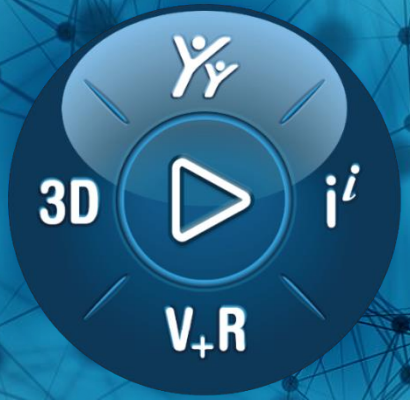
5 Critical Approaches to Accelerate Advanced Nuclear Enterprise Success with Digital Transformation



DASSAULT SYSTEMES

Virtual Worlds for Real Life

Don JOHNSON, Industry Technical Executive/Solution Architect, Senior
Vince GATTOLA, Industry Process Consultant , Senior MGR

DASSAULT SYSTEMES

OUR COMPANY

Dassault Systèmes in a nutshell

We help our customers meet today's major challenges. To do this, we rely on our most valuable assets : Our People

23, 800 +
employee worldwide

350 00 +
clients

194
offices

142
countries

DASSAULT SYSTEMES **Virtual Worlds for Real Life**

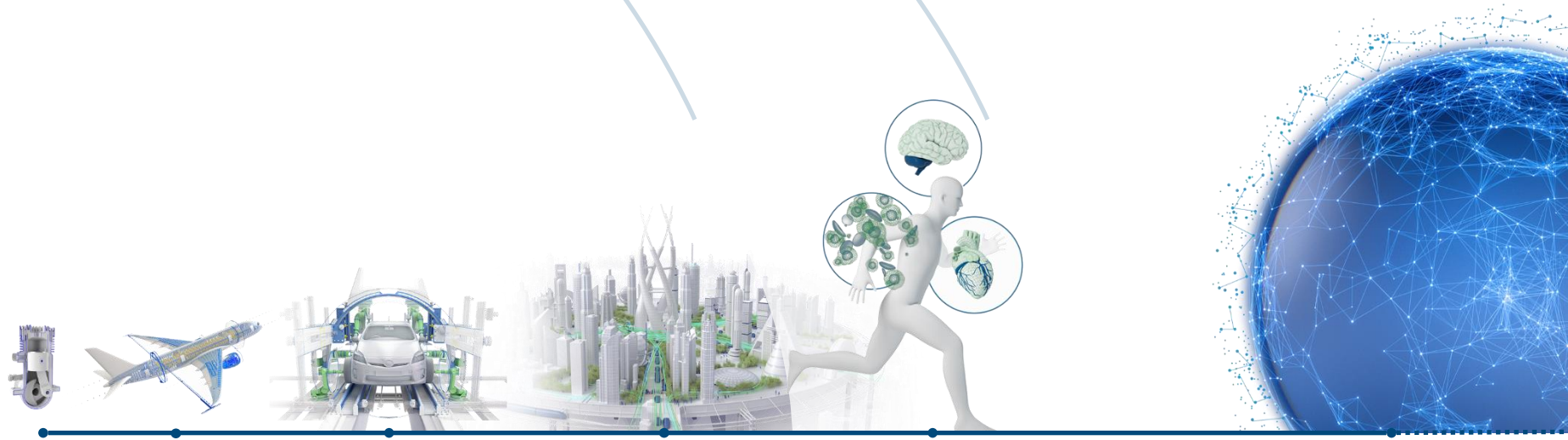
100%
aircraft, including those powered by solar energy, are designed using our software.

Over 50%
drugs and medical devices are developed using our solutions

100%
electric vehicle manufacturers innovate thanks to our design and manufacturing solutions

