Engineering data Management addressing Virtual Aircraft Development

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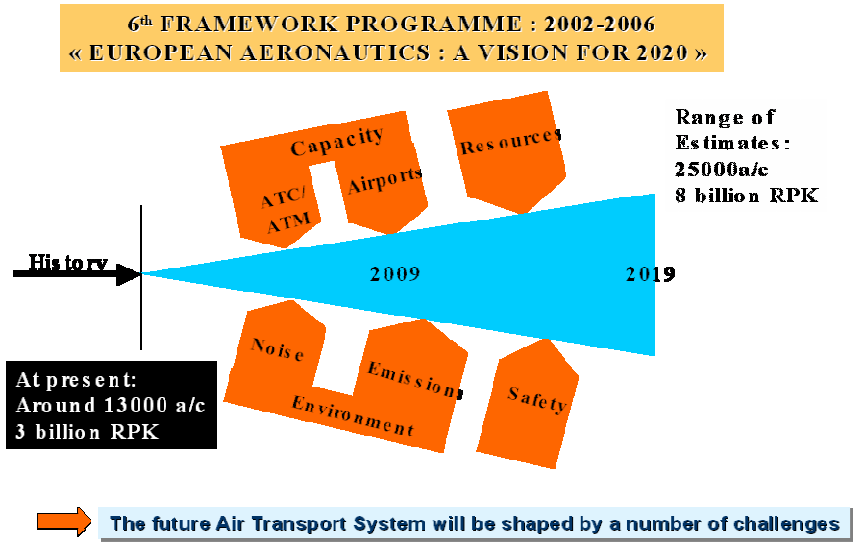
Director Global Aerospace Business Development

Agenda

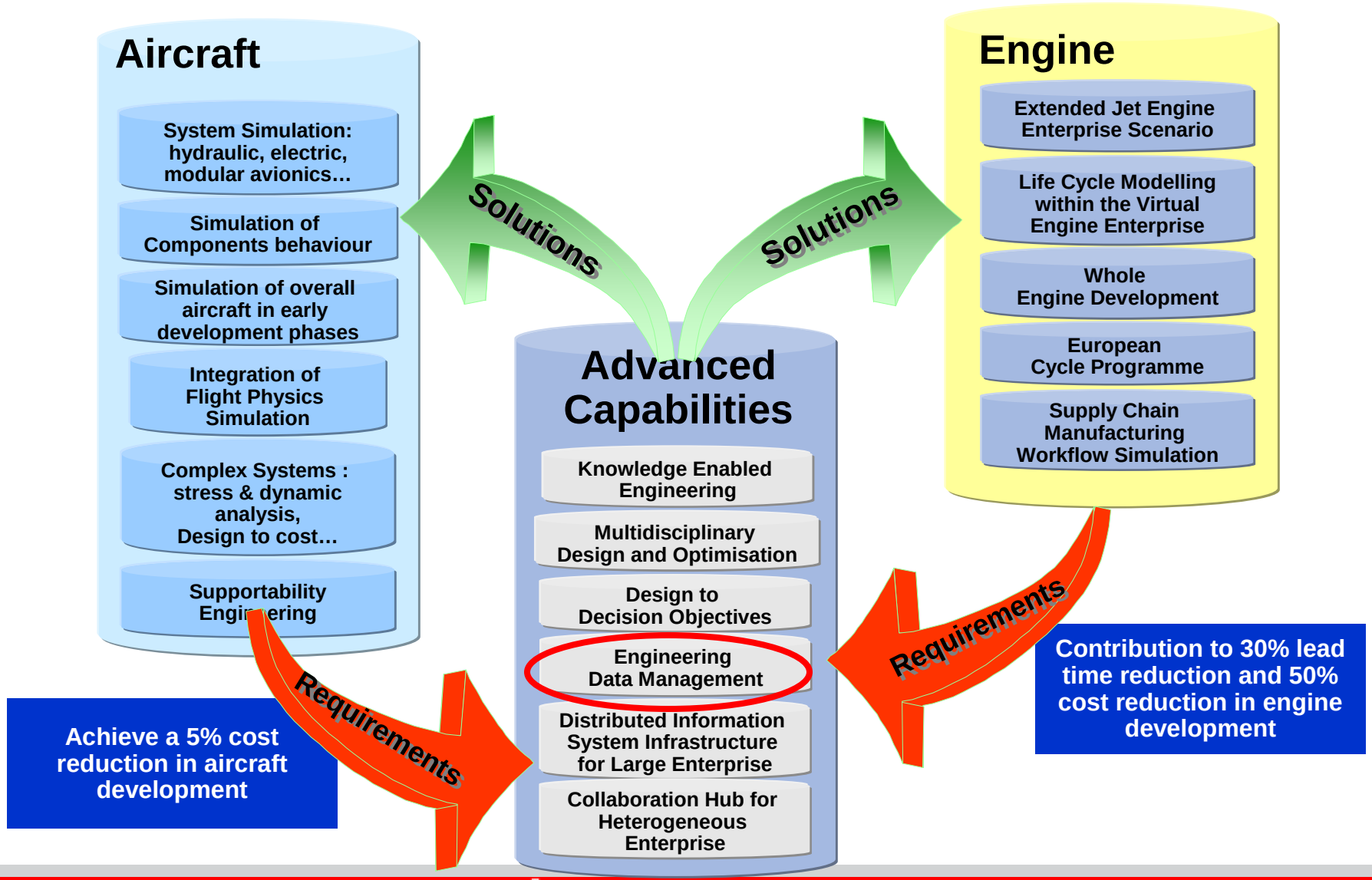
- ACARE 2020 Vision
- VIVACE Project Structure
- EDM Specification to Implementation
  - Controlled Engineering with EDM
  - EDM Business Objectives
  - EDM Main Drivers
  - Interoperability Required
  - EDM Model Definition
  - EDM Developed Concept
  - The EDM Framework for Controlled Collaboration
  - Use Cases Demonstration Scenario
- VIVACE outcomes Industrialization with MSC Virtual Product Development Solution
- Customers Engagements
- Perspectives/Conclusions

European Aeronautics: A Vision for 2020



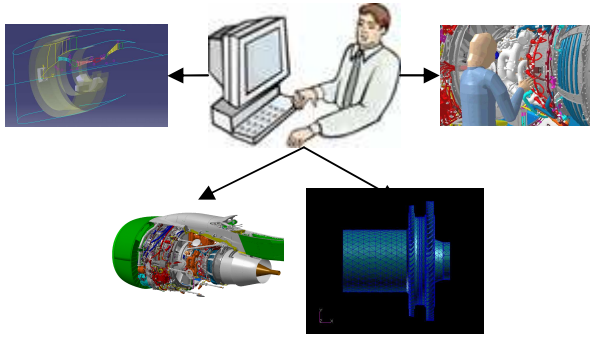
- 80% cut in NO_x emissions
- Halving perceived aircraft noise
- Five-fold reduction in accidents
- Air traffic system capable of handling 16 million flights a year
- 50% cut in CO_2 emissions per pass-Km
- 99% of all flights within 15 minutes of timetable
- 50% reduction of time to market

VIVACE Project structure



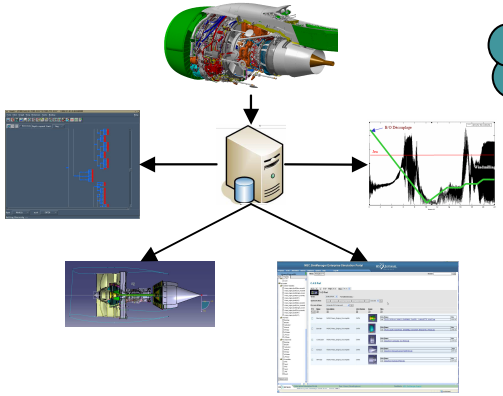
Controlled Engineering with EDM

Engineering



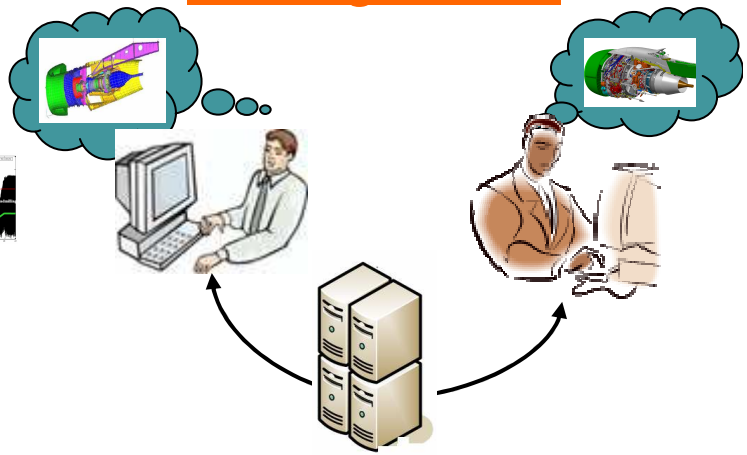
Concurrent activities for product development

Data



Data related to product

Management



Collaborative and partnership view

EDM addresses

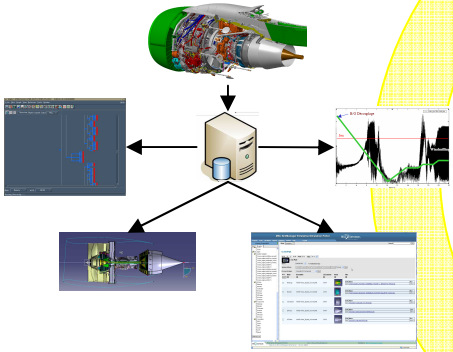
- **In context** management of heterogeneous data (Design & Simulation data)
- Persistence of **relevant information** for exchange & sharing
- Management of **business process** between partners, domains and disciplines

EDM Business Objectives

Access and navigation on information to give a global overview on all the final product data

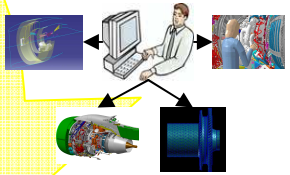
Triggering of the workflows activities between actors / teams / partners…

