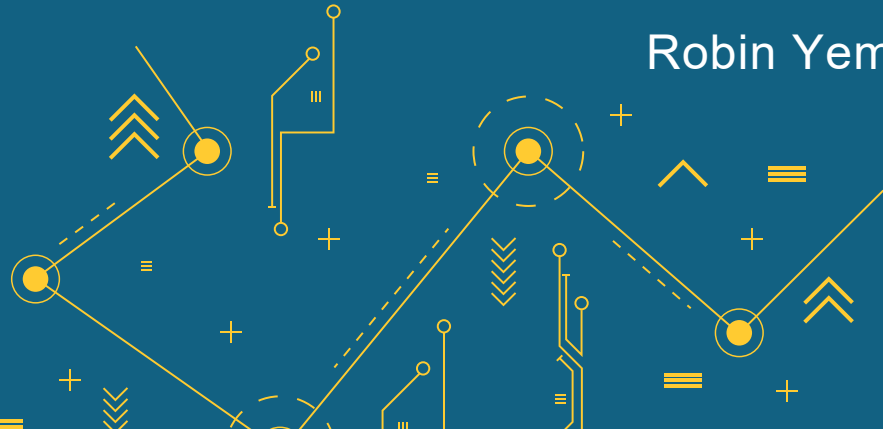


build better systems faster

INDUSTRIAL DEVOPS

*Catalyzing Change: The impact of Product
Management on Future Technologies*

Robin Yeman



Introduction



Robin Yeman

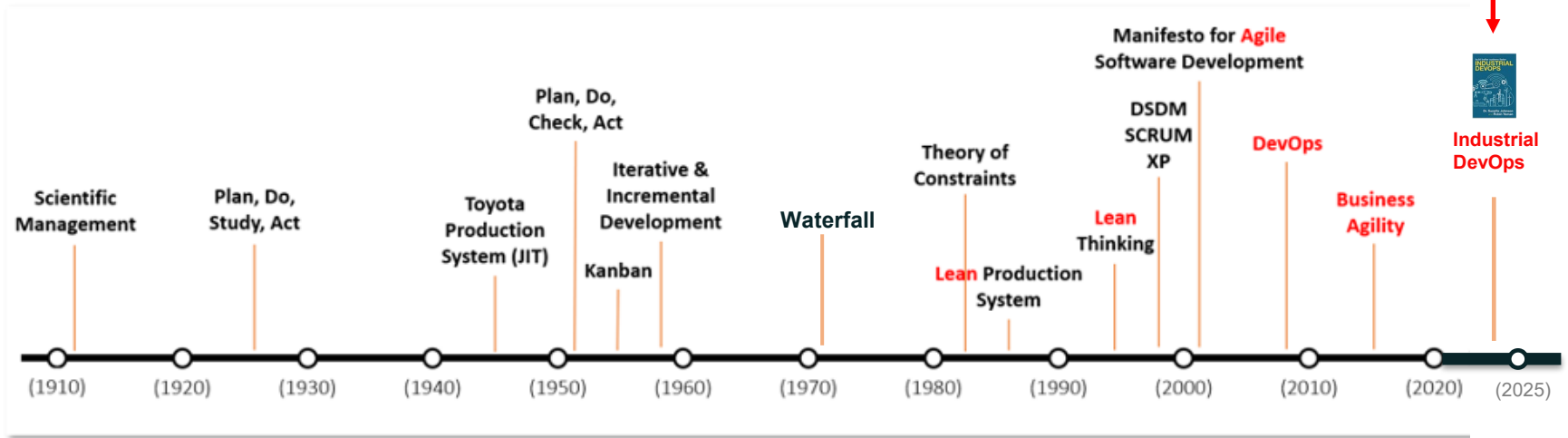
Journey to improve the state of the practice
in building large-scale safety-critical cyber-
physical systems using Agile and DevOps

Carnegie Mellon University
Software Engineering Institute

Evolution



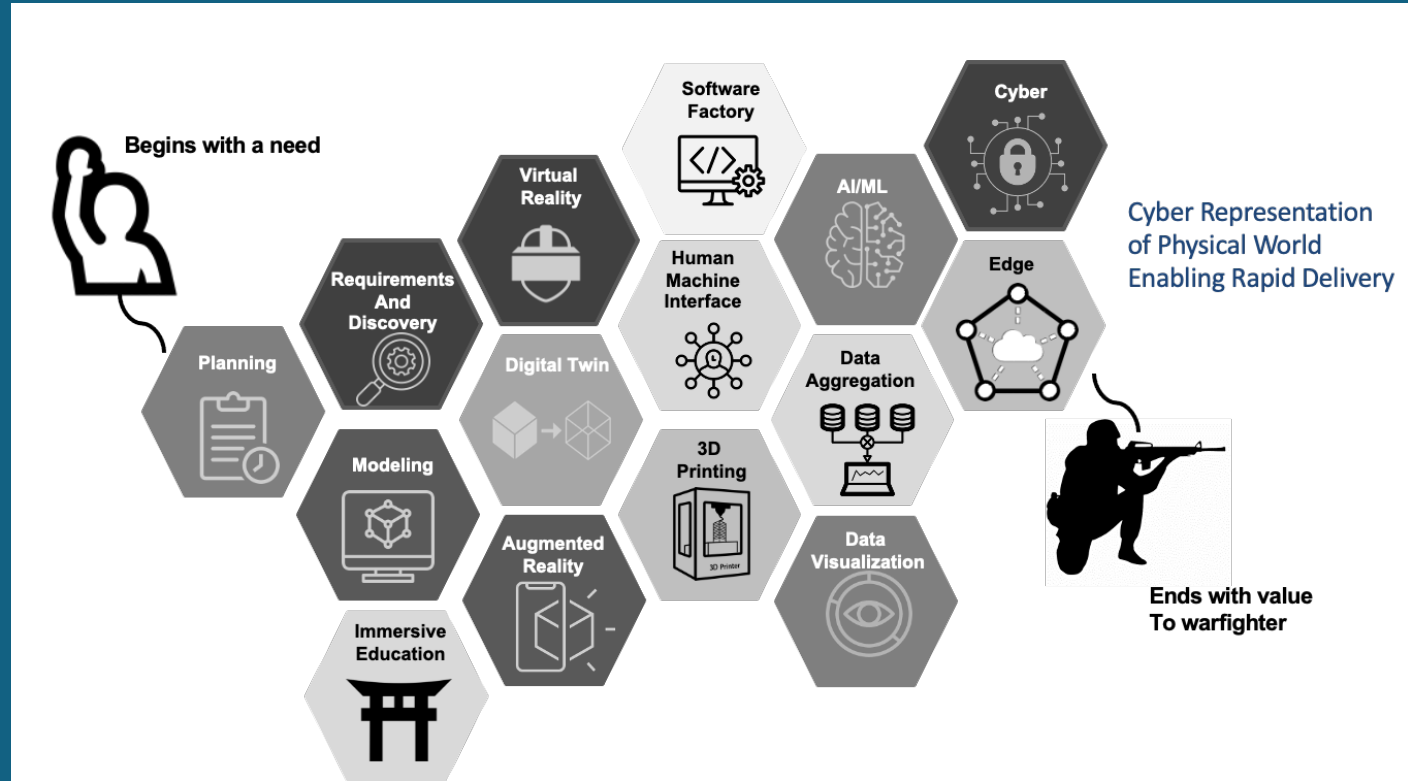
Extending Principles and Practices to System Level



