Slide 1

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Slide 2

W10

Introduction to BIM: People, Processes and Tools

Presented by buildingSMARTalliance

The facility delivered using a building information model is significantly different than the one delivered today. Owners see what they are buying, engineering analysis has been done to better predict the outcome, conflicts have been eliminated, building code compliance has been validated, change orders are all but eliminated, and a more sustainable, energy efficient and environmentally friendly product is delivered. This session will examine those changes. What is here today and what is coming in the near future.

Alan Edgar, Assoc. AIA
OSCRE Workgroup Program Manager
Chair, National BIM Standard Committee
May 20, 2008

Agenda Alert

Slide 3

Agenda

What is the Problem to be Solved?

A Utopian View

Introduction to BIM

Getting There From Here

Immediate Next Steps

Slide 4

Inquiring Minds Want to Know

- What is BIM?
- Is BIM software widely available?
- How is BIM different than 2-D CAD programs? And why is 3-D better?
- What type of facility data is (or could be) included in BIM?
- How does BIM benefit the building owner, developer, and facility manager?
- I've heard that BIM saves time and money; why, how, and how much?
- Who among the owner, architect, or contractor is most apt to use/recommend BIM for a project?
- What words of wisdom or advice do you have for building owners and developers who are considering BIM for their next project?
- What are the drawbacks of BIM?
- Why is it important to have a National Building Information Modeling standard? And what has been the progress?
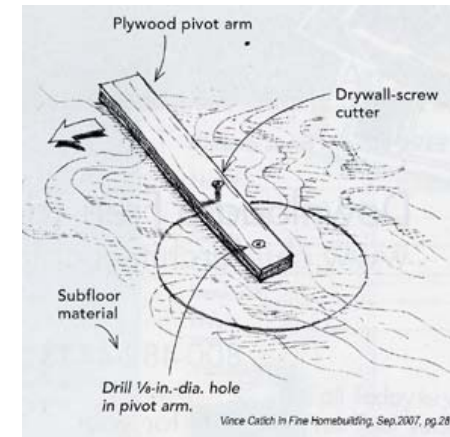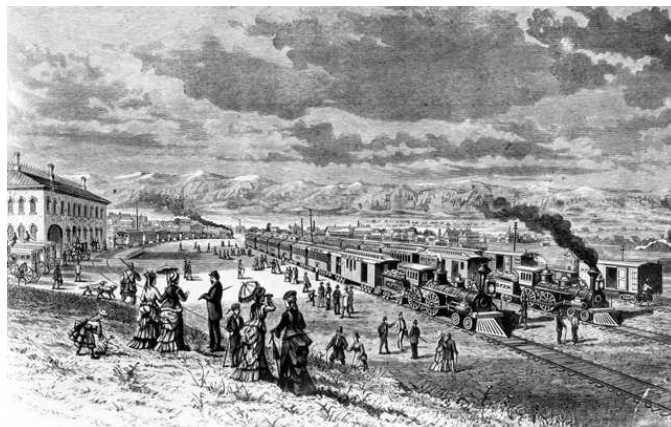
Additional Questions to Answer

- ?

First, A Story…

Vince Catich in Fine Homebuilding, Sep.2007, pg.28

And in case you've heard that one…

Colorado Railroad Museum

Housekeeping and A Survey

Owner	Designer	Engineer	Builder

- CFO, CTO, CIO
- Commercial Real Estate Professionals (lease, buy/sell)
- Corporate Real Property Professionals (own/operate)
- CAD/BIM Manager
- Maintenance Engineer

