



Challenges and Success Patterns to Delivering Capabilities Faster

Industrial DevOps: Building Better Systems Faster

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Introduction

Work Experience

- Worked for a technology startup during the dotcom era
- Started Northrop Grumman in 2002/2004
- Northrop Grumman Fellow, Lean-Agile
- More than 15 years Lean-Agile experience
- Started the grass roots journey in 2005
- Led the enterprise Lean-Agile transformation
- NDIA, Systems Engineering Division, Vice-Chair
- Active in several working groups with NDIA, INCOSE, MOSA, SEI, DAU, SAI, DevOps/IT Revolution
- International speaker and published author on Industrial DevOps for Cyber Physical Solutions (2018-2023)

Interesting-ish Facts

- Backpacked across Europe
- Presented in Las Vegas on the same stage that Lady Gaga and Willy Nelson have performed



- Received a doctoral degree in management and technology at the University of Maryland with a dissertation focused on investigating the impact of leadership styles on software project outcomes in traditional and agile engineering environments.
- Scaled Agile Program Consultant Trainer (SPCT) and Scaled Agile Fellow
- Certified Enterprise Coach (CEC), Scrum Alliance
- Certified Green Belt, 2008

Innovation and Collaboration

Innovation and collaboration across all levels of the organization, are critical for a company's growth and survival in today's fast-paced working environments where new digital capabilities emerge every day





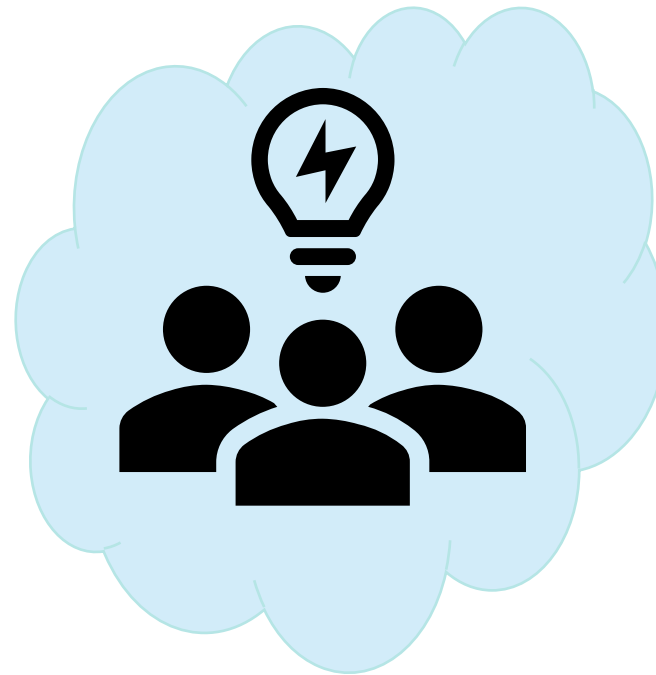
Success Patterns

Industrial DevOps Principles

A common disease that afflicts management the world over is the impression that “Our problems are different”. They are different to be sure, but the principles that will help to improve quality of product and service are universal in nature.

—W. Edwards Deming

Getting to Know You



What is Industrial DevOps?

- The application of continuous delivery principles to the *development, manufacturing, deployment, and serviceability of significant cyber-physical systems to enable these programs to be more responsive to changing needs while reducing lead times.*
- Focuses on building a continuous delivery pipeline that provides a multi-domain flow of value to the users and stakeholders of those deployed systems.
- Based on DevOps, Lean manufacturing, Lean product development, Lean startup, systems thinking, and scaled Agile development.

Industrial DevOps Applied

Cyber-physical systems include critical human-safety requirements



F-35



B-2

Common Problems

- Lack of alignment among stakeholders on practices used to engineer, develop, integrate, test, certify
- Lack of alignment among stakeholders on tools used to engineer, develop, integrate test, certify
- Lack of transparency – data, measures, decisions – among stakeholders
- “Nothing is done until everything is done”—large batch processes and mindset
- Delays due to bureaucracy and outdated practices
- Long lead time for hardware procurement

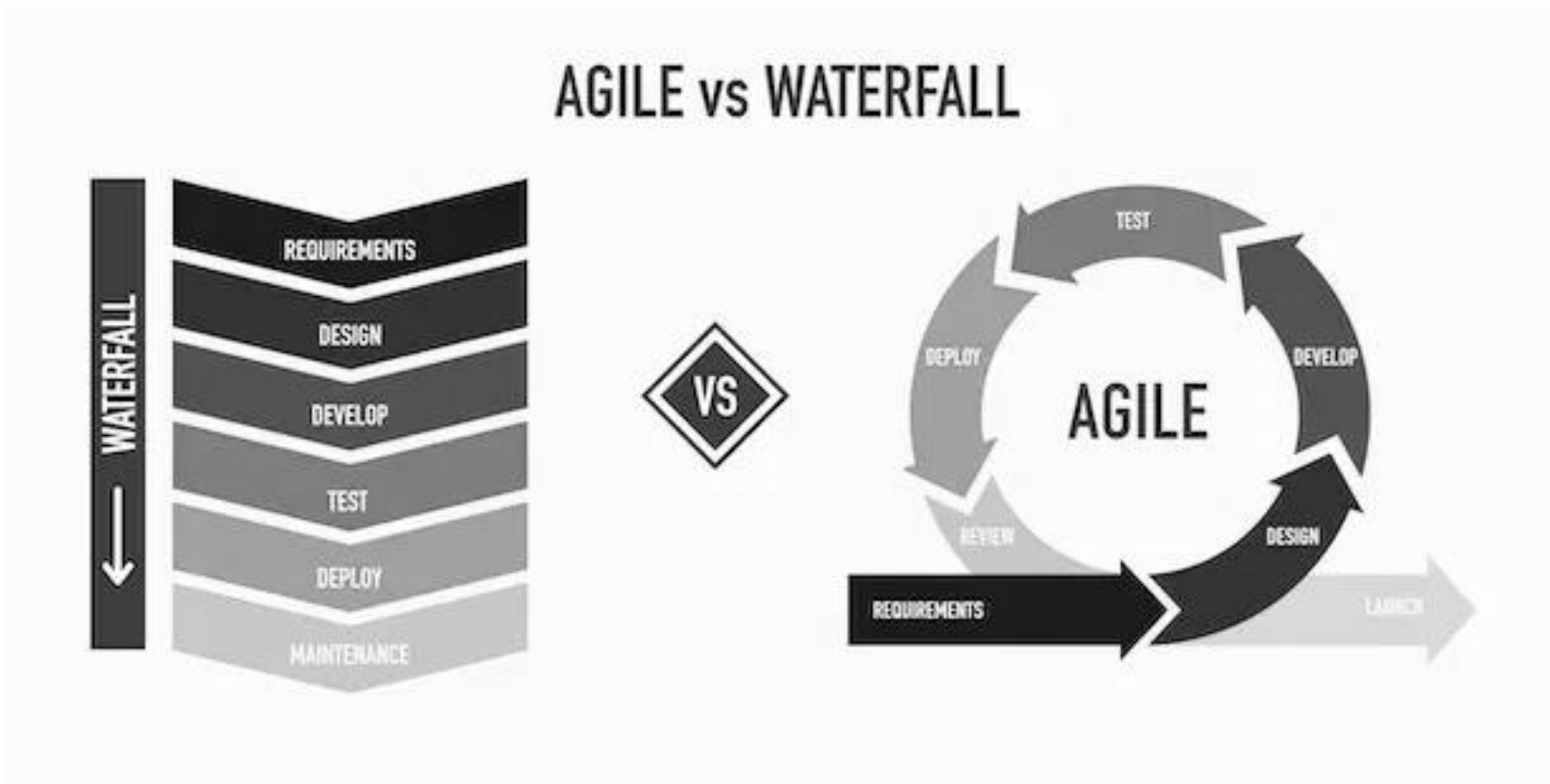
Reference: Carnegie Mellon/SEI, Hasan Yasar

Benefits of Industrial DevOps

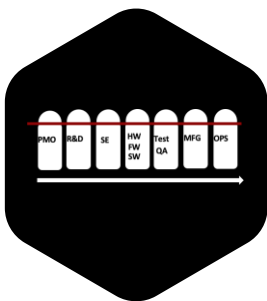
- Delivery of value in the shortest, sustainable lead time
- Improved collaboration and knowledge sharing across functional areas
- Build competitive advantage through rapid learning and experiments
- Improved quality
- Improved customer happiness
- Happier, more engaged employees

Agile is a Lifecycle

Waterfall is a predictive lifecycle based on phase gates, Agile is an empirical lifecycle based on objective data.



