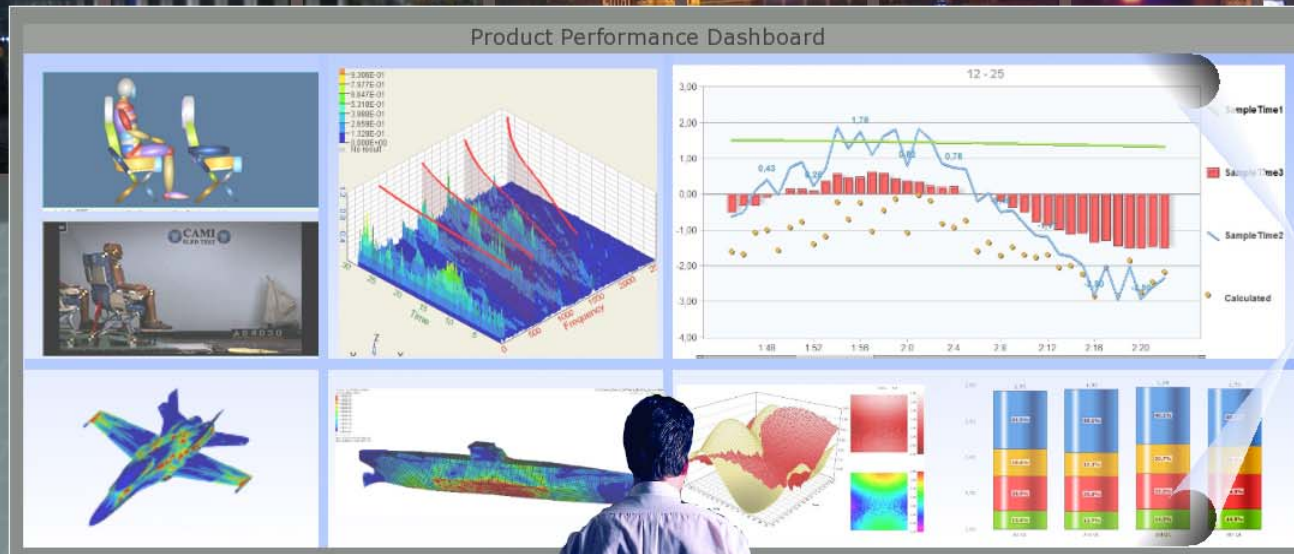


Product Performance Information Management

NSRP Conference, May 14-16, San Diego, CA



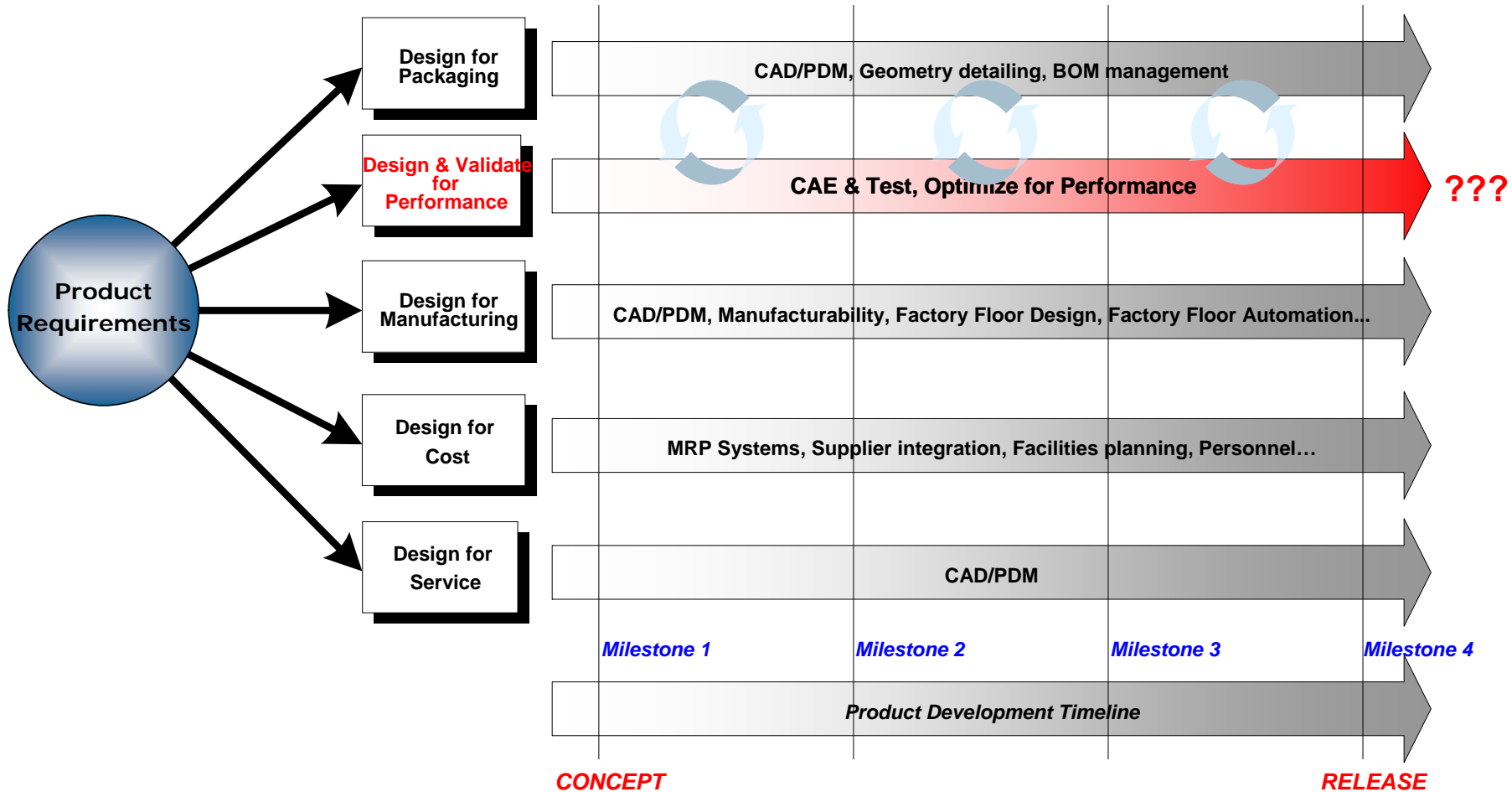
Alhad Joshi

Director, Enterprise Solutions

1. Introduction
2. Domain & Positioning
3. Challenges for Stake-holders
4. The Solution
5. Recap: Performance Data Management with ADM
6. Case Studies
 - Magna Steyr
 - Test data management
 - NAVSEA-ASSET Concepts management proof of concept