- Facility Manager
- Software Vendors
- Planners
- Mapmakers
- Building Product Manufacturers
- Fireman/Law Enforcement
- Developer
- Specifier
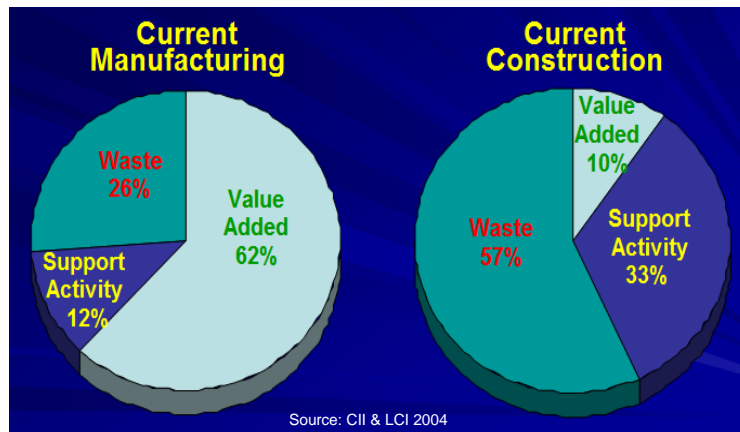- Estimator
- Material Scientist

- 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)
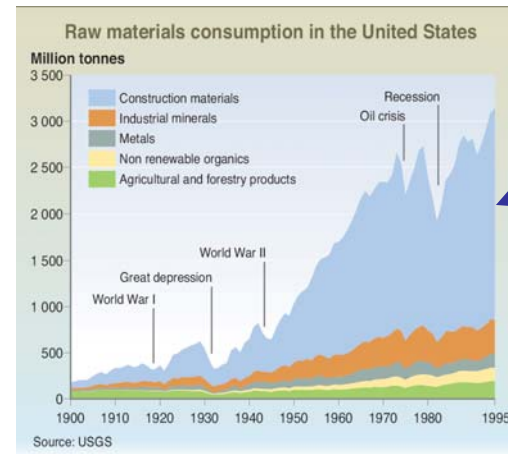
© NIBS 2007

What is the Problem to be Solved?

W21 buildingSMARTalliance®Projects in Progress, Tu 1:30p - 4:30p
S100 Overview of the National BIM Standard Wed. 8:30-9:30a

© NIBS 2007

What is the Problem to be Solved?

Current Manufacturing

- Waste 26%
- Value Added 62%
- Support Activity 12%

Current Construction

- Value Added 10%
- Support Activity 33%
- Waste 57%

Source: CII & LCI 2004

© NIBS 2007

Another Sign of the Times…

Raw materials consumption in the United States
Million tonnes

- Construction materials
- Industrial minerals
- Metals
- Non renewable organics
- Agricultural and forestry products

Recession
Oil crisis
World War II
Great depression
World War I

Need to reduce waste here also!!

Source: USGS

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Slide 1

AEC/O costs of non-interoperabilty

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%

Interoperability in the Construction Industry, Smart Market Report – Design and Construction Industry, 2007 Interoperability Issue, McGraw-Hill, Oct. 2007, pg. 5.

© NIBS 2007

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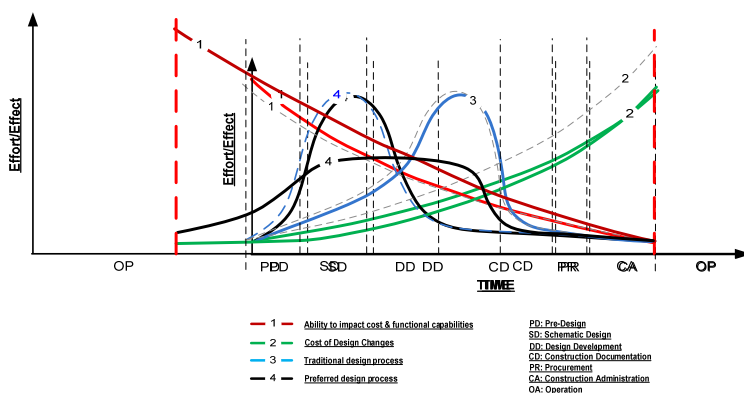
What is driving costs due to lack of interoperability?
• Manually re-entering data (69%)
• Time using duplicate software (56%)
• Document version checking (46%)
• RFI processing (40%)
• Cost of data translations (31%)

• Most industry participants would benefit from industry interoperability:
  – 8 in 10 report sharing Medium (41%) or High (31%) quantity of data.

