SEAMLESS DIGITAL INTEGRATION

3DEXPERIENCE Platform Openness for Marine and Offshore

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DASSAULT
SYSTEMES

SUSTAINABILITY TRANSFORMATION

13%

of WW CO_2 emissions from transport

3%

of global Greenhouse Gas emissions from shipping

2050

0

Europe's Climate Target for 2050
Zero Net Carbon emission

?

Energy management

Systems Upgrade

Lightweight design

Onboard maintenance

Fleet management

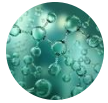
Autonomous ship

Power & propulsion systems

Modular systems series

Superefficient hull

New materials



Alternative fuels

Route optimization

First Millennium

Wood boats
Man Power

XVth Century

Wind Power

XIXth Century

Steam propulsion
Iron ships

XXth Century

Combustion
& diesel engine

TODAY

Container ships

FROM STATIC DIGITAL TWINS TO CYBER PHYSICAL VIRTUAL TWINS

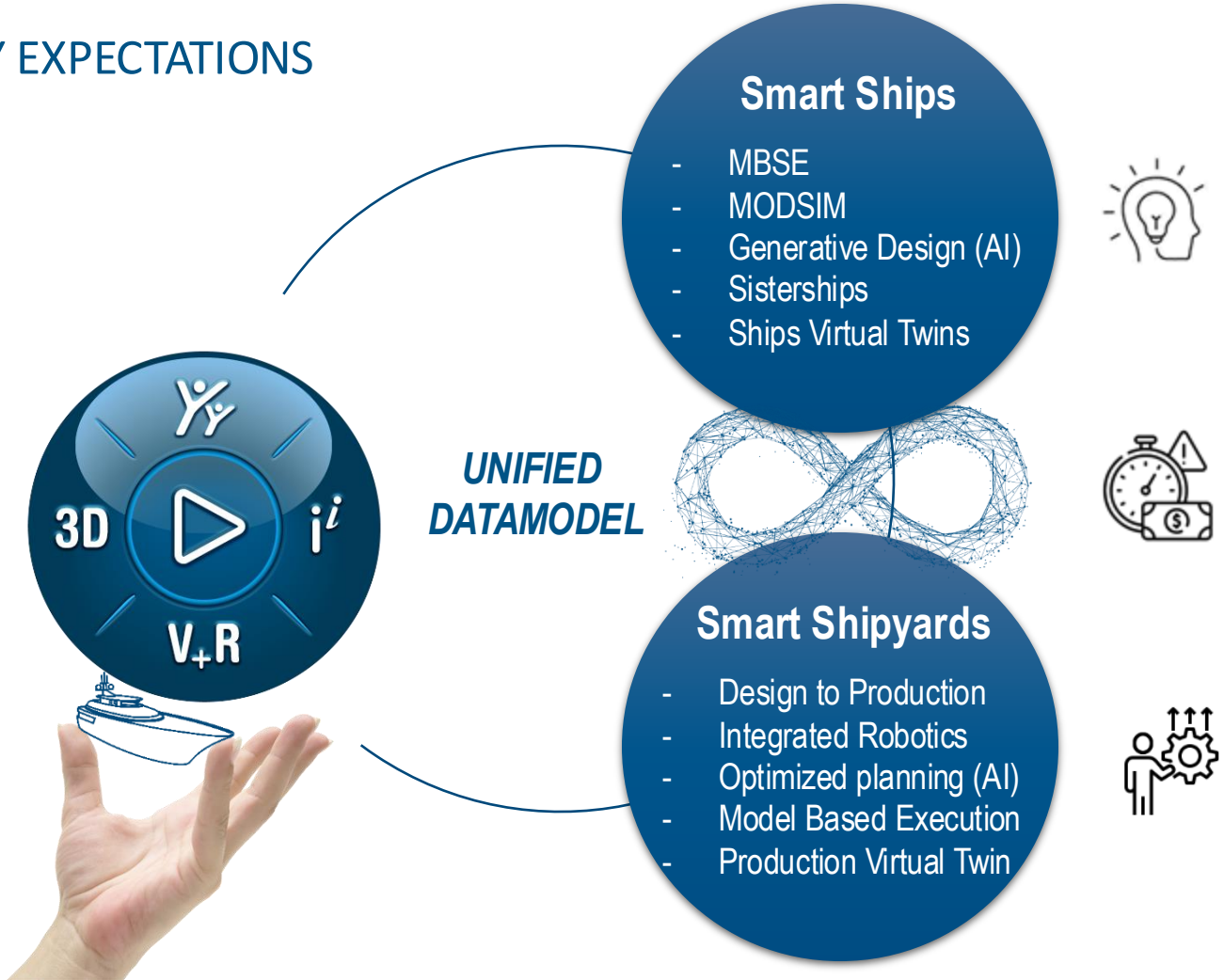
The VIRTUAL TWIN is a scientifically accurate virtual model of objects that can be tested to analyze and optimize how they will behave under different scenario's using real-tie or experimental data

DIGITAL TWIN	VIRTUAL TWIN
ISOLATED	CONNECTED
LINEAR	MODEL BASED
STATIC	DYNAMIC
SINGLE PURPOSED	REUSABLE IN CONTEXTS
3D	4D – INCLUDES TIME!

Source: https://blog.3ds.com/brands/delmia/back-to-basics-digital-twin-vs-virtual-twin/

DASSAULT SYSTEMES

INDUSTRY EXPECTATIONS



VIRTUAL TWINS FOR SHIPBUILDING EXCELLENCE

SHIPS VIRTUAL TWINS

SHIPYARDS VIRTUAL TWINS

Ready for Future Ships → Workforce Challenges → Improve Profitability and Capacity

- Innovations, Energy Efficiency
- Advanced Simulations
- Robotization & Automation
- Augmented Reality + Artificial Intelligence
- Production Planning Optimization
- Supply Chain Planning
- Visible and Predictable Production
- Quality control integration & automation

FROM DOCUMENT-BASED TO **MODEL-BASED SHIPBUILDING**

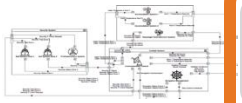
DASSAULT SYSTEMES

FROM ‘DOCUMENT-BASED’ TO ‘MODEL-BASED’ SHIPBUILDING

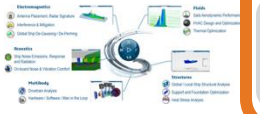
Get Ready for Future Ships

Solve Workforce Challenges

Improve Ships Capability

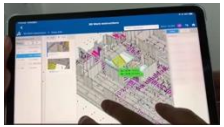


MODEL BASED SYSTEMS ENGINEERING (MBSE)



MODEL BASED SIMULATION (MODSIM)

