



# DIGITAL THREAD AND BOM MANAGEMENT AT GE AVIATION'S DIGITAL SOLUTIONS

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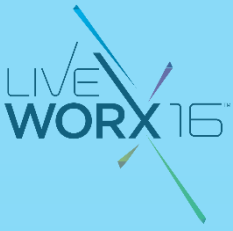
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# AGENDA

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- Overview of GE Aviation
- Mechanical CAD (MCAD) Storage and BOM Management
- Engineering Bill of Material (eBOM) and Manufacturing Bill of Material (mBOM) Management
- Future Vision

# GE AVIATION LOCATIONS



## North America

### Canada

Bromont, Quebec

### Mexico

Saltillo

Querétaro (GEIQ: GE Infrastructure Querétaro)

### U.S.A.

Clyde, NY (AAT)  
ACSC, OH  
Asheville, NC  
Auburn, AL  
Austin, TX  
Baltimore, MD  
Batesville, MS  
Butte, MT (Montana Precision Products)  
Cincinnati, OH  
Charleston, SC (Venture Aero)  
Clearwater, FL  
Dayton, OH  
Durham, NC  
Ellisville, MS  
Englewood Cliffs, NJ  
Erlanger, KY  
Evendale, OH  
Grand Rapids, MI  
Grand Prairie, TX  
Greenville, SC  
Hooksett, NH  
Irving, TX  
Jacksonville, FL  
Lafayette, IN  
Long Island, NY

Lynn, MA  
Macon, GA  
Madisonville, KY  
McAllen, TX  
Miramar, FL (PTI)  
Muskegon, MI  
Newark, DE (CCP)  
Norwich, NY  
Peebles, OH  
Pompano Beach, FL  
Rockford, IL  
Rutland, VT  
San Marcos, TX (CFAN)  
Santa Ana, CA  
Sterling, VA  
Strother, KS  
TDI, Dayton  
Terre Haute, IN  
West Jefferson, NC  
Wilmington, NC  
Vandalia, OH  
Victorville, CA

## South America

### Brazil

Petropolis

## Europe/ME

### France

Saint-Nazaire (FAMAT: Fabrications Mécaniques de l'Atlantique)  
Toulouse

### Czech Republic

Praha

### Germany

Regensburg

### Hungary

Veresegyhaz

### Italy

Rivalta di Torino  
Naples  
Brindisi

### Netherlands

Woensdrecht  
Eindhoven

### On-Wing Support<sup>SM</sup>

London (LHR)  
Warsaw, Poland (WAW)

### Poland

Bielsko Biala  
Dzierzoniow (UEC)  
Warsaw

### Qatar

Doha

### Romania

Bucharest (UEC)

### Turkey

Eskisehir (TEI: Tusas Engine Industries)  
Gebze (GEMTC: GE Marmara Technology Center)

### United Kingdom

Cardiff, Wales  
Cheltenham  
Eastleigh  
Gloucester  
Hamble  
Newmarket  
Prestwick, Scotland

## Asia

### Australia

Brisbane

### China

Shanghai  
Suzhou

### India

Bangalore

### Japan

Chiba

### Malaysia

Kuala Lumpur  
Kuala Lumpur (GEMTC)

### On-Wing Support<sup>SM</sup>

Seoul, Korea (ICN)

### Singapore

GEASO

# GE AVIATION PORTFOLIO...21% OF THE GE COMPANY



Commercial engines  
**32%**



Commercial engine services  
**41%**



Military engines and services  
**15%**



BGA and Integrated Systems  
**6%**



- ✓ General aviation engines
- ✓ Power, mechanical, electronics

Avionics and Digital Solutions  
**3%**



- ✓ Avionics
- ✓ Digital Services

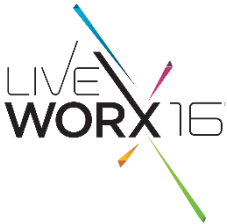
Avio Aero  
A GE Aviation Business  
**3%**