Management of all actors activities at a global level



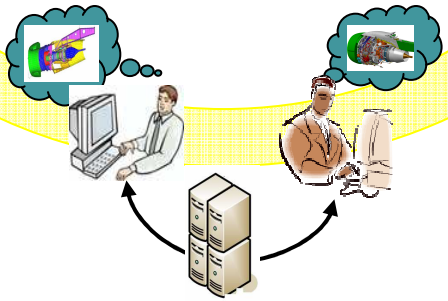
Data related to product

Monitor multi-views activities and manage collaborative environment



Concurrent activities for product development

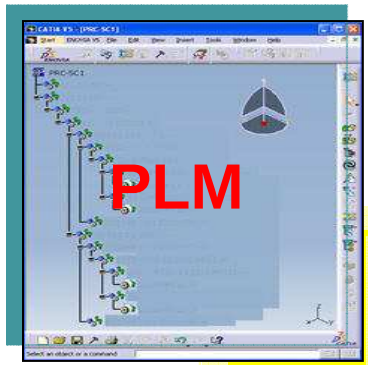
Access and visualisation of information with regards to the end-user's profile

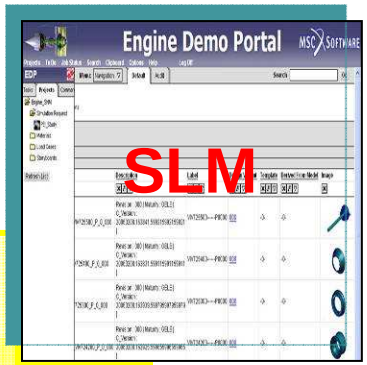


Collaborative and partnership view

Setup of a global dashboard to monitor the product data maturity and to early visualize the Virtual Aircraft

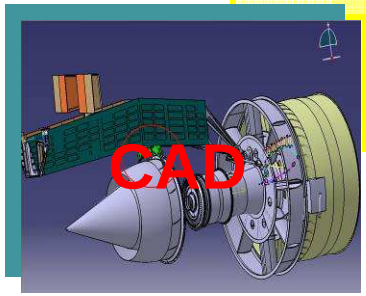
EDM Main Drivers





Develop a non-invasive framework

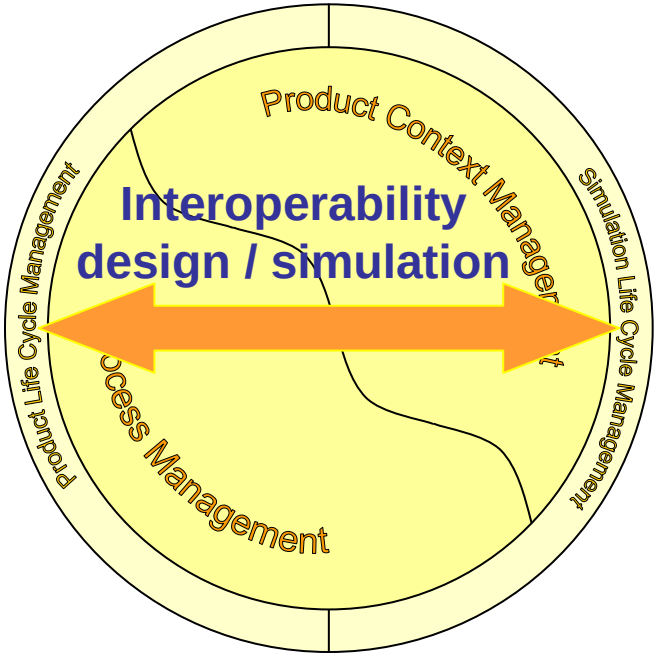
Standard based ontology



- ***Add-on based solution*** to complement user environment features provided by COTS
- ***Information Model*** that provides a context of usage for each data
- ***Domains interoperability*** by using a semantic reference based on standards

Develop services that provide information in context

Interoperability Required (1/2)



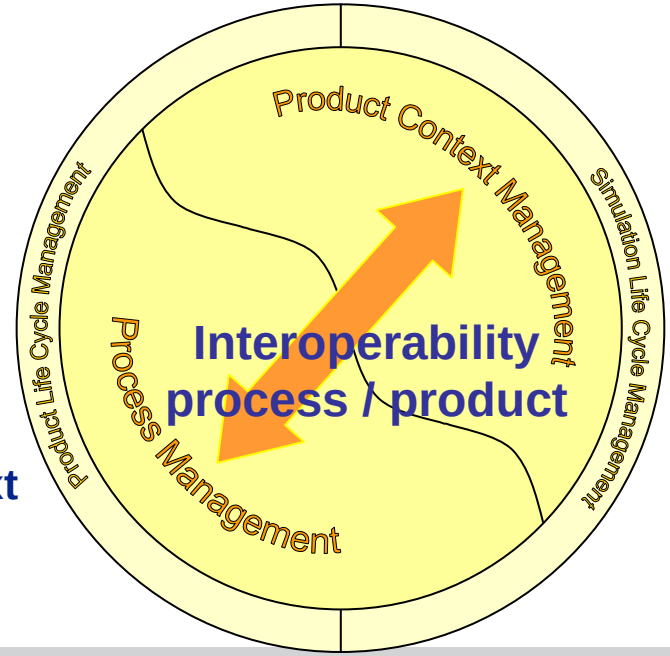
at discipline level: **interoperability for coherency and consistency of all Engineering data**

Design and Simulation interoperability through:

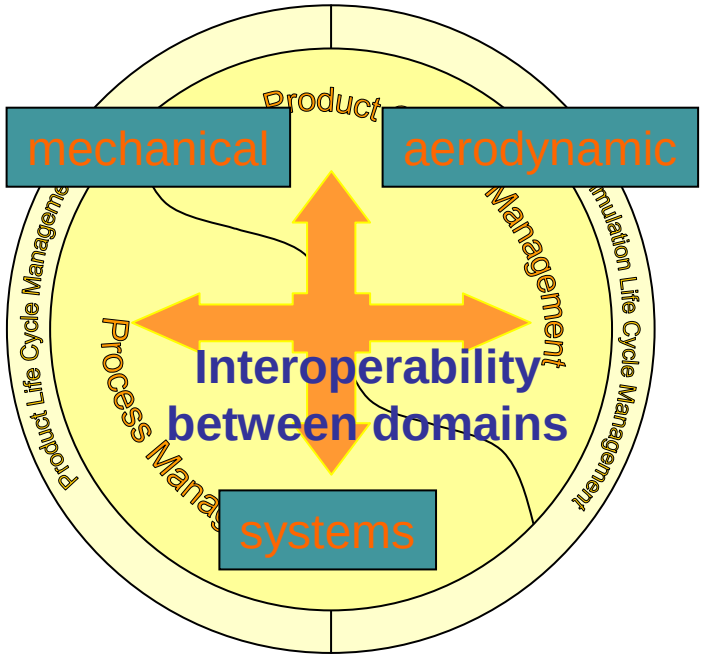
- **Information Exchanges**
- **Environments definition (context)**

at context level:

- **Interoperability and integration of Product and Process to work in Context**

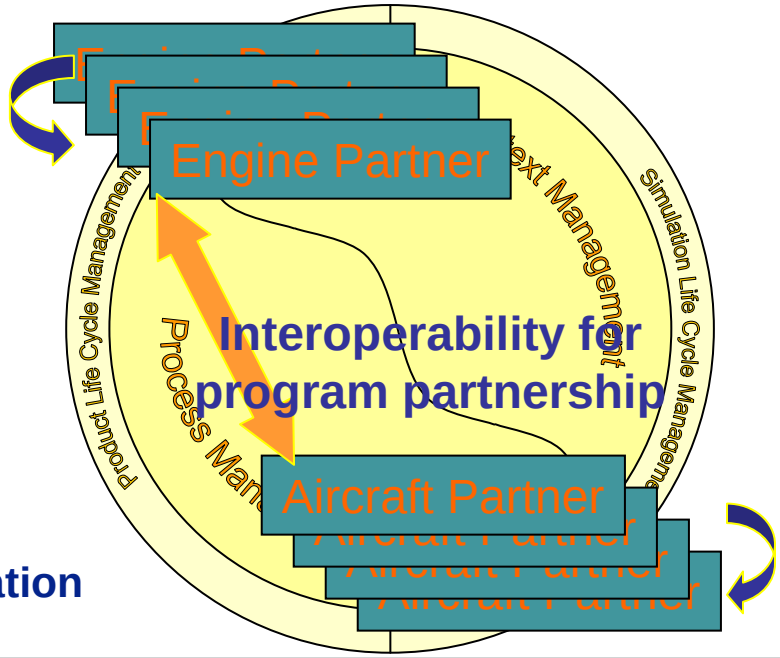


Interoperability Required (2/2)



at domain level:

- **Mechanical / Systems / Aerodynamic**
  (associated to a common dictionary to share references at project level)



at business level for extended enterprise:

