Operationalize 3D Modeling in Production Today

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Presenters Bio

Michel Gadbois
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Michel brings over 30 years of manufacturing experience to iBase-t. During his tenure at the company, he has played a key role in global sales and product expansion. As SVP and Chief Enterprise Architect, Michel is responsible for a combination of leadership duties across Sales, Services, and Product Management.

Michel is an expert in providing creative solutions to complex business problems by challenging current ideas and championing industry best practices. Michel began his career in operations as Plant Superintendent of a chemical packaging facility where he implemented several MRP II systems, before joining a manufacturing management consulting group that specialized in productivity and quality improvements.

A small step back…

Do you remember anyone telling you?

“ I can do it FAST. I can do it WELL. And I can do it CHEAP.”

PLEASE PICK TWO!

Key Terminology for Today's Presentation

THE DIGITAL THREAD:

A formal framework for controlled interplay of authoritative technical, process and as-built data with the ability to access, integrate, transform and analyze data from disparate systems throughout the product lifecycle into actionable information.

MODEL-BASED DEFINITION (MBD):

The necessary dimensions, tolerances and annotations included in the 3D model

CONTINUOUS VS. CONTIGUOUS:

Continuous

As edits are made to a design, the new values keep flowing.

Contiguous

An object inherits changes from an interconnected web of product and process relationships.

PRODUCT AND MANUFACTURING INFORMATION (PMI) AND SEMANTIC PMI:

The dimensions, tolerances and annotations -- from the model to the areas needed.

Semantic PMI enables data to be interpreted and enacted by machine intelligence.

Additional Terminology

- **The Trinity | Model + Control Plan + Process Plan**
- **SCM (single component model)… It's all about the features!**
- **MCM (multi-component-model)… It's all about the parts & context**
- **Model Context – tools, fixtures, next higher assembly**
- **Intelligent Model Views… What did U want to know?**

Financial Waste in Complex Discrete Manufacturing

3-5% REVENUE

Each of the following plays a role in financial waste

- Bills of materials processes – moving from engineering to manufacturing to operations to supplier bill of materials
- Work instruction graphics (initial and sustained)
- Cycle-time for data preparation and engineering change order processing is 10X what happens in a model-linked environment
- Engineering change + shopfloor redlines
- Error-prone manual processes
- Inability to support the digital twin or cyber asset
- Disconnection from data collections to control plan

Aerospace & Defense | Electronics | Industrial Equipment | Medical Devices | Nuclear | Shipbuilding | Space

Where are the dollars are going? (example)

Elements	Baseline	Consumed each year by a lack of Digital Continuity
Annual Revenue	**1.2 Billion**	36 Million (3%)
Engineering Change Costs	**24 Million**	6 Million
Cost of Managing MBOMs	**4 Million**	2 Million
Cost of Managing Visuals	**6 Million**	5 Million
Cost of Updating Control Plans	**4 Million**	2 Million
Cost of Poor Quality	**105 Million**	21 Million


Design
Sustainment

The Characteristic ID Journey

1. **Each solid model houses multiple Characteristics / Feature IDs.**
2. **Each Feature fully describes tolerances, datums, callouts.**
3. **Once a part is published by PLM the control plan is linked to the model and housed in the inspection definition tables.**
6. **The Feature ID is copied to each data collection item.**
7. **Discrepancies and SPC inherit the Feature ID.**
8. **A 3D process capability analysis data warehouse leverages the Feature IDs to create measles chart and other analysis documents.**

What is the Key to the Digital Thread Link?
The CAD ID and Feature IDs!

THE
OCCURRENCE ID!