Principles



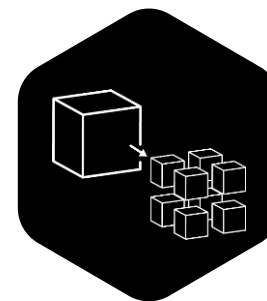
**Organize for
flow of value**



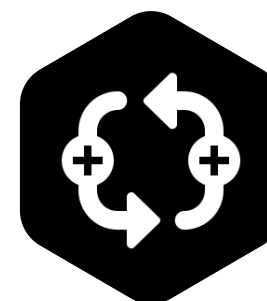
**Multiple
Horizons of
planning**



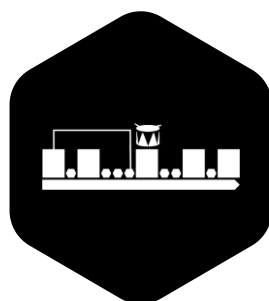
**Data driven
decisions**



**Architecture for
speed and change**



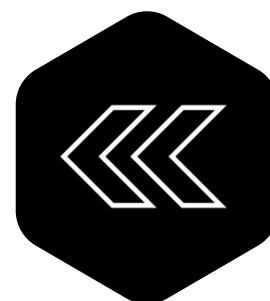
**Iterate and
improve flow**



**Cadence and
Synchronization**



**Integrate early
and often**



Shift Left



**Growth
Mindset**

Reference: Johnson and Yeman. Industrial DevOps. 2023. IT Revolution.