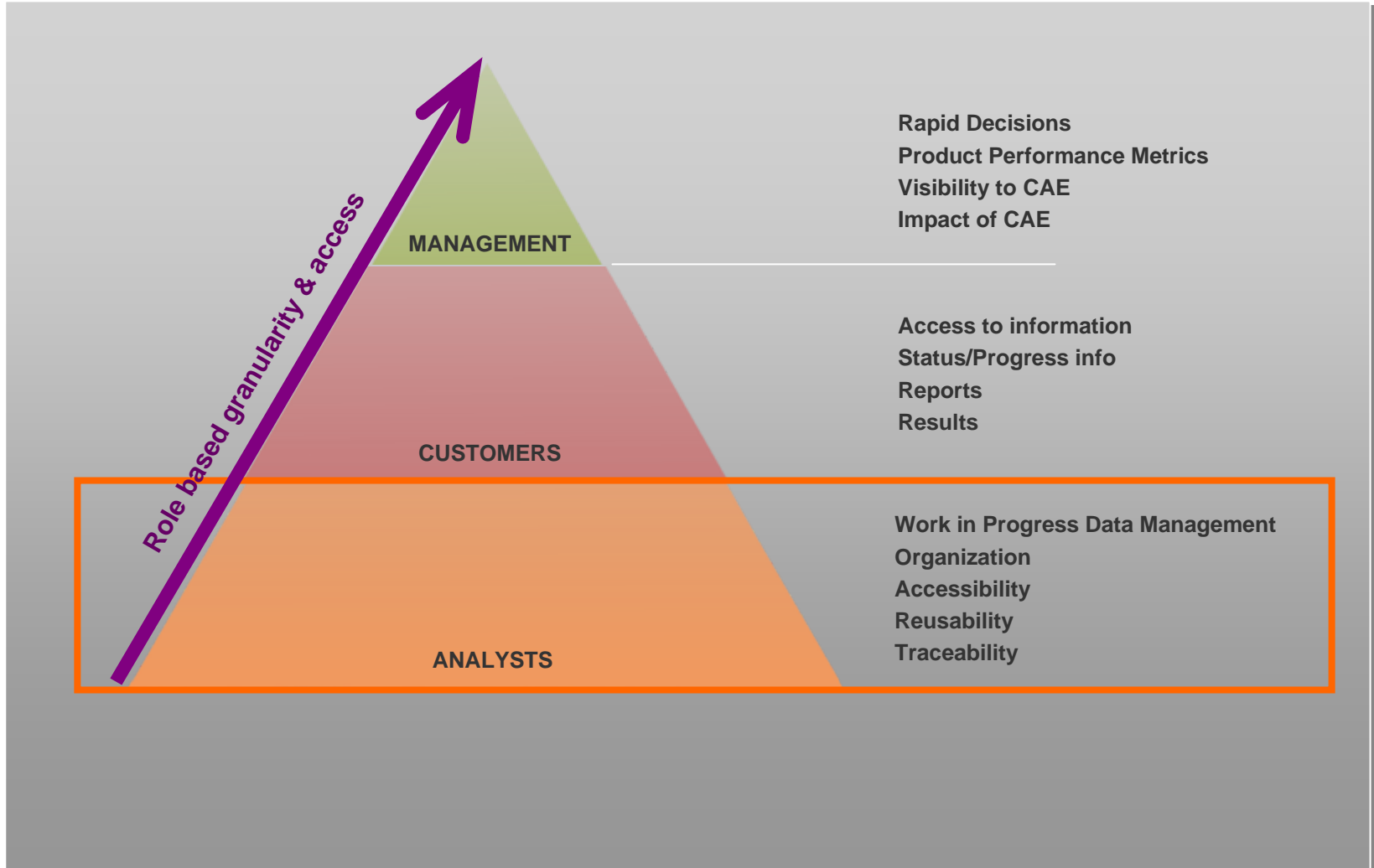


Product Development Lifecycle

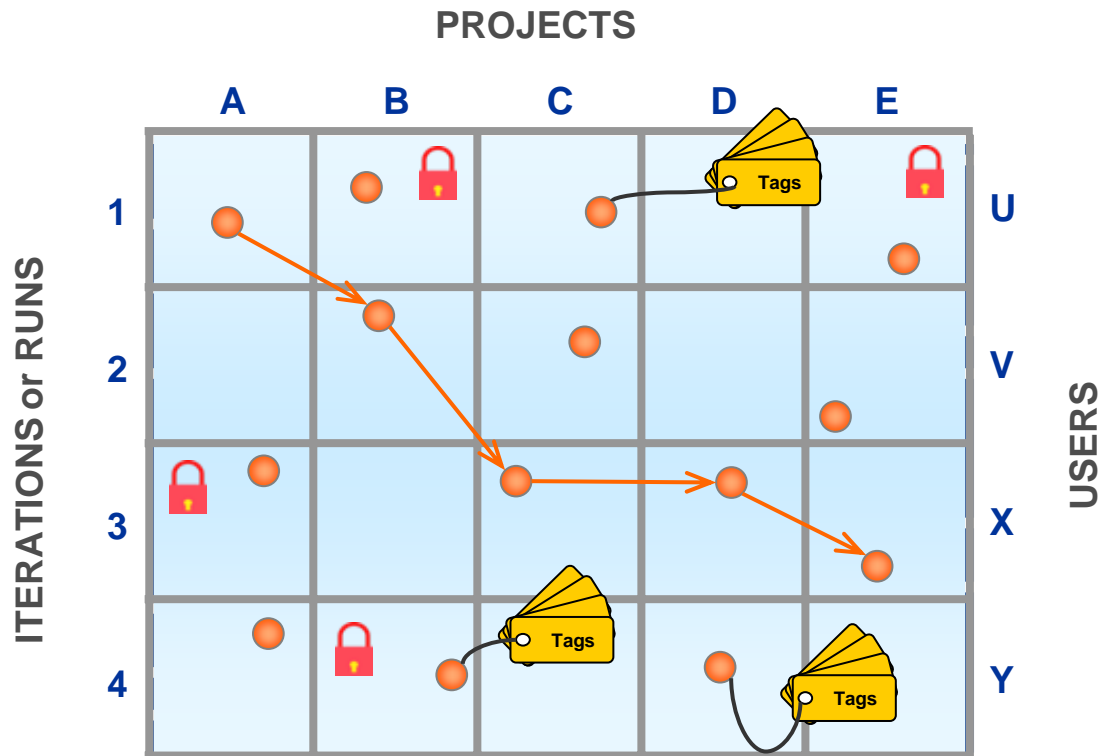


- A comprehensive Data Management solution that lets stakeholders easily
 - manage,
 - share, and
 - control**Engineering Simulation and Test Data**
Concept through Release
- Addresses the needs of
 - Management
 - Design Release Engineers
 - Analysts





Where is your product performance data?



THE BASICS

- Organization
- Tags/Meta-data
- Search/Query
- Traceability
- Security

- Enterprise Solution
 - Highly Scalable (1- thousands of users)
 - Multi-site
 - Technology: Oracle, DB2, MSSQL, J2EE, .NET & IIS
 - Web based access from any location
 - Audit trail

- Pre-Post & Solver Neutral Solution
 - Use any application for analysis

- Open Architecture
 - Stable & Robust client-server architecture
 - Stable & Robust integration framework

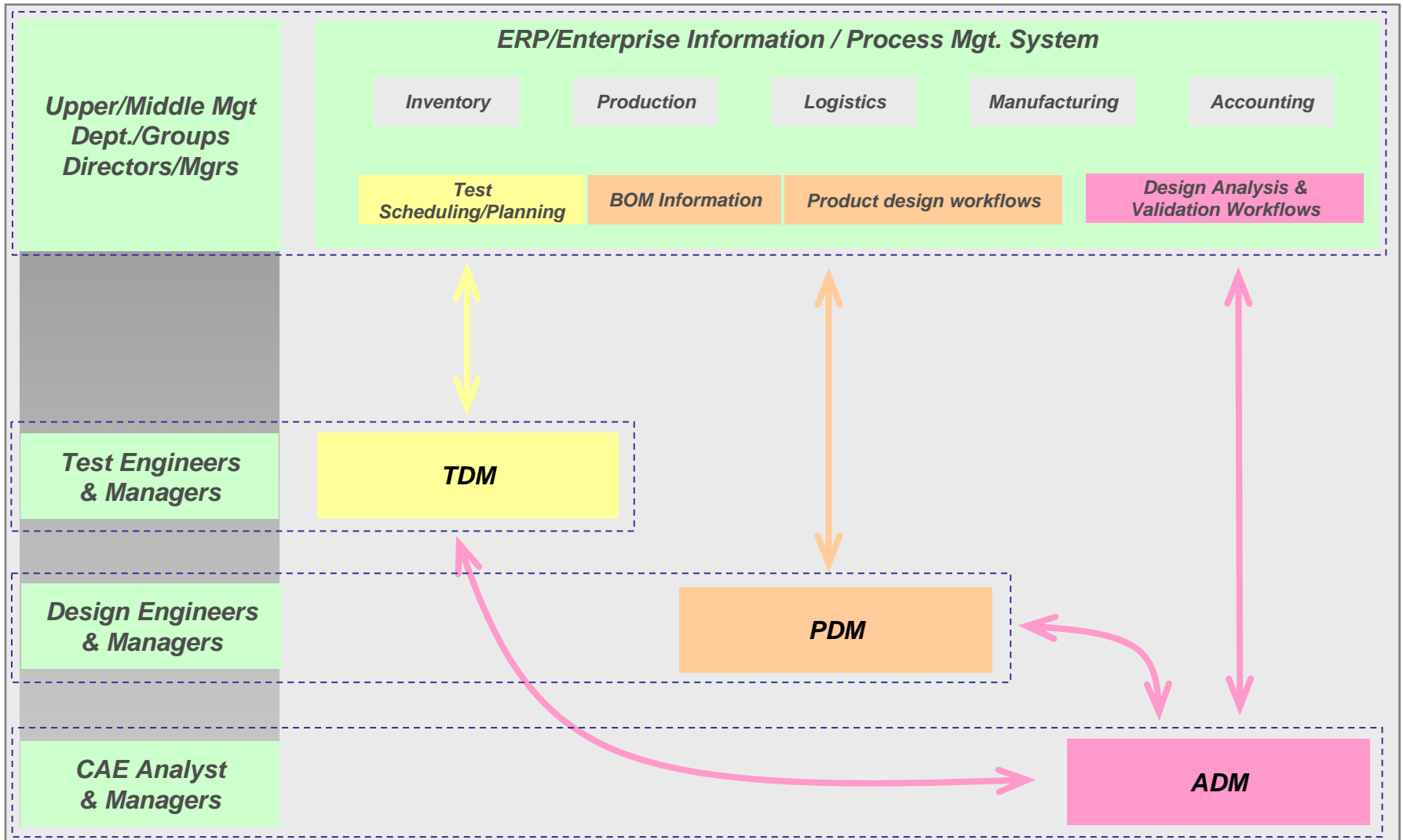
- Comprehensive CAE & Test Data Management Infrastructure
 - Flexible CAE & Test Data model
 - Process & Workflow driven mode
 - Advanced search & query framework

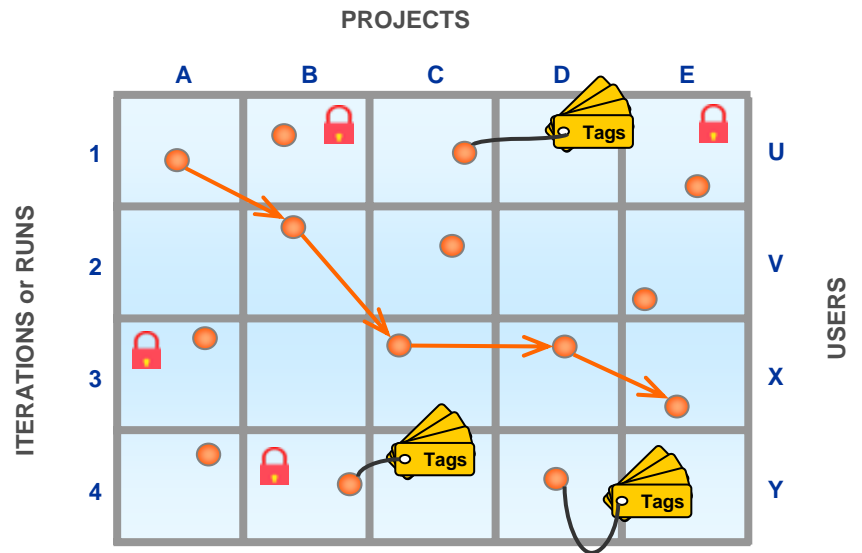
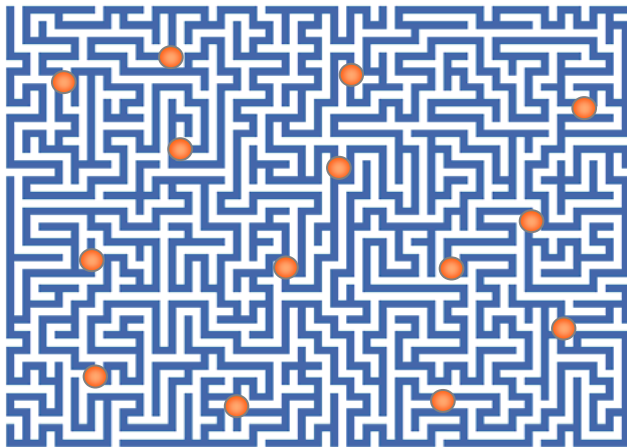


