

PTC® Live Global

Aerojet Rocketdyne's Deployment of Windchill

Session: Cust109

Eric J. Krieg
Fellow & PLM Chief Architect
Aerojet Rocketdyne Inc.

June 8, 2015

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Speaker Introduction

PTC® Live
Global

Eric Krieg, Aerojet Rocketdyne



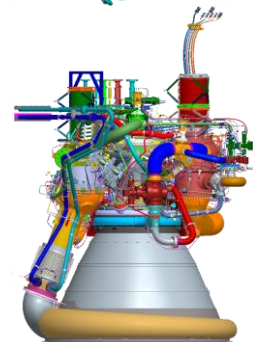
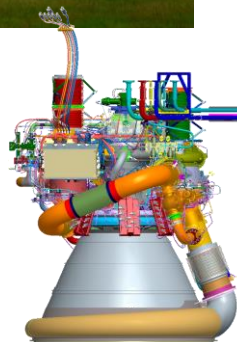
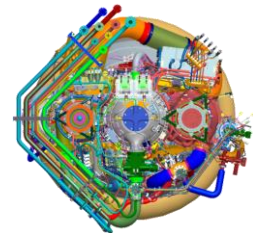
Eric is the Chief Architect for Windchill at Aerojet Rocketdyne. He is a Design Fellow with emphasis on Product Lifecycle Management (PLM) and Systems Integration and is also a member of the Windchill Solutions Technical Committee.

Eric has a 28 year career steeped in new product development that started as a Turbomachinery Design Engineer on the Space Shuttle Main Engine program, progressing into impactful positions such as Lead Designer for the Delta IV Rocket Turbomachinery, and as Deputy Chief Engineer and Test Analysis Lead for the Space Launch System Upper Stage engine.

Eric is now supporting the new AR1 engine targeted to replace the Russian built booster engine currently launching the Atlas V Vehicle.



- Aerojet Rocketdyne Overview
- Project Summary
- Implementation Highlights
- Key Activities for Success
- Retrospection and the Future
- Questions



J-2X Engine (Space Launch System Upper Stage) images courtesy of NASA

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Aerojet Rocketdyne at a Glance (NYSE Symbol: AJRD)



Aerojet Rocketdyne is a world-recognized aerospace and defense leader providing propulsion and energetics to the space, missile defense, strategic, tactical missile and armaments areas in support of domestic and international markets.

Aerojet Rocketdyne Holdings, Inc., formerly GenCorp, is a leading technology-based manufacturer of aerospace and defense products and systems with a real estate segment that includes activities related to excess real estate assets.

- ▶ **2014 Net Sales of \$1,597M**
 - Aerospace and Defense - \$1,591M
 - Real Estate - \$6M
- ▶ **Aerospace and Defense Leadership**
 - Space Launch Systems
 - Tactical Systems
 - Missile Defense and Strategic Systems
 - Space Systems
 - Specialty Metals
 - Space Advanced Programs
 - Defense Advanced Programs
- ▶ **Significant Real Estate Holdings**



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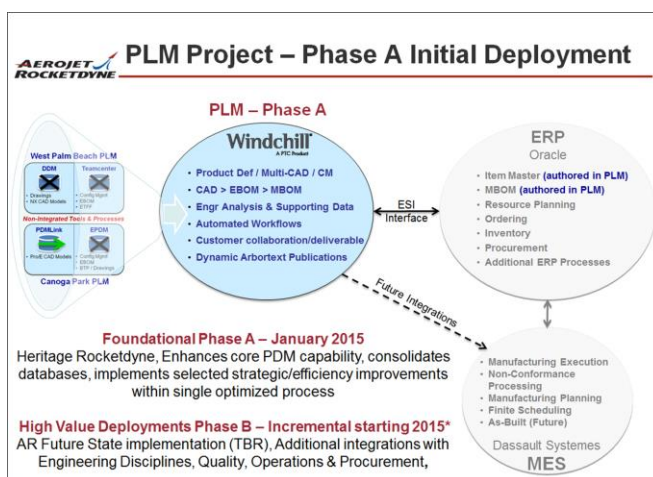
Summary of What We Accomplished

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What did we Accomplish?

Existing systems sunset with all data migrated and Windchill fully deployed within budget and on schedule.

