MODEL-BASED PRODUCT LINE ENGINEERING (MBPLE):

THE FEATURE-BASED PATH TO PRODUCT LINES SUCCESS

SWISSED, 15.09.2025

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INCOSE PLE Working Group Chair

20.08.2025


Video
Riproduci (k)


Video

Clone-&-Own

MBPLE

NH90: €292 M INVESTED, 12 YEARS OF OPERATION
AND…

Norway Is Done With Its Unreliable NH90 Helicopters, Wants $500M Back

No amount of money, spare parts, or maintenance time will get the Airbus-built rotorcraft flying reliably, Norwegian defense officials say.

DAN PARSONS / JUN 10, 2022 3:10 PM EDT / 273

Belgium retiring NH90 helicopters due to maintenance costs, 'bad purchase'

AIR

14 JULY 2025 | By: Robert Dougherty

Australia's NH90 Helicopter Nightmare Is Finally Ending

Australia has dumped its NH90s after years of budget blow-outs, low availability, defects, mission failures and the tragic loss of aircrew.

JOHN HUNTER FARRELL / OCT 3, 2023 12:41 PM EDT / 277

Despite its modularity promise, the NH90 ended up with 23 national variants that are heavily customized

DOUBLE-DECK TRAIN DESIGNED FOR ALUMINIUM
AND…

..The team realizes the customer requested a stainless-steel carbody!

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1999-1-1:2007+A1

June 2009

ICS 91.010.30; 91.080.10

Supersedes ENV 1999-1-1:1998

English Version

Eurocode 9: Design of aluminium structures - Part 1-1: General structural rules

Eurocode 9: Calcul des structures en aluminium - Partie 1-1: Règles générales

Eurocode 9: Bemessung und Konstruktion von Aluminiumtragwerken - Teil 1-1: Allgemeine Bemessungsregeln

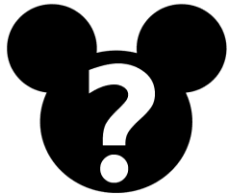
Rolling stock

Two-year delay for Swiss double-deck trains

February 3, 2014
Written by Keith Barrow

SWISS Federal Railways (SBB) confirmed on January 31 that the delivery of a fleet of 59 long-distance trains from Bombardier will be delayed by two years.

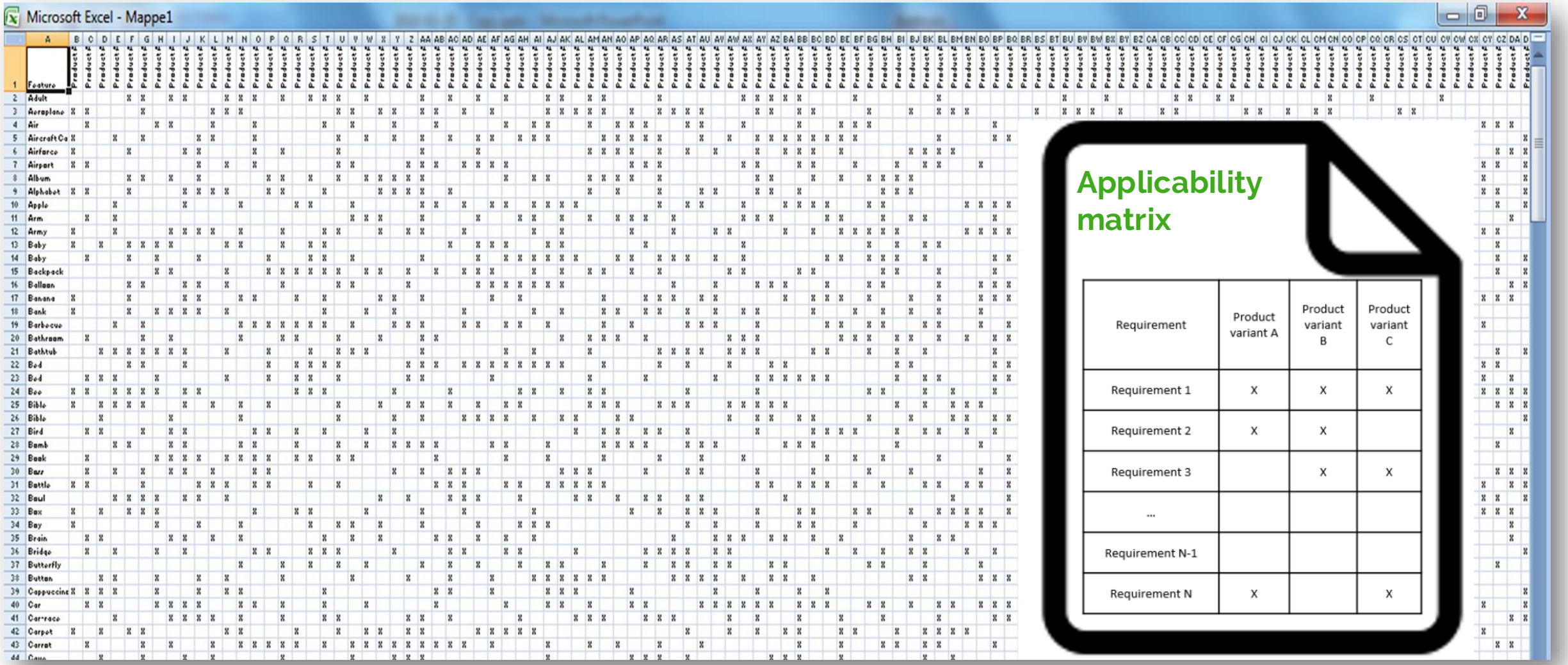
WHAT DO THEY HAVE IN COMMON WITH DISNEY?