Principle 1: Organize for Flow of Value

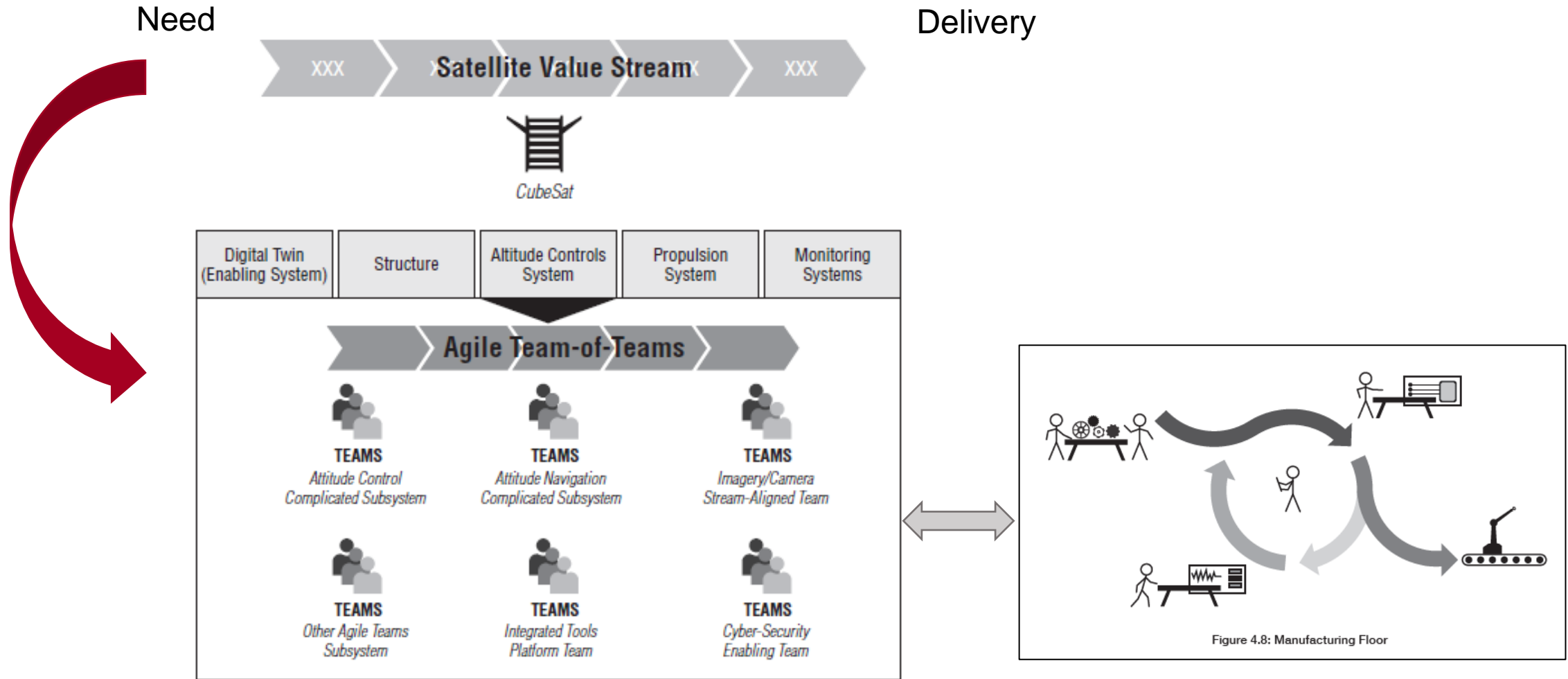


Figure 4.6: Attitude Control System Team-of-Teams Structure

Principle 2: Apply Multiple Horizons of Planning

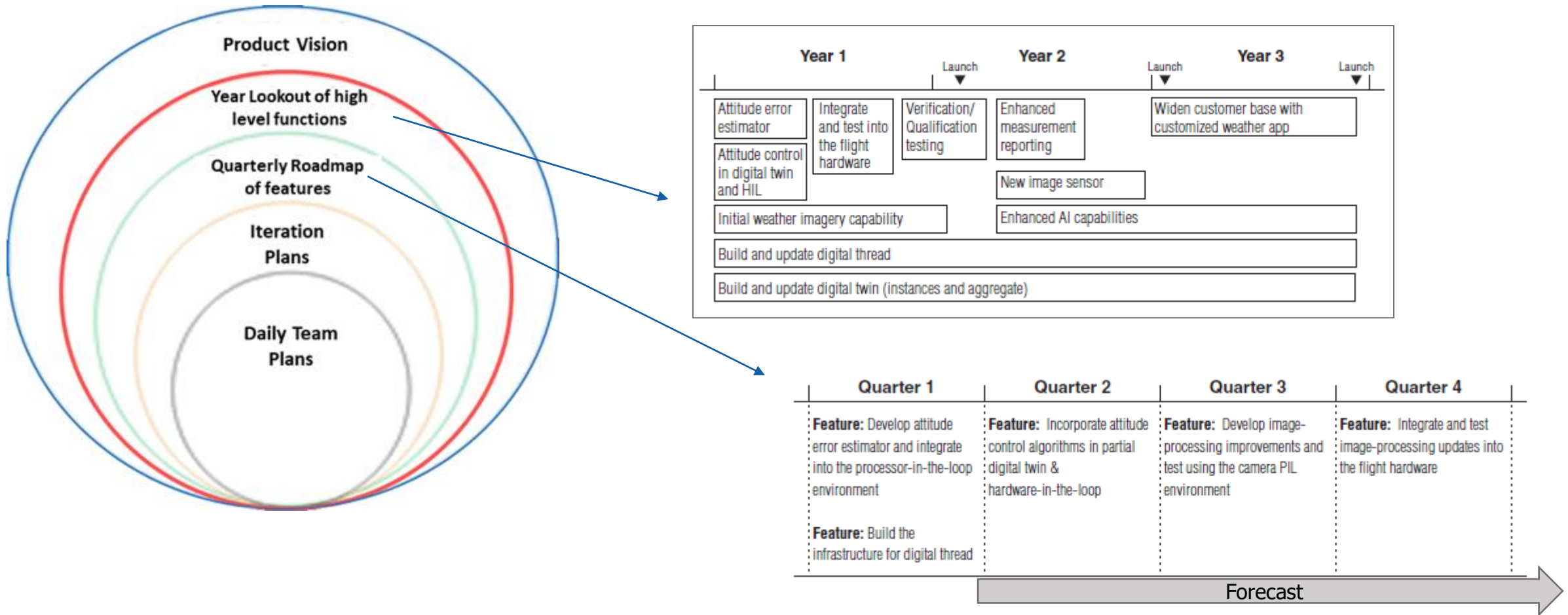


Figure 5.8: Annual Road Map Broken into Quarters for CubeSat

Short Term Minimal Viable Product To Long Lead Items

Practical Implementation

NASA Human Space Exploration

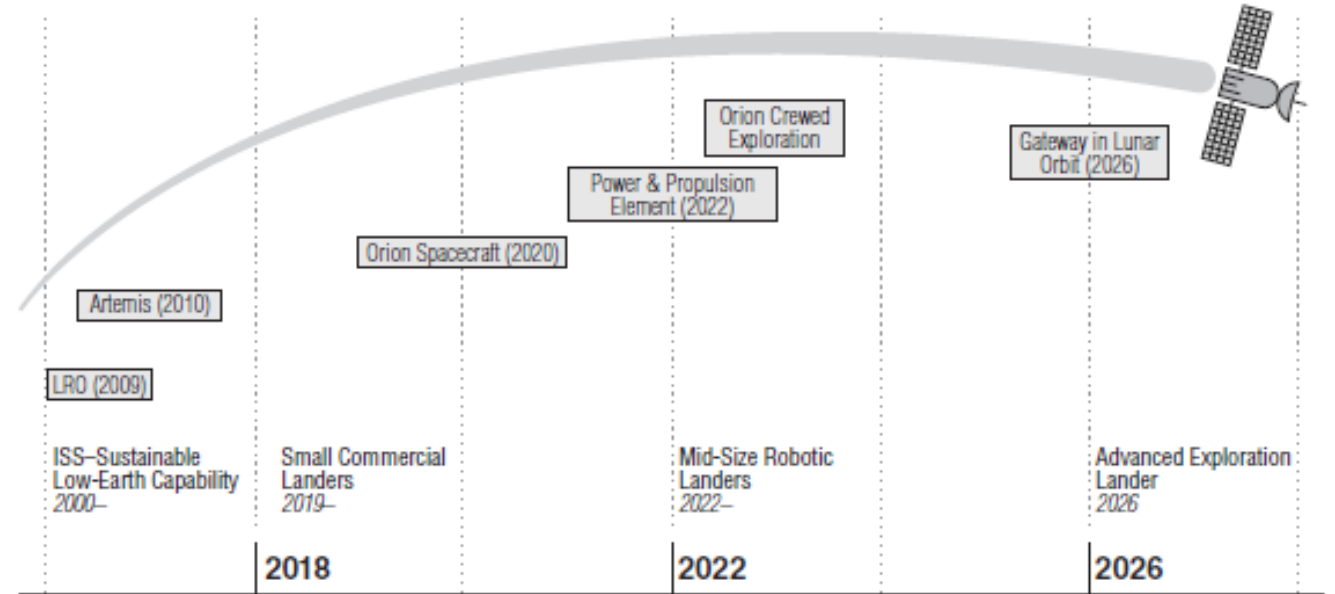
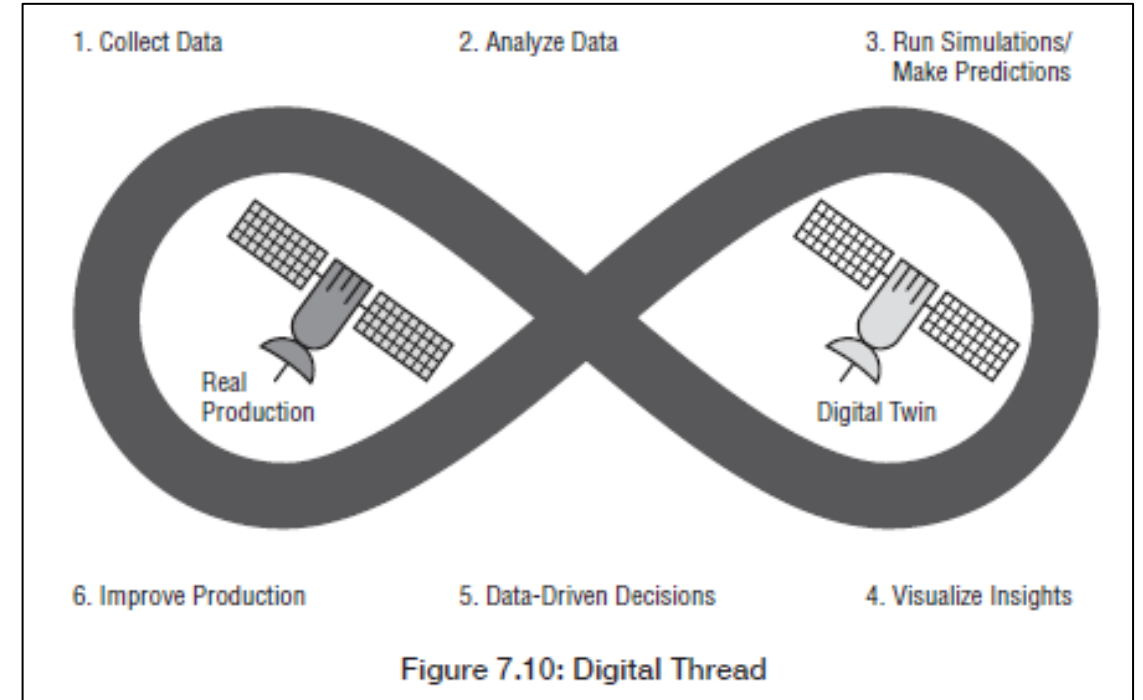


Figure 5.4: NASA's Road Map for Human Space Exploration

Principle 3: Implement Data Driven Decisions

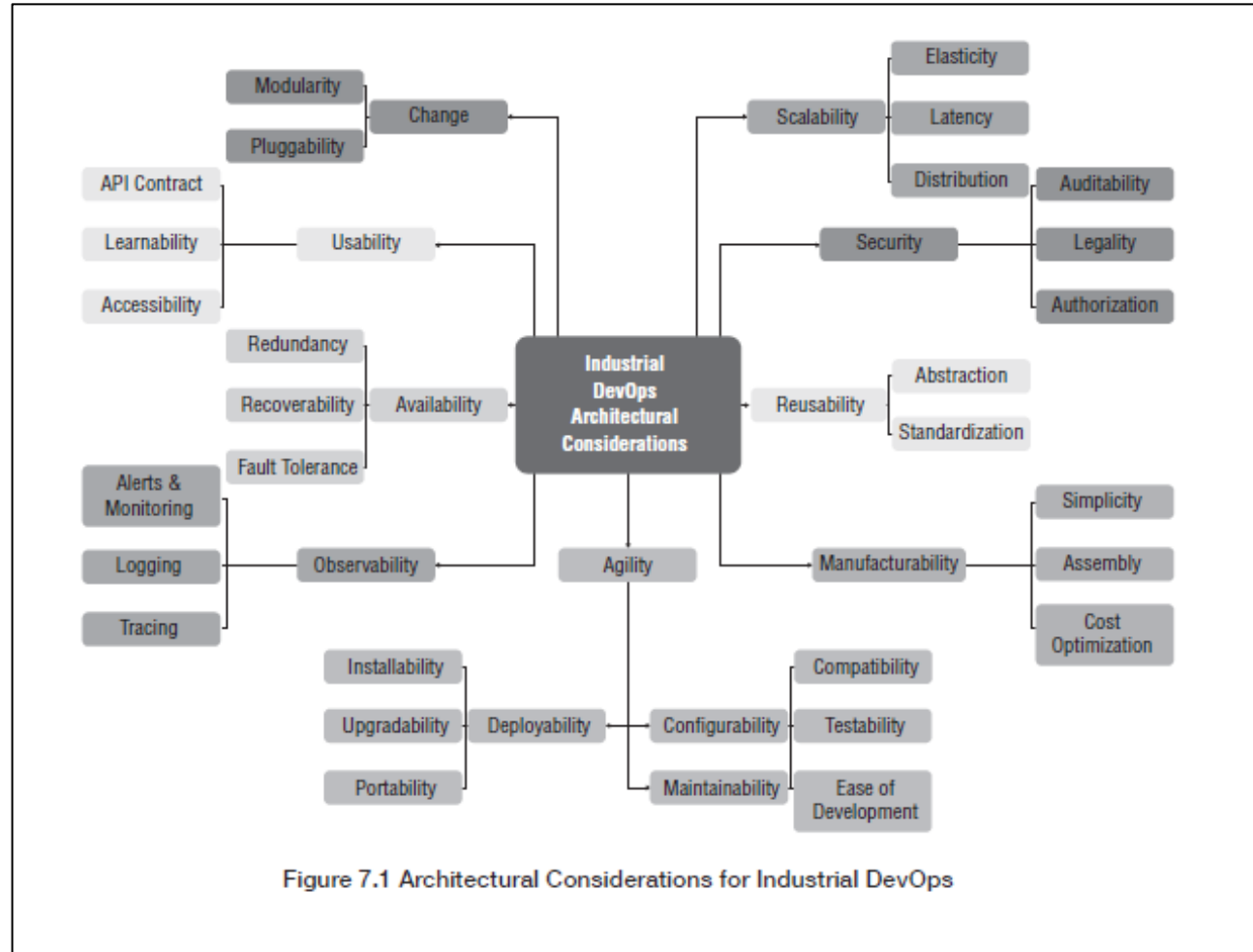
Backlog

	Time Horizon	Capability	Evidence
epic	Annual	Enhance obstacle detection through updates to sensor types; refactoring architecture	Drive vehicle through multiple scenarios to validate sensor types; Evaluate deployment rate for new updates
feature	Quarterly	Enhanced Lidar sensor color profile	View colors in simulator to verify improvement
User story	Iteration	Split Lidar by component value	Validate demonstration of Lidar split by through test of
task	Day	Update cloud point extents in ESRI	CI/CD Pipeline has identified no errors with change