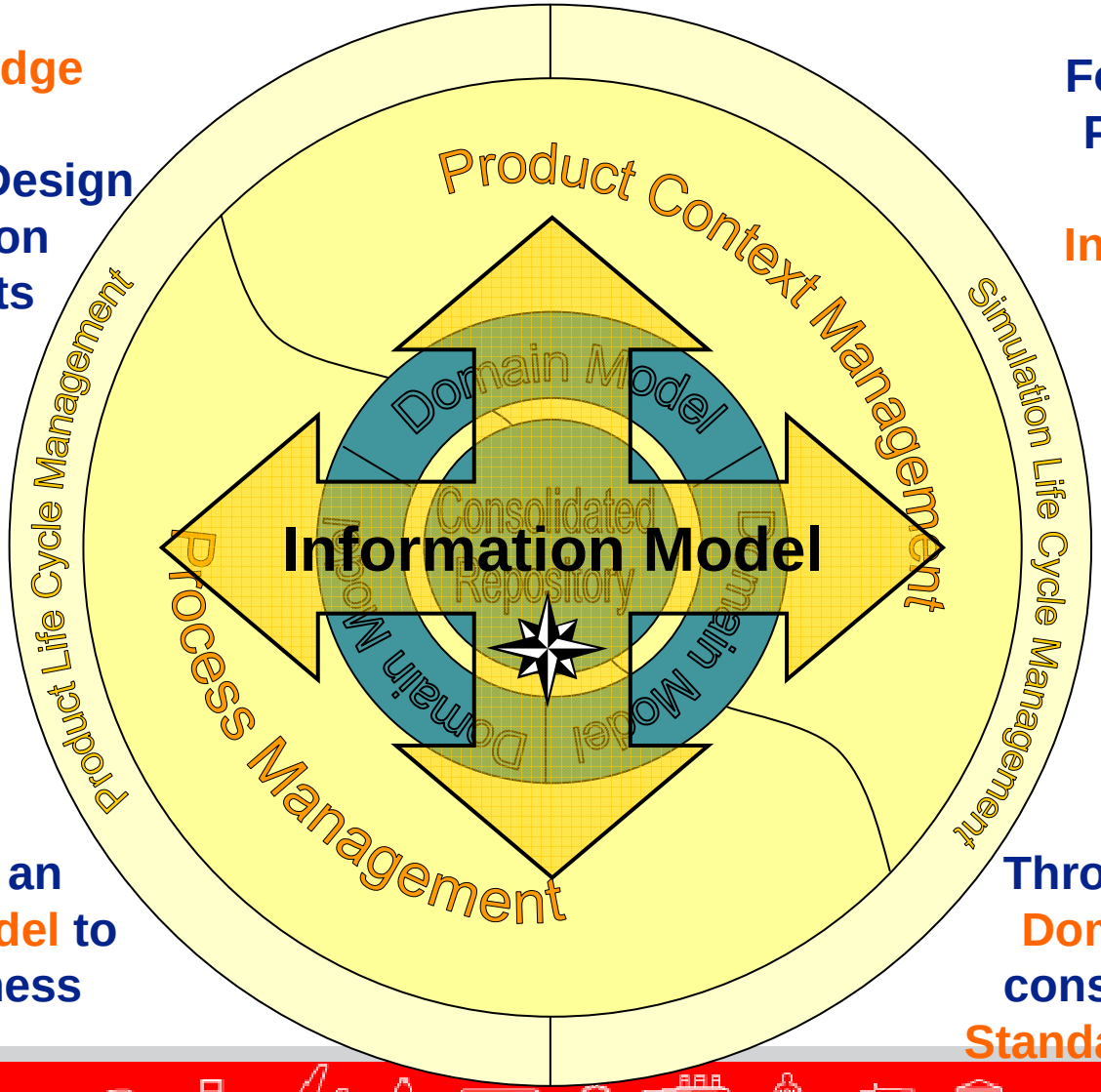
interoperability for data exchange and sharing

- **Collaboration for engine integration**
- **Collaboration for engine-aircraft integration**

EDM Model Definition

To create a bridge between heterogeneous Design and Simulation environments

For managing Product and Process Information in Context



By providing an Information Model to perform business activities

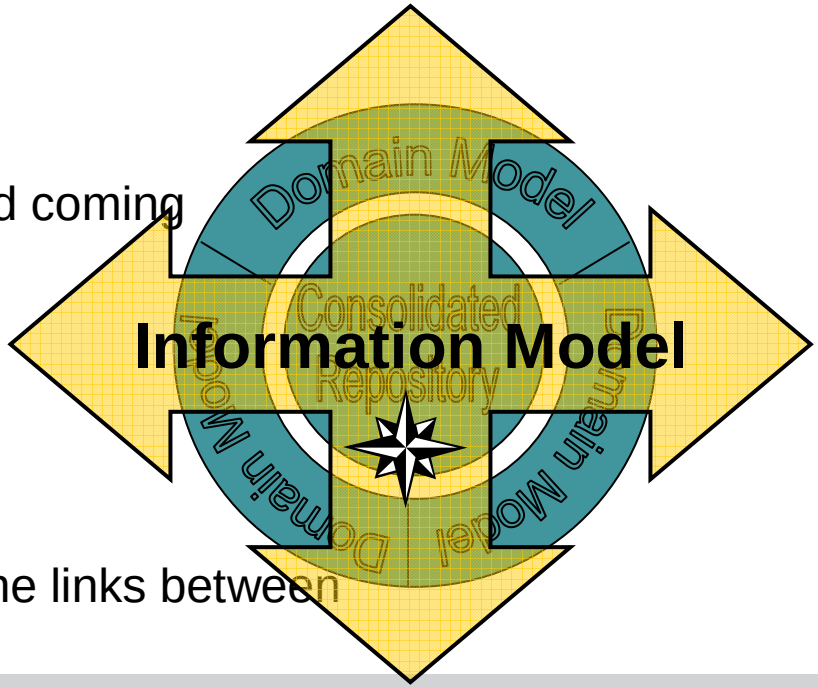
Through relevant Domain Models consolidated in a Standard Repository

EDM Developed Concepts

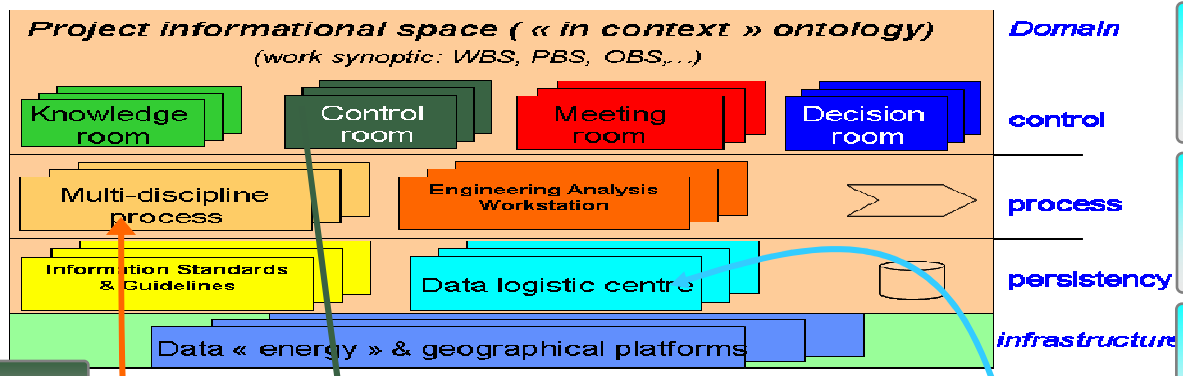
- Domain Model
  - Sub-set of a domain data structure that contains the relevant necessary information to be shared
  - Enables interoperability between
    - Disciplines (Design, Simulation, Test, etc.)
    - Domains (Mechanical, Aerodynamic, Thermal, etc.)
    - Organisations

- Consolidated Repository
  - Contains all information to be shared and coming from the Domain Models
  - Based on STEP Standard (PLCS)

- Information Model
  - Navigation & Persistence Services
  - Enables context management through the links between Product, Process & Resources



