BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Course Number: WE102
Wednesday | April 26 | 8:30 am – 12 pm
3.75 LU/GBCI/RIBA

Session Opening
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Overall Course / Learning Objectives

• Understand owners' needs when working with BIM deliverables and identify solutions to meet these needs.

• Deliver high-value BIM lifecycle data to owners during the design and build phases that owners can immediately use.

• Learn various approaches to integrating lifecycle management into the AEC business model.

• Review case studies from different owner environments that delivered BIM projects that met unique challenges.
Course Outline / Timeline

• **Workshop Welcome & Introduction** / 5 min.
• **Session 1**
  • Chris D'Souza / 45 min.
• **Session 2**
  • Nick Jang / 45 min.
• **Break** / 10 minutes
• **Session 3**
  • Reeves Davis / 45 min.
• **Session 4**
  • Mark Handy / 45 min.
• **Panel Discussion** / 30 min.
• **Closing Thoughts / Thank You** / 5 min.
Speakers List

- Chris D'Souza – Product Marketing Manager, ARCHIBUS, Inc.
- Nick Jiang – President, ARCH Building Data Solutions, LLC.
- Reeves Davis – EVP | Managing Director, JLL, Technology Solutions
- Mark Handy, AIA – Director of Building Data Solutions, TRC Worldwide Engineering
Robert Dazel has been a registered Architect since 1992, a long-standing member of AIA, CSI and maintains his LEED GA credentials. He has spent the last twenty years in the Exterior Insulated Wall Cladding Industry holding positions such as architectural services, technical, marketing and sales management. The total of his professional experience has allowed him to become an authority and expert on Exterior Wall Surfacing Materials and Building Envelope Codes, Design, Detailing, Specification and Performance.
Speaker / Bio.

Role: Workshop Presenter
Chris D'Souza
Product Marketing Manager
ARCHIBUS, Inc.
Email: chris_dsouza@archibus.com
Office Telephone: (617) 513-3092

Chris D'Souza leads strategic BIM and IWMS product marketing and development initiatives at ARCHIBUS Inc. He brings over twenty years of experience developing, deploying, and educating global enterprise organizations about technology solutions that relieve operational pain points and promote mission success. Chris has spoken at numerous industry conferences and has introduced innovative, paradigm-shifting workflow methodologies for the built environment through his contributions in leading industry journals. Chris holds a MS in Computer Engineering from Boston University, a BSEE from the University of Pune in India, and an MBA from Babson College.
Role: Workshop Presenter

Nick Jiang
President
ARCH Building Data Solutions, LLC
Email: njiang@archbds.com
Office Telephone: (314) 445-9529

Nick Jiang is President of ARCH Building Data Solutions. Nick works with public and private sector clients to develop and implement cohesive technology solutions that deliver measurable productivity benefits for infrastructure, workplace, and facilities lifecycle management. Nick has led IWMS design and implementation teams for over 20 major clients, has successfully integrated BIM and GIS into business processes for facilities lifecycle management, and has himself administered and managed millions of square feet of facility space.
Speaker / Bio.

Role: Workshop Presenter
Reeves Davis
EVP, Managing Director
JLL
Email: reeves.davis@am.jll.com
Office Telephone: (980) 365-8970
Cell Phone: (704) 909-8838

Reeves Davis is responsible for the delivery of IWMS solutions to JLL’s customers, including setting the vision for technology enablement, design of technical solutions, and overseeing JLL’s delivery team across the entire engagement. He provides analytical and technical solutions to JLL’s Strategic Workplace Services accounts, focusing on Key Performance Indicators, Industry Benchmarking, Dashboards and Analytical Reporting. Reeves is experienced with a wide variety of industry initiatives including the management of capital projects, space planning, employee moves, assets, risks, fleets, hazardous materials, facility operations, and mobile solutions.
Role: Workshop Presenter
Mark Handy, AIA
Director of Building Data Solutions
TRC Worldwide Engineering
Email: mhandy@trcww.com
Cell Phone: (317) 509-4043

Mark Handy is Director of Building Data Solutions at TRC Worldwide Engineering. He has over 37 years of experience which have included Healthcare and Higher Education design & facilities management projects. His main focus throughout his career has been on facility life cycle knowledge management. With a technology services orientation - BIM, CAD, Facilities Management, Databases, 3D Laser Scanning - he has worked with over 30 million sf of building spaces and assets for many clients. Products of design and construction can migrate to facility operations for data analysis providing more efficient processes, higher return on investment, and long term value for clients.
Owners lament: I’ve been given BIMs from our latest project. What do I do with them?

This workshop helps BIM practitioners provide answers to this and other vexing questions posed by owners.
Speakers List

• Chris D’Souza
  • Product Marketing Manager, ARCHIBUS Inc., Boston, Massachusetts

• Nick Jiang
  • President, ARCH Building Data Solutions, LLC, Chesterfield, Missouri

• Reeves Davis
  • EVP, Managing Director, JLL, IP, Inc., Charlotte, North Carolina

• Mark Handy, AIA
  • Director of Building Data Solutions, TRC Worldwide Engineering, Indianapolis, Indiana
BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Session 1
Foundations In Lifecycle Management with BIM
Chris D’Souza, Product Marketing Manager
Learning Objectives

1) Identify stakeholders, their roles, and their objectives in using lifecycle information that originates from a BIM project and from outside the BIM project.

2) Study three approaches to integrating a lifecycle management practice into the AEC business model.

