Model Based Engineering @ Boeing

PLM Roadmap & PDT Fall 2020

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AGENDA

1: Introductions

2: MBE @ Boeing

3: Standards @ Boeing

4: Summary

HISTORY

Founded in 1916 in the Puget Sound region of Washington State in the U.S.

Became a leading producer of military and commercial aircraft

Completed a series of strategic mergers and acquisitions to become the World's Leading Aerospace Company

BOEING

STEARMAN

Rockwell International

BOEING

A heritage that mirrors the history of flight

WHAT WE DO TODAY

COMMERCIAL AIRPLANES

Boeing 7-series family of airplanes leads the industry

GLOBAL SERVICES

A dedicated services business focused on the needs of global defense, space and commercial customers

DEFENSE, SPACE & SECURITY

One of the world's largest manufacturers of military aircraft and satellites and major service provider to NASA

Large-scale systems integration, networking technology and solutions provider

BOEING CAPITAL CORPORATION

Global expertise in innovative aerospace financing solutions

WHERE WE ARE

$76.6 BILLION
in 2019 revenues

Products and services support to customers in more than **150 COUNTRIES**

Manufacturing, service and technology partnerships with companies around the world

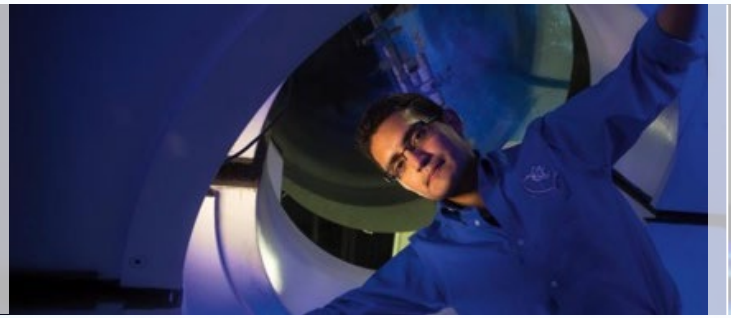
Contracts with more than **12,000** suppliers globally

More than **160,000 BOEING EMPLOYEES**

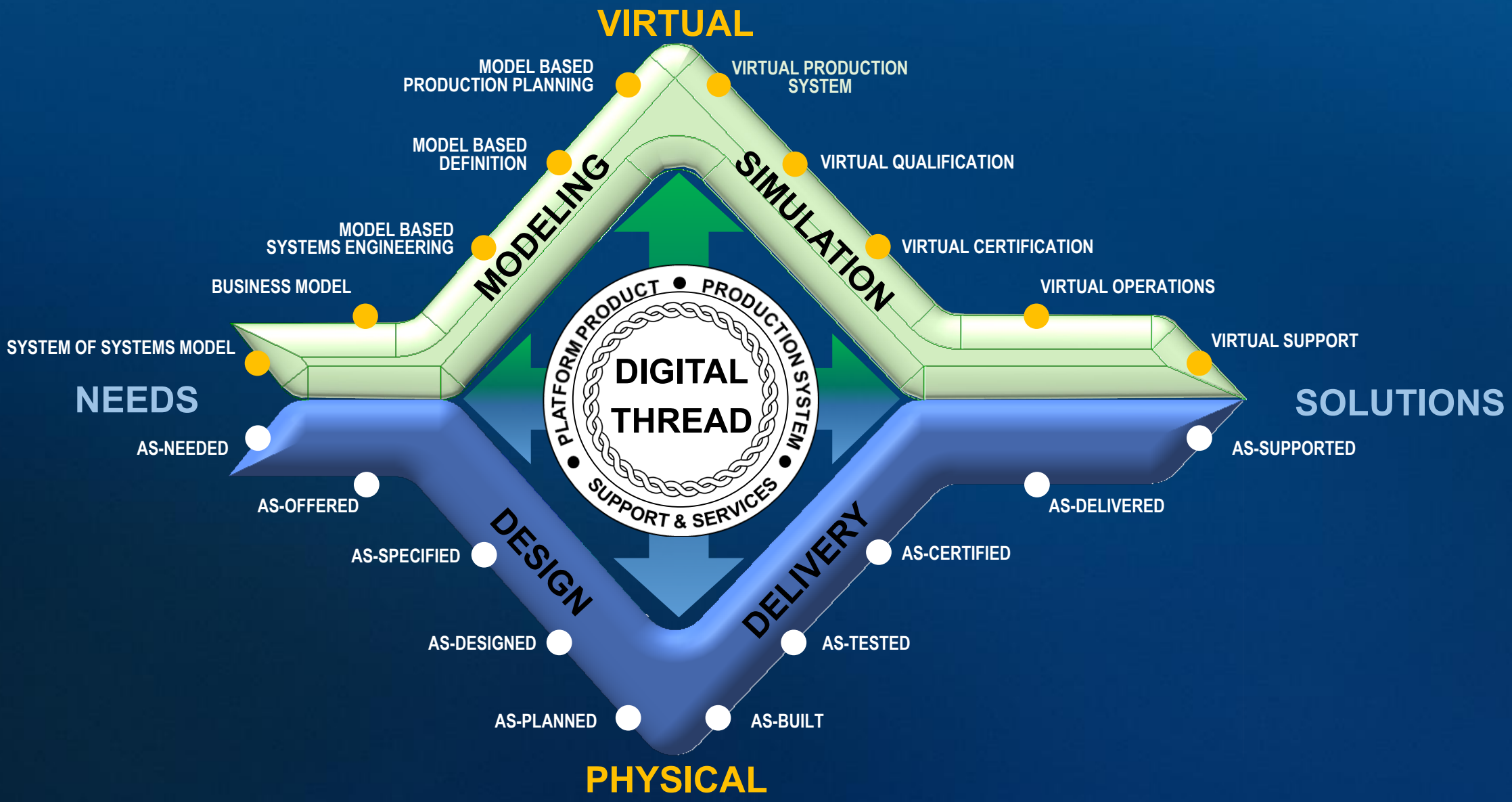
across the United States and in more than **65 COUNTRIES**