- ✓ Power Transmissions
- ✓ Turbo machinery

A leading provider of jet engines, systems and services

# GE AVIATION'S DIGITAL SOLUTIONS CORE PRODUCTS



## Avionics



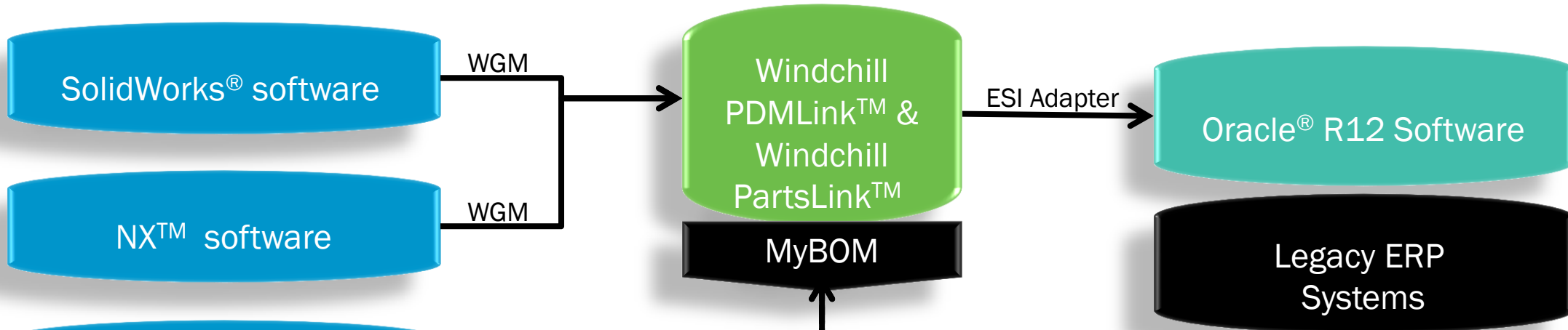
## Power



## Digital/Analytics



# GE AVIATION'S DIGITAL SOLUTIONS TOOL LANDSCAPE



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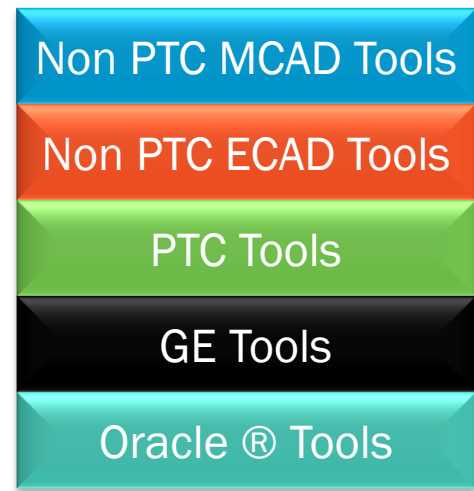
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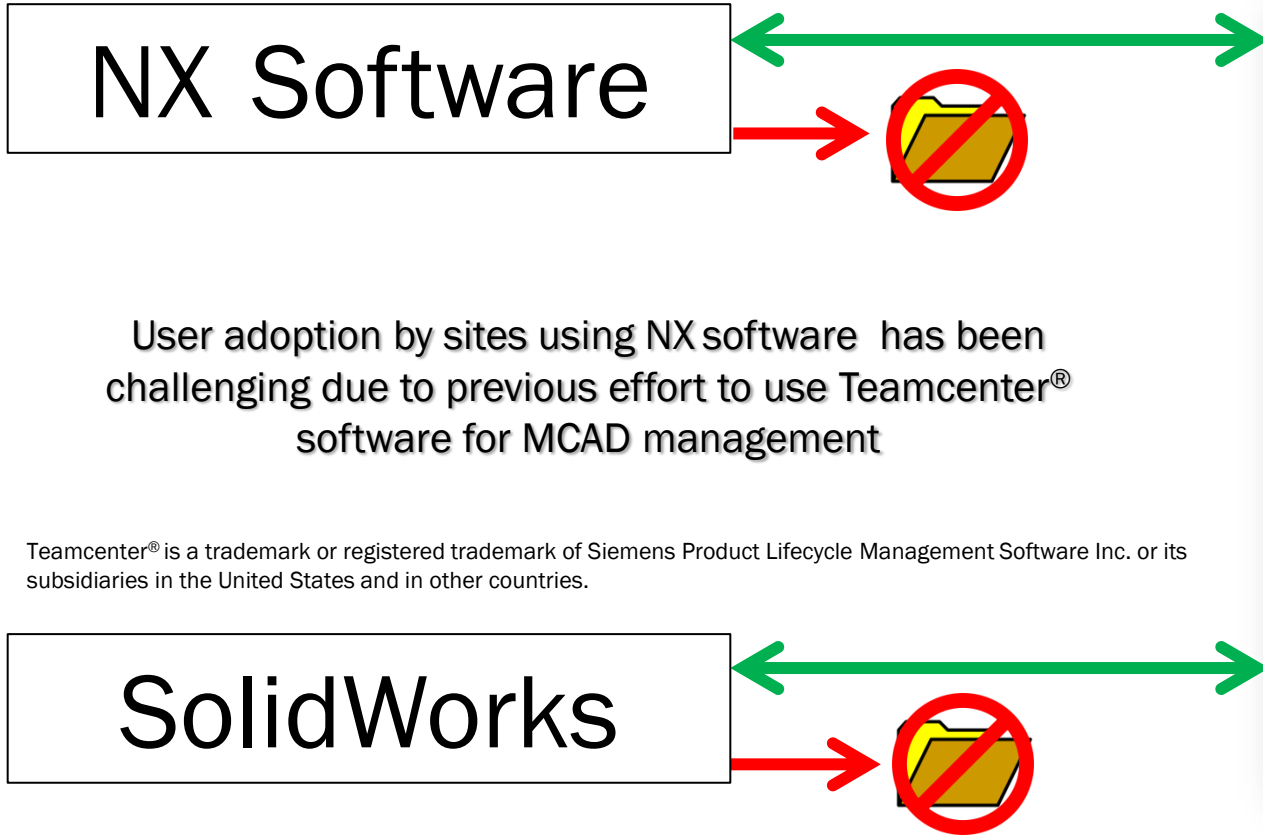