- Multi-site Installation
 - Independent
 - With data replication



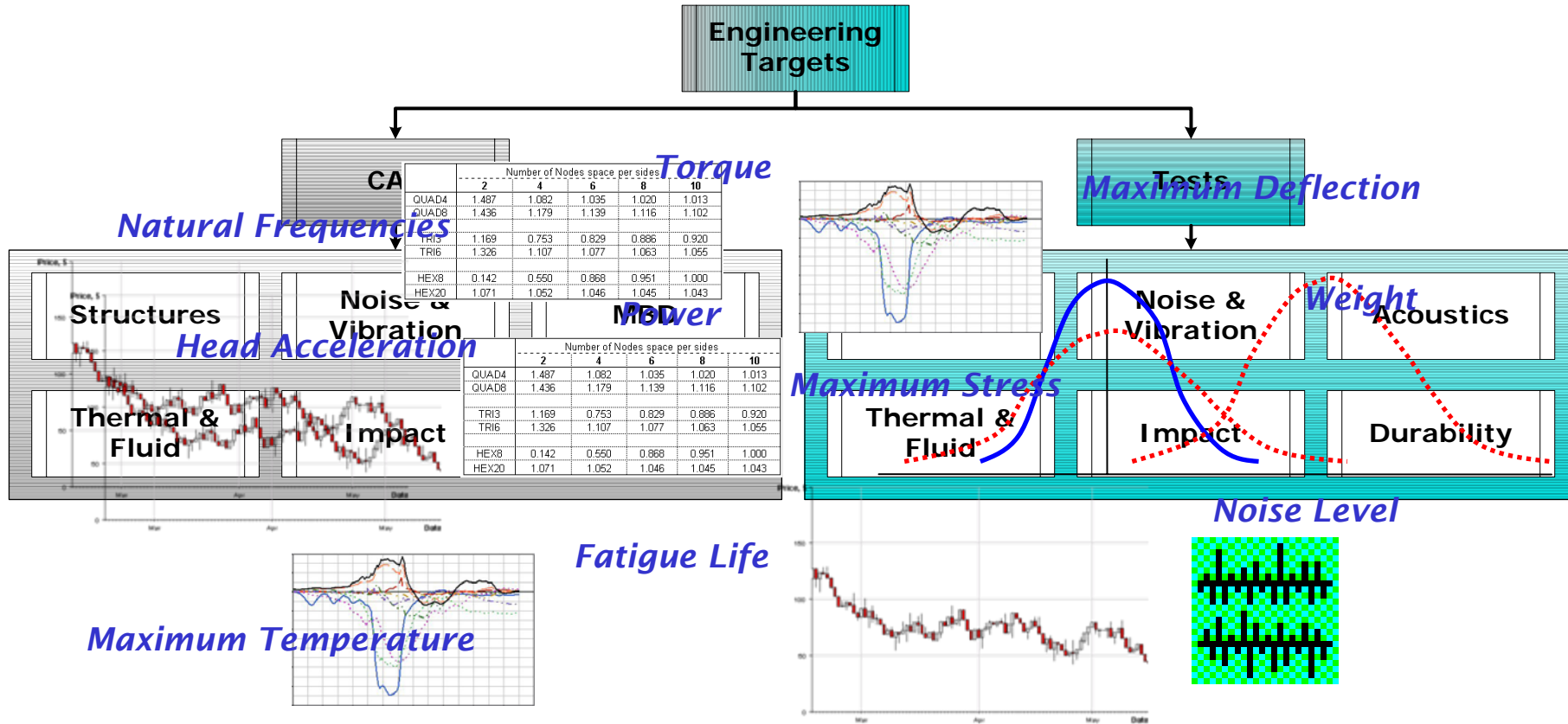
System Positioning





Essence of ADM Data Organization

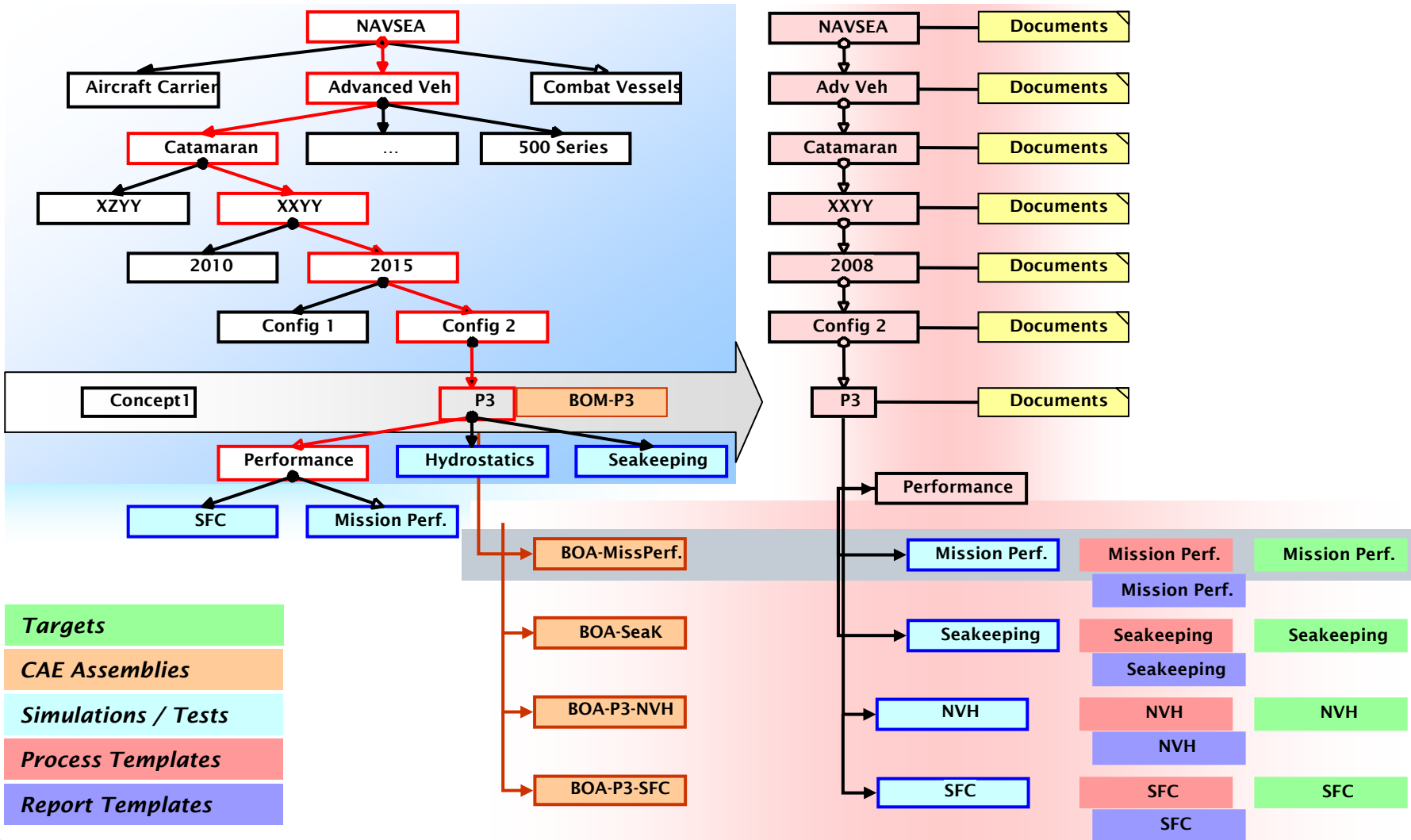
Organize CAE/Test Data by Validation Type

