Driving MBE Success Without Redesign: A Playbook for Legacy Programs

Optimizing MBE returns and eliminating waste in a heterogeneous mix of newer and older 3D CAD-supported programs

(MBE Maturity Levels 0 to 5)

Michel P. Gadbois, iBase-t

GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT 2025

BOEING ELYSIUM LOCKHEED MARTIN NORTHROP GRUMMAN Parker PDES, Inc.® Connecting the Digital Enterprise

Model-Based Enterprise
ON-DEMAND WEBINAR SERIES

1. Fundamentals of a Model-based Enterprise and Your Product Lifecycle
2. Continuity from Engineering to Shopfloor and Back ~ presented with Razorleaf
3. Operationalize 3D Modeling in Production Today
4. MBE in Action: Complex Discrete Manufacturing Expert Panel

https://www.ibaset.com/resource/model-based-enterprise-webinars/

Presenters Bio

Michel Gadbois

**Senior Vice President
& Chief Enterprise Architect**

iBase-t
Aerospace & Defense Experts

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.

Defining the Model-Based Enterprise (MBE)

- A strategy whereby the model-based definition of a product serves as the authoritative information source for all activities throughout the product lifecycle.
- You can achieve the model-based enterprise by harnessing and propagating data elements which are created upstream and reused downstream to manufacturing and throughout the product lifecycle.

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.

THESE VARY GREATLY BASED ON PROGRAM DESIGN DATE

MBE MATURITY LEVELS

There are numerous approaches to grading a program's MBE Maturity. The most utilized and referenced in US Defense is the National Security Enterprise (NSE) Maturity Index.

THE CATEGORIES USED TODAY WERE INSPIRED BY NSE BUT DEVIATE IN AREAS

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 MBE OBJECTS | Model + BOM + 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… Shop Views that auto-update with as-built

CXO View of MBE Importance

Global Product Data Interoperability Summit | **2025**

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)

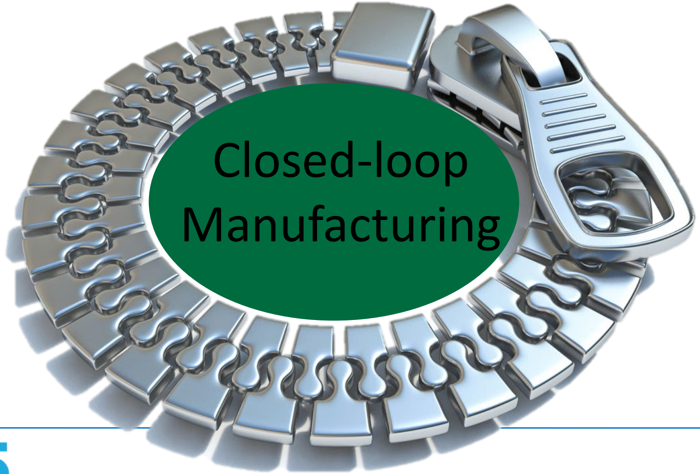
Elements	Baseline $	Consumed each year by a lack of Digital Continuity $
Annual Revenue	1.2 Billion	36 Million (3%)
Engineering Change Costs	24 Million	**6 Million**
Cost of Managing MBOMs	4 Million	2 Million
Cost of Managing Visuals	6 Million	**5 Million**
Cost of Updating Control Plans	4 Million	2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

Three Key Elements of Model-based Definition

Product Model & BOM

Control Plan

Process Definition



4 Continuous Elements, in Continuous Alignment

Model/BOM
- CAD IDs
- Characteristic IDs

Control Plan
- AQLs
- Sampling Rules
- Tools
- Certifications

Process Plan
- Operations
- Data Collections
- Tools
- Signatures & Certs

Now that we know where all the Value and ROI is sitting, why are so few Companies Leveraging the Model-Based-Enterprise?