The EDM Framework for Controlled Collaboration



EDM-02
Product life cycle mgmt service

EDM-03
Simulation life cycle mgmt service

EDM-04
Product context mgmt service

EDM-06
Consolidated repository service

EDM-07
Consolidated vault service

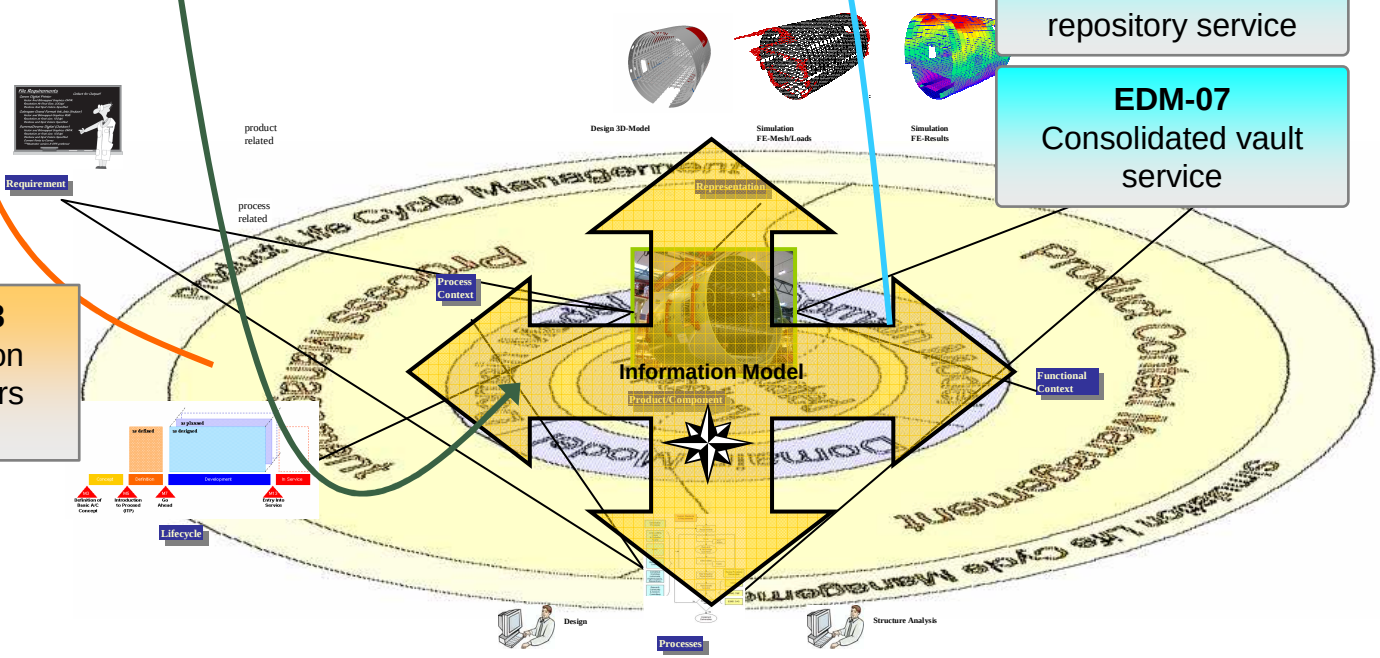
EDM-05
Process mgmt service

EDM-01B
Information model navigator service

EDM-01A
Information model builder service

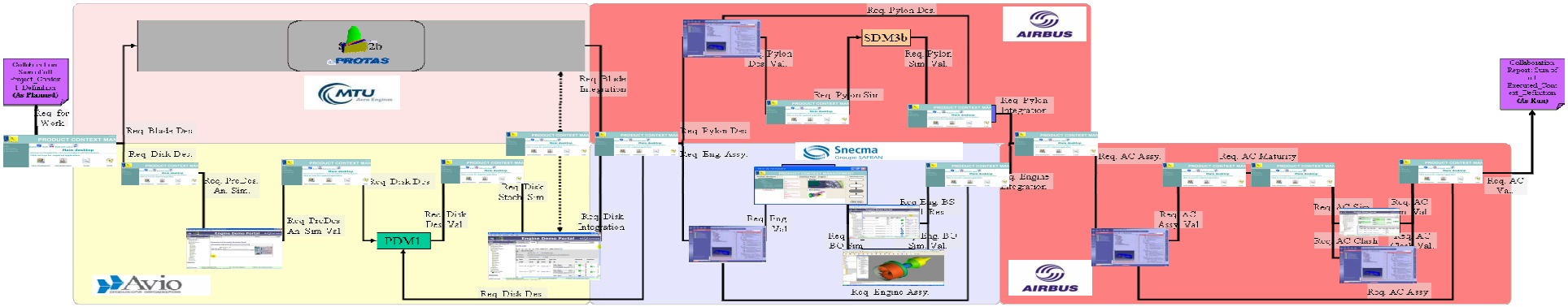
EDM-08
Application connectors service

EDM provides:
- **Services for VIVACE Toolbox**

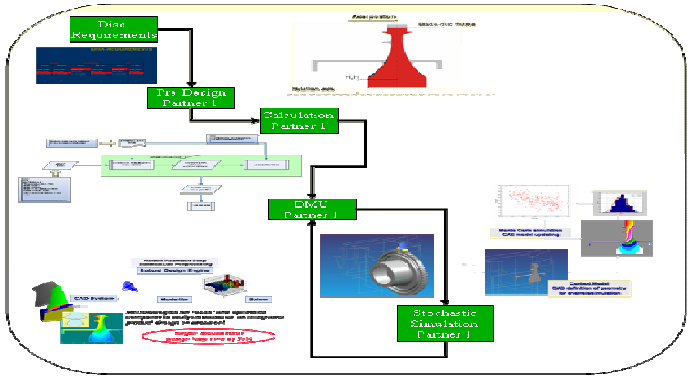


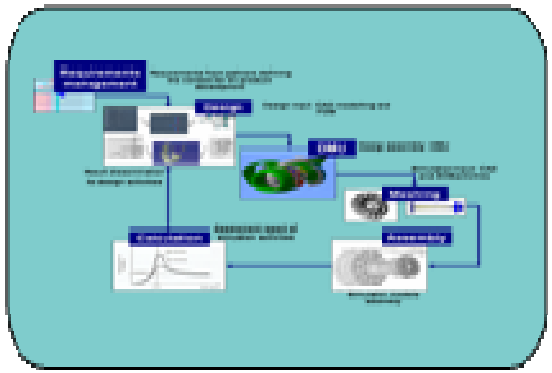
EDM Implements:
- **Standard based ontology**
- **Non-invasive framework**
- **Information in context**

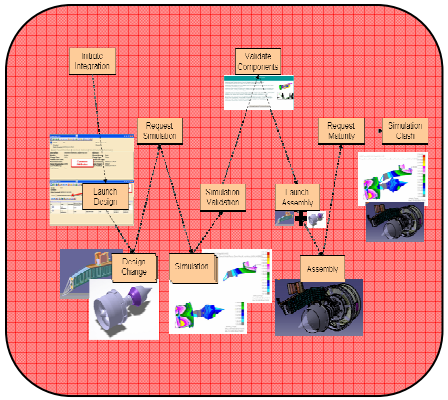
Use Cases Demonstration Scenario



Preliminary Design Stochastic simulation | **Integrator Design Process** | **OEM Validation Process**