- Created “One Process” with one configuration
- Wide breadth of Windchill 10.1m040 capability
 - Product Definition, Multi-CAD, Change Management, Associative CAD/EBOM/MBOM, Standard Notes
- Migrated over 8 Million objects (99.9% success) from 4 major systems
 - Product Definition, EBOMs, Change Management:
 - Teamcenter Enterprise – Boeing heritage
 - Teamcenter Unified – Pratt & Whitney heritage
 - NX CAD from Documentum
 - Manufacturing items and MBOMs from SAP
 - 20 years of Creo data already in Windchill
- Interfaces: Oracle (via ESI) and custom Supplier Portal (via Web Services)
 - Concurrent rollout with new ERP system – Firm go-live of January 5th, 2015



Alignment at all levels and across entire organization

- AR procedures defined Model Based Enterprise (MBE) as one corporate strategy to improve productivity
 - Disciplines required to develop
 - Programs required to utilize
- Islands of excellence
 - Concurrent Engineering isn't new
 - Lacking integration and re-use
- MBE led to Windchill system requirements
 - Achieve productivity Goals
- Executive sponsor drives top down momentum

**Model Based Enterprise (MBE)
Product Lifecycle Management (PLM)**

Desired Productivity → MBE Strategy → PLM System Requirements

Objective:
Achieve > X% gains in productivity & quality across product lifecycle

Current state:
Capable, highly customized, but loosely integrated systems, internally developed & maintained

Desired solution:
*Effective use of electronic product definition
Access to centralized data sources
Integration of data systems across enterprise
Concurrency in functional value streams
Common AR process/system alignment
Commercial solution for lower cost of ownership*

Key MBE Precepts per Site Level Procedure PWR 2.3.6

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Implementation Highlights

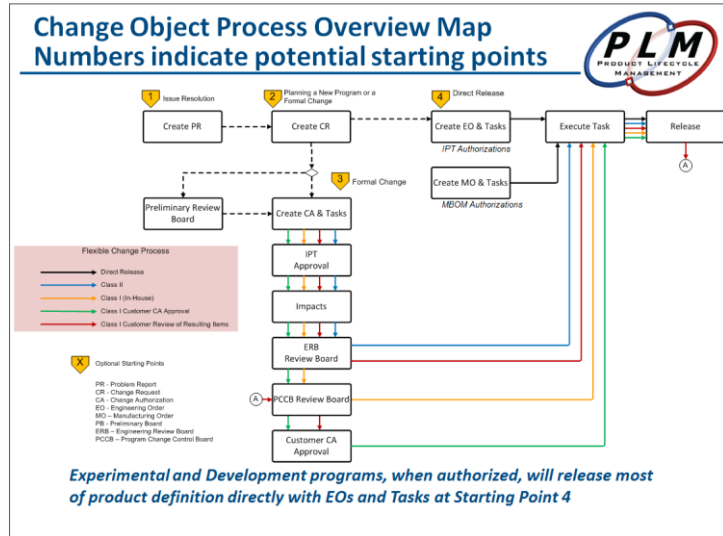
Largest Obstacles to Overcome Led to Largest Business Opportunities to Realize

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Implemented all PTC “Out of the Box” Change Objects

Utilized all Change Objects, yet implemented to facilitate research/experimental through production program needs.

- Use cases with unique attribution defined for each change object
- Unique workflows
- Each can stand alone
- Full production programs may utilize all in linear flow shown
 - Experimental will not
- Programs have flexibility to engage change process at different starting points per plan

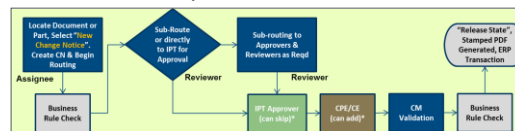


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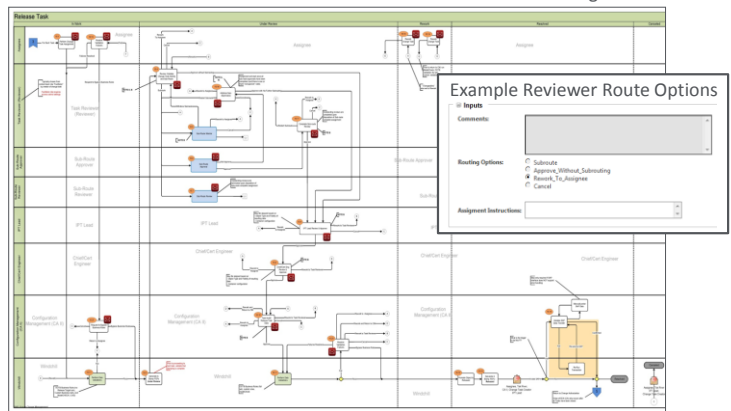
Workflows Maximized PTC Capabilities

High automation, capability, flexibility and with data validations incorporated without customization.