+8 000
active clinical trials are conducted with MEDIDATA

OUR LEGACY – HERITAGE AND AMBITION



13D
Design
981

1989
3D DMU
Digital
Mock-up

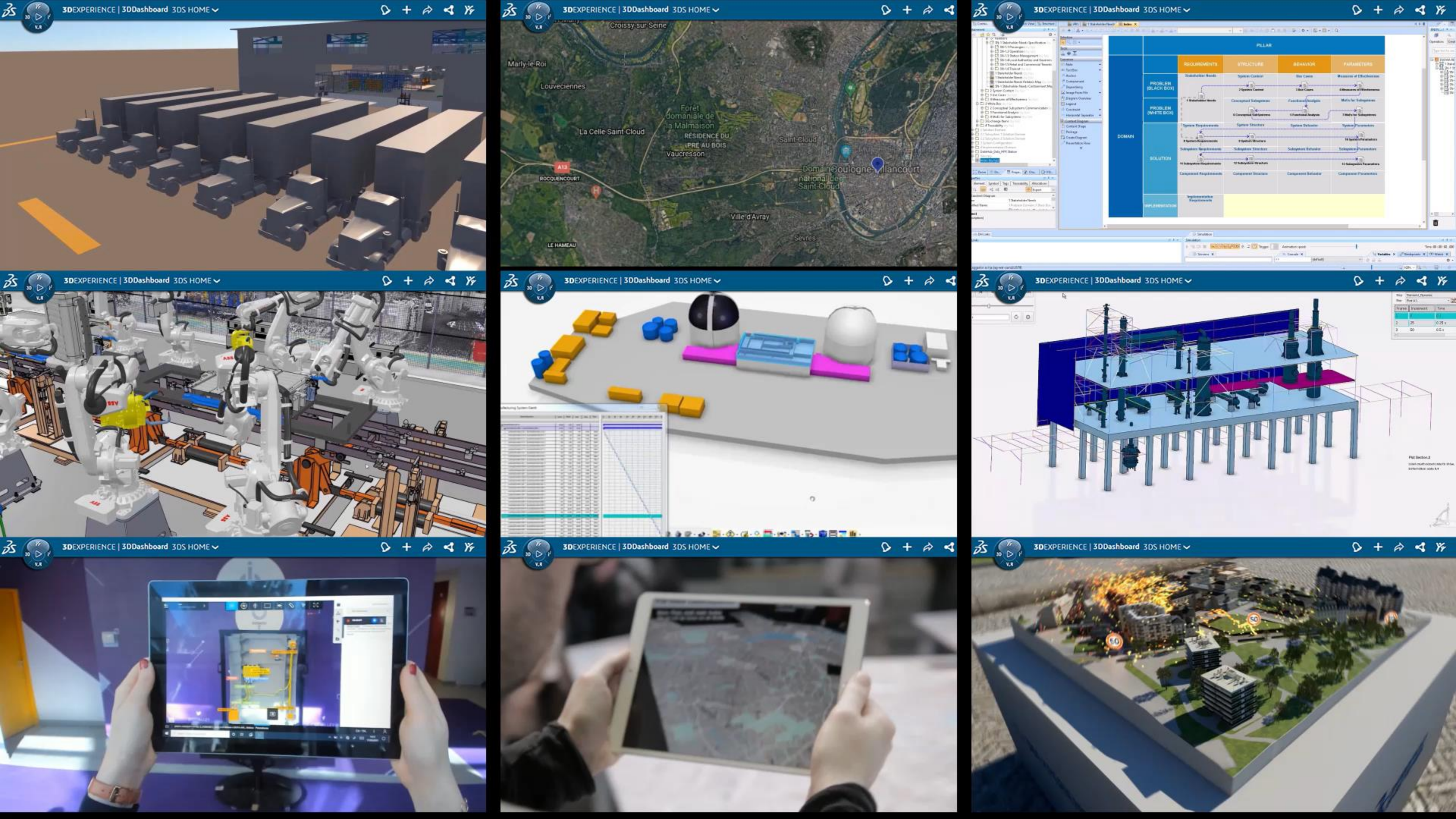
1999
3D PLM
Product Lifecycle
Management