# MCAD STORAGE AND BOM MANAGEMENT

# MCAD STORAGE AND BOM MANAGEMENT

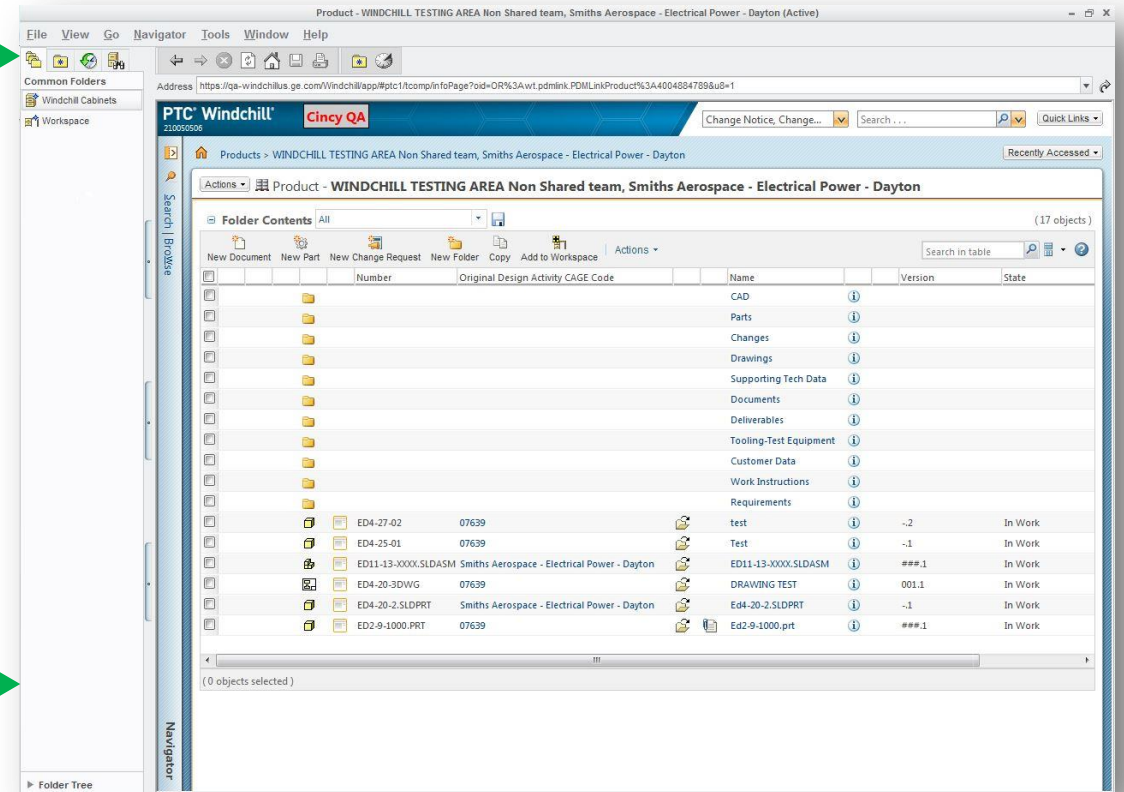


Successfully migrated MCAD data for 2 sites from shared network drives to WGM



User adoption by sites using NX software has been challenging due to previous effort to use Teamcenter® software for MCAD management

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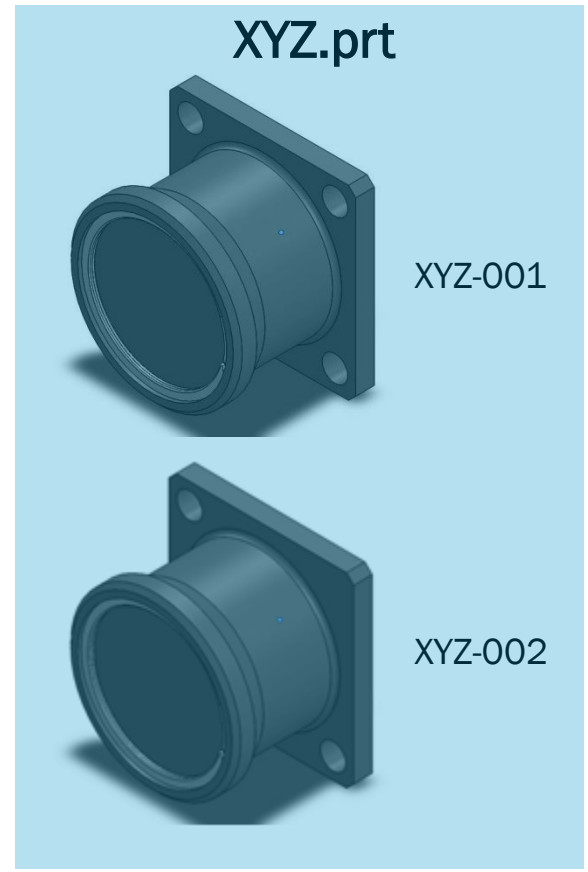
# MCAD STORAGE AND BOM MANAGEMENT MIGRATION ISSUES