Some Stats from the Tier 1 A&D Companies:

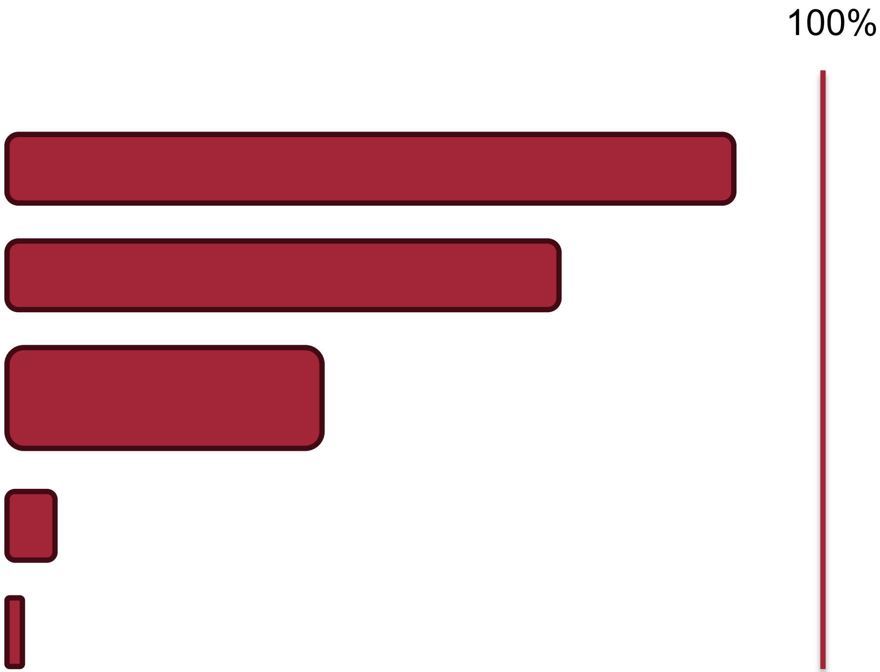
Engaged in Some Digital Transformation

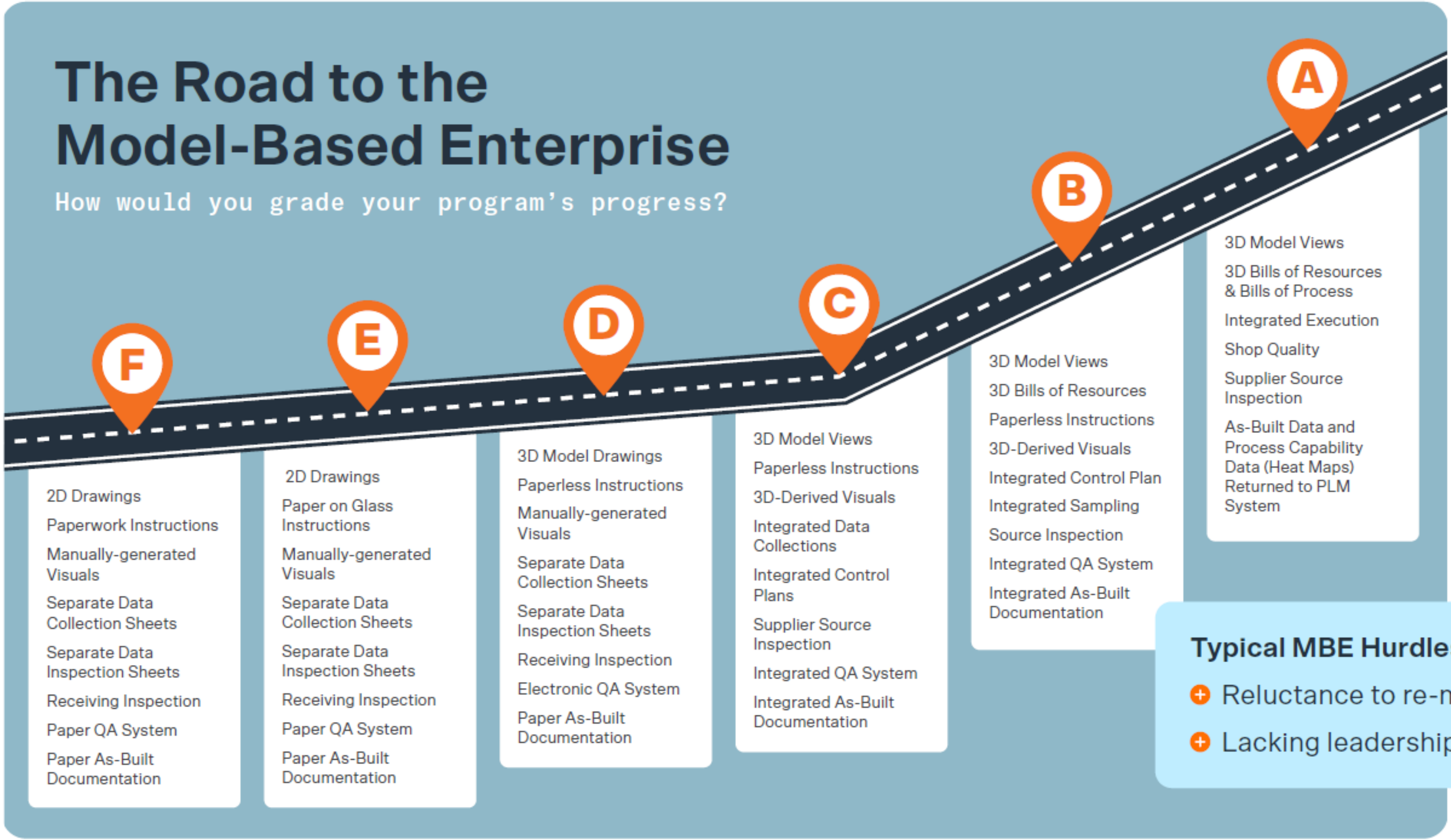
Committed to Model Based Definitions

Have at least ONE DoD contract with some Digital Twin or Cyber-Asset Requirements