2012
3DEXPERIENCE®
platform

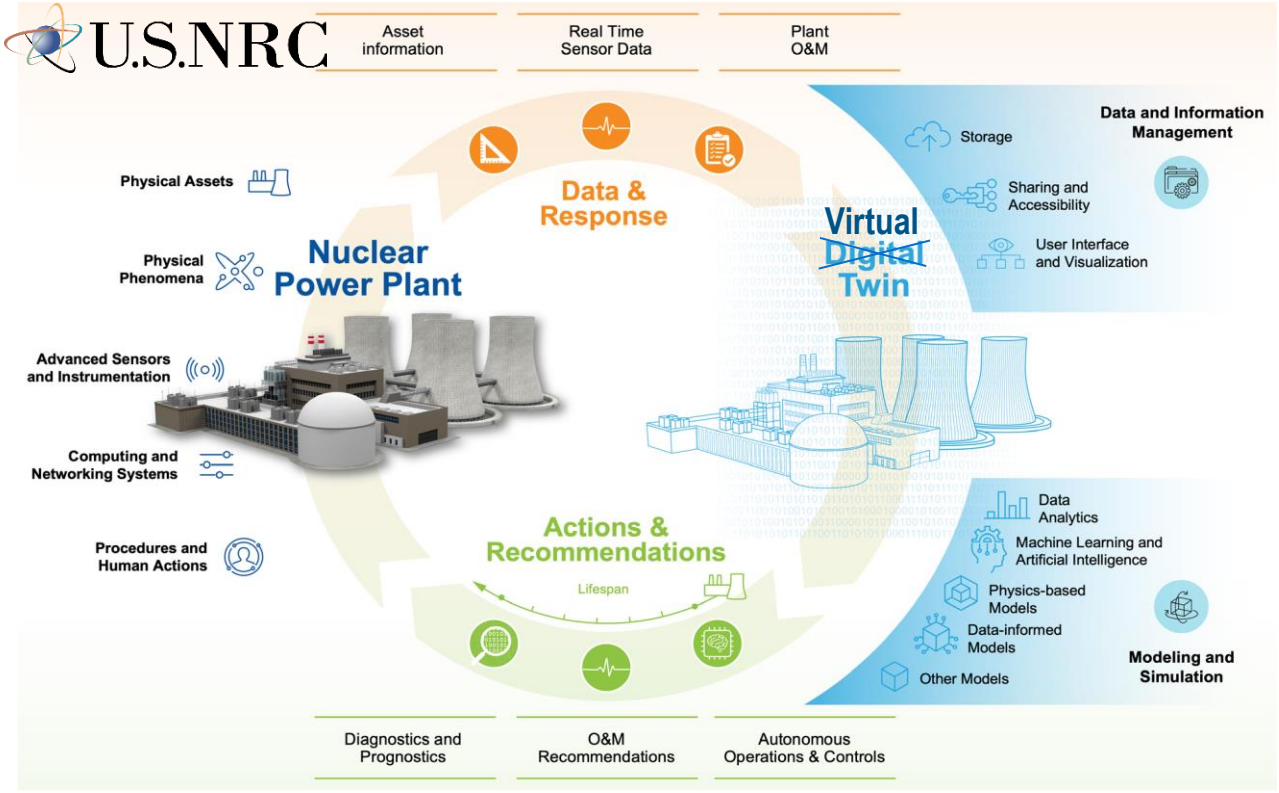
2020
Virtual Twin
Experience
of Humans

2040
Virtual Twin
Experiences
for a Sustainable
World

INDUSTRY — EXPERIENCE — HUMAN — METAMORPHOSIS


3DEXPERIENCE | 3DDashboard 3DS HOME
Croissy sur Seine
Marly-le-Roi
Louveciennes
Forêt domaniale de la Malmaison
La Celle-Saint-Cloud
RÉSIDENCE DU PRÉ AU BOIS
Vaucresson
Saint-Cloud
A13
ROCQUENCOURT
Domaine national de Saint-Cloud
Boulogne-Billancourt
Ville-d'Avray
Sèvres
LE HAMEAU
PILLAR
REQUIREMENTS
STRUCTURE
BEHAVIOR
PARAMETERS
PROBLEM (BLACK BOX)
PROBLEM (WHITE BOX)
DOMAIN
SOLUTION
IMPLEMENTATION

NRC VISION | THE DIGITAL TWIN



https://www.nrc.gov/reactors/power/digital-twins.html

THE NEED FOR CHANGE IS ACKNOWLEDGED BY THE NRC

DIGITAL / VIRTUAL TWINS ARE ESSENTIAL FOR FUTURE SUCCESS

SOLUTIONS MUST ADDRESS FULL **LIFECYCLE MANAGEMENT** CAPABILITIES

EXPERIENCE SHOWS FULL **DATA MANAGEMENT** AND CONFIGURATION GOVERNANCE ARE DIFFICULT TO ACHIEVE

OPERATING MUST BE CONNECTED TO DESIGN

SMR/AMR DELIVERY CYCLE MUST BE REPEATABLE, PREDICTABLE AND SUSTAINABLE

A SINGLE SOLUTION TO UNIFY AND GOVERN AS ENVISIONED EXISTS!

KEY CONCEPTS | THE VIRTUAL TWIN & DIGITAL TWIN

Virtual Twin: A virtual twin is a comprehensive digital model that spans the entire lifecycle of a product or system, from design to operation.

Digital Twin: A digital twin is a real-time digital representation of a specific physical asset, focusing on current state monitoring and predictive maintenance.

Aspect	Virtual Twin	Digital Twin
Virtual model spanning full lifecycle	☑	✗
Real-time digital representation of physical asset	☑	☑
Supports simulations and optimizations	☑	✗
Lifecycle coverage from design to operation	☑	✗
Real-time monitoring	☑	☑
Combines multiple components into one system	☑	✗
Specific asset or component-level detail	☑	☑
End-to-end lifecycle management	☑	✗
Extensive simulations	☑	✗
Complex system integration	☑	✗
Predictive maintenance	☑	☑
Optimizes operational efficiency	☑	☑
Advanced evolution integrating multiple twins	☑	✗
Cross-disciplinary simulations and data integration	☑	✗

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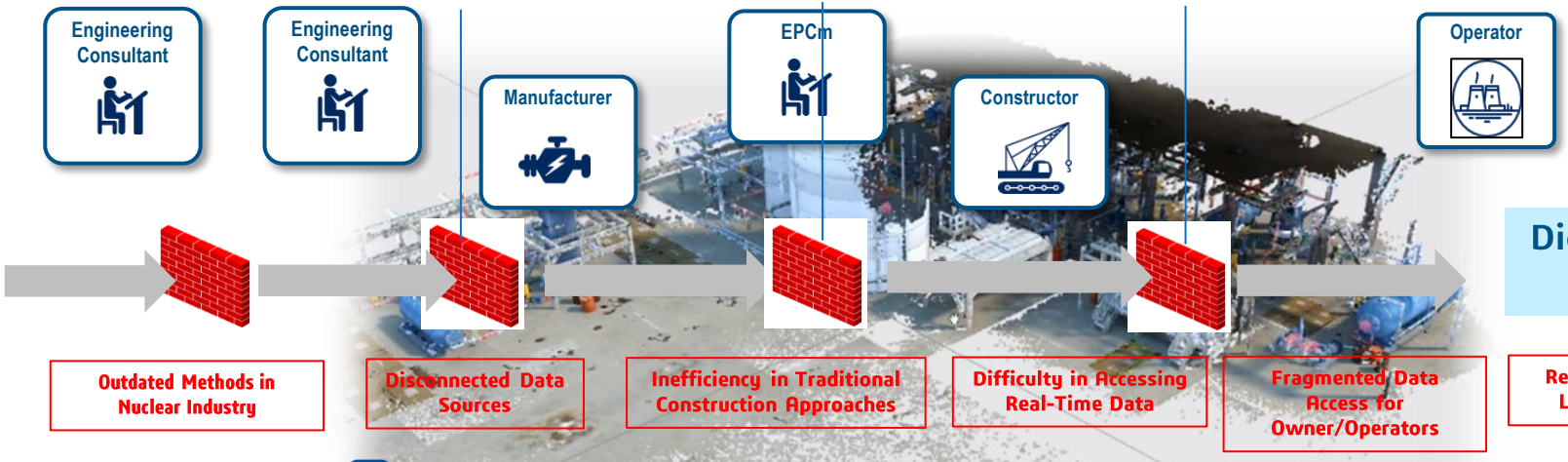
SILOS ARE AN OBSTACLE TO DIGITAL TWIN IN OPERATIONS