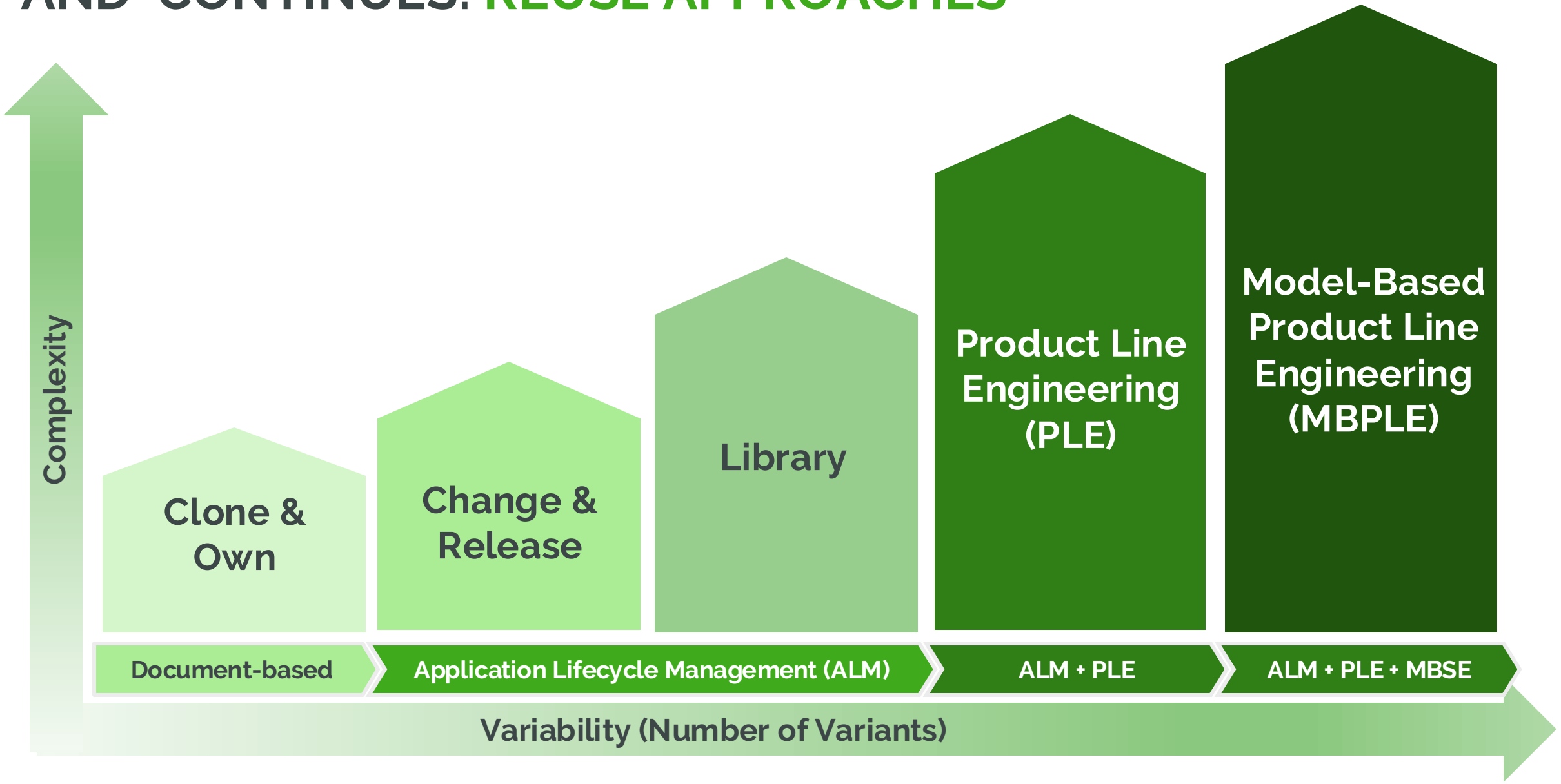
WHAT WE CAN LEARN FROM DISNEY

WHAT IS (NOT) SYSTEMATIC REUSE

HOW THE JOURNEY STARTS: APPLICABILITY MATRIX

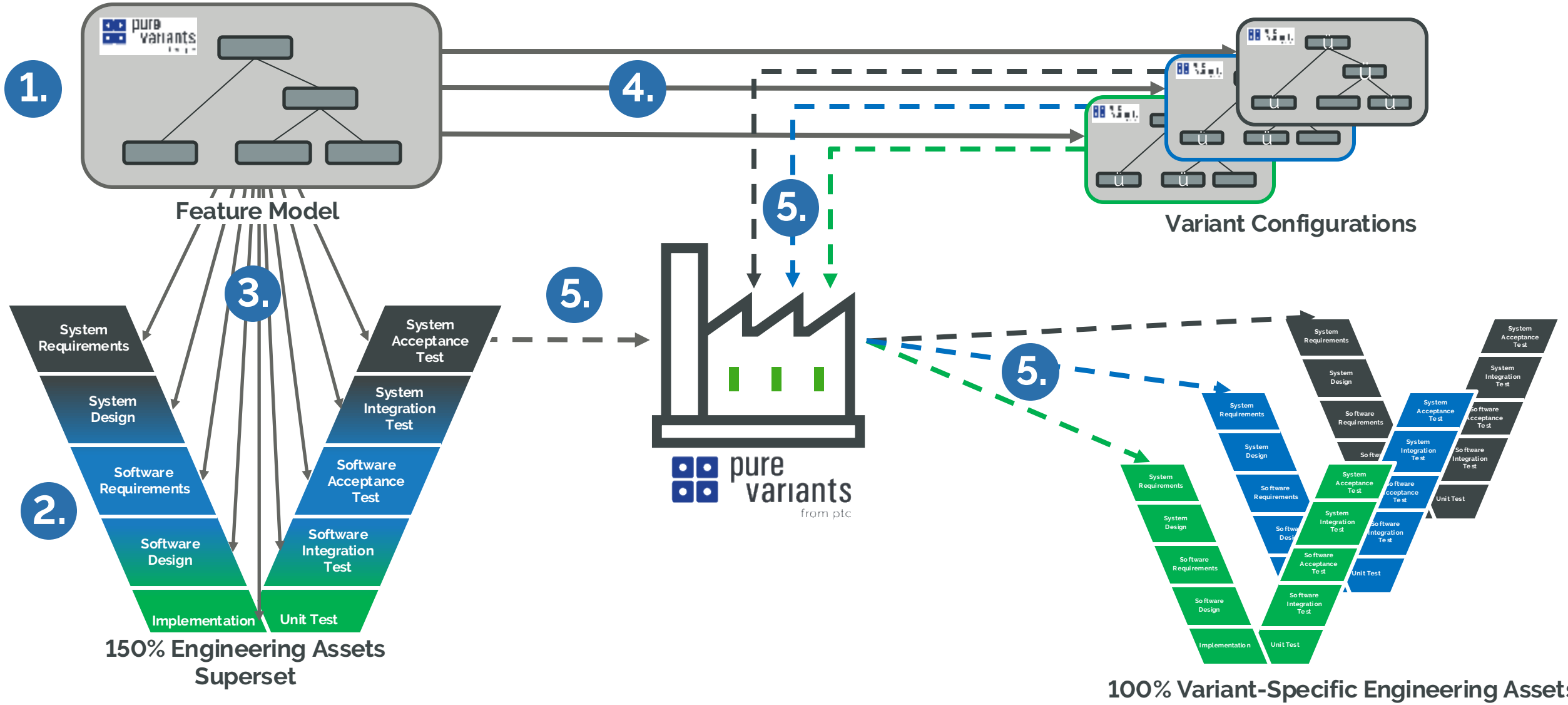


AND CONTINUES: REUSE APPROACHES



FEATURE-BASED (MB) PRODUCT-LINE ENGINEERING

ISO 26580



MB + PLE

MB

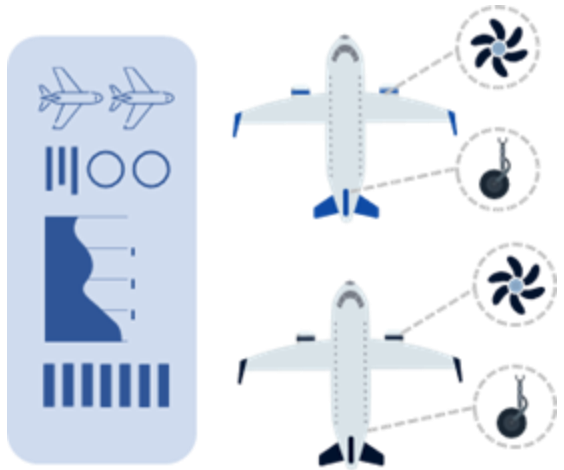
- CONSISTENCY
- COLLABORATION
- MANAGED COMPLEXITY

MB + PLE

MB

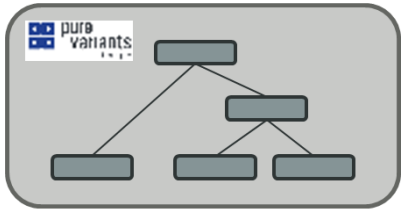
- CONSISTENCY
- COLLABORATION
- MANAGED COMPLEXITY

PLE



- SYSTEMATIC ASSETS REUSE
- MANAGED VARIATION
- SINGLE SOURCE OF VARIABILITY

DEFINE FEATURE MODELS



Feature Model

pure variants from ptc ▸Drone HEAD Drone · /

Drone

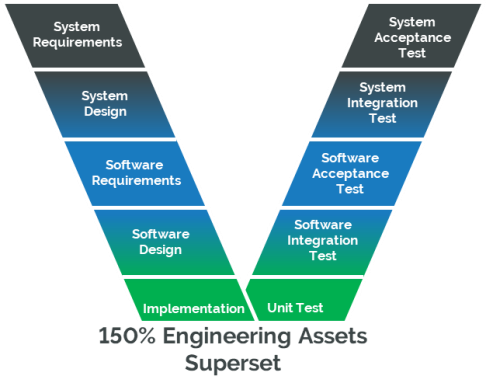
- Drone
  - Range ← Mandatory
    - Standard_Range
    - Extended_Range
  - Mission
    - Delivery
    - Inspection ← Alternative
    - Monitoring
  - Regions
    - Singapore
    - USA ← OR
    - Germany
  - Payload
    - Light_Payload
    - Extra_Payload
      - Weight_Kg =
  - HIgh_Resolution_Camera ← Optional

