W15: Introduction to BIM: People, Processes and Tools

Presented by National Institute of Building Sciences, National BIM Standard Committee

AEC technology is unalterably moving to the integration of the BIM (Building Information Model) in all phases of Design, Engineering, Construction, and Facility Management. If you want to understand this digital technology and what effect it will have on the industry; this presentation will explain the history, the present state, and future of the BIM.

Alan Edgar, Assoc. AIA
OSCRE Workgroup Program Manager
Chair, National BIM Standard Committee
December 11, 2007

Agenda Alert
Agenda

What is the Problem to be Solved?

A Utopian View

Introduction to BIM

Getting There From Here

Immediate Next Steps
First, A Story…
# Housekeeping and A Survey

<table>
<thead>
<tr>
<th>Owner</th>
<th>Designer</th>
<th>Builder</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CFO, CTO, CIO</td>
<td>• Facility Manager</td>
<td>• Software Vendors</td>
</tr>
<tr>
<td>• Architect</td>
<td>• Software Vendors</td>
<td>• Planners</td>
</tr>
<tr>
<td>• Design Engineer</td>
<td>• Planners</td>
<td>• Mapmakers</td>
</tr>
<tr>
<td>• Builder</td>
<td>• Mapmakers</td>
<td>• Building Product Manufacturers</td>
</tr>
<tr>
<td>• Commercial Real Estate Professionals (lease, buy/sell)</td>
<td>• Building Product Manufacturers</td>
<td>• Fireman/Law Enforcement</td>
</tr>
<tr>
<td>• Corporate Real Property Professionals (own/operate)</td>
<td>• Fireman/Law Enforcement</td>
<td>• Developer</td>
</tr>
<tr>
<td>• CAD/BIM Manager</td>
<td>• Developer</td>
<td>• Specifier</td>
</tr>
<tr>
<td>• Maintenance Engineer</td>
<td>• Estimator</td>
<td>• Material Scientist</td>
</tr>
</tbody>
</table>

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Survey Questions

• What is level of knowledge
• What is level of experience
• Beliefs concerning transition effort and timing.
• Rate importance of several issues: (contracting, cost, skills/training, availability of information, availability of technology)
Agenda

What is the Problem to be Solved?

A Utopian View

Introduction to BIM

Getting From Here to There

Immediate Next Steps
What is the Problem to be Solved?

• NIST in 2004 identified $15.8B lost to lack of inter
  $4.8 trillion 2008
• $3 trillion industry with possible 30% waste
• 40% of global raw materials are consumed by buildings
• Facilities consume 40% of the energy
• 65.2% of total U.S. electricity consumption
• Facilities contribute 40% of the emissions
• Facilities contribute 20% of land fills
• U.S. is no longer the worlds largest consumer…but we did not slow down
What is the Problem to be Solved?

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Source: CII & LCI 2004
Another Sign of the Times…

Raw materials consumption in the United States

Source: USGS

Need to reduce waste here also!!
Problems Related to Lack of Interoperability

AEC/O costs of non-interoperability
Average = 3.1%
- Build team members:
  - 50% say it adds < 2%,
  - 31% say 2-4%.
  - 13% say 5 to 10%
  - 2% say > 10%
- Engineers say 4%
- Owners say 2.5%

Problems Related to Lack of Interoperability

What is driving costs due to lack of interoperability?

- Manually re-entering data (69%)
- Time using duplicate software (56%)
- Document version checking (46%)
- RFI processing (40%)
- Cost of data translations (31%)

- Most industry participants would benefit from industry interoperability:
  - 8 in 10 report sharing Medium (41%) or High (31%) quantity of data.
Time is of the essence

**Tipping Point Prediction**

**BIM Demand by Firms**

- **Evolution**
  - Exploring Involvement/Moderate Share of Projects (<16%)
  - Significant Share or More of Projects (16%+)
- **Revolution**
  - Largely to Fully Dedicated (60%+ of Projects)
- **Disruption**

**Extrapolation based on trend**

- 2005: 7% (Evolution), 11% (Revolution), 15% (Disruption)
- 2006: 7% (Evolution), 11% (Revolution), 24% (Disruption)
- 2007: 24% (Evolution), 29% (Revolution), 47% (Disruption)
- 2008: 24% (Evolution), 32% (Revolution), 47% (Disruption)
- 2009: 15% (Evolution), 30% (Revolution), 49% (Disruption)
Savings Opportunities

IAI “BuildingSMART” model supports lifecycle data

Utilization Stage

Optimized approach with virtual modeling and analysis with reduced change orders & delivery time and lower operating and sustainment costs

Typical approach failing to do routine maintenance and having to replace items earlier and more often

Typical design/build approach with required maintenance

The savings we are currently experiencing with faster delivery and fewer change orders

The yet untapped $avings

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What is the Problem to be Solved?

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Immediate Next Steps
The opportunity now exists…

- to virtually design new or to modify existing facilities
- to coordinate design documentation
- to simulate construction and operation prior to physical implementation
- to drive out problems and predict performance
- to coordinate the construction to reduce construction time and eliminate change orders
- to enter data once as part of the business process then re-use it throughout the business; throughout the lifecycle and beyond.
The Opportunity Also Exists:

– To harvest business intelligence and operational information to inform strategic planning.
– To harvest building information for use in programming and design.
– To aggregate data from Building Automation Systems with facilities operations to create unique customer experiences, provide analytics and enable high performance buildings.
– To design with computers then provide parameters and constraints to BIM-based rationalization processes.
– To merge geospatial and building information for planning, development and emergency response.
In many cases Capital Facilities projects create the ‘seed’ data that make these capabilities possible.
Lean Principles – Waste in Construction

**Correction**: Rework, re-doing some tasks because of errors in the design process discovered after work was started.

**Over Production**: Performing work ahead of schedule, causing interferences with other planned work. Additional material ordered due to inability of suppliers to provide quality.

**Motion**: Construction teams returning back to “office” to pick up plans, tools or materials not available at the site.

**Material Movement**: Moving materials from one staging to another, handing off work between crews.

**Waiting**: People waiting for equipment, plans, or instructions on how to proceed. Waiting for material because of ineffective supply chains.