Research, design and technology-development centers and programs in multiple countries

of commercial airplane revenue historically from customers outside the United States

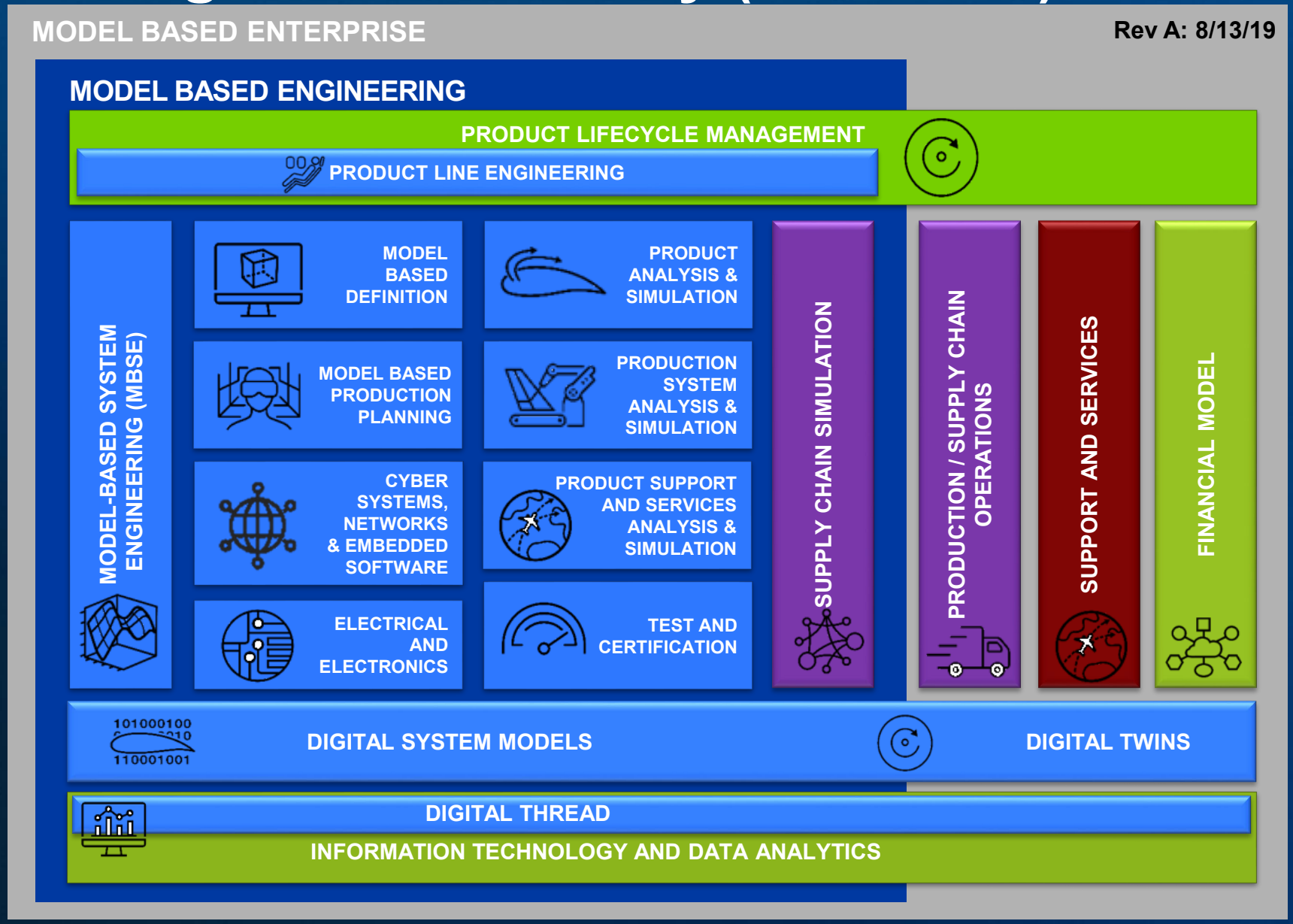




MBE Diamond Symbol



Approved for Public Release (RROI 19-00155-BDS)

Boeing MBE Taxonomy (Elements)



MBE Starter Kits

- *People / Training*
- *Processes*
- *Tools / Apps*
- *Data*
- *Enabling Architectures*
- *Reusable Models*

Legend

- Product Lifecycle Management
- Domain Engineering
- Operations Management
- Support & Services
- Enterprise Services

DIGITAL TWIN POSITION PAPER

BOEING

Boeing Digital System Model / Digital Twin White Paper