## Outdated CAD Models



## Models with multiple reference sets to create different CAD parts



## Missing CAD attributes in the models.

Model without Attributes

	Property Name	Value / Text Expression
1	<Type a new property >	

Model with Attributes

	Property Name	Value / Text Expression
1	Description	REGULATOR ASSEMBLY, REFERENCE
2	Material	SEE DETAILS
3	Weight	"SW-Mass@RYLB-1954-1.SLDASM"
4	Finish	-
5	Hardness	-
6	PartNo	\$PRP:"SW-File Name"
7	CDA	05624

# MCAD STORAGE AND BOM MANAGEMENT



Assembly - RYLB-1954-1.SLDASM, 05624, 002.1 CAD Structure

Structure Content Related Objects Changes History Traceability Relationship Explorer

Viewing New/Add To Filter Tools

Show/Hide Display Add to New Edit Filter Saved Filters Compare to Part Structure Open in

Find in Structure

File Name	Number	Version
RYLB-1954-1.SLDASM	RYLB-1954-1.SLDASM	002.1
AL6-19.SLDPRT	AL6-19.SLDPRT	-2
AW1-132.SLDPRT	AW1-132.SLDPRT	001.3
AS3472-100.SLDPRT	AS3472-100.SLDPRT	ZZ.2
RYLB-1957-1.SLDPRT	RYLB-1957-1.SLDPRT	002.2
RYLB-1959-1.SLDPRT	RYLB-1959-1.SLDPRT	001.2
MS9386-019.SLDPRT	MS9386-019.SLDPRT	ZZ.3
ALS-155.SLDPRT	ALS-155.SLDPRT	002.2
AP4-161.SLDPRT	AP4-161.SLDPRT	003.2
RYLB-1980-1.SLDPRT	RYLB-1980-1.SLDPRT	001.2
AW1-128.SLDPRT	AW1-128.SLDPRT	001.3
RYLB-2111.SLDASM	RYLB-2111.SLDASM	001.1
ALS-154.SLDPRT	ALS-154.SLDPRT	001.2

Link models and Wtparts via eBOM association

Custom Part - RYLB-1954-1, REGULATOR ASSEMBLY, REFERENCE, 05624, 002.2 Windchill Structure

Editing Check Out/In Clipboard Viewing New/Add To Filter

Insert Existing Remove Check Out Revise My Checkouts Paste Copy Show/Hide Display New Add to Edit Filter Saved Filters

Find in Structure

Name	Number	Attributes	Visualization	Uses	Occurrences	Supersedes	Classification
REGULATOR ASSEMBLY, REFE	RYLB-1954-1						
PISTON SEAL	ALS-154						
CAP, REGULATOR	RYLB-1959-1						
PISTON, REGULATOR	RYLB-1957-1						
SHIM	AW1-128						
ORIFICE	RYLB-2111						
PISTON SEAL	ALS-155						
GREASE, AIRCRAFT AND II	AL6-19						
RETAINING RING, INTERN	AS3472-100						
SPRING, COMPRESSION	AP4-161						
PACKING, PREFORMED - #	MS9386-019						
HOUSING, REGULATOR	RYLB-1980-1						
SHIM	AW1-132						

Items not MCAD modeled and Electronic CAD (ECAD) items added via MyBOM Tool

Assembly #	Downloaded Version	Assembly CAGE Code	Iteration	MyBOM Structure				
Company Part #	Part Name	Part CAGE Code	Line Item	Quantity	Unit of Measure	Find Number	Reference Designator	Substitute Parts
RYLB-1954-1	002.2	05624						
AW1-132	SHIM	05624		1.0	as needed			
RYLB-2111	ORIFICE	05624		1.0	each			
AL6-19	GREASE, AIRCRAFT AND II	05624		1.0	each			
AW1-128	SHIM	05624		1.0	as needed			
ALS-154	PISTON SEAL	05624		1.0	each			
AS3472-100	RETAINING RING, INTERN	05624		1.0	each			
RYLB-1959-1	CAP, REGULATOR	05624		1.0	each			
RYLB-1957-1	PISTON, REGULATOR	05624		1.0	each			
ALS-155	PISTON SEAL	05624		1.0	each			
AP4-161	SPRING, COMPRESSION	05624		1.0	each			
MS9386-019	PACKING, PREFORMED - A	05624		1.0	each			
RYLB-1980-1	HOUSING, REGULATOR	05624		1.0	each			