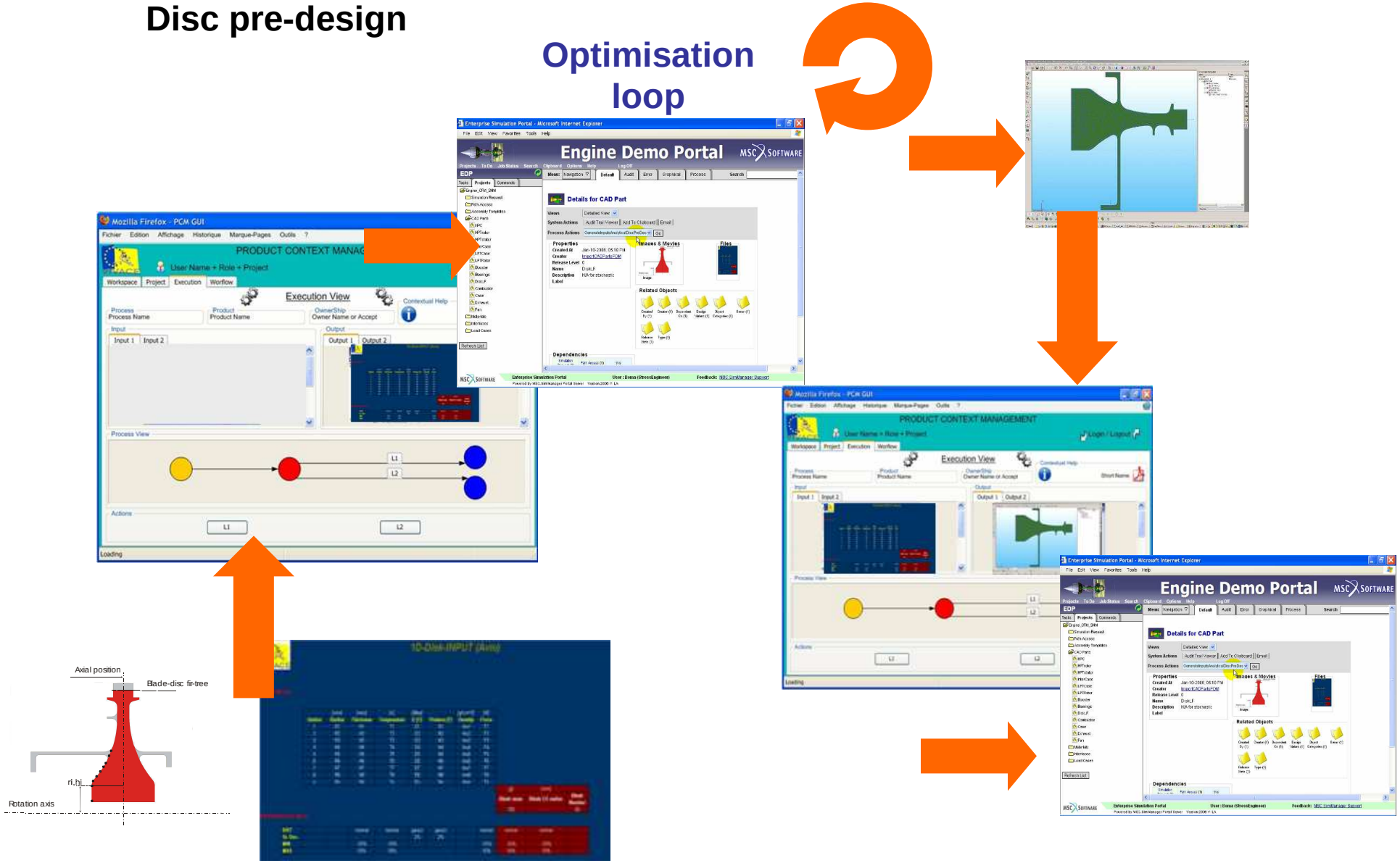




Stochastic scenario

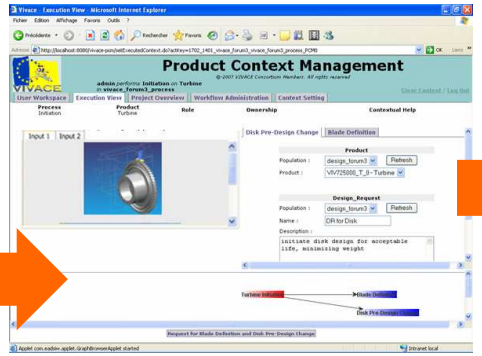
Disc pre-design

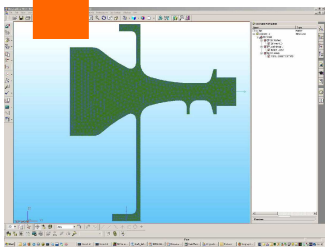
Optimisation loop



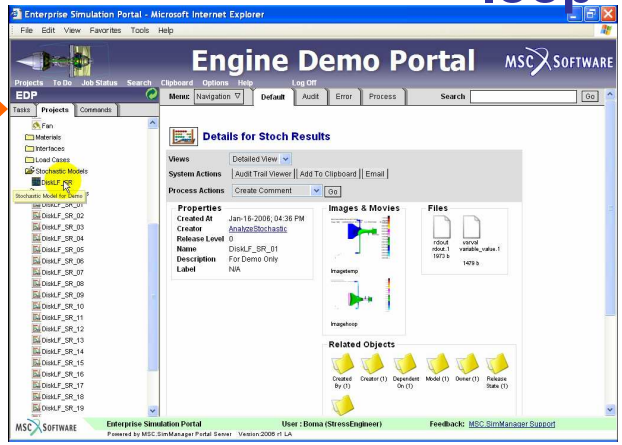
Stochastic scenario

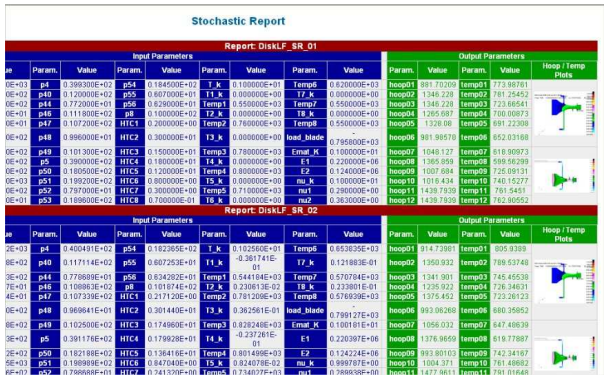
Disc design





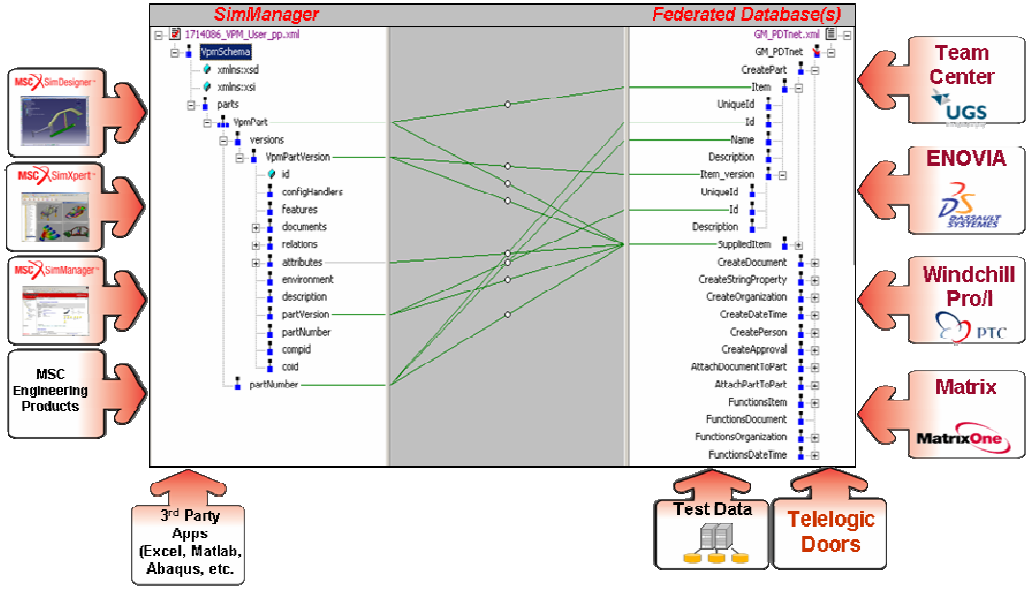
Stochastic loop





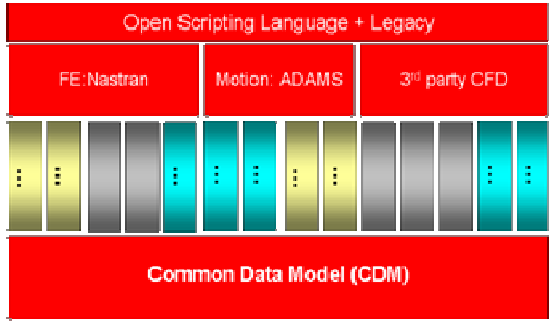
VIVACE outcomes Industrialization with MSC Virtual Product Development Solution 1/2

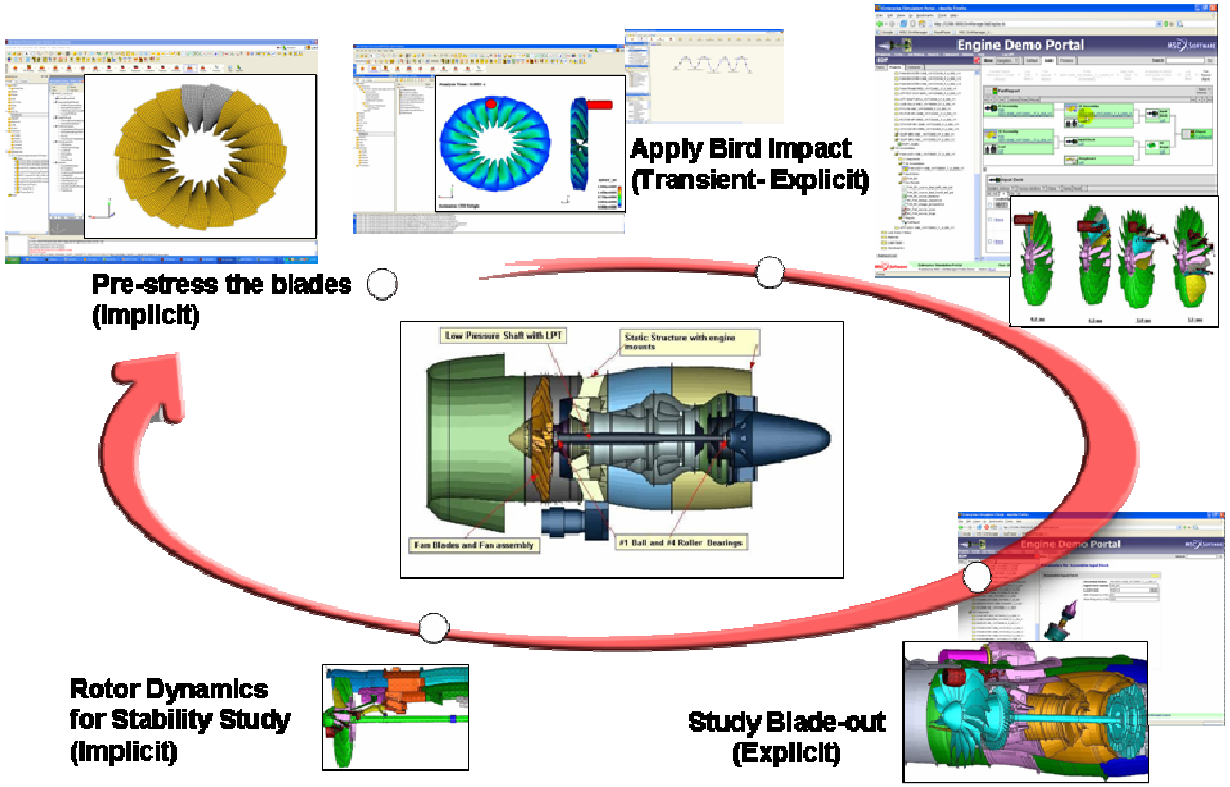
- **MSC.SimManager out of the box plug in to STEP/(PLCS)**
  - **ProStep OpenPDM used as information model for PDM/SDM/TDM consolidated repository seamless interoperability**



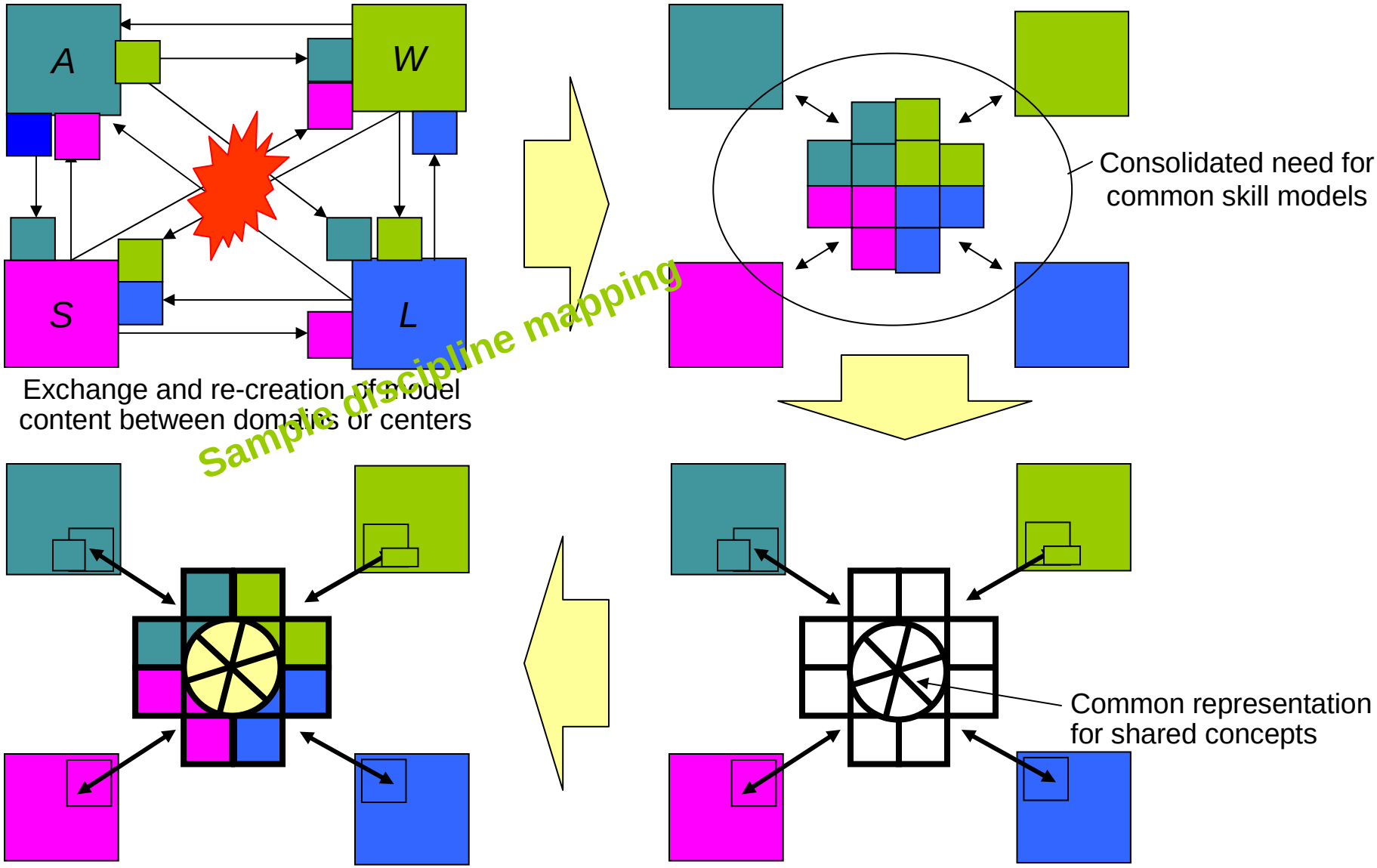
VIVACE outcomes Industrialization with MSC Virtual Product Development Solution 2/2