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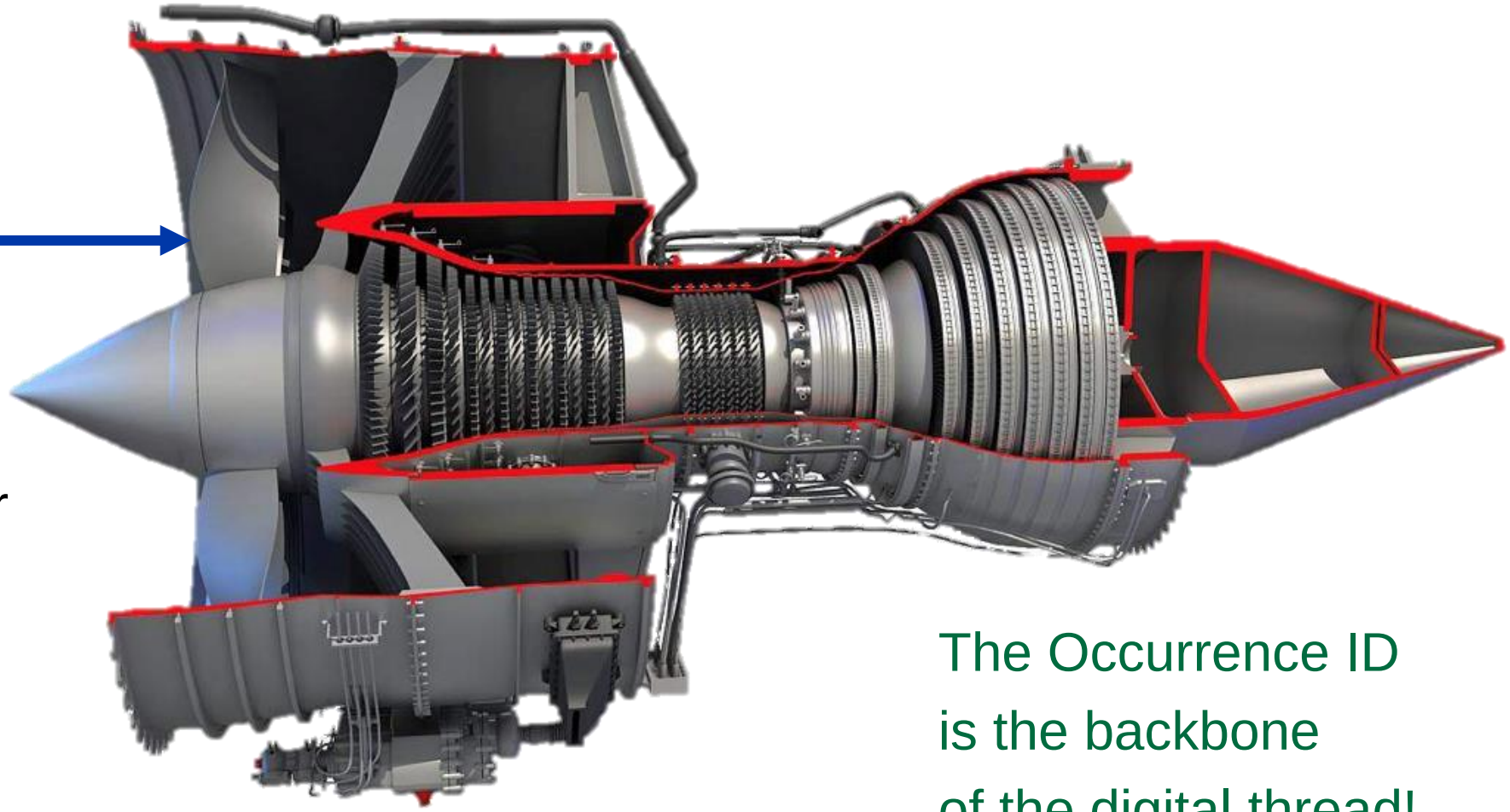


We fetch and store it for every single item listed in a Bill of Material.

The Occurrence ID is the backbone of the digital thread!