Interoperability in the Construction Industry, Smart Market Report – Design and Construction Industry, 2007 Interoperability Issue, McGraw-Hill, Oct. 2007, pg. 5.

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Effort, Affect, Timing & Value

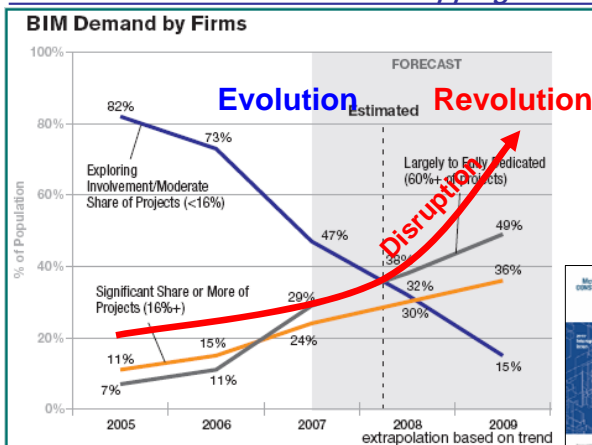|	
1 — Ability to impact cost & functional capabilities	PD: Pre-Design SD: Schematic Design
2 — Cost of Design Changes	DD: Design Development CD: Construction Documentation
3 — Traditional design process	PR: Procurement
4 — Preferred design process	CA: Construction Administration OA: Operation

"Collaboration, Integrated Information and the Project Lifecycle in Building Design, Construction and Operation", The Construction Users Roundtable, August 2004, p4.
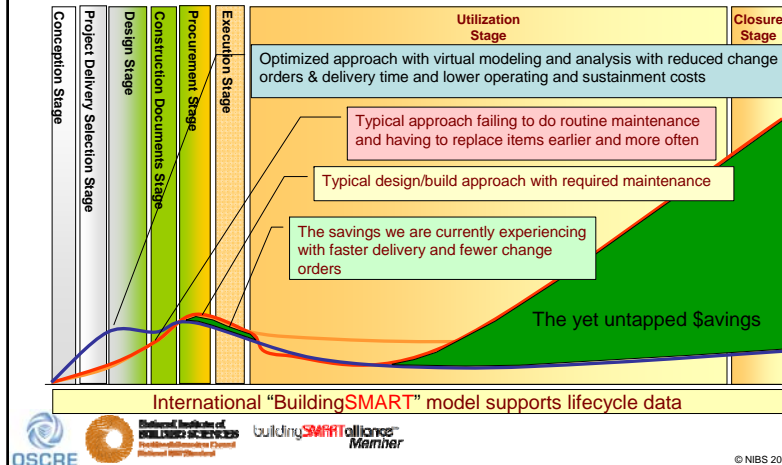
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Tipping Point Prediction

Time is of the essence

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Slide 1

Savings Opportunities

Stages (vertical labels): Conception Stage | Project Delivery Selection 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

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

International "BuildingSMART" model supports lifecycle data

© NIBS 2007

Slide 2

A Utopian View

EXIT 211 A

56 WEST

Utopia

© NIBS 2007

Slide 3

Megatrends for Facilities Industry

Buildings, Location and Commerce will be unified

Land, buildings, sub-buildings and structures will be uniquely identified and this unique identifier will tie all facilities commerce together

Change management will become the mantra for facilities. New facilities will have to be designed to be highly adaptable 'change ready' assemblies

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Slide 4

Megatrends for Facilities Industry

Just like elevators, stairs, water and electricity, broadband networks will be an expected utility in the base building

Facilities will be seem much more like living organisms

Occupants will be safer, more comfortable & much more productive

© NIBS 2007

Building, remodeling and re-purposing will generate almost no waste

New and renovated buildings - at or near carbon-neutral energy consumption

National codes will require model-driven certification of designs and many owners will require additional certification

© NIBS 2007

On-demand collaboration and (virtual) co-location of working teams will be the norm

Most design firms and many owners will maintain an open-format model server – some will have several

© NIBS 2007

and lastly…

None of this will be surprising to university graduates

© NIBS 2007

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.