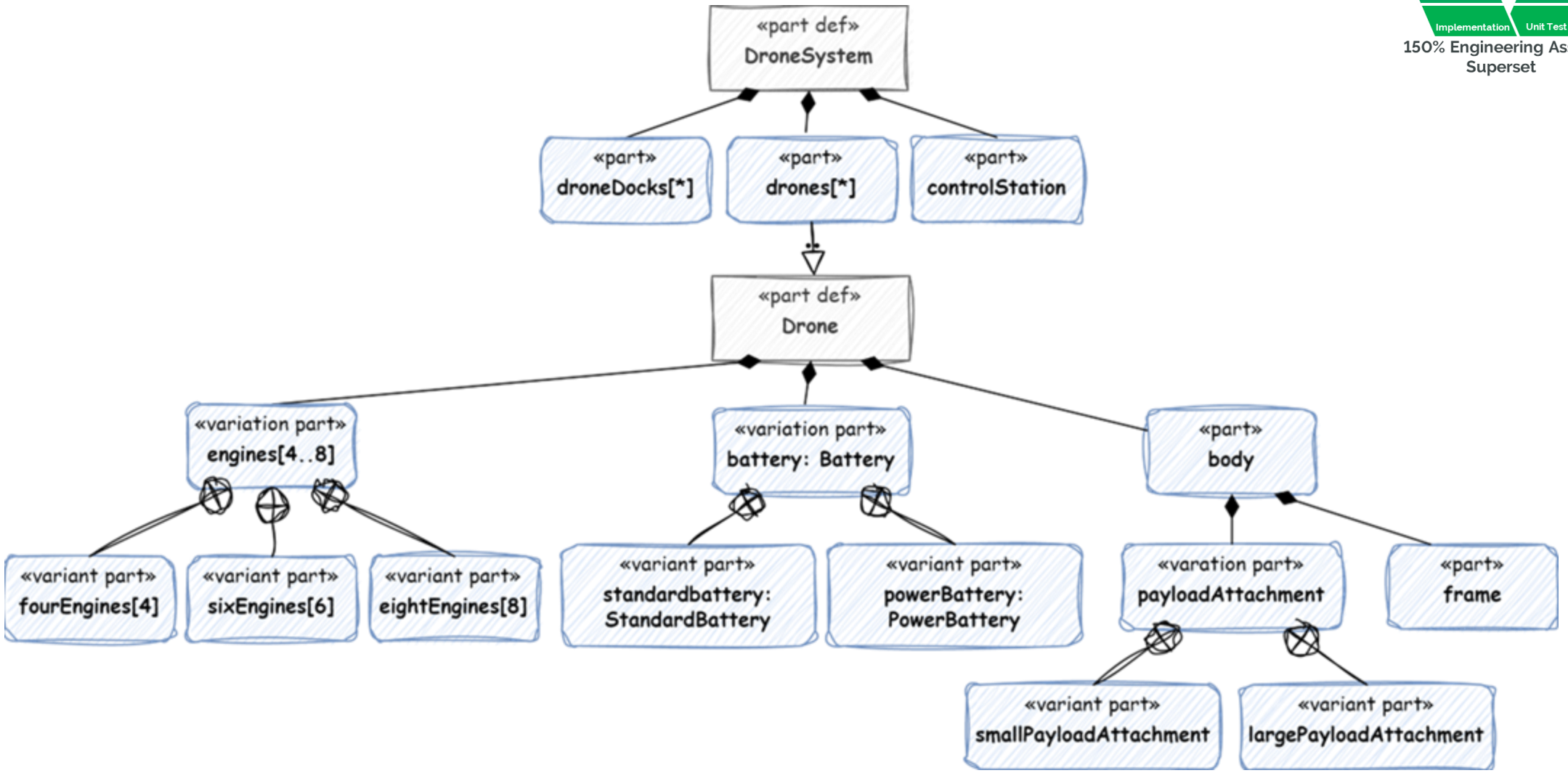
Feature

Drone

Unique Name:	Drone	**Visible Name:**	Drone
Class / Type:	ps:feature / ps:feature	**Unique ID:**	ioNN6gsWrorAyoL2_
Default Selected:	off		
Model:	Drone · Drone · HEAD		
Created:	Marco / Aug 28, 2025, 5:04:11 PM	**Changed:**	Marco / Aug 29, 2025, 10:43:42 AM

DEFINE SHARED ASSETS SUPERSET





SELECT FEATURE CONFIGURATIONS

pure variants from ptc ▸ Drone ↑ HEAD — Delivery_Drone_100 · /Drone_Config/

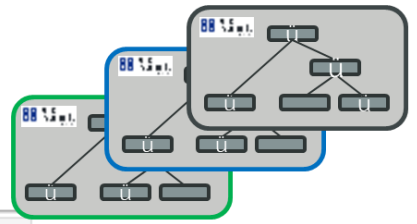
Drone_Config

Delivery_Drone_100

- Drone
  - Range
    - Standard_Range
    - Extended_Range
  - Mission
    - Delivery ← **Selected**
    - Inspection ← **Excluded**
    - Monitoring
  - Regions
    - Singapore
    - USA
    - Germany
  - Payload
    - Light_Payload
    - Extra_Payload
    - HIgh_Resolution_Camera

pure variants from ptc ▸ Drone ↑ HEAD — Drone_Config · /

Model Elements	Level	1 Delivery_Drone_100	Monitoring_Defense_...	Insspection_Drone_100
Drone				
Drone		✓	✓	✓
Range	1	✓	✓	✓
Standard_Range	1.1	☒	☒	☑
Extended_Range	1.2	☑	☑	☒
Mission	2	✓	✓	✓
Delivery	2.1	☑	☒	☒
Inspection	2.2	☒	☒	☑
Monitoring	2.3	☒	☑	☒
Regions	3	✓	✓	✓
Singapore	3.1	☑	☐	☑
USA	3.2	☐	☑	☑
Germany	3.3	☐	☐	☑
Payload	4	✓	✓	✓
Light_Payload	4.1	☒	☑	☑
Extra_Payload	4.2	☑	☒	☒
Weight_Kg		?	?	?
HIgh_Resolution_Camera	5	☐	☑	☑