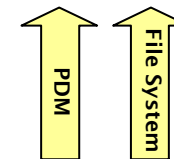
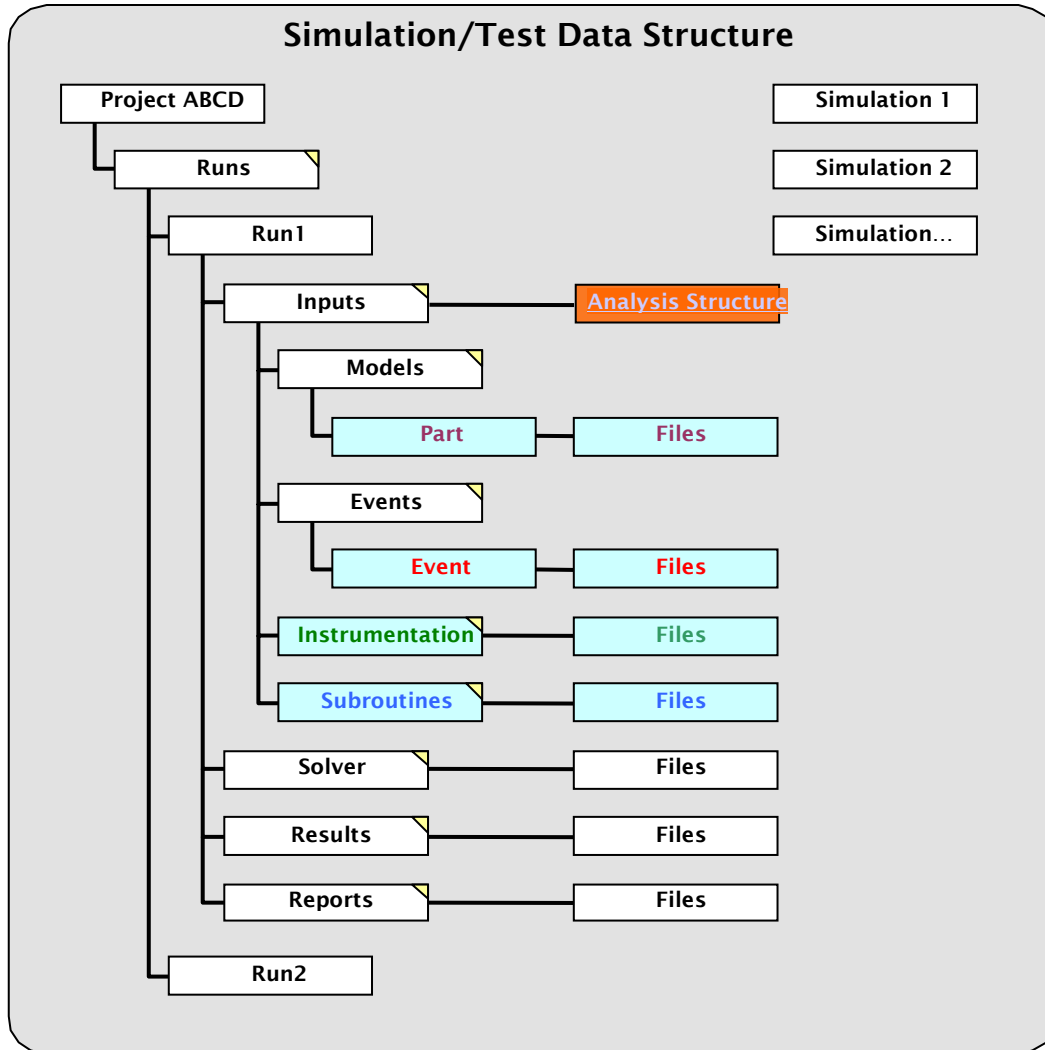


Present Product Performance Reports based on these METRICS

ADM Data Organization - 1

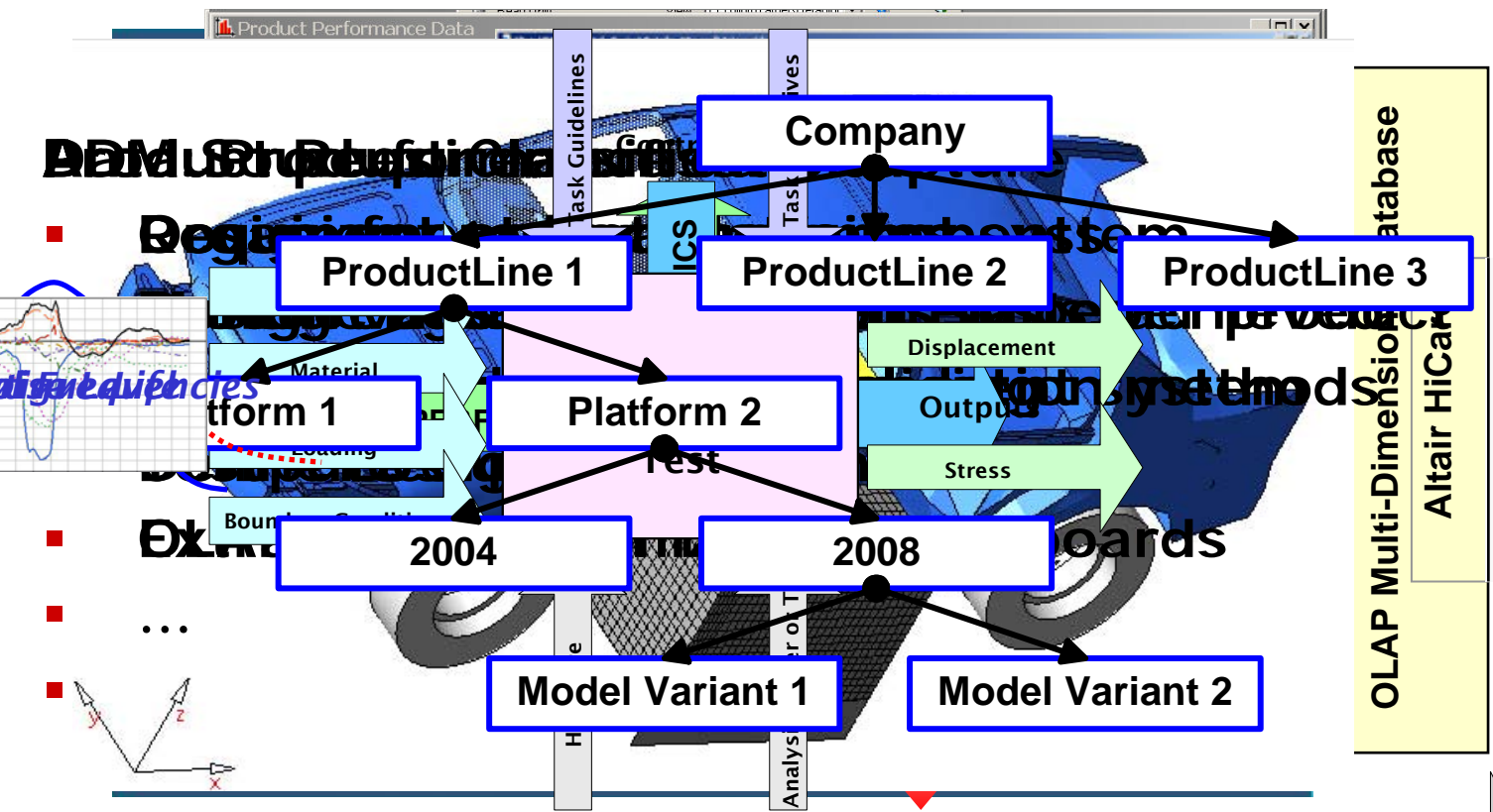
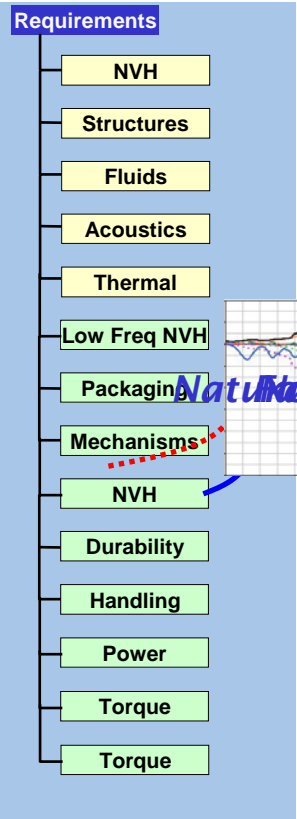
BOM for CAE Analysis Data



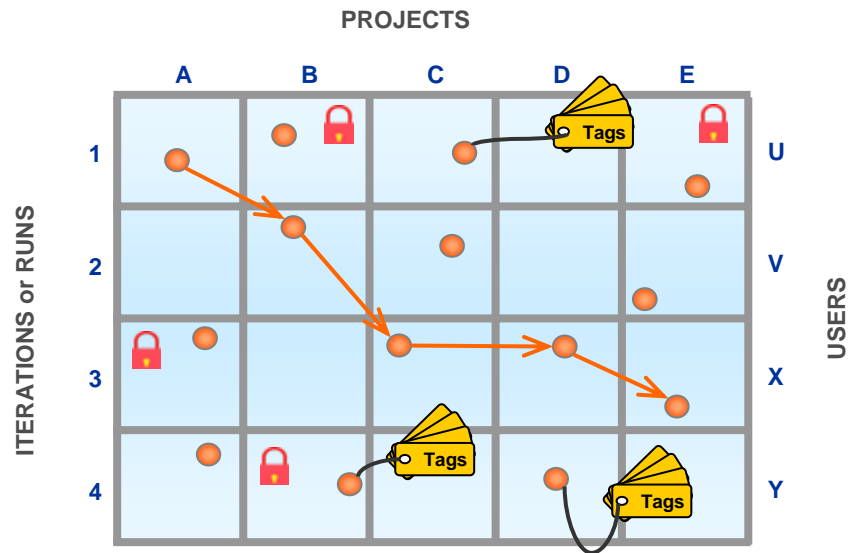
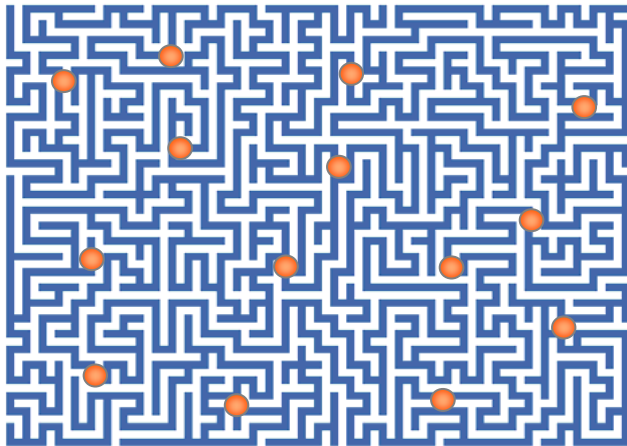