© NIBS 2007

Foundation Elements

The Opportunity Also Exists:

– To harvest business intelligence and operational information to inform strategic planning.

– To harvest building information for use in program, throughput and design.

In many cases Capital Facilities projects create the 'seed' data that make these capabilities possible.

– 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.

W20 BIM Implementation Strategies: Changes in Your Office
Tu 1:30p - 4:30p

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.

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.
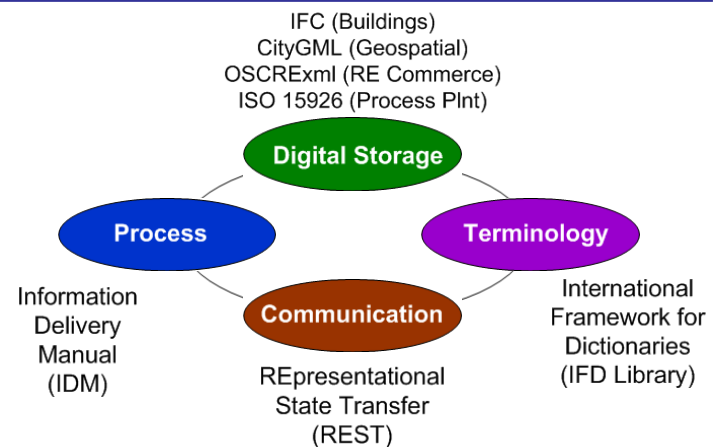- Not necessarily 'everything to everything'.

Software Technical Interoperability

- Seamless data exchange at the software level among diverse applications

- The NBIM Standard maintains that viable software interoperability in the capital facilities industry requires the acceptance of an **open data model** of facilities and **an interface to that data model for each participating application**.

Interoperability Through Standards

IFC (Buildings)
CityGML (Geospatial)
OSCRExml (RE Commerce)
ISO 15926 (Process Plnt)

Digital Storage

Process — Information Delivery Manual (IDM)

Terminology — International Framework for Dictionaries (IFD Library)
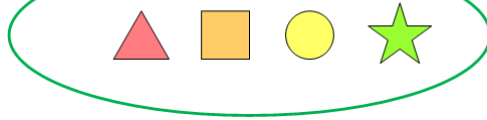
Communication — REpresentational State Transfer (REST)

Based on work by Janne Aas-Jakobsen, Jotne EPM Technology AS. IFD Library is a trademark of CSI, OSCRExml is a trademark of OSCRE Americas, Inc.
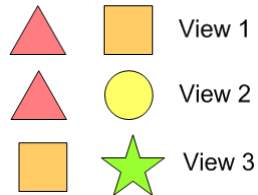
Digital Storage

Exchange Views

View 1
View 2
View 3

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- 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).