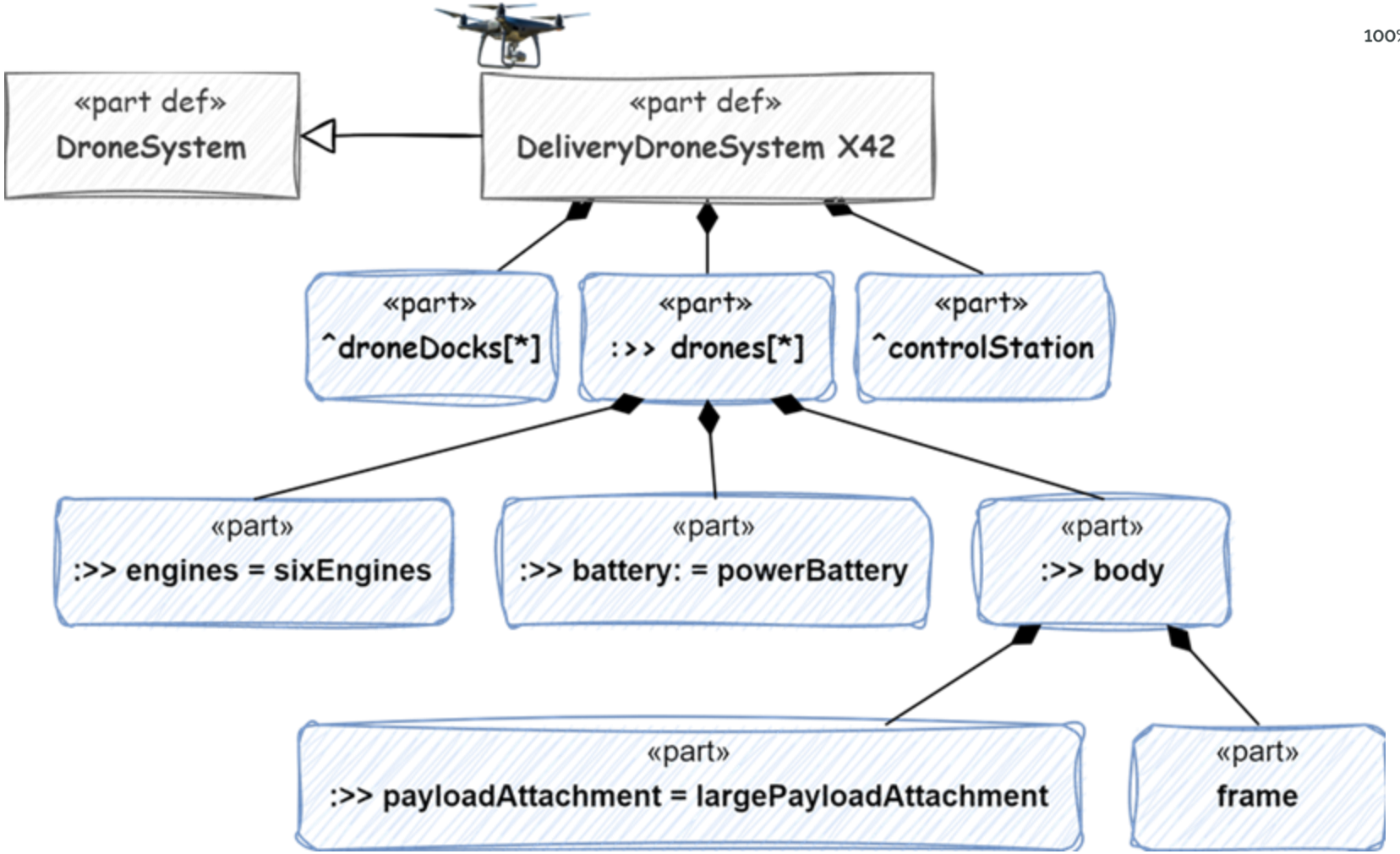


Variant Configurations

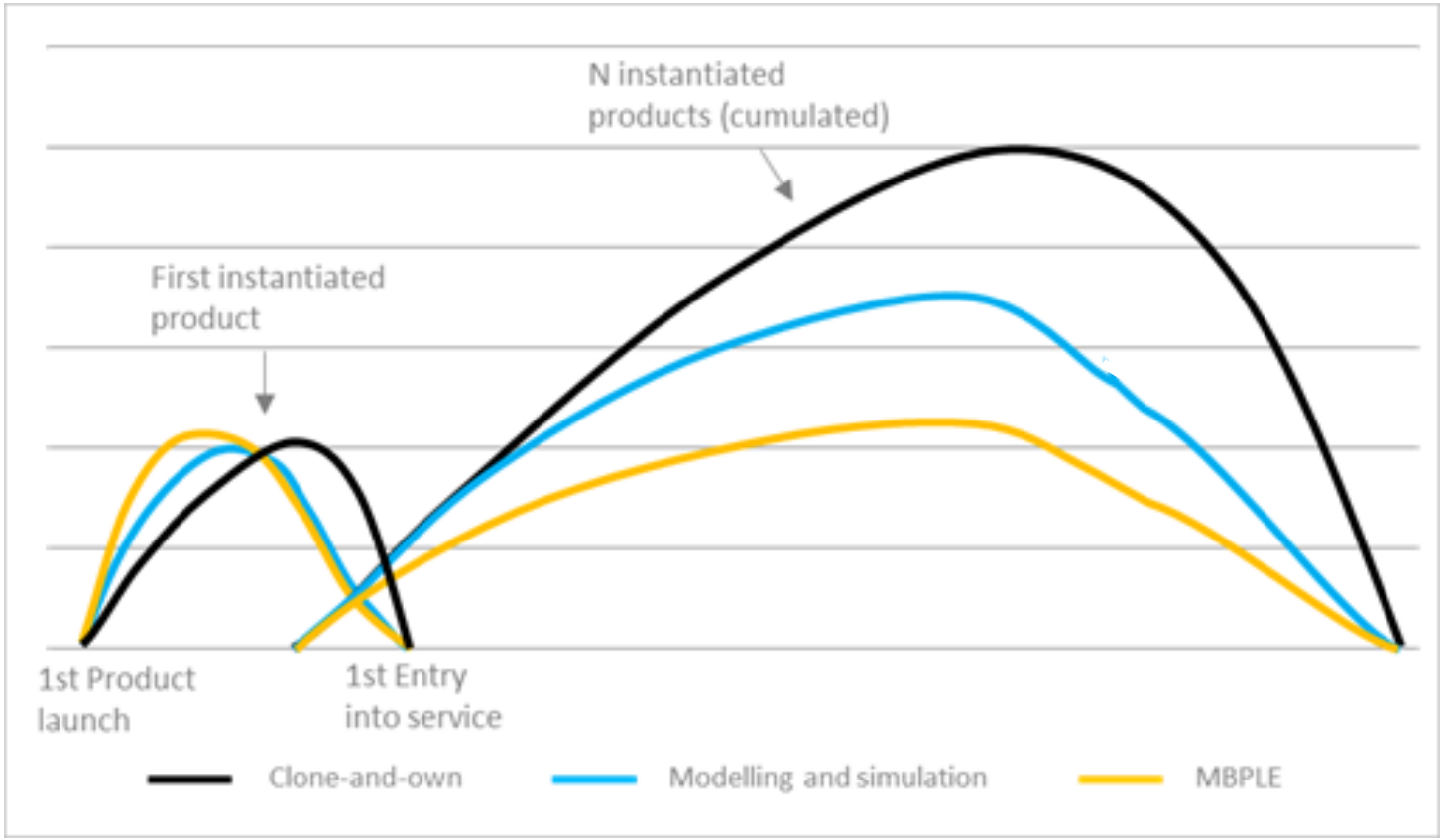
← **Configurations**

DERIVE PRODUCT MODELS

100% Variant-Specific Engineering Assets