3) Learn how the latest technologies integrate BIMs with lifecycle management systems, and simplify transfer of BIM lifecycle information to owners.
Learning Modules

1. Lifecycle Management Ecosystem
2. Business Opportunity for AEC Firms
3. BIM and Lifecycle Technology Integration

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Lifecycle Management Ecosystem
On a BIM project, what do owner’s really care about?
Ecosystem Stakeholders

- Architect/Contractor
- MEP/FP/etc. Engineers
- Owner's Requirements
  - Verifies Conformance With Owner's Requirements
- Lifecycle Management System
  - Asset Information Database
- Commissioning Agent
- HR, Finance, Corporate RE, EH&S, Design/Construction, Employee
- Equipment Vendor
- Facilities Manager
- Craftsperson
- Owner's Representative
Occupancy Costs over Facility Lifecycle

The annual cost split for a new office occupation*

- Rent: 35%
- Taxes: 15%
- Annualized Costs: 15%
- Hard FM: 23%
- Soft FM: 11%
- Management: 3%

Are there other hidden costs?

*Source: The Total Office Cost Survey 2013 edition (Actium Consulting)
From Model to Lifecycle Management

“One item that the Level of Development does not specify is the facility data needed about each facility element. The facility data, attributes, and properties should be specified about each element and even elements not modeled may require facility data to be documented.”

Planning Guide For Facility Owners, Version 2.0, June 2013, Penn State University
Information Components in the Building Information Model

Information essential to Lifecycle Management
- Facility Space: ex: rooms
- Facility Specific Asset: ex: Mech. Equipment

Sample Asset Attributes
- Room number, level, space classification, area, perimeter, etc.
- Equipment id, Tech specs, manuals, equipment classification, mfg., system info

Information non-essential to lifecycle management

Enterprise-class Integrated Workplace Management System (IWMS)

Asset Information Database

Asset Information originating from outside the BIM
Lifecycle Management: People, Data, Standards

Information Stakeholders

- Real Estate Portfolio
- Design/Construction
- Maintenance & Operations
- Environment & Risk
- Finance
- Human Resources

Data Formats

- Real Estate Software: Space/Lease locations, lease tenure, contracts
- CAD, BIM, Paper: CAD drawings, 3D Models, paper drawings
- Bound Paper Manuals; CMMS: Maintenance records, manuals, service contracts
- Spreadsheets, Forms: Compliance Standards; conformance info
- RDBMS: CAPEX, OPEX, depreciation, warranty, insurance
- MS Access: Departmental info, headcount, space standards

Information

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**BIMs as Foundation for Lifecycle Management**

### Core Domains
- Space Inventory & Performance
- Personnel & Occupancy
- Move Management
- Workplace Services
- Asset Commissioning
- Asset Maintenance
- Enterprise Asset Management
- Environment & Risk

### Extended Domains
- Energy Management
- Strategic Real Estate Portfolio Management
- Strategic Financial Analysis
- Capital Project Management

**Integrated Workplace Management Systems (IWMS)**
Questions from Owners

- We have the models. How do we use them?
- Does the model have what I need for lifecycle management?
- Who will help my organization get started with the model?
- Can I receive useful lifecycle data before project completion?
- Do I have to invest in new technologies to use the models?
- How do I specify the model data I’d like to have before project completion?
What Determines Successful Model Handoff

• Scope
• Value
• Scalability
• Usability (of Technology Solution)
Business Opportunity for AEC Firms
“OK, but what’s in it for me?”

**AEC Firm Objective:**
- Gain intimate knowledge of client infrastructure
- Facility infrastructure knowledge repository for client
- Shorter learning curve on new projects
- FM is a value-added offering to existing services
- Revenue diversification

**Benefit:**
- Build long term relationship and trust
- Maintain contact with client after handoff
- Useful on fast-track and negotiated contract projects
- Competitive differentiator on new bids
- Useful during slow growth periods
Lifecycle Management Practice

• Business Models for A/E/C Firms
  • Consulting Model
  • Execution Model
  • Post-Handoff Management Model
Consulting Model

Client Expectations

- **Build trust equity (no change in revenue)**
  - Benefits to Firm:
    - New Operating Infrastructure:
      - New Investment Costs:
        - Risks:
          - Minimal; must deliver core BIM deliverables
  - Opportunity Costs:
  - None
  - Partnerships:
    - Not essential
  - None
  - None

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**Execution Model**

- **New Operating Infrastructure**
  - FM specialist/co-ordination resource; BIM-FM technology integration resource
- **New Investment Costs**
- **Risks**
  - Staffing costs for new resources; BIM-FM technology investment
- **Opportunity Costs**
- **Benefits to Firm**
  - Resource/skill set gaps; Co-ordination challenges
- **Partnerships**
  - With selected FM solution partners; or work with any vendor
- **Client Expectations**
  - Build trust equity; one-time accretive revenue (per project)
  - Additional time, resources that could be spent on other projects

*Note: Contents are placeholders and should be replaced with actual content.*
Post handoff Management Model

Management and reporting process between client and firm; internal staff management

New Operating Infrastructure

New Investment Costs

Risks

Client Expectations

Opportunity Costs

Benefits to Firm

Partnerships

FM operations staffing cost; BIM-FM technology/IT investment

External dependencies; communication challenges

Additional time, resources that could be spent on other projects

Build greater trust equity; continuous revenue

With selected FM solution partners; or work with any vendor

Additional time, resources that could be spent on other projects

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Embracing Lifecycle Management: Best Practices

• Select FM model based on firm’s strategic objective

• Begin with sectors you have experience with

• Use expected client deliverables to identify firm’s gaps

• Clearly articulate value proposition to target clients

• Align pricing with FM value proposition

• Start small and build practice incrementally
BIM and Lifecycle Technology Integration
Technology Integration Options

Data Transfer

- Standards-based Export/Import of spreadsheet data files
- Third Party software tools
- Direct Connect Methodology (DCM) between Model and IWMS