Nuclear energy renewal involves the rise of Advanced Nuclear Technologies development programs who face many specifics challenges

As-Specified | As-Designed | As-Procured | As-Manufactured | As-Supplied | As-Built | As-Tested | As-Maintained

Conceptual and Basic Design Detailed Design → Procurement & Manufacturing → Construction & Commissioning → Operation & Maintenance → Decommissioning



- Architectural Challenges
- Time to market
- Consideration of the entire life cycle
- Nuclear Safety & Licensing
- Achieve Cost Objective

OUR 5 STRATEGIC V + R PORTFOLIO TOPICS FOR AMR/SMR

2030 PLAN FOR VENDORS (EPC's , OEM's , Owner & Operators)

As-Specified | As-Designed | As-Procured | As-Manufactured | As-Supplied | As-Built | As-Tested | As-Maintained

Conceptual and Basic Design
Detailed Design
Procurement & Manufacturing
Construction & Commissioning
Operation & Maintenance
Decommissioning

1 SMR/AMR Unit – Product Virtual Twin fostered within Unified Intelligent Data Environment

.....start of digital thread.... *.....Digital thread Continuity.....*

2 Modular Fabrication, Assembly and Testing

3 Excellence in SMR/AMR Facility Delivery

4 Operation & Maintenance Engineering & Optimization

Project control across entire lifecycle to ensure requirements are met

5 Fleet O&M Services and Optimization

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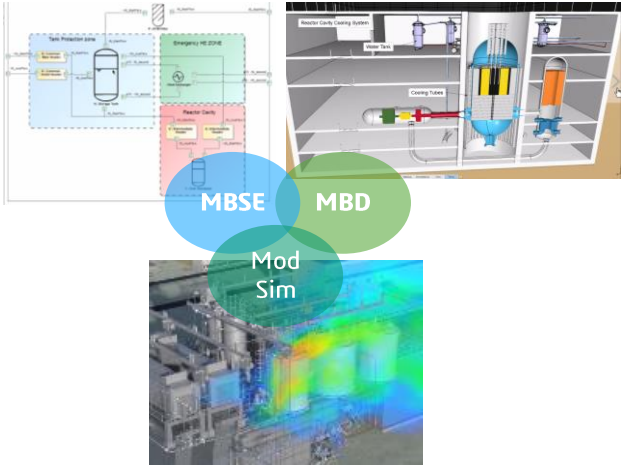
AMR/SMR
VIRTUAL TWIN PRODUCT
WITH MBSE

"Improve design accuracy and ensure fewer design changes later in the process and achieving a zero-defect engineering "

