An Owner’s Approach to BIM Implementation

Shrimant Jaruhar, BIM Manager
Ken Kaiser, Manager Facility Planning & Construction
Agenda:

- Northwestern Memorial HealthCare
- Benefits of an Owner Driven BIM Process

  - Approach and Process
    - BIM Guidelines
    - Facility Operations Initiatives

  - Current Focus and Next Steps
Northwestern Memorial HealthCare

Where Everything Matters

- 894 bed nationally recognized academic medical center
- 117 bed community hospital in Lake Forest, Illinois
- Over 25 outpatient clinical sites in Chicago and suburbs
- More than 5 million square feet of managed space
- National leader in quality and consumer preference
- Primary clinical affiliate of Northwestern University’s Feinberg School of Medicine
BIM: An Enterprise Strategy

• 2yrs ago: Enterprise Mandate – BIM
• Outpatient Care Pavilion ("OCP")
  1st contractually mandated BIM project for NMHC

Key Facts & Figures:

• 26 Story, 1M SqFt Medical Office Building
• Separate contracts w/ Arch. and CM-at-Risk
• ConsensusDOCS 301 BIM Addendum amended to contracts
• BIM - FM proof-of-concepts already on-line
• Project is a laboratory for optimizing BIM processes on all future projects
BIM: A Strategy Being Realized

Grayslake Medical Office Building
• 2\textsuperscript{nd} Contractually Mandated BIM project for NMHC
• 1\textsuperscript{st} To Fully Utilize New Standard

Key Facts & Figures:
• 3 Story, 60,000 GSF Medical Office Building
• Separate contracts with Architect and Construction Manager
• ConsensusDOCS 301 BIM Addendum Amended to Contracts
• BIM - FM Proof-of-Concepts have been Tested and are being Implemented
• Project is the Testing Ground for the BIM Processes that were Prescribed on OCP
Benefits to Owner driven BIM

• Cost Savings
• Conflict Avoidance
• Schedule Compression
• BIM-enabled, Data-linked, Legacy Systems
• BIM-enabled Facilities Operations & Management
• Accurate As-Builds for Future Projects
• Design & Construction Visualization & Coordination
Key Metrics

- Number of conflicts/clashes found and resolved prior to construction
- Number of RFIs
- RFI Response and resolution time
- Budget variance from SD to GMAX
- Schedule variance from estimate to actual
- Value and time lost to document based changes/rework
Achieving Measurable Results

BIM Execution Plan ("BEP")

NMH BIM Guidelines & Standards
# BIM Guidelines

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# BIM Execution Plan

**Northwestern Lake Forest Hospital**
Medical Office Building
Grayslake, Illinois

May 14, 2012
Version 1.0 - Design Phase DEP

## BIM Execution Plan

### Northwestern Lake Forest Hospital

Medical Office Building
Grayslake, Illinois

---

### Level of Detail (LOD)

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<thead>
<tr>
<th>LOD</th>
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<tbody>
<tr>
<td>LOD 0</td>
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---

*This document outlines the BIM execution plan for the Northwestern Lake Forest Hospital Medical Office Building project.*

*Design, engineering, and construction phases are clearly defined, ensuring efficient project management.*

---

*Contact Information*

**Pepper Construction**

*Address and contact details for project stakeholders.*

---

*Additional resources and references for BIM execution plans.*
Owner Engagement

CURRENT PROCESS

Planning → Design → Execution → Closing

Design Phase
- Design Team
- Owner
- Owner Input and Review
- 100% Construction Drawings
- SCOPE TO IMPROVE PROCESS
- Construction Team
- Construction Team brought in after Design

Construction Phase
- Construction Drawings
- Sub-Contractor Drawings
- Deliverable to NMH

Substantial Completion
- Owner Operations
- As-built Drawings
- Record Design Drawings
Owner Engagement

FUTURE PROCESS

Planning → Design → Execution → Closing

Design Phase
- Design Model
- Owner Input and Review
- Owner Input and Review

Construction Phase
- Design Model
- Owner Input and Review
- Owner Input, Review & Handover
- Owner Handover
- Owner Mgmt.

