

Industrial DevOps and Whole Product Thinking

Creating a Model-Based Enterprise in Pratt and Whitney



COLLINS AEROSPACE | PRATT & WHITNEY | RAYTHEON

Brian Moore
David Borzillo

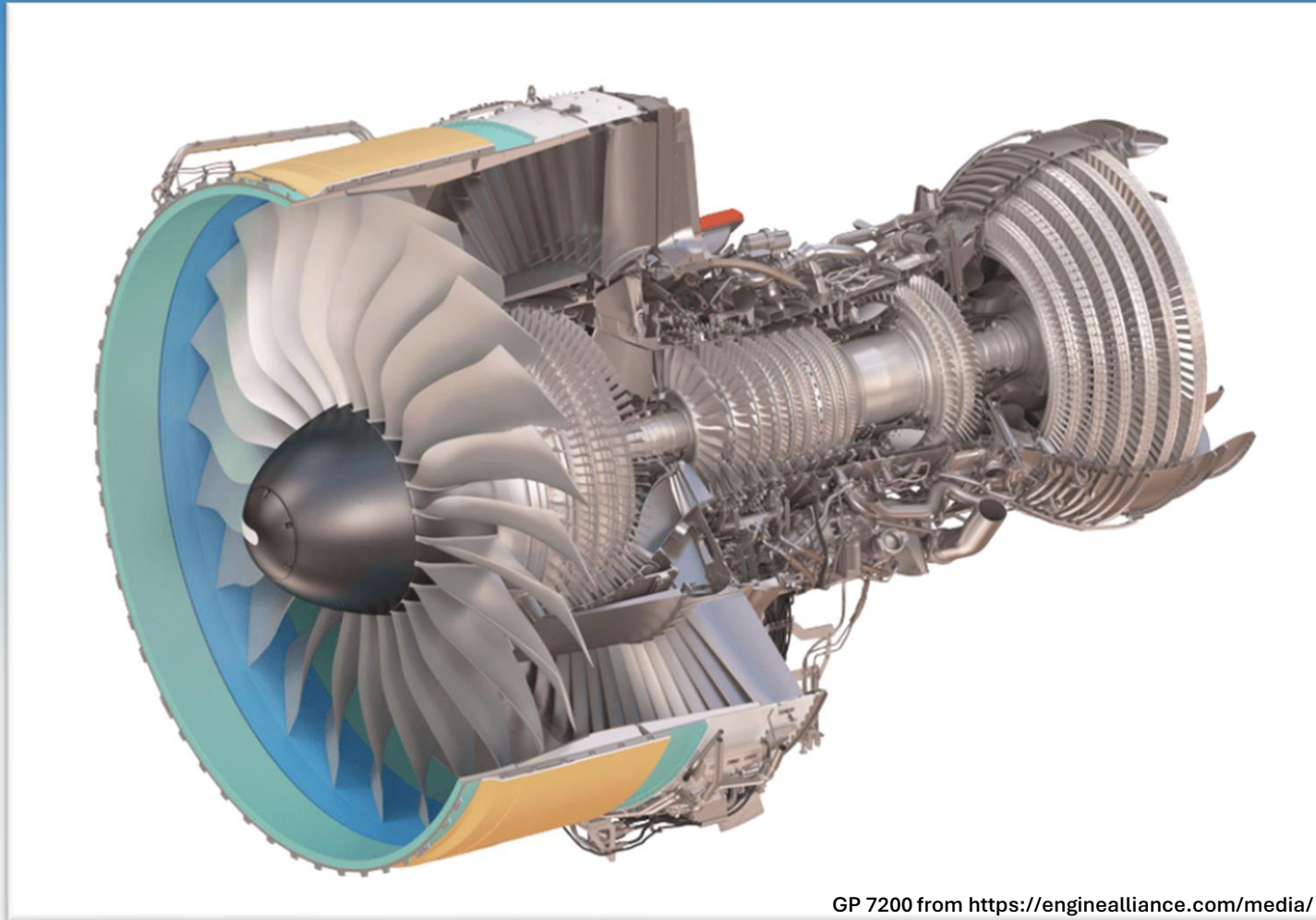
August 21, 2024



Photo credit: Airbus

How most of us got here

Unnoticed -- some of the most complex, high-consequence systems in modern society



GP 7200 from <https://enginealliance.com/media/>



A two-hour flight for a GTF engine generates about 4 million data points.