The CAD ID Journey

1. **Each MBOM (or EBOM) will carry a unique ID for each entity.**
2. **The entity (part / tool / fixture) is authored into a step. It carries the CAD ID with it into the grid.**
3. **The work order inherits the CAD ID for each entity in each step (quantities >1 have separate entities for each quantity of 1).**
6. **The as-built maintains the CAD ID reference for each installed or removed entity.**
7. **New related objects (discrepancies, holds) inherit the CAD ID.**
8. **The operations excellence data warehouse is created around these CAD IDs for 3D visualizations of PLE events.**

Each Part/Program has different needs when it comes to continuity

Single Part Manufacturing and Sustainment

- CAD ID is less important if the part does not become part of a Modeled assembly
- The Characteristic IDs are MOST important
  - Dimensional
  - Visual
  - Master/Subordinate relationships
  - Include/Exclude in Control Plans
- Sampling Rates
- Tool Requirements
- Each part has multiple transformation/Value Added **STAGES**

Assembly Integration and Sustainment (Single Unit)

- CAD ID is most important
- The Characteristic IDs linked to Integration are secondary
- Integration Progression needs to be linked to TEST STAGES
- Tool and Jig Requirements are Critical
- Program Success is less about repeatability and more about Contractual Requirements

Assembly Integration and Sustainment (Multi-Unit)

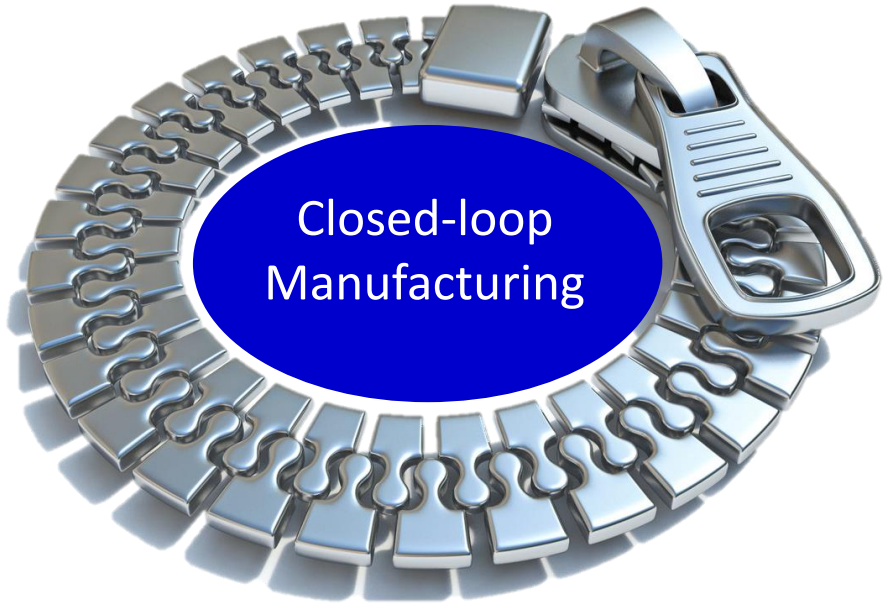
- CAD ID must be CONSISTENT from Unit to Unit
- The Characteristic IDs are linked to each CAD ID for multi-Unit Analysis and Predictive Analysis
  - Cycle Times
  - Defect Rates
  - Vendor Performance
  - Efficiency
  - Throughput
- Sustainment As-Inspected Data becomes Critical to entire Value-Stream