Delivering MBE Compliant Models

Full MBE Execution on ONE Program





Typical MBE Hurdles

- Reluctance to re-model
- Lacking leadership commitment

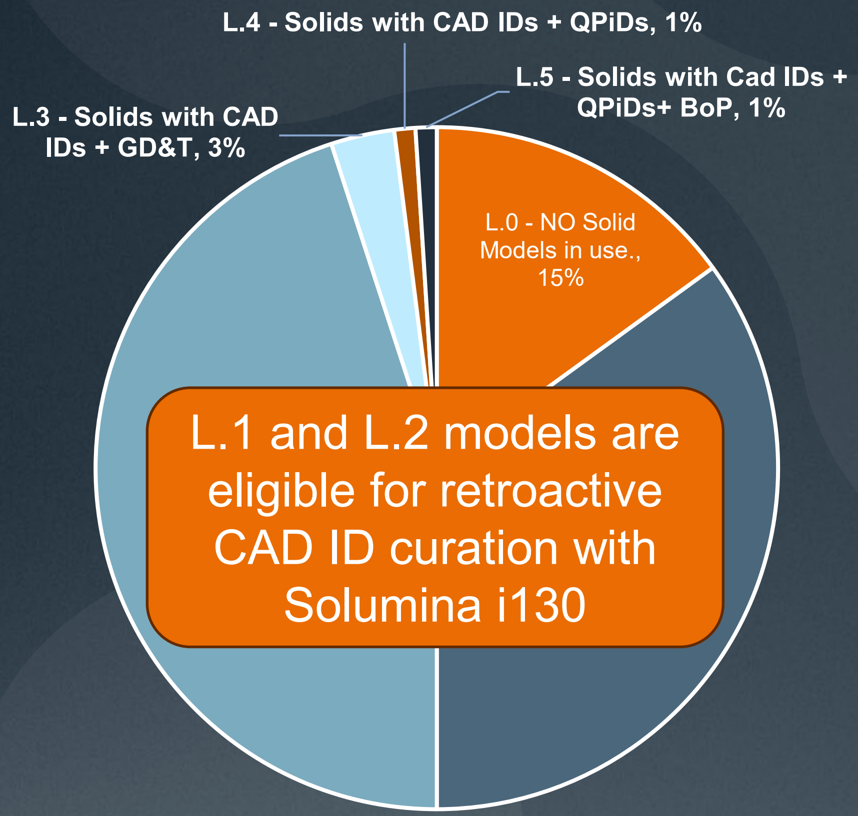
What process improvements will you achieve when you adopt an MBE approach?