Visualization

- 2D: Published to IWMS
- 3D: IWMS with third party 3D Viewer
- 3D: IWMS with integrated 3D Viewer

Asset Information Database

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Direct Connect Methodology (DCM)

DCM Connects Model to IWMS Using Web Services

Seamless Instantaneous Bi-directional

Asset Information Database
Model Data Exchanges

Design Intent Model

- Architecture BIM
- Mechanical BIM
- Electrical BIM
- Plumbing BIM
- Fire Protection BIM

Design Phase

Owner’s IFC-compliant IWMS

- Building IDs, Floor IDs, Room IDs, Room Names, Room Dimensions, Floor Plans
- Room Standards, Room Categories, Room Types
- Occupant Organizational Affiliation, Occupant IDs
- Mechanical Equipment IDs, Mechanical Equipment Standards
- Electrical Equipment IDs, Electrical Equipment Standards
- Plumbing Equipment IDs, Plumbing Equipment Standards
- Fire Protection Equipment IDs, Fire Protection Equipment Standards
- Equipment Specs, O&M Manuals, Commissioning Specifications, Documentation, PM Procedures, Maintenance Schedules, Warranty and Insurance Information, equipment lifecycle data, equipment financials

Construction (Field Commissioning) Phase

- Created via DCM-enabled BIMs or directly in IWMS
- Commissioning Updates to IWMS through role-specific IWMS mobile and desktop forms
- Space Occupancy and Commissioning Updates
- Mechanical Installation and Commissioning Updates
- Electrical Installation and Commissioning Updates
- Plumbing Installation and Commissioning Updates
- Fire Protection Installation and Commissioning Updates

DCM Connection

- BIM data from discipline BIMs seamlessly transferred to IWMS via DCM
- Relevant lifecycle data from IWMS seamlessly transferred to discipline BIMs via DCM

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Model Data Exchange Milestones

**Design Phase Triggers and Actions**
- Implement Technology Setup for Design Phase Stakeholders
- Design Phase Team Members finalized
- Conduct Design Phase Stakeholder Training on Direct Connect Interface to IWMS
- Direct Connect Update from discipline model to IWMS: Space
- Direct Connect Update from discipline model to IWMS: Mechanical
- Owner’s Space Requirements incorporated into BIM; space design review completed
- Owner’s Equipment Requirements incorporated into BIM; mechanical design review completed
- Owner’s Equipment Requirements incorporated into BIM; other discipline design review completed

**Construction Phase Triggers and Actions**
- Conduct Construction Phase Stakeholder Training on Role-Specific IWMS Asset and Commissioning Forms
- Construction Phase Team Members finalized
- Contractors and FM update IWMS with Detailed Space and Asset Data using IWMS Forms (BIMs updated automatically via DCM)
- Begin Space and Equipment Commissioning using role-specific IWMS commissioning forms (BIMs updated automatically via DCM)

**Legend**
- Key milestones that trigger data integration actions through DCM
- Milestones similar to preceding milestone

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DCM Owner Requirements: Visualization

Milestone Driven Geometry Deliverables

Document Owner Requirements:
• 2D Drawings (Floor Plans)
  • Buildings, Floors, Rooms
• 3D Model
  • Model categories published by floor
  • Model categories published per building
  • Model categories published by system
    • Ex: All HVAC equipment grouped
DCM Owner Requirements: Lifecycle Data

BIM Guide (Organization-wide)

Milestone Driven Data Deliverables

- Discipline-based
  - Architectural Model
  - Mechanical Model
  - Electrical Model
  - Plumbing Model
  - Fire Protection Model
- Relate LOD to Asset Standards
  - Space Standards
  - Equipment Standards
  - Other Standards
BIM for Lifecycle Management In Action (video)
Key Takeaways

**Business Takeaways**
- Decide on the business model that best works for your firm
- Evaluate opportunities within your vertical specialties
- Start small and grow FM practice incrementally

**Managerial Takeaways**
- Establish clear distinction between deliverables of each team member
- Dedicate a facilities liaison to manage FM deliverables
- Invest prudently in resources only after clearly identifying role of the new resource

**Technology Takeaways**
- Get familiar with BIM-FM ecosystem and technologies
- Let technology do the heavy lifting
- Technology is only an enabler. How its harnessed will determine success
Reading Material

  - Chris D’Souza – Lifecycle Data Handoff: Guidelines for BIM Project Managers

- Penn State University
  - BIM Project Execution Planning Guide
  - BIM Planning Guide for Facility Owners
  - The Uses of BIM
Contact Information

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Session 2
Case Study: Enterprise Information Modeling (EIM) Deployment for Wuhan Metro, China
Nick Jang – President
Case Study: Enterprise Information Modeling (EIM) Deployment for Wuhan Metro, China
Course / Learning Objectives

• Creating Enterprise Information Modeling Framework from various data sources
• Use of BIM data for daily operations and asset management
• Unobtrusive change of workflow with mobile and Web technologies
• Central data repository for ease of knowledge transfer
Project Background

- **Wuhan**: Largest city in Central China with a population of 10.6 million in 2015
- **Phase 1**: 4 lines, 102 stations, 80 miles, 400 million annual ridership
- **By 2017**: 9 lines, 169.7 miles
- **By 2025**: 25 lines, 649 miles
- **Project Goal**: Leverage BIM technologies for asset lifecycle management throughout all phases including – planning, designing, construction, commissioning and operation.
- **Keywords**: Intuitive Business Transformation
Enterprise Information Modeling Framework for Intelligent Rail Transportation Operation

• Four Key Components
  1. CAFM as the backbone for central data repository and daily operations
  2. GIS to visually manage lines/stations and other linear assets
  3. BIM as the platform to collaborate and serve as the source of asset data
  4. QR Code and RFID for asset tagging