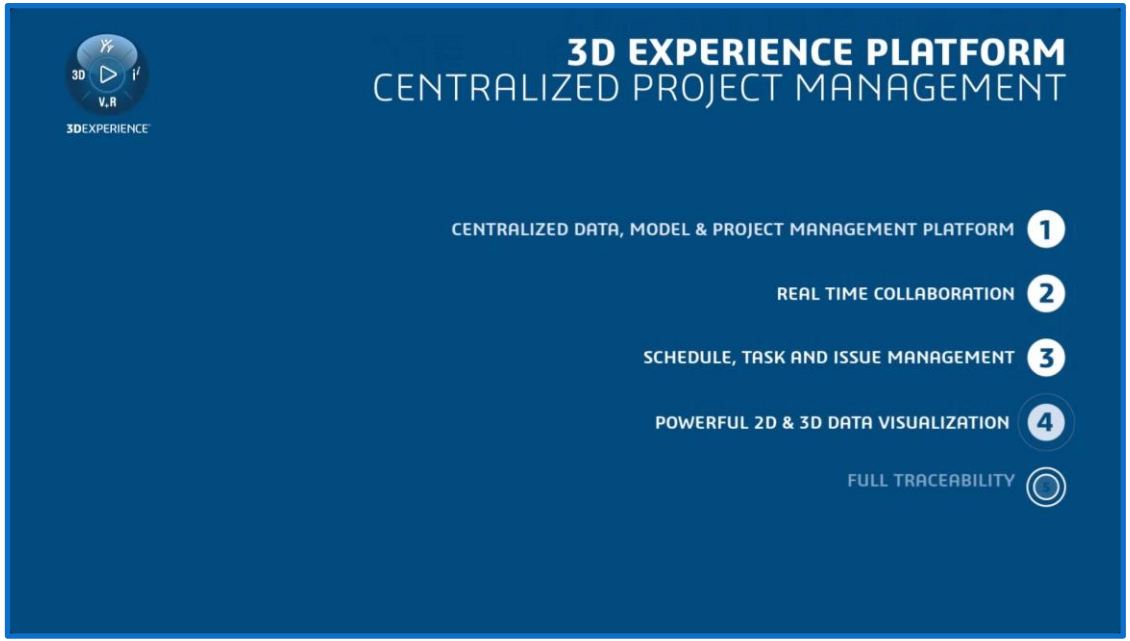


3DEXPERIENCE

OUR UNIFIED INTELLIGENT DATA ENVIRONMENT

3DEXPERIENCE PATFORM AS YOUR CDE - "Unified Intelligent Data Environment

- A common platform for seamless global collaboration
- Centrally stored data to deliver a single source of truth throughout the entire plant lifecycle
- Data indexed to deliver intuitive access to information and analytics
- Compliance with global nuclear standards



- Empowers real-time agile collaboration, enabling seamless communication and engagement across the ecosystem
- Ensures seamless data flow and orchestrates and end-to-end business processes across value chains
- To predictive outcomes, uncover blind spots, and reveal insights to make informed decisions quickly and accurately
- To institutionalize best practices, optimize ways of working, and drive standardization across the extended enterprise and/or projects

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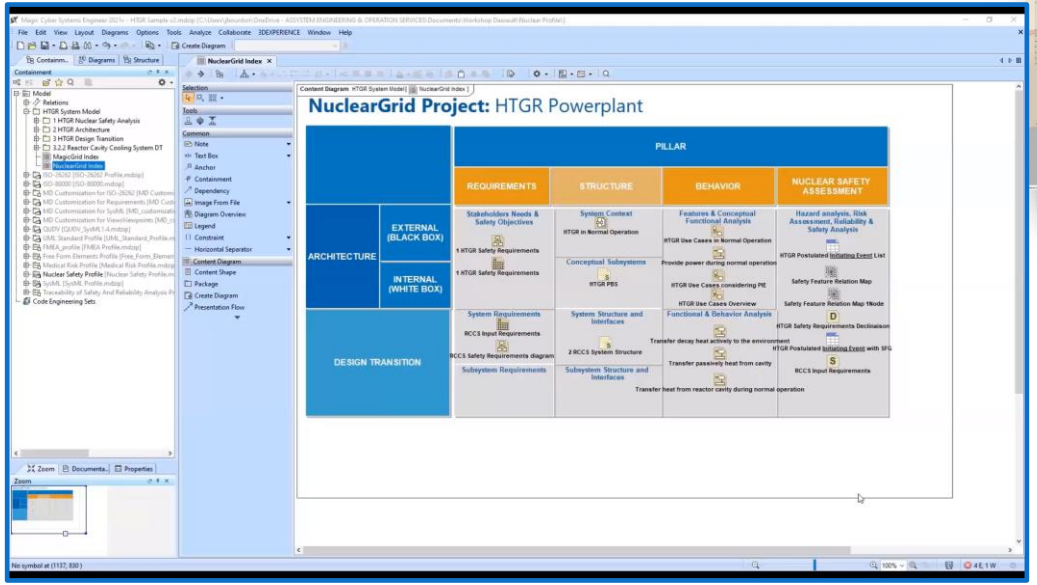
1- OUR VIRTUAL TWIN | WITH MBSE

Virtual Twin of a Nuclear Referential with Model Based Systems Engineering

- Virtual Twin Creation and Design Precision
- Lifecycle Continuity through RFLP Modeling
- Ensures full traceability across product lifecycle, enhancing compliance and reducing risks.
- Seamless Collaboration Across the Ecosystem



1 **AMR/SMR Product Virtual Twin**

- Improves design accuracy
- reduces errors and costs
- streamlines engineering validation processes

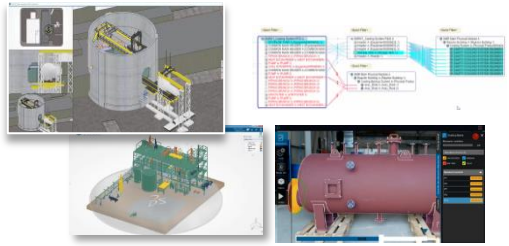
Ensures full traceability across product lifecycle, enhancing compliance and reducing risks.

Allows for testing different scenarios digitally, mitigating risks and reducing prototyping costs.

Streamlines communication, improves collaboration efficiency, and reduces project timelines.