Three Key Elements of Model-based Definition

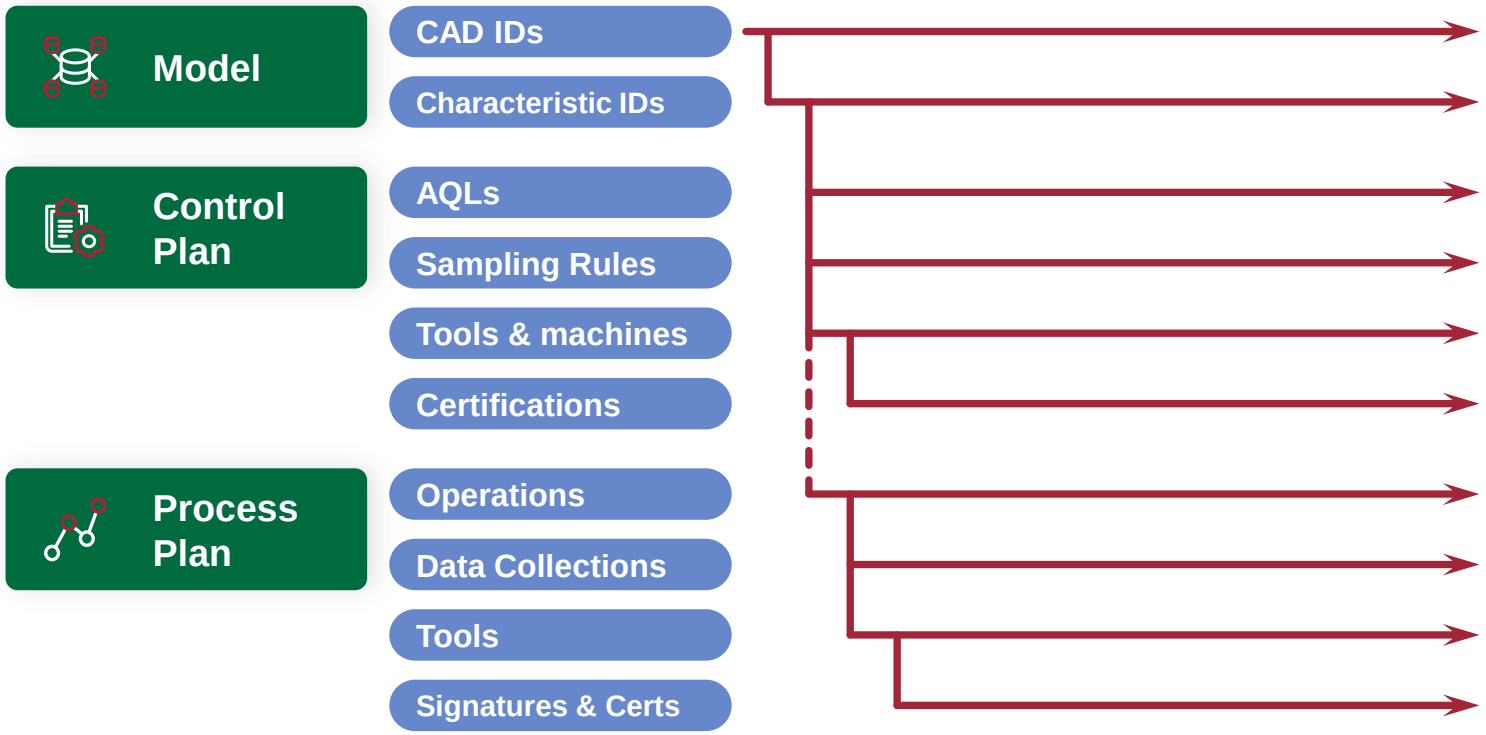
Product Model

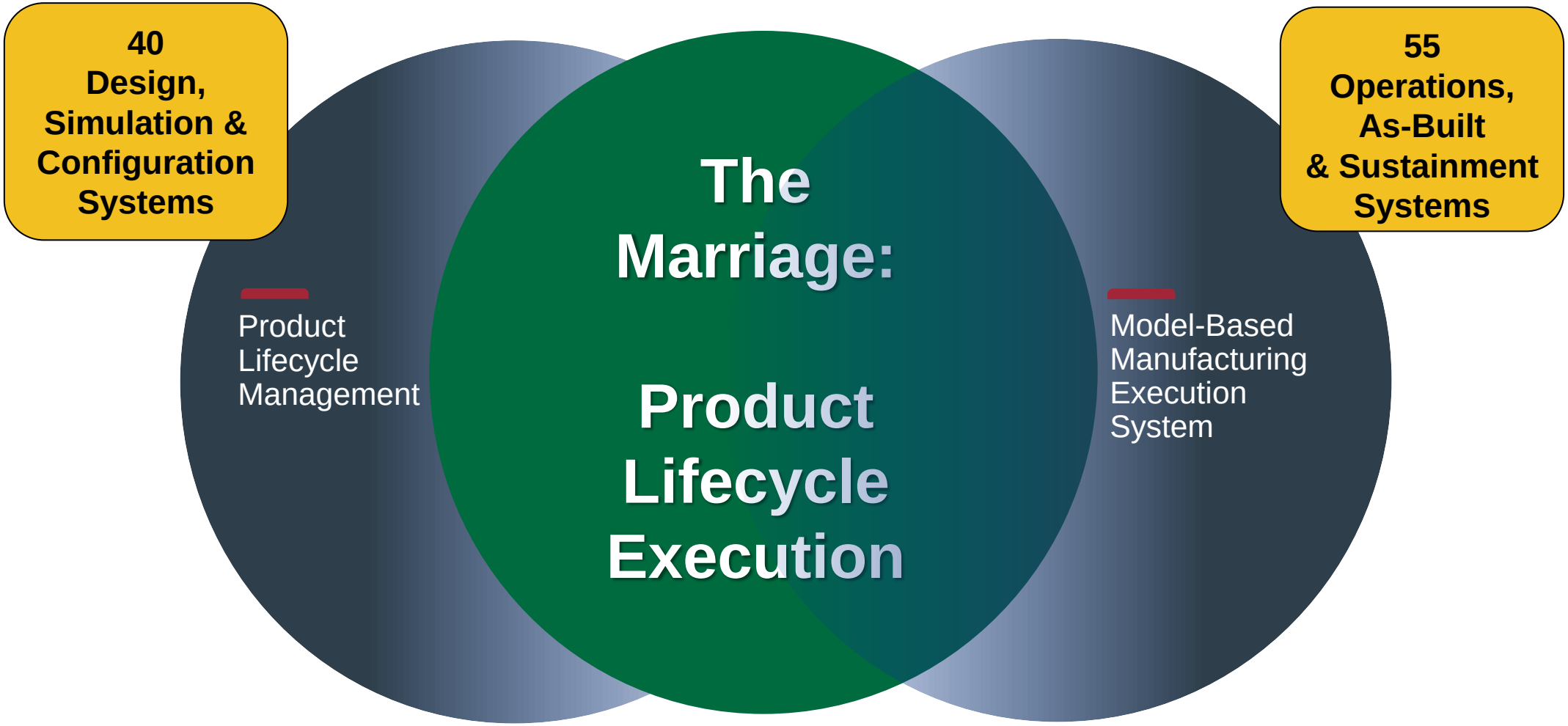
Control Plan

Process Definition



3 Continuous Elements, in Continuous Alignment

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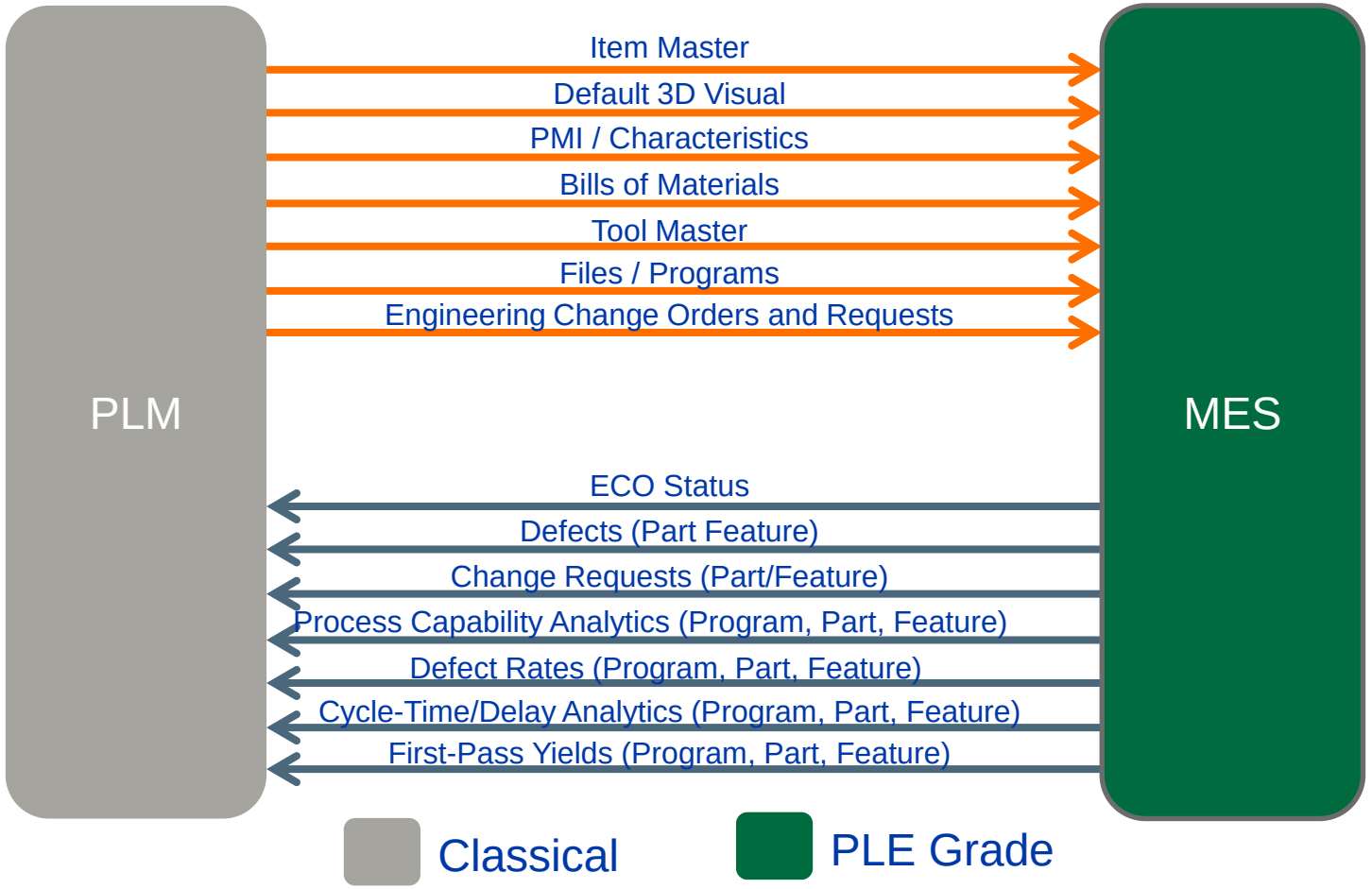
Design,
Simulation &
Configuration
Systems
Product
Lifecycle
Management
The
Marriage:
Product
Lifecycle
Execution
Model-Based
Manufacturing
Execution
System
55
Operations,
As-Built
& Sustainment
Systems

PLM to MES Micro-Services Integration to Achieve PLE Functions



Suggested Actions

01

Identify all programs with remaining life

02

Evaluate & grade each program for it's MBE potential

03

Pick your target programs (examples)

- F program raised to a C
- C program raised to an A

04

Calculate ROI for each program

05

Present approach to your leaders:

- Program Management
- Engineering
- Operations
- Sustainment
- Quality

06

Build your team and go!

Make mistakes!