Standard BOM import formats:

- STEP AP214
- UGS PLMXML
- VPM/ATOEXPAND



Product Development Timeline



Magna-Steyr (Deployed)

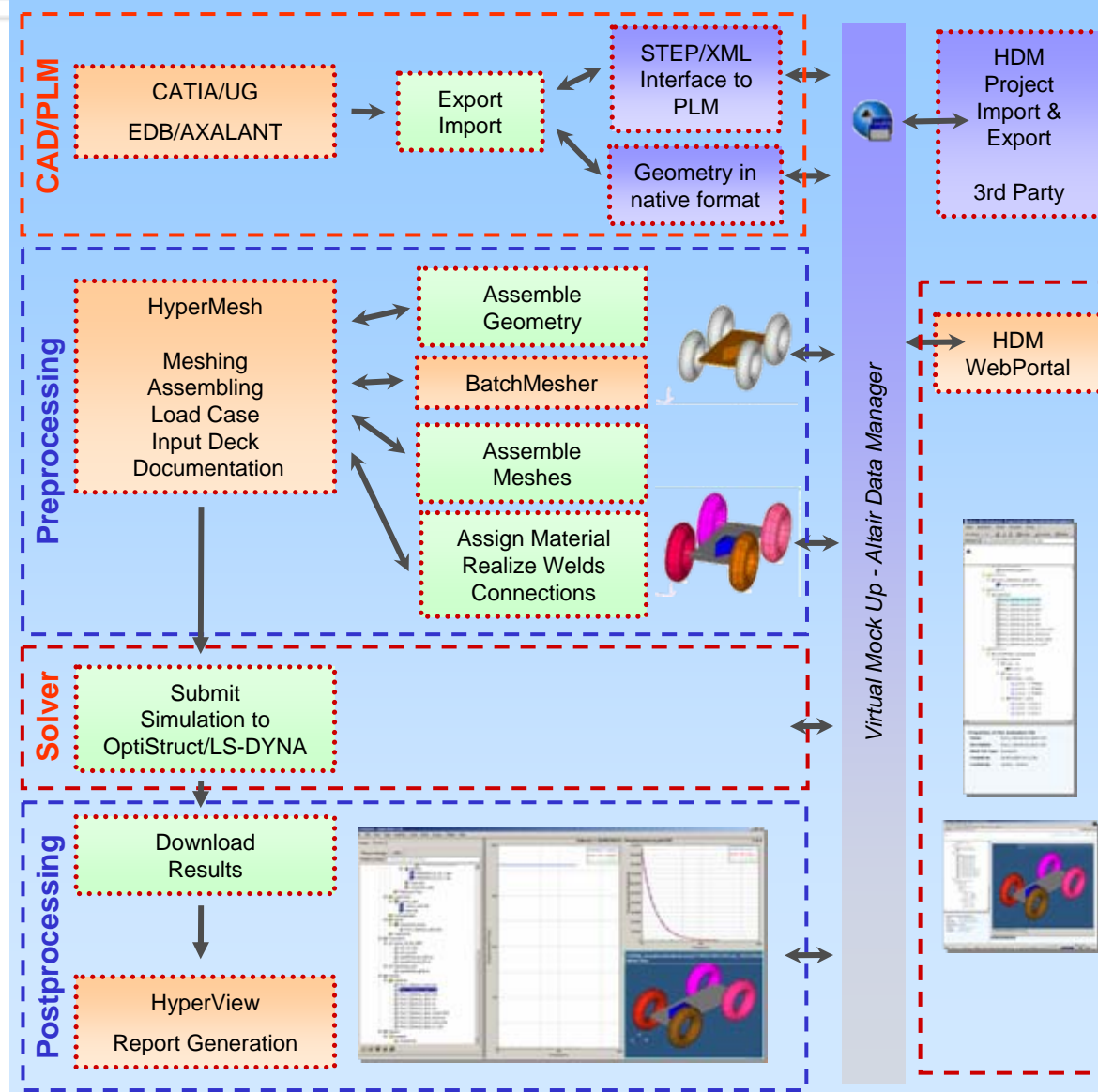
Description & Process

Complete modeling process to set up vehicle load cases and manage all data

- Interface to Product Structure
- Import of part geometry and applying transformations
- Assembling the model with transformation
- BatchMesh unmeshed geometries
- Material databases for solvers
- Apply load cases
- Import and Export of Simulations
- Load cases for OptiStruct & LS-DYNA
- Automated process documentation and reports
- HDM Web Portal to View the Reports

Benefits

- Centralized CAE Data Management
- Improve Data Supply Speed
- Standardization and reproducibility of CAE processes



Test Data Management (Deployed)

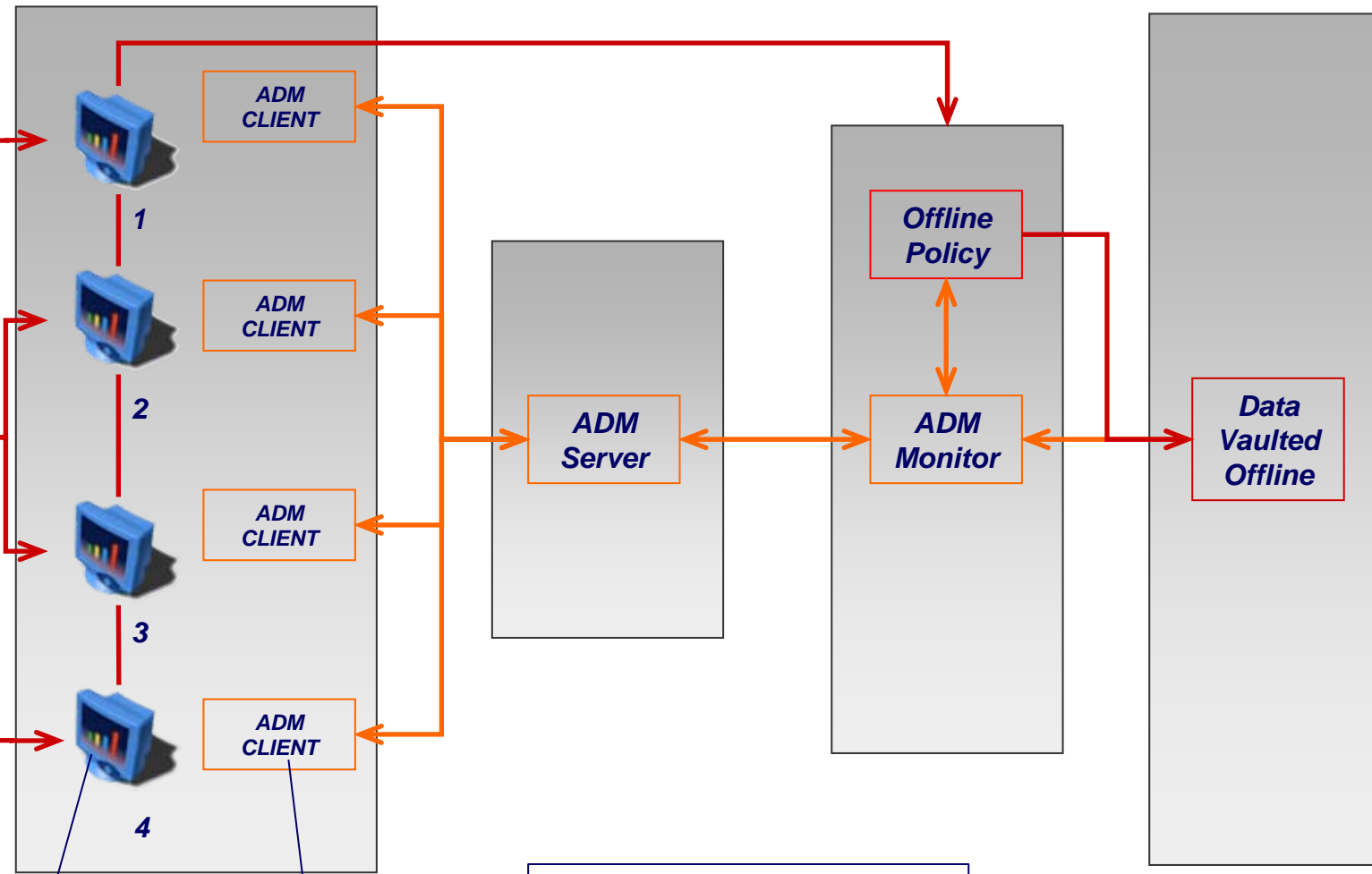
Engines

Test Facilities

Altair Data Manager (ADM)

Mass Storage Appliance

Long Term Storage



Interface PC's

ADM Clients Integrated with Post-Processing Software.