RELEASE DATE
June 2019

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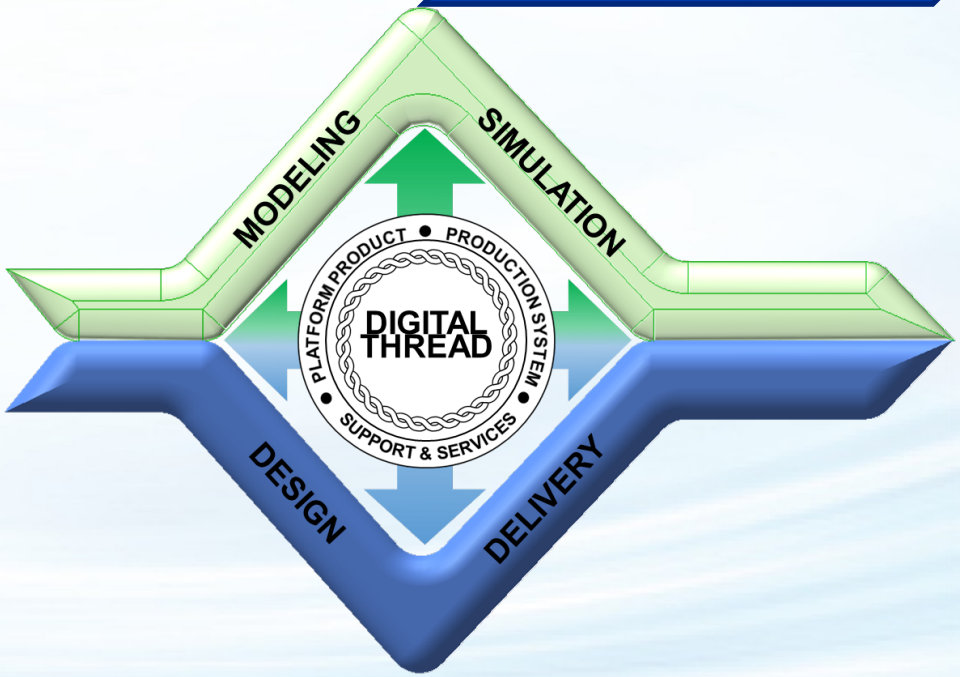
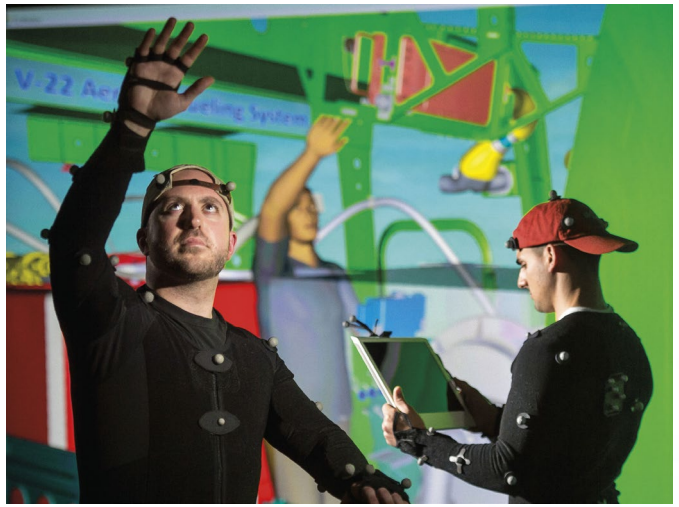
The **Digital System Model (DSM)** is a calibrated digital surrogate of a product, at the level of fidelity currently available that is intended to be the enduring, authoritative source of truth for data-driven decisions.
A **Digital Twin (DTw)** is a virtual representation of the properties and behaviors of a specific instance of a physical system or process that enables prediction and optimization of performance and maintains synchronization with that physical system or process through its operational life.