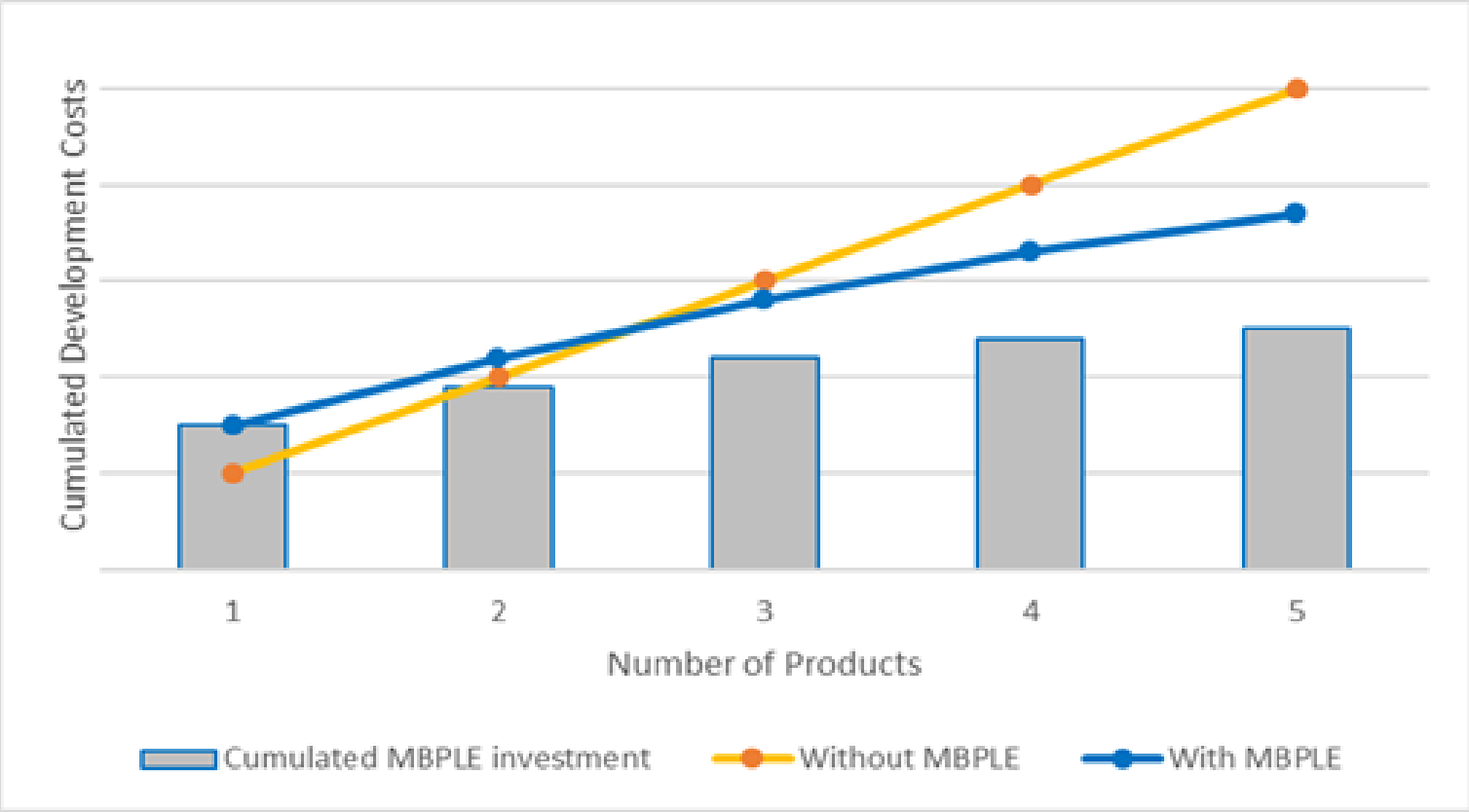


THE BUSINESS CASE OF MBPLE



Non-recurring costs for a given number of member products **over a period of time**