**Inventory**: Material staged on site too far in advance of when needed.

**Processing**: Redundant or unnecessary reporting, expediting material orders, or excessive coordination between suppliers.

Source: GHAFARI Associates, Inc
Some Distinctions

- Building Information Modeling
- Building Information Models
- Building Information Management
- Interoperability
National BIM Standard BIM Definition

- A Building Information Model (BIM) is a digital representation of physical and functional characteristics of a facility. As such it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life cycle from inception onward.

- A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM to support and reflect the roles of that stakeholder. The BIM is a shared digital representation founded on open standards for interoperability.
Definitions - Interoperability

- Technical – the ability to manage and communicate electronic product and project data among collaborating firms.
- Cultural – ability to implement and manage collaborative relationships among members of cross-disciplinary build-teams that enables project execution.
- Not necessarily ‘everything to everything’.

Information Forms and Formats

- Unstructured – drawings, e-mails, memos, most reports, forms, etc.
- Structured – based on a data schema.
- Proprietary – defined and owned by a specific company. Format is often referred to as ‘native’ to a software application.
- Standard
  - Defacto – may have originated with a single vendor but now publicly available and widely supported.
  - De jure – maintained by a standards development organization; e.g.: International Organization for Standardization (ISO).

Longevity and Reusability of Forms and Formats

**Foundation Elements – 3D / VDC**

*For Example…*

**Accurate steel members**
- Size, weight, performance, cost.

**Accurate connections**

**Accurate 3D position**

**Simulation of**
- Installation process & equipment requirements
- lighting
- structural performance
- etc.

**Overlap with other 3D elements to identify collisions.**
- Mech, elec, plbg,
- Walls, ceilings, FF&E
- Access for maint. & repair
Foundation Elements – Data Commissioning

Data Commissioning for Facilities Operations & Management

DATA SETS

• 3D Geometry
• Real Property
• Space Inv.
• Equipment
• Warranty
• Maint. Tasks
• Instructions
• Schedules
• Cost

FUNCTION

• Legal
• Fiduciary
• Store Ops
• Bldg. Ops
• Fac. Mgmt
• Asset Mgmt

[ Construction to Operations Building Information Exchange ]

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Contrasting choices/approaches to BIM

- Slight preference for scalable solution supporting collaboration vs. single database (although easier to set up)
- Large preference for BIM-integrated CAD vs. BIM-only with more efficient modeling.
- Large preference for fully automated coordination vs. more flexible modeling
- Intuitiveness and easy to use beats ability to model more complex forms.
Contrasting choices/approaches to BIM

- Additional important criteria:
  - Ability to be localized—to capture local building codes and standards
  - Integration with facilities management
  - Integration with space programming and planning tools
  - Integration with related disciplines such as urban design, landscape design, civil engineering, and GIS
  - Compatibility with other BIM applications
  - Improved link from design to fabrication
  - Support for rapid prototyping/3D printing
  - Ability for specification data development and management within the application
  - Support for LEED
Other Stakeholder Interests..
Commercial and Corporate Real Estate & Allied Professions

- Open Standards for Real Estate (OSCRE)

Real Property Marketplace
“No longer is Real Estate a passive back-office function. The transition, in many respects, mirrors the shift experienced a decade ago in IT, which evolved from a tactical delivery system, to a strategic competitive advantage. Companies are recognizing that real estate and facilities can be a key business enabler. Its no longer about the real estate asset itself; its about optimally managing the portfolio of assets in a way that best supports the enterprise.”

Align by Design, Alvarez and Marsal Real Estate Advisory Services, Dec. 2005
Real Estate Information Opportunities

“Of the 25 participating firms, 80% indicated that CRE had strategic objectives but noted that these were not always formally documented. Of those that had a CRE strategy, roughly one-third could tie the strategy directly back to the enterprise strategy.”

“Constantly asked to do ‘more with less’, CREs are looking at how organizations, processes, reporting and systems… CREs ranked their organizations as most mature followed by processes, reporting and systems.”

- Aligned by Function – CRE has no FM responsibility
- Aligned by Activity – Central acquisition, decentralized O&M.
- Particularly with ‘execution functions’ - 92% outsource but very few single-source.
- Corporates call upon service providers for advice but typically hold strategy in-house. Portfolio administration, lease administration and space planning can go either way.

*Align by Design*, Alvarez and Marsal Real Estate Advisory Services, Dec. 2005
Real Estate Information Opportunities

• CRE professionals need timely, accurate, secure data.
• Today’s available technologies are good, but challenge is lack of standards around industry metrics.
• ROI difficult to measure:
• 76% use KPIs; most within Financial and Internal Operations.
• Occupancy Cost/SF, Cost/Employee, Vacancy & Utilization typical.
• But lack of standards makes it difficult to compare across portfolios & industries.

Biggest Issues:
• Portfolio Rationalization
• Demonstrating Value
• Increased Efficiencies and Productivity in the Workplace
• Leveraging Technology

Align by Design, Alvarez and Marsal Real Estate Advisory Services, Dec. 2005
• Personnel
• Real Property Asset Management
• Personal Asset Management
• Facilities Operations Management
• Maintenance and Repair Management
• Building Automation Systems
• Building Intelligence Integration and Network Convergence (data, telcom, display/notice, tenant services).
• Geospatial Context
Real Estate Landscape

Use Real Estate as a Resource

• Corporates
• Education
• Health Care
• Commercial
• Industrial
• Government
• Residential

• Manage Occupant Workforce
• Concerned about worker productivity
• Concerned about how building supports ‘Brand’.
• Building supports service model.

Use Real Estate as Their Business

• Investors
• Owners
• Multi-Family Housing
  • Multi-Unit
  • Apartments
  • Condo
• Service Providers
  • Brokers
  • Listing Exchanges
  • Mortgage Banking
  • Appraisal
  • Lawyers
  • Insurance/ Title
  • Operators
    - JLL, TCC, JCI, CBRE, C&W
• Construction Industry (AEC)
• Vendors
  • Manage Property & Portfolio
  • Concerned about Investment Performance
How 72% Work Now..
Creating A New Way To Work

- "..all of us who use computers in complex ways are using computers to design or to participate in the processes of design. Consequently we as designers, or as designers of design processes, have had to be explicit as never before about what is involved in creating a design and what takes place while the creation is going on."

