Mike Carrancho, P.E.
Smithsonian Institution

BIM for the ASSET Lifespan
Office of Facilities Engineering and Operations

600+ Buildings
12 million Sq Ft
1,800+ OFEO Staff
Smithsonian around the Globe
19 Museums, 9 Research Centers, plus the National Zoo

Smithsonian Facilities
- Museums
- Research
- Admin/Support/Storage

609 Buildings, 12 million Sq Ft (gross)
Challenges of Stewardship

- Over 6,000 employees and 5,000 volunteers
- Monumental and historic icons
- Collection care for 137 M artifacts, including living collections
- Open 364 days per year
- High rate of visitation: 24 million per year
- Museums, Laboratories, Field Stations, Telescopes
Begin with the End in Mind

**Required Outcomes of using BIM**
- BIM usefulness required long after design and construction
- Asset management
- Portable for maintenance and operations personnel
- Accessible at multiple user levels across the institution
Begin with the End in Mind

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

**During Construction**
- Define ‘As-Built BIM’
- Asset management
- Integration with Computerized Facility Maintenance System (Tririga Facility center)
OFEO BIM Program Timeline

• 2013: Planning for BIM
  – Market and industry survey
  – Use Case Analysis, SI staff and AEs
  – In-house BIM Technician

• 2014: BIM Pilots, Standards and Wiki Sites
  – Identified major upcoming design project
  – Developed draft language for SOW
  – Create BIM templates & Guidance
  – BIM Viewer and Model Checker recommendations
  – Develop internal BIM Wiki sites using MS Sharepoint

• 2014 – 2015:
  – Updated AE Center, public facing website
  – Refine BIM guidelines and design deliverable requirements through pilot project feedback
  – Implement BIM Viewer
  – Focus on Asset replacement workflows

• 2015 – 2016:
  • Developing AE Scope of work language
  • Developing Div 1000 construction specification language
  • Implement Model Checker
Use Cases: Capital Program, Design, Construction

**Capital Program**
- Introduce use of 2D and 3D (low detail) to visualize location and extent of capital project areas

**Design**
- More efficient access to accurate as‐builts, shop drawings
- Introduce 3D models to planning stages of design projects – to use in what‐if scenarios, cost alternatives, and client meetings
Use Cases: Facilities and Energy Management

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
Use Cases: Smithsonian Gardens

Smithsonian Gardens

• Support geospatial analysis of exterior spaces - use site plans and landscape plans to visualize valuable plants and trees and how they intersect with water lines, sewer lines, curbs and gutters, and other critical, exterior information.
Use Cases: Historic Preservation, Security, Collections

**Historic Preservation**
- Identify rooms and spaces of historic importance
- Create new map layer of critical historic data

**Other Special Map Layers**
- Visualize intersection of events and construction schedules
- Security systems maps
- Collection storage spaces – more data
- Refine / improve tracking of HazMat locations
- More accurate abatement tracking

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Establishing a BIM Foundation
SI BIM Program Development

- Establish SI Revit Templates
- Verify and establish the SI’s FM data fields to incorporate in BIM; data exchanges
- Integrate BIM file and naming standards into existing SI framework
- In-house BIM capture & development

- SI Revit Templates User’s Guide
- Level of Development Guide DRAFT
- SI BIM Project Execution Plan (PxP) DRAFT
- SI BIM Standards

- NASM Pilot Project
- New Contract Language for BIM
- Refine Guidance & Standards

- BIM Support Applications (3D model viewers, model checkers)
- Review upcoming projects for BIM development
- BIM training for SI professionals
SI BIM Templates

• Provides a standardized Revit work environment to foster consistency in BIM development— for both AEC project teams and internal SI initiatives

• Support SI spatial data management by providing SI data fields and geometry for rooms and floors, and standard attributes

• Standardize model development, BIM guidelines and CAD exports with National CAD Standard and SI document conventions, standardize views and naming conventions

• Provide SI-specific asset data parameters and schedule views for O&M
Guidance & Standards

Revit Template User’s Guide

- Guidance for AEC project teams (primarily)
- Develop consistent model development across projects (and in-house)
- Not a tutorial – expect reader to know Revit
- Walks the user through Smithsonian minimum standards
- Based on National CAD Standard (v5) 5
- Customized title blocks, syntax for SI
- Identifies “Best Practices” (items not required)
FM BIM: Data Development

**IWMS/CAFM**

- Provide critical asset data, “ready” for Tririga Facility Center Upload
- Focus: less data and higher quality

**GIS**

- BIM exchanges CAD geometry + data attributes for rooms and spaces

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

Level of Development Guide (DRAFT)

- SI has developed a guidance framework for the level development required for BIM deliverables
- BIM LOD will be identified early in the project (passed on to the team to detail in the project BIM PxP)
- The Scope of Work of the project ultimately defines the BIM requirements
BIM Project Execution Plan (PxP)

- A living document populated and updated by the project team
- Clarifies and maintains the project BIM development process for the owner, and the team
- Provides a vetting process for any changes made in the BIM development process
Supporting SI BIM Project Reviews

BIM Viewers

- Provides a means to review developing project models by SI users who are not Revit experts
- Offers versatile methods for viewing BIM: PDFs, mobile devices

Model Checkers

- Provides an automated means to check a BIM against a customized rule set
- Useful by SI and by their project consultants
Next Steps for BIM
How will it all work?