- **MD Multi Disciplinary Data Model**





Airbus MDOW Common Engineering Model 1/2



Exchange and re-creation of model content between domains or centers

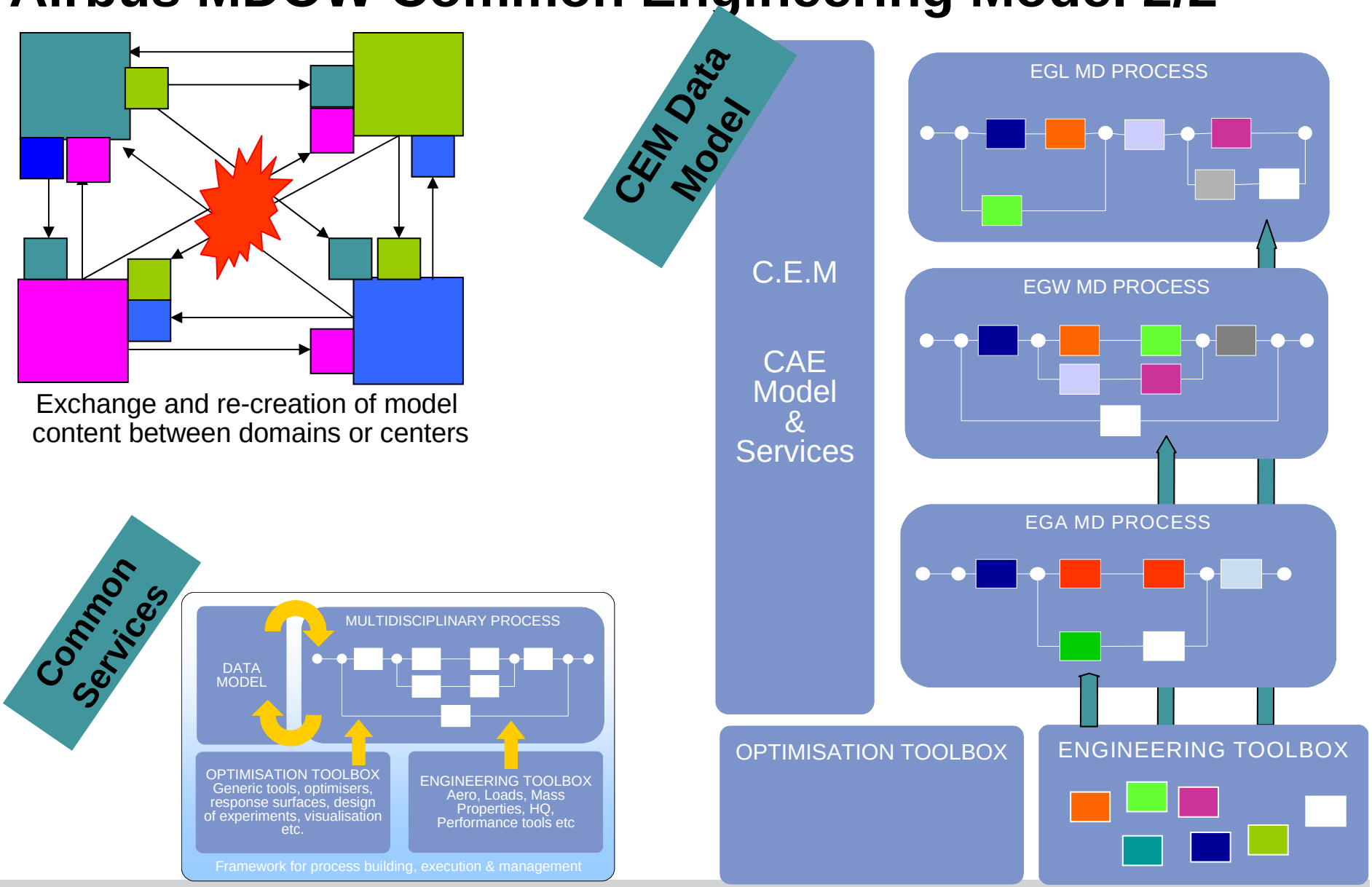
Sample discipline mapping

Modeling solutions to ensure rapid & consistent model generation & sharing

Architecture to control sharing and rationalization of skill models & data

Airbus MDOW Common Engineering Model 2/2

Exchange and re-creation of model content between domains or centers

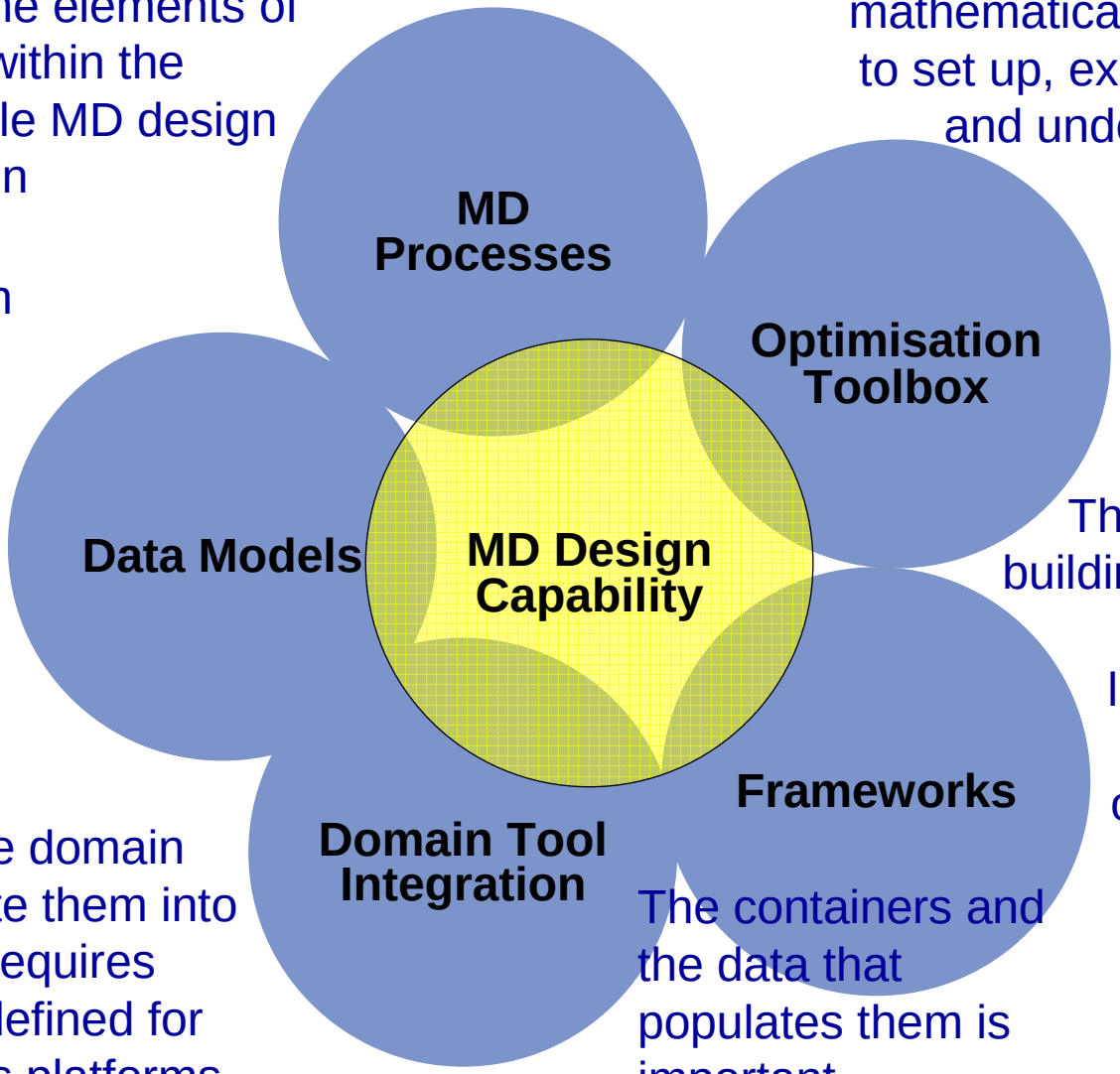


MDOW Elements of MD Capability

Delivery of MD processes via the ability to connect the elements of the MD capability within the framework to enable MD design and data generation

The set of common mathematical tools required to set up, explore, visualise and understand aircraft design space

The identification of the variables required to describe the aircraft and the ability to create instances of designs for evaluation

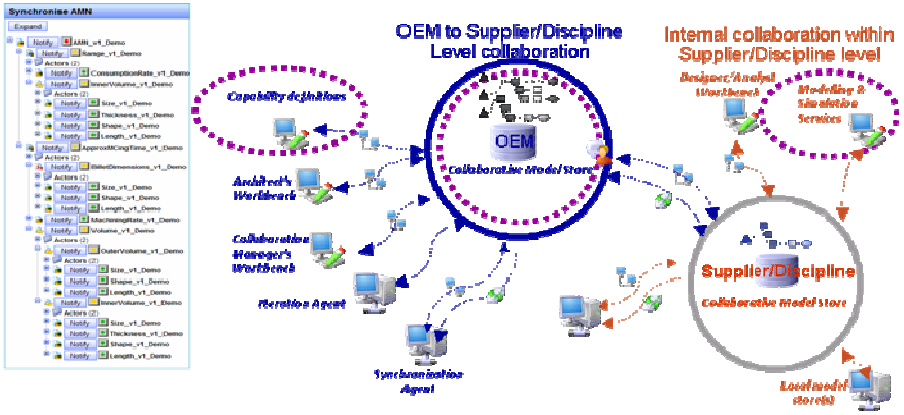


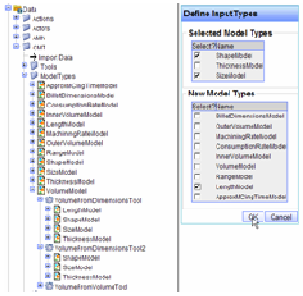
The mechanism for building and executing processes which link data, models, domain and optimisation tools & which manage the process throughout the product lifecycle