General Buildings Information Handover Guide, Principles Methodology and Case Studies, National Institute of Standards and Technology, Fallon, Palmer, Aug. 2007, p. 22-23.
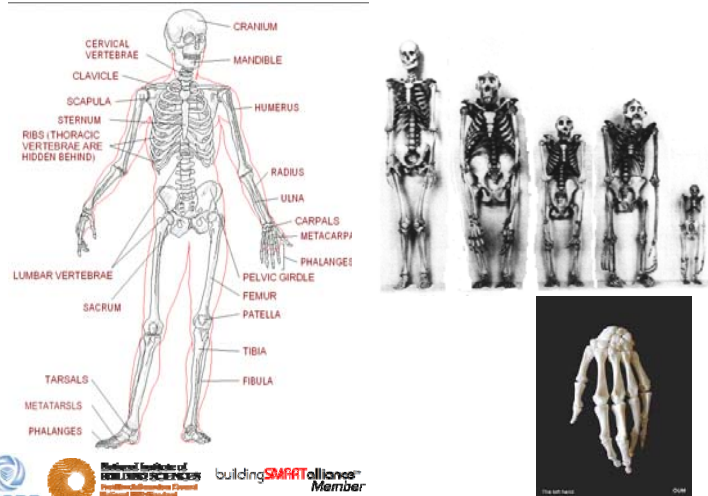
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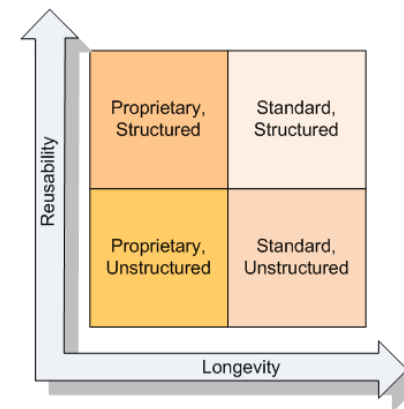
General Buildings Information Handover Guide, Principles Methodology and Case Studies, National Institute of Standards and Technology, Fallon, Palmer, Aug. 2007, p. 57.

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Foundation Elements – 3D / VDC
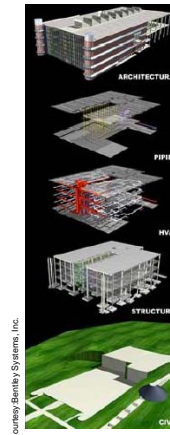

Courtesy: Kling
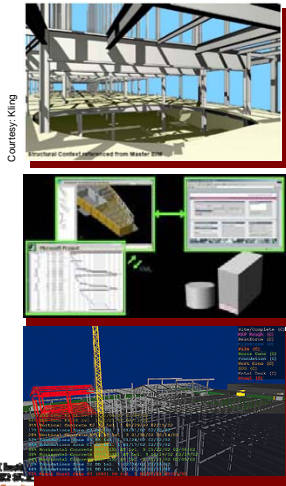
For Example…

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

Courtesy: Bentley Systems, Inc.

COBIE

DATA SETS	FUNCTION
• 3D Geometry	• Legal
• Real Property	• Fiduciary
• Space Inv.	• Store Ops
• Equipment	• Bldg. Ops
• Warranty	• Fac. Mgmt
• Maint. Tasks	• Asset Mgmt
• Instructions	
• Schedules	
• Cost	

[Construction to Operations Building Information Exchange]

Where are we now?

■ 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.

Where are we now?

■ Contrasting choices/approaches to BIM

– Additional important critieria:
  • 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
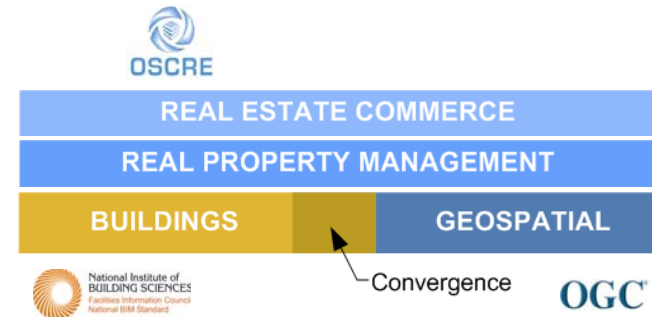 • Support for LEED

Other Stakeholder Interests..

Convergence of Buildings, Geospatial and Commerce

OSCRE
REAL ESTATE COMMERCE
REAL PROPERTY MANAGEMENT
BUILDINGS | GEOSPATIAL
National Institute of BUILDING SCIENCES — Convergence — OGC

Voluntary Consensus Standards Organizations

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What is a Voluntary Consensus Standards Organization?