MODEL BASED APPROVAL



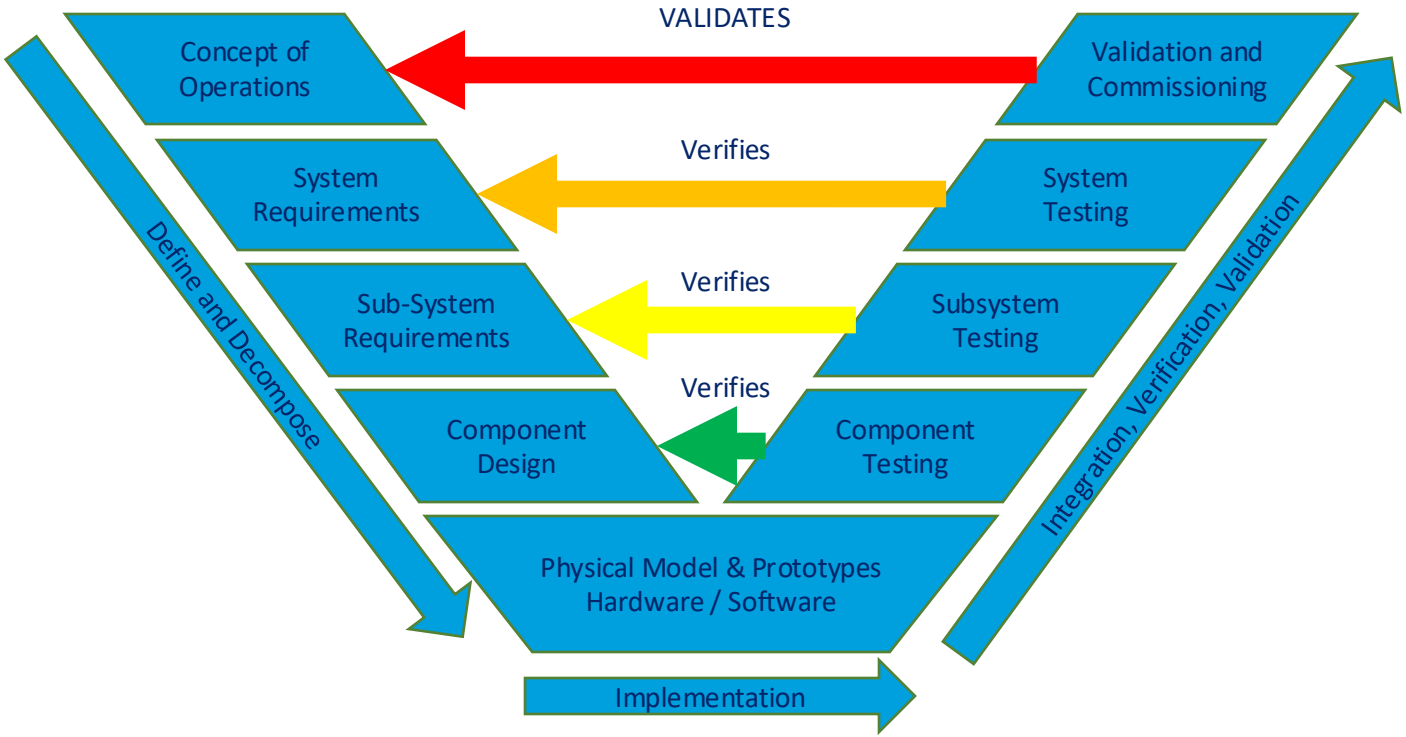
MODEL BASED MANUFACTURING

MODEL BASED COLLABORATION

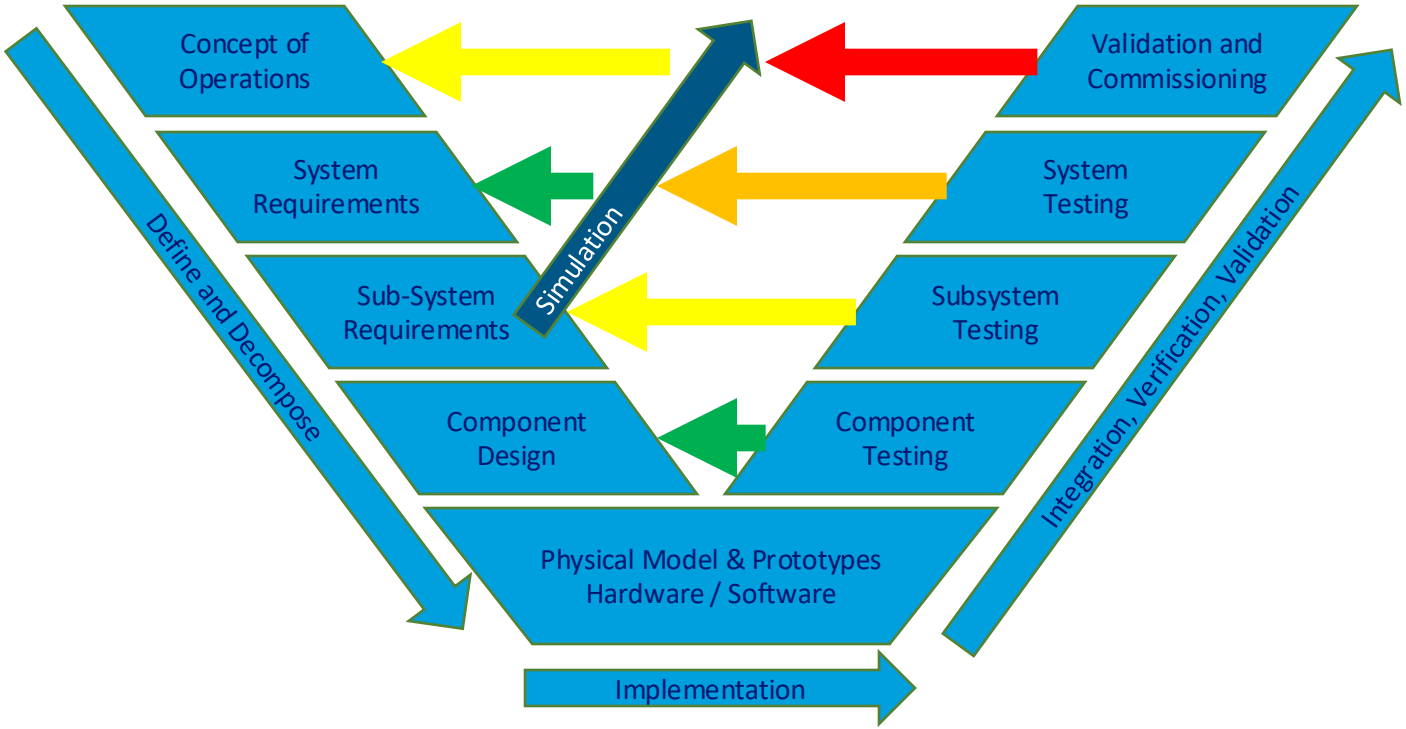
MODEL BASED SUSTAINMENT

Improve Production Capacity and Risk Control

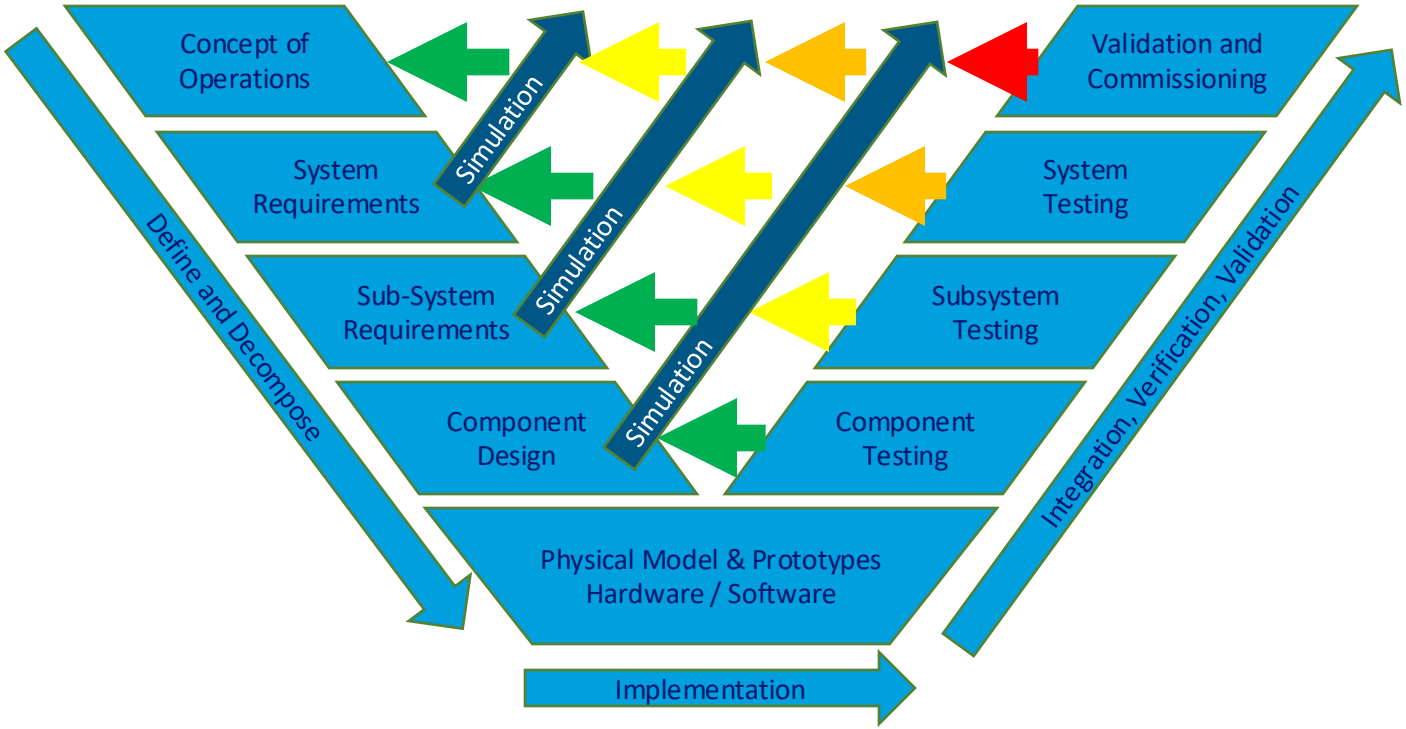
SYSTEMS ENGINEERING V DIAGRAM



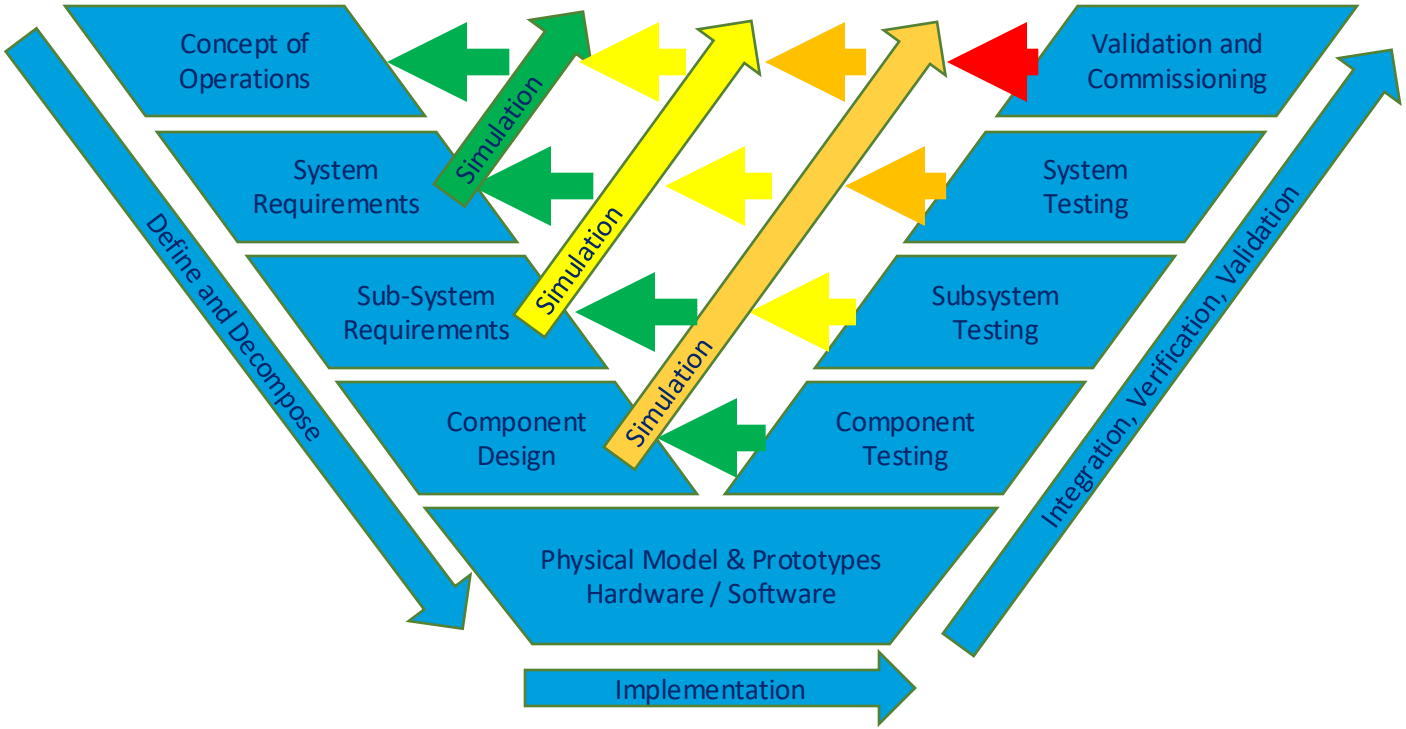
SIMULATION HELPS REDUCE RISK



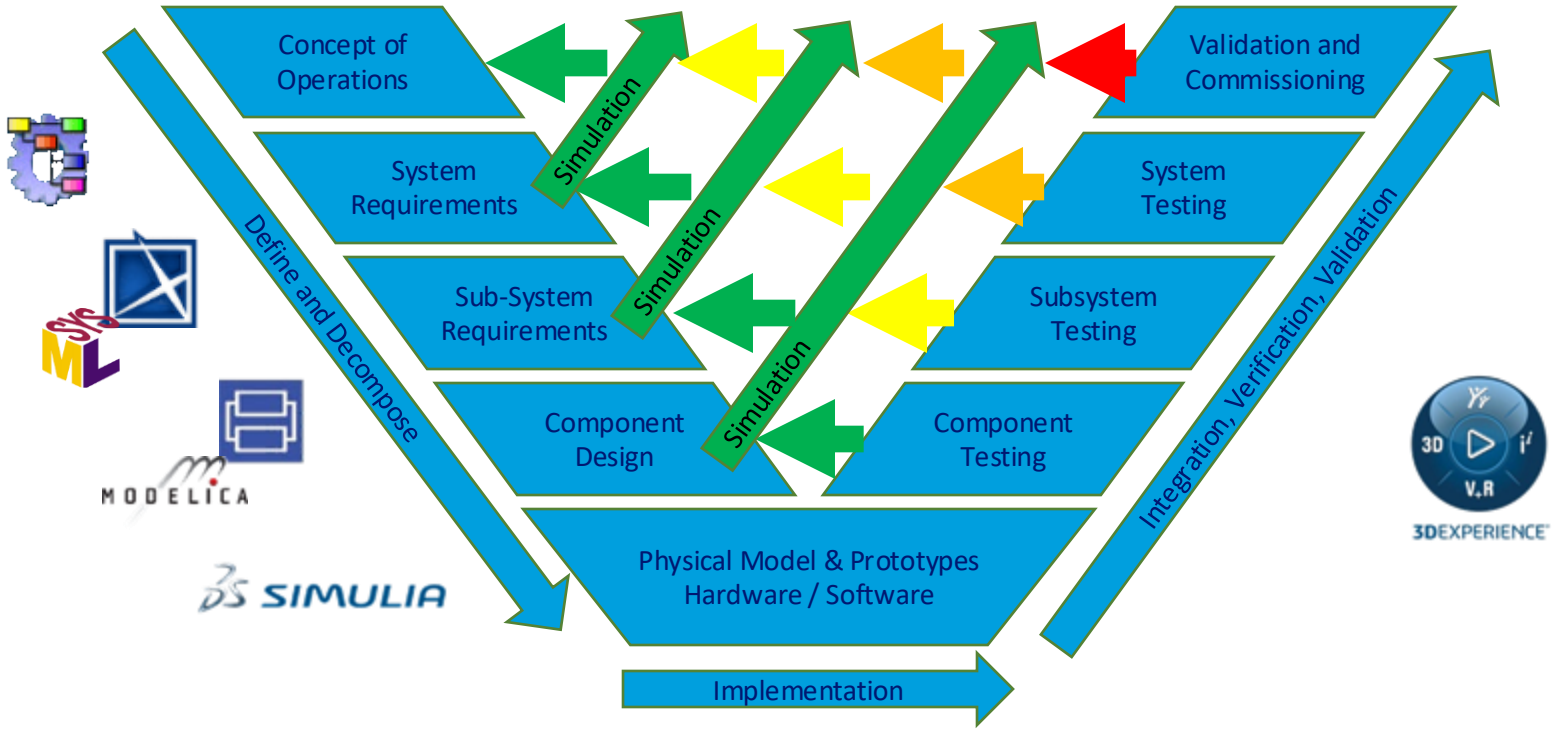
MORE SIMULATION = LESS RISK



DEEPER & BROADER SIMULATION

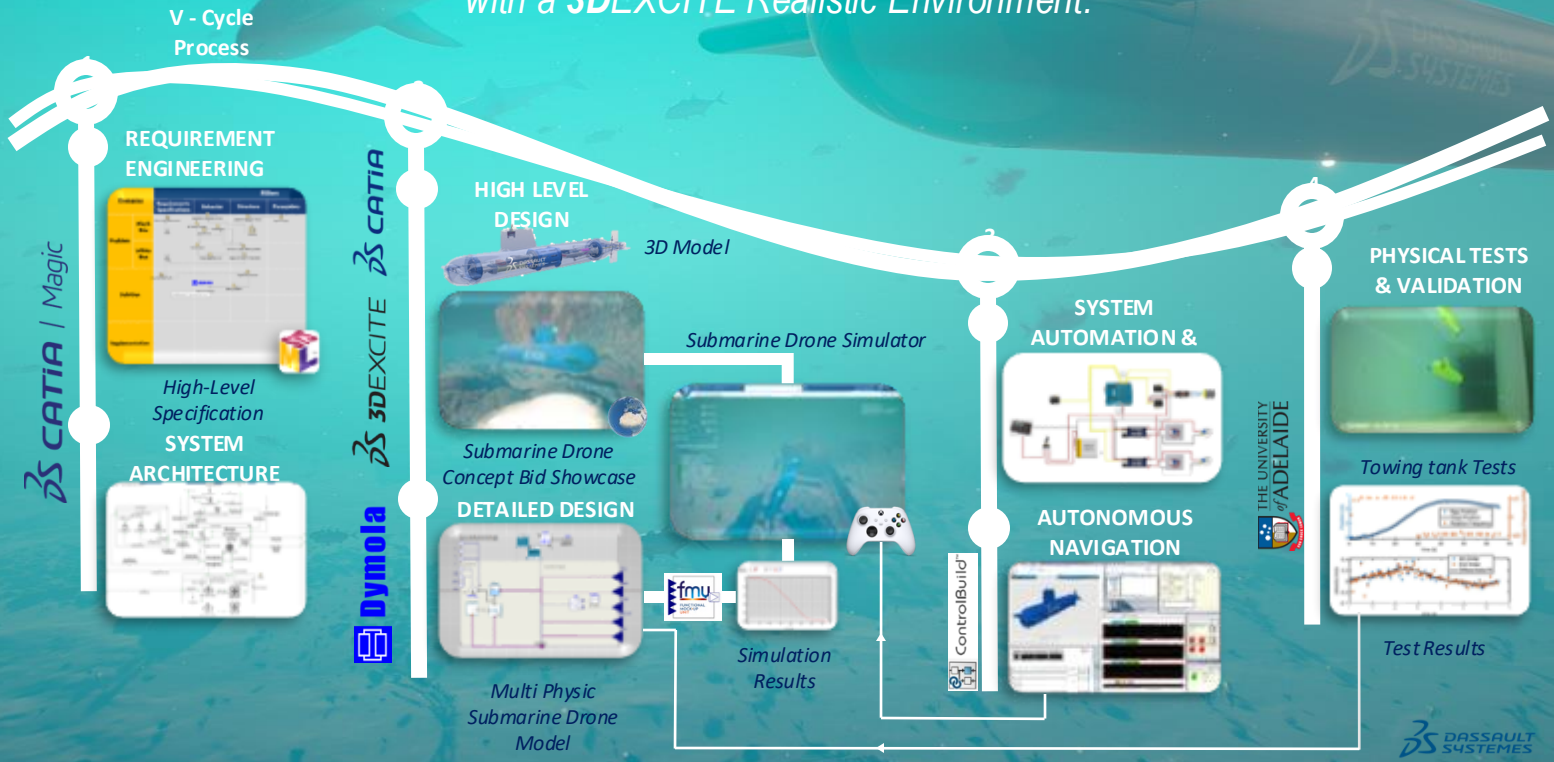


INCLUDING REQTIFY, CATIA MAGIC & DYMOLA ON 3DX

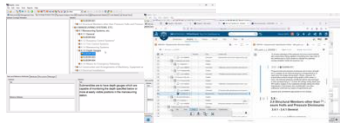


RISEE : REAL-TIME INTERACTIVE SYSTEM ENGINEERING EXPERIENCE

*Contribute to the Submarine Drone **Virtual Twin** by proposing a **Submarine simulator demo** showing cross-discipline capacity of **3D**EXPERIENCE platform for digital continuity, by coupling a **DYMOLA** Behaviour Model with a **3D**EXCITE Realistic Environment.*

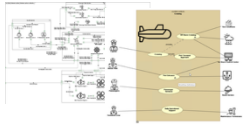


MARITIME DRONE USE CASE



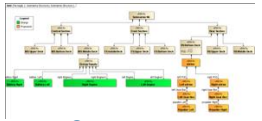
Stakeholder needs & Standards

1



Operational Analysis

2



System Architecture

3

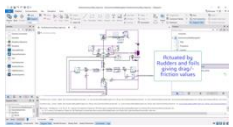
New Standard Definition

4

3D Model (Preliminary Design)

5

Multi Physic Model



6

Control & Control Command Model

7

Verification Traceability

8

3D Model (Detailed Design)