- Detailed Visio “swimlane” workflows defined with each routing/assignment option
- Task workflows drive resulting object states
 - Access controls
 - Automated document re-stamping
- Multiple business rule sets
- Parallel sub-routing with participant vote checks
- Skip selected serial approvals by product and object type
- Re-route and by-pass options



Training Materials Vs. Configuration Docs

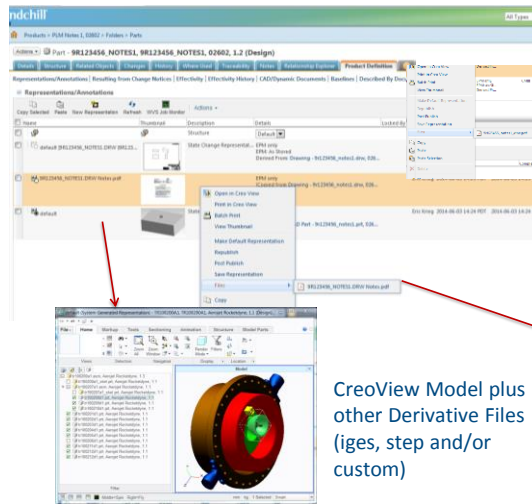


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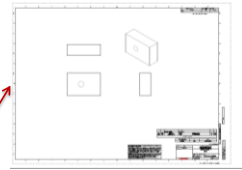
Representations Enables a Single Table View for Full Product Definition

Significantly improves user experience to find definition on the Part or on the CAD.

- Part utilized as collector
 - Owner links (CAD model)
 - Content links (CAD dwg)
- Publishing
 - File types by checkin, state and object
 - State & version stamping of all PDFs via Adobe LiveCycle
 - Custom file types integrated with OOTB publish
- TechNotes fully integrated within EPMdocuments. Utilizes same publishing with custom AR template.



Stamped Drawing PDF



Stamped Notelist PDF

CreoView Model plus other Derivative Files (iges, step and/or custom)

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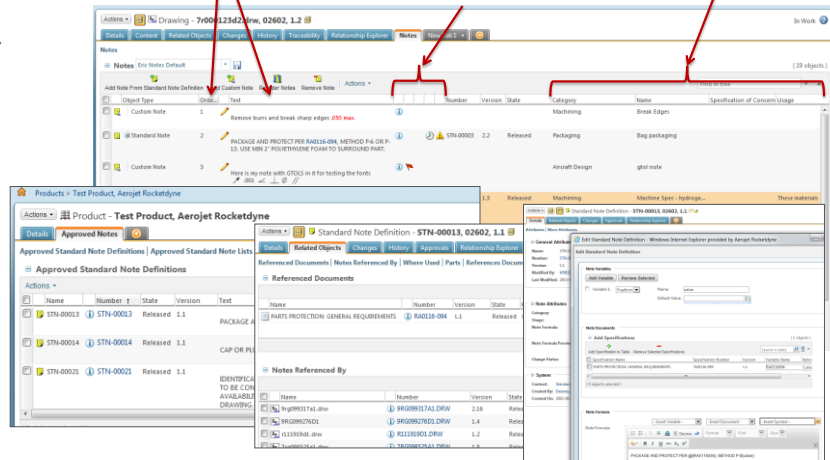
TechNotes (KPIT) Provides Full Function Note Management and Usage

Tool created to Aerojet Rocketdyne's requirements based on internally developed system in place for 10 years.

- Library of company wide standard notes
- Products or projects (networks) approve notes for usage
- Notes integrated within EPMdocument
 - Standard and custom notes
- Standard Notes
 - Formatting, symbols, enumerated or text variables, links to specs (latest or rev)
 - All standard WC table relationships and searching

Usage & status indicators
 Flag note
 Note Lock – set at release
 Later Version of note available
 Used Version of note no longer approved

Unique IBAs
 Category
 Specification of Concern
 Usage guidance



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Tremendous advancement achieved with creation, maintenance and authority in one system.

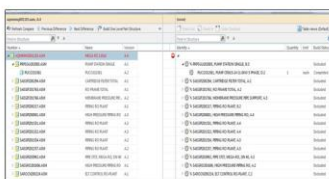
- Approaching complete OOTB solution with WC and MPMLink
- Minimal customization required for CAD to part/BOM creation
 - Multiple cage codes
 - Multi-CAD
 - Legacy data, family tables
 - Non CAD, industry designs
- MBOM published to Oracle
 - No creation or edit in Oracle permitted
- Huge process and role change

Automated CAD to EBOM to MBOM Creation

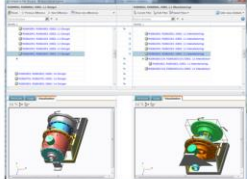
Facilitated Comparative Analysis and Visualization



CAD to EBOM Analysis



Visual MBOM construction from EBOM

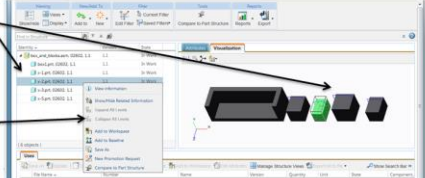


Indented structure with query/response association to visualization

Select part → CAD responds

Select CAD → part responds

Common actions directly thru RMB



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Selected Key activities

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Migration Challenge – 50+ years of Critical Aerospace Data

Most complex activity of the implementation due to current system’s maturity and extent of use.

