Putting BIM in Practice at the Smithsonian Institution with the National Air and Space Museum Renovation
SI by the Numbers

- 154 million artifacts
- 27 million in-person visitors
- 13 million square feet
- 43,000 acres of land
- 28,000 equipment assets
- 12,000 volunteers
- 6,500 employees
- 600 buildings
- 300 structures
Review of Key As-Is Business Processes

OEDC – High Level Information Needs

Supporting Decision-Making and Improving Project Execution

- **Critique**: Addressing and refining the existing business processes.

OfEO Total Facilities Lifecycle Management

- **Planning**: Geospatial and IT Strategic Plan Updates, OEDC Strategic Planning Updates
- **Budget**: S&E Salaries/Expense Review, S&A Salaries/Expense Review
- **HR**: Projected S&A and S&E vacancies, Status of current HR recruit/fulfillments

D&C Project Execution

- **Construction**: Outstanding Change Orders, Outstanding NTPs, Schedule Growth, Cost Growth, CM Workload Distribution, Project Close-out Status, DART by RE Office, Contract Modification Analyses
- **Cost Engineering**: Approved CWE vs. Actual Award Amount, Award Amount vs. Final Contract Amount, Approved CWE vs. Final Contract Amount, % of Capital Program w/ CEO approved CWES, % of Capital Program w/ CPDs

Project + Data Delivery
Owners Have Common Challenges

All happy families are alike; each unhappy family is unhappy in its own way.”

- Leo Tolstoy, Anna Karenina

Data Gaps:
- Data is inaccurate or unavailable
- Inadequate or nonexistent audit trails
- Lack of data sharing

Information Technology Gaps:
- Fragmented and independent systems
- Lack of interoperability
- Parallel and duplicative functions

BIM can be part of the solution
Consider This…

• 92% believe it will be ‘de facto’ design standard in 3 years

• Only 25% of US owners have ‘very high involvement’ in BIM

• 75% of these stated that the AEC team used BIM when it wasn’t required by the owner

• UK is a leader in BIM with over 98% of owners having some involvement in BIM compared to 59% in the US

(Sources: NBS National BIM survey, 2015; McGraw Hill Construction, 2014)
Begin with the End in Mind

• Define Use Cases
• BIM Requirements for A-Es (guidance)
• Contract Language for A-Es and Contractors
• BIM Templates
• BIM Inventory
• BIM PxP
• BIM Design Review
• BIM Wiki
Evaluating BIM Delivery

NMAAHC Project Practice + BIM Review

• Case study in BIM development and delivery at the high-end of project complexity
• Many parties involved
• A standard workflow to transition the project BIM(s) to an FM BIM needs to be developed, a few components would be:
  - Reduce redundant families
  - Remove elements particular to the project
  - Realign work sets (groupings of components)
  - Apply SI BIM conventions not picked up by AECs
  - Workflows to capture a partial building BIM
BIM Development Framework

Initial Goals

• Identify and develop an initial group of BIMs to a **consistent level of detail**

• Refine BIMs to sufficiently support AE project development, reduce the need for discovery – roughly equivalent to the information within the SI CAD Inventory (architectural)

• Incorporate SI data fields for spatial, asbestos, and asset information

• Incorporate SI standards for documentation, drawing conventions, and standard naming
BIM and Space Management

Integrating BIM-GIS process for Spatial Management

• Develop a Revit workflow to replicate and improve SI’s current (tedious) manual processes for migrating spatial data from CAD to CAFM/IWMS to SI Explorer (GIS)

• Verify the workflow for spatial data exchange with the NASM BIM configured with a new SI BIM spatial template and the SI Explorer geodatabase

• Test the newly released add-in tool that will automate the process further
NASM Revitalization Project – BIM Prototype

- First required BIM deliverable by SI (done large!)
- Prototype to vet and refine SI BIM standards, develop lessons learned
- Currently vetting design review with BIM
- Design team (contractor) very experienced with BIM - *how this changes the project process*
BIM in Design

- Site plans
- Floor plans
- Area plans
- Structural plans
- Life safety plans
- Reflected ceiling plans
- Roof plans

- Mechanical and electrical assets -- ready for export to Facility Center
- GIS requirements – ready for export to OFEO Geodatabase
- Asset and spatial parameters
- 3D views, walkthroughs, elevations, plans
- SI title blocks and sheet layouts with agency logo, smart labels and graphic scale symbols
- Includes disciplines, standard layer names
BIM in Design Review

During Design

- Incorporate specific BIM design review capabilities
- Address multiple user capabilities: equipment and skills
- Develop standards for AE to follow
During Construction

- Define ‘As-Built BIM’
- Asset Management
- Integration with Computerized Facility Maintenance System (Tririga Facility Center)
BIM in FM

Facilities Management

• Support **preventative maintenance** through visualization of work tasks and asset location

• Support **emergency response** through visualization of critical asset and shut off locations

• Use 3D for **vetting new systems** prior to installation - make sure new equipment will fit in tight space

• Integrate geospatial data into facilities mobile applications

Energy Management

• Introduce geospatial component to existing power and water usage analysis
BIM to FM Systems: GIS

GIS

Exchange of spatial geometry + data attributes to GIS and IWMS

SI Revit templates organize data to be developed in the project BIM, and delivered to SI at project turnover, exported to GIS and IWMS

SI Explorer (ESRI GIS application linked to TRIRIGA - spatial data system of record)

Safe Software FME ETL (translation) application

- Initially: CAD files exported from Revit
- Future: Safe Software FME plugin for Revit

Project Architectural BIM using SI Revit Architectural Template
BIM to FM Systems: IWMS

IWMS/CAFM

- Provide critical asset data, “ready” for upload to the SI O&M database (Tririga Facility Center)
- Focus: Core data fields from TRIRIGA

**SI Revit MEP templates**

- Asset schedules (Revit project model)
- MEP project models

**Key TRIRIGA data fields**
- = Revit asset parameters

**BIM to IWMS**

- Exchanges to SI Facility Center O&M database (TRIRIGA)
  - Initially: Text (.csv) files exported from Revit
  - Future: Export Revit add-in (Safe Software FME) or TRIRIGA-side app
BIM “Wiki”

Value Proposition
– Leverage additional technologies to improve information support

• Develop a go-to source for information about SI buildings
  - Highly visual, collaborative web-based environment
  - Leveraging SI’s SharePoint expertise

• Provide links and information from existing SI sources
  - Create a format that is easily updatable and flexible
  - Incorporate info from SI Explorer, CAD, BIM, Tririga, Document Locator, and more …

• Promote interactivity via collaborative technologies
  - Calendaring, FAQs, videos, discussion forums
Extending BIM

Second generation development – building on a base BIM practice and incorporating additional data and GIS integration

• Campus BIM
• SI Landscape Management
• Capital Planning - Visual Display and Analysis
• Security Management and Analysis BIM
• Historic Preservation Building Information Management
Summary

• Clearly define use cases prior to implementing BIM
• Have a data management schema
• Decide what to BIM and what not to
• Collaborate with AEC industry for best practices
• Recognize that the AEC community is not prepared for owners requirements
• Benefits we expect:
  – Reduced GIS workflows
  – More accurate asset information
  – Better design review outcomes with fewer construction changes
  – Reduced decision latency resulting higher productivity