9

Submarine Simulator

CATIA Magic

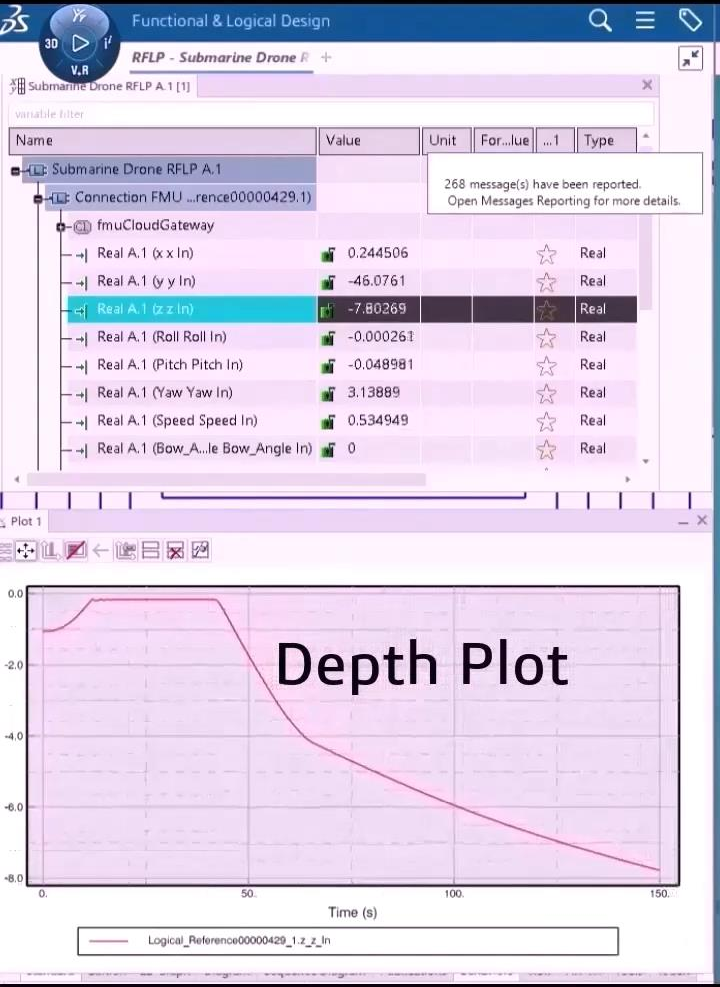
Dymola

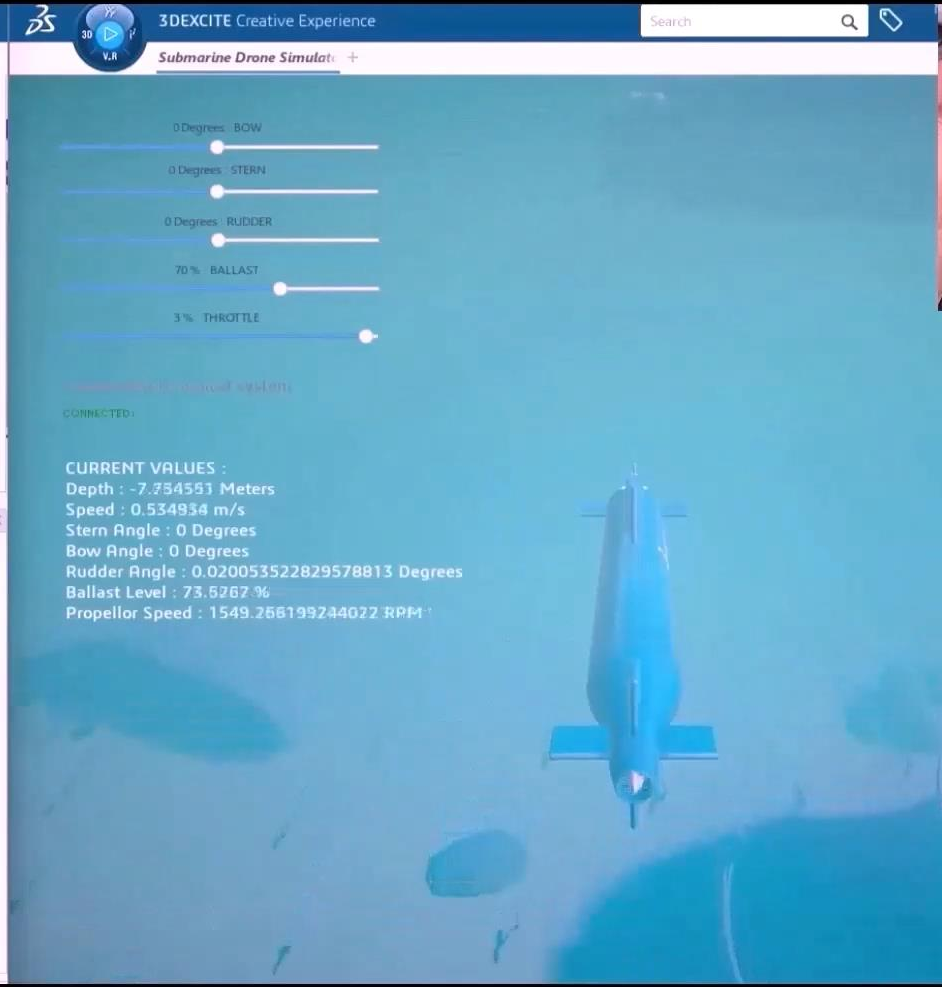
Creative Experience

System Traceability

Reqtify

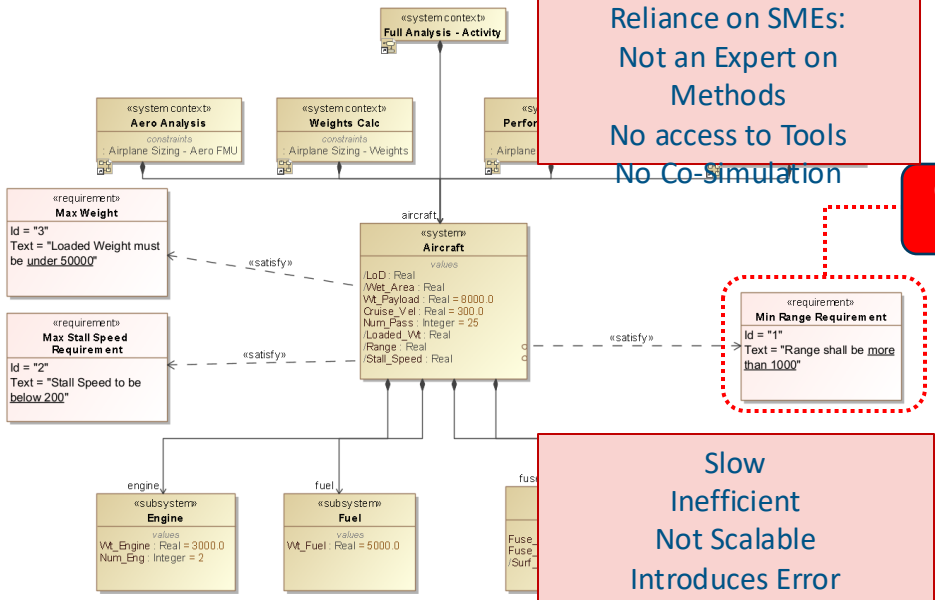
Requirement Management


Functional & Logical Design
RFLP - Submarine Drone R
Submarine Drone RFLP A.1 [1]
Name
Value
Unit
For...lue
...1
Type
Submarine Drone RFLP A.1
Connection FMU ...rence00000429.1)
fmuCloudGateway
Real A.1 (x x In) 0.244506 Real
Real A.1 (y y In) -46.0761 Real
Real A.1 (z z In) -7.80269 Real
Real A.1 (Roll Roll In) -0.000261 Real
Real A.1 (Pitch Pitch In) -0.048981 Real
Real A.1 (Yaw Yaw In) 3.13889 Real
Real A.1 (Speed Speed In) 0.534949 Real
Real A.1 (Bow_A...le Bow_Angle In) 0 Real
268 message(s) have been reported.
Open Messages Reporting for more details.
Plot 1
Depth Plot