Background

1. ASSET is an EXPERT SYSTEM for early ship design
2. There are no physical parts during early phases of concept design
3. ASSET helps generate a variety of CONCEPT designs
4. Each CONCEPT comprises of a number of sub-modules
5. Each module focuses on a sub-system
6. Inputs for each module can come from preceding modules
7. Inputs can be manually entered
8. Each module generates a variety of reports
9. Reports from each sub-module provide **Key Performance Indicators**

10. **Ship programs span decades**
11. **Concept design spans years**
12. **Hundreds of Concepts are generated for a program**



Issues

1. There are no existing systems to **record** each Concept
2. There is a need to have available concise Concept summaries
3. There is a need to have the ability to review older Concepts
4. Concept records need to include information about all **INPUTS** and **REPORTS** from each sub-module of the Concept
5. It would be desirable to have Concept Comparison Dashboards



ADM Implementation Approach

- 1.** *ADM manages Simulation or Test data structures*
- 2.** *A simulation comprises of*
 - *Inputs*
 - *Solver Deck*
 - *Solver Output*
 - *Reports*
- 3.** *ADM provides the ability to define a high level product classification schema*
- 4.** *ADM allows complete configuration of meta-data (or searchable properties)*
- 5.** *ADM provides an infrastructure to record Performance Metrics, their Target Values, and Design Validation Plans*
- 6.** *ADM uses these data structures to provide very flexible dashboard generation using **Altair HiQube**, a multi-dimensional OLAP system*



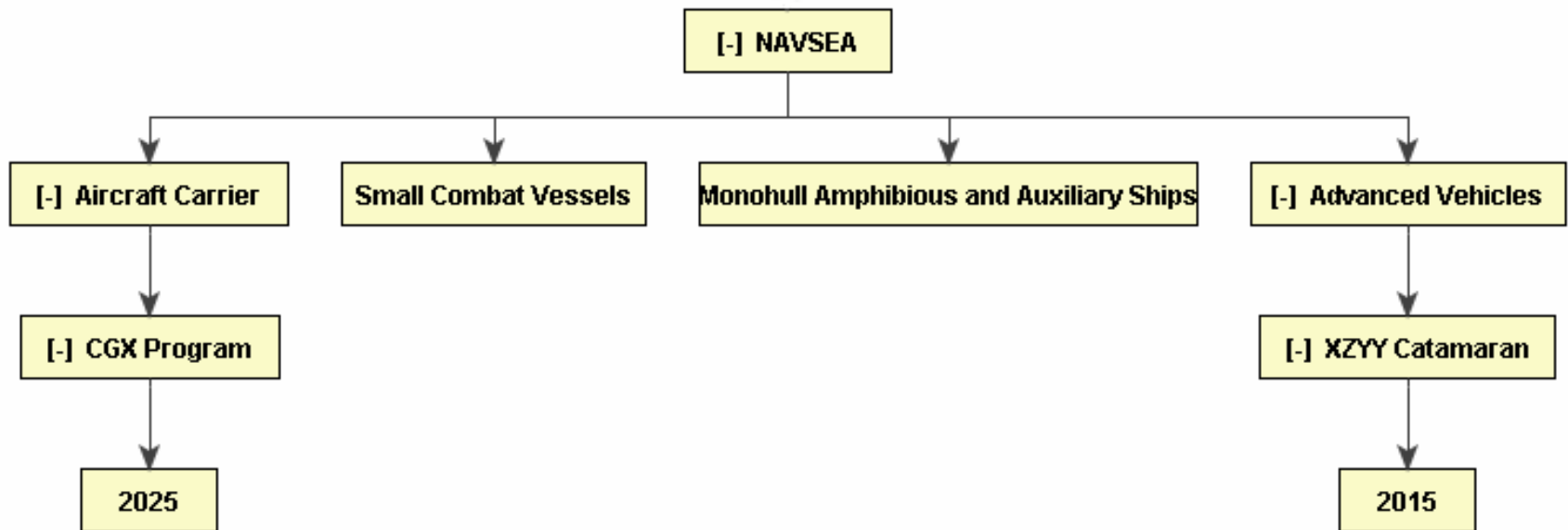
ADM Implementation: Proof of Concept

- 1. A high level Product Classification was created to represent NAVSEA programs*
- 2. Multiple Concepts were created for each program-year*
- 3. Each Concept was given a unique ID*
- 4. All sub-modules for each concept were created as simulation projects*
- 5. Input files and Reports were imported into these sub-modules*



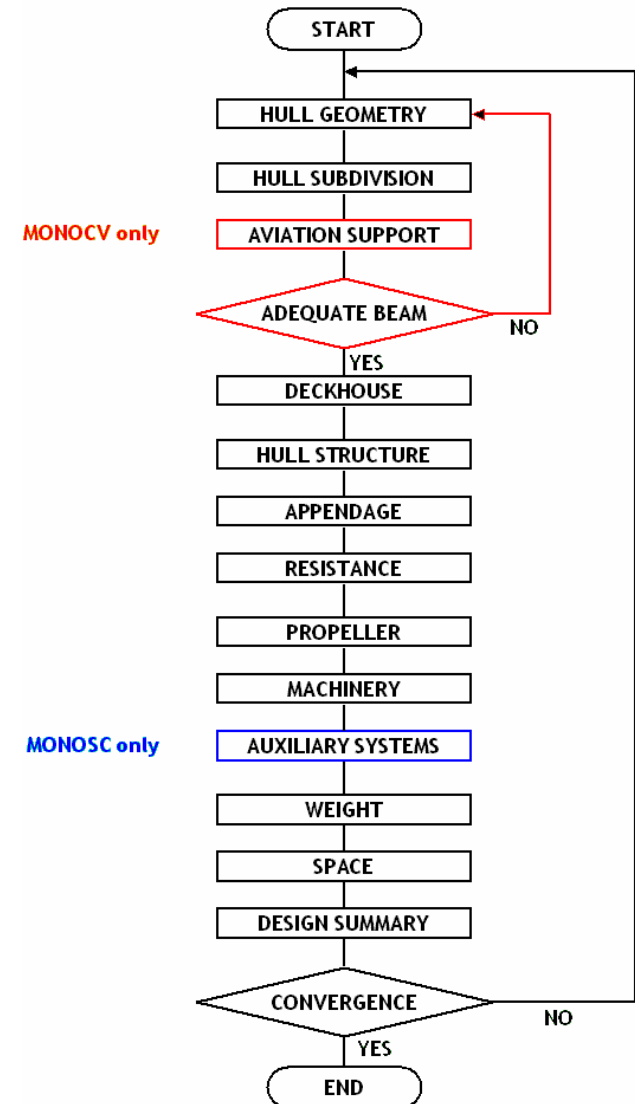
ADM Implementation: Product Classification Definition

- 1. High Level Product Classification for NAVSEA***
- 2. Each Program Year could contain hundreds of Concepts***
- 3. Access privileges can be assigned based on classification***



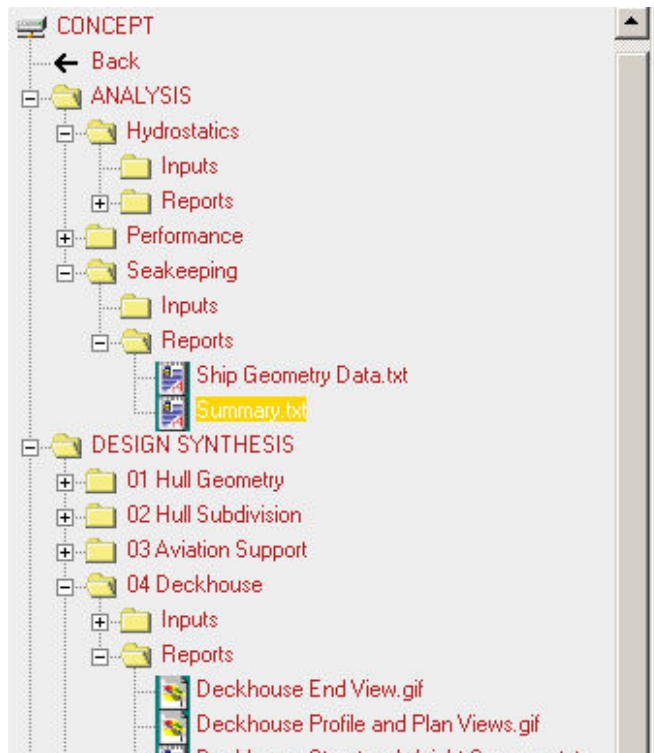
Modeling ASSET Modules in ADM

1. Each ASSET Module is modeled as a Simulation Project
2. Each ASSET Module has the following META-DATA
 - Concept Number
 - Project Name (eg. Hull Geometry, Hull Subdivision...)
 - Ship TYPE (MONOSC, MONOCV, ...)
 - Name of parent Project
 - Name of child projects
 - Creation, Modification dates
 - Name of creator
 - ...
3. Each ASSET Module in ADM contains sub-folders to capture all Inputs, Input Files, Output Files and Reports