iBase-t

MBE Stage One	MBE Stage Two	MBE Stage Three	MBE Stage Four	MBE Stage Five
Manufacturing visuals can be auto-generated and updated	BOM changes are easy to reconcile & publish	Engineering changes are manageable & traceable to shop-floor and supply chain actions	Quality Engineers can receive current and traceable process capability data	80% of commissioning decisions and enhancements can be completed in the Digital World

Where are my current programs related to MBE readiness?

L.0 - NO Solid Models in use.	**15%**
L.1 - Baseline Solids (No PMI)	**35%**
L.2 - Solids with GD&T for Dims	**45%**
L.3 - Solids with CAD Ids & GD&T	**3%**
L.4 - Solids with CAD Ids & Semantic PMI	**1%**
L.5 - Solids with Cad Ids & Semantic PMI + BoP	**1%**



L.1 and L.2 models are eligible for retroactive CAD ID curation with Solumina i130

MBE Maturity Level by Applicable Active Program(s)

	Dist	Data Sources						3 to 5% of Revenue
Maturity Level:		Engineering Definition Format	Characteristics Format	Quality Notes Format	PO Notes Format	FAI PAM Format	Process Definition Format	Potential Program Return
L.0 - NO Solid Models in use.	15%	2D Drawings	Manually created and reconciled	Found on Drawings	Unrelated to Drawings	Manual FAI Elements	Stand Alone Process Definition	0% of Waste Eligible for removal
L.1 - Baseline Solids (No PMI)	35%	2D Drawings	Manually created and reconciled	Found on Drawings	Unrelated to Drawings	Manual FAI Elements	Stand Alone Process Definition	30% of Waste Eligible for removal
L.2 - Solids with GD&T for Dims	45%	2D Drawings	Digital list of Dimensional Chars.	Found on Drawings	Unrelated to Drawings	Partial Digital FAI Elements	Stand Alone Process Definition	40% of Waste Eligible for removal
L.3 - Solids with CAD Ids & GD&T	3%	2D Drawings	Digital list of Dimensional Chars.	Found on Drawings	Unrelated to Drawings	Partial Digital FAI Elements	Hybrid Process Definition	70% of Waste Eligible for removal
L.4 - Solids with CAD Ids & Semantic PMI	1%	Rev'ed 3D Models	Digital QPiDs	Embedded in Model Def.	PO Notes linkable to QPiDs & Process Codes	Fully Digital FAI Elements	Hybrid Process Definition	80% of Waste Eligible for removal
L.5 - Solids with Cad Ids & Semantic PMI + BoP	1%	Rev'ed 3D Models	Digital QPiDs	Embedded in Model Def.	PO Notes linkable to QPiDs & Process Codes	Fully Digital FAI Elements	BoP linked to CAD IDs & Qpids	100% of Waste Eligible for removal

MBE Transformation Drivers and return Level by Applicable Active Program(s)