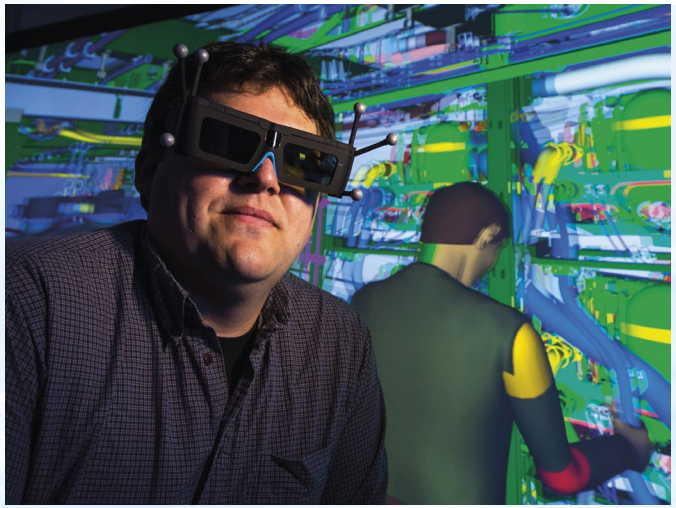
Digital System Model

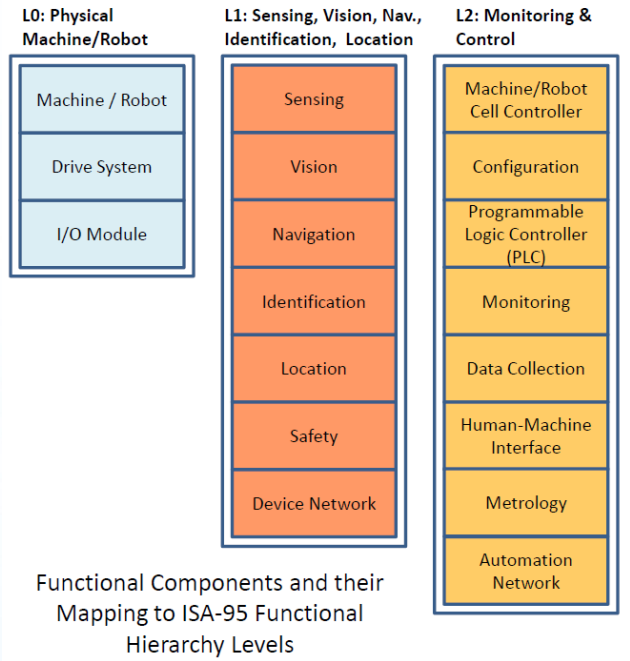
Digital Twins



DIGITAL TWIN EXAMPLES



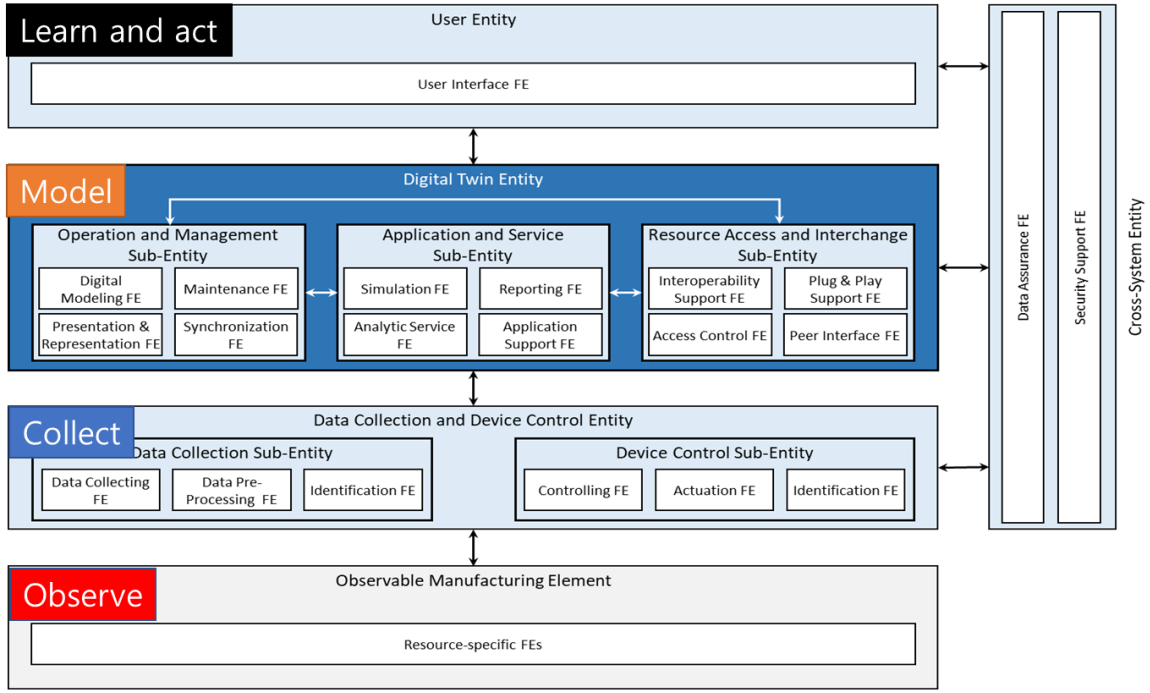