• Integration with other Enterprise Data Sources
Problems Prior to EIM Implementation

01. Too much paper work
   Difficult to store and search

02. Not enough well trained workforce

03. No work order system to keep track of maintenance

04. Manual reporting process with inaccurate and inconsistent data
Internal and External Business Needs

Main Requirements

1. Online Work Requests Reporting
2. Dynamic Reporting
3. Craftsperson Scheduling
4. Craftsperson Mgmt
5. Document Mgmt

Main Requirements

1. Proper Maintenance Procedures
2. Maintenance Process Tracking
3. Historical Data Tracking
4. Problems Analysis
5. Equipments Tracking

Main Requirements

1. Historical Maint. Data
2. Mobile Deployment
3. MEP Problem Analysis
4. MEP Equipment Tracking
5. Retrieval of BIM drawings
6. Business Intelligence
Implementation Process

1. Needs Assessment
2. Align technical requirements with business needs
3. Data normalization and application customization
4. Agile development
5. Training and ongoing support
Five Major Functions

- Asset Management
- Line/Station Management
- Operation Management
- Document Management
- Reporting
Better Collaboration and Integration

Collaborate among various departments

Inter-operable between various systems

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A Video Is Worth A Million Words...

Now the properties (information) of air duct are displayed to us.
1.1 Line/Station Management Summary

1. Personnel Management
   - Organization
   - Team
   - Personnel
   - Division./Dept

2. Space Management
   - GIS+BIM
   - Room Layout
   - Zone Layout
   - Egress
   - 360 Degree View

3. Space Analysis
   - Space Assignment
   - Space Occupancy
   - Space Chargeback

- Improve Space Utilization Efficiency
- Automate Space Classification and Reporting
- Transparent Space Chargeback Process
- Support Space Strategic Planning
1.2 Line Station management – Personnel

✓ Check personnel name, department, position and attaching team etc.

✓ Currently 3,000 employees, 20,000+ in the near future
1.4 Line Station Management – Room Management

✓ Room Layout with 360 degree view
1.5 Line Station Management – 360 Degree View
1.6 Line Station Management – Space Management

- Fire safety zone
- Functional zone
- Egress route

Space Mgmt

Egress Route

✓ Fire safety zone
✓ Functional zone
✓ Egress route
1.7 Line Station Management – Space Assignment and Analysis

Better Space utilization calculation to improve space occupancy
2.1 Asset Management Summary

- BIM Integration
  - Better Data Capture
  - Faster WR reporting
- RFID Integration
  - 3D VR functionality
  - 3D Virtual Tour
- 3D Display
  - 3D VR functionality
  - 3D Virtual Tour

- BIM Integration
  - 3D Display
  - BIM Model in operation
  - EIM Framework
- Asset List
  - Asset Tracking
  - Asset BIM Model
- Service Provider & Supplier Mgmt
  - Performance Assessment
  - Service Providers Tracking
2.2 Asset Management – Use of RFID

Mobile Scanner

Sensing

RFID

Retrieve Maintenance Historical Records

Quick Response to Work request
2.3 Asset Management – Use of QR Code

- Retrieve Maintenance Historical Records
- Prompt Response to Work Request

Scan via QQ or WeChat

QR Codes
2.4 Asset Management – Both RFID and QR Codes
2.5 Asset Management – Creation of RFID/QR Code
2.6 Asset Management – Equipment Tracking

- Model Browsing with virtual tour
- Equipment Info Retrieval via BIM model
- Equipment Location with Document Management
- Equipment Isolation from others for better analysis
2.7 Asset Management – Yet Another Video
2.8 Asset Management – Query and Statistics

01 Asset List
By Asset ID, Category, Floor etc

02 Asset Statistics
Standard statistical reporting format

03 Vendor Management
By vendor with associated assets for performance assessment

04 Service Provider Management
By Service providers with associated assets for performance assessment
3.1 Operation Management – Workflow Summary

1. Request via Mobile Device
   - Request
   - Dispatch to Team Leader
   - Assign to Worker

2. Scheduling
   - Work order

3. Update
   - Update using photo/video

4. Feedback
   - User / client feedback

5. Integrating automatic mobile notice service
3.2 Operation Management – Demo on Cellphone

Now I will like to show you the attendance update of operational staff via WeChat mobile app.
3.3 Operation Management – Submit Work Orders
3.4 Operation Management – Instant Syncing
Let us show you how we can submit a service request via mobile app.
3.6 Operation Management – Analytics

- PIE Chart Analysis
- Drilldown Details
- Filter by Time Range
3.7 Operation Management – Response Time Measurement

- Analyse by Month
- Good for Analytical Statistics

- Automated Response Time Calculation
- Dynamic and Efficient
4.1 Other Features – Document Management

Documents Access Right Control
4.2 Other Features – Integration with Ticket Sales Mgmt
4.3 Other Features – Surveillance Camera Streaming
4.4 Other Features – IoT Integration for Air Quality Monitoring
4.5 Other Features – BAS Integration
4.6 Other Features – Centralized Web Portal
4.7 Other Features – Powerful Mobile Model Viewer

- Access by iPad, iPhone, Android Phone, Notebook/Laptop Anytime Anywhere
- 3D visualization via touch screen
- Instantaneous Data at your finger tip
- Clearly defined roles & responsibilities of each personnel
4.7 Other Features – Mobile App Suite
Challenges We Encountered

- **Change Management**
  Strategy: TOP-DOWN Pushing

- **Existing Management Problem**
  Strategy: Help to suggest to establish standards and best practices with solution

- **Redundant and Inconsistent Processes**
  Strategy: Reconcile Processes and Establish Unified Workflow