Continuously improve through demonstrated capabilities and real-time data

Principle 4: Architecture for Change and Speed



Modularity enables continuous flow in software, hardware, and manufacturing

Modular Architecture Example

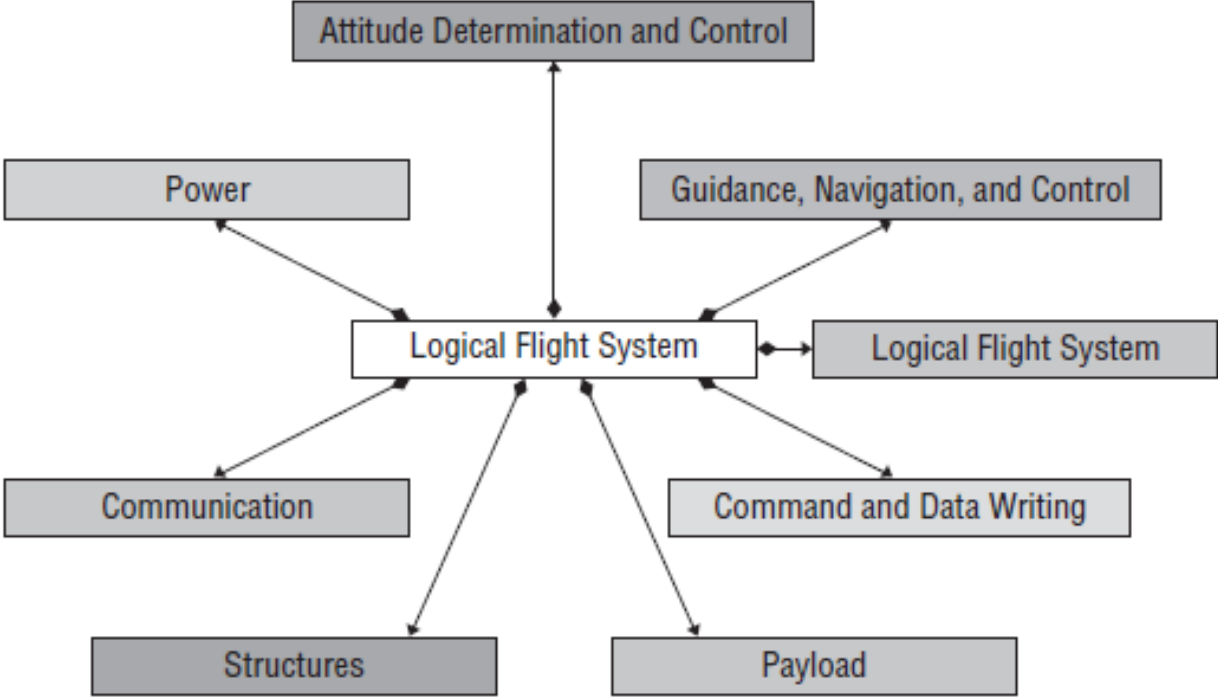


Figure 7.11: Modular Architecture Example

Practical Implementation

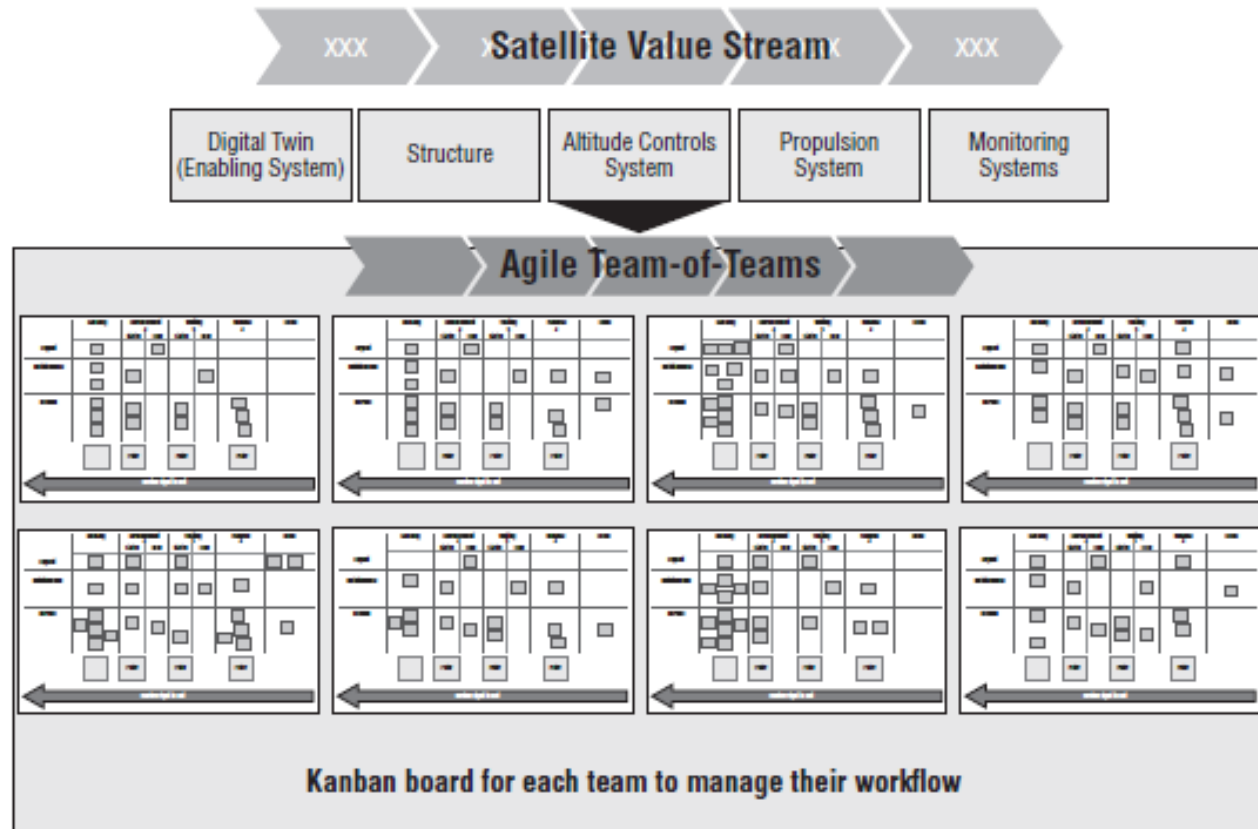
Joby Aviation



American aerospace company developing an electric vertical takeoff and landing aircraft for urban air mobility with plans to launch an air-taxi service.

Joby uses a modular architecture with standardized interfaces and a delivery pipeline that enables them to rapidly iterate on changes to the vehicle. They use agile practices and test-driven development of the entire vehicle to ensure quality is built in.