Three – Three - Three

There are Three threes to Remember:

1. Three Percent of Revenue is at stake. MBE will redirect this money to EBIT-DA

2. There are Three key components to Master that will act as the FOUNDATION of your Digital Platform (Model, Control Plan, Process Plan)

3. There are Three Distinct types and an Evolution to MBE Deployment that needs to be mastered in order:

    1. Single Component Manufacturing and Sustainment

    2. Multi-Component (Assembly) Integration and Sustainment – Single Unit

    3. Multi-Component (Assembly) Integration and Sustainment – Multiple Units

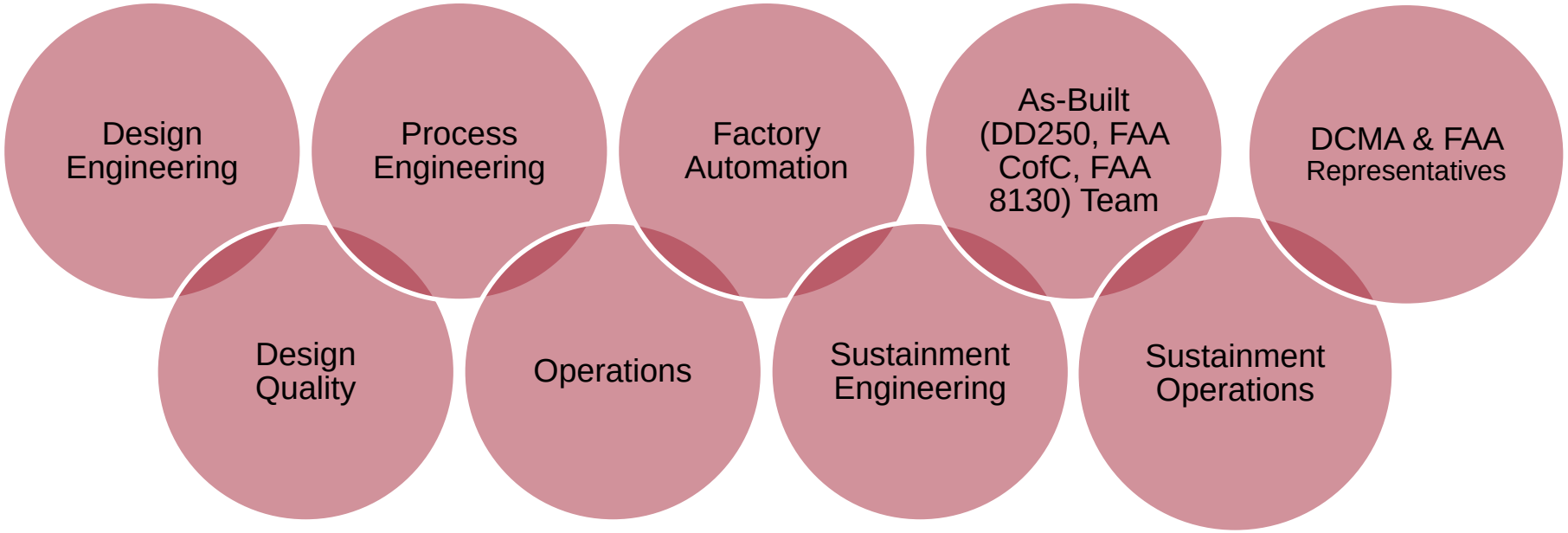
CAUTIONS and WARNINGS

iBase-t is deeply engaged in MULTIPLE MBDMI/MBE initiatives with the World's Leading A&D Companies.

Here is what we have learned so far…

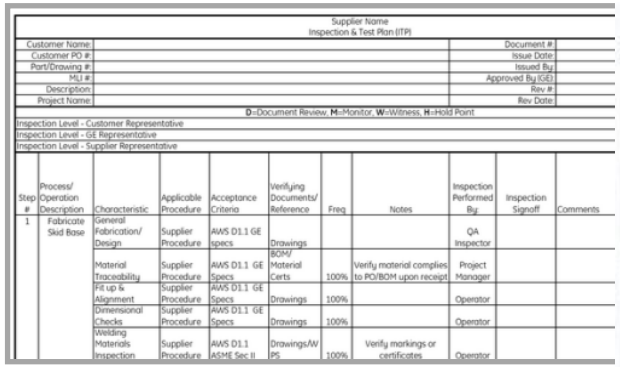
Model-based Design and Manufacturing Information is NOT a Design Engineering Project! It's an Enterprise Project!