Being Specific is Important for BIM

Conceptual  Schematic  Physical

[ Analysis ]

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STORYBOARD MODEL #1: NEED ADDITIONAL WORK (COMMERCIAL) OR LIVING (RESIDENTIAL) AREA

PLANNING
Step 1

REAL ESTATE

LEGAL

FINANCIAL

PROGRAM & PROJECT MANAGEMENT

FACILITIES MANAGEMENT

PERFORMANCE MANAGEMENT

ANALYSIS
FORECAST INDICATES ADDITIONAL SPACE REQUIRED IN 'X' MONTHS

ANALYSIS
SITE, BUILDING, SPACE REQUIREMENTS

ANALYSIS
COMPARE AVAILABLE PROPERTY SITE, BUILDING, SPACE REQUIREMENTS

ANALYSIS
PURCHASE, LEASE OR REMODEL

ANALYSIS
LEASE OR PURCHASE PARAMETERS

ANALYSIS
COMPARE AVAILABLE PROPERTY SITE, BUILDING, SPACE REQUIREMENTS

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COMPARE AVAILABLE PROPERTY SITE, BUILDING, SPACE REQUIREMENTS

SP&M-WG
DEVELOP SPACE ANALYSIS WORKFLOW & SCHEMA

CPM & LEASE-WG’s
Lease Abstract

VIRTUAL DESIGN & CONSTRUCTION
3D/4D/5D BUILDING INFORMATION MODEL

ANALYSIS
ESTABLISH PROGRAM & PROJECT BUDGETS AND TIMELINES

ANALYSIS
ESTABLISH OPERATING REQUIREMENTS AND BUDGETS

ANALYSIS
ESTABLISH BASELINE PERFORMANCE METRICS AND OPERATING COSTS

FM-WG
DEVELOP MOVE REQUEST PACKAGE WORKFLOW & SCHEMA

ANALYSIS
COMPILE AND REVIEW DATA

ANALYSIS
COMPILE AND REVIEW DATA

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ANALYSIS
COMPILE AND REVIEW DATA

COMMODICAL & RESIDENTIAL PROPERTY LISTINGS
EXCHANGE – WG’s

CPM & LEASE ABSTRACT – WG’s
Tenants, Recurring Charges, M&A, Lease Abstracts

COMMODICAL & RESIDENTIAL PROPERTY LISTINGS
EXCHANGE – WG’s

CPM & LEASE ABSTRACT – WG’s
Tenants, Recurring Charges, M&A, Lease Abstracts

ASSUME LEASED PROPERTY FOR THIS SCENARIO

ASSUMPTIONS (ONE OR MANY)
1- BASIC MOVE IN REQUIREMENTS (TELECOM, SECURITY, FURNITURE)
2- CONSTRUCTION RETROFIT
3- VENDORS, CONTRACTORS REQ'D
4- CONTRACTS ASSIGNED
5- PURCHASE ORDERS

PROJECTS

ASSUMPTIONS (ONE OR MANY)
1- BASIC MOVE IN REQUIREMENTS (TELECOM, SECURITY, FURNITURE)
2- CONSTRUCTION RETROFIT
3- VENDORS, CONTRACTORS REQ'D
4- CONTRACTS ASSIGNED
5- PURCHASE ORDERS

RPUID-WG
Real Property Unique Id

REMODEL

NO

NO

YES

APPROVAL

PURCHASE

LEASE

APPRaisal-WG

ANALYSIS
CONTINUOUS MONITORING

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ANDY FUHRMAN DECEMBER 3, 2003
10. Communications

A goal to promote the effective exchange of information or ideas in an organization may call for **networks or patterns** of communication: Who communicates with whom? How? How often?

---

**Building Types**
The following building efficiency ratios are reasonable for the building types listed, until they can be modified by the specific conditions of a particular project.

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Efficiency Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Office Buildings</td>
<td>50/50%</td>
</tr>
<tr>
<td>University Administration</td>
<td>55/45%</td>
</tr>
<tr>
<td>Corporate R + D</td>
<td>50/50%</td>
</tr>
<tr>
<td>University R + D</td>
<td>60/40%</td>
</tr>
<tr>
<td>Science</td>
<td>60/40%</td>
</tr>
<tr>
<td>Dormitory</td>
<td>60/40%</td>
</tr>
</tbody>
</table>

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And What Does One End Up With?

• Volumes of Unstructured Information:
  – SD/early DD drawings (pictures)
  – Outline specifications (text)
  – Study models (physical)
  – Conceptual engineering calculations (spreadsheets, reports w/charts & diagrams)
Is BIM the Answer?
A Visual Reason For BIM

Daniel Libeskind’s Denver Art Museum

Visualization with Conflict Analysis

Slide courtesy of C. Eastman

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Geospatial Relationship

Geospatially Located

Building Information Model

Copyright Sydney Opera House.
Courtesy Utzon Architects/Johnson Pilton Walker (Architects in collaboration), ARUP, with permission

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2006 AIA Firm Survey - 16 percent of AIA member-owned architecture firms have BIM software, and 64 percent of these use BIM for billable work (ie: 10.2% use BIM software)

- 86% SD, 90% DD, 81% CD.
- Large firms, international scope, institutional specialization.
Build Team Use of Software

- 57% - 2D CAD most frequently used by A/E. (33% of contrs.)
- 50% - PM software by contrs.
- 39% - Scheduling software; esp. contractors & owners.
- 28% - Build team frequent-users of BIM. (2006 AIA – 10% use BIM software for billable work)
- ca. 10% - Collaboration, engineering analysis, bidding
Why Do Build Team Member Want Interoperability?

Factors influencing use of BIM:

- Less time drafting, more time designing (69%)
- Owners demanding it (49%)
- BIM ability to improve communication with Client/Others. (47%)
- Parametric Modifications of Designs (43%)
- Improved interoperability (41%)
- Reduced RFI, document version control, improved budget/cost estimating. (38%)
- Clash detection, reduced insurance claims (32%)
- Scheduling, Code Compliance checking (25%)
- Safer worksites and lean construction (ca. 17%)

Where are we now?

- Identify the most important requirements that AEC professionals would like BIM (building information modeling) solutions to fulfill.