- **Hardware & Software are operating as islands with little**
  Strategy: Automate and integrate hardware & Software in meeting operational requirements
Before And After – Work Request

Deployment of Technology is a “MUST” for Facilities Management
Before And After – Record Tracking
Before And After – Document Management
SUMMARY

✓ 70% of BIM value is realized in operation management using EIM

✓ EIM framework enabled operation to be part of BIM data collaboration during Design and Construction stages

✓ Expanded visibility of FM and established standards & best practices

✓ Automated real-time property and asset management which has helped to optimize resources utilization

✓ Non-disruptive change to the existing workflow
Contact Information

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Session 3

Reeves Davis – EVP, Managing Director

JLL

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Learning Objectives

• Identifying Gaps in BIM to Lifecycle Transition
• Planning for Data Management Beyond Transition
• Avoiding Knowledge Loss Post Construction
• How Communication Strategy Supports Integrated Lifecycle Management
Agenda

• Section 1: What perspective can we add?
• Section 2: Technology Landscape
• Section 3: Integrated Lifecycle Management
• Section 4: Client Specific Case Study
• Section 5: Questions
Silo Approach of Information Transfer

- Information is delivered long after facility is in operation and is time consuming
- Information may not be accurately structured for an IWMS
- Information is Electronic but on DVD’s
- Operator has to re-gather information now that building and data has been HANDED OVER
- Typically does not have good warranty information

- Thousand+ page PDF to cycle through
- Typically assigned to low level personnel and is not high priority or quality product
- Data transfer issues are mostly manual
- Lack of shared project knowledge between teams

Owner-Driven Exchange Process
Business As Usual Workflow
Traditional Development & Handover Process

- 71% of Facility Records are paper based & inaccessible
- Facility Managers spend 10-30% of their time looking for info
- $.23/sf related to inadequate data in Operational Costs
- Equipment data takes 18-24 months to reach the CMMS
Total Cost of Ownership Questions

1. How often do you get handed the actual FM data needed for your IWMS/CMMS or to create your PMs?

2. How many hours does it take your team to find and populate the FM data from your last building project?

3. Where is the data you received from your last BIM Project?...or built project!
Our NEW Norm!

Buildings = Data
CRE Technology Landscape

Integrated Solutions

ERP Platforms
- SAP
- Infor
- Apteon
- Workday
- Oracle
- PeopleSoft
- JD Edwards
- Microsoft Dynamics
- NetSuite
- Epicor
- FinancialForce.com
- Lawson

IWMS Platforms
- Archibus
- Tririga
- IBM
- BigCenter
- FMSystems
- Oracle
- Accruent

Point Solutions

Real Estate
- Yardi
- ProLease
- Qube
- Lucernex
- CoStar

Space Planning
- officeCenterStone
- Ceridian
- EAM
- 360Facility
- AssetWorks

Facilities
- Corrigo
- Serrview
- CAFM Explorer

Capital & Projects
- Meridian
- VFA
- Sage
- Expesite
- eSight

Energy Management
- Rockwell
- BAS/BCS

Analytics

Enablers

SP Overlays
- CBRE
- Intrepid

Business Intelligence
- Tableau
- Crystal Reports

Mobile
- SAP
- Kony
- Autocad Map 3D
- ArcGIS

CAD/BIM/GIS
- Bentley
- ArchiCAD
- Siemens
Inconsistent Data Structuring and Naming

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Coil Unit</td>
<td>???</td>
<td>Airstream</td>
</tr>
<tr>
<td>FCU</td>
<td>LWH-45s</td>
<td>???</td>
</tr>
<tr>
<td>Fan Unit</td>
<td>???</td>
<td>???</td>
</tr>
<tr>
<td>Terminal Box</td>
<td>???</td>
<td>Airstream</td>
</tr>
</tbody>
</table>

Folders are organized and labeled differently by each team. Handover folder contains a folder called “08-11-00”.

No Standards or Reference for document naming. Document’s name – 01.pdf?

PDF file contains 403 pages that are not searchable, bookmarked nor organized.
Single Source Integration
What is Integrated Lifecycle Management?

ILM is a management process that improves collaboration and optimizes efficiency between the AEC team and Owner through standardization and refinement of business structures and facility practices into a process that collaboratively optimizes efficiency through all phases of design, fabrication, construction and lifecycle management.
Changing Business As Usual Workflow

Phase 1: DEVELOP
Planning, Standardizing and Preparing

Phase 2: COLLECT
Implementation, Coordination and Validation

Phase 3: EXCHANGE
Data Exchange and Technology

Phase 4: MAINTAIN
Ongoing Data Management

Continuous Standards and Process Development
Leveraging the Process

The **ILM Project Strategy** is the development and planning service for creating a BIM for FM vision; and to assist the organization during new construction and renovation projects through all 5 phases of a project’s Lifecycle to achieve that BIM for FM workflow vision.

1. Planning & Programming
2. Design
3. Construction
4. Project Closeout/Commissioning
5. Operations and Maintenance
Scope of Services

- Industry is focused on design & construction costs
- Lower the total cost of building ownership through VDC
- Recognize the importance of ‘tribal knowledge’
- Goals are only met through collaborations & relationship building
Critical FM Data Standards