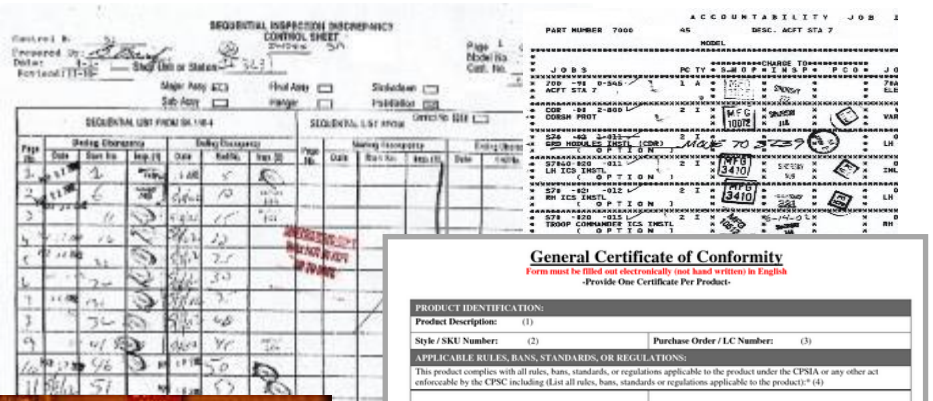
a) Gather a multi-disciplinary team representing all value-adding parts of the business

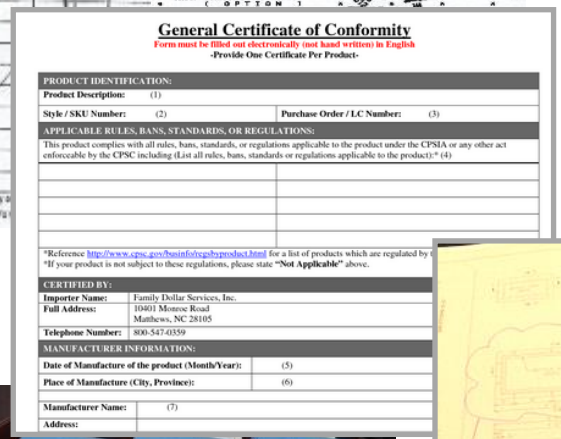


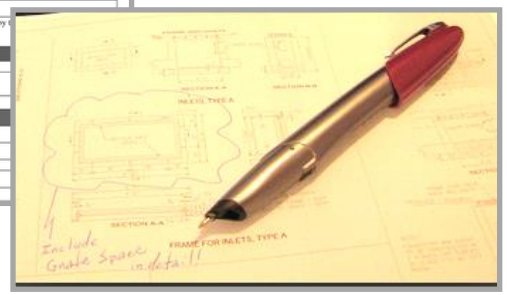
Looks at ALL of Today's Deliverables for EACH phase of the Value add, however primitive.

- Carefully Analyze ALL of your artifacts and determine what data needs to start in the model and which is RELATIONAL to the CAD ID and Characteristic IDs
- Layout your Data Diagram across the Cycle from Design to Unit Retirement
- Choose your Data Owners and repositories. **This will not all be storable in your PLMs**










The secret to getting ahead is getting started.
~ Mark Twain

Keep Exploring

- **Contact the iBase-t team to continue the conversation**
- **Download the iBase-t Report:**
  The Model-Based Enterprise: The Crucial Role Manufacturing Plays in Executing Model-based Design
- **Register for iBase-t's four-part webinar series**
- **Follow iBase-t on LinkedIn**