- June 20 – July 9, 2007. Published October 10, 2007
- Compare Revit® to Bentley BIM solutions (BIM authoring bias)
- Most important use – drawing production
- low interest in analysis, performance simulations & rendering/animation, interoperability.
- Participants mostly Architects and allied professionals, smaller sized (1-99) firms with 1-4 offices
- BIM solutions used or being evaluated. Revit 67%, Archicad 32%, Bentley BIM 15%, all others 4 to 20%.
Where are we now?

- Identify the most important requirements that AEC professionals would like BIM (building information modeling) solutions to fulfill.


- **Top wish list:**
  - Full support for CDs – no other drafting application needed (8.8)
  - Coordinated objects (8.0)
  - Availability of Object libraries (8.3)
  - Large project capability (8.0)
  - Multi-disciplinary capability; architecture, structure, M/E/P (7.8)
  - Direct integration with structural (7.1)
  - Cost estimating, construction scheduling, integration with analysis, integration with PM (6.98)
  - IFC compatibility (6.7)
  - Market leadership (4.9)
Getting There From Here

How to get everything we want…
One step at a time.
Foundation Elements

- Lifecycle Information Helix
- Focus on Information Exchanges
- Single Providers Mythology
- Collaboration
- Terminology – 3D, VDC, Lifecycle BIM
- Delivering Buildings + Value
The building process is not linear…
Each cycle should add knowledge
Share and re-use information easily

Interoperability

Information Backbone

Knowledge over time

Conceive, Plan, Design, Build, Operate, Renovate, Dispose

Lifecycle Phases

Information Exchanges

Share and re-use information easily

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National Building Information Modeling Standard

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Projects create buildings + lots of information
A Member
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BIM for Planning and Design
Wed. 4:00-5:00

OPS™ is Built on Open Industry Standards
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Strategy: Focus on the Information Exchanges
**Architect to Structural Design Engineer (Multiple Applications)**

**Workgroup:** Architectural Design to Structural Design (Sample)

**Business Process Map:** Design Development - Structural

1. Architectural Design Model
2. Preliminary Design - Structural
3. Structural Design Steel
4. Structural Design PC Concrete

1. Send Preliminary Design Concrete
2. Send Preliminary Design Steel

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Economic Value of Exchange Standards

Typical Systems Integration Without Data Standards

<table>
<thead>
<tr>
<th>Number of Components to Integrate</th>
<th>Formula/Calculation (See Last Slide for Calculation Details)</th>
<th>Cost of Integration (FTE’s)</th>
<th>Labor Cost ($50,000/FTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>N(N-1) 20(19)=380</td>
<td>38</td>
<td>$1,900,000</td>
</tr>
<tr>
<td>20</td>
<td>N=2.0 20(2.0)=40</td>
<td>4</td>
<td>$ 200,000</td>
</tr>
<tr>
<td><strong>NET SAVINGS</strong></td>
<td><strong>340 CONNECTIONS</strong></td>
<td><strong>34 FTE’s</strong></td>
<td><strong>$1,700,000</strong></td>
</tr>
</tbody>
</table>

Frictionless Systems Integration Using OSCRE’s Common Data Exchange Standards With Translators

Study performed by the Open Application Group (OAGi)

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BIM-Based Integrated Practice Delivery

Teaming around project or task.

Co-location or remote reviews from Shared BIM model.

Persistent data & standard exchanges.

Brings integrated view to issue – facilitating resolution.
Digital Rights Management

- Key to shared data resource
- Manage access to provide and retrieve data.
- Based on contracted relationships.
  - New AIA C106™-2007 Digital Data Licensing Agreement
Who Benefits from Lifecycle BIM?

Facility Information Views
- Owners
- Planners
- Realtors
- Appraisers
- Mortgage Bankers
- Designers
- Engineers
- Cost & Quantity Estimators
- Specifiers
- Contracts & Lawyers
- Construction Contractors
- Sub-Contractors
- Fabricators
- Code Officials
- Zoning
- Facility Managers
- Maintenance & Sustainment
- Renovation & Restoration
- Disposal & Recycling
- Scoping, Testing, Simulation
- Safety & Occupational Health
- Environmental & NEPA
- Plant Operations
- Energy, LEED
- Space & Security
- Network Managers
- CIO's
- Risk Management
- Occupant Support
- First Responders
- Disaster Recovery
- Continuation of Operations Plans

Building Information Model (BIM)
My BIM vs. Your BIM

- **Data Richness** – How complete is the model?
- **Life-cycle Views** – How many phases are included?
- **Roles Or Disciplines** – How many players?
- **Business process** – Business processes defined?
- **Change Management** – Change management process in place?
- **Timeliness/ Response** – How long does it take to respond to RFI’s or Change Orders?
- **Delivery Method** – Single platform or SOA and web?
- **Graphical Information** – Using 3D models?
- **Spatial Capability** – Tie to geospatial or spatially aware?
- **Information Accuracy** – Information assurance for input and output?
- **Interoperability/ IFC Support** – Do you use IFC’s as a primary tool?
National Building Information Modeling Standard Committee

Overview of the National BIM Standard, Wed. 10-12:30
Organization – North America

National Institute of Building Sciences

Board of Directors
  President
  Board of Direction
  buildingSMART Staff

IAI-International
  Product Development Team
  Bjørn K Stangeland
  Lars C. Christensen

National CAD Standard
  Mark Butler

National BIM Standard
  Alan Edgar

Technical Committee
  (IAI – North America)
  Coordinator – Deke Smith
  IFC – Kimon Onuma
  IDM – Dianne Davis
  MVD – Richard See
  IFD – Roger Grant

Business Practice Integration

Real Property Community

Energy And Environment

Economy & Sustainability

Alliances And Standards

Visualization, Simulation & Analysis

Quality of Life

Research And Development

Project listing and coordination

Pankow Projects
  Precast Concrete Structural Steel Execution Planning

Facility Information Council
  David Jordani

Education

User Groups

Research And Development

Education

User Groups

Alliances And Standards

Technical Committee
  (IAI – North America)
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  MVD – Richard See
  IFD – Roger Grant