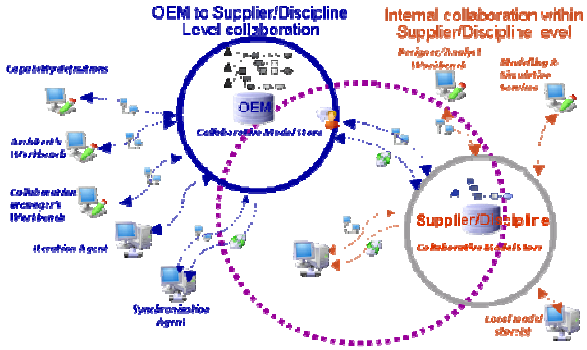
To 'wrap' the core domain tools and integrate them into the framework. Requires standards to be defined for integration across platforms

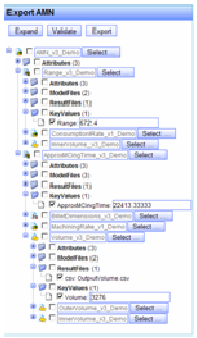
The containers and the data that populates them is important

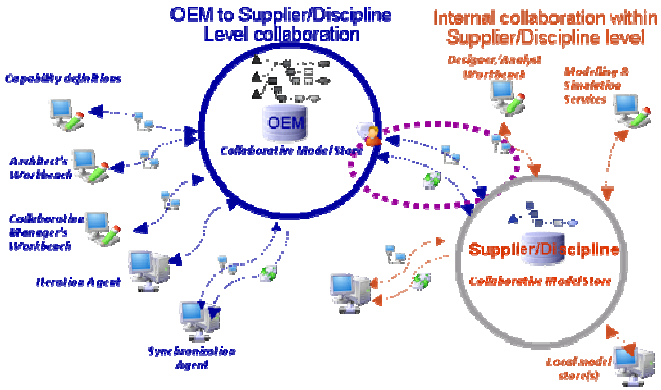
SimManager (MDOW) Model Based engineering

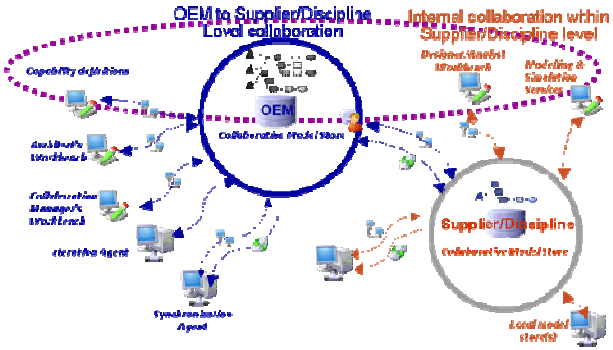






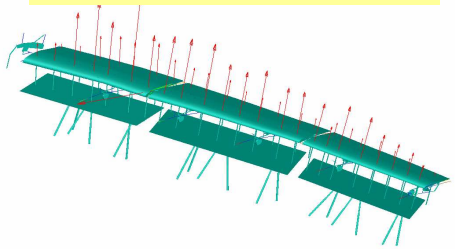






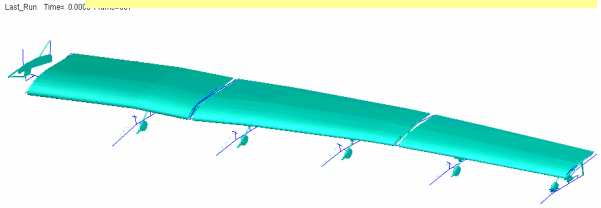
Airbus Physical and Virtual Test Scenario 1/2

Virtual Test Basic Model

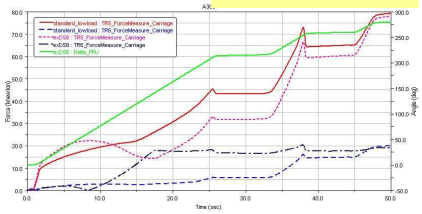


Extension of Test Scope

VT validated extended Model



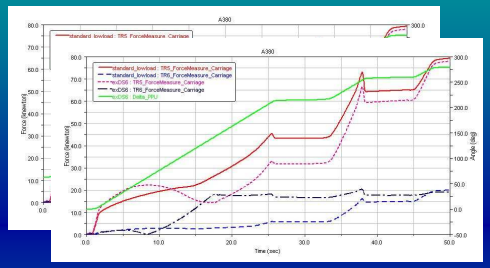
VT Results



Testrig and Virtual Test coordination

VT model validation and acceptance

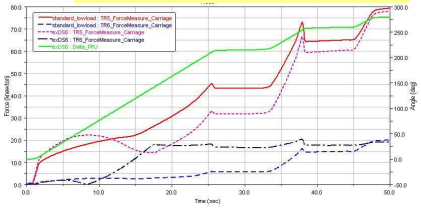
Consolidated Test Result



Test Rig

Improved Quality

Phys. Test Results



Improved Certification Process

- Time and Cost Reduction
- Extension of Test Range
- Testrig and Virtual Test coordination
- Sensitivity Studies

Airbus Physical and Virtual Test Scenario 2/2

AIRBUS
High Lift Test Portal (R3)

Home | Clipboard | Help | Advanced

Logged in as manager (ManagerUserProfile) | Options | Support
Workspace HLT

Tree HLT

- Action
  - 0.1 Setup VTInstance
  - 1.2 Import VTEquipment
- Equipment
  - First equipment
  - Tobias_Model
- Instance
  - A350_Dynamic Flap Failures
  - A400M_Flaps
    - Equipment
    - Review
    - CheckCaseProcedure
    - CheckCaseProcedure - Execution Planned
    - CheckCaseProcedure - Evaluated
    - TestFrame
  - A400M_SLM_DEMO

History: First equipment | Audit Trail Viewer | A350_Dynamic Flap Failures | First equipment | A350_Dynamic Flap Failures | List

Default | Audit

Check Case Procedure

Objects: 7/7 Selected: 0

System Actions | Process Actions | Views | Save | Reset | -

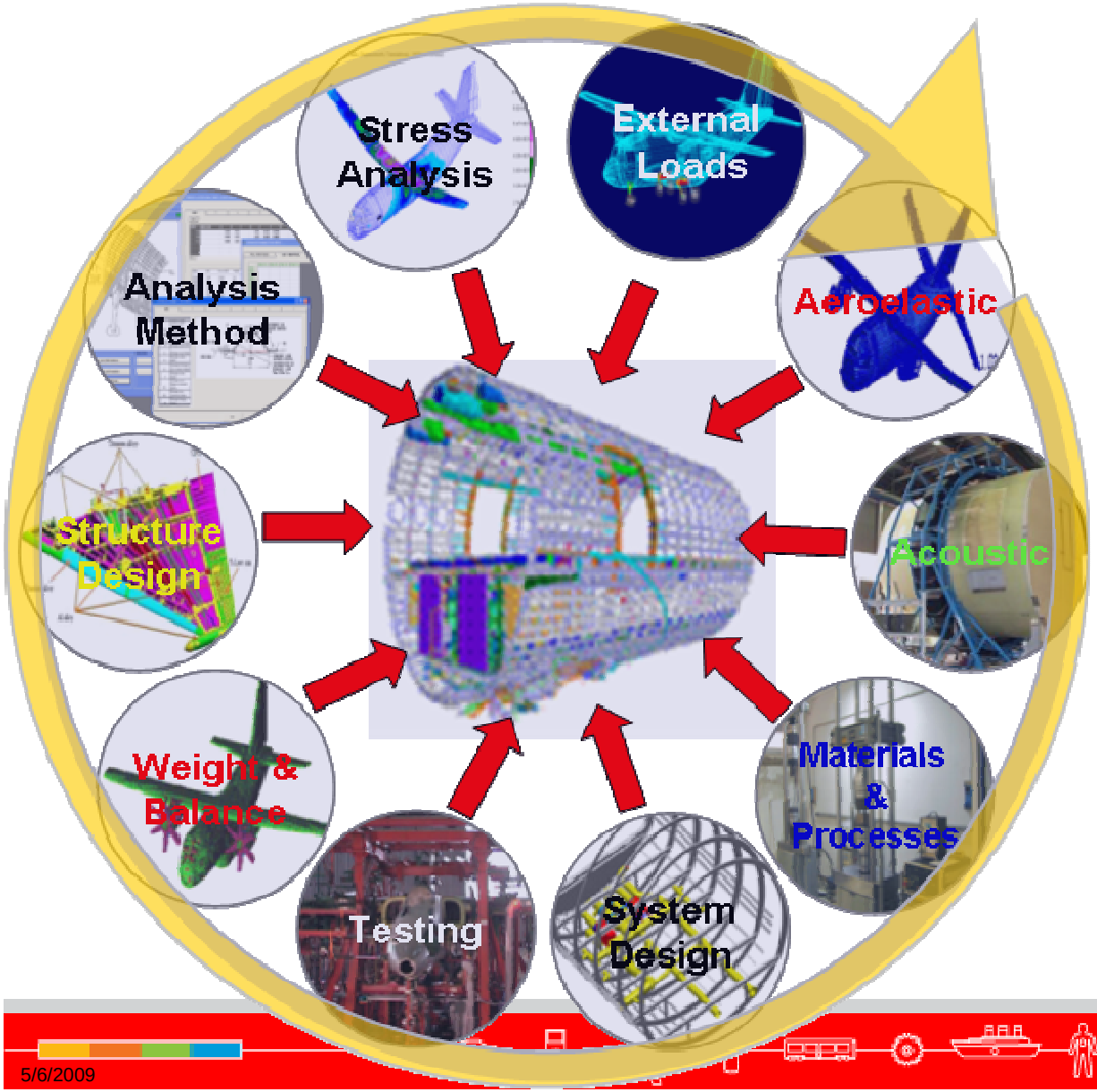
2.2 Import VTProcedure | 2.3 Review VTProcedure | 3.2 Start Execution | 3.3 Set ExecutionResultData | 4.2 Start Evaluation | 4.3 Set EvaluationResultData

