Enabling The Source of Truth
For Model Based System Development
April 2020
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A&D Challenges Today

- Weapon system and C5I complexity is accelerating
- Lack of a digital thread or twin
- Inability to access information for innovation
- Designing weapon systems to meet unique & evolving missions
- Supporting new business models
84% of digital transformations fail. - Forbes, 2016

14% say their (Digital Transformation) efforts have made and sustained performance improvements. - McKinsey 2018

50% of digital transformation efforts stalled out completely. - Forrester, 2018

3% report complete success at sustaining their (Digital Transformation) change. - McKinsey 2018

18% of companies rate their use of digital technology as very effective. - Harvey-Nash-KPMG COI Survey, 2017

5% of those companies involved in digital transformation had achieved or exceeded the expectations - Bain, 2017
Digital Engineering Core Tenets

1. **Model Based Enterprise**
   Enterprise Configuration Management Platform Overlay, Holistic, Tool Agnostic Approach

2. **Authoritative Source of Truth**
   Platform Overlay:
   Connect PDM environments & Tool agnostic
   Open - data model & API

3. **Technological Innovation**
   Holistic approach – all domains
   Tool agnostic approach
   Open – data model & API

4. **Infrastructure Environments**
   Agile methodology
   Greenhouse, Cloud, Virtualization
   Open – data model & API

5. **Transform Culture**
   KAIZEN 101 > BY THE PEOPLE
   Commander's Intent > Empower
Full Lifecycle Digital Thread
Integrated Product Development

- Rip & Replace | Platform overlay
- Enterprise Configuration Management
Interdisciplinary Collaboration – Systems Focus
Requirements Engineering

- Move beyond traditional methodology
  - Monolithic, disconnected documents
- Ontologies – meaning & purpose
- Stand alone controlled & **reusable** items
- Structured, shareable, **reusable** content
  - Text, Equations, Graph, parameter
- Relatable – RFLP, internal/external
- Requirements Documents allow grouping & reuse
DOORS Integration: Use Cases

- Select and link requirement to part or other item
- Create and update requirement in Innovator
- Create backlink in Doors to requirement/part
- Identify and visualize suspect state: “Has something changed in Doors?”
- Create/update requirements in Doors
- Revise part and requirement
- Navigate to Doors requirement
- Delete part/requirement link
- Display live Doors data
DOORS Integration

- Link DOORS requirement
- DOORS UI from Aras
- Aras Requirement in DOORS
- Multiple links
- Requirement change

Full video online: https://youtu.be/JlQKevkfReI
Systems Architecture

- Central System Architecture & Ontology
- Enterprise Configuration Management & traceability
- Model variants and PLE configurability as early as possible
- Enables cross-discipline collaboration with downstream/supplier specialists
- MBSE Integration
  - Model object abstraction - granularity
  - Configuration control of abstraction and models
  - Dynamic data exchange
Systems Architecture

### System Model

- **Created By:** Innovator Admin
- **Created On:** 5/19/2017
- **Modified By:** Innovator Admin
- **Modified On:** 5/25/2017
- **Locked By:**
- **Major Rev.:** A
- **Release Date:**
- **Effective Date:**
- **Generation:** 2

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<tr>
<td>Brake</td>
<td>2</td>
<td>Preliminary</td>
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<tr>
<td>Brake with generator</td>
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<tr>
<td>Charge battery</td>
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<td>Convert kinetic energy to electrical energy</td>
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<td>Decelerate wheels speed</td>
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<td>Engage friction brake</td>
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<td>Force brake pads to move inwards</td>
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<tr>
<td>Generate friction brake contacting brake</td>
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<td>Move piston inside master cylinder</td>
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<td>Push Brake Pedal</td>
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<tr>
<td>Wheel</td>
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<td>Preliminary</td>
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Flagged as affected

Updated in SysML

Created in SysML
MagicDraw Integration

- SysML user manipulates parametrically-driven requirements at will
- Integration provides visual feedback regarding Platform status of SysML changes
  - Red -> modified from Platform (change)
  - Green -> not in Platform (create)
  - No color -> query from Platform (add)
MagicDraw Integration