Functional Components and their Mapping to ISA-95 Functional Hierarchy Levels

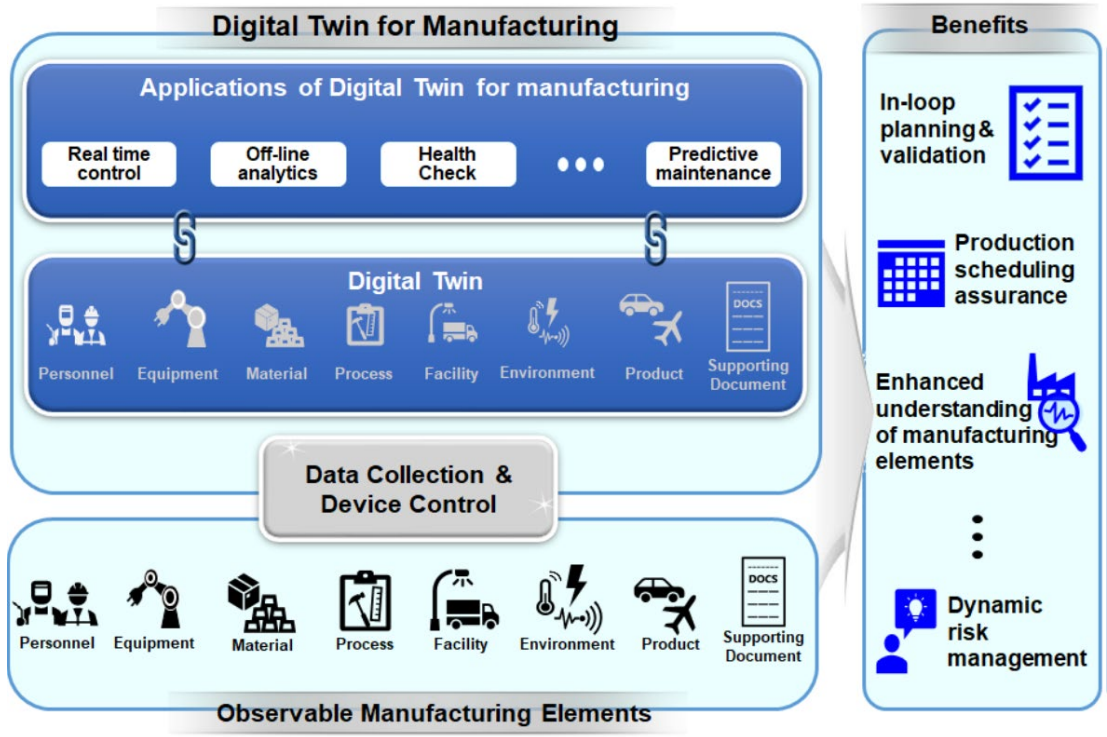
ISO 23247 – Digital Twin manufacturing framework