0.0
-2.0
-4.0
-6.0
-8.0
0.
50.
100.
150.
Time (s)
Logical_Reference00000429_1.z_z_In


3DEXCITE Creative Experience
Search
Submarine Drone Simulat
0 Degrees BOW
0 Degrees STERN
0 Degrees RUDDER
70 % BALLAST
3 % THROTTLE
CONNECTED
CURRENT VALUES :
Depth : -7.754551 Meters
Speed : 0.534934 m/s
Stern Angle : 0 Degrees
Bow Angle : 0 Degrees
Rudder Angle : 0.020053522829578813 Degrees
Ballast Level : 73.5267 %
Propellor Speed : 1549.266199244022 RPM
DASSAULT SYSTEMES

AS-IS: SYSTEM REQUIREMENTS ANALYSIS

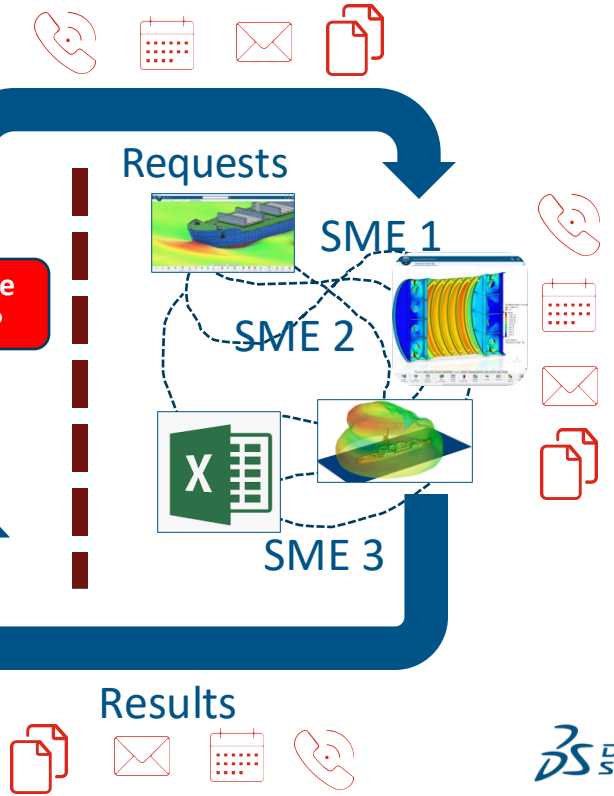
- Requirements often require subject matter expertise to verify
- Example: How do changes to weight & cruise speed affect an aircraft's range?



Reliance on SMEs:
Not an Expert on Methods
No access to Tools
No Co-simulation

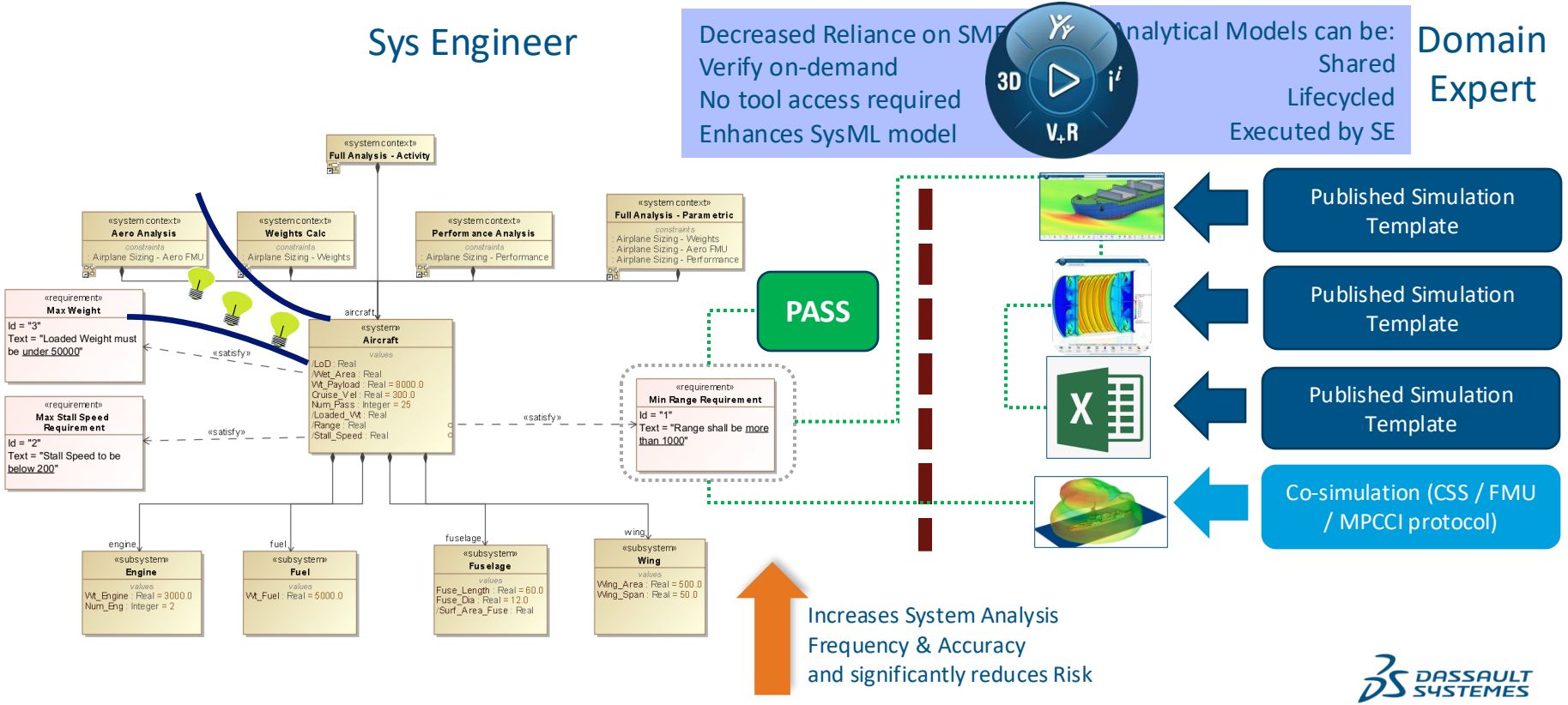
Can be met?