# ENGINEERING BILL OF MATERIAL (EBOM) AND MANUFACTURING BILL OF MATERIAL (MBOM) MANAGEMENT

# ENGINEERING BILL OF MATERIAL (EBOM) MANAGEMENT



## Why create our own tool?

- The Out of the Box BOM loader is not user intuitive
- Needed for migration of new sites into PDMLink

## Overview

- Excel based tool that uses the Windchill API
- InfoEngine tasks pull additional info via VBA Macro

Assembly #	Downloaded Version	Assembly CAGE Code	Iteration Description	MyBOM Structure View				
END ITEM	A.3	35351						
Company Part #	Part Name	Part CAGE Code	Line Item Comment	Quantity	Unit of Measure	Find Number	Reference Designator	Substitute Parts
DETAIL PART 1	Detail Part	35351		1.0	Gallon (US)	3		
SUB ASSEMBLY 2	Assembly 2	35351		1.0	each	2		
ELECTRICAL COMPONENT	Electrical Component 1	QPD		16.0	each		R1-R15,R19	
DEMO PART 1	DEMO Part 1	35351		1.0	Inches	1		SUB ASSEMBLY 1A; SUB ASSEMBLY 1B

Windchill Structure View

Number	Name	Original De...	Comments	Quantity	Unit	Find Num...	Reference Designator	Collapsible
END ITEM	End Item	35351						No
DEMO PART 1	DEMO Part 1	35351		1	Inches	1		No
SUB ASSEMBLY 1A	Sub Assembly 1A	35351						No
SUB ASSEMBLY 1B	Sub Assembly 1b	35351						No
DETAIL PART 1	Detail Part	35351		1	Gallo...	3		No
ELECTRICAL COMPONENT	Electrical Component 1	QPD		16	each		R1-R15,R19	No
SUB ASSEMBLY 2	Assembly 2	35351		1	each	2		No

# MYBOM DOCUMENT TO PART LINKING



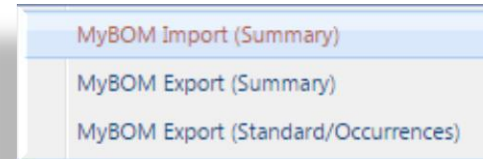
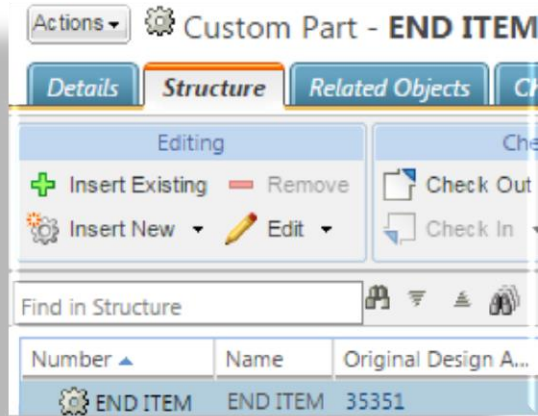
## MyBOM

Assembly #	Downloaded Version	Assembly CAGE Code	Iteration Description	
End Item	A.1	35351	Check-In comment	
Number	Name	Document CAGE	Revision	Link Type
End Item DWG	Installation Drawing	35351	-	Described by
ASME Y14.100-2000	ENGINEERING DWG PRACTICES	QPD	ZZ	Reference