- International organizations that plan, develop, establish, or coordinate voluntary consensus standards using agreed-upon procedures and can prove its processes are non-collusional

- A voluntary consensus standards body is defined by the following attributes:
  - Openness - Resources, standards, information models and schemas, best practices, discussion, forums, reference implementations
  - Balance of interest
  - Well defined Policies and Procedures
  - An appeals process
  - Vertical and Horizontal Consensus Process that are Transparent and Accountable

Microsoft Terraserver

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Open Geospatial Consortium - Quick Background

- 350 member organizations from 34 countries & 6 continents
  (Antarctica represented by OGC university and research members)
  - 158 North America
  - 146 Europe
  - 38 Asia-Pacific
  - 2 Africa
  - 1 South America
  - 5 Middle East

- 26 approved, publicly available Implementation Specifications

- 25 Additional Best Practices, Standard Profiles

- OGC standards used in broader IT standards (OASIS, IETF, others)

- 417 compliant or implementing products

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Seamless semantics and spatial information for AEC/Geospatial/BIM

Installation

Site

Real Property Asset

Land (Parcel)

OR

Facility

Geospatial Oriented

Water Tower

Power line

Building

OR

Structure

OR

Linear Structure

BIM Oriented
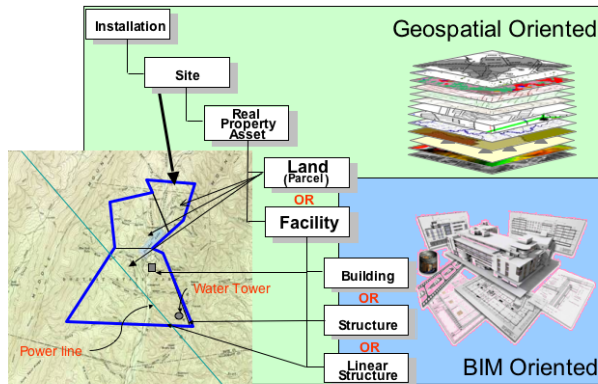
Source: DoD/FRPC

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Connecting the Real Estate Industry…Now!

OSCRE exists to establish a common business language for the Real Property industry

Supporting Member organizations of OSCRE Americas represent:

– Owners, investors, operators, tenants, developers, service providers, regulatory agencies, consulting firms, vendors, and suppliers

– In excess of $2.1 trillion in real estate assets,

– 12.3 billion square feet of floor space and

– 1,352,500 association members.

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

Commercial and Corporate Real Estate & Allied Professions

■ Open Standards for Real Estate (OSCRE)

Real Property Marketplace

Real Estate Information Opportunities

"No longer is Real Estate a passive back-office function. …[it has] 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."
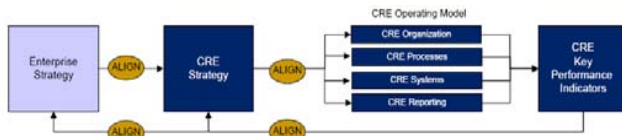
Align by Design, Alvarez and Marsal Real Estate Advisory Services, Dec. 2005

© NIBS 2007

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:
- 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

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Corporate **Building** Information
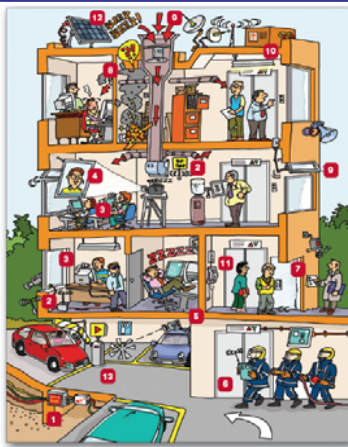
- Personnel
- Real Property Asset Management
- Personal Asset Management
- Facilities Operations Management
- Maintenance and Repair Management
- Building Automation Systems
- Building Intelligence Integration and Network Convergence (data, telcom, display/notice, tenant services).
- Geospatial Context

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Corporate **Business** Information

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Slide 1

How 72% Work Now..