### HVAC Assets and Asset Parameter Details

The following Asset Parameters should be tracked on all Equipment Assets:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Category</td>
<td></td>
</tr>
<tr>
<td>Equipment Type</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Serial Number</td>
<td></td>
</tr>
<tr>
<td>Model Number</td>
<td></td>
</tr>
<tr>
<td>Warranty Start</td>
<td></td>
</tr>
<tr>
<td>Warranty End</td>
<td></td>
</tr>
<tr>
<td>Date Installed</td>
<td></td>
</tr>
<tr>
<td>Date Serviced</td>
<td></td>
</tr>
<tr>
<td>Code Number</td>
<td></td>
</tr>
<tr>
<td>Refrigeration Type</td>
<td></td>
</tr>
<tr>
<td>refrigeration System</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiller</td>
<td></td>
</tr>
<tr>
<td>Chilled Water LWT</td>
<td>Degree F</td>
</tr>
<tr>
<td>Chilled Water Flow</td>
<td>gpm</td>
</tr>
<tr>
<td>Condenser Water RWT</td>
<td>Degree F</td>
</tr>
<tr>
<td>Condenser Water Flow</td>
<td>gpm</td>
</tr>
<tr>
<td>Nominal Temp</td>
<td>Ton</td>
</tr>
<tr>
<td>Refrigeration Type</td>
<td></td>
</tr>
</tbody>
</table>

- **Source Power Panel Name**: Panel Name
- **Service Type**: System Type
- **System Type**: System Type

### Commissioning Report

- **Start-Up and Shut Down Procedures**
- **Additional Equipment Testing**

### Diagram

[Diagram showing floor plans and labels such as R-203, R-204, R-205, R-206, R-207, R-208, R-209, R-210, R-211, R-212, R-213, R-214, R-215.]

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BIM to IWMS/CMMS Data Exchange Planning

**Design Team:**
- Room Name
- Room Code
- Equipment Mark
- Equipment Code

**Construction Team:**
- Further Development w/ As-Built Data

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## Coordinated Facilities Maintenance Data

### Asset Details

<table>
<thead>
<tr>
<th>Name</th>
<th>Equipment Standard</th>
<th>Equipment ID</th>
<th>Manufacture</th>
<th>Model</th>
<th>Serial</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAV1-301</td>
<td>HVAC-Price-FDV54012</td>
<td>EWT-HVAC-VAV1-301</td>
<td>Price</td>
<td>FDV5-4012</td>
<td>795272-014-001</td>
</tr>
<tr>
<td>HWP3-205</td>
<td>PLBG-Armstrong-43602D</td>
<td>EWT-HVAC-HWP3-205</td>
<td>Armstrong</td>
<td>4360 2D</td>
<td>713111</td>
</tr>
<tr>
<td>AHU2-601</td>
<td>044-245-MMD18E</td>
<td>124010440003</td>
<td>Liebert</td>
<td>MMD18E</td>
<td>Y11MBI5748</td>
</tr>
<tr>
<td>CU2-R03</td>
<td>057-109-FFCB0601F</td>
<td>1240R05700010</td>
<td>Trane</td>
<td>FFCB0601F</td>
<td>T12J44193</td>
</tr>
</tbody>
</table>

![Illustration of assets and data](image)
52.1% of applications don’t offer data integration and data is transferred via Excel spreadsheets. For a total of 87.4% of all data transfer being done manually.

BIM authoring applications do not natively support facilities management, but AEC tools can be integrated to support BIM and populate Facilities Management Systems Real-Time. So our approach to Lifecycle Management is about cross platform integration.
Record Model for As-Maintained Use

1. Concept
   - Identify Information Requirements
     - Owner
   - Equipment Requirements
     - Owner/FM Consultant
   - Project Submittal Requirements
     - Contractor & Owner

2. Compile Information
   - Design Model
   - Coordination Model
   - 4D Model

3. Generate & Validate Required Information
   - As-Built Authoring Models

4. Validate & Develop Information in FM Application
   - Owner

5. As-Built FM Metadata

6. Is Record Model Deliverable Acceptable?
   - NO
   - YES

7. IWMS

Authoring Software, for As-Maintained Model
Full Lifecycle Data Integration
Integrated Data & Management – As-Maintained Model
Generation Park

- 72 acre site
- 7 buildings
  - Office
  - Manufacturing
  - Parking
- 1.7 million square feet
What Did the Owner Want?

- Build an in-house FM team
- Obtain Space and Equipment Data before occupancy
- Avoid lock-in to proprietary system or data format
  - Concurrent procurement process for IWMS system
  - Selected COBie format
**Owner Goal:** Load facility data into integrated workspace management system (IWMS) before occupancy using COBie Standard.

**Results:**
By Substantial Completion:
- 8 Data Sets
- 7 buildings
- Site
- 1,603 Rooms
- 14,177 pieces of equipment
- Maintenance Procedures
- 28,000 Spare Parts
- 8,700 O&M Documents
**Owner Goal:** Load facility data into integrated workspace management system (IWMS) before occupancy using COBie Standard.

**Construction Benefits:**

Construction Phase BIM coordinators found fewer problems and submitted fewer RFIs once models were fully populated with COBie data.

Ability to search, export and report on building data:

- Allowed quick reaction to problems and requests for changes due to easy and rapid quantification and location of every equipment type
- Revealed missing safety equipment through COBie “Punchlist” reports
- Permitted loading of COBie equipment inventories and spare parts into 8 additional systems, saving data entry time and creating common naming
- **Common naming** allows these systems to communicate and, e.g., automatically produce work orders in the IWMS when a problem occurs

**Operations Benefits:**

- Equipment history tracking
- Preventative Maintenance scheduling
- Knowing equipment location
- Reporting metrics on:
  - Cost
  - Downtime
  - Labor

**Work Request By Problem Type**

- **MAINTENANCE:** 43%
- **PREVENTIVE MAINT:** 25%
- **UNDEFINED:** 7%
- **FIRE SP:** 3%
- **ELECTRICAL:** 3%
- **OTHER:** 19%

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Generation Park Project Phase COBie Participants