Beyond engines, customers need whole-product solutions

Pratt and Whitney has been providing whole-product solutions for nearly 100 years

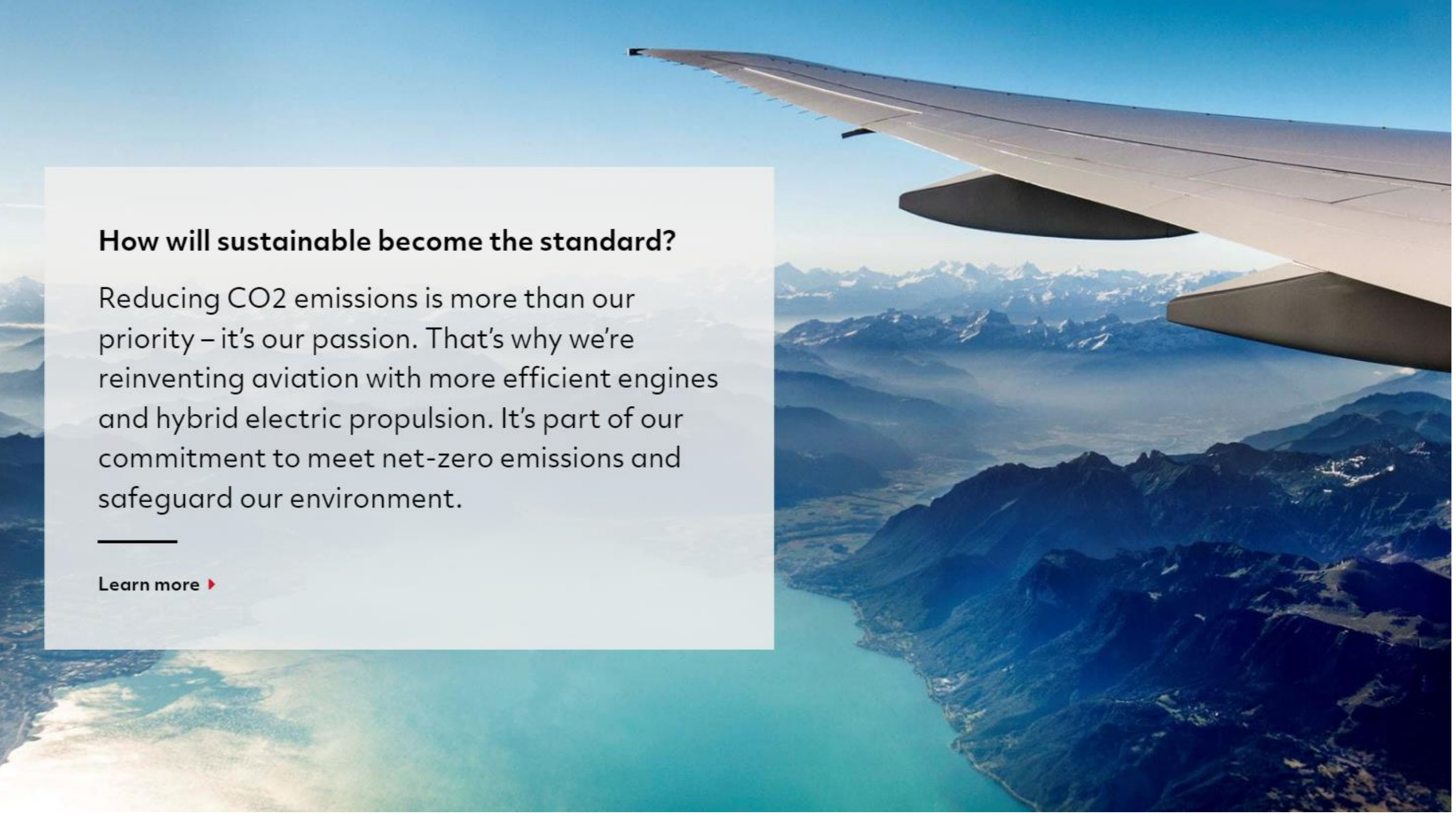
- ✓ **Innovative design** providing industry-leading performance
- ✓ **Lean operations** delivering affordability, predictability, and reliability
- ✓ **Global sustainment** ensuring safety and extending lifespans



Accelerating whole-product innovation is critical

- **Unprecedented challenges** face both defense & commercial customers
- **To connect and protect** the world is the RTX Mission





How will sustainable become the standard?

Reducing CO2 emissions is more than our priority – it's our passion. That's why we're reinventing aviation with more efficient engines and hybrid electric propulsion. It's part of our commitment to meet net-zero emissions and safeguard our environment.