Slow
Inefficient
Not Scalable
Introduces Error
No Traceability
No oppy to perform trades



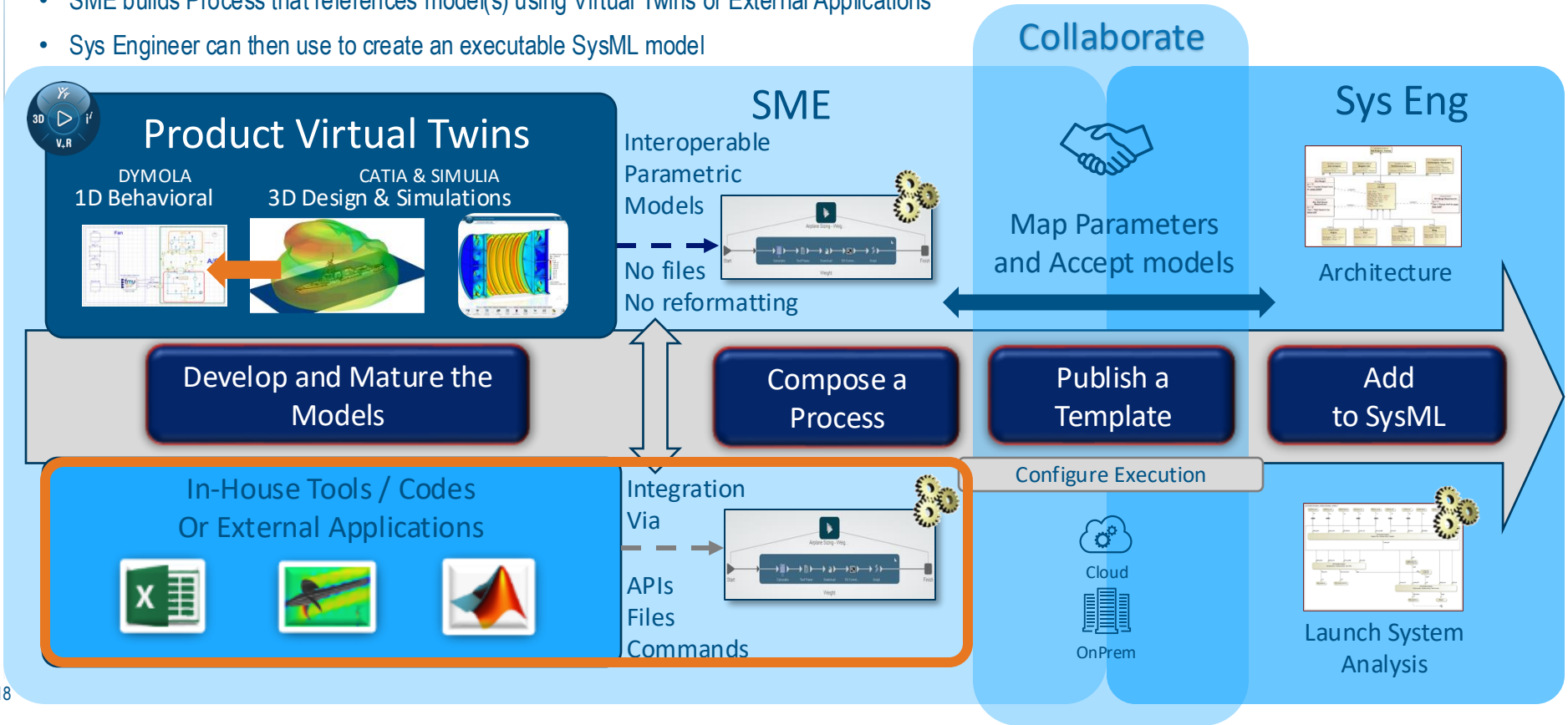
TO BE: SYSTEM ANALYSIS WITH ENHANCED SIMULATIONS

- Evaluate Requirements Directly from CATIA Magic using latest SME-approved validation models and co-simulation

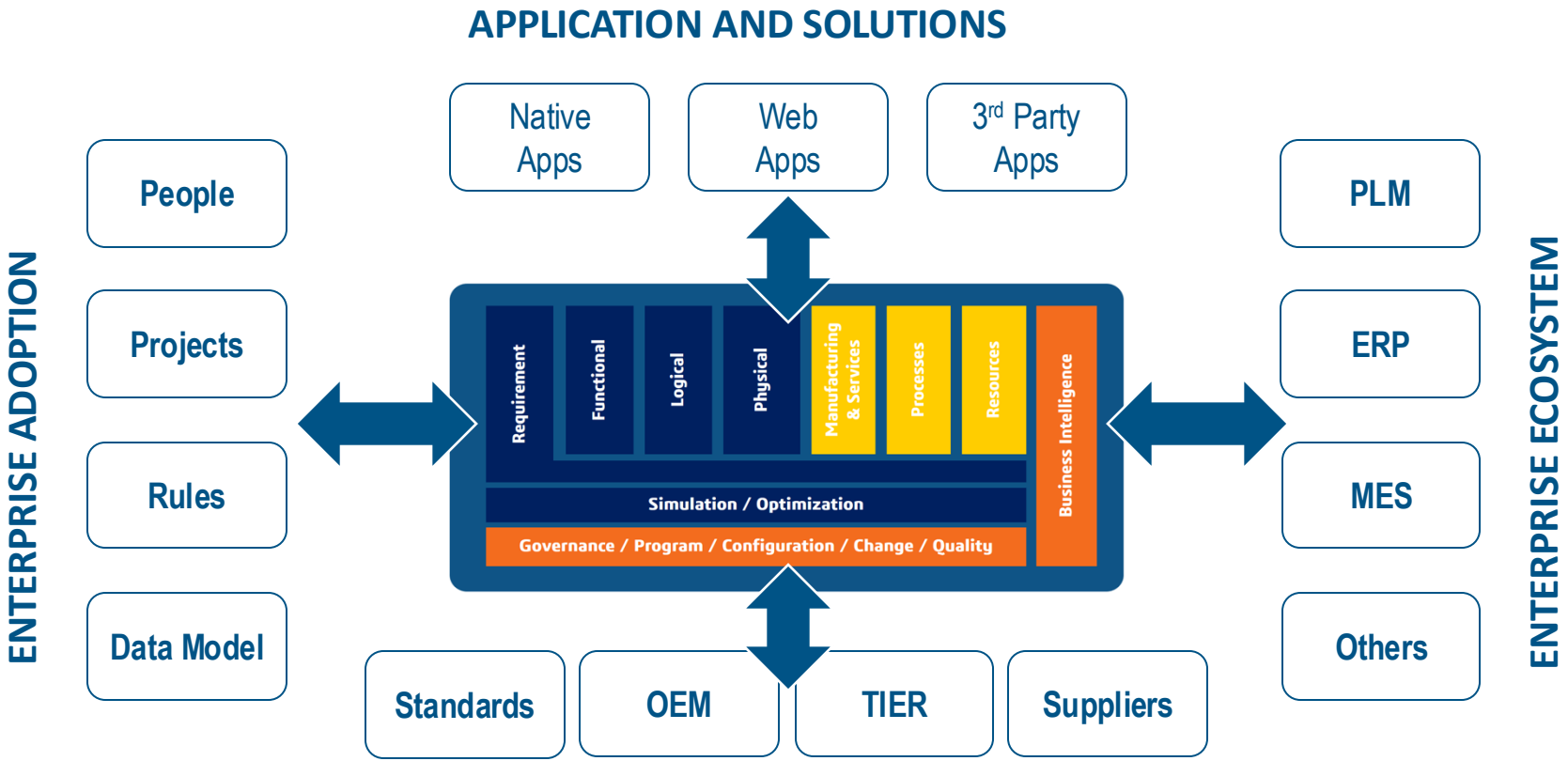


CREATING & PUBLISHING ANALYSIS MODEL TEMPLATES

- SME builds Process that references model(s) using Virtual Twins or External Applications
- Sys Engineer can then use to create an executable SysML model

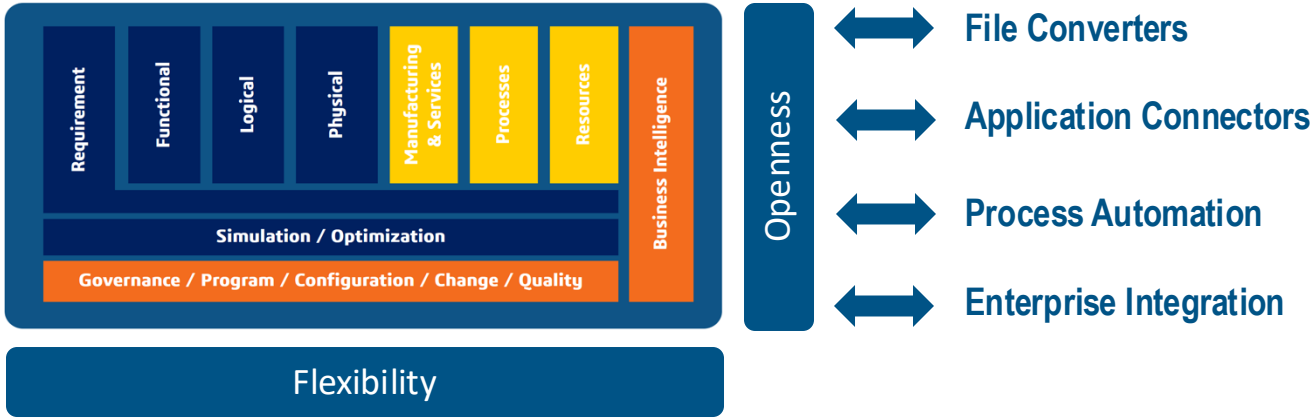


THE 3DEXPERIENCE PLATFORM IS **FLEXIBLE AND OPEN**



WHAT UNDERPINS THIS FLEXIBILITY AND OPENNESS?