DASSAULT SYSTEMES

2- VIRTUAL FABRICATION, ASSEMBLY & SIMULATIONS



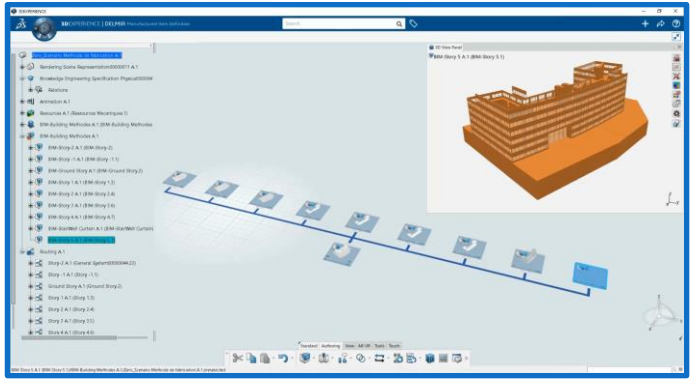
"To ensure a highest quality of fabricated assets and deliver on time and on budget"

3DEXPERIENCE

2-OVERVIEW OF VIRTUAL FABRICATION, ASSEMBLY, AND TESTING

Adopting Our Modular Construction Solution to Create Great Efficiency and Predictability

- Designing for Modularity and Constructability
- Offsite Testing and Commissioning
- Simulation to Digitally validate for Seamless Assembly
- Optimized Manufacturing via Module-Based Design

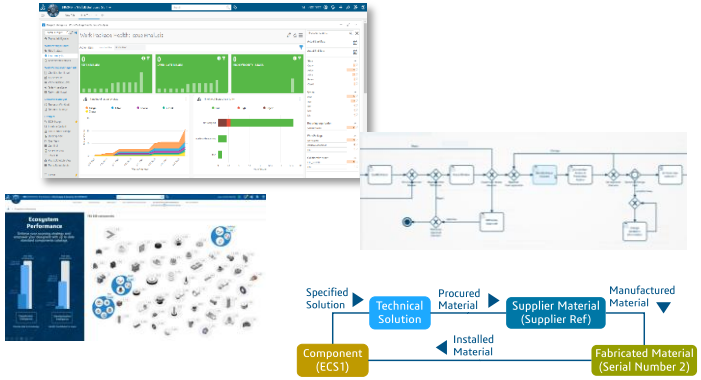


2 Modular Fabrication, Assembly, and Testing

- Reduces risks, minimizes delays, and ensures adherence to standards through controlled manufacturing.
- Ensures quality standards are met before components reach the site, reducing rework and project costs.
- Simulates and optimizes assembly processes, minimizing on-location disruptions.
- Drives down costs, improves quality, and increases supply chain efficiency through repeatable, scalable manufacturing processes.

3- EXCELLENCE IN AMR/SMR FACILITY DELIVERY

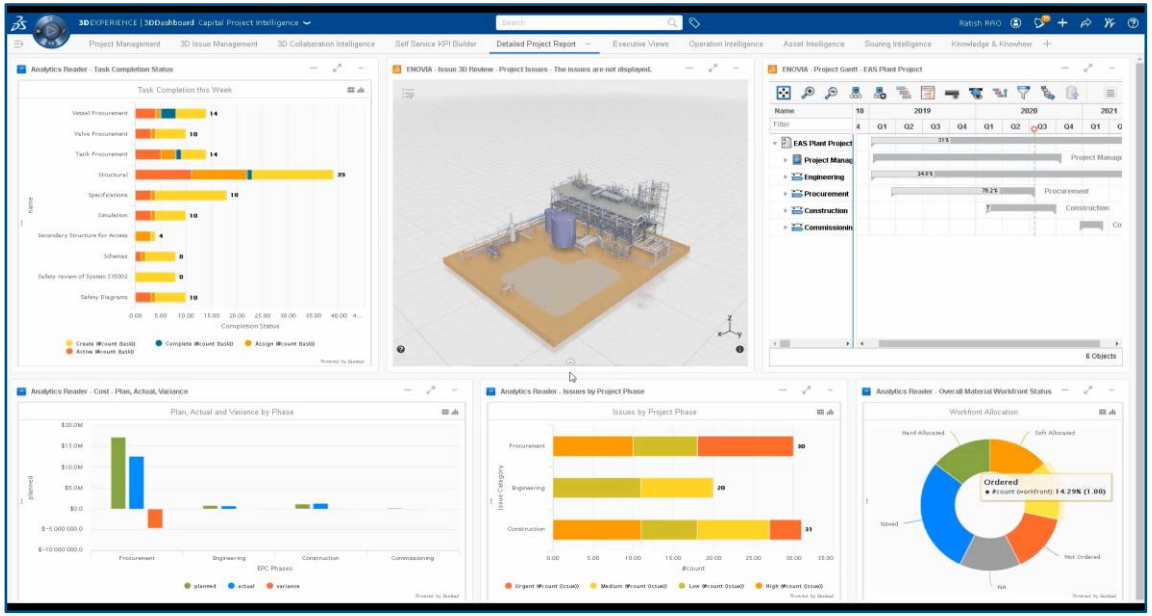
"Streamlining Project Data Intelligence during Projects Run"



3- EXCELLENCE IN SMR/AMR FACILITY DELIVERY

Streamlining Project Data Intelligence during Projects Run

- Integration of Data Across the Digital Thread for Supply chain Coordination
- Project Intelligence Dashboards
- Streamlined Business Process Management for Efficient Procurement and Delivery
- Enhanced Visibility and Collaboration Across the Ecosystem