- **Client:** FMC Technologies Inc. (now TechnipFMC)
- **Development Manager:** Trammell Crow Houston Industrial Development Inc.
- **BIM & COBie Consultant:** Kristine Fallon Associates Inc.
- **Architect:** Gensler
- **Civil Engineer:** Cobb-Fendley & Associates
- **MEP Engineer:** Wylie Consulting Engineers
- **General Contractor:** D.E. Harvey Builders & Inc.
- **COBie Coordinator & Preventive Maintenance Data Integrator:** ENGworks
- **IWMS Implementation and Data Loading:** BRG (now JLL)
COBie: Construction to Operations Building information exchange

- A subset of international standard ISO 16739 - IFC information model
- Incorporated in the National BIM Standard-US
- Focused on electronic delivery of data about Spaces and Equipment, not on geometric modeling
COBie Workflow / Data Validation

- **100% CD**
- **Product Data Manager (PDM): Data Validation & Aggregation**
- **Document Repository**
- **Merged COBie File from PDM**
- **IWMS**

**Design Data**
- **Contractor Product Data Forms (CPDFs)**
- **Spares Jobs Resources**
- **PDM checks Documents are complete and properly named**
- **O&M Documents**
- **Installation Progress Barcodes**

**Field Technology**

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The Challenge

- BIM is a **Cross-Organizational, Data-Centric** approach to design and construction.
- Much attention has been given to the Cross-Organizational aspects.
- Little attention has been paid to the Importance or Quality of the Data.
Process Challenges

• Timing
  • COBie Execution Plan was approved at the CD stage
  • Contractor Product Data Forms were not submitted as part of the regular submittal process
  • Facility Management team had not been assembled when the COBie Execution Plan was developed
    • Post-construction uses of the data were not developed
    • IWMS had not been selected
    • Naming standards needed adjustment
    • Needed to cull vendor-directed maintenance
Addressing Process Challenges

• Project team was able to catch up and deliver data by Substantial Completion

• **In the future**
  • Facility Management team input is crucial to defining the right amount of data
  • FM team needs to decide what preventive maintenance orders should be scheduled
  • COBie naming standards should be informed by the IWMS data structure
  • COBie Standards and Execution Plan should be developed before modeling begins, based on FM input
  • Design data should be complete and validated at the end of CDs
Technology Gaps and Technology Management Challenges

• COBie process and tools were new to everyone and therefore hard to manage

• Although COBie is based on the idea of capturing data throughout the project, the COBie format only supports a one-time turnover of all data

• COBie tools provided by major technology vendors are immature
  • Technology users are not familiar with these tools

• There is a lack of technology tools that support collaboration on and validation of data
Addressing Technology Gaps and Technology Management Challenges

- **BIM & COBie Consultant** provided tools to fill the technology gaps
- **Product Data Manager (PDM)** to validate and aggregate data
  - Accepts data from multiple applications
- **Contractor Product Data Forms**, generated from PDM, that allowed the Contractor to:
  - Know what product data was required
  - Know what the design intent was for that product
  - Easily provide required data in an electronic format
- **Two-way data passing with field technology**
- **Tools for checking that all documents were submitted and named correctly**
- **COBie punch lists**

<table>
<thead>
<tr>
<th>Designer Provided</th>
<th>Contractor Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value</strong></td>
<td><strong>Units</strong></td>
</tr>
<tr>
<td>System</td>
<td>HVAC</td>
</tr>
<tr>
<td>Class</td>
<td>Variable Air Volume Devices</td>
</tr>
<tr>
<td>Type</td>
<td>VAV</td>
</tr>
<tr>
<td>TypeName (Standard)</td>
<td>HV-VAV2</td>
</tr>
<tr>
<td>Type Description</td>
<td>HVAC-Variable Air Volume Terminal Units</td>
</tr>
<tr>
<td>Category (OmniClass Table 23)</td>
<td>23-33-41 17 13: Single Duct Variable Air Volume Terminal Units</td>
</tr>
<tr>
<td>Spec Section (MasterFormat)</td>
<td>23 36 00</td>
</tr>
<tr>
<td>Asset Type</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

| Inlet Size | 10 inches |
| Manufacturer | MFlynn@hdgrant.com |
| Maximum Depth (in) | 14 inches |
| Model Number | SDV5000 |
| Nominal Height | 16 inches |
| Nominal Length | 20 inches |
| Nominal Width | 16 inches |
| Organizations Preferred Contact Email | Bsellers@letsos.com |
| Pressure Drop | 0.25 in/H2O |
| Submittal Documents Listed | Variable Air Volume Devices |
| Warranty Duration Labor | 12 N/A |
| Warranty Duration Parts | 12 N/A |
| Warranty Duration Unit | Month |
| WarrantyGuarantor Labor | MFlynn@hdgrant.com |
| WarrantyGuarantor Parts | MFlynn@hdgrant.com |
Human Factors Challenges

• Reluctance to change established organizational methods
  • Modeling typicals versus complete models
  • Drawing annotation versus COBie naming
  • Primacy of drawings versus model or data

• Need to climb the learning curve
  • New processes

• New tools
  • Information-centric versus drawing-centric approach
  • Rigor of standard structured data

• Because processes and tools were not refined before each phase (D,C,O&M), users became skeptical of the technology
Addressing Human Factors Challenges

- Be ready
  - Get input from all stakeholders
- Provide user-friendly training in processes and standards
- Provide tools to help team members gauge progress
  - Performance metrics create ownership
- Communication, Communication, Communication
  - Bi-weekly COBie Progress Meetings
  - Provide advice and support
  - Provide feedback: what is the data doing for us; how will it save Owner money?
- Strong contract terms provide motivation to perform
  - Detail BIM and COBie data delivery requirements in Division 1
  - Six-figure retainage “if delivery of COBie data, documents and photographs is not up-to-date or if the deliverables do not conform to the requirements and standards in the COBie Execution Plan and meet the quality standards…”
Recap and Questions?