[Learn more ▶](#)



How can data be the difference?

In aviation, data is everywhere – from passengers tapping their phones to radars watching the weather. We bring all that data together to deliver insights that make flight, safer, smarter and more sustainable.



How can AI enable predictive maintenance?



United States Government Accountability Office

Report to Congressional Committees

JUNE 2024

Weapon Systems Annual Assessment

DOD Is Not Yet Well-Positioned
to Field Systems with Speed

AIR FORCE

ARMY

JOINT DOD

NAVY

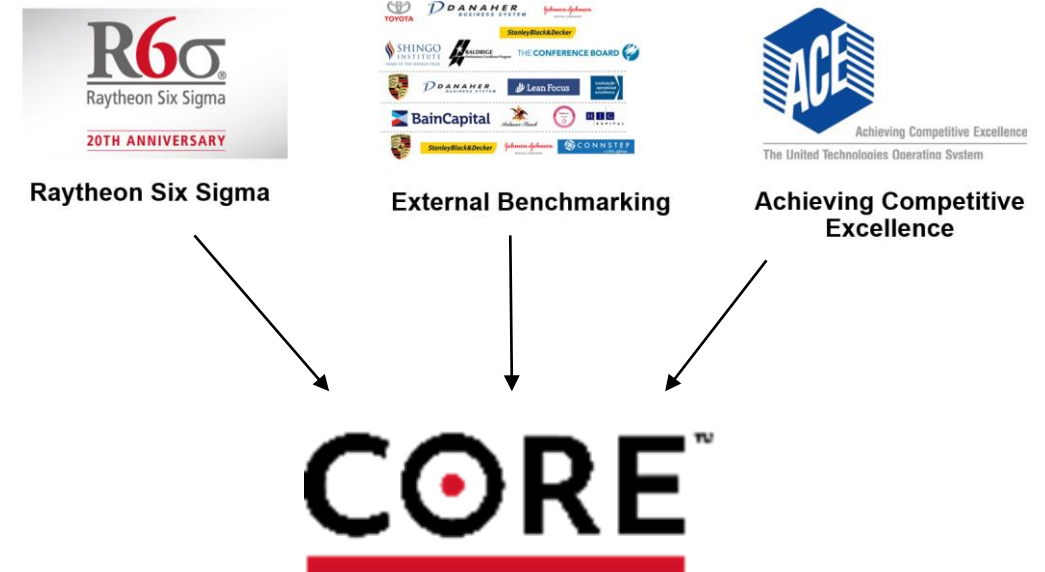
SPACE FORCE



P&W's response is enabled by CORE™

Customer Oriented Results & Excellence™

- Built upon decades of experience in RTX legacy companies
- Provides a framework to integrate the best thinking in industry
- Is our foundation for responding to challenges



The RTX operating system

CORE Principles

1

Understand Customer Value

Ascertain value in the eyes of the customer

2

Drive Culture of Excellence

Involve, align and empower employees to relentlessly pursue perfection

3

Focus on Critical Processes

Use data to discover root causes and eliminate waste and variation

4

Make Work Visible

Identify the value stream and make value flow at the pull of the customer

5

Grow Value

Deliver results incrementally with fast and integrated cycles of learning

Realizing the RTX Values

TRUST

We act with integrity and do the right thing

RESPECT

We embrace diverse perspectives and treat others the way they want to be treated

ACCOUNTABILITY

We honor our commitments, expect excellence and take pride in our work

COLLABORATION

We share insights, learn together and act as a team

INNOVATION

We experiment, design, build and transform with speed and agility

CORE principles — along with RTX values — are “true north” for all CORE behaviors and activities