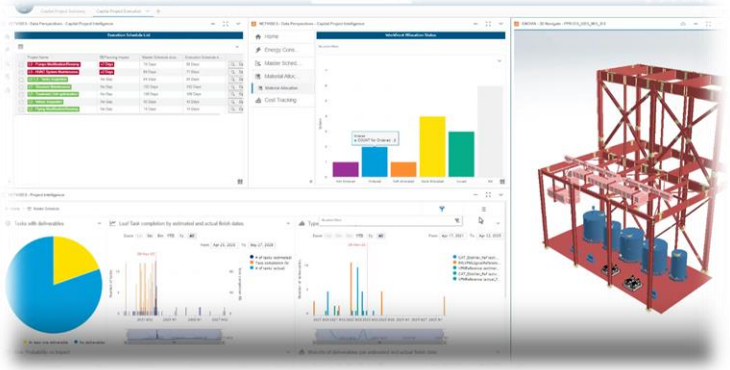


3 Excellence in SMR/AMR Facility Delivery

- Improved supply chain coordination, reducing lead times and risks mitigation
- Real-time insights for better, faster decision-making
- Streamlined workflows, reduced errors, and enhanced efficiency.
- Improved collaboration efficiency, aligning stakeholders and reducing project timelines.

4- VIRTUAL TWIN FOR OPERATIONS

"Share trusted knowledge for effective decisions"



4- VIRTUAL TWIN FOR OPERATIONS

Unifying the Virtual Twin Referential and share trusted knowledge

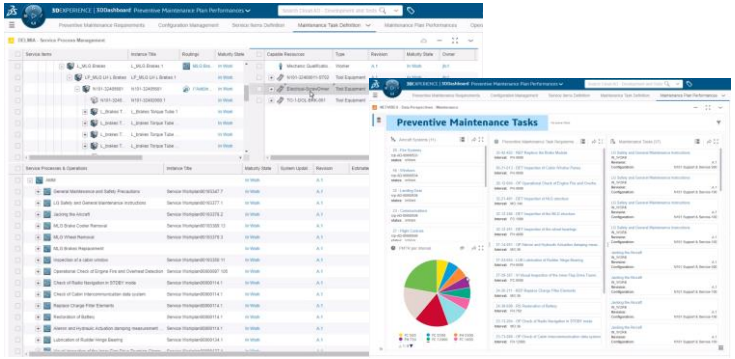
- Supply Chain Coordination and Procurement Optimization
- Data Integration for Effective Supplier and Material Management
- Data-Driven Decision Support for Enhanced Reliability
- Seamless Cross-Functional Collaboration

4 Virtual Twin for SMR/AMR Operations

- Reduced lead times and optimized procurement.
- Improved visibility into supplier and material tracking.
- Predictive insights and timely decision-making.
- Improved project coordination and reduced errors..

5- OPTIMIZED OPERATION & MAINTENANCE FOR ENHANCED LONGEVITY

"SMR operational monitoring to enable operations decision making"



5- OPTIMIZED OPERATION & MAINTENANCE FOR ENHANCED LONGEVITY

Enabling Efficient Operations Management

- Real-Time Condition Monitoring
- Predictive Maintenance Scheduling
- Service Process Optimization
- Knowledge Transfer and Training via Virtual Twins

5 Optimized fleet O&M for enhanced longevity

- Gain immediate visibility, detect anomalies early, and reduce downtime
- Accurately forecast maintenance needs, reducing costs and unnecessary inspections.
- Optimize service processes, improve communication, and accelerate resolutions.
- Use Virtual Twins for safe, cost-effective, and immersive training..

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SUMMARY

Our 5 strategic V + R portfolio topics for AMR/SMR

As-Specified | As-Designed | As-Procured | As-Manufactured | As-Supplied | As-Built | As-Tested | As-Maintained

Conceptual and Basic Design Detailed Design | Procurement & Manufacturing | Construction & Commissioning | Operation & Maintenance | Decommissioning

1 **SMR/AMR Unit – Product Virtual Twin fostered within Unified Intelligent Data Environment**

.....start of digital thread.... *.....Digital thread Continuity.....*

2 **Modular Fabrication, Assembly and Testing**

3 **Excellence in SMR/AMR Facility Delivery**

4 **Operation & Maintenance Engineering & Optimization**

Project control across entire lifecycle to ensure requirements are met

5 **Fleet O&M Services and Optimization**

DASSAULT SYSTEMES

5- OPTIMIZED OPERATION & MAINTENANCE FOR ENHANCED LONGEVITY

Enabling Efficient Operations Management

Real-Time Condition Monitoring

EDF Energy used Dassault Systèmes' Virtual Twin at Sizewell B. It **reduced unplanned downtime by over 20%** through early anomaly detection (Source: EDF, 2022).

Predictive Maintenance Scheduling

In manufacturing, using Dassault Systèmes' 3DEXPERIENCE platform, companies **cut equipment downtime by up to 40%** and **lowered maintenance costs by 20%** (Source: McKinsey, 2022).

Service Process Optimization

Rolls-Royce integrated Dassault's platform for better communication, **reducing maintenance task times by 15%** (Source: Rolls-Royce, 2022).

Knowledge Transfer and Training via Virtual Twins

A leading energy utility used Dassault's Virtual Twin for training, **reducing costs by 40%** and increasing knowledge retention (Source: Dassault Systèmes, 2023).