- Configuration ↔ Data Mapping
 - Both critical path and inter-related
- Overly complex but no choice
 - Teamcenter Unified & Enterprise
 - SAP – MBOM (mfg views)
 - Documentum and other DBs
 - 20 years of PDMLink Creo CAD
- Mini and major rehearsals
- Process and architecture knowledge
- Data cleansing
- Data verification vs. process validation
 - Then start mapping over... config changes
- Post go-live data loading
 - Achieved >99.9%, additional 1M objects

EPDM/TCU/NX Migration Status

A GENCorp Company

EPDM/TCU Migration Status

PDMLink Object	Load Order	# Records Staged (Waiting DB)	# Records Loaded (Total Success)	# Records Failed (Total Fail)	% Success (TOTAL)
WTPart	1	369594	369594	0	100.00%
WTPDocument	2	566552	566552	0	100.00%
WTPChangeActivity2	3	339672	339668	4	99.98%
WTPChangeObject2	4	237356	237262	94	99.89%
WTPChangeRequest2	5	3938	3938	0	100.00%
APMChangeBy	6	2954	2954	0	100.00%
APMChangeActivityData	7	62936	62936	0	100.00%
ChangeRequest	8	266366	266366	0	100.00%
APMChangeObject	9	22316	22428	112	99.50%
APMChangeReferenceLink	10	53378	53378	0	100.00%
APMChangeBy	11	6388	6388	0	100.00%
APMChangeObject	12	36932	36968	36	99.90%
APMChangeBy	13	326672	326668	4	99.99%
WTPChangeActivityLink	14	63136	63136	0	100.00%
WTPChangeObjectLink	15	1481176	1481176	0	100.00%
Total		7,000,000	6,999,999	1	99.99%

7 million records loaded
99.93% *

NX File Migration Status

NX Files Attempted	Files Loaded	Files Failed	Percent Success
38,655	38,487	168	99.6%

MBOM/Item Migration Results

Type	PDMLink Object	Load Order	# of CSV Records	# Records Loaded (Total Success)	# Records Failed (Total Fail)	% Success (TOTAL)
Item	WTPart	1	56,195	56,195	0	100.00%
Item	WTPDocument	2	81,113	81,113	0	100.00%
Item	WTPart (New View/Version)	3	116,240	116,240	0	100.00%
Item	WTPart (Legacy Link)	4	11,722	11,722	0	100.00%
Item	WTPart (Structure Link)	5	791	791	0	100.00%
Total			268,021	268,021	0	100.00%

100% of SAP Parts and MBOMs loaded!

* Over 80% of failed records are of no concern ; they have no data and ideally would have been removed from load files.

- Content, Notes, Notelinks, Config Ref link

EPDM/TCU/NX Migration Extremely Successful - Supports Go-Live

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Development and Testing – Quality Assurance

Performed extensive testing of every aspect of implementation, and still had areas we could have done more.

- Maintaining multiple environments challenge
 - Develop new capability
 - Test developed capability integrated with configuration
 - Migration rehearsals
 - Report development
 - Production
- Unit, solution and user acceptance testing
 - Environments and project timeline
 - Issue and resolution tracking
- Use cases, test scripts
 - No OOTB from PTC
 - ACLs and populating roles essential
 - Representative data
 - Pay now or pay later with users

AR & PTC Joint Application Development

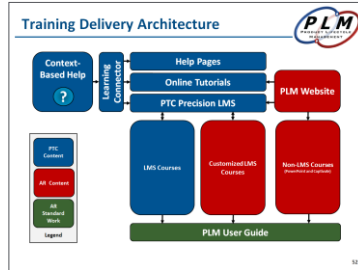
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Issue Resolution Process – All captured and managed in Mantis

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Extensive resources created for end users training and adoption

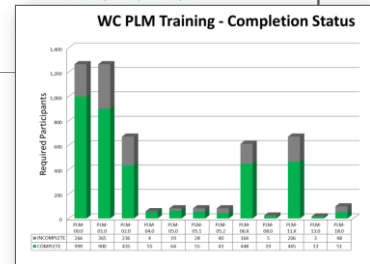
- No training = no logon!
- LMS + custom content
- Role based
- Instructor led, CBT (ppt versus video)
- Lot of documentation
 - Procedures, standard work, training, online user guide
- Acceptance testers screened materials, then developed into Power Users for Go-Live



The table 'Training Assignments by Role/Activity in Windchill' shows a grid of course requirements for different roles. A callout box at the bottom states: 'You have been assigned a learning role. You are responsible for taking the required courses for that learning role.'