CORE leverages multiple methodologies, strategies & mindsets

Voice of
Customer

RTX Goal
Alignment

Change &
Thayer
Leadership

Lean

RCCA &
Problem
Solving

Agile/
SAFe

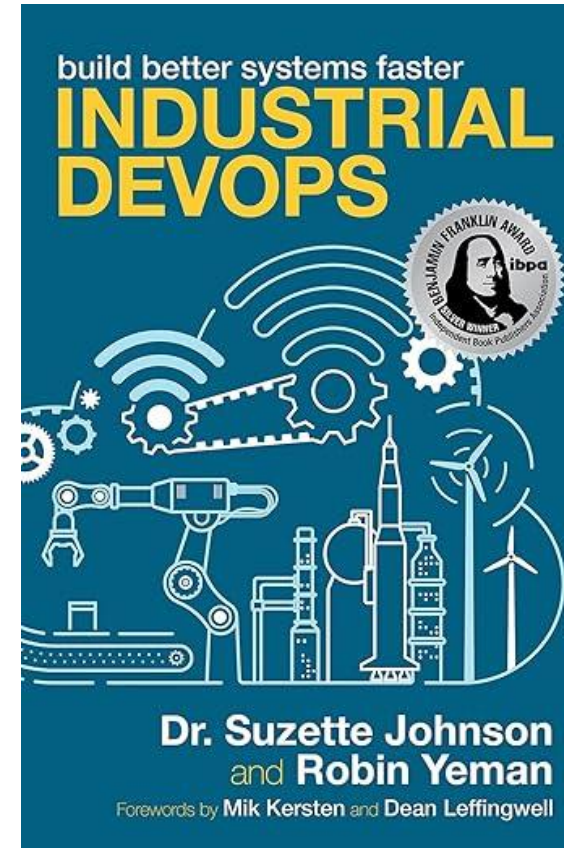
Theory of
Constraints

Process
Control &
Six Sigma

CORE integrates Industrial DevOps Principles

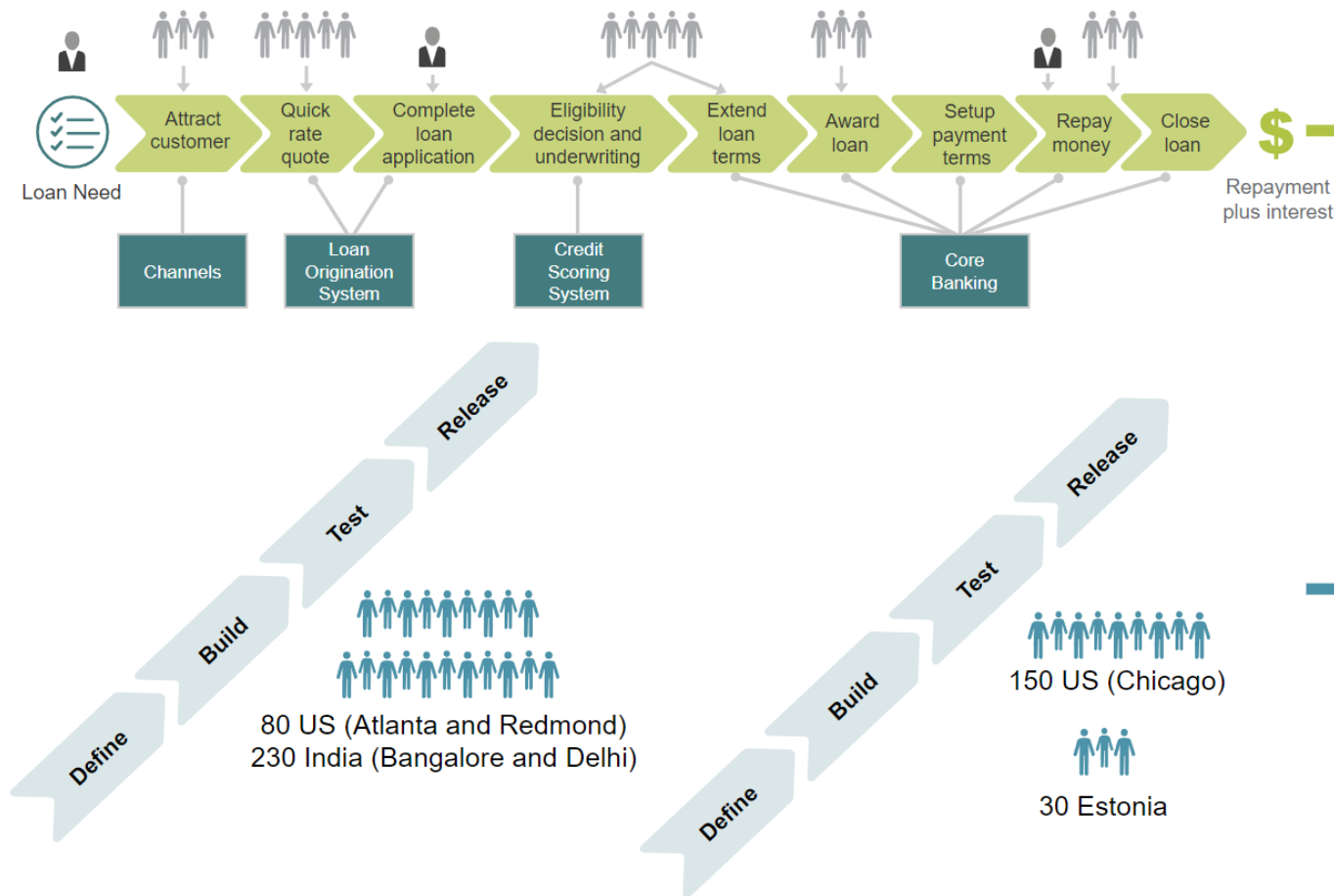
Key IDO principles are driving MBE development:

- Organize around value
- Establish synchronization and flow
- Integrate early and often



CORE enables the rapid adoption of IDO

Organizing around value



1. Operational Value Streams

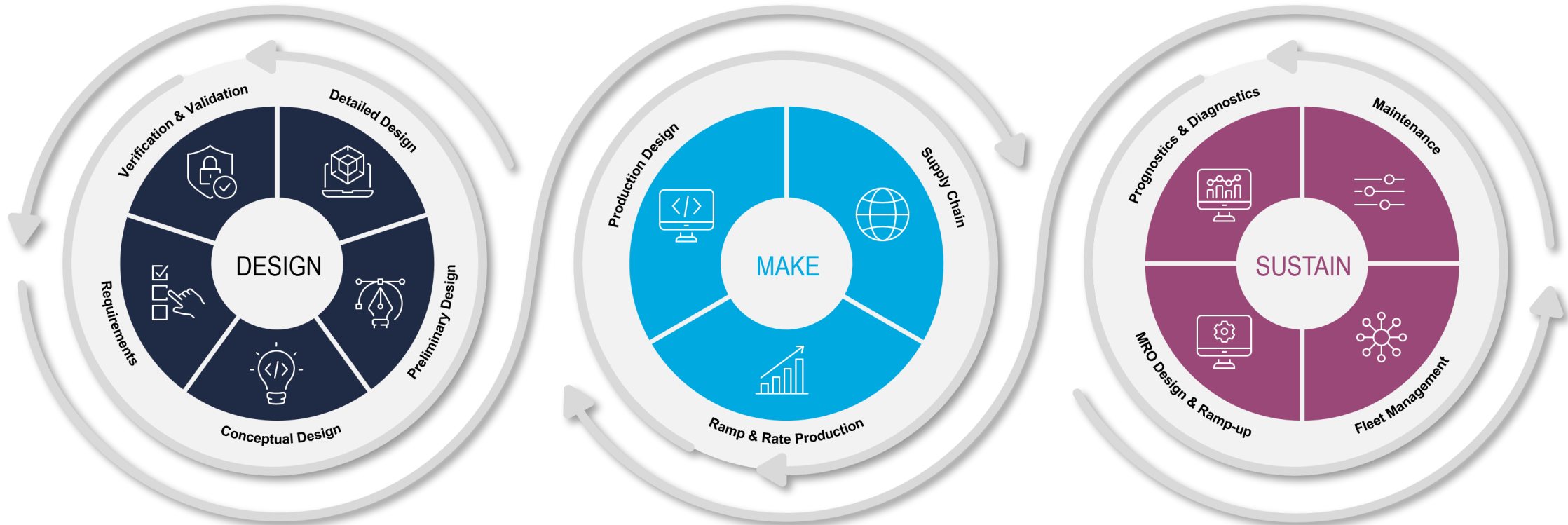
The sequence of activities needed to deliver a product or service to a Customer. Examples include manufacturing a product, fulfilling an e-commerce order, admitting and treating a patient, providing a loan, and delivering a professional service.

2. Development Value Streams

The sequence of activities needed to convert a business hypothesis into a technology-enabled Solution that delivers Customer value. Examples include designing and developing a medical device, developing and deploying a CRM system, and an eCommerce web site.

© Scaled Agile, Inc.