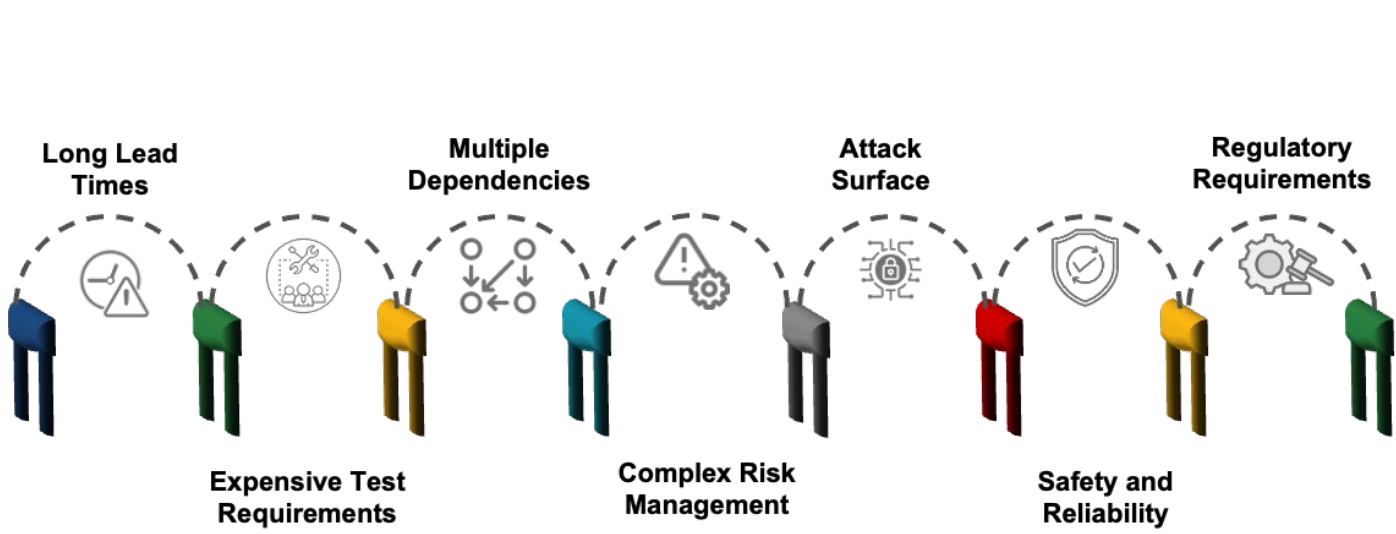
Digital Engineering Value Stream



*Use all the tools
in your toolbox
for product
management.*



Challenges for space domain

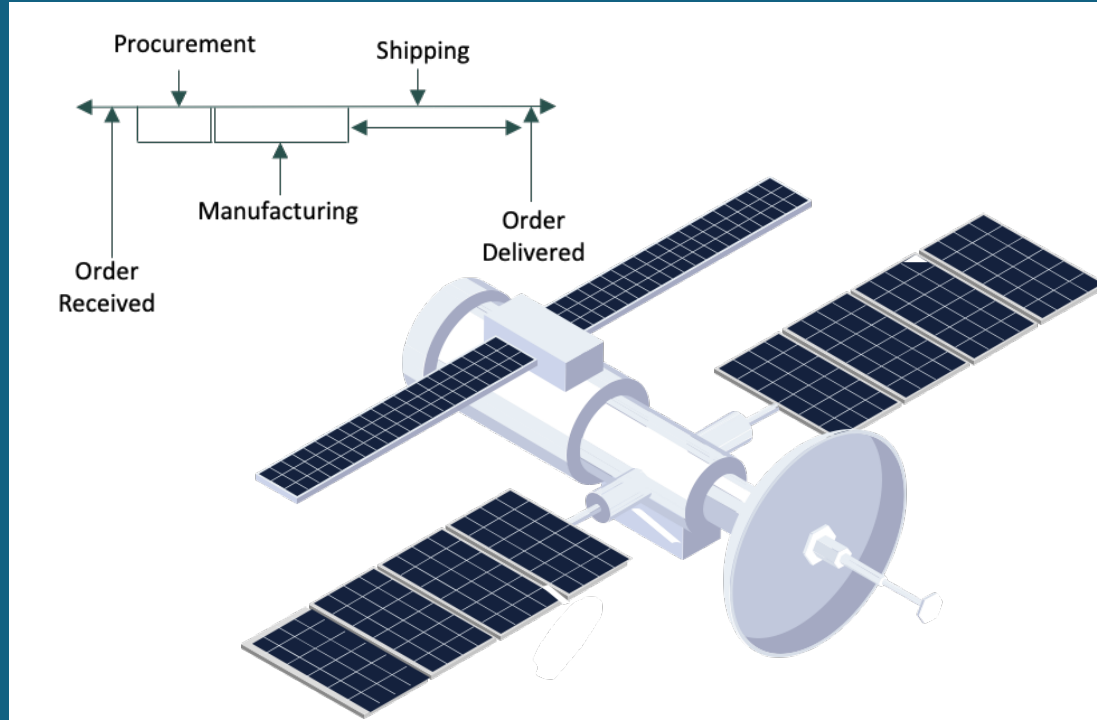
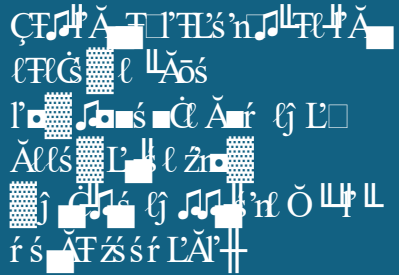