Substantial Completion
- As-built Models
- As-maintained Models

Deliverable to NMH

Construction Team
- Construction Team brought in during Design
BIM Guidelines

Design Team Guidelines:

- Design Team BIM Software and Processes
- Coordination with Owner’s Consultants
- Minimum Design Model Elements
  - Architecture BIM Elements
  - Structure BIM Elements
  - Mechanical, Electrical, and Plumbing BIM Elements
  - Life Safety and Fire Protection BIM Elements
  - Telecommunications BIM Elements
  - Civil Engineering BIM Elements
- NMH Unique ID
- Systems and Quantity Cost Estimating
- Geo-Referenced BIM
- Design Team BIM Collaboration Software & Clash/Collision Meetings
- NMH Existing Building/Space/Area BIM Files
- Energy Modeling
- Program and Space Validation
Achieving Measurable Results

Integrated Project Process:

DESIGN TEAM EXPECTATIONS:

- Continuously maintain and update the Design Models through end of construction
- Publish the Design Model at a minimum of once (1) per month during construction
- Review the as-built models published by the Construction Team
BIM Guidelines

Construction Team Guidelines:

- Construction Team BIM Software and Process
- Coordination with Owner’s Consultants
- Construction Team BIM Collaboration Software
- NMH Unique ID
- Systems and Quantity Cost Estimating
- Fabrication Models as As-Built Drawings
- Link to Operations and Maintenance Documentation
- Minimum MEPFP Subcontractor Model Elements
Achieving Measurable Results

Integrated Project Process:

CONSTRUCTION TEAM EXPECTATIONS:

• Incorporate all design updates into the Construction Model

• Submit the as-built models for the project within 30 days of substantial completion. These models will be submitted to the Design Team for review.
# BIM Execution Plan

## Model Element Table

Identify (1) the LOD required for each Model Element at the end of each phase and (2) the Model Content Author (MCA) responsible for developing the Model Content to the LOD identified. Insert Abbreviations for each MCA identified in the table below; see Legend.

**Note**: LODs must be adjusted for the unique characteristics of each project.

## MCA Legend

- AMA – Andersen Mikos Architects, Ltd.
- KJEU – KJEU Consulting Engineers
- EEA – Eriksson Engineering Assoc. Ltd.
- PCC – Construction Manager
- SUB – Trade Contractors

## Model Elements Utilizing CSI UniFormat™

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</table>
Cost & Conflict Avoidance: Design Side Clash Detection

Executive Summary: Weekly Coordination Meeting

Coordination Meeting Date: 10/27/2011
Project Timeline: Post 100% DD, pre Foundation CD Package

**Critical Note** Total # of Zone Clashes may include False Positives. Review summary as overview document accordingly.

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<tr>
<td>Comp vs. Piping</td>
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<td>Comp vs. Elec</td>
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<table>
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<tr>
<td>Comp vs. Mvrs</td>
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% Below Grade Clashes

% Lower Level Clashes

Service Spaces

UNIT
Cost & Conflict Avoidance: Construction Side Clash Detection

Pepper Construction
Northwestern Lake Forest Hospital
Grayslake Medical Office Building
Grayslake, IL

Clash Results

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<th>Total Clashes Per Hour</th>
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<td>Level 1: 248</td>
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<td>Level 2: 140</td>
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<td>Total: 388</td>
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Northwestern Medicine
Accessibility Review

Clear Idea: BIM needs to support O&M
Accessibility Review

Before – No access

After – Access for maintenance
Benefits of photo documentation / BIM integration:

• Direct access to photos in OAC, Clash Detection and other collaboration meeting
• Integration of As-Built photos into BIM driven Facilities Management (FM) tools
General Approach
1. Arrows analogous to Multivista’s standard 2-D offering are imported into the BIM environment.

2. The arrows are hyperlinked directly to the corresponding photo in the Multivista environment.
Achieving Measurable Results

**Owner Driven Benefits, Cost & Conflict Avoidance:**
- Ensures Designer’s full participation
- More opportunity to engage Facilities & Operations
- Constant Transparency
- Change Management for Schedule and Budget
- More Frequent & Accurate Updates
- Concise & Consistent Reporting Metrics
Cost & Creep Avoidance: BIM in Support of GMAX
BIM in Support of GMAX

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<td>Shown and nearly complete, able to be quantified from model with sc</td>
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BIM in Support of GMAX
BIM in Support of GMAX

Owner Driven Benefits - GMAX

- Tight budget control SD to GMAX; <1% variance achieved
- Constant Transparency
- Change Management for Schedule and Budget
- More Frequent & Accurate Updates
- Concise & Consistent Reporting Metrics
BIM-enabled Facility Operations

The Million Dollar Question to our Facilities & Operations Team:

Out of this data storm, what do you want to manage?
BIM-enabled Facility Operations

- ?? ?? r?Sm?r B ?? ?? ?? ??b?n?q?pG
- ?? ?? d?? ?? C?SG5 .. ?? ?P??
BIM-enabled Facility Operations

Start with the End in Mind

- Mobile CMMS system
- As-Built Drawing Repository
- Life Safety Reporting
- Integrated Accounting
- Photo Documentation
- Asset Tracking/Bar Coding
- Project Management

Northwestern Medicine
Facilities Coordination and COBIE Requirements

All Project Operations and Maintenance ("O&M") data shall be hyperlinked into Project Models for easy access and updating of Project information post-occupancy.