Name	State in TMS	Procedureid	Version	Executionresultid	Evaluationresultid	Files
TD-28317_Broken Jack 1 29082008	EVALUATED	33455	2			Role: vir; Name: ccp.vir; Size: 158 b
TD-28349_Broken Jack 1 test 29082008	EVALUATED	33463	2	33465	33468	Role: vir; Name: ccp.vir; Size: 168 b Role: proc; Name: bar10.acf; Size: 173 b
TD-28750_Broken Jack 3	Planned for execution	33472	2			Role: vir; Name: ccp.vir; Size: 158 b
TD-28333_Broken Jack 3 after import fix	EVALUATED	33443	2		33509	Role: vir; Name: ccp.vir; Size: 167 b
TD-28285_Broken Jack 1 HLCC12 in flight CSU 4 Wingtwist Load Profile GetHome LC 561 neutral	Planned for execution	33439	2			Role: vir; Name: ccp.vir; Size: 158 b
TD-28301_Broken Jack 3	Planned for execution	33441	2			Role: proc; Name: bar10.acf; Size: 173 b Role: vir; Name: ccp.vir; Size: 158 b
TD-28365_Broken Jack 3 02092008	Planned for execution	33501	2	33503	33506	Role: proc; Name: DyFaTestDef091.acf; Size: 2706 b Role: vir; Name: ccp.vir; Size: 168 b

Hide column
Sort column
Expression filter
Value filter

ALENET approach 1/2

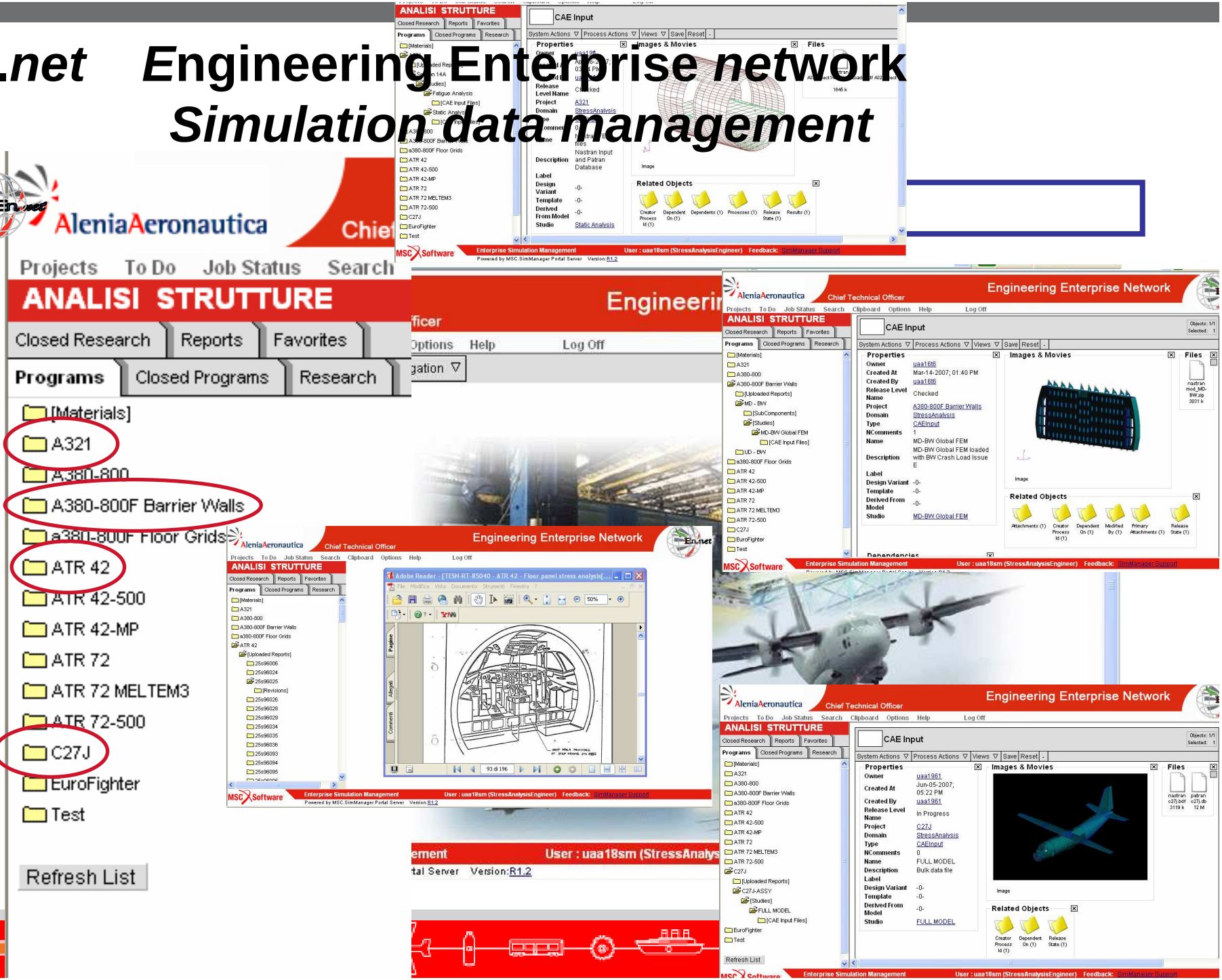
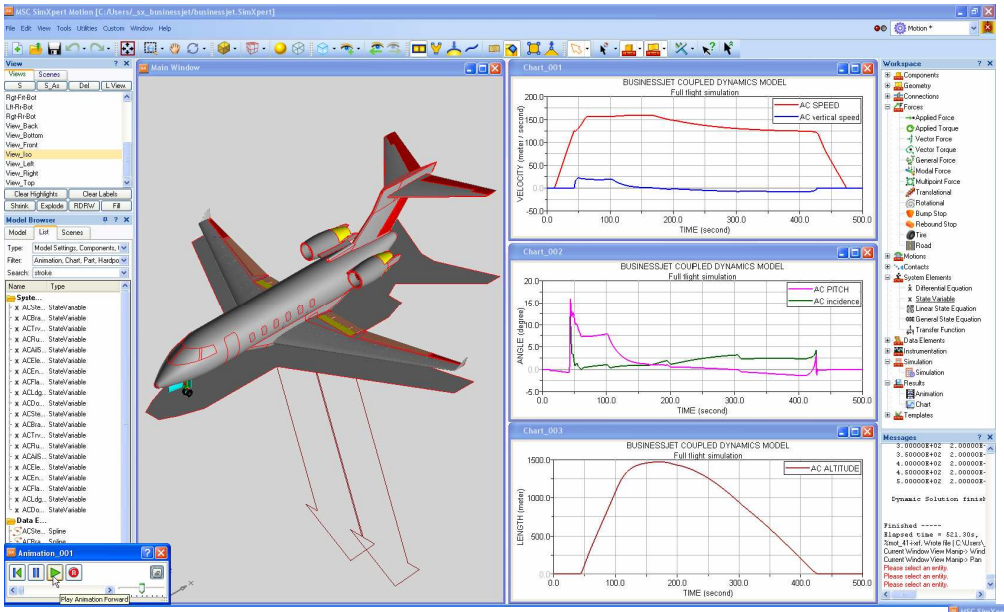
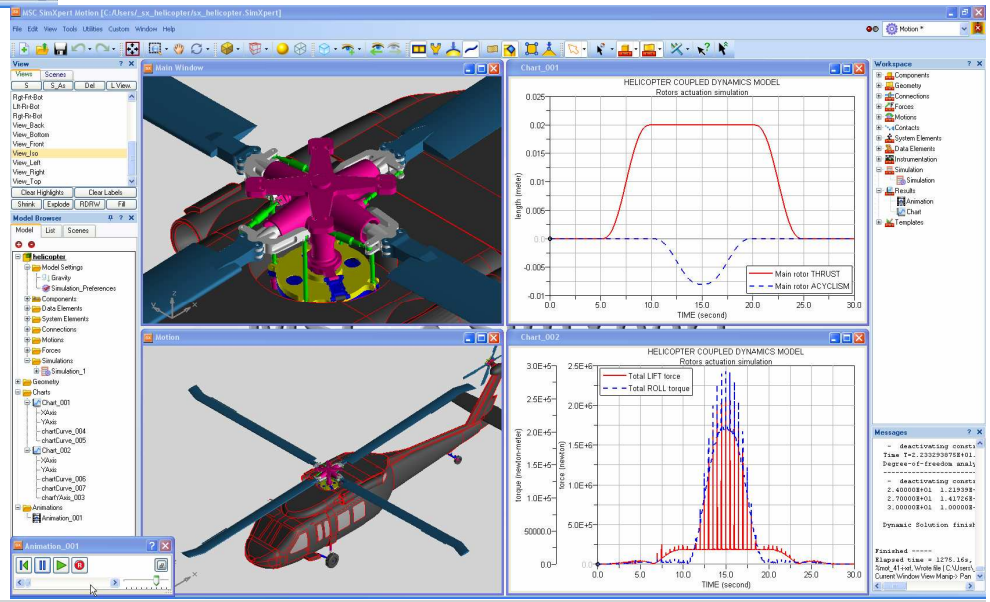
ALENET approach 2/2



- The design is done by the integration of several disciplines all involved in a multidisciplinary environment.
- High performance, low weight, low cost and excellent process reliability are the main targets of each design approach.
- Maintain the excellent know-how level by a dedicate Research program strategy

En.*net* *Engineering Enterprise network*

Simulation data management



Perspectives/Conclusions