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Long lead time

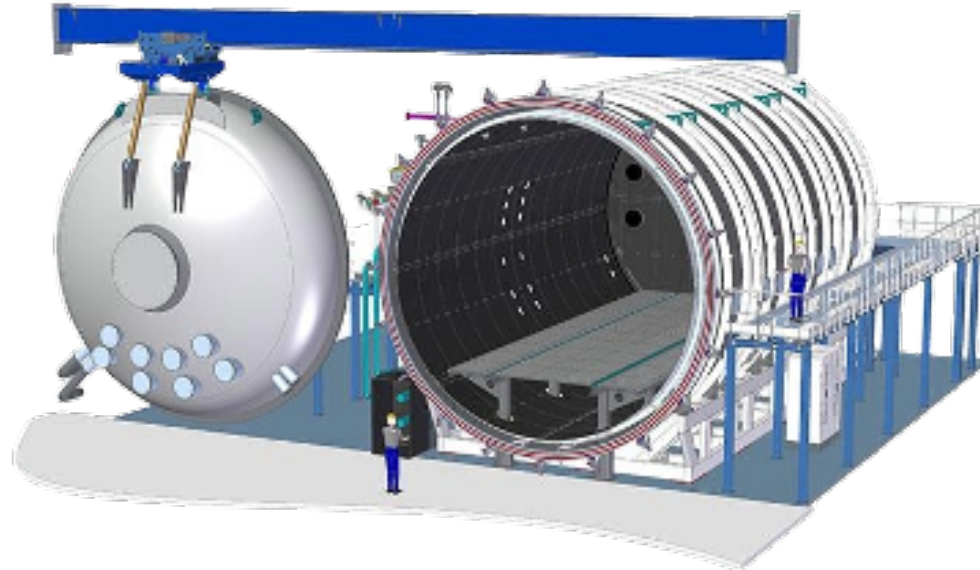


Expensive integration and test requirements

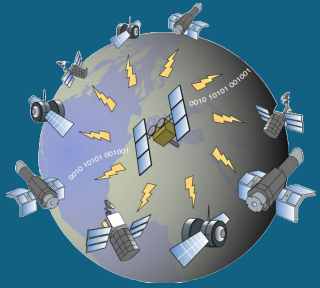
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Huge Thermal Vacuum chambers
cost millions of dollars, and the tests
can take months



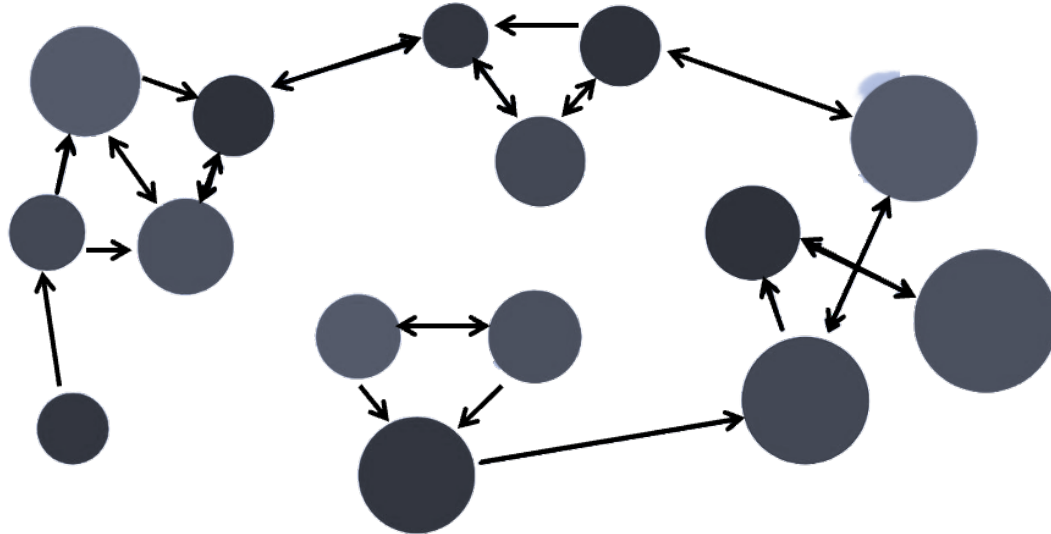
Multiple dependencies



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Cyber-Physical systems have many dependencies and are often systems of systems magnifying those dependencies.



Complex risk management

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{ Ä G ■ ■ P ■ ■ G ■ ■ Ä C ■ ■ □



Example GPS Risks

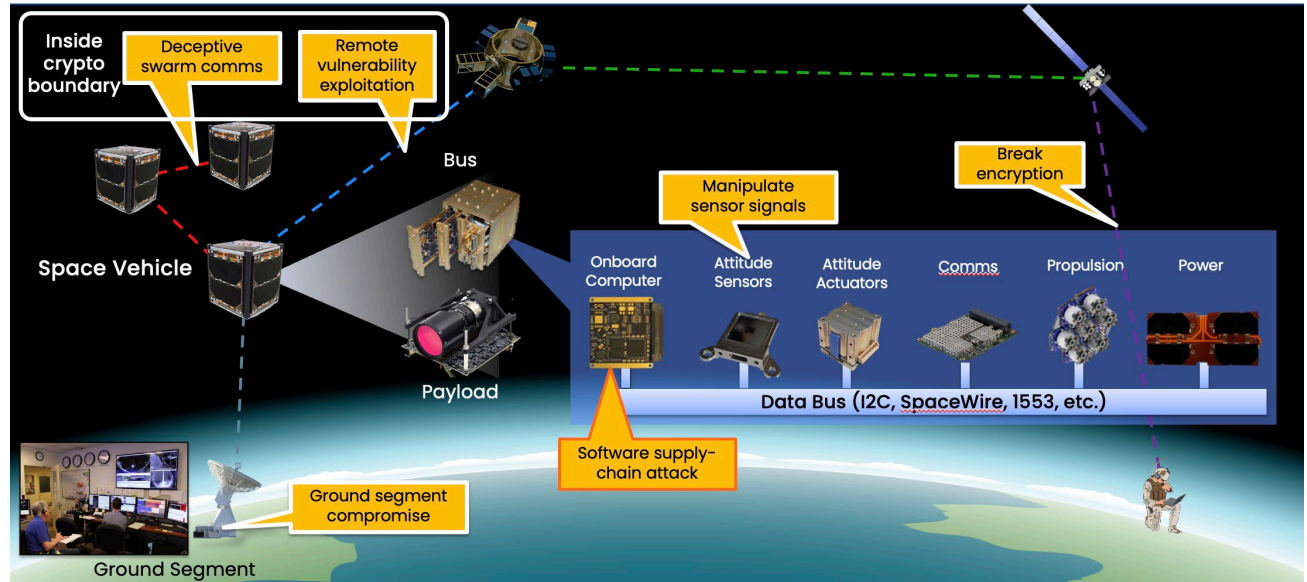
- Solar Interference
- Frequency Crowding
- Signal Degradation
- Jamming
- Spoofing
- System under attack (Cyber/physical)

Extensive attack surface

According to Forbes
There is a growing
global consensus that
governments and
businesses need to
prioritize security when
securing the frontier of
space systems.