5 Optimized fleet O&M for enhanced longevity

- Gain immediate visibility, detect anomalies early, and reduce downtime
- Accurately forecast maintenance needs, reducing costs and unnecessary inspections.
- Optimize service processes, improve communication, and accelerate resolutions.
- Use Virtual Twins for safe, cost-effective, and immersive training..

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4- VIRTUAL TWIN FOR OPERATIONS

Unifying the Virtual Twin Referential and share trusted knowledge

Supply Chain Coordination and Procurement Optimization

An energy sector project, the Virtual Twin **reduced lead times by 25%** for critical components, thanks to integrated supply chain visibility. (Source: Dassault Systèmes case study).

Data Integration for Effective Supplier and Material Management

In a recent nuclear project, using the Virtual Twin **led to a 20% reduction** in supply chain disruptions, keeping materials on schedule. (Source: Dassault Systèmes case study).

Data-Driven Decision Support for Enhanced Reliability

A client using real-time dashboards **reduced downtime due to material shortages by 15%,** showing the power of up-to-date information. (Source: Dassault Systèmes technical whitepaper).

Seamless Cross-Functional Collaboration

Using Virtual Twin tools, a project saw a **15%** faster delivery due to reduced communication gaps. (Source: Dassault Systèmes blog).

4 Virtual Twin for SMR/AMR Operations

- Reduced lead times and optimized procurement.
- Improved visibility into supplier and material tracking.
- Predictive insights and timely decision-making.
- Improved project coordination and reduced errors..

3- EXCELLENCE IN SMR/AMR FACILITY DELIVERY

Streamlining Project Data Intelligence during Projects Run

Integration of Data Across the Digital Thread for Supply Chain Coordination	According to McKinsey, companies that adopted digital integration saw a **35% reduction in lead times** and up to **20% risk mitigation** (Source: McKinsey & Company, 2021).
Project Intelligence Dashboards	Boeing used real-time dashboards to **reduce decision-making time by 25%,** contributing to better project delivery (Source: Boeing Case Study, Aviation Week, 2020).
Streamlined Business Process Management for Efficient Procurement and Delivery	PwC found that digital procurement tools led to a **15% reduction in overhead** and a **22% boost in sourcing efficiency** for major energy projects (Source: PwC Digital Procurement Report, 2022)
Enhanced Visibility and Collaboration Across the Ecosystem	The ITER nuclear fusion project used a similar platform, resulting in a **30% reduction in project timelines** through better communication (Source: World Nuclear News, 2021)

3 Excellence in SMR/AMR Facility Delivery → Improved supply chain coordination, reducing lead times and risks.. → Real-time insights for better, faster decision-making. → Streamlined workflows, reduced errors, and enhanced efficiency. → Improved collaboration efficiency, aligning stakeholders and reducing project timelines.

2-OVERVIEW OF VIRTUAL FABRICATION, ASSEMBLY, AND TESTING

Adopting Our Modular Construction Solution to Create Great Efficiency and Predictability

- **Designing for Modularity and Constructability** — Modularity cut **onsite labor by 25%** and **shortened timelines by 17%** compared to traditional methods. (Source: IAEA, 2021)
- **Offsite Testing and Commissioning** — Recent SMR projects with offsite testing saw **30% less rework** and **20% cost savings**. (Source: DOE, 2022)
- **Simulation to Digitally validate for Seamless Assembly** — At the Vogtle Plant, digital validation **reduced onsite disruptions by 35%.** (Source: Nuclear Energy Institute, 2023)
- **Optimized Manufacturing via Module-Based Design** — Module-based design **cut costs by 18%** and **increased productivity by 15%.** (Source: Petrochemical Modularization Study, 2021)

2 Modular Fabrication, Assembly, and Testing

- Reduces risks, minimizes delays, and ensures adherence to standards through controlled manufacturing.
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- Drives down costs, improves quality, and increases supply chain efficiency through repeatable, scalable manufacturing processes.

1- OUR VIRTUAL TWIN | WITH MBSE

Virtual Twin of a Nuclear Referential with Model Based Systems Engineering

Virtual Twin Creation and Design Precision	In aerospace, using a unified virtual twin led to a **30% drop in engineering rework** (Source: Aerospace Study, 2021),
Lifecycle Continuity through RFLP Modeling	This holistic continuity **cuts down on engineering change orders by up to 50%** (Source: Industry Data, 2022)
Ensures full traceability across product lifecycle, enhancing compliance and reducing risks.	For energy projects, leveraging virtual simulations **reduced prototype requirements by nearly 40%** (Source: Energy Project Report, 2022),
Seamless Collaboration Across the Ecosystem	This integration has been shown to **reduce project timelines by 25%** (Source: Major Engineering Projects Review, 2023)

1 AMR/SMR Product Virtual Twin

- Improves design accuracy
- reduces errors and costs
- streamlines engineering validation processes

- Ensures full traceability across product lifecycle, enhancing compliance and reducing risks.

- Allows for testing different scenarios digitally, mitigating risks and reducing prototyping costs.

- Streamlines communication, improves collaboration efficiency, and reduces project timelines.

DASSAULT SYSTEMES

Questions & Answers

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