New Projects

Existing BIMs at SI

Improved BIMs
How will it all work?

BIM data improvement over time
How will it all work?

BIM data improvement over time
How will it all work?

BIM data improvement over time
How will it all work?

BIM data improvement over time
How will it all work?

- First SI contract with BIM deliverables
- A-E has provided valuable input to Revit Templates and user guide
Future Plans

• More templates – life safety and security templates
• BIM Viewer – easy to use -- to facilitate early project visualization by clients and reviewers
• Model Checker to assist both contractors and SI staff in verifying data accuracy – especially in complex deliverables.
Building Information Management Portal

BIM “Wiki”

Develop a go-to source for information about SI facilities

- Highly visual
- Collaborative web-based environment
- Leveraging SI’s SharePoint expertise

Provide links and information from existing SI systems

- No new data, just a clearinghouse for existing systems
- SI campus specific
- Simplifies access to critical facilities information
BIM “Wiki” – Home Page

Top level page – access to all building pages and support documentation

Access:
Individual Building Wikis

Access:
Top level access to OFEO systems

Search
3D Models

Direct Download of Autodesk Revit Files
SI Explorer – GIS Mapping & Viewer

Visualize 2D drawings and sites
A different way of getting to document locator
--- same data
Welcome to the Lessons Learned SharePoint Site!

To begin using the Lessons Learned (LL) database:
1) Click the link under Document Locator Lessons Learned to activate the site.
2) Use the search box to search lessons learned related to a key word.
3) Or expand "Documents" to browse the library.

Projects Lessons Learned

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<thead>
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<th>Tracking Number</th>
<th>Version</th>
<th>Checked Out By</th>
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Other OFEO resources
# Building - Home Page (NMAI)

The NMAI Home Page contains several key features:

- **Building Photos**: Visuals of the museum's architecture.
- **Document Locator**: Access to relevant documents, projects, BIM, and architectural master records.
- **Projects List**: An Excel downloadable list of projects, linked to MOPS.
- **NMAI IFT Calendar**: Calendar for updates and events.
- **NMAI IFT Contacts**: Contact information for relevant individuals.

### Projects List (Excel Download - Live Link to MOPS)

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<tr>
<th>Project Name</th>
<th>Description</th>
<th>Status</th>
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<td>Description A</td>
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<tr>
<td>Project B</td>
<td>Description B</td>
<td>Ongoing</td>
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<tr>
<td>Project C</td>
<td>Description C</td>
<td>Planned</td>
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</tbody>
</table>

### NMAI IFT Calendar

<table>
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<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>August 1</td>
<td>Museum Opening</td>
</tr>
<tr>
<td>August 15</td>
<td>Gala Event</td>
</tr>
<tr>
<td>August 31</td>
<td>Closing Ceremonies</td>
</tr>
</tbody>
</table>

### SharePoint Functions

- View NMAI in SI Explorer (requires Flash)
- National Museum of American Indian
- NMAI Building Photos
- NMAI IFT Calendar
- NMAI IFT Contacts

### Related Links

- NMAI IFT SharePoint Site
- NMAI Website

**SharePoint functions**

- Document Locator: Building specific shortcuts to Projects, BIM, Architectural Master Records
- Reports
- Related links
- NMAI IFT contacts
Architectural History – second tab

Architectural Description

History:
The National Air and Space Museum, designed by Gyo Obata of Henningson, Kaplan, and Obata, is a series of alternating masses of Tennessee marble and glass. Four sections are clad in this marble, chosen to complement the National Gallery of Art’s west building. The marble alternates between glass in three recessed exhibit bays, flooded with even, north-facing light, these glass areas feature heavy tuss systems to support the planes suspended above. Window walls were placed at the end of each building to bring in large artifacts; the one at the west end is still active.

In 1998 the original architects designed a restaurant at the east end with panes of glass to echo the original building. The grounds of the museum contain several sculptures:
- Delta Solar by Alejandro Otero (1922-90)
- Continuum by Charles O. Perry (b.1929)
- Air Astra by Richard Leopold (1943-2002)

The building features exhibition spaces that show airplanes suspended against the natural backdrop of the sky.

For more information, please contact Amy Bills
Salal@Smithsonian.edu, Senior Nature Preservation Specialist

Historic Image Gallery
Questions

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