National BIM Standard
  Alan Edgar

National CAD Standard
  Mark Butler

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Industry Presentations

IFC-based Product Library

Object placed in BIM model

Maintaining, Repair, Replacement

Automated model analysis

Commissioning & Operating

Construction & Installation

Procurement

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# Electrical Manufacturing Lifecycle Value Chain

<table>
<thead>
<tr>
<th>PHASE</th>
<th>VALUE ADD</th>
</tr>
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<tbody>
<tr>
<td>Standards and Manufacturing Specifications</td>
<td>Basic physical &amp; performance characteristics</td>
</tr>
<tr>
<td>Virtual Design/Engineering</td>
<td>Design requirements</td>
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<td>Product Selection</td>
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<td>Planned cost, quantity</td>
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<td>Geometry placed into model</td>
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<td>Systems integration</td>
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<td>Conflict resolution</td>
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<td>Performance Analysis</td>
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<tr>
<td>Procurement &amp; Installation Planning</td>
<td>Nameplate info</td>
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<tr>
<td></td>
<td>Actual cost</td>
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<td></td>
<td>Inventory management</td>
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<tr>
<td>Contractor Installation</td>
<td>Validate installed components</td>
</tr>
<tr>
<td></td>
<td>Commissioning data</td>
</tr>
<tr>
<td>Operations Engineering</td>
<td>Maintenance and repair specs &amp; data</td>
</tr>
<tr>
<td></td>
<td>Renewal and replacement specs &amp; data</td>
</tr>
</tbody>
</table>

© NIBS 2007
• First draft released March 07
• Two month review period
• Revision period extended
• Revisions complete
  • Initiative
  • Info Exchange Concepts
  • Dev/Use Process
  • References (guides)
  • Appendix (normative)
• V1-P2 in planning
The National BIM Standard will consist of specifications and encodings to define the requirements for exchanges of data between parties using building information modeling processes and tools.

NBIMS will

a.) Organize groups of industry professionals to define requirements, then publish exchange specifications for use in specific business contexts within a holistic facility lifecycle framework

b.) Publish encodings for the exchange specifications employing internationally acceptable open standards as normative references

c.) Facilitate implementation by software developers of encodings in software

d.) Facilitate use of certified software by end-users to create and use interoperable building information model exchanges.
Caution Semi-Technical Content Ahead
NBIMS Scope

Request & Delivery of BIM Data

North American Data Standards
Used in the exchange of Information between team members

OmniClass™, IFDLibrary™, IFC
NBIMS Production and Use Process

Products:
- Interest groups form, locate resources and/or define a new need.
- Process description, and
- Required, optional and variable data required at each exchange as agreed by experienced subject-matter experts.

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many purposes by certified software.

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**NBIMS Production and Use Process**

**PROGRAM**

- Workgroup Formation
- Process Map
- Exchange Requirements and Business Rules

**Standard Requirements**

**DESIGN**

- Exchange Requirement Models
- Generic Model View Definition

**DEPLOY**

- Project Agreed Requirements
- BIM Creation
- BIM Exchange and Data Validation
- BIM Data Reuse and Extension

**CONSTRUCT**

- Model View Definition and Implementation Specifications
- Facilitate SW Product Implementation and Certification

**Implementation in Software**

**Products:**
- Interest groups form, locate resources and/or define a new need.
- Process description, and
- Required, optional and variable data required at each exchange as agreed by experienced subject-matter experts.

**Products:**
- Non-specific association of data to specific version of IFC.
- NBIMS works with software vendors who implement technical exchange definition into their software, and
- Assist in getting software products tested.

**Products:**
- Individual parties to contracts agree on BIM function to be provided using BIM Guides that are not product specific.
- Project parties create BIMs using Certified software & product-specific BIM Guides.
- BIM construction and data content are checked using validation software.
- BIMs are used for many purposes by certified software.

Version 1.0 - © NIBS 2007
In order for a real free flow of information to occur, three factors need to be in place:

1. The format for information exchange,
2. A specification of which information to exchange and when to exchange the information, and
3. A standardized understanding of what the information you exchange actually is

Interoperability through Standards, courtesy Janne Aas-Jakobsen, Jotne EPM Technology AS

Excerpted from NBIMS V1-P1, Appendix C – IFDLibrary, Roger Grant, CSI
Tell me and I'll forget.  
Show me and I'll remember. Involve me and I'll understand.  
Confucius
**IDM Business Case Development**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | **WHO** (is requesting)  
Actor requesting information to support a process or decision  
(Authoritative Reference OMNI CLASS – Table 33 & 34) |   |   |   |
| 2 | **WHY** (project/process use or benefit)  
Why is this information important for a project activity  
(Authoritative Reference OMNI CLASS- Table 32) |   |   |   |
| 3 | **WHEN** (stage in project)  
(Authoritative Reference OMNI-CLASS-Table 31) Table 31 is tied to IFC Phases (Project Lifecycle) |   |   |   |
| 4 | **WHAT**  
Dataset in BIM that supports the request and benefit)  
Because BIM use aggregates information several tables support this activity.  
Authoritative Reference OMNI-CLASS Tables 11, 12,14, 21, 23, 41, 49 |   |   |   |
| 5 | **To WHOM**  
Group/Actor that provides/fullfills the information need OMNI-Class 33 34 |   |   |   |
| 6 | **HOW**  
Tools/formats/results Table 35 & 22 |   |   |   |
| 7 | **INPUTS & OUTCOME**  
Information, Product or Service Delivered Omniclass 36 |   |   |   |

For Example:

1. (Table 34) Architect aka: 34-25 21 00
2. (Table 32) Conception services, Designing, Preliminary Designing aka: 32-11 14 13
3. (Table 31) Conception Stage aka: 31-10 00 00
4. (Table 12) Building 12-11 00 00;  
   (Table 21) Superstructure, Enclosure aka: 21-41 31 00;  
   (Table 23) Electrical Power and Lighting 23-80 00 00
5. (Table 34) Engineer 34-25 31 00
6. (Table 36) Design Tools (OmniClass NA for IFC)
7. (Table 36) Building Envelope Design Information:36-21 17 21
NBIMS Candidates

- Precast Design (MVD)
- GSA Spatial Validation
- COBIE
- ICC Automated Code Checking
- Specifiers’ Property Information Exchange
- Sheet Metal
- Owner’s Deliverable
- Structural Steel
- Early Design

Architectural Precast Concrete - Architect to Detailer
Funded by Charles Pankow Foundation
Next Steps – Related Activity

• **Business Process Roadmaps** – Provide the business relationships of the various activities of the real property industry. May be basis for organizing the business processes - help organize the NBIMS and the procedures defined in the Information Delivery Manuals (IDM’s). (FIATECH Capital Projects, USACE BIM Roadmap)

• **Candidate Standard** – Candidates to go through the NBIMS development/consensus process in the future. (COBIE, Early Design).