## PTC Windchill

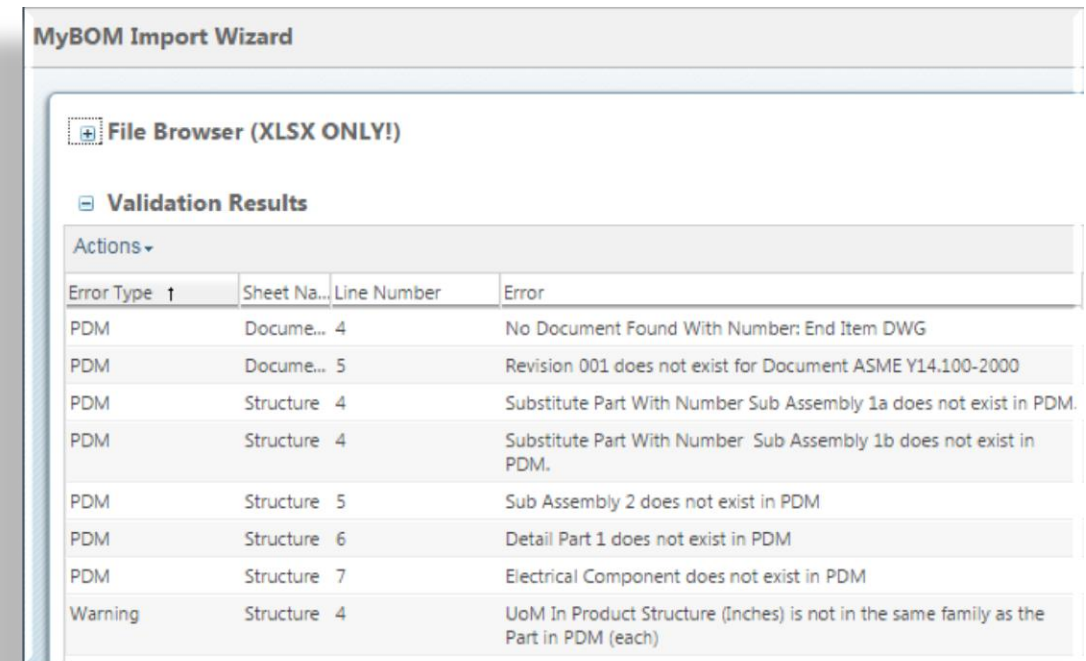
The screenshot shows the PTC Windchill interface for a 'Custom Part - END ITEM, End Item, 35351, A.3'. The 'Related Objects' tab is active, displaying a table of documents. The table has columns for Number, Version, Latest Version, Name, Context, State, and Last Modified. One document is listed: 'END ITEM DWG' with version '-.1', 'Latest Version' status, 'End Item DWG' name, 'Test Product GP' context, 'In Work' state, and a last modified date of '2016-May-10 14:21 ED'. Below this, the 'Secondary Described By Documents' and 'References Documents' sections are visible. The 'References Documents' section shows a document 'ASME Y14.100-2000' with version 'ZZ.2', 'ENGINEERING DWG PRACTICES' name, 'MIL-SPECS-STDS' context, 'Released' state, and a last modified date of '2014-Nov-21 11:19 EST'.

# EBOM IMPORT AND VALIDATION USING MYBOM

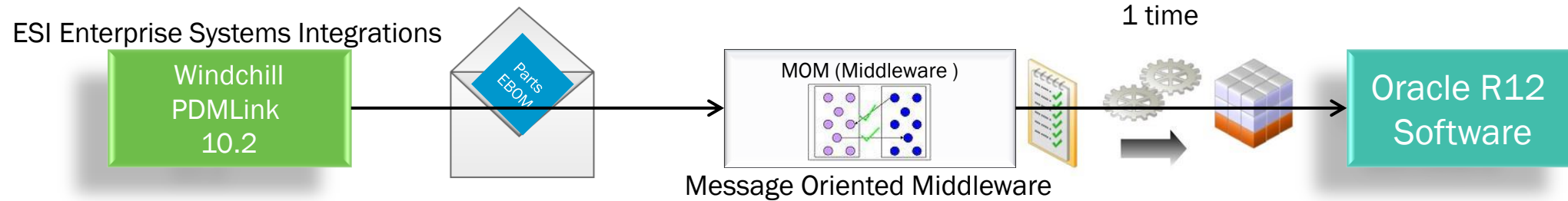


## Take Aways

- InfoEngine tasks are powerful and can aid in rapid prototyping of tools
- Users like to create napkin BOMs in the tool
- The use of error and warning messages is very helpful
- TEST, then TEST, then, TEST. Repeat!



# EBOM TO MBOM TRANSFORMATION



- Customized ESI interface to communicate with Oracle R12 via internal integration tool
- Constraints from ERP integration team forced OOB ESI tool customization
- Updates to MBOM after integration performed in Oracle R12

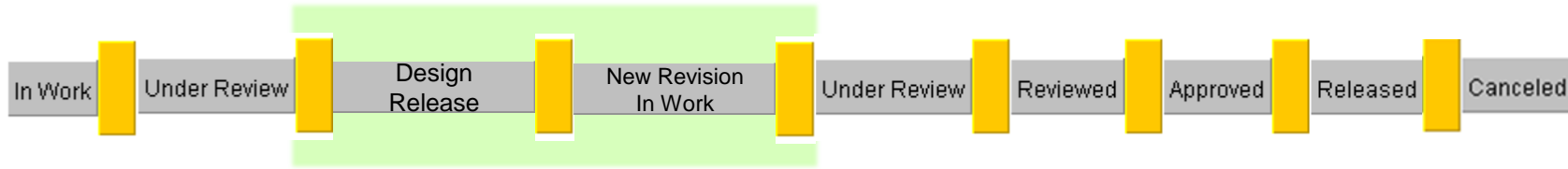
## Take Aways

- Still more manual steps in Oracle than expected after integration
- The integration fails more often than expected (Unit of Measure, item revision)
- Engineers requesting cross-tool reporting mechanism (Part cost and Inventory levels)