Principle 5: Iterate, Manage Queues, Create Flow

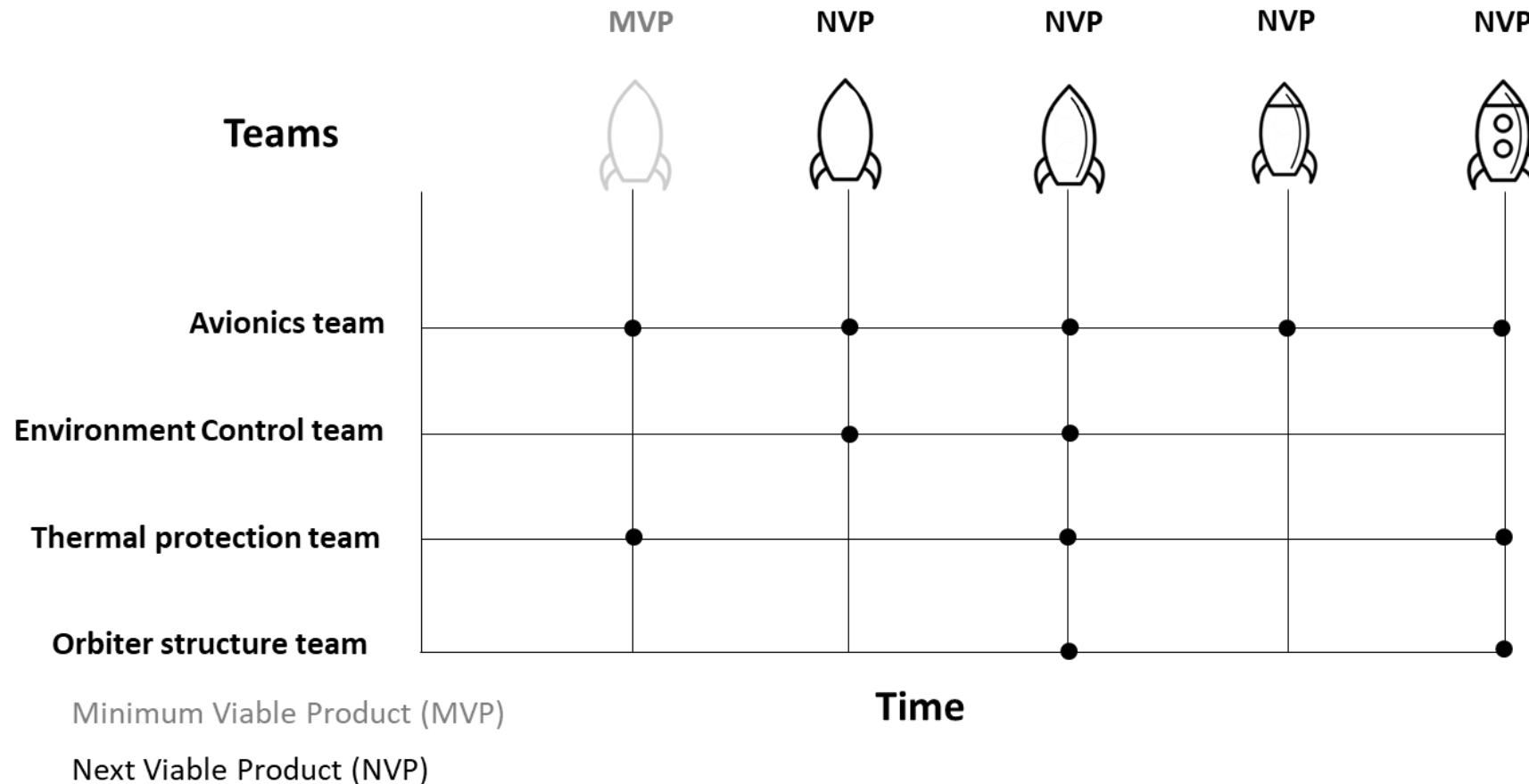


In early stages of product development, the hardware is not available. As a result, early iterations of development occur in virtual and simulated environments, and over time, development includes the physical environment as hardware becomes available.

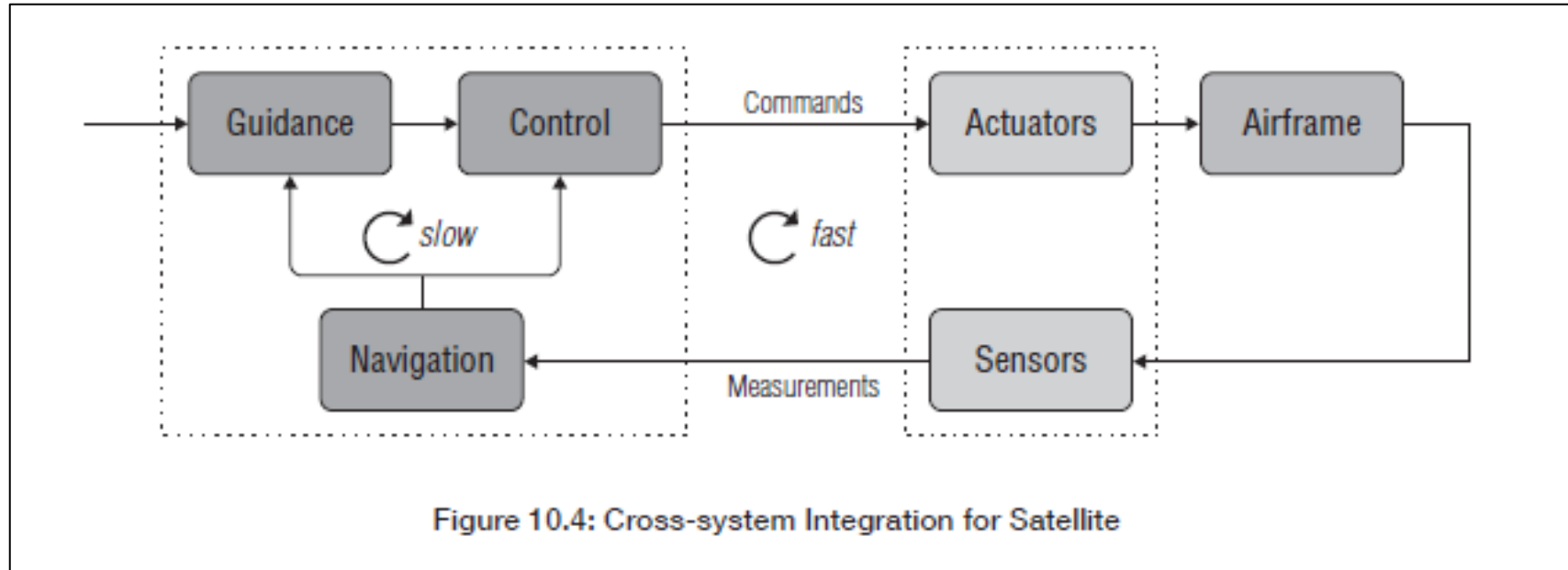
Figure 8.4: Visualizing the Flow of Value through Team Kanban

Principle 6: Establish Cadence and Synchronization

Teams established a cadence of regular quarterly planning and short iterations. Regular synchronization occurs through demonstrations at the end of each iteration for fast feedback.

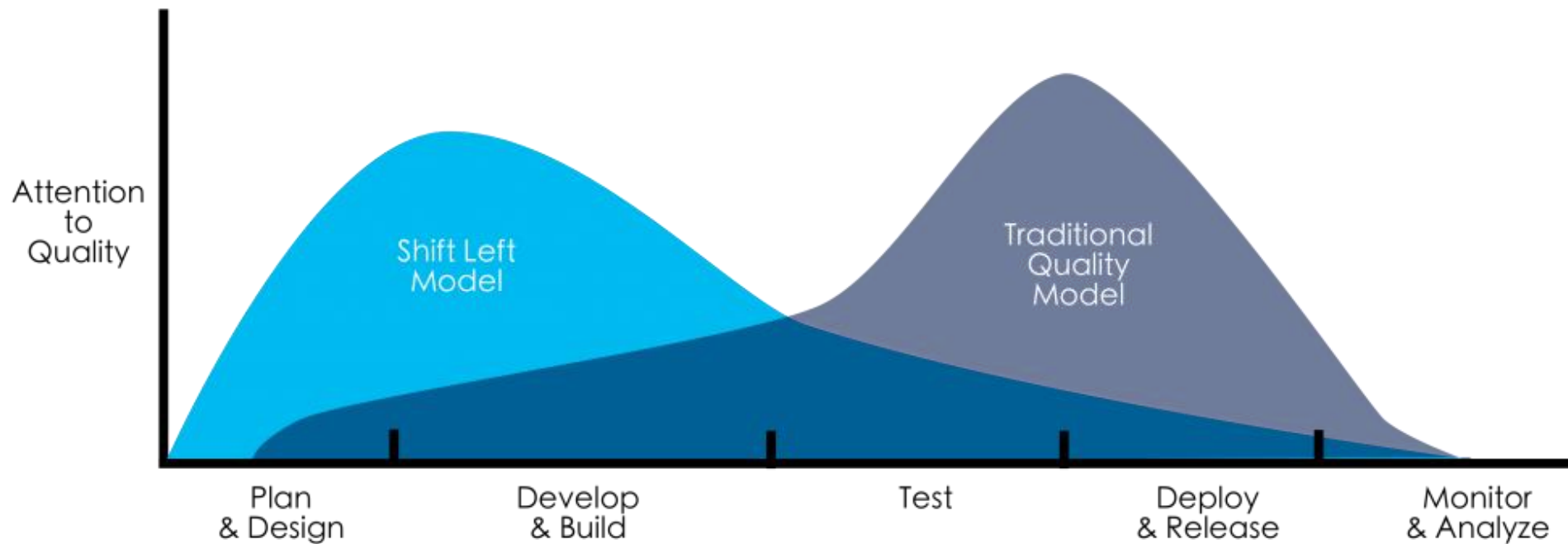


Principle 7: Integrate Early and Often



Example: You want to demonstrate how to use the satellite hardware to adjust the attitude using a software command. You will need a lab environment that can simulate an actuator and the simulator to validate they integrate successfully.

