Integrating Simulation & BIM to Optioneer EPC Projects

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Boeing 777 – Data Centric Optioneered Design

- 3D modeling software (CATIA) used for complete design
- Manufacturers, suppliers, and customers engaged from the start
- Performance simulation combined with clash detection

Results (compared to 757/767) -
- Elimination of more than 3000 assembly interfaces
- 90% reduction in engineering change requests (6000 to 600)
- 50% reduction in cycle time for engineering change requests
- 90% reduction in material rework

This was accomplished 20 years ago
Bechtel – A Global EPC Company

• EPC = Engineering, Procurement & Construction
• Vast array of large challenging projects
  – Roads and rail systems
  – Airports and seaports
  – Fossil and nuclear power plants
  – Renewable energy
  – Refineries and petrochemical facilities
  – Mines and smelters

Aluminum Smelter Constructed by Bechtel
Iceland - 2005
Optioneering Bechtel Projects Simulation-Based Design

- Many First-of-a-Kind Projects (FOAK)
- Advanced technology tools increasingly used for design and engineering
- Logistics, schedule, environment, and risk can be crucial factors
- Design Basis - The means need to justify the ends

Tacoma Narrows Bridge - 2003 Simulation-Based Caisson Design
Airport Optioneering Case Study - 2003

The architect-to-CAD-to-mesh-to-analysis cycle

Small Caribbean Island Airport
Determine feasibility of a natural ventilation-based HVAC

Use of natural circulation can greatly reduce the power consumption demand from air conditioning
Design Goal – Minimize Airport Energy Use
Iterative Model-Based Execution
Optioneering for Structural Design
Middle East Airport Project - 2011

- Use of FEA to optimize complex joint design
Fast-Forward - Evolution to BIM Enables “Collaborative Optioneering”

- How can BIM be geared towards an information flow that continuously enhances the design process, construction process, AND performance of the facility?
- BIM >>
- Collaboration >>
- Optioneering >>
- LEAN Execution >>
- Optimization >>

“Business Transformation Model”
Optioneering Site Planning & Development

- Road/Building Layout
- Excavation Costs
- Accessibility Issues

LNG Project on island in British Columbia
Current Optioneering Focus
Project Constructability and Lifecycle

2-D Design Documentation
+ Advanced 3-D Design Tools
+ Cost & Schedule Data Integration
+ Design Validation & Simulation
+ Architectural Visualisation

Large Airport Expansion in UK
Moving towards Optioneering for Project Lifecycle

Two way, 3D navigation

COBIE Exported

COBIE Imported

BIMFORUM

#humanBIM
CONCLUSION - Where we want to go

From EPC to “BIM-EPC”

- Optimization driven by Integration of Simulation
- Delivery driven by Technology Transformation
- Execution driven by Cultural Transformation