Once we connected everything, they attack surface magnified.



Brooks, C. (2024, April 15). Cyber-securing
space systems a growing global concern.
Forbes.
<https://www.forbes.com/sites/chuckbrooks/2024/04/09/cyber-securing-space-systems-a-growing-global-concern/>

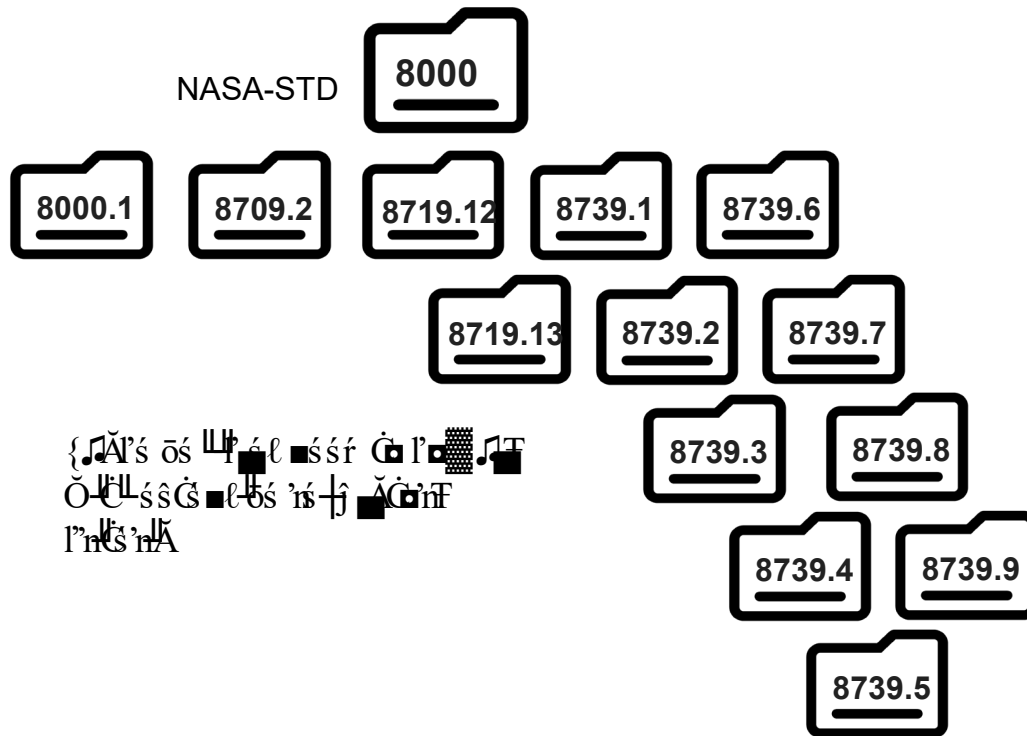
MIT Lincoln Laboratory. (n.d.). Space systems cyber-resiliency. MIT Lincoln Laboratory.
<https://www.ll.mit.edu/r-d/projects/space-systems-cyber-resiliency>

