Digital Engineering @ NRIC

Implementation of digital engineering principles applied to micro reactor design and construction
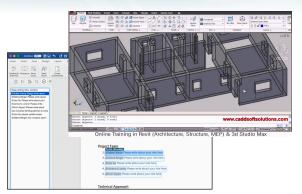
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What is Digital Engineering?

Stone Tablet

Paper Blueprint

Online Training in Revit (Architecture, Structure, MEP) & 3d Studio Max

Information Management

Digital Engineering

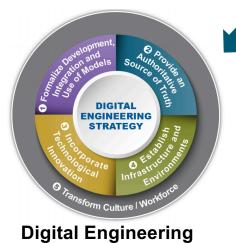DIGITAL ENGINEERING STRATEGY

1. Use Models
   MBSE & BIM
2. Source Of Truth
   Central Datawarehouse
3. Technological Innovation
   Lab & University Research

4. Infrastructure and Environment
   Cloud Computing & HPC
5. Transform Culture
   Training & Cultural Integration

Opportunity

- Significant program impacts, for example published impacts at Mortenson Construction demonstrate
  - **600 cumulative day** direct **schedule reductions**
  - **25% productivity increase**
  - Use across 416 VDC programs
- **40% improvement** in first-time quality through use of digital twins (Boeing)
- Expected **$30M** savings at NNSA
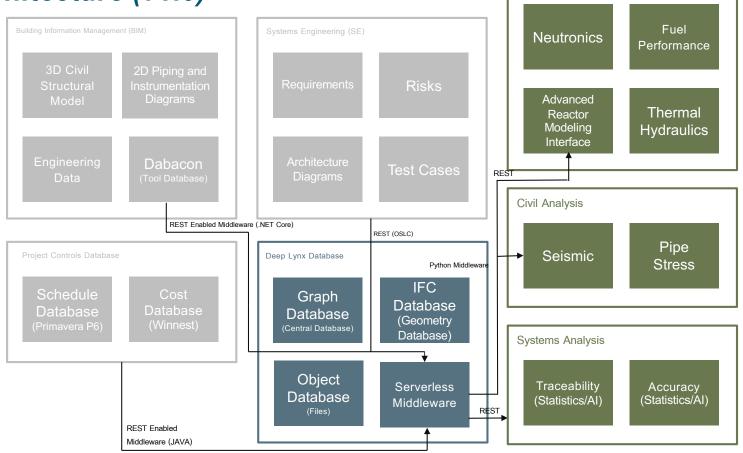- Proven across engineering domains: Construction (Mortenson VDC), Aerospace (Boeing 777), Automotive (Bugatti)

Level 7	automated design optimization	Artificial Intelligence
Level 6	analytics automation	Advanced Analytics
Level 5	connections across lifecycle	Digital Thread
Level 4	connections within in each domain	Digital Links
Level 3	data storage are centralized	Data Lake
Level 2	document storage are centralized	Content Management
Level 1	data and documents disconnected	Siloed Program

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Example Derivative Solution: Plant Digital Engineering Architecture (v1.0)

- Cloud-based service of industry leading COTS tools
- Automation of design, modeling, & analysis integration
- Visualization of traceability between siloed tools
- Analysis of overall system traceability and accuracy

Building Information Management (BIM)

- 3D Civil Structural Model
- 2D Piping and Instrumentation Diagrams
- Engineering Data
- Dabacon (Tool Database)

Systems Engineering (SE)

- Requirements
- Risks
- Architecture Diagrams
- Test Cases

REST Enabled Middleware (.NET Core)

REST (OSLC)

Project Controls Database

- Schedule Database (Primavera P6)
- Cost Database (Winnest)

Deep Lynx Database

Python Middleware

- Graph Database (Central Database)
- IFC Database (Geometry Database)
- Object Database (Files)
- Serverless Middleware

REST Enabled Middleware (JAVA)

REST

REST

Nuclear Analysis

- Neutronics
- Fuel Performance
- Advanced Reactor Modeling Interface
- Thermal Hydraulics

Civil Analysis

- Seismic
- Pipe Stress

Systems Analysis

- Traceability (Statistics/AI)
- Accuracy (Statistics/AI)

Work Scope

- Scope
  - This work scope will utilize model-based systems engineering (MBSE) to design traced physical, functional, and requirements models. These models will be developed in a data-first paradigm where the underlying database is the authoritative source of truth which generates visual representations of the data. To develop these models a data model will be developed and infrastructure will be deployed to DOE internal and/or cloud systems.

- Key Personnel
  - Chris Ritter, Chief Architect
  - Peter Suyderhoud, MBSE Architect
  - Jason Kuipers, Senior Software Engineer
  - Nancy Gomez, Infrastructure Lead