The Digital Thread in Shipbuilding – Vision or Reality?

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Product Manager

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One of the first “CAD Boats”
...and one of the latest
Agenda

- Vision vs reality
- Underlying causes
- PLM Platform
- Open technology approach
Digital Thread

Vision?

Concept

Development

Manufacturing

Service

Requirements  As Designed  As Planned  As Built  As Maintained

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Digital Thread
What’s the reality?

- Configuration knowledge (and control) is repeatedly lost and regained through every stage of the product lifecycle

- As-Designed
  - Engineering changes

- As-Planned
  - Manufacturing restructuring
  - Supplier parts

- As-Built
  - Concessions
  - Serialized parts
  - Batches/lots

- As-Maintained
  - Maintenance
  - Modifications
  - Repairs

ERP
MES
MRO
Too hard to fix?

- Many initiatives today are focused around regaining short-term control, not fixing the problem
- 20 years from now we may be in exactly the same situation
What are the causes?

- Long lifecycles
- Multiple stakeholders with conflicting motivations / contractual obligations
- Increasing product complexity
- Fragmented systems at every lifecycle stage
- Legacy/Cultural tendencies
- Technology
- Open/Richness of data
We thought we could solve the problem
Smart Product Model (SPM)

- Integrated *Product* Data Environment (IDE/IPDE) as the single source of data
  - Direct use of engineering and model data within the IDE to support simulation and analysis
  - Explicit definition of interdependencies among systems / subsystems
    - E.g., Conduit connectivity
    - And other less tangible design aspects
      - E.g., Survivability

- IDE ~ PLM

The SPM includes the connections
But legacy PLM failed to meet the vision

Adapted from: Aerospace & Defense Industry PLM Value Gap Survey, CIMdata, March 2013
Hard to Implement, Difficult to Upgrade

“Over a third of current PLM (PDM) implementations have more than 3 years of development remaining”

“Astronauts”

“Astronauts”

“Astronauts”

“Over a third of current PLM (PDM) solutions are more than 5 years old”

Aerospace & Defense Industry PLM Value Gap Survey, CIMdata, March 2013
Focused on the Science of Engineering

MCAD PDM
<table>
<thead>
<tr>
<th>System</th>
<th>Concept</th>
<th>Development</th>
<th>Manufacturing</th>
<th>Service</th>
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<td>IOT Analytics</td>
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<td>Software Development</td>
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<td>Manuf. Planning</td>
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Leaving engineers working like this

PLM Underground
Impacting the ability to do business

- Poor cross-discipline communication compromises design integrity
- Lack of an integrated product configuration creating confusion at critical hand-offs
- Fragmented data and processes making it hard to support new business opportunities
What are our requirements?
PLM Redux – the PLM Platform?

Integrated Applications
Access Management
Collaboration Business Process Workflow
Configuration & Change Management

PLM Platform

MBSE  ALM  ECAD  MCAD PDM  ERP  MES  Maint. Mgmt.
Simulation  Suppliers  IOT
Look or sound familiar?

Overview

- NAVSEA tasked NSRP to specify the requirements for and drive the implementation of product data systems
  - based on an open architecture
  - having suitable functionality and
  - enterprise-wide interoperability
- to support affordable
  - Navy vessel design,
  - construction and
  - service life support
Technology requirements for PLM Platform

- **Resilient** technology that is:
  - **Flexible**
    - Meets the unique, evolving needs of the organization
  - **Scalable**
    - Supports users across the extended enterprise
  - **Upgradable**
    - Upgrade to new releases in a timely and economical manner

- **Open** business model

- **Innovative** deployment approach
Model-based technology

- Flexible, common services
  - Item management
  - Configuration and change
  - Lifecycles and workflow
  - Visual collaboration
  - Vault management
  - Search, etc.

- Scalable - tested to 250k concurrent users

"Average response times were excellent"
Model-based technology

Adaptive Client

Modeling Engine
Flexible data and process model

Services Layer
Standard PLM services

Repository
Model and data

“Aras’s modelling capabilities … enable solutions to be developed quickly”

CIMdata
Model-based technology

- Applications are built and modified using the Modeling Engine
- Models "subscribe" to the services that they need
- Models dynamically update the client
Model-based technology

- Applications are built and modified using the Modeling Engine
- Models "subscribe" to the services that they need
- Models dynamically update the client
- Models are stored in the repository

Diagram:
- Adaptive Client
- Modeling Engine
  Flexible data and process model
- Services Layer
  Standard PLM services
- Repository
  Model and data
Model-based technology

- Separation of Models allows the Services Layer to be upgraded quickly and easily
- Customized Models are fully preserved during upgrades
- Lets you stay current and benefit from innovation

- 15 Years with Aras Innovator
- 9 major version upgrades
- No lost Integrations
- No lost customization investments
Open business model

- Enterprise open source
  - Open access to evaluate, test and deploy

- Open interfaces: gives you options
  - To authoring tools and enterprise systems

- Open community: puts you in control
  - Users and partners
  - Guides the roadmap
  - Collaborative open-source development
Innovative deployment approach

- On-site, cloud or hybrid
  - Flexibility to be deployed on-site, in a public or private cloud, or in hybrid configurations

- Agile implementation
  - Architecture enables a flexible, agile deployment approach that demonstrates tangible business results quickly at lower risk
Deployed as PLM Platform

- Platform deployment connects the extended enterprise
  - Single data and process model
  - Integrated applications
  - Through-life configuration management
  - Connected to authoring tools and integrated to enterprise systems

- Overlay or replace legacy PDM environments
Through life configuration management
Conclusions

- The NSRP study identified the need for and the benefits of an IPDE nearly 10 years ago

- Key challenges have been
  - Spanning the product lifecycle – especially configuration management
  - Integrating engineering domains (hardware and software)
  - Availability of an open solution

- A proven, open solution is available now
Next Steps

- Propose a *series of pilots* to further develop technology and best practices

- Focused on *key lifecycle stages and interfaces*:
  - Planning to Construction
  - Construction
  - Construction to Service
  - In-Service

- Multi-year effort but lessons learned can be applied quickly

- Will require high level of stakeholder sponsorship for viability