ADM Implementation: Concept Sub-module Structure

1. Each Concept comprises of multiple sub-modules
2. Each sub-module has Inputs and Reports
3. Sample Concept structure is shown below



```
ASSET/MONOSC V5.0.0 - SEAKEEPING ANALYSIS - 2/ 2/2004 14:10
      DATABANK-MSC500.BNK  SHIP-FRIGATE

PRINTED REPORT NO. 1 - SUMMARY

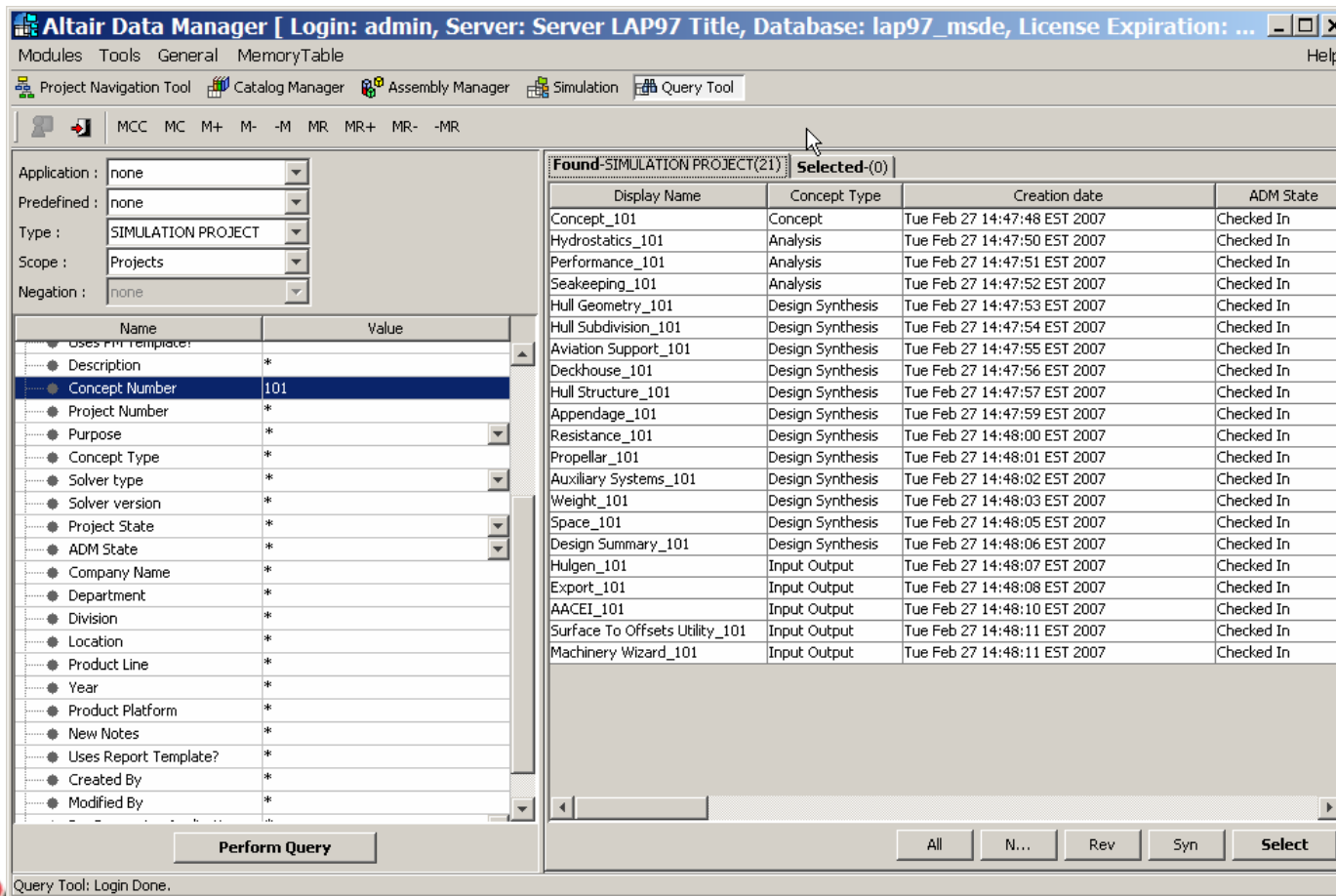
APPENDAGE IND-WITH

FULL LOAD WT, MTON      3997.8

                                FULL LOAD
                                -----
BALES RANK
RANK OF THE SYNTHESIZED SHIP (ACTUAL DISP)      4.406
RANK OF THE SYNTHESIZED SHIP (NORMALIZED)      5.313
RANK OF THE CLOSEST DATA BASE HULL (NORMALIZED) 5.080
ID NO OF CLOSEST DATA BASE SHIP                11
MCCREIGHT RANK
RANK OF THE SYNTHESIZED SHIP (ACTUAL SHIP)      5.914
RANK OF THE CLOSEST DATA BASE HULL              5.965
ID NO OF CLOSEST DATA BASE SHIP                1
```

ADM Implementation: Concept Number based QUERY example

1. All simulation projects with Concept Number = 101 are returned through a query based on Simulation Project meta-data



Altair Data Manager [Login: admin, Server: Server LAP97 Title, Database: lap97_msde, License Expiration: ...]

Modules Tools General MemoryTable Help

Project Navigation Tool Catalog Manager Assembly Manager Simulation Query Tool

MCC MC M+ M- -M MR MR+ MR- -MR

Application : none
Predefined : none
Type : SIMULATION PROJECT
Scope : Projects
Negation : none

Name	Value
Description	*
Concept Number	101
Project Number	*
Purpose	*
Concept Type	*
Solver type	*
Solver version	*
Project State	*
ADM State	*
Company Name	*
Department	*
Division	*
Location	*
Product Line	*
Year	*
Product Platform	*
New Notes	*
Uses Report Template?	*
Created By	*
Modified By	*

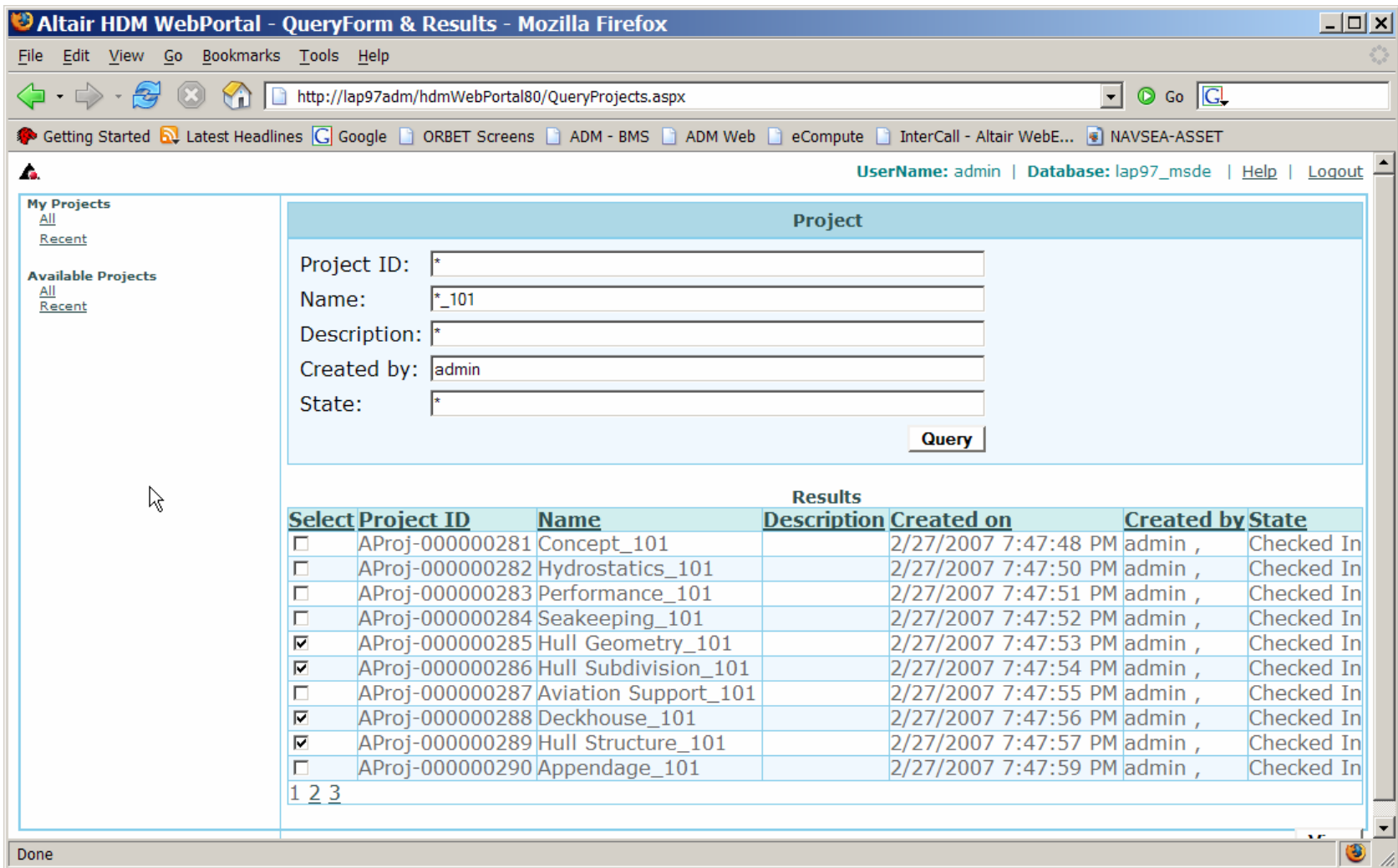
Found-SIMULATION PROJECT(21) Selected-(0)

Display Name	Concept Type	Creation date	ADM State
Concept_101	Concept	Tue Feb 27 14:47:48 EST 2007	Checked In
Hydrostatics_101	Analysis	Tue Feb 27 14:47:50 EST 2007	Checked In
Performance_101	Analysis	Tue Feb 27 14:47:51 EST 2007	Checked In
Seakeeping_101	Analysis	Tue Feb 27 14:47:52 EST 2007	Checked In
Hull Geometry_101	Design Synthesis	Tue Feb 27 14:47:53 EST 2007	Checked In
Hull Subdivision_101	Design Synthesis	Tue Feb 27 14:47:54 EST 2007	Checked In
Aviation Support_101	Design Synthesis	Tue Feb 27 14:47:55 EST 2007	Checked In
Deckhouse_101	Design Synthesis	Tue Feb 27 14:47:56 EST 2007	Checked In
Hull Structure_101	Design Synthesis	Tue Feb 27 14:47:57 EST 2007	Checked In
Appendage_101	Design Synthesis	Tue Feb 27 14:47:59 EST 2007	Checked In
Resistance_101	Design Synthesis	Tue Feb 27 14:48:00 EST 2007	Checked In
Propellar_101	Design Synthesis	Tue Feb 27 14:48:01 EST 2007	Checked In
Auxiliary Systems_101	Design Synthesis	Tue Feb 27 14:48:02 EST 2007	Checked In
Weight_101	Design Synthesis	Tue Feb 27 14:48:03 EST 2007	Checked In
Space_101	Design Synthesis	Tue Feb 27 14:48:05 EST 2007	Checked In
Design Summary_101	Design Synthesis	Tue Feb 27 14:48:06 EST 2007	Checked In
Hulgen_101	Input Output	Tue Feb 27 14:48:07 EST 2007	Checked In
Export_101	Input Output	Tue Feb 27 14:48:08 EST 2007	Checked In
AAACEI_101	Input Output	Tue Feb 27 14:48:10 EST 2007	Checked In
Surface To Offsets Utility_101	Input Output	Tue Feb 27 14:48:11 EST 2007	Checked In
Machinery Wizard_101	Input Output	Tue Feb 27 14:48:11 EST 2007	Checked In

Perform Query All N... Rev Syn Select

Query Tool: Login Done.