Specific procedures or requirements for integrating O&M data into Project Models via the Horizontal Glue collaboration platform, and into any NMH systems and processes, including but not limited to, the ATG© platform, and 4-1-Where® will be incorporated as amendments to this BEP as necessary.

The Construction Team shall update the Design Team’s COBIE worksheets.

COBIE Operations Planning Set:

This set shall be provided at 70% fiscal completion or four (4) months prior to beneficial occupancy, whichever is earlier.

The following table lists the metadata information that shall be provided.

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<thead>
<tr>
<th>Data Field</th>
<th>Field Type</th>
<th>Notes</th>
<th>Example</th>
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<td>OPC-AHU-1</td>
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<td>2 Barcode #</td>
<td>Alphanumeric</td>
<td>Sub-contractor attached NMH asset barcode</td>
<td>A87997</td>
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<td>3 NMH Asset Profile ID</td>
<td>Number</td>
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<td>Floor number</td>
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BIM-enabled Facility Operations

- NMH Unique ID
- <CAMPUS>-<BUILDING>-<EQUIPMENT TYPE>-<SERIAL NUMBER>
- CHI-OCP-FD90-1103 (Fire Door with 90 minute rating on the 11th floor)

- Consistency through Design and Construction
- Data for maintenance
# BIM-enabled Facility Operations

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<td>Quad Receptacles</td>
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<td>Photocells</td>
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<td>Push Button Wall Stations</td>
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<td>Meters</td>
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<td>Fire Alarm Control Panels</td>
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<td>18</td>
<td>Fire Alarm Annunciator Panels</td>
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<td>19</td>
<td>Fire Alarm Visual Notification Devices</td>
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<td>21</td>
<td>Smoke Detectors</td>
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<td>22</td>
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<td>1</td>
<td>Linear Diffusers</td>
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<td>Air Curtain</td>
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<td>3</td>
<td>Louver</td>
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<tr>
<td>4</td>
<td>Boiler</td>
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<tr>
<td>5</td>
<td>Cabinet Heater</td>
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<td>6</td>
<td>Computer Room Unit</td>
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<tr>
<td>7</td>
<td>Drycooler</td>
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</table>
# BIM-enabled Facility Operations

<table>
<thead>
<tr>
<th>Data Field</th>
<th>Field Type</th>
<th>Notes</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Name</td>
<td>Alphanumeric</td>
<td>This is the NMH Unique ID</td>
<td>OPC-AHU-1</td>
</tr>
<tr>
<td>2 Barcode #</td>
<td>Alphanumeric</td>
<td>Sub-contractor attached NMH asset barcode</td>
<td>A87997</td>
</tr>
<tr>
<td>3 NMH Asset ProfileID</td>
<td>Number</td>
<td>ProfileID used for cost segregation</td>
<td>50100</td>
</tr>
<tr>
<td>4 Building</td>
<td>Alphanumeric</td>
<td>Name of the building as three letter code</td>
<td></td>
</tr>
<tr>
<td>5 Floor</td>
<td>Alphanumeric</td>
<td>Floor number</td>
<td>11</td>
</tr>
<tr>
<td>6 Room</td>
<td>Alphanumeric</td>
<td>Room number</td>
<td>1103</td>
</tr>
<tr>
<td>7 Department ID</td>
<td>Alphanumeric</td>
<td>NMH Department</td>
<td>SURGICAL</td>
</tr>
<tr>
<td>8 System</td>
<td>Alphanumeric</td>
<td>System name</td>
<td>AHU-1</td>
</tr>
<tr>
<td>9 Part Of</td>
<td>Alphanumeric</td>
<td>The equipment this object is part of (e.g. motor being part of an AHU)</td>
<td>AHU-1</td>
</tr>
<tr>
<td>10 Manufacturer</td>
<td>Text</td>
<td>Manufacturer's name</td>
<td>Trane</td>
</tr>
<tr>
<td>11 Model</td>
<td>Alphanumeric</td>
<td>Model number</td>
<td>TX8092</td>
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<td>12 Serial #</td>
<td>Alphanumeric</td>
<td>Serial number</td>
<td>9789724243</td>
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<tr>
<td>13 Warranty Start Date</td>
<td>Date</td>
<td>Start of warranty</td>
<td>41122</td>
</tr>
<tr>
<td>14 Warranty End Date</td>
<td>Date</td>
<td>End of warranty</td>
<td>42948</td>
</tr>
<tr>
<td>15 Special Instructions</td>
<td>Yes/No</td>
<td>Access, Steps to Shut down, etc.</td>
<td>Yes</td>
</tr>
<tr>
<td>16 Serviceable Components</td>
<td>Yes/No</td>
<td>Does this equipment have components which need to be serviced?</td>
<td>No</td>
</tr>
</tbody>
</table>
BIM-enabled Facility Operations