	Dist	Maturity Level						Percent of Savings
Digital Thread enabled Automation:		L-0 No Solids	L-1 Baseline Solids	L-2 Solids w/ GD&T	L-3 Solids w/ CAD ID	L-4 Solids + PMI	L-5 Solids+PMI+BoP	Potential Program Return
Auto-Generation of Work Instruction 3D Graphics	85%	No Automation						**15%**
Auto Generation of 3D As-Built for Work Orders	85%	No Automation						**5%**
Model-Centric Parts Requests	85%	No Automation						**3%**
Model-Centric Defect Creation and Visibility	85%	No Automation						**3%**
Automated BOM Updates on Process Plans	5%	No Automation						**12%**
Automated BOM Updates on Work Orders	5%	No Automation						**15%**
Auto-Ingestion & Creation of Control plans	2%	No Automation						**15%**
Automated Control Plan Updates on Process Plans	2%	No Automation						**12%**
Automated Control Plan Updates on Work Orders	2%	No Automation						**10%**
Model-Centric Data Collections	2%	No Automation						**10%**
Total recovered Waste:		**0%**	**23%**	**26%**	**53%**	**90%**	**100%**	

Key Takeaways

Unlock 25% MBE Benefits Across 85% of Programs

Even partial MBE integration delivers measurable returns across most active programs.

CAD ID Integration Extends Value to Legacy Models

Solumina’s curated CAD IDs bring MBE returns—up to 80% program coverage—without redesigning parts.

Semantic PMI Unlocks 37% More Gains

Dimensional and non-dimensional PMI delivers transformative automation, but requires re-CAD discipline, often applied to new programs.

Virtual Process Simulation Delivers the Final 10%

Digital factory commissioning cuts NPI cycle time and drives savings beyond traditional waste metrics.

Want More?

Contact the iBase-t team to continue the conversation

Visit the Expertise>Resources section of iBase-t.com

Subscribe to our Blog

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.

THESE VARY GREATLY BASED ON PROGRAM DESIGN DATE

MBE MATURITY LEVELS

There are numerous approaches to grading a program's MBE Maturity. The most utilized and referenced in US Defense is the National Security Enterprise (NSE) Maturity Index.

THE CATEGORIES USED TODAY WERE INSPIRED BY NSE BUT DEVIATE IN AREAS

PRODUCT AND MANUFACTURING INFORMATION (PMI) AND SEMANTIC PMI:

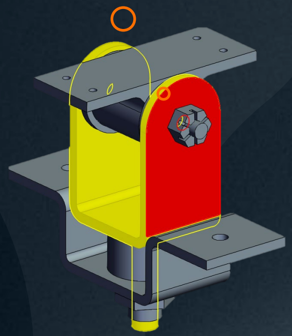
The dimensions, tolerances and annotations -- from the model to the areas needed.

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

The Digital Thread Critical-Data-Trace - The Feature ID

Action	Item Master Create	EBOM Create	EBOM Components added	MBOM Create	MBOM Components	EBOM Edit	MBOM Edit	Bill of Process Create	Bill of Process Edit
Item Key Created	YES								
Item Key Used		YES	YES						

PMI Data
Keyed Here



PMI Data
Maintained Here

The Feature 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.
4. The Feature ID is copied to each data collection item.
5. Discrepancies and SPC inherit the Feature ID.
6. 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!

iBase-t

THE OCCURRENCE ID!

de7a8e65-ff17-447a-8b33-7a27e4f37bac

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 Digital Thread Critical Data Trace
The CAD ID

Action	Item Master Create	EBOM Create	EBOM Components added	MBOM Create	MBOM Components	EBOM Edit	MBOM Edit	Bill of Process Create	Bill of Process Edit
Occurrence Number (ID) Created			YES						
Occurrence Number Used				YES	YES	YES	YES	YES	YES

BOMs
Routings
Defects
As-Built
ALL Keyed Here

The CAD ID Journey

iBaseт

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).
4. The as-built maintains the CAD ID reference for each installed or removed entity.
5. New related objects (discrepancies, holds) inherit the CAD ID.
6. The operations excellence data warehouse is created around these CAD IDs for 3D visualizations of PLE events.