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The screenshot shows the 'Windchill PLM - User Guide' page. It includes sections for 'About This Guide', 'CAD Creo Users', and 'PLM-00.0 Getting Started with Windchill PLM'. The 'About This Guide' section explains that the guide focuses on step-by-step instructions for Assistant Rockwell's configuration of Windchill and the common processes that it supports. The 'CAD Creo Users' section directs users to the CAD Process Training site. The 'PLM-00.0 Getting Started with Windchill PLM' section lists 'Types of Data Managed and Basic Features', 'Windchill Objects', 'Change Objects', 'Site Specific Changes', and 'Other Training Resources'. Below this, there is a sub-section for 'PLM-00.1 Windchill Deployment Strategy and Value'.



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Transition, Final Migration and Finally Go-Live!

All the preparations and hard work of the team finally pays off... but don't expect a lot of "Thanks" from users!

- Program preparations
- Delightful holiday migration
 - End to end, or pause to evaluate
- Easy access resources for all users
 - Dedicated Hyper-Care team
 - SharePoint, FAQ, PLM updates
- Primary system issues
 - Populating roles, product mapping
 - Configuration – new use cases
 - Migration – WIP, few missing files
 - ESI to Oracle mystery
- New process challenges
 - Overall new "complexity"
 - MPMLink MBOM for MEs
 - CAD to part for Design
 - CM expertise learning curve

You only have TWELVE HOURS left to check your models in!!
 Friday (12 December) at 6:00 PM the PDMLink server will no longer be accessible. Access to the Read-Only (Go Dark) server will be available on Monday (15 December)

The announcement page for 'Product Lifecycle Management Windchill PLM NOW LIVE!!!' features a 'Top 10 Questions...' list and a 'Known Data Migration' section. The 'Top 10 Questions...' list includes: 1. How do I login to Windchill? 2. Payment Error - Log In Questions 3. Am I Locked Out? What is my Training Status? 4. Product Area Access (What is my Role? What is my Area?) 5. How do I find my data from heritage systems? 6. How do I search/browse for Content and create? 7. Do I need software installed? (Mac, Java, .NET) 8. Understanding my home page and navigation 9. How do I submit a new document? Document 10. Where is the PLM User Guide? (link to site) • ROOTS - How can I learn more about all data? The 'Known Data Migration' section states: 'Our migration was extremely successful' and lists 'Over 50 years of data' and '7+ million objects and links'.

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Retrospection and the Future

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Executed to Plan... Additional Keys to Success

Team's unwavering commitment led to success even through the storms.

- Benchmarking and overcoming our system choice prejudice
- 100+ page SOW & Requirements Document still can't capture it all
- Project Management "Best Practices"
 - Execute to SOW/contract, risk management,
- Project Governance and Operating Principles
 - PTC partnership with Sales, Global Services, and R&D – access to critical resources
 - Monthly Steering Committee (executives, discipline, PTC)
 - Acceptance Review Board defined and evaluated go-live progress to pre-defined criteria
- Resources
 - Business Team ok, but IT Team understaffed
 - Full time and co-Located, extended team, power users
 - Planned and not so planned activities

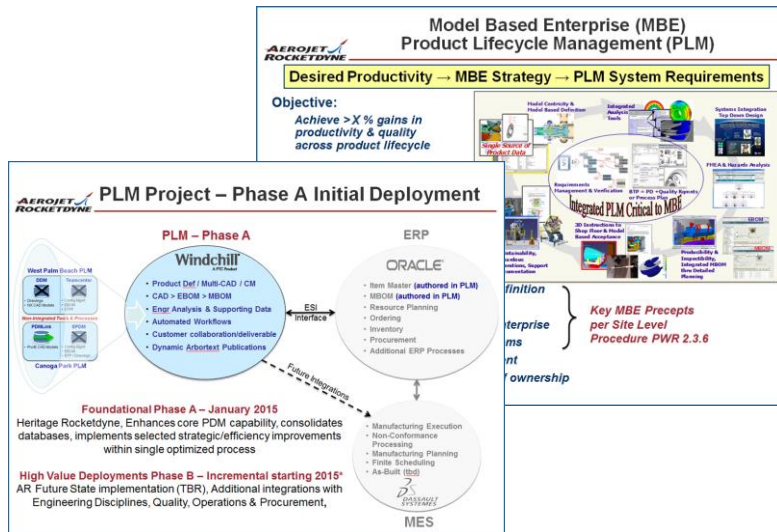
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Are we done now... What's in Store for the Future?