THE BUSINESS CASE OF MBPLE



The point where the two lines cross represents the **payoff point of MBPLE.**

Go with an **Incremental Investment!**

A MBPLE STORY FROM THE FIELD

THALES: SUCCEEDING WITH A PRODUCT LINE DELIVERY APPROACH BASED ON MBPLE

Ground Master 400 (GM 400)

→ 4 large contracts.

In parallel

Ground Master 200 radar (GM 200)

→ development phase

Ground Master 60 radar (GM 60)

→ prospect phase.

Thales Defence

THALES

THALES: SUCCEEDING WITH A PRODUCT LINE DELIVERY APPROACH BASED ON MBPLE

At that time (2011), the Surface Radar economic results were not so good, leading to **2 main issues**:

1. **“How to secure the reuse at the level of the Ground Master product line”?**

Thales Defence

THALES

THALES: SUCCEEDING WITH A PRODUCT LINE DELIVERY APPROACH BASED ON MBPLE

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2. **“How to ensure the qualification achievement when using a BBs platform for a radar with high variability and many parameters”?**

Thales Defence

THALES

THALES: SUCCEEDING WITH A PRODUCT LINE DELIVERY APPROACH BASED ON MBPLE

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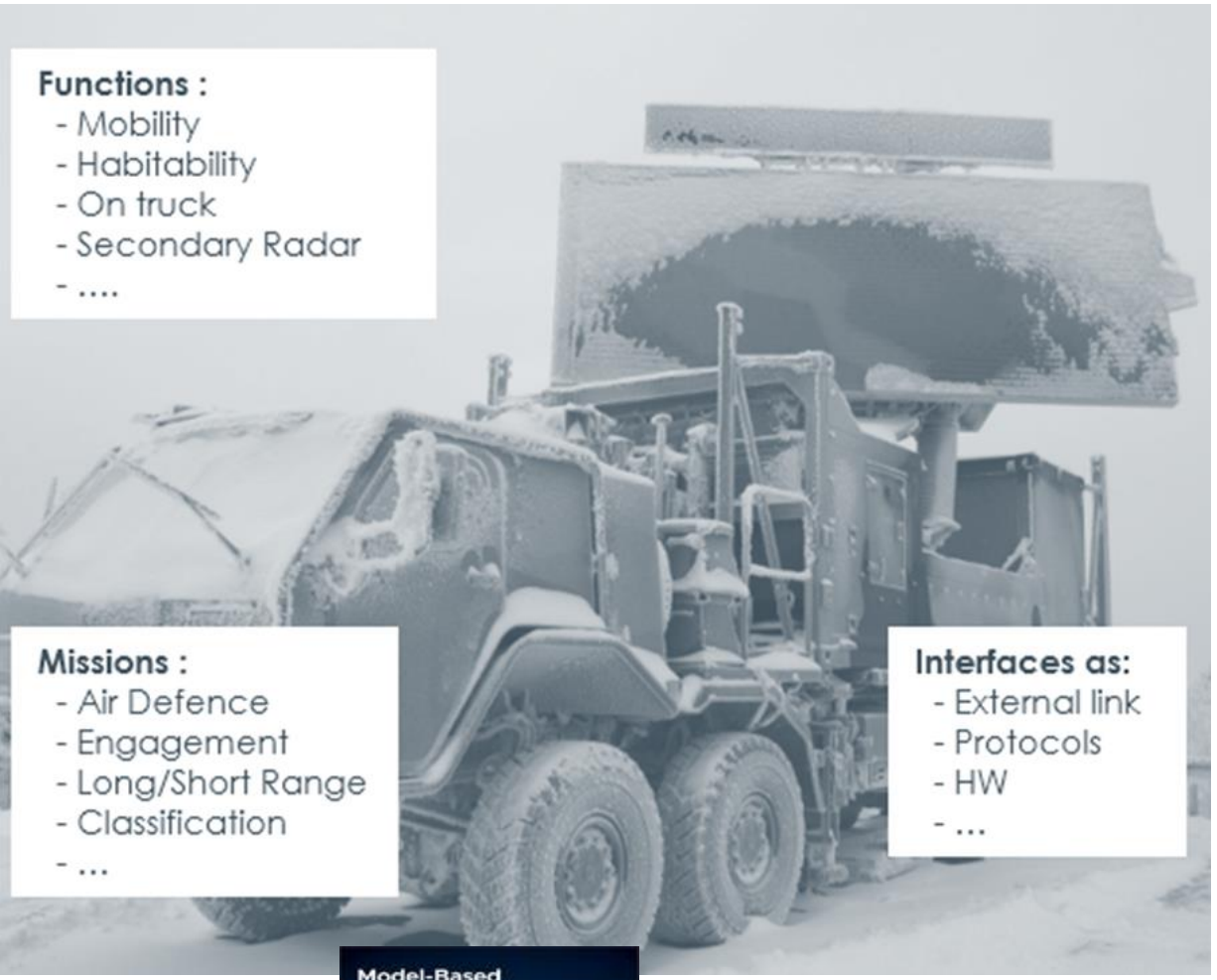
Thales Defence

THALES



Thales Defence

THALES

Thales: Ground Master Radars Product Lines

Concrete Challenge:. **managing 3000 parameters** across **40** overly **large components**.