Technical framework



FE = Functional Element

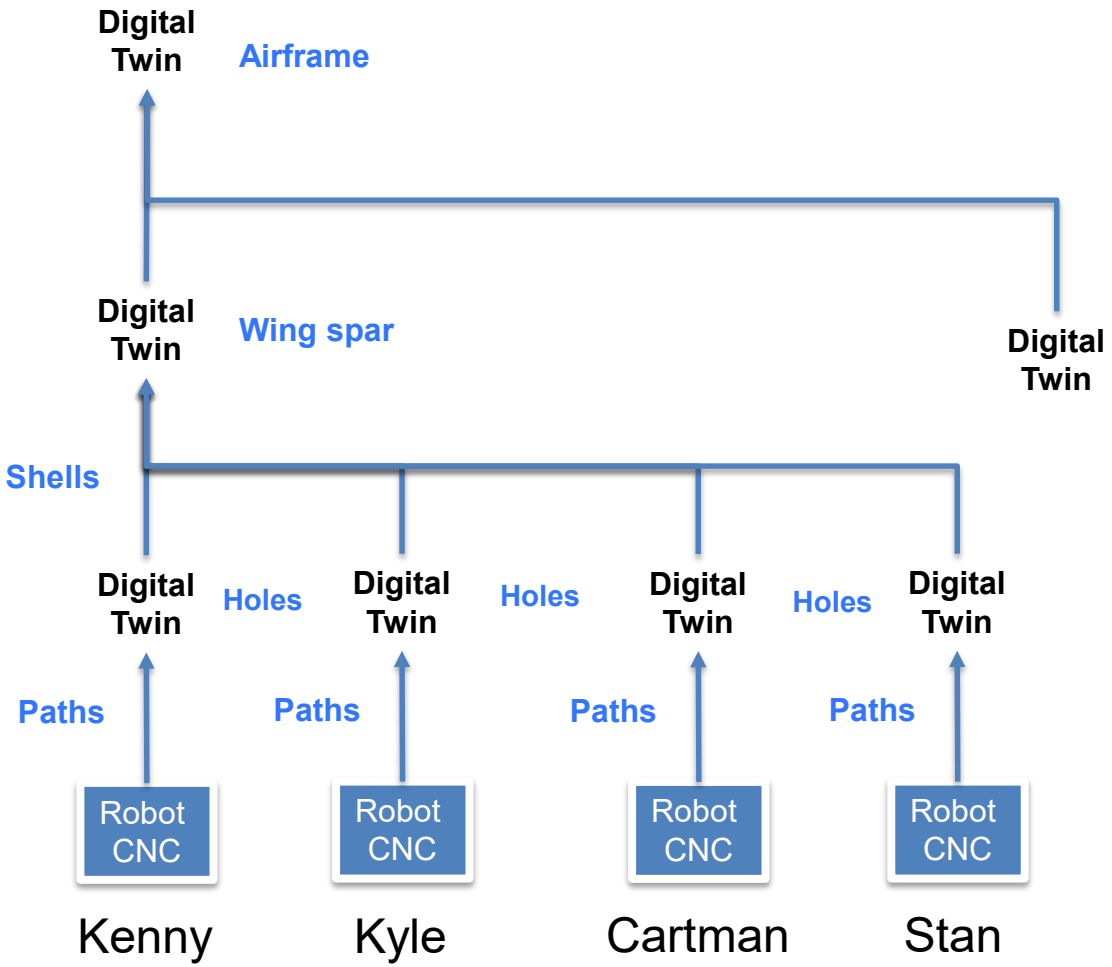
Implementation Approach



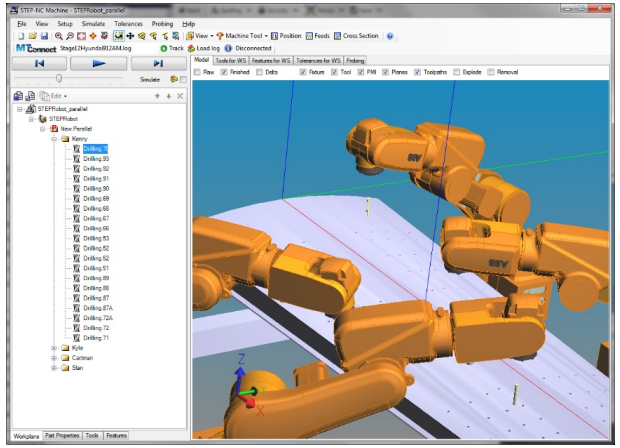
A practical standard for implementation in a company of any size.