(8) Shift-Left



- Test First Mindset: Test-driven development applies to software and hardware development.
- Design for manufacturability, reduce rework and late discoveries.
- Integrate small batches from product development to manufacturing for learning and feedback.

Practical Implementation

Planet Labs



American Private company with a mission to image all the Earth daily to identify temporal global changes. The imaging data allows them the ability to analyze agricultural, energy, forestry, maritime, and sustainability events and impacts.

Optimizing spacecraft design using success patterns of modularity, standardized interfaces, and open architecture along with Agile and DevOps practices.

Results: Faster time to delivery; ability to continuously optimize designs.

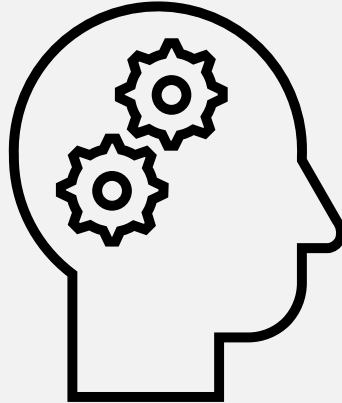
(9) Apply a Growth Mindset

Fixed Mindset



*Are we
fixed?*

Growth Mindset



*Are we open
to new
ideas?*

“A growth mindset is best described by Carol Dweck as “the belief that your basic qualities are things you can cultivate through your efforts.”

It is the ability each of us has that enables us to continuously grow our behavior, skills, performance, talents, or thinking.

Through applied learning and resilience, we have seen those who may have felt defeated rise to unimagined success.

They explore, innovate, and recreate. They are resilient!

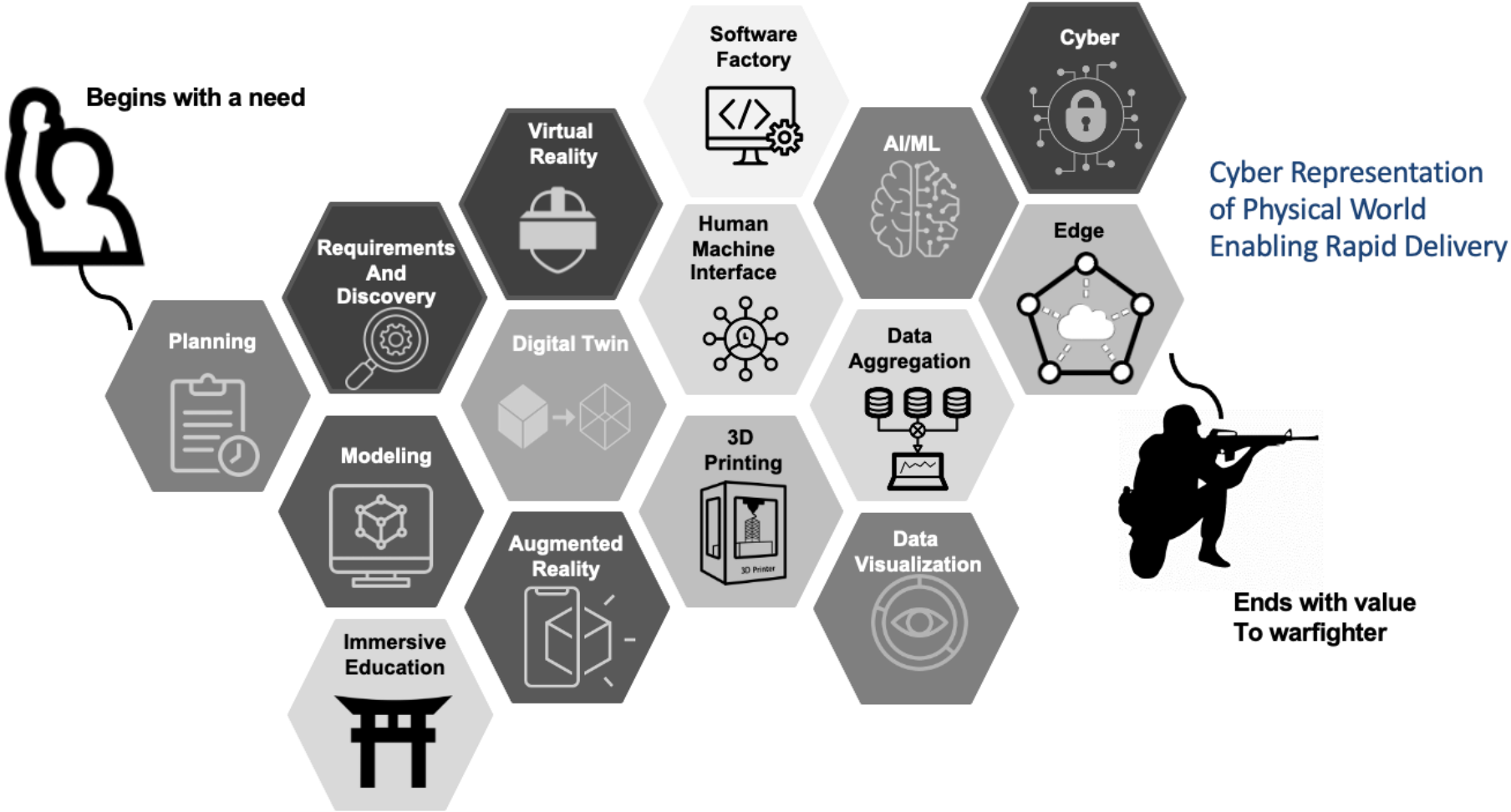
A learning organization applies the same growth mindset.”