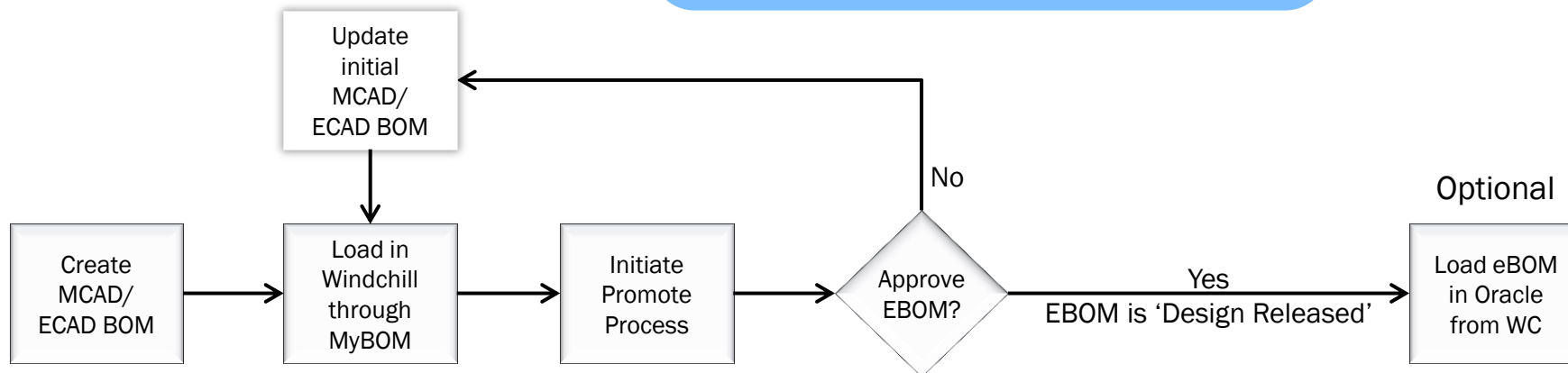
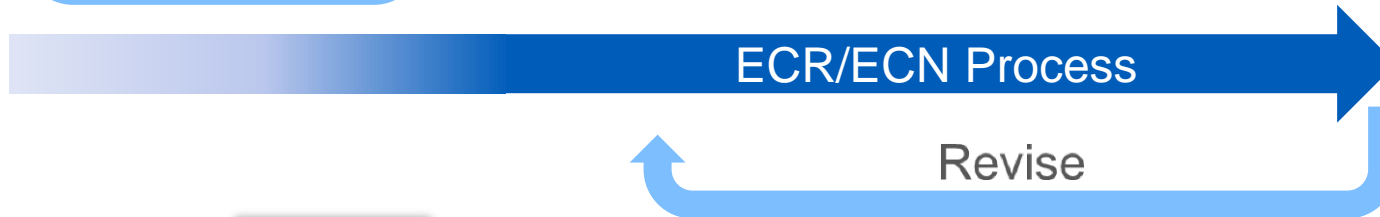
# EARLY PART PROCUREMENT



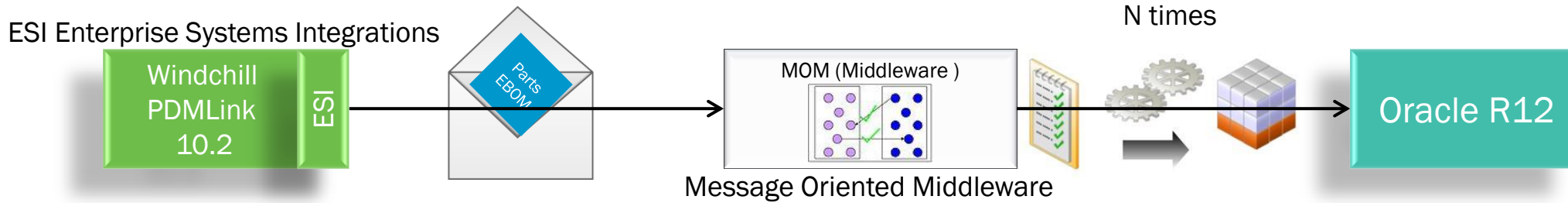
# CREATING EBOMS FOR LONG LEAD PART PROCUREMENT



- Early push to ERP for long lead items
- Rapid evolution of design, prior to Production Release