• **Guidelines** – Available from several organizations and some items should be considered for inclusion in NBIMS. (AIA-IP, AGC BIM Guide, Coast Guard Model Guidelines, General Buildings Information Handover Guide, GSA 3D-4D-BIM Program)

• **Other Key References** – Parallel efforts being developed in concert with the NBIMS however are not part of the NBIMS and in fact, may be standards in their own right. (ICC SmartCodes, OGC© OWS-4, OGC© AECOO Interoperability, OSCRE Real Property Exchange Standards, Pankow/NIBS/FIATECH Architectural Precast Concrete, US National CAD Std., ISO 15926).
Related Industry Activities
Examples of Other Data Standards

- gbXML - Green Building XML schema, BIM to engineering analysis. (USGBC)
- agcXML - XML schema for electronic interchange of common construction data and document. (NIBS & AGC)
- ifcXML – XML representation of IFC Express model (IAI)
- IFC2x3G - Prototype for linking BIM to geographical & geospatial information
- GML/CityGML - an open data model and XML-based format for the storage and exchange of virtual 3D city models (Open Geospatial Consortium)
Journal of BIM

- NIBS publication
- Issue #1 on the street
- Issue #2 in production
- Semi-annual for now.
AIA Integrated Project Delivery

- Change is now
- Collaborative, Productive and Integrated Teams
- Early involvement of key participants.
- Trust, transparent processes, information sharing, team success tied to project success, value-based decision making, use available technology and support.
- Open and interoperable data exchanges, open standards technology, disciplined and transparent data structures.

http://www.aia.org/ipdg
## AIA Integrated Project Delivery

### Traditional design process

<table>
<thead>
<tr>
<th>WHAT</th>
<th>HOW</th>
<th>REALIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predesign</td>
<td>Schematic Design</td>
<td>Design Development</td>
</tr>
<tr>
<td>Owner</td>
<td>Designer</td>
<td>Design Consultants</td>
</tr>
</tbody>
</table>

### Integrated design process

<table>
<thead>
<tr>
<th>WHAT</th>
<th>HOW</th>
<th>REALIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptualization</td>
<td>Criteria Design</td>
<td>Detailed Design</td>
</tr>
<tr>
<td>Agency</td>
<td>Owner</td>
<td>Designer</td>
</tr>
</tbody>
</table>

April 2007 AIA published two new standard form documents addressing transmitting data in a digital working environment and maintaining control over its future use.

AIA’s new documents C106™-2007, Digital Data Licensing Agreement, and E201™-2007, Digital Data Protocol Exhibit, allow contracting parties to share digital data in accordance with agreed-upon protocols for transmission, format, and use of the data.
AIA Digital Documents

• Standardizes ad-hoc agreements.
• Protection from infringement
• Misuse
• Reduce risk of data degradation & downstream software incompatibility.
• Reduce unintended reliance on accuracy of information.
• Impediments caused by broad disclaimers
• ‘Chain of licenses’ and intellectual property.
ARTICLE 3 PROJECT PROTOCOL TABLE

§ 3.1 The parties agree to comply with the data formats, transmission methods and permitted uses set forth in the Project Protocol Table below when transmitting or using Digital Data on the Project.

(Complete the Project Protocol Table by entering information in the spaces below. Adapt the table to the needs of the Project by adding, deleting or modifying the listed Digital Data as necessary. Use Section 3.2 Project Protocol Table Definitions to define abbreviations placed, and to record notes indicated in the Project Protocol Table.)

<table>
<thead>
<tr>
<th>Digital Data</th>
<th>Data Format</th>
<th>Transmitting Party</th>
<th>Transmission Method</th>
<th>Receiving Party</th>
<th>Permitted Uses</th>
<th>Notes (Enter #)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.1 Project Agreements and Modifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1.2 Project communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting notices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agendas</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requests for information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

§3.2 PROJECT PROTOCOL TABLE DEFINITIONS

(Below are suggested abbreviations and definitions. Delete, modify or add as necessary.)

Data Format:
(Provide required data format, including software version.)
W .doc, Microsoft® Word 2002

Transmitting Party:
O Owner
A Architect
C Contractor

Transmission Method:
EM Via e-mail
EMA As an attachment to an e-mail transmission
CD Delivered via Compact Disk
PS Posted to Project Web site
FTP FTP transfer to receiving FTP server

docinfo@aia.org
BIM Risk Issues 2D vs 3D

- Risk has always existed – no shortage of litigation
- Collaborative view, broad participation can only reduce E & O.
- Clash detection has demonstrated results
- Blurred responsibilities create liability?
  - Design, construction coordination, shop drawings, etc.
  - Maintain ‘responsibility swimlanes’ with protocols and technology.
- ‘Owner’ of master model?
  - Use ‘Federation’ model
  - Contracts define responsibilities for specific elements.
- Diminished liability protection. Same for 2D & 3D.
- Software induced error? Owner accepts both increased efficiency and promise of reduced errors as well as potential for software glitches or errors in using software.