High stakes safety and reliability

extensive

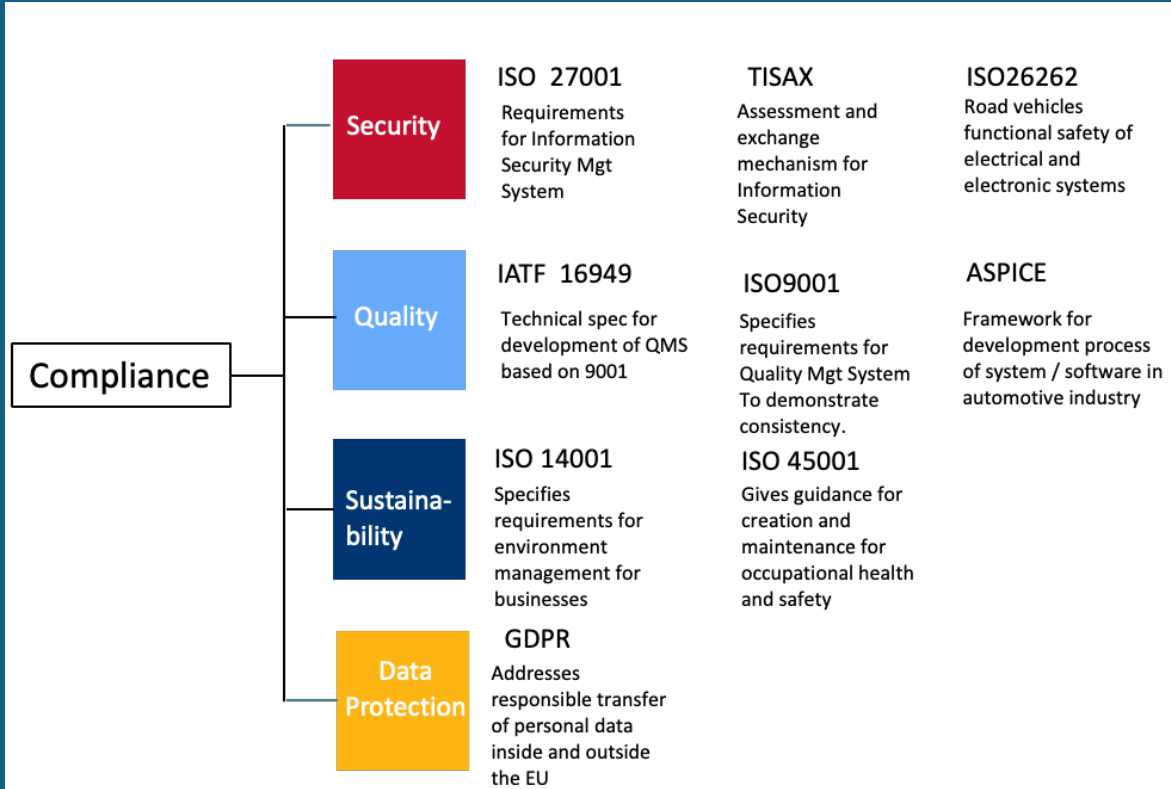


extensive

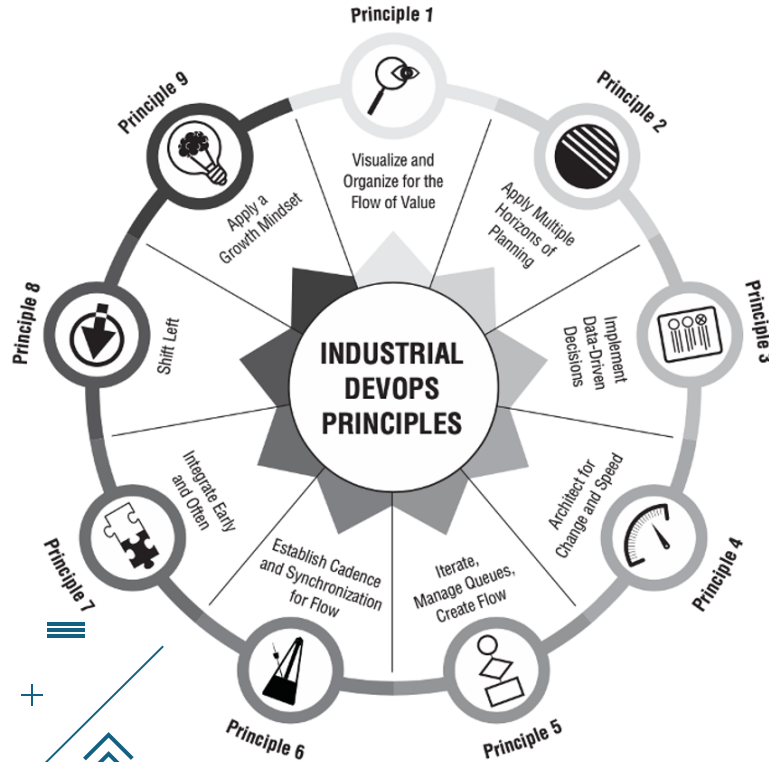


Regulatory and compliance hurdles

/ EL's n' u' l' u' h' p' A' s' u' l' s' i' c' systems A' n' s' u' l' s' i' c' G' a' r' d' i' n' g' s' i' s' t' e' m' s' l' a' n' d' A' i' r' l' i' n' e' s'

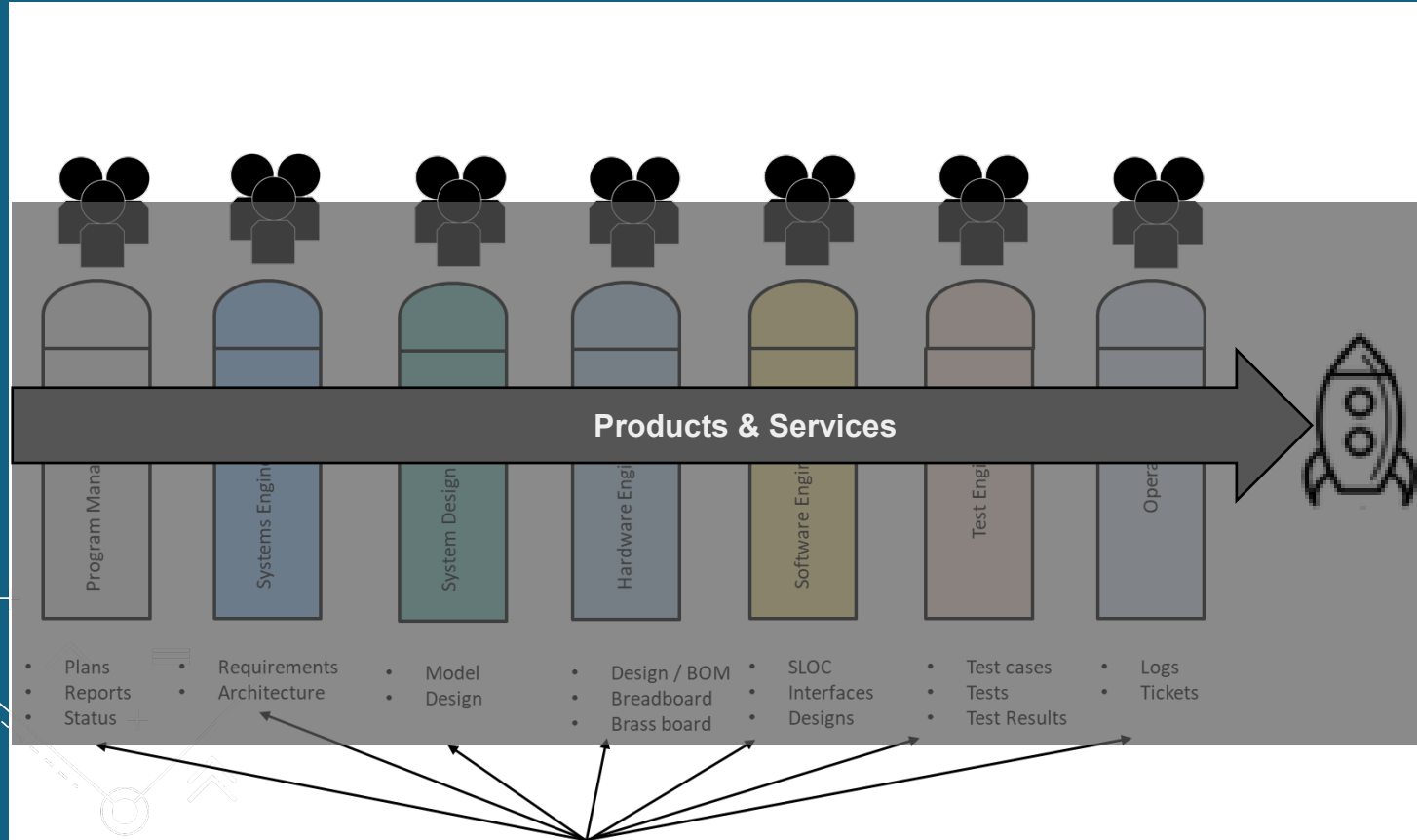
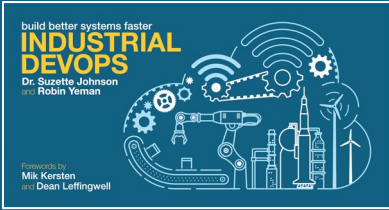


Industrial DevOps Principles



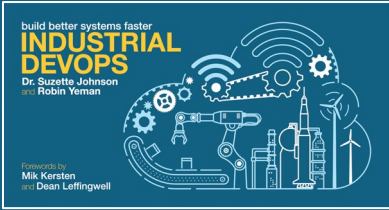
The application of Lean, Agile, and DevSecOps principles to the planning, development, manufacturing, deployment, and serviceability of significant cyber-physical systems.