Relative links to the equipment excel spreadsheet
BIM-enabled Facility Operations

- B is a software tool for managing building information.
- It allows for efficient operations and maintenance.

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</tr>
</thead>
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</tr>
<tr>
<td>Barcode #</td>
<td>Alphanumeric</td>
</tr>
<tr>
<td>NHF Asset Profile ID</td>
<td>Number</td>
</tr>
<tr>
<td>Building</td>
<td>Alphanumeric</td>
</tr>
<tr>
<td>Floor</td>
<td>Alphanumeric</td>
</tr>
<tr>
<td>Room</td>
<td>Alphanumeric</td>
</tr>
<tr>
<td>Department ID</td>
<td>Alphanumeric</td>
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<tr>
<td>System</td>
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<tr>
<td>Part Of</td>
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<td>Warranty Start Date</td>
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BIM-enabled Facility Operations

- pmoBt B pEnB PPP PPP pBnpG
- nBe3nB BfoL rS EL rS prB1 r
- 55.. Bl D5EG. 24 5C37 1234 243 125USI 24
- Sc5. 1432 1478 1429 152f72 125USI 24
BIM-enabled Facility Operations

Editing Scheduled Unassigned Overdue Work Order W-28396 - OPEN

- Request date: 7/9/2012 at 12:20 AM by System
- Schedule: 34/79
- Asset: Exhaust Fan 1, Exhaust Fan 2
- Common Problem: None Selected
- Description: Exhaust Fan Monthly Monthly, Exhaust Fan
- Due date: 09/05/2012
- Assign to: Unassigned
- Estimated Hours: 0
- Priority: Scheduled Medium
- Department: PLANT ENGINEERING
- Job Type: Administrative
- Workorder is patient related?
- Workorder is a callback?
- ILSM Work Order?
BIM-enabled Facility Operations

- Proof-of-concept: Receive data from Proj. Doc. system
- Proof-of-concept: Bi-directional back into Revit® - “As-maintained”
BIM-enabled Facility Operations

- Location Query
- Cost Center Query
- Download Model
  - Axonometric Views:
    - Axon Lobby Stairs -01
    - Axon Parking -01
    - Axon Parking -02

Northwestern Medicine
BIM-enabled Facility Operations

Understand What we want – How do we Get it?

**ENTERPRISE**
- Governing Contract Clauses, etc.
- Guidelines & Standards
- Facilities Hand-over
- Specifications
- New SOW for existing FM partners

**PROJECT**
- BIM Execution Plan
- CM-Sub BIM Exhibit language
- Consultant agreements
- Project Mgmt. Methods
Specific BIM Initiatives

- Currently in-process:
  - Standardization of design spaces
  - Early-design energy modeling
  - Design review
  - Design-side clash detection
  - Cost Estimation
  - Construction clash detection
  - 4D-Linked to construction schedule
  - Capturing facility information
    - BIM Model
    - Spreadsheets
    - Photo-documentation
  - Site-FM, ATG, Plans & Specs Integration
  - RFI and Change order Integration
Current Focus:

• End-of-design Energy Modeling
• Renovation Projects
  • Developing naming convention for renovation projects
  • Rolling out requirements for data to be captured during renovation
• Virtual Reality Design Reviews / User Training / Wayfinding
• Existing Space Conversion to BIM
  • Developing methodology for most efficient conversion of existing space into BIM
  • Developing network wide coordinate system
Future BIM Integration

- Real Estate / Properties Management
- Biomedical Engineering
- Facilities Management
- Information Technology / Systems Architecture
- Security
- Asset Management
- Materials Management
- Emergency & Safety Management
Thank You!

Contact Information

- Ken Kaiser – Manager, Facility Renovations
  - Email: kkaiser@nmh.org

- Shrimant Jaruhar – BIM Manager
  - Email: sjaruhar@nmh.org