Solution with Pure Variants: By **applying PLE with Pure Variants over 3000 parameters** were controlled and managed **with just 70 key features,**

leading to:

- **Reduction in** parametrization time **from 120 hours to 4 hours** per update!

MORE IT CAN BE FOUND HERE

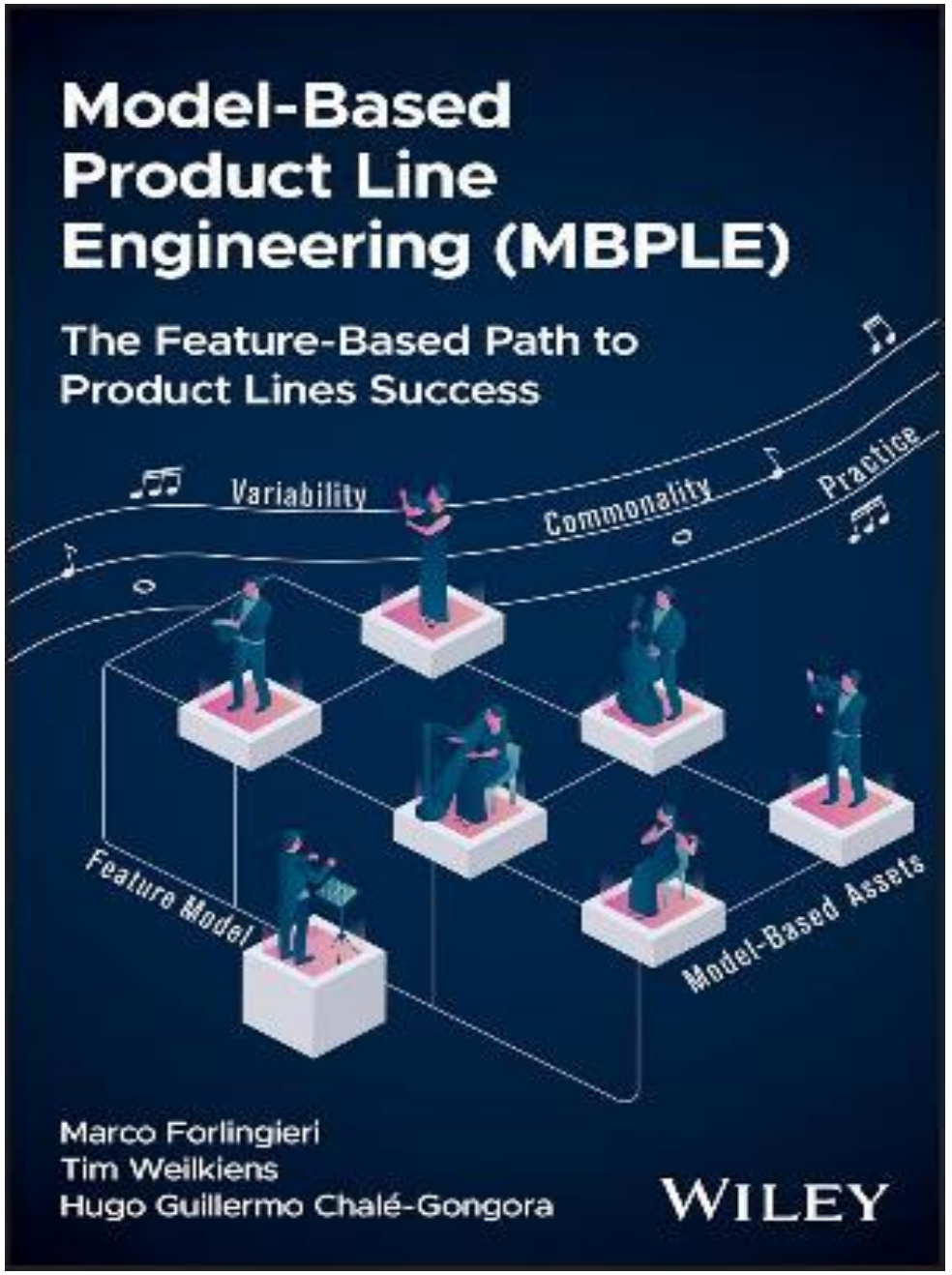
AIRBUS

MBDA MISSILE SYSTEMS

Raytheon An RTX Business

THALES

BELIMO



MORE IT CAN BE FOUND HERE

35th Annual INCOSE international symposium
hybrid event
Ottawa, Canada
July 26 - 31, 2025

MBPLE Adoption in the European Aviation, Defense and Automotive Industries.

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Abstract. This paper focuses on the adoption of Model-Based Product Line Engineering (MBPLE) across three European industries, showcasing its potential to address system's complexity and variability. MBPLE, as combination of feature based PLE and Model-Based Systems Engineering (MBSE), leverages standards like ISO/IEC 26580 to enable machine-readable models for managing variants and supporting the digital thread across multiple domain-specific assets. The work highlights a common pattern in MBPLE adoption, from initial motivations to practical implementations, in terms of process, methods, information model, toolchain and organization, while noting differences driven by industry-specific contexts.

Keywords. Feature-based PLE, MBPLE, ISO/IEC 26580, European Industries, Aviation, Defense, Automotive, Real-world Adoption

Q&A