Slide 2

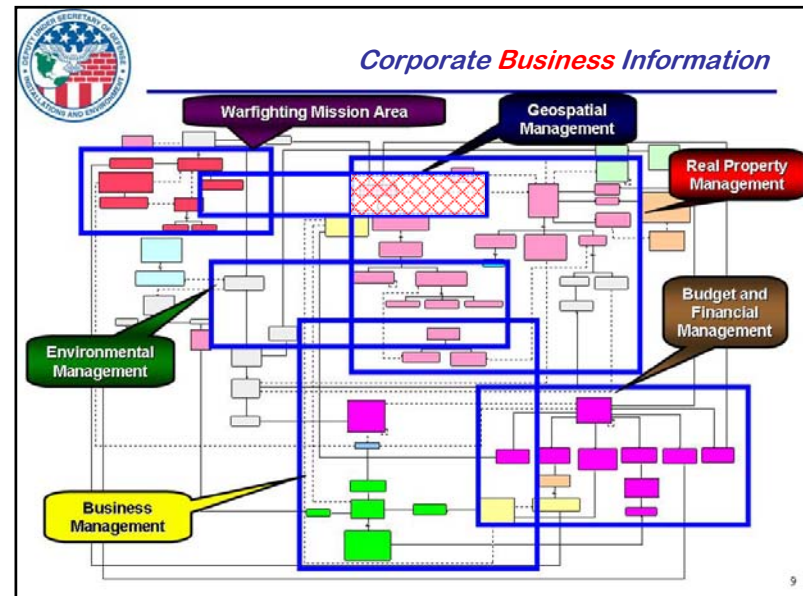### Creating A New Way To Work

- "..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."

- Herbert A. Simon: "The Science of Design", *The Sciences of the Artificial - 3rd Edition.*

Slide 3

Being Specific is Important for BIM

Conceptual	Schematic	Physical

Modeled

CLINICAL FACILITIES EXPANSION

[Analysis]

Actual

Slide 4

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

Conceptual | Schematic

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?   BIM Without Makeup

15

Is BIM the Answer?

A Visual Reason For BIM

Daniel Libeskind's Denver Art Museum

2D   3D

Visualization
with Conflict
Analysis

Reality

Slide courtesy of C. Eastman

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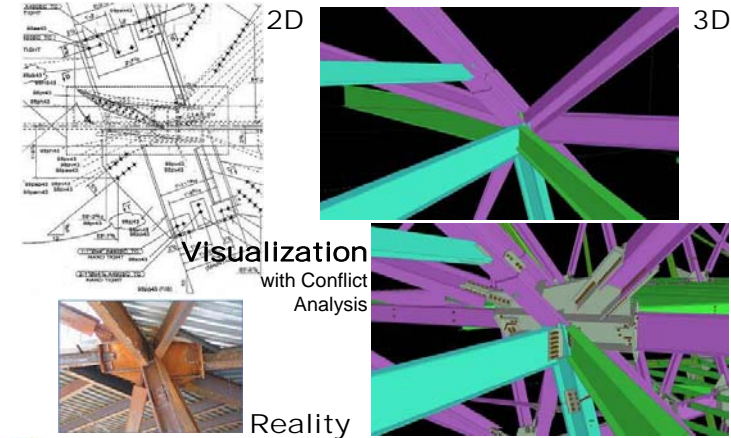
Projects: Geospatial Relationship