Johnson and Yeman. Industrial DevOps. 2023. IT Revolution

Use all the tools in your toolbox



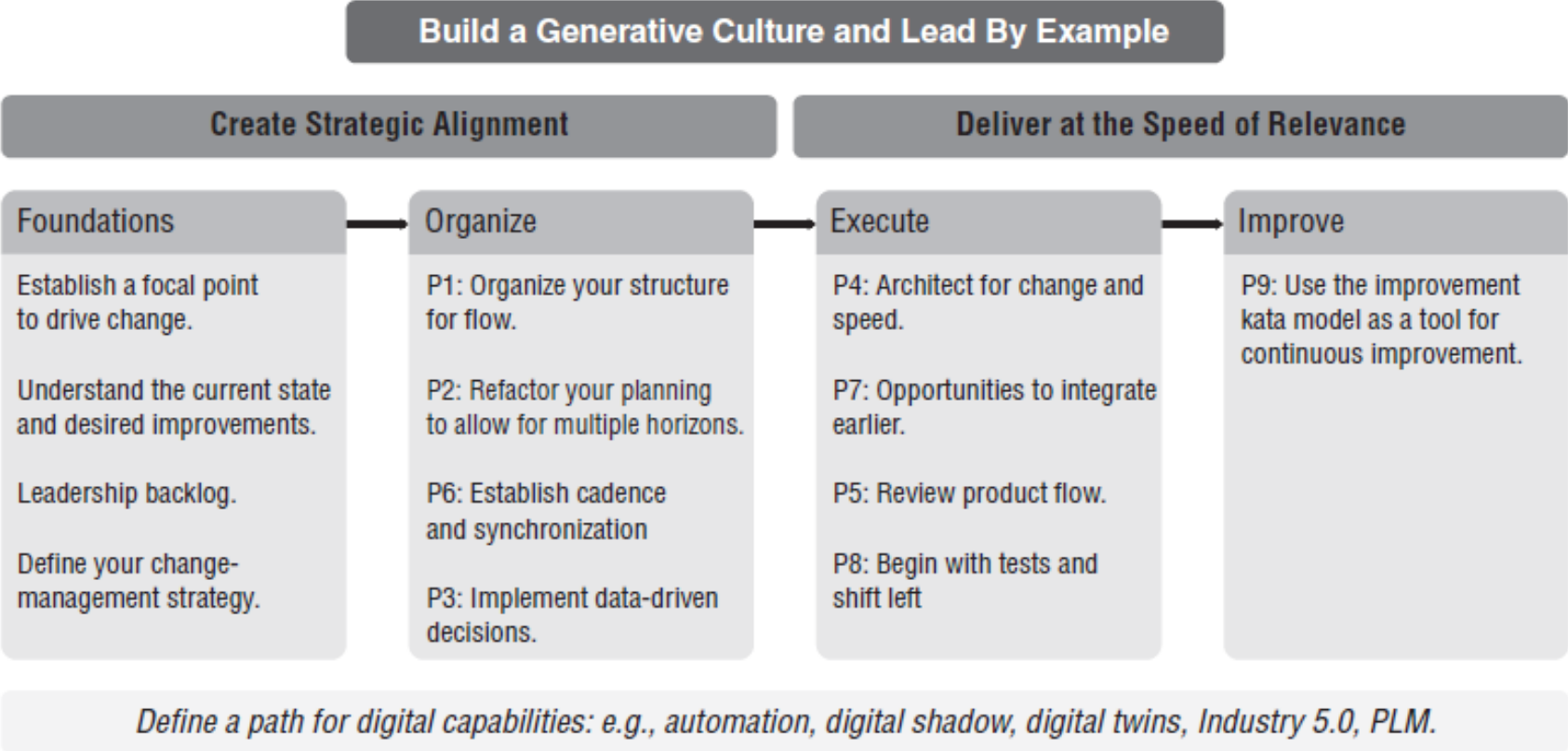
Follow the flow of value and leverage all of the tools



Getting started with Industrial DevOps success patterns

Define your business outcomes.

Begin with understanding your current state.



Challenges





1. Existing organizational structures
2. Lack of common language in the new way of working
3. Not understanding the Value Stream
4. Access to patterns to break down the system
5. Valuing exclusivity over inclusivity
6. Lack of Psychological Safety



Create an Intentional Culture

Often many of the barriers to implementation stem from the organization's culture.

1. Mind-set Validation
2. Org Surrounding Support Structure
3. Technical Competency
4. Active Role-modeling

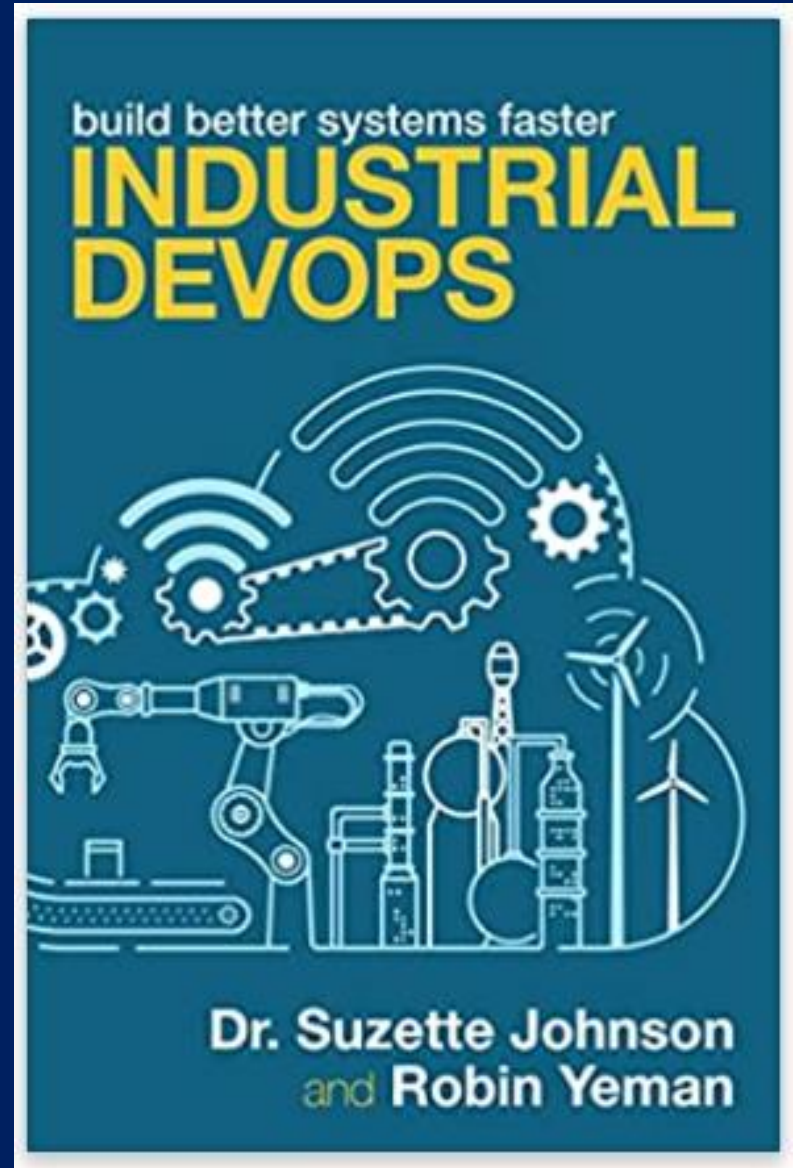
Organizational Change Roadmap		
Owner: Lean-Agile Leaders		
	Q1	Q2
 Mind-sets	Provide relevant external case-studies that drive the point to change	Develop and publish Internal case-studies to share internally (localized outcomes/success)
 Structures	Permission to fail (ie provide awards for failure)	Team-based performance awards
 Competency	Role based learning- acknowledge the gaps and build learning plans	Brown-bag lunch & learns
 Role-modeling	Leadership commits and uses Lean-Agile language	Leadership participates in <u>an</u> Lean-Agile book club

Reference: Johnson ,et. al Applied Industrial DevOps. 2020. IT Revolution.

Closing

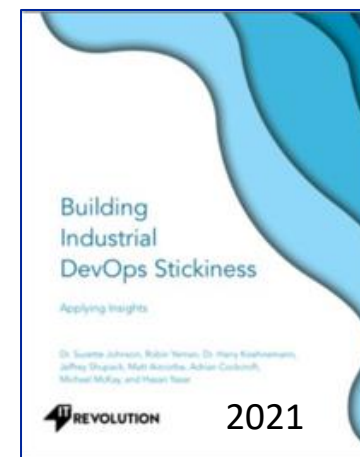
Leveraging the power of Industrial DevOps is an industry step change.

Companies that solution this problem first will increase transparency, reduce lead time, increase value for money, and innovate faster.



Industrial DevOps

Industrial DevOps expands the definition of DevOps beyond software to enable significant cyber-physical systems development programs to be more responsive to changing needs while reducing lead times. It is the application of continuous delivery and DevOps principles to the development, manufacturing, deployment, and serviceability of significant cyber-physical systems.