(P1) Organize Around the Flow of Value

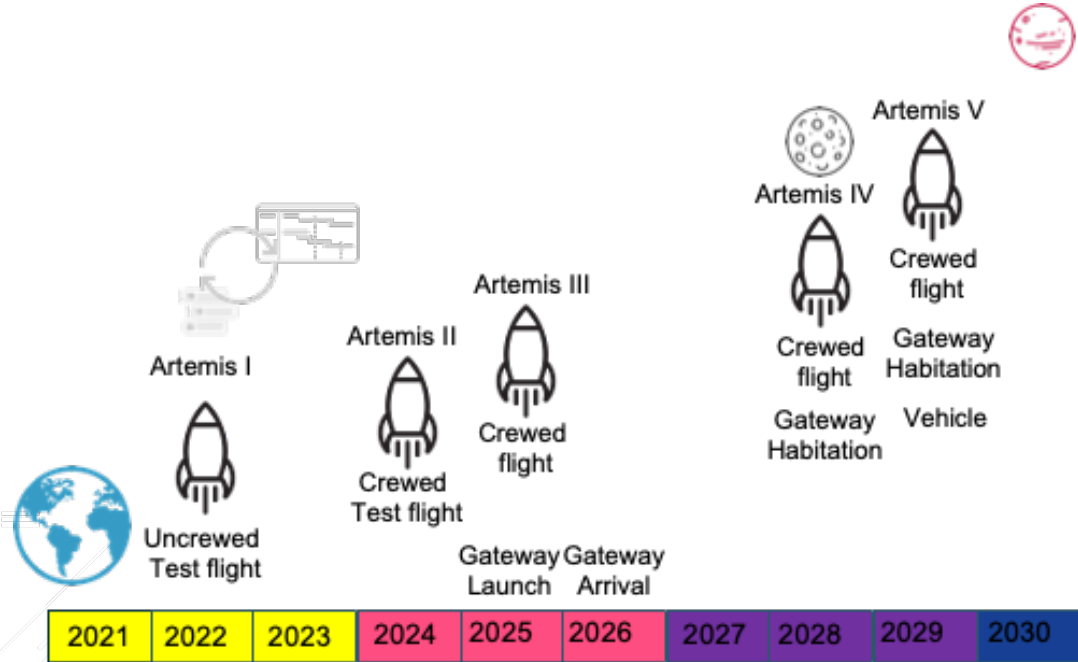


(P2) Multiple Horizons of planning

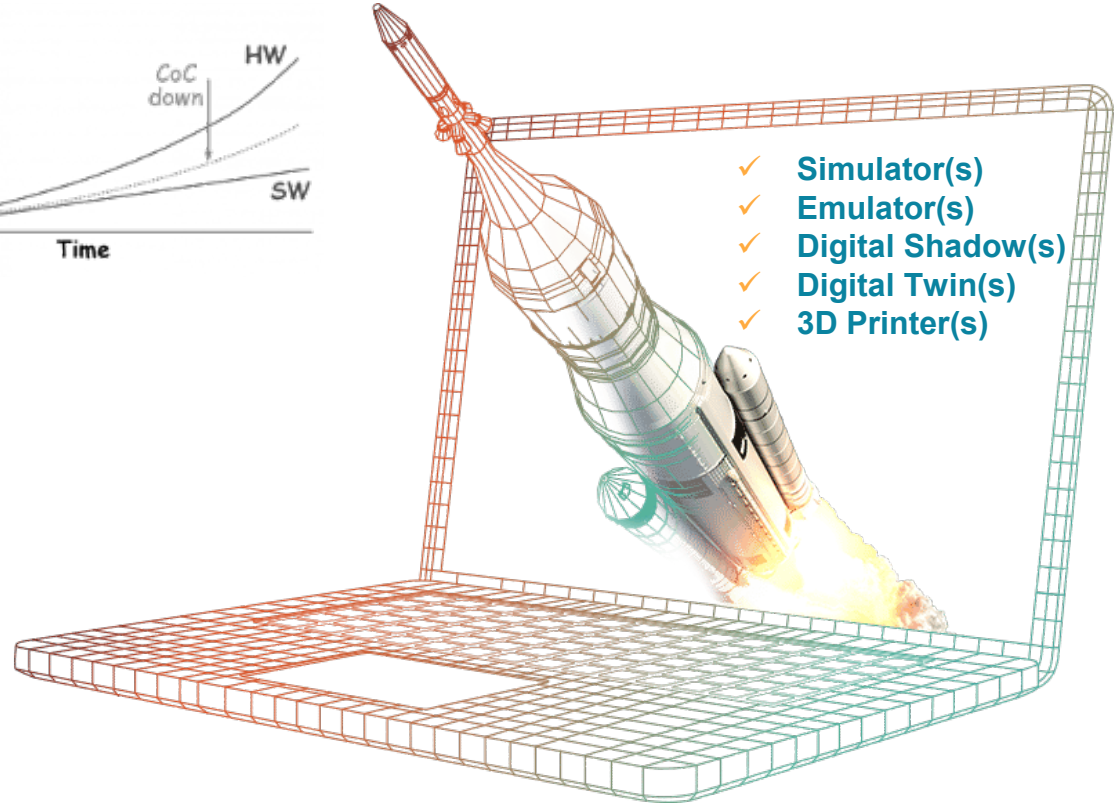
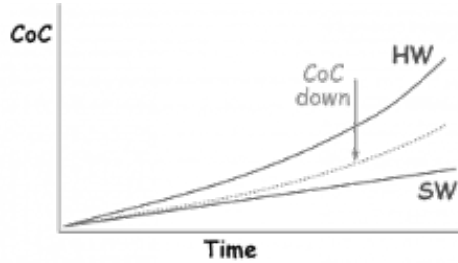
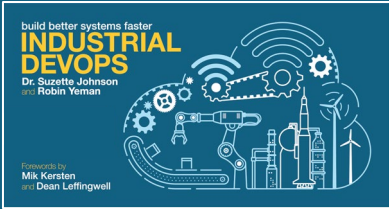
Moving from predictive planning to empirical planning requires multiple planning horizons that are regularly updated based on objective evidence.