ADM Implementation: Web Portal Query example



The screenshot shows a web browser window titled "Altair HDM WebPortal - QueryForm & Results - Mozilla Firefox". The address bar shows the URL "http://lap97adm/hdmWebPortal80/QueryProjects.aspx". The browser's address bar and tabs are visible, including "Getting Started", "Latest Headlines", "Google", "ORBET Screens", "ADM - BMS", "ADM Web", "eCompute", "InterCall - Altair WebE...", and "NAVSEA-ASSET".

The main content area is divided into two sections:

- My Projects:** Contains links for "All" and "Recent".
- Available Projects:** Contains links for "All" and "Recent".

The central section is titled "Project" and contains a query form with the following fields:

- Project ID: *
- Name: *_101
- Description: *
- Created by: admin
- State: *

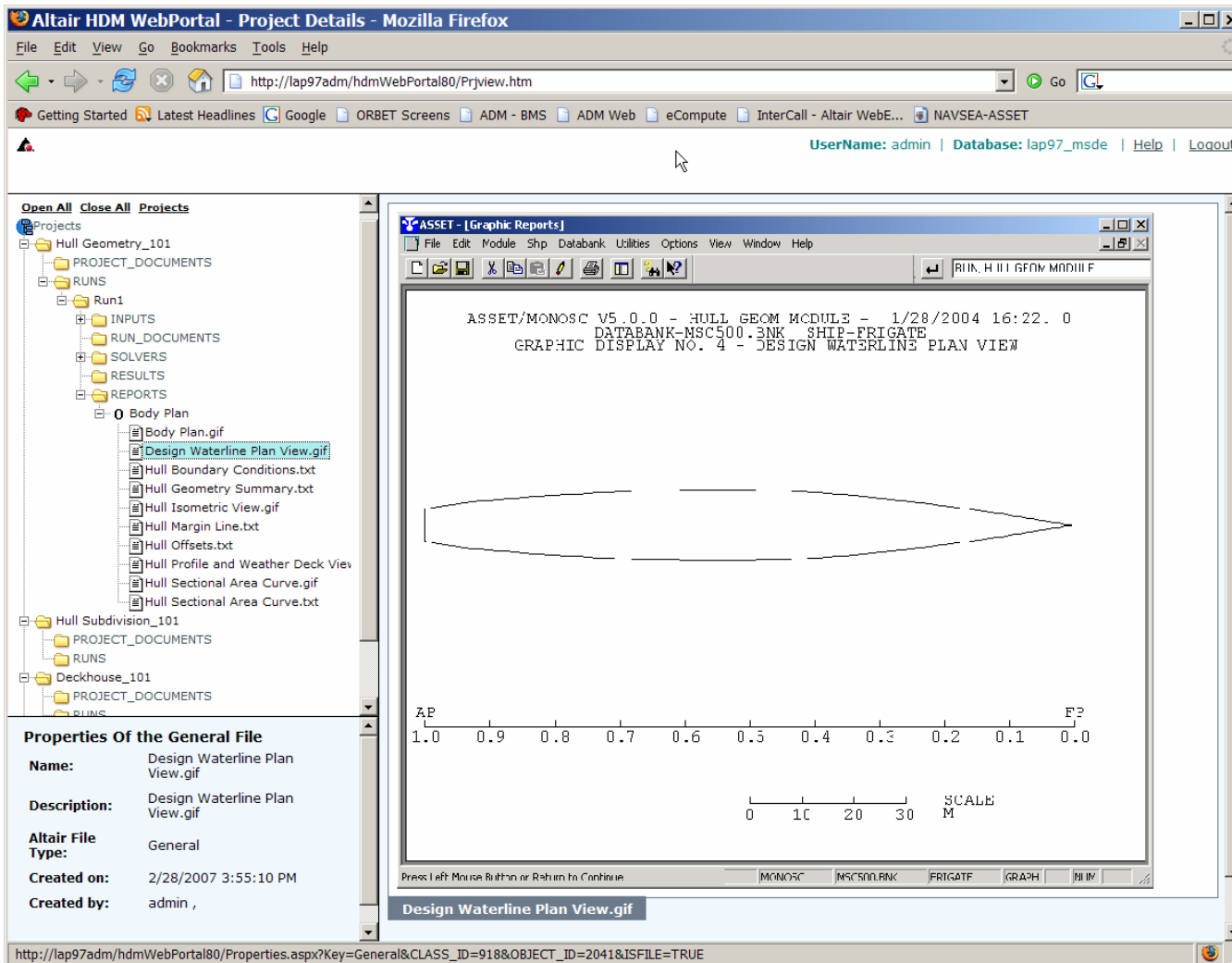
A "Query" button is located below the form fields.

Below the form is a table titled "Results" with the following columns: Select, Project ID, Name, Description, Created on, Created by, and State. The table contains 10 rows of data, with the first row selected.

Select	Project ID	Name	Description	Created on	Created by	State
<input type="checkbox"/>	AProj-000000281	Concept_101		2/27/2007 7:47:48 PM	admin ,	Checked In
<input type="checkbox"/>	AProj-000000282	Hydrostatics_101		2/27/2007 7:47:50 PM	admin ,	Checked In
<input type="checkbox"/>	AProj-000000283	Performance_101		2/27/2007 7:47:51 PM	admin ,	Checked In
<input type="checkbox"/>	AProj-000000284	Seakeeping_101		2/27/2007 7:47:52 PM	admin ,	Checked In
<input checked="" type="checkbox"/>	AProj-000000285	Hull Geometry_101		2/27/2007 7:47:53 PM	admin ,	Checked In
<input checked="" type="checkbox"/>	AProj-000000286	Hull Subdivision_101		2/27/2007 7:47:54 PM	admin ,	Checked In
<input type="checkbox"/>	AProj-000000287	Aviation Support_101		2/27/2007 7:47:55 PM	admin ,	Checked In
<input checked="" type="checkbox"/>	AProj-000000288	Deckhouse_101		2/27/2007 7:47:56 PM	admin ,	Checked In
<input checked="" type="checkbox"/>	AProj-000000289	Hull Structure_101		2/27/2007 7:47:57 PM	admin ,	Checked In
<input type="checkbox"/>	AProj-000000290	Appendage_101		2/27/2007 7:47:59 PM	admin ,	Checked In

At the bottom of the table, there are pagination links: 1 2 3.

ADM Implementation: Web Portal Sub-module Reports View example



The screenshot displays the Altair HDM WebPortal interface in Mozilla Firefox. The browser address bar shows the URL `http://lap97adm/hdmWebPortal80/Prjview.htm`. The page header includes the text "UserName: admin | Database: lap97_msde | Help | Logout".

On the left side, a project tree is visible under "Projects". The tree structure includes:

- Projects
 - Hull Geometry_101
 - PROJECT_DOCUMENTS
 - RUNS
 - Run1
 - INPUTS
 - RUN_DOCUMENTS
 - SOLVERS
 - RESULTS
 - REPORTS
 - 0 Body Plan
 - Body Plan.gif
 - Design Waterline Plan View.gif
 - Hull Boundary Conditions.txt
 - Hull Geometry Summary.txt
 - Hull Isometric View.gif
 - Hull Margin Line.txt
 - Hull Offsets.txt
 - Hull Profile and Weather Deck View
 - Hull Sectional Area Curve.gif
 - Hull Sectional Area Curve.txt
 - Hull Subdivision_101
 - PROJECT_DOCUMENTS
 - RUNS
 - Deckhouse_101
 - PROJECT_DOCUMENTS
 - RUNS

The "Properties Of the General File" section at the bottom left shows:

- Name: Design Waterline Plan View.gif
- Description: Design Waterline Plan View.gif
- Altair File Type: General
- Created on: 2/28/2007 3:55:10 PM
- Created by: admin ,

The main content area displays a report window titled "ASSET - [Graphic Reports]". The report text is:

```
ASSET/MONOSC V5.0.0 - HULL GEOM MODULE - 1/28/2004 16:22.0  
DATABANK-MSC500.3NK SHIP-FRIGATE  
GRAPHIC DISPLAY NO. 4 - DESIGN WATERLINE PLAN VIEW
```

Below the text is a technical drawing of a ship's hull waterline plan view. The drawing shows a cross-section of the hull with a curved bottom and a pointed bow. The horizontal axis is labeled with "A.P" at the left end and "F.P" at the right end. The axis has numerical markings from 1.0 to 0.0 in increments of 0.1. Below the axis, there is a scale bar with markings at 0, 10, 20, and 30, and the text "SCALE: M".

At the bottom of the report window, there are several buttons: "MONOSC", "MSC500.3NK", "FRIGATE", "GRAPH", and "FIN".

ADM Implementation: Additional Enhancements

- 1.*** While ADM can be used OTB to manage all FILES generated and used by all ASSET modules along with their context, simple integrations to import files through a directory structure are possible
- 2.*** If **Key Performance Indicators** are defined for each Module within a Concept, it will be possible to create extensive dashboards to allow for concept comparisons based on the Concepts managed by ADM