A holistic connected data model built on modern service orientated architecture

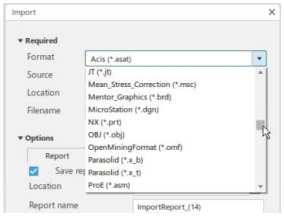


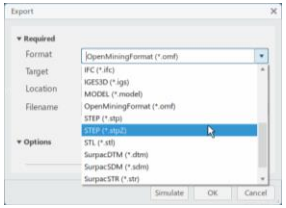
A modern service based approach to platform design:

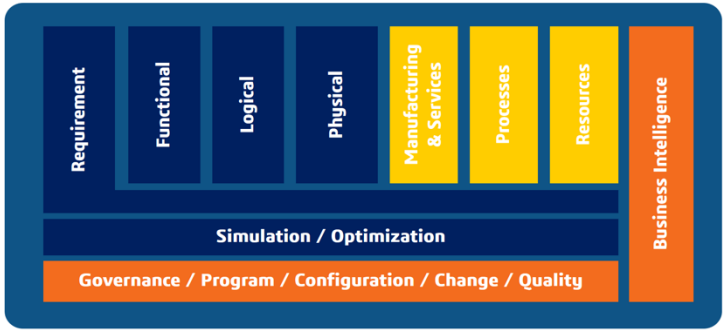
- Plugin data from different sources in different formats
- Extend core capabilities through APIs (Application Programming Interfaces)
- Expand core data model to tailor to specific business needs

IMPORT AND EXPORT DATA

Import and Export a large number of 3rd party formats

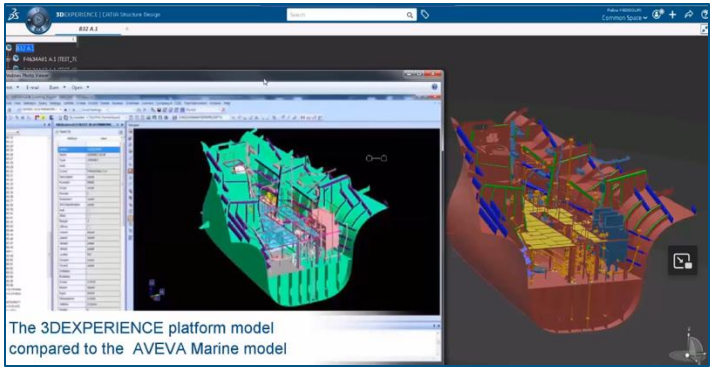






Openness

Flexibility

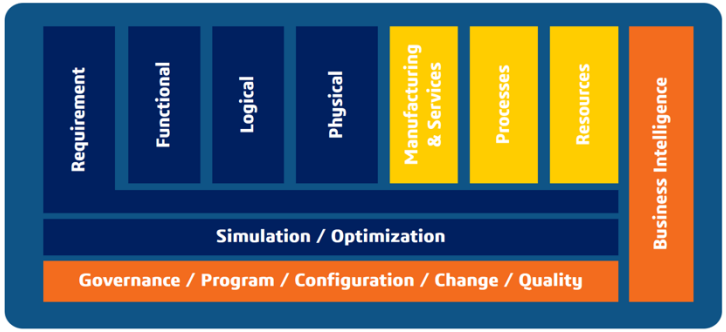


File Converters

3DPDF	←	GL2	←	RHINO	↑
3DXML Briefcase	←↑	ICEM Surf	←↑	Signal_Data	↑
3MF	←	IDF	↑	SLX Matlab	←↑
Abaqus_Material	↑	IFC	←↑	SOLID EDGE	↑
ACIS	↑	IGES	←↑	Solidworks	↑
Allegro	↑	INVENTOR	↑	STEP Multidiscipline	←↑
AMF	←	JPG	←	STL	←↑
Autocad 2D	←↑	JT	↑	Stress_Spectrum	↑
Autocad 3D	↑	MDL Matlab	←↑	SurPac	←↑
CATIA Composer	←	MDZIP (CATIA magic)	←↑	SVG	←
CATIA V4	←↑	Mean_stress_Correction	↑	SysML (CATIA Magic)	←↑
CATIA V5	←↑	Mentor_Graphics	↑	TIF	←
CGM	←	MICROSTATION	↑	VRML	←↑
CityGML	↑	MO Modelica	←↑	XCDM	←↑
COLLADA	↑	NX	↑	XMpLant	↑
CREO / ProE	↑	OCX	←↑		
Deltagen	←↑	OBJ	↑		
DXF 2D	←↑	Open Mining Format	←↑		
DXF 3D	↑	PARASOLID	↑		
EMN	↑	PDF	←		
FMU Functional	←↑	PS	←		
FBX	↑	REVIT	↑		
		ReqIF (CATIA magic)	←↑		

MIXED ASSEMBLIES

Standard connectors for many 3rd party applications provide OOTB integration



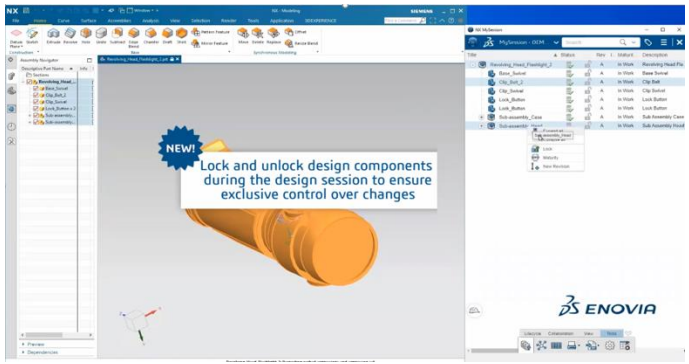
Openness

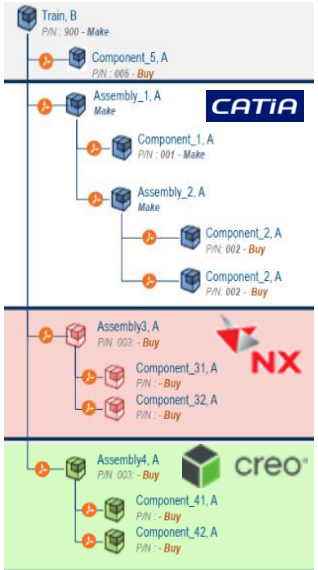
File Converters

Application Connectors

Office
NX
SOLIDWORKS
CATIA
ZUKEN
Adobe
creo
cadence
AutoCAD
INVENTOR
xpedition
Altium
EPLAN

Flexibility





Enables cross-function:

- Multi-CAD BoM
- Lifecycle Controls
- Design Review
- Single change management process
- Web based viewing 3D/2D – no client to install

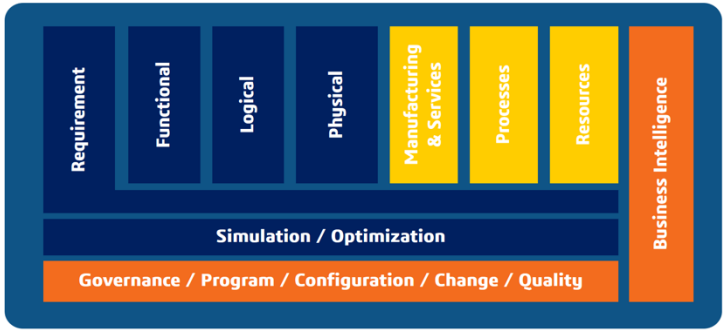
Provides disruption free transition/migration:

- Preserve original/certified data
- Stepwise data migration/conversion
- Move project by project or function by function
- On demand data migration/conversion

DASSAULT SYSTEMES

MIXED ASSEMBLIES

Automatic and on-demand generation of neutral formats



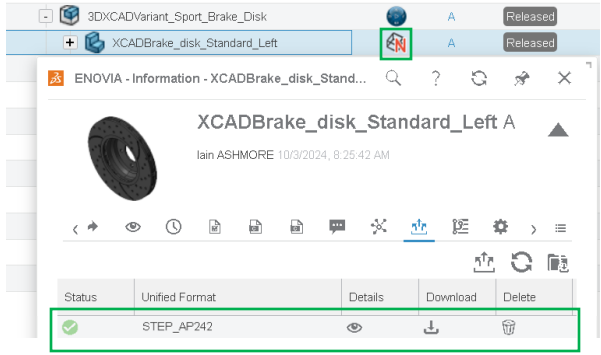
Openness

File Converters

Application Connectors

Converter	Origin	Type	Event	Unified Format
3DEXPERIENCE	CATIAV5	Part	On Demand	STEP
3DEXPERIENCE	3DEXPERIENCE	Part	On Save	STEP
AutoCAD	AUTOCAD	Drawing	On Save from Connector	PDF
Inventor	INVENTOR	Part and iPart	On Save from Connector	STEP
SolidEdge	SOLIDEDGE	Part and She…	On Save from Conr	
CREO	CREO	Part and Part…	On Save from Conr	
NX	NX	Part	On Save from Conr	