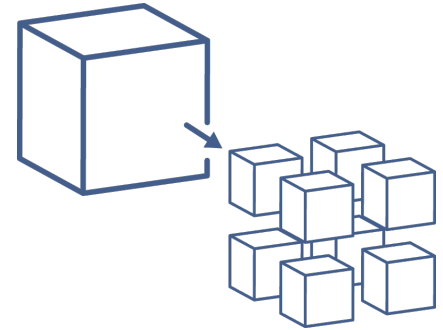
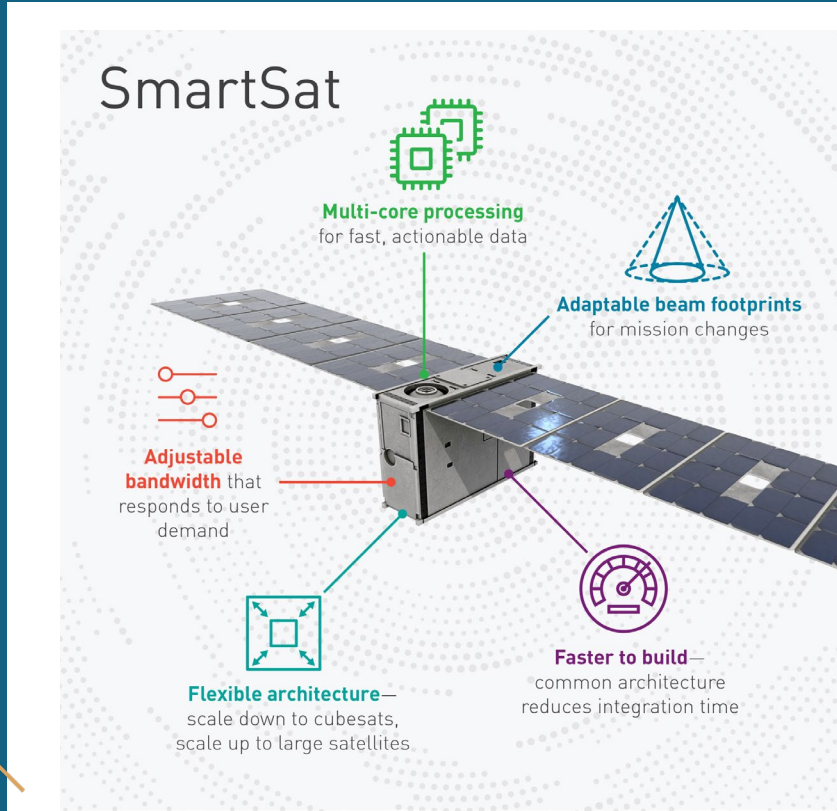
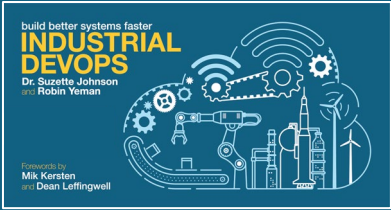
To deliver big hairy Audacious goals....



(P3) Implement Data Driven Decisions



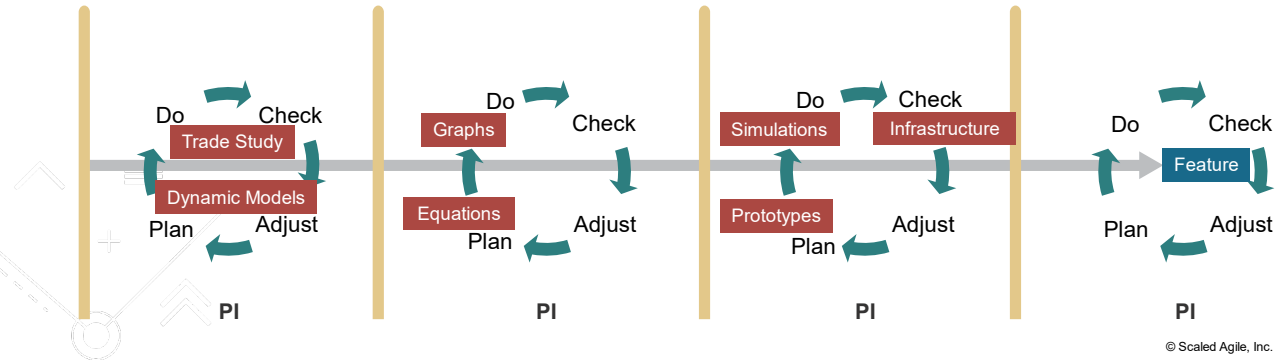
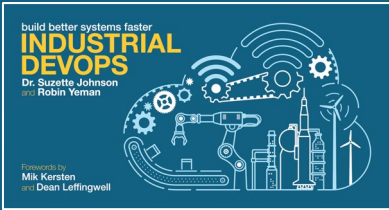
(P4) Architect for change and speed



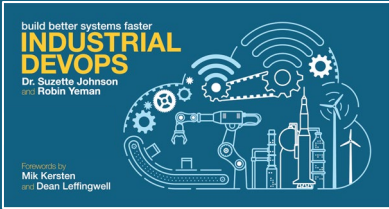
SmartSat can change its mission by uploading a new application, its like a smartphone on space

Lockheed Martin's first smart satellites are tiny with Big Missions. Media - Lockheed Martin. (n.d.). <https://news.lockheedmartin.com/2019-03-20-Lockheed-Martins-First-Smart-Satellites-are-Tiny-with-Big-Missions>

(P5) Iterate and manage queues



(P6) Cadence and Synchronization



Teams

Avionics team

Environment Control team

Thermal protection team

Orbiter structure team

MVP

NVP

NVP

NVP

NVP

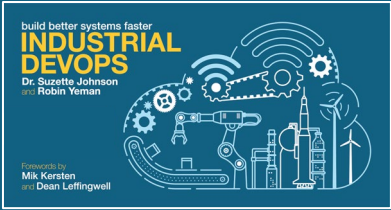


Time

Minimum Viable Product (MVP)

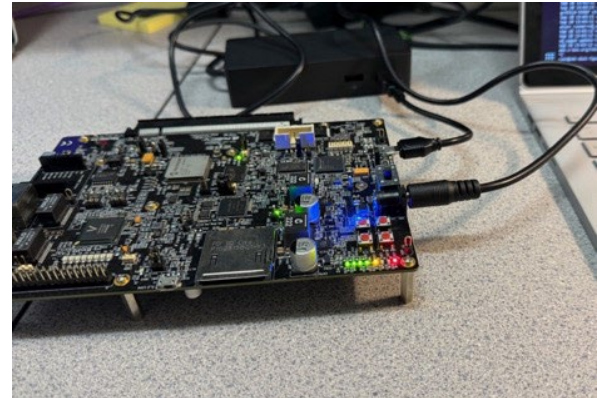
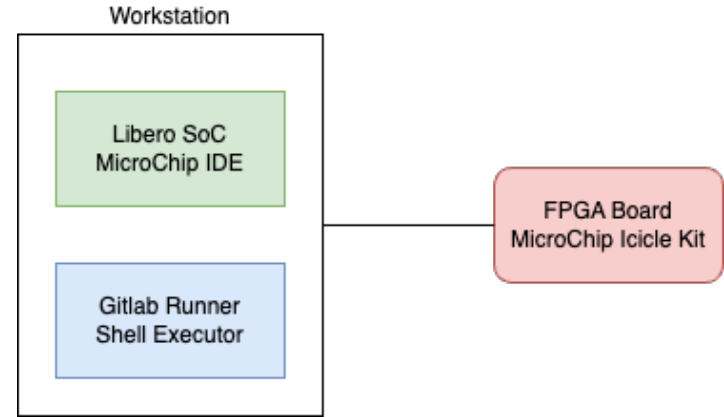
Next Viable Product (NVP)