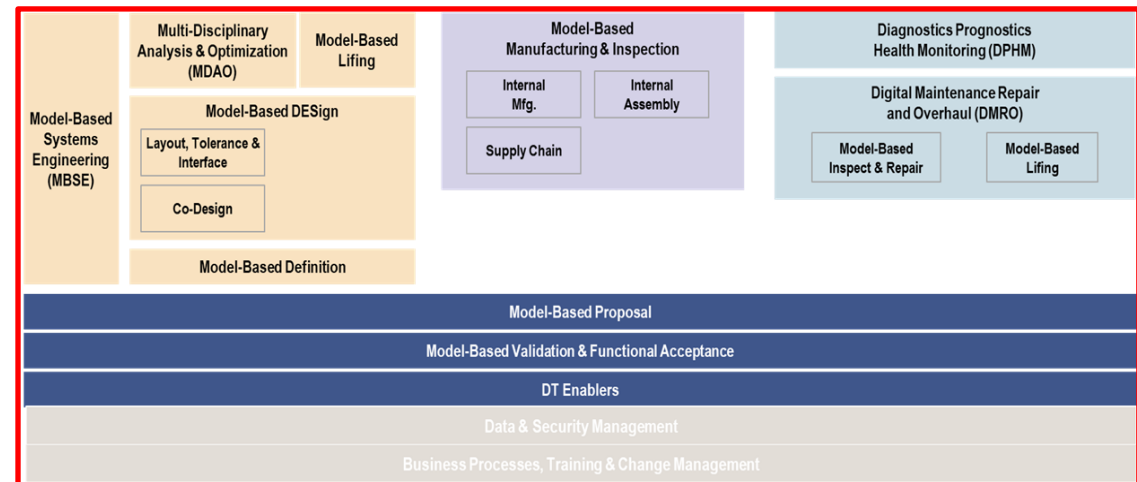
Three integrated operational value streams create whole-product solutions



The Model Based Enterprise (MBE) accelerates digital collaboration across the operational value streams

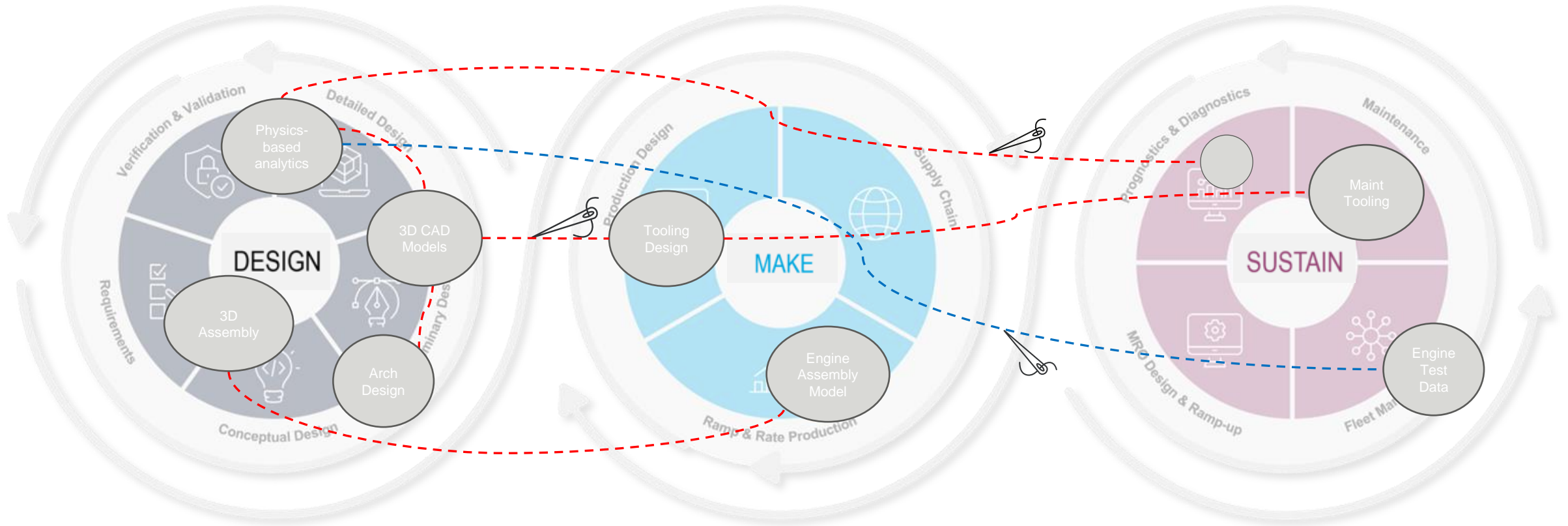
- **The MBE is a whole-product solution:**

- Infrastructure hardware and software
- Enterprise applications
- Engineering applications and tools
- Automation
- Analytics
- Information management and security
- Processes and policies
- Change management & training