ISO 23247 – Digital Twin manufacturing framework

Example – robot manufacturing



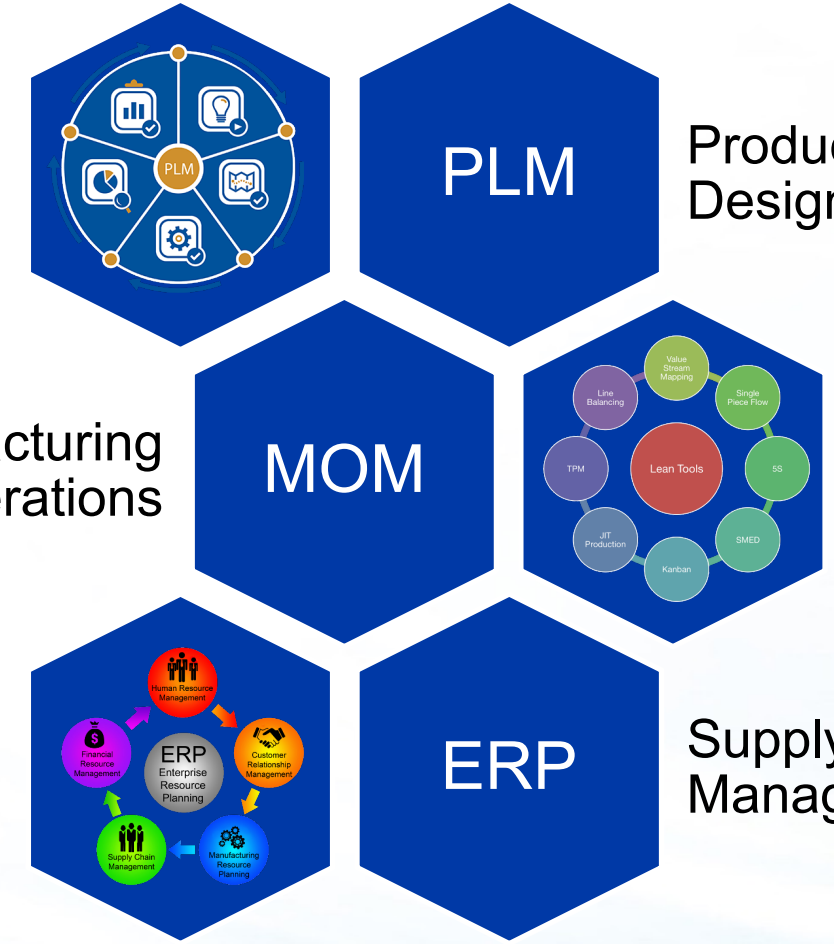
Robots Kenny, Kyle, Cartman and Stan drill and fasten a wing panel.