CAD/BIM/GIS Integration

Geospatial Information (GIS)

Country
State / Province
County
City
Site
Real Property Asset
Land / Parcel
Facility / Built

Building information Modeling (BIM)

System
Space
Overlay
Level
Sub-Systems
Components
Room
Node
Segment

System
Space
Overlay
Level
Sub-Systems
Components
Room
Node
Segment

Overlay
Building
Structure
Linear Structure
Node
Segment
OGC OWS-4 CAD/GIS/BIM Integration

• Standards-based Web Service architecture and technologies tested against GSA and DOD business cases:
  – Provide feedback to IAI International IFC work
  – Compliment National BIM Standard development activity

• December 2006 Demonstration – Location of Field Hospital as part of regional emergency event
  – BIM, Geospatial, and real time (sensor) integration / fusion
  – Newark Airport
  – Port Authority of NY / NJ hosting

© NIBS 2007
AECOO Testbed

Energy Code Compliance Checking

Costing

Energy Analysis

Green Buildings

© NIBS 2007
Coordinating Object Definitions

ISO/PAS 16739
(Industry Foundation Class)

ISO 15926
(Process Industry)
GSA Spatial Program Validation

2006 Released GSA BIM Guide for Spatial Program Validation.

• 340MSF in 8700 owned and leased buildings
• Prospectus level projects receiving design funding in FY2007+, require spatial program BIMs for final concept approval. Handovers from Preliminary Concept Design and Final Concept Design.
• Contains Floor Calc, Tenant Stack Plan, ANSI/BOMA Stack Plan.
• First in a planned series of exchange standards.
• 60 projects to date, 20 underway.
• Vendor neutral- Support the GSA Spatial Validation IFC Model View.
• Assessing industry readiness and technology maturity
• 11 Regions & home office; 36 BIM Champions, 1 3D-4D Program Manager
• Also 4D sequencing, laser scanning, & energy modeling.
Model Checking

2006 International Energy Conservation Code®
SmartCodes demo: http://www2.iccsafe.org/io/smartcodes/

A buildingSMART alliance™ Member
“Use of technology and process to create a building that is safer and more productive for its occupants and more operationally efficient for its owners.”

Courtesy of Paul Ehrlich:
What Integrated Building Systems Features?

- Networking / Telecom
  - Common network infrastructure
  - Structured – maintainable cabling
  - Wifi, VOIP
- Security / Life Safety
  - Digital video monitoring
  - Access control and monitoring
  - Automatic fire detection, suppression and egress support
  - Contaminant monitoring and containment
  - Physical security / guard services
- A/V
  - Digital signage
  - Paging
  - Entertainment
  - Presentation support

Courtesy of Paul Ehrlich: A buildingSMART alliance™ Member
Technologies and Systems

- **Mechanical**
  - Personal comfort control
  - Energy efficient equipment
  - Thermal storage
  - Combined heat and power
  - Controls optimization

- **Electrical**
  - Energy efficient lighting
  - Lighting control
  - Distributed generation
  - Dual power feeds / emergency power
  - Power quality monitoring
  - Sub-metering / billing

© NIBS 2007

Courtesy of Paul Ehrlich:
Lessons Learned

• BIM = Intelligent Design
• IBMS = Intelligent Building Operations
• Looking for:
  – One tool for design, construction and operations
  – System and equipment information becomes operating procedures and input for maintenance management
  – Ability to run energy models on operating buildings
  – Real time validation of design
  – Integrated facility information management
• BIM is largely an Architectural tool today – Engineers are still learning about it
• Could expose the gap between design and construction

Courtesy of Paul Ehrlich:
How To Proceed

• Need for real systems integrators (not just ATC contractors)
• Need to know:
• What’s ready today?
  – Technologies are fairly mature
  – Standards exist and are widely available
  – Products are largely available
• What’s missing?
  – Good financial justification tools
  – Trained consultants
  – Contractors
  – Operations staff
Schematic Diagramming & Provisioning
Mission Dependency Analysis

Metric Data

MDI / SUI / FCI / Security / Other
Alliance Vision and Mission

• **Vision**
  – A global environment where all participants can readily and transparently share, apply and maintain information about facilities and infrastructure

• **Mission**
  – Improve all aspects of the facility and infrastructure lifecycle by promoting collaboration, technology, integrated practices and open standards
IAI Global Organization: November 2007

- 13 chapters - 26 countries - 542 organizations

Membership
- Owners
- Architects
- Engineers
- Facility managers
- Builders
- Manufacturers
- Software vendors
- Universities
- Research laboratories
Entities With Known BIM Efforts

- 3XPT Strategy Group
- 7group
- American Institute of Architects (AIA) - Building Connections
- AIA - Integrated Project Delivery
- American Institute of Steel Construction (AISC)
- American Society for Quality (ASQ)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- American Society of Civil Engineers (ASCE)
- American Society of Interior Designers (ASID)
- Association of General Contractors of America (AGC) - BIMForum
- Building Owners and Managers Association (BOMA)
- buildingSMART alliance
- Continental Automated Buildings Association (CABA)
- Canadian Green Building Council (CaGBC)
- Center for Facilities and Environment (CIFE)
- Construction Industry Institute (CII)
- Construction Managers Association of America (CMAA)
- Construction Owners Association of America (COAA)
- Construction Specifications Institute (CSI)
- Construction Users Round Table (CURT)
- Design Build Institute of America (DBIA)
- FIATECH
- General Services Administration (GSA)
- International Alliance for Interoperability (IAI)—International
- Institute for Market Transformation to Sustainability (MTS)
- International Center for Facilities (ICF) Ottawa
- International Code Council (ICC) - SMARTcodes™
- International Facilities Managers Association (IFMA)
- Lean Construction Institute (LCI)
- National Academy of Sciences Federal Facilities Council (FFC)
- National Association of Home Builders (NAHB)
- National Institute for Standards and Testing (NIST)
- NIBS - Building Enclosure Technology and Environment Council (BETEC)
- NIBS - Building Seismic Safety Council (BSSC)
- NIBS - Facility Information Council (FIC)
- NIBS - Facility Maintenance and Operations Committee (FMOC)
- NIBS - High Performance Building Council (HPB)
- NIBS - International Alliance for Interoperability of North America (IAI-NA)
- NIBS - Multihazard Mitigation Council (MMC)
- NIBS - National BIM Standard (NBIMS)
- NIBS - National CAD Standard (NCS)
- NIBS - Whole Building Design Guide (WBDG)
- Open Geospatial Consortium (OGC)
- Open Standards Consortium for Real Estate (OSCRE)
- Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- Sustainable Buildings Industry Council (SBIC)
- US Army - Civil Engineering Research Laboratory (CERL)
- U.S. Green Building Council (USGBC)