<https://itrevolution.com/book/industrial-devops/>
<https://itrevolution.com/book/applied-industrial-devops/>
[Building Industrial DevOps Stickiness \(itrevolution.com\)](https://itrevolution.com/book/building-industrial-devops-stickiness/)

A letter to the Hardware Engineering community

Thank You





Challenges

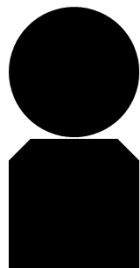
Six Challenges

1. Existing organizational structures
2. Lack of common language in the new way of working
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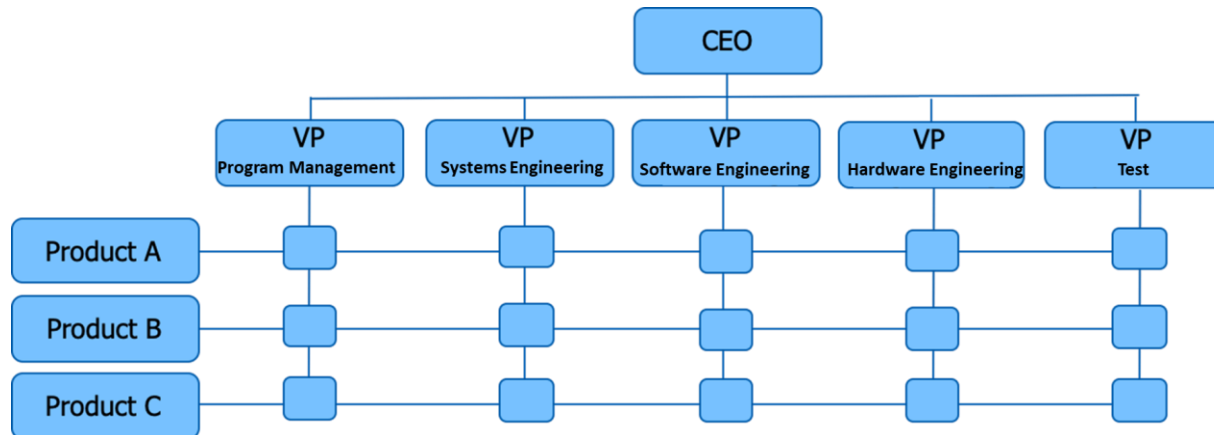


Challenge: The Existing Organizational Structure

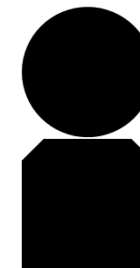
IDO Coach



- Conway's Law
- Incentive mismatch
- Handoffs cause delays
- Reduce dependencies



Executive



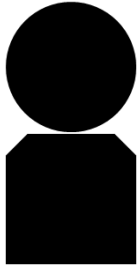
- Specialization creates efficiency
- Clear roles and responsibilities
- Existing role descriptions
- Schools educate by function

Recommendation to the business

- Decide if you want to optimize for product delivery or individual specialization and efficiency
- Consider a dual operating structure
- Conduct an impact analysis as part of the decision-making process
- Involve technical people in organization design of the team structure

Challenge: Lack of Common Language in the New Way of Working

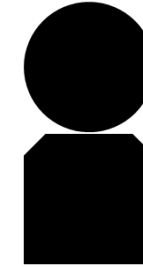
IDO Coach



- Cross-functional teams reduce handoffs
- Working together drives innovation



Executive



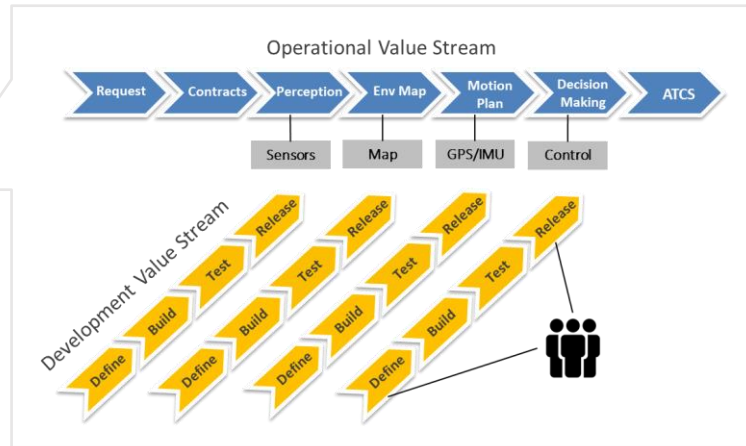
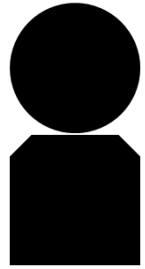
- Cross-functional teams don't understand each other
- Language barrier reduces trust

Recommendation to the business:

- Agree upon a common language
- Identify terminology and lexicon
- Map them together and make it visible and accessible
- Create a Rosetta Stone when you need to align process to tools

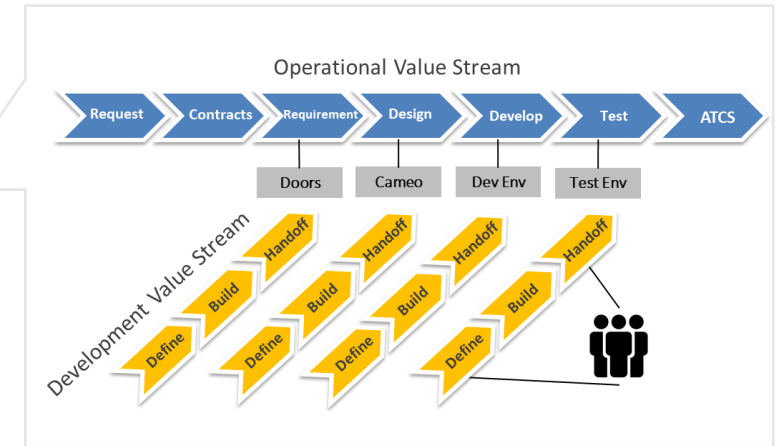
Challenge: Not Understanding the Value Stream

IDO Coach



- Organize teams around value stream
- Make improvement metrics visible

Executive



- Organize Teams around value stream
- Use metrics to make decisions

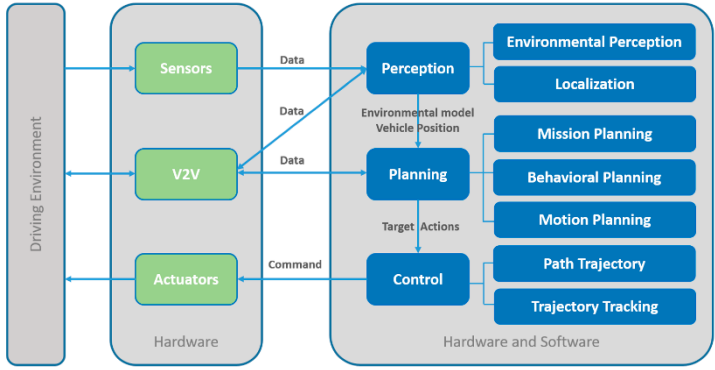
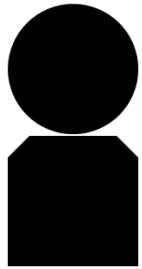
Recommendation to the business

- Hold training and workshops on value stream identification/mapping, this is often misunderstood
- Identify bottlenecks in your value stream and create improvement items (Current state, Improvement, New State)
- Use metrics to understand the impacts of change
- Use a modeling tool make the value stream visible
- Revisit regularly

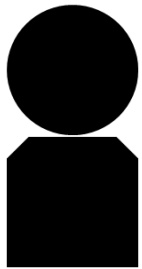
Challenge: Access to Patterns to Design System

“Any organization that designs a system will inevitably produce a design whose structure is a copy of the organizations communication structure”

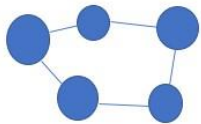
IDO Coach



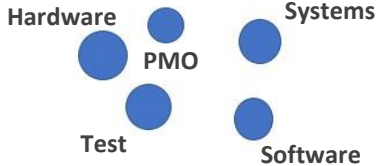
Executive



System



Organization



- Design systems around products and services

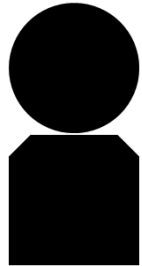
- If we have good documentation and clear roles and responsibilities functional based teams should work fine

Recommendations to the business

- Decompose your system into outcome-based products not by functional roles
- Shift to product teams versus project teams
- Architect to reduce handoffs
- Create small, cross functional, persistent teams that share a common set of practices and rules of engagement

Challenge: Valuing Exclusivity Over Inclusivity

IDO Coach



- Diverse culture, skills, and experience produce better products
- Inclusive environments have happier employees

Executive



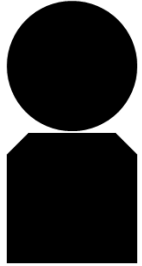
- I have earned my position
- I have more knowledge

Recommendation to the business

- Apply a growth mindset
- Use a model for Decentralized Decision making
- Build environments where ideas are shared openly
- Ask questions and practice active listening
- Access to tools where teams can brainstorm and exchange ideas easily

Challenge: Lack of Psychological Safety

IDO Coach



- Transparency is critical
- Failure in the short term needs to be an option



Executive



- We need to keep funding
- People want to see success
- Success allows you to move up

Recommendation to the business

- Lead by example. Be present.
- Assess your culture.
- Build a Generative Culture.
- Intent based leadership.
- Consider re-evaluating performance appraisals from top down to bottom up and build leader competencies