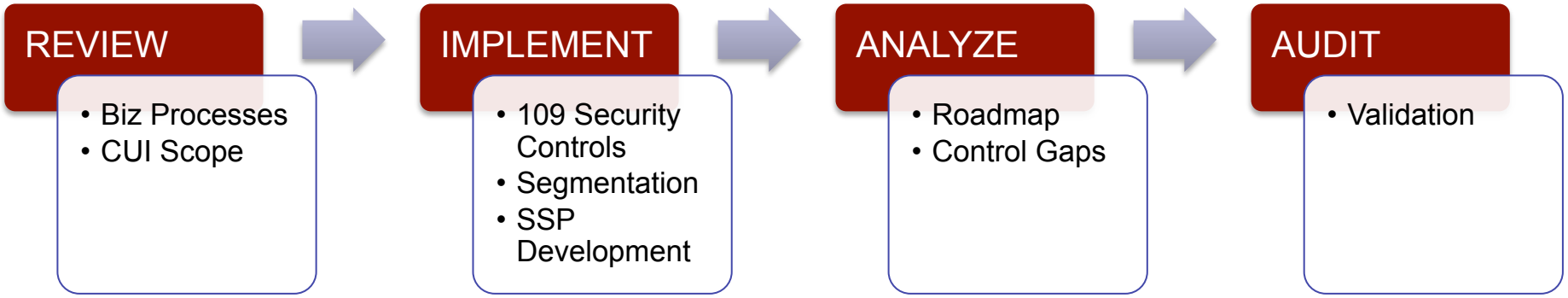


https://aida.mitre.org/cyber-rmf/

USG/DoD Contractor Cyber Requirements

- **NIST issued cyber safeguards (Special Publication 800-171) in June 2015 to protect CUI in non-federal information systems.**
- **DoD issued the "Network Penetration" DFARS in Aug. and Dec. 2015 and these were revised on Oct. 21, 2016.**
- **Federal civilian agencies issued a new FAR "Basic Safeguarding" clause, effective June 15, 2016, requiring all contractors to protect "Federal Contract Information" on "Information Systems."**
- **NARA issued the Final Rule on "Controlled Unclassified Information" (CUI) on Sep. 14, 2016.**
- **A "General FAR Rule" is in development that will obligate all federal agencies to require cyber protection of CUI, per SP 800-171, in all contracts and agreements. Expect this Rule to be final in 2017.**

Path to NIST SP800-171 Compliance



SMB Supply Chain Cybersecurity Issues

- Small suppliers/businesses have become a prime target for attackers and act as a stepping stone to primes
  - From janitorial services to software engineering-- with physical or virtual access to information systems, software code, or IP
- Small businesses are spending less on cyber security while large businesses are spending more
- Small businesses generally don't have formal cyber security awareness efforts for their employees

Recommendations

- Learn lessons from past industry digitization
  - Telecom with the Internet of Things (IOT) to digital photography
- Now is the time to build cybersecurity into the process
  - Corporate leadership tends to be reactionary, we must get ahead of disruptive technology
  - Address cybersecurity concerns throughout the component lifecycle
  - Create active defense, don't wait to respond
  - Don't bolt it on at the end…

Cybersecurity Recommendations

QUESTIONS?

Center for Advanced Nuclear Manufacturing

- With the advent of the next generation of SMRs and AR's there is a clear need for advanced manufacturing technologies to support the efficient fabrication of complex modular systems
- Two organizations have recently developed models for a manufacturing technology center for U.S. nuclear industry -
  - DOE NE vision for a nuclear advanced manufacturing technology center
  - USNIC's concept for a U.S. Virtual Advanced Manufacturing and Research Center (VNAMRC)
- Leveraging CTC's experience in operation of the Navy Metalworking Center (NMC) helps to facilitate an efficient start-up and operation of the Center -
  - Transferrable experience and capabilities
  - Extensive experience in managing project identification and development efforts
  - Experienced management and technical staff with "right mix" of skills.

CANM Operation

- With USNIC's support, CTC made the decision in 2017 to establish the Center for Advanced Nuclear Manufacturing (CANM)
- CANM will utilize existing metalworking capabilities to establish a self-sustaining global resource to develop and deploy applied metalworking and manufacturing capabilities to advance SMR / AR design, fabrication and operation
  - Bring together the right mix of technologists, engineers and solution providers from industry and academia to develop and demonstrate cost effective and implementable technical solutions
  - Provide manufacturing and demonstration facilities to support the fabrication and testing of functional prototype systems
- CANM is initially being operated as an industry-funded organization
- DOE is working to establish an advanced manufacturing technology center with an industry cost-share requirement for awarded projects.