CAD

Geospatially Located

Building Information Model

ARUP

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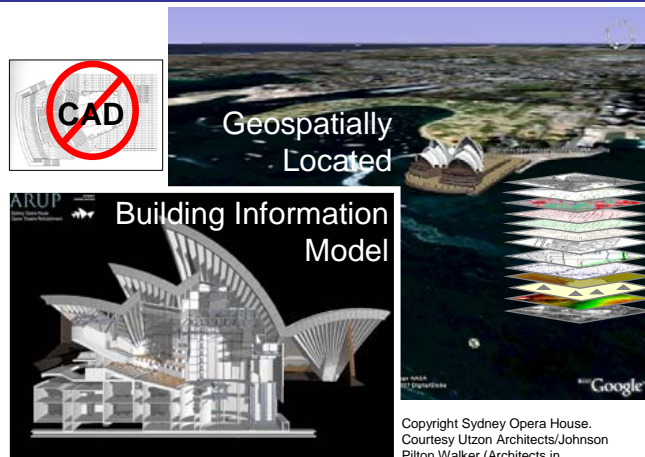
Copyright Sydney Opera House.
Courtesy Utzon Architects/Johnson
Pilton Walker (Architects in
collaboration), ARUP, with permission

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Foundation Elements – AIA Research

- *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.

AIA Architect, AIA, April 27, 2007 [http://www.aia.org/aiarchitect/thisweek07/0427/0427b_bim.cfm]

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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

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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%)

Interoperability in the Construction Industry, Smart Market Report – Design and Construction Industry, 2007 Interoperability Issue, McGraw-Hill, Oct. 2007, pg. 4.

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Where are we now?

- Identify the most important requirements that AEC professionals would like BIM (building information modeling) solutions to fulfill.
- http://www.aecbytes.com/feature/2007/BIMSurveyReport.html

- 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%.

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Where are we now?

- Identify the most important requirements that AEC professionals would like BIM (building information modeling) solutions to fulfill.
- http://www.aecbytes.com/feature/2007/BIMSurveyReport.html

- 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)

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Getting There From Here

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

Building Virtually, Validate, Build to the Model.

Courtesy Benjamin D. Hall Interdisciplinary Research Building

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Building Information Modeling Opportunities

Geospatial Info

Product Selection

Fabrication

Invoicing/ Payment

Computerized Maintenance Management System (CMMS)

Ordering/ Delivery

Planning   Design   Construction   Operations   Sustainment

Legal Info

Code Compliance Checking

Computer Aided Facility Management

Engineering Analysis

Project photos courtesy of Dennis R. Shelden, Ph.D., Chief Technology Officer, Gehry Technologies. The picture is of the Disney Conference Hall, designed by Frank Gehry.

The building process is not linear…

Building is a Verb

National Building Information Modeling Standard

Conceive · Plan · Design · Build · Operate · Renovate · Dispose

Lifecycle Phases

Each cycle should add knowledge

Learn and Improve

Knowledge over time

Information Exchanges

Conceive Plan Design Build Operate Renovate Dispose

Lifecycle Phases

© AEdgar 2006

Share and re-use information easily

Interoperability

Information Backbone

Knowledge over time

Information Exchanges

Conceive Plan Design Build Operate Renovate Dispose

Lifecycle Phases

© AEdgar 2006

Projects create buildings + lots of information

Lifecycle Information

Information Backbone

Knowledge over time

Information Exchanges

Vendor

Conceive Plan Design Build Operate Renovate Dispose

Project Team

Lifecycle Phases

© AEdgar 2006

NBMS: Project Methodologies
Wed. 4:00-5:00

A New Integrated Reality

Planning System
The Web Enabled Knowledge Tool

Other IFC Apps

ARCHICAD

XML

OGC Member

CityGML

SOLIBRI

IFC

Autodesk

Google Earth

Geospatial

GIS

Web Feature Services

Sustainable Knowledge

GSA
GSA BIM Guide Listed

OPS™ is Built on Open Industry Standards

buildingSMART

OGC Member

OGC Member

© copyright 2007 , ONUMA, Inc.

© NIBS 2007

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Slide 1

Strategy:
Focus on the Information Exchanges

Slide 2

Information Exchange Requirement

Structural Design
Architectural Design → Structural Analysis

Structural Analysis → Structural Design / Architectural Design

Business Processes

Chuck Eastman – Georgia Tech

OmniClass Table 31 - Phases

Conception | Project Delivery Selection | Design | Const. Doc. | Procurement | Execution | Utilization | Closure