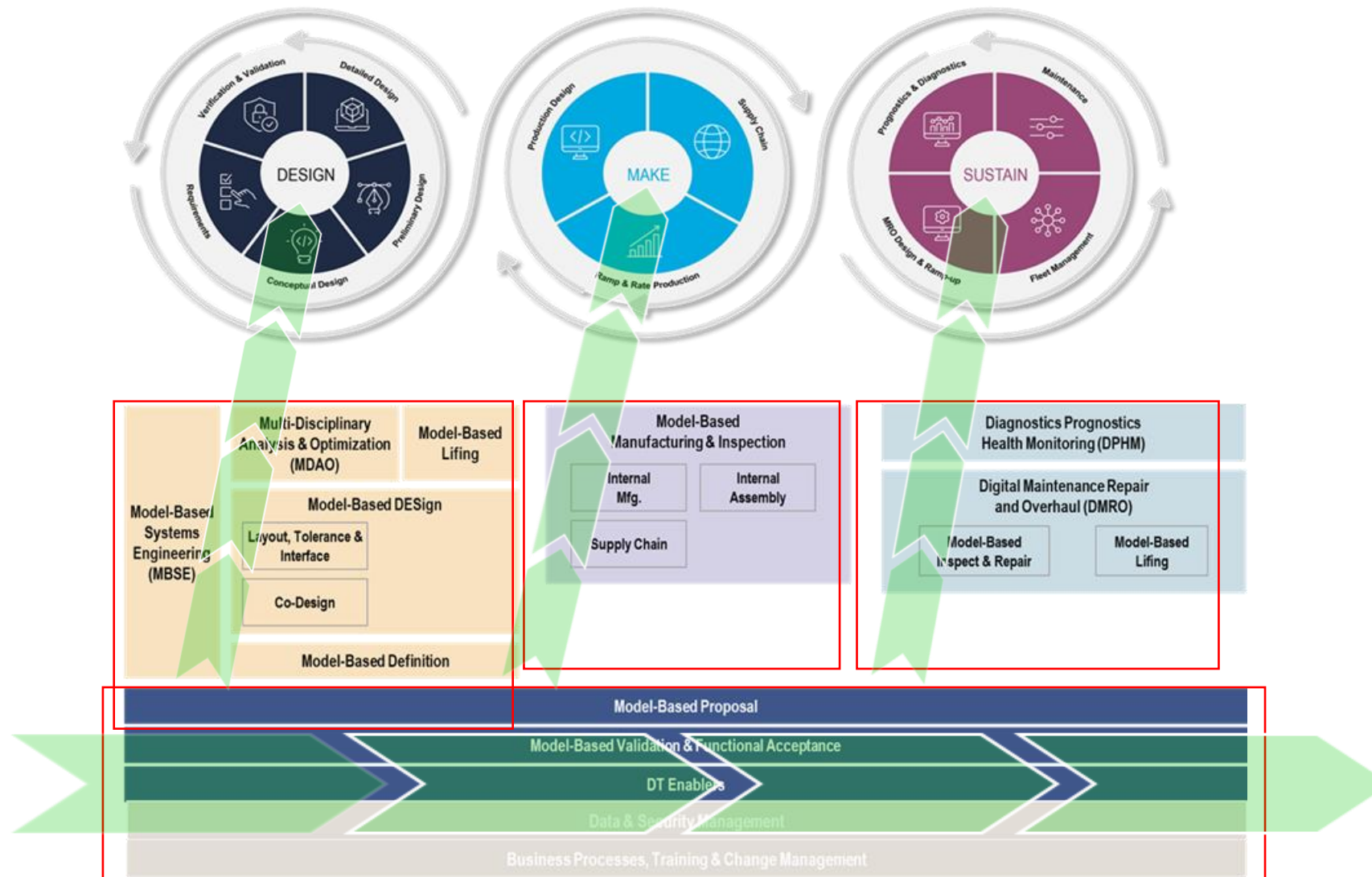
Like Rome, it won't be built in a day

P&W knits the MBE together with a digital thread

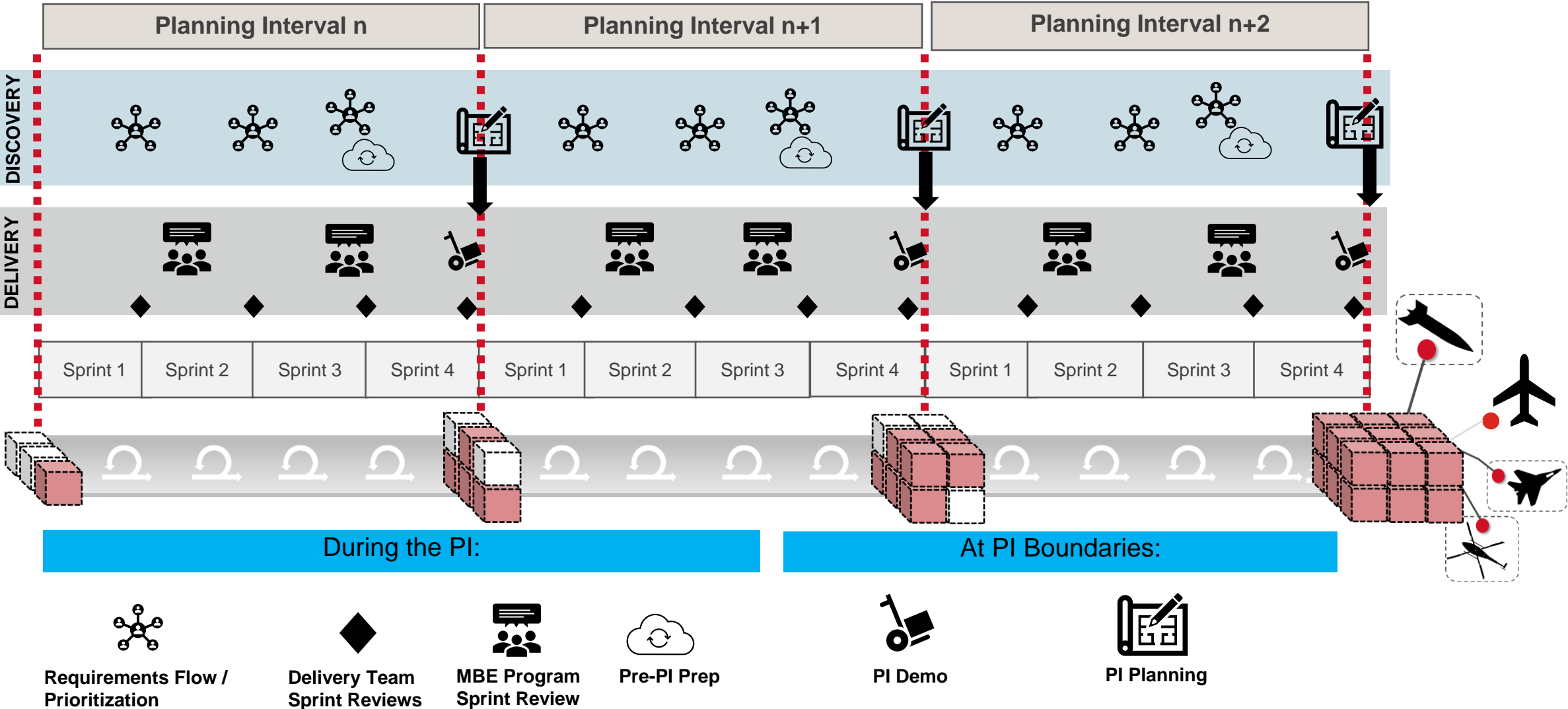


Connects data and models, enabling each team to extract, utilize, and update data

Four development value streams develop and operate the MBE as a whole product



Establish synchronization & flow; Integrate early and often



With the MBE & CORE, P&W is creating the wiring it needs to support its customers & society

- **Amplification**

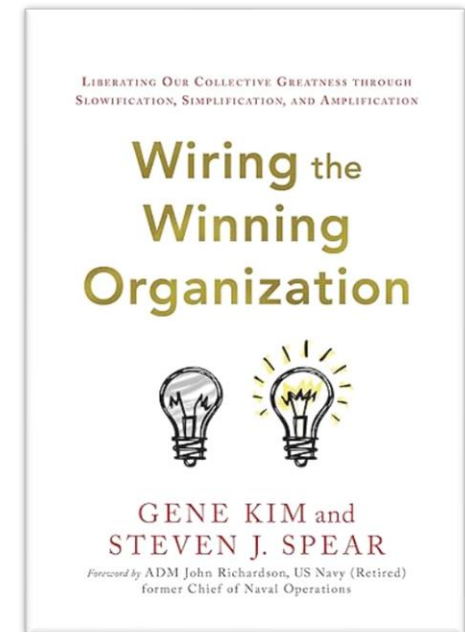
- MBE provides integrated sensing, analytics and 2-way feedback loops
- CORE prioritizes making work and problems visible

- **Slowification**

- MBE enables simulations using digital twins and integrated sets of digital models
- CORE emphasizes skill development and disciplined problem solving

- **Simplification**

- The MBE is implementing coherent, whole-product architectures
- CORE culture spurs continuous improvement at all scales



Continually Improving

- Improving cadence speed for demos and delivery
- Platform Updates
- Restrictions due to security requirements
- Transitioning to new ways of working and new platforms