Who is Coordinating?
Support The Alliance to Help …

- Provide visibility to ongoing efforts to develop buildingSMART® practices.
- Identify the interfaces, gaps, overlaps and collaboration opportunities among groups addressing buildingSMART® practices.
- Provide buildingSMART® products, such as the U.S. National Building Information Model Standard (NBIMS).
- Support ongoing buildingSMART® projects.
- Reduce wasted industry time, effort and cost.
- Demonstrate the benefits to industry of moving toward a common vision of buildingSMART®.
Immediate Next Steps
Owner Organizations

- Invest in education & re-training
- Manage across or eliminate stove-piped business functions
- Integrate IT applications focused on business alignment and services.
- Support more integrated design/delivery teams
- Create project information manager role.
- Support value-enhanced services
- Require & support higher functioning facilities
- Measure results – standardize metrics
- Adopt available standards:
  - OSCRE, IFMA/BOMA, OGC, NBIMS
- Invest in Transformation
Architects & Design Engineers

- Involve senior management – build business case
- Software is typically 20% of the investment.
- Invest in education & re-training
- Create project information manager role.
- De-layer design & production activities/staffing
- Seek contracts that reward value enhancement
- Sell value-enhanced services. Optimize ‘project’ outcomes.
- Adopt available standards
  - NCS, MasterFormat®, UniFormat®, Structural & Systems Design, BAS technology
Architects & Design Engineers (cont.)

- Implement and report metrics
- Profile model content, consider outsourcing library development
- Maximize collaboration with owners, consultants, contractors early in process and often throughout.
- Use authoring & analysis tools that support open exchanges & interoperability.
- Participate in product library development based on standards.
- Re-Invest short-term gains in long-term transformation.
Constructors

- Invest in education & re-training
- Create project information manager role.
- Drive lean construction methods
- Seek projects and contracting methods that reward value enhancement
- Sell value-enhanced products & services
- Adopt and implement advanced IT
- Implement BIM 4D (Scheduling) & 5D (Cost)
- Build to the Model
- Use authoring & analysis tools that support open exchanges & interoperability.
- Participate in Standard development.
- Re-invest short-term gains in long-term transformation.
What To Do?

• See what stake you have – where you have the most to gain.
  – Read the literature.
  – Implement lean methods.
  – Enhancing value services and products
  – Reduced cycle time
  – <4% change orders for projects. Data becoming available.
  – Better coordination between design, construction & operations.

• Find out what it’s costing not to operate this way.
• Find out what the competition are doing.
• Leverage innovations – the bar is being raised.
• Leverage open standard innovators.
  – Industry organizations.
  – Professional associations.
  – Standards developers.

• Be a leader – not a follower.
What To Do?

• It's not about tomorrow. It is in your hands today.
• It's not about technology. It is about how you do business.
• Benefits are very big.
• Not just commercial, it is residential and more.
• Break down barriers or lose competitive ground.
• Leverage innovations and implement them.
Funding Transformation
Delivering Buildings + Value

• Today: Delivering buildings – creating value for design & construction participants.

• Soon: Delivering buildings + lifecycle information to create value and opportunities throughout the supply chain.

• Leverage ‘local efficiencies’ to pay for collaboration and interoperability.
Business Model – Future Values

- Conception Stage
- Project Delivery Stage
- Design Stage
- Construction Documents Stage
- Procurement Stage
- Execution Stage
- Utilization Stage
- Closure Stage

Optimized approach with virtual modeling and analysis with reduced change orders & delivery time and lower operating and sustainment costs.

The savings we are currently experiencing with faster delivery and fewer change orders.

The yet untapped savings.
### Value Opportunities – Reduce Cycle Time

<table>
<thead>
<tr>
<th>2005 All Stores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Store Count</strong></td>
</tr>
<tr>
<td><strong>Gross Sales</strong></td>
</tr>
<tr>
<td><strong>Net Income</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2005 Avg. Per Store</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># New Stores</strong></td>
</tr>
<tr>
<td><strong>Net Income</strong></td>
</tr>
<tr>
<td><strong>Net Income per Week</strong></td>
</tr>
</tbody>
</table>

| Net Income Potential per Week - 150 stores | $6,477,528 |

<table>
<thead>
<tr>
<th>2006 Est. New Stores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>150</strong></td>
</tr>
</tbody>
</table>
Value Opportunities

Data Commissioning Cost Reduction

$50K per building

x

150 buildings per year

= $7,500,000

Data Commissioning

- Nearly automatic data commissioning
  
  (Source: NASA-USACE/CERL COBIE Project)

- Change orders reduced from 8-10% to .05%
  

Change Orders

<table>
<thead>
<tr>
<th>Store Count</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store SF</td>
<td>50,000</td>
</tr>
<tr>
<td>Gross cost per SF</td>
<td>$120</td>
</tr>
<tr>
<td>Gross Base Building</td>
<td>$6,000,000</td>
</tr>
<tr>
<td>8% Change Orders</td>
<td>$480,000</td>
</tr>
<tr>
<td>.5% Change Orders</td>
<td>$300,000</td>
</tr>
<tr>
<td>Net savings per store</td>
<td>$180,000</td>
</tr>
<tr>
<td>Net savings all stores</td>
<td>$27,000,000</td>
</tr>
</tbody>
</table>
Case Study – Letterman Digital Arts Center

“Despite numerous design layout changes that were required by Lucas Film Ltd. due to company restructuring, the LDAC project was completed on time and below the estimated budget….over two hundred design and construction conflicts were identified, most of which were corrected before construction, resulting in an estimated savings of over $10 million on this $350 million project.”
A Culture of Investment

1. Implementing integration in homogenous, proprietary teams with ‘lean’ aims. Gaining benefits from BIM tools and methods used in project-specific scope. Pocket benefits.

2. Same as #1 but pocket most benefits and use some to fund interoperability development and industry adoption.

3. Implement interoperability across greater scope of lifecycle in heterogenous, project-specific and ‘loose’ federations. Gain greater benefits from higher use of BIM tools and methods. Pocket greater benefits and continue to use a percentage of gains to fund more transformation.
Presenter Contact Information

Alan R. Edgar
OSCRE Workgroup Program Manager
Chair, National BIM Standard Committee
765-215-8251
www.oscre.org
www.facilityinformationcouncil.org/bim/

• For more information:
  www.nibs.org
  www.buildingsmartalliance.org/

Thank You