Full video online:
https://youtu.be/HPlWyS0vgr0
Embedded Software

- Integrated Software and Hardware development and operation processes (DevOps)
- Support domain differences
- Tool agnostic approach
- Synchronize master with other systems for visibility and integrity
- Single, cross-discipline problem reporting and change process

JIRA
Issue tracking, change management, agile planning

Git
Software configuration management

Jenkins
Automated build – Creating software binaries from source code
Embedded Software

ALM Environment

- **Program Management (PM)**
  - Requirements Engineering (RE)
  - Systems Architecture (SA)
- **Product Engineering (PE)**
  - Physical Software Build
  - Baseline
- **System Engineering (SE)**
  - Status

**Jira**

- Change
  - Part
  - Software Build
  - Git

**Git**

- Jira
  - Example project with Groovy-based Jenkins pipeline (jenkinsfile)
  - Git
  - Jenkins

Jira & Git Integration: Aras ECO
Jira & Git Integration

- Kanban ticket from Innovator ECO - Aras info on Card, Jira info on ECO
- New Git branch auto created
- Software engineer takes Jira task/ticket
- Perform work (code)
Simulation Data Management

- **Manage simulation in the digital thread**: Connect processes and results to configurations and requirements for traceability

- **Improve visibility**: More teams can access simulation processes and results in context with their work

- **Leverage existing tools while supporting reuse**: Simulation experts use their preferred tools and best practices

- **Accelerate innovation**: Drive new value as more lifecycle teams can access repeatable, multi-physics simulations

Full video online: https://youtu.be/SaY2NdJrjJ4
Simulation: Drive From Requirements
Simulation: Modelica Integration

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<th>Hard points</th>
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<tr>
<td>r0H</td>
<td>{0.0, 0.7, 0.0} m</td>
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<tr>
<td>r0A</td>
<td>r0H m</td>
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<tr>
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<td>r0L3X</td>
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- Position of hub center, resolved in vehicle frame
- Position of origin of stabilizerFrame, resolved in vehicleFrame
- Position of origin of steerLinkFrame, resolved in vehicleFrame
- Position of front link mount in chassis, resolved in vehicleFrame
- Position of rear link mount in chassis, resolved in vehicleFrame
- Position of spring mount in chassis, resolved in vehicleFrame
- Position of strut/damper mount in chassis, resolved in vehicleFrame
- Position of spring mount in upright, resolved in vehicleFrame
- Position of damper mount in upright, resolved in vehicleFrame
- Position of upright-strut joint, resolved in vehicleFrame
- Position of steer link inner joint, resolved in vehicleFrame
- Position of steer link outer joint, resolved in vehicleFrame
Simulation: Manage Simulation Process
Simulation: Integrated Demo

Full video online: https://youtu.be/SaY2NdJrjJ4
Simulation Studies Correlate Testing

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<thead>
<tr>
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<td>lca Silk</td>
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Aras | XPLM Integrations
Middleware Architecture IBIS with OpenPDM Connectors

Interaction between the PLM systems and ARAS Innovator (data view)

ARAS / Engineering Cockpit

- Project
- Config 1
- MET-BOM (EBOM)
- Config 2
- ECR
- ECO

Transfer of identities & permissions to ARAS

„IBIS“: Schaeffer Process Engine / Integration Bus

Arrow: Trigger (not data flow)

Planisware
- Project
- APs
- Gateway
- Integrity Connector
- ECR
- ECO

Integrity Source
- Project
- Req
- 5W
- ECR
- ECO

Allium
- Project
- EE
- ECR
- ECO

Windchill
- ME BOM
- Comp.1
- Assembly
- Comp.2
- Comp.3
- ECR
- ECO

CREO
- 3D native
- Doc.-ASM
- Doc.-COMP1
- Doc.-COMP2
- Doc.-COMP3
- ECR
- ECO

Windchill
- Project
- PPR
- ECR

SAP
- MBOM
- RFQ / OGP
- IOP
- MBOM
- AP
- 3D-layout
- ECR
- ECO

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Thank You

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Detailed demos/examples call or email