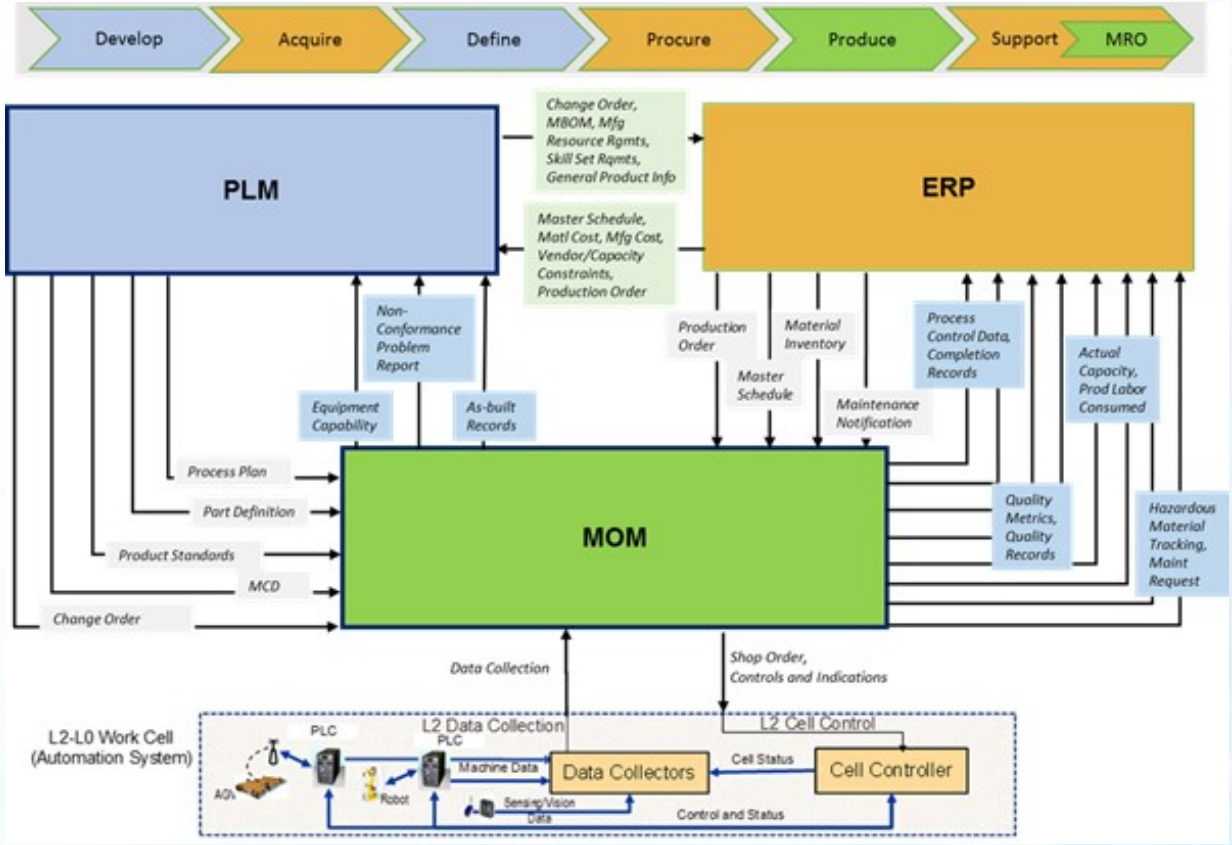


In real time, robots self schedule when one goes offline.

BOEING STANDARDS STRATEGY

Platforms federated through stable interfaces





Industry proven, consensus based standards at architectural boundaries protect technology investments

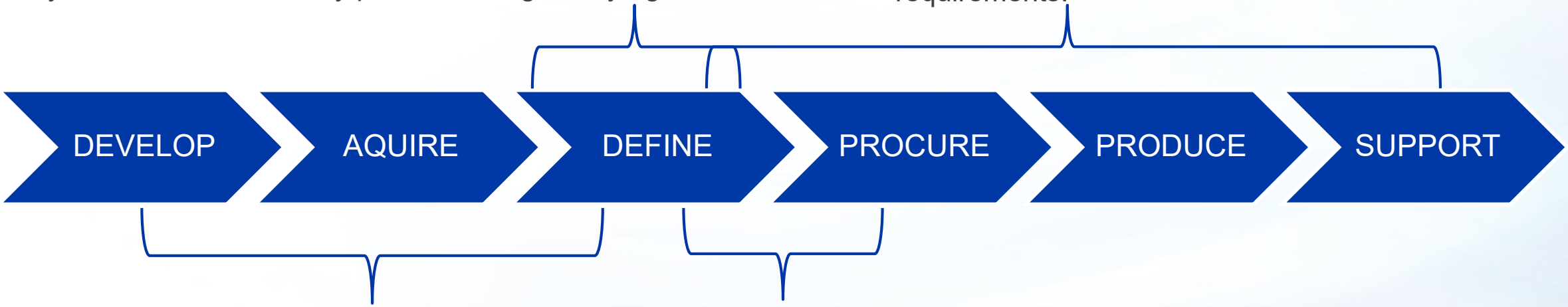
PLM ACTION GROUP INVESTMENTS

Model-Based Definition (MBD) and Bill of Material Definition

Define the minimum data content in Model Based Definition type design required to meet manufacture, inspect, and regulatory certification requirements. Evaluate existing standards and tools to provide an industry standard data delivery process to regulatory agencies.

Multiple View Bill of Material (Multi-BoM)

Define scope (e.g. eBoM, mBoM, sBoM) and use cases (e.g. reconciliation, consistency-traceability, add-replace-suppress part); and agree on high level objectives and requirements.



Model-based Systems Engineering (MBSE)

Evaluate current capabilities of a typical aerospace supplier and an aerospace OEM to produce, exchange, and consume digital information via a collaborative shared data site using commercial MBSE software tools (i.e., SysML) and related data exchange standards.

Global Collaboration

Define A&D collaboration patterns between airframe and engine OEMs, determine best practices for sharing electronic data throughout the lifecycle, and create a template to facilitate data standard formats and exchange practices for setup and connection of OEMs and their suppliers

MBE @ BOEING

A Model Based Enterprise offers significant value and a digital representation of the product is foundational: *rapid agreement on taxonomy is essential.*

Early work with Digital Twins have demonstrated the capability and standards bodies are engaging: *Now is the time to get your requirements on the table.*

Federated Architectures benefit from strong interoperability standards: *Industry consensus on the MBSE standards roadmap needs your support.*