(P7) Integrate early and often

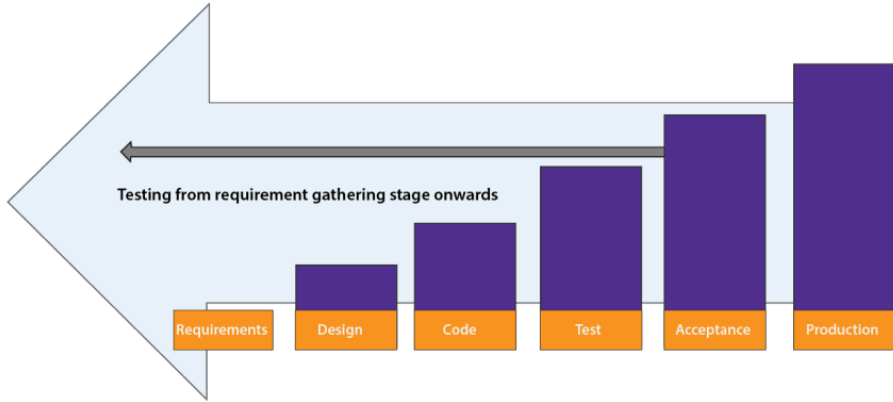
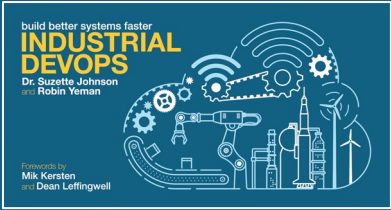


Carnegie SEI Laptop/Workstation Setup:
LiberO SoC
Gitlab Runner
FPGA Board connected via USB

FPGA Board has built-in programmer



(P8) Shift Left

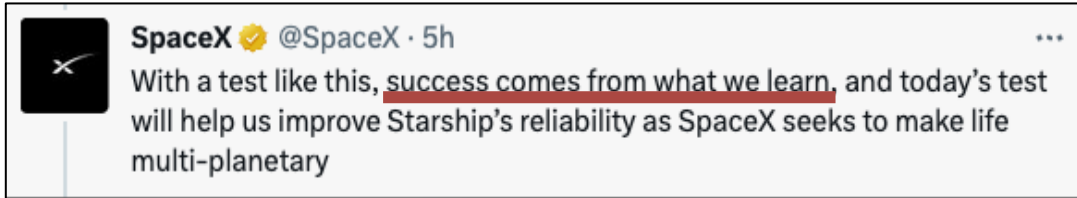
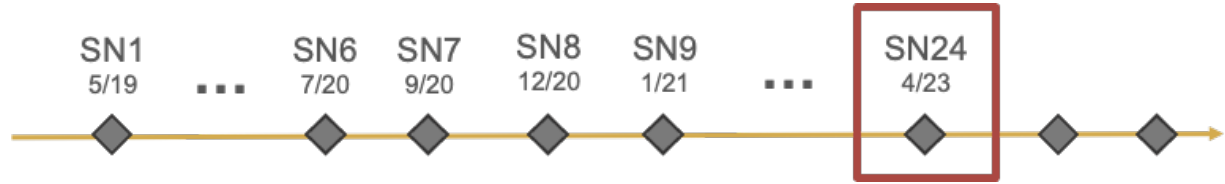
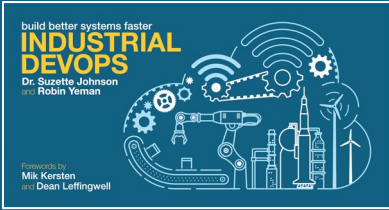


Shifting towards "LEFT"



McLaren commercial technology head Edward Green stressed the importance of maximizing digital twins to succeed under a budget cap.

(P9) Growth Mindset



RUD – Rapid Unscheduled Disassembly

1st State of Industrial DevOps

Industrial DevOps is important because it addresses the escalating cybersecurity risks and operational inefficiencies that traditional OT management practices can no longer handle.

By adopting Industrial DevOps, manufacturers can reduce preventable downtime, enhance collaboration between teams, and ensure a secure, agile, and resilient operational environment.

Key Takeaways from the State of Industrial DevOps Report:

1. **50%** of downtime is attributed to industrial code issues.
2. Cybersecurity breaches are the **#1** cause of unplanned downtime.
3. The average cost of downtime is **\$4.2 million per hour**.
4. **10%** of respondents identified as first movers faced no challenges adopting Industrial DevOps.
5. **78%** of respondents reported that ad hoc fixes are commonplace, leading to increased vulnerabilities.



<https://hubs.la/Q02FPvnn0>

By Copia Automation

Industrial DevOps

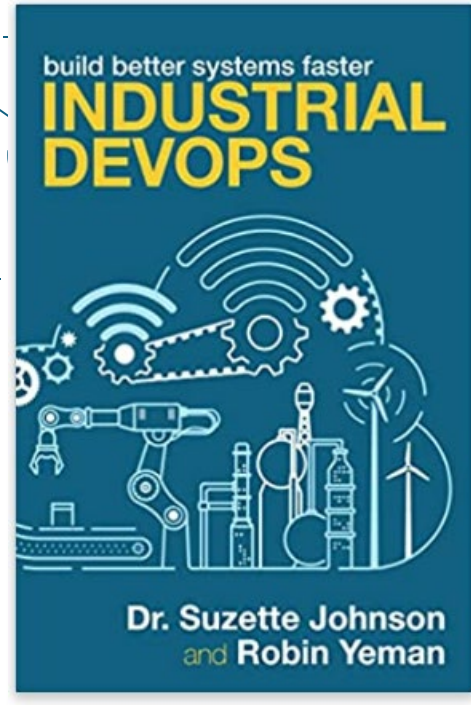


<https://itrevolution.com/book/industrial-devops/>

2020



Free chapters





Q & A

ASK AWAY!

Session Evaluation

Scan QR Code