• Process oriented not technology dependent
• Success and efficiency is dependent on the Quality of Standards and Process Workflow.
• Educated Owner’s can drive an Owner-Driven Process.
• Coordinate and Leverage processes and applications from the AEC Team for workflow integrations
• BIM doesn’t fix, correct or resolve any lack of standards, controls or integrity of your current facility data
Contact Information

Reeves Davis – EVP, Managing Director, JLL, IP, Inc.
EVP, Managing Director, JLL
reeves.davis@am.jll.com
704-909-8838
Speakers List

• Chris D’Souza
  • Product Marketing Manager, ARCHIBUS Inc., Boston, Massachusetts
• Nick Jiang
  • President, ARCH Building Data Solutions, LLC, Chesterfield, Missouri
• Reeves Davis
  • EVP, Managing Director, JLL, IP, Inc., Charlotte, North Carolina
• Mark Handy, AIA
  • Director of Building Data Solutions, TRC Worldwide Engineering, Indianapolis, Indiana
BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Session 1
Case Studies in BIM for Lifecycle Management
Mark Handy – Case Studies in BIM for Lifecycle Management
Acknowledgements/Credits

• Precision Point, Inc. – Mark Hanna
• TEG Architects – Wayne Estopinal
• Bob Hartig AIA
Course / Learning Objectives

• Learn about benefits obtained through the use of BIM in facility lifecycle management

• Gain insights regarding 3D point cloud scanning related to BIM development

• Study specific instances of BIM documentation used for existing buildings, during design of new projects, during construction and for continuing maintenance and management
BIM perspectives → Points of view

• **Designer** – visualization, functional relationships, systems coordination, clash detection, room data, schedules, life safety

• **Contractor** – augmented reality, quantity take offs, scheduling, coordination models, as-built documentation, product data, maintenance & warranties

• **Owner** – record documents, facility drawings, space management, asset management, data analytics
Getting Started…

The process still is about…

Timing, Collaboration & Innovation

• What do you (or your client) really want and need?
• What can you (or your client) afford?
• What do you have to begin the project?
Case Study: University Student Union

• Design Criteria and Layout
  • Locations shown on floor plans and visualized spaces
  • Solution Visualization
  • Reporting from connected and embedded data

• Master Facility Drawings & Performance Analytics
  • Development of construction phasing
  • Operations & Maintenance

• University BIM Standard
  • Deliverables
  • Timeline
Exterior Image
Plans with programmed areas

First Floor

Second Floor

Third Floor
Isometric

- Illustrate systems layout and function
- 3 Dimensional color highlighted image is easier to understand
Sections

• The fitting…
• Multiple levels
• Spaces with a variety of proportions
Case Study: Academic Building Renovation

- Existing historic building modeled for engineering retrofit
- Design Criteria and Layout
  - Locations shown on floor plans and visualized spaces
  - Solution Visualization
  - Reporting from connected and embedded data
- Logistics documentation – allowed development of construction phasing including a tenant buildout
Coordinated Engineering Retrofit
Coordinated Engineering Retrofit
Case Study: Hospital

- New hospital modeled during design
- Functional documentation – allowed development of building performance analytics
  - Space allocations
  - Room data sheets
  - Travel distance
- Asset & Maintenance Management
  - Locations shown on floor plans and visualized spaces
  - Reporting from connected and embedded data
Design graphics

Expandability

Circulation

Adjacency

Visibility
Design visualization: Asset Management
Equipment: MRI and associated data
Equipment: Warming cabinet and associated data
HVAC Engineering modeling used for design and construction
Case Study: Medical Office Building

• Existing medical office building modeled from CAD base plans and field verification
• Shared with designers for ongoing tenant build out projects
• Space management
  • Highlighted drawings
  • Reporting
• Locate assets to be maintained
Built virtually after construction
Plans exported from the model & published
BIM used to show space allocations
Case Study: Healthcare Clinic Building

Rendering

Model

Ground Floor

First Floor

Second Floor

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Case Study: Hospital Mechanical Room

• 3D point cloud created
• Scanned data visualization – navigating & labeling
• Asset & Maintenance Management
  • Locations shown on floor plans and visualized spaces
  • Reporting from connected data
Point Clouds: Real World to Digital 3D...

Real World → 3D Laser Scanning → Digital 3D

Photograph

3D Reality Capture Scan
Project Virtualization: As-Built Data in the “Cloud”

3D as-built project data & documentation readily available to project stakeholders from any device.
Case Study: Retail & Higher Education

- Building Exteriors modeled from 3D point cloud scanning
- Scan data visualization
- Conversion to BIM
- Existing building documentation to begin new design projects
- Process to document multiple building campuses and shopping centers
Interoperability: Point Cloud to BIM

Conversion Application
Scan-to-BIM Workflow

Analyze and access as-is project conditions prior to commencing the design process
Case Study: Medical Office Building

- Existing medical office building project updates
  - Visualized in 3D
  - Drawn to scale – dimensions may be displayed
  - Created from library of components
- Shared with contractors and trades for ongoing projects
In-house project views
The Future – ???

• Process improvements needed?
• Lessons Learned - Tips and Tricks
• Standardizing project updates
• Using the data during the entire building life cycle means it is best to start the process early
• Lifecycle facilities and asset management can truly improved through BIM
BIM stands for…

Building Information Modeling and Better Information Management
Contact Information

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BIM for Lifecycle Management: Bootcamp for Architects, Contractors, and Engineers

Course Number: WE102
Wednesday | April 26 | 8:30 am – 12 pm
3.75 LU/GBCI/RIBA

Panel Discussion
Panel Discussion

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A Final Thank You