# EARLY EBOM PUSH TO ORACLE R12



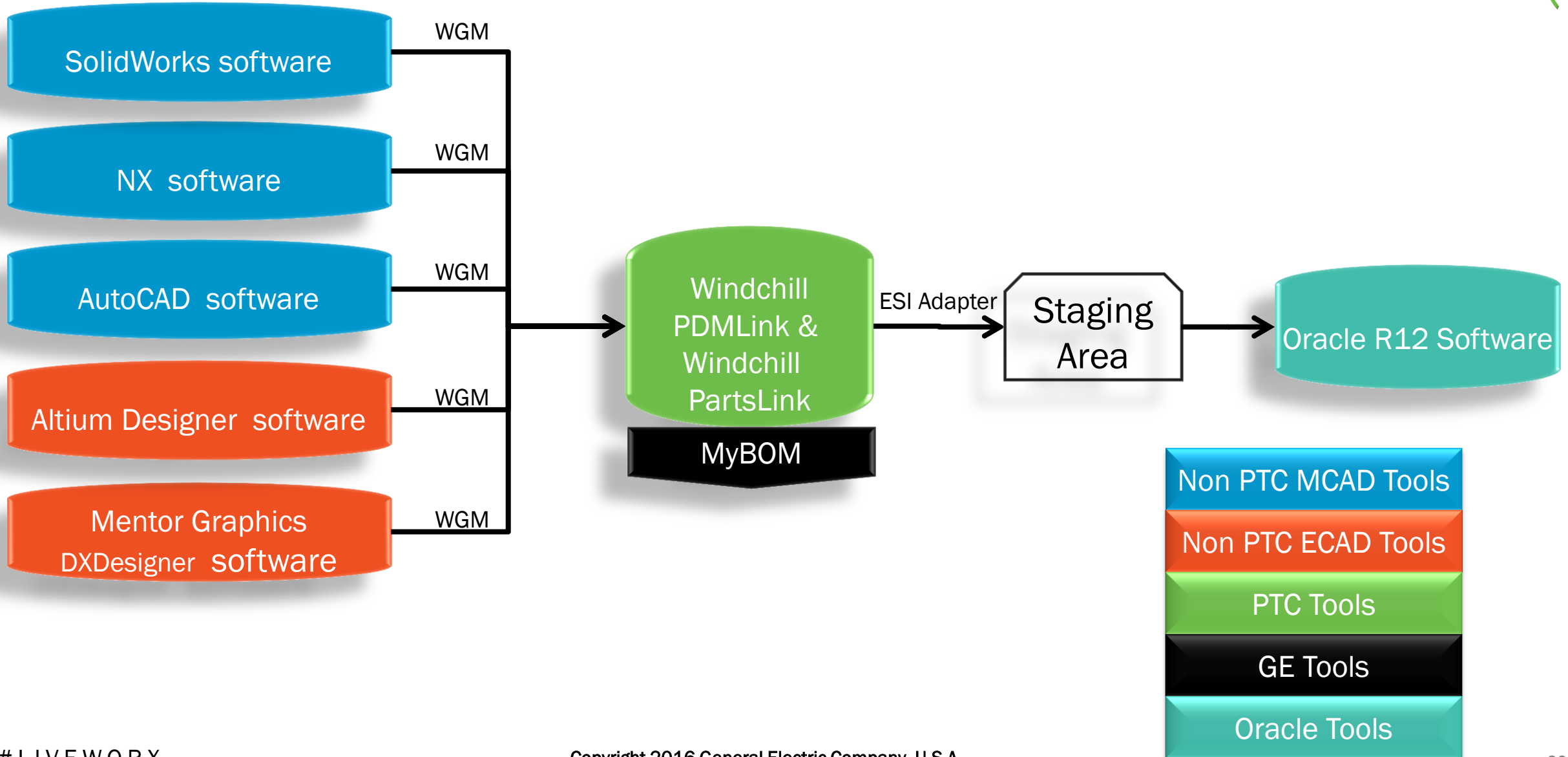
- Developed an eBOM re-push via the ESI integration
  - Only at Design Release stage
- Parts created in PTC Windchill and Oracle R12 earlier in the item's lifecycle

## Take Aways

- Supply Chain now has single flow for parts purchase
- Financials are directly tied to engineering via the integration

# FUTURE WORK

# FUTURE VISION



# QUESTIONS?



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Greg Noorman (Lead IT Engineer) [gregory.noorman@ge.com](mailto:gregory.noorman@ge.com)

Gavin Phillips (Program Leader Windchill PLM) [gavin.phillips@ge.com](mailto:gavin.phillips@ge.com)

The image features several colorful geometric shapes, primarily triangles and lines, scattered across the background. A large, multi-colored triangular shape is prominent on the right side, composed of various shades of blue, green, yellow, orange, and purple. Several thin, colored lines (blue, pink, green, orange) radiate from the center of the text area. The text 'LIVE WORX 16' is the central focus, with 'LIVE' in a thin, outlined font and 'WORX 16' in a bold, solid black font. A small 'TM' trademark symbol is positioned to the upper right of the '6'.

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