Flexibility

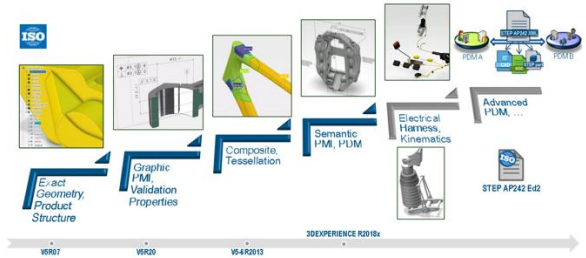


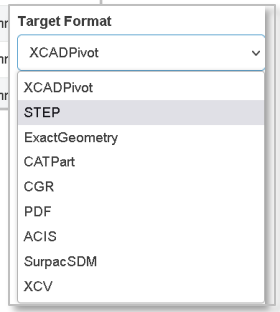
Download neutral formats

OCX

ISO

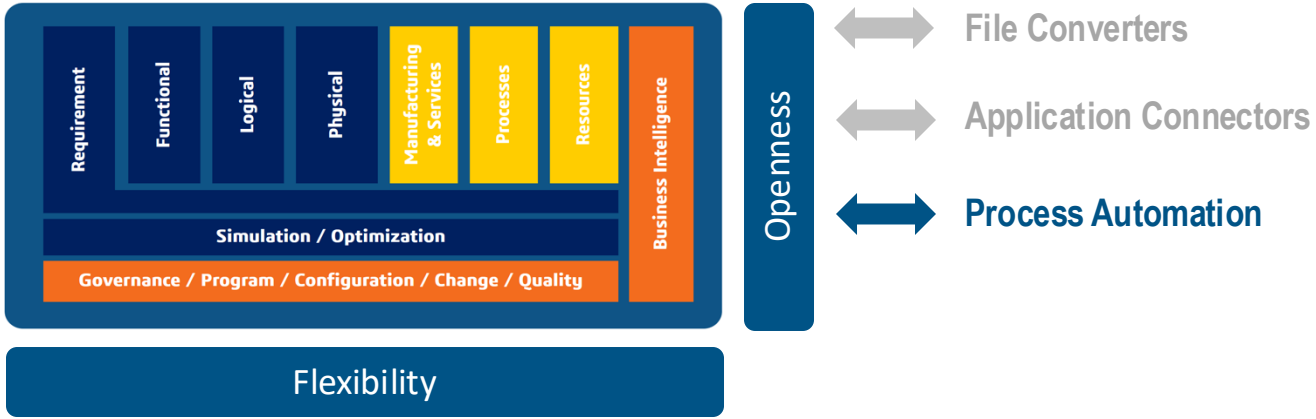
STEP

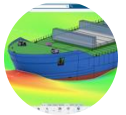


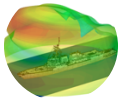


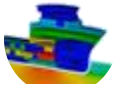
PROCESS AUTOMATION FOR SIMULATION

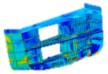
MODSIM unifies modeling and simulation on a common data model




Fluids

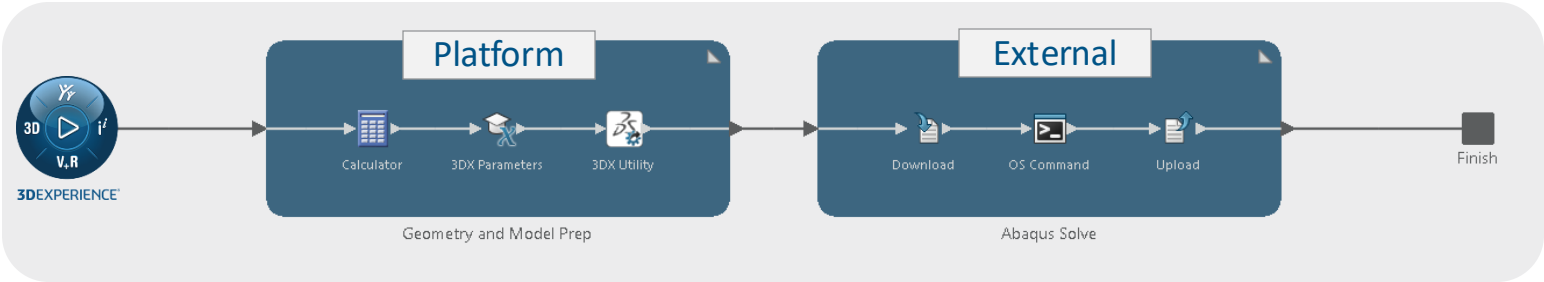

Electromagnetics


Acoustics


Structures

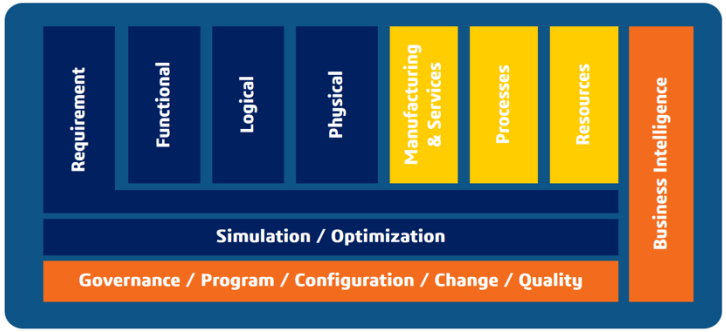

Motion

Ability to execute platform and/or external tools for multi-scale & multi-discipline simulations



ENTERPRISE INTEGRATION

Connect to the wider enterprise to support end-to-end business processes

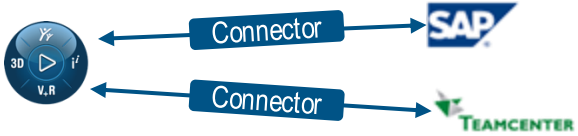


Openness

- File Converters
- Application Connectors
- Process Automation
- **Enterprise Integration**

Flexibility

- Publish + subscribe
- CAD+JSON
- REST APIs



- Point-to-point
- CAD+XML+JSON
- Connectors

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DASSAULT SYSTEMES

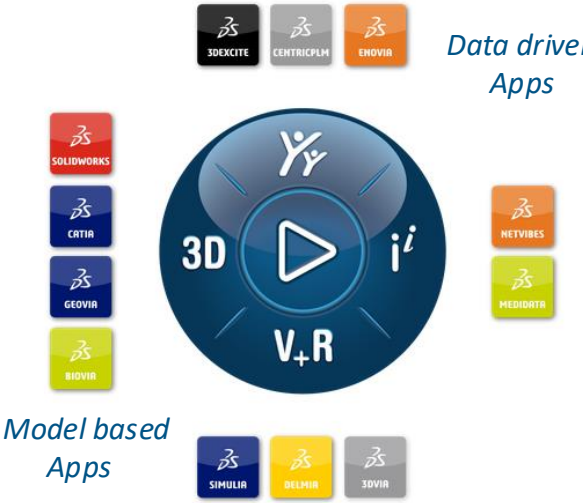
DIGITAL ENTERPRISE OPENNESS[1]

Industry Solution Experiences

Model Connectors

Office, Adobe, CATIA, SOLIDWORKS, NX, creo, INVENTOR, AutoCAD, cadence, Altium, ePLAN, ZUKEN, xpedition

Connected Software engineer



Enterprise Connectors [2]

SAP, Jira, ePLAN, Mentor Graphics, windchill, Microsoft Dynamics 365, ORACLE PRIMAVERA, aras, IBM DOORS, TEAMCENTER, REQTIFY, OPENDXM GLOBAL X, RVT

Autodesk

Connectors & Standards

STEP, ReqIF, MODELICA, SysML, SciLab, DDS, git, MATLAB SIMULINK, SSP, fmi, efmi, eclipse, AUTOSAR, OSLC, UAF, RAMML

(1) Extract for information only – Subject to change (2) Provided by partners

DASSAULT SYSTEMES

RECAP

- From Document-Based to Model-Based Shipbuilding
  - Accelerate design cycles and reduce project risk
  - Achieve digital continuity across all disciplines and phases
  - Define and optimize system architectures to manage complexity
  - Maintain end-to-end traceability within a collaborative, online data environment

- MBSE with Integrated Simulation
  - Introduce multiphysics and co-simulation early in the design (left shifting)
  - Enable system engineers to validate concepts using standardized, SME-defined methods
  - Conduct rapid trade studies and optimizations with parallel execution and streamlined analysis

- Flexibility and Openness of the 3DEXPERIENCE Platform
  - Support for file conversion across tools
  - Connectors and industry-standard integrations
  - Automated processes to reduce manual effort
  - Seamless integration with enterprise systems

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