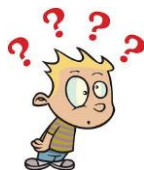
It was a long journey, but now the foundation is built so this is just the beginning to realize our opportunities.

- Project closeout and repairs
- Maintenance
 - Change management
- Upgrade to 10.2 or wait?
- Evaluating new scope/modules
- Steering Committee
 - Program/Discipline forum
 - Evaluating enhancements
- Deploy for heritage Aerojet sites?



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Questions

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 818-586-0414

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- Your feedback is valuable
- Don't miss out on the chance to provide your feedback
- Gain a chance to win an instant prize!
- Complete your session evaluation now

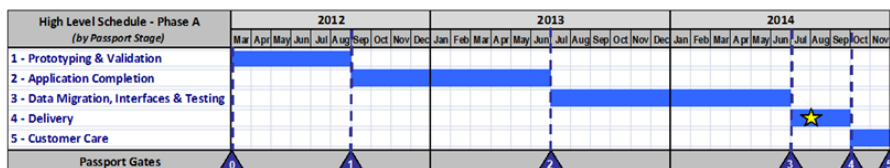
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Additional Back-Up Materials

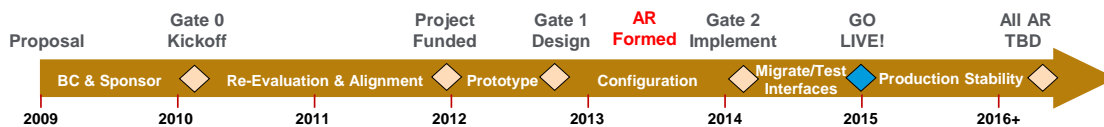
Project Timeline

Existing systems sunset with all data migrated and Windchill fully deployed within budget and on schedule.

- Initial project was scheduled to be completed July, 2014



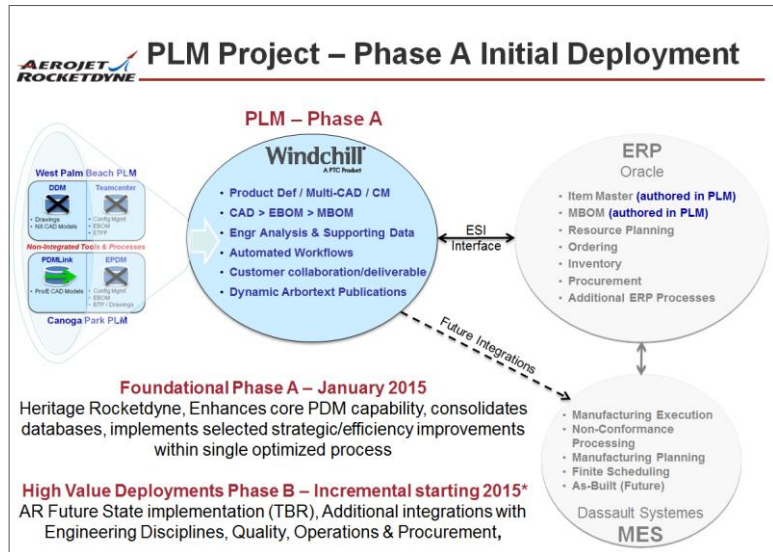
- Addition of MBOM, ERP system change to Oracle and concurrent go-live extended scheduled by 5 months to Jan, 2015



Crisp Boundaries of What is in and What is out

Impossible to run project on cost/schedule if continually considering additional scope.

- No shortage of ideas
- Foundational initial deployment
- Sunset existing systems
 - Migrate all data
 - No lost capability
 - Selective new capability
- MBOM/Oracle interface added scope fall 2013
 - Funding and schedule added
- Phase B considerations awaiting stability



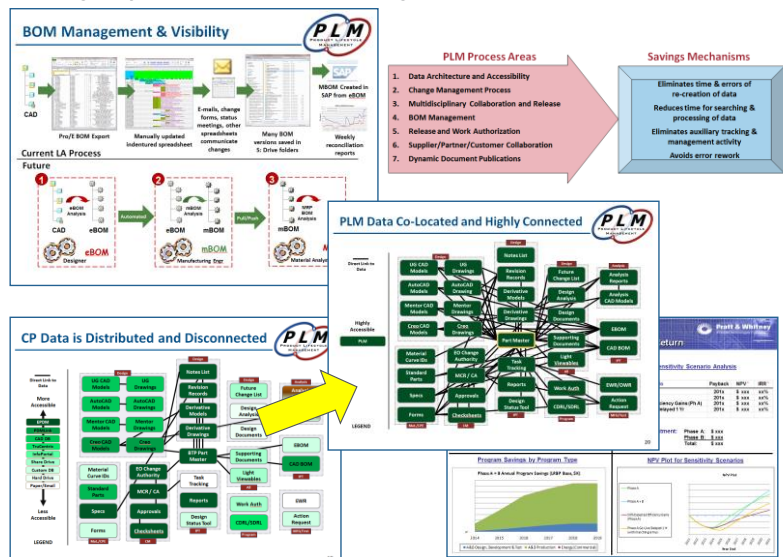
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Describing the Future State – Tangible Business Case

This may be the least desirable aspect of obtaining project approval, but it won't get started otherwise!

- Keep it simple, if you can...
 - Align with corporate goals
- Few understandable examples vs. many detailed
 - Cost avoidance, efficiency
- PLM team vs. program analysis
 - Generic vs. specific
- Multiple scenarios for rate of return calculations
- Never lose sight of your why!



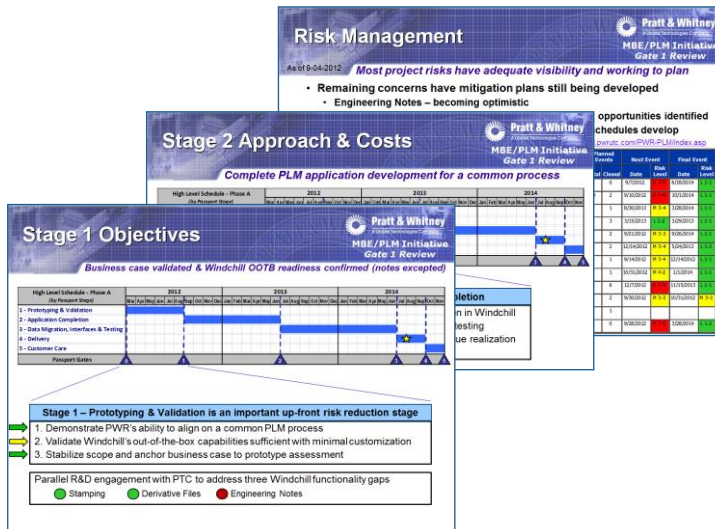
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After Executive Approval... We're Really Going to Have to Do This?

Implement Applicable and Appropriate Level of Project Management Best Practices.

- The team
 - Full & part time, outsource?
 - Knowledge, dedication & barrier busters
- Detailed plan
 - Merge available funding and business needs
 - Gated process
- PTC Global Services partnership, R&D
 - Project & Windchill expertise
 - Access to critical resources
- Risk management
- Issue tracking
 - Process & Tool
 - Migration, WC bugs, configuration
- Governance and commitment
 - Steering Committee
 - Executive Committee & Sponsors
 - PTC GS, sales, R&D



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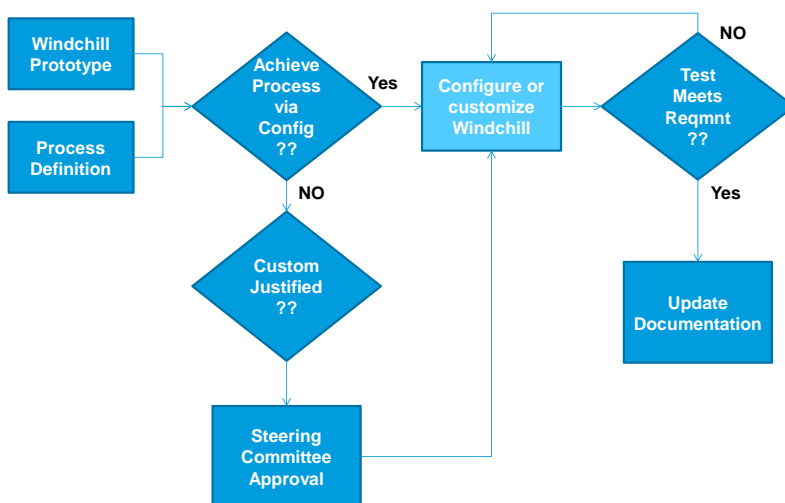
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Extensive Process and Administrative Effort to Achieve Configuration

Don't underestimate the difficulty to grasp & control the implementation. If done well, very high value to user base.

APPROACH

- Extensive process workshops
- Don't lose sight of MBE and system/company issues to resolve
- Minimal customization
- Iterative configuration
 - Objects, attributes
 - Relationships
 - Workflows
 - Containers, access controls, views
- Test, fail, record, fix... repeat
- Project gates & PTC milestones
 - Committed functionality with documentation deliverables



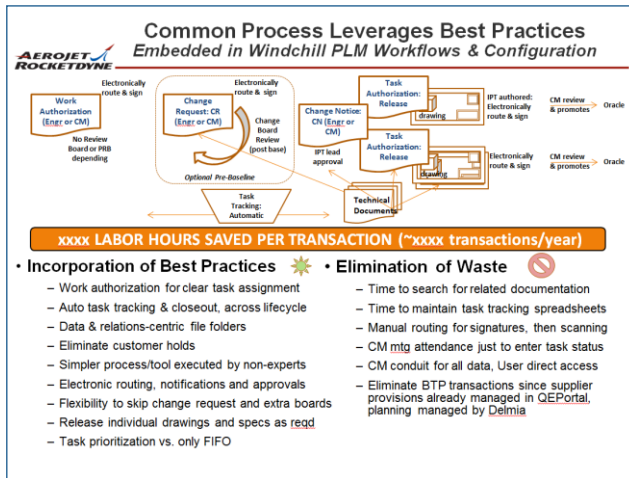
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Primary Business Objective – One Common Process & Tool

Combining the legacy processes & data of Rockwell, Boeing and Pratt & Whitney into “One System”

- Started With...
 - Documenting current processes
 - Understanding issues and opportunities
 - Workshops and more workshops
 - Demo/Prototype
 - Iterative configuration



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Go-Live Criteria – Are We Ready? Now Convince the Company...

Universally understood and approved specific criteria across breadth of deployment.

- **Acceptance criteria board**
 - Program & disciplines
 - Accountable advocates and go-to program help
 - Not a steering committee
- **Criteria**
 - Understood by all
 - Mature & status over time
 - March towards go-live without surprising new scope
- **Meet criteria? Then you're ready!**
 - Forum to identify known issues and acquire acceptance

AEROJET ROCKETDYNE ACB Meetings - High Level Schedule

Review	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1
Go-Live Criteria Kick-off Meeting	Jun 7							
Review & Finalize Acceptance Criteria			Dec 13					
Preliminary Review/Status						Jul		
Preliminary Review/Status						Oct		

Item	Description	Owner	Criticality	Date	ECD	Status
1	Infrastructure/Software	Karo	High	6/15/2014	12/15/2014	●
2	Data Migration	Tim	High	11/15/2014	12/12/2014	●
3	Interfaces	Tim	High	8/1/2014	12/05/2014	●
4	System Testing	Karo	High	9/23/2014	12/05/2014	●
5	Cutover Plan	Tim	High	11/24/2014	12/2/2014	●
6	Support Plan	Karo	Medium	11/1/2014	12/15/2014	●
7	ONE Process	Eric	Medium	11/1/2014	11/1/2014	●
8	Training	Sam	Medium	12/15/2014	12/19/2014	●
9	Communication Plan	Veronica	Medium	12/15/2014	12/15/2014	●

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Cut-Over... so this is really happening?

Executing all of your planned efforts and be prepared for surprises.

- Final criteria = pass user acceptance testing
 - Configuration and migration
- System shutdown prep
 - Time, scheduling & pad
 - Migration
 - Program disruption – preparation, WIP, Go-Live... back out plan?
- Brownout
 - Enterprise read only, CAD exception with workspaces
- Production migration
 - End to end or stop to evaluate
- Final system check & GO!

You only have TWELVE HOURS left to check your models in!!

Friday (12 December) at 6:00 PM the PDMLink server will no longer be accessible. Access to the Read-Only (Go Dark) server will be available on Monday (15 December)

*EPDM Transition to PLM
Friday, December 12, 2014
6 PM*

EPDM will become read-only on Friday, December 12th at 6:00 PM

NOTE: This outage is subject to change based upon Launch Freeze schedules.

What is happening?

- Starting COB December 12th, AR will begin the process of shutting down EPDM to replace with the Windchill PLM system.
- After December 12th, no additional data can be entered into the system; however, EPDM continue to be available in a read only mode.
- Processes for emergency manual releases after December 12th and post go-live data process of data in the EPDM workflow at the time of the shutdown will be in place. Click here to the [manual process](#).
- Contact [Veronica Garcia](#) for details on these processes.

For outage specifics:

[IT Outage Calendar](#)

[IT Change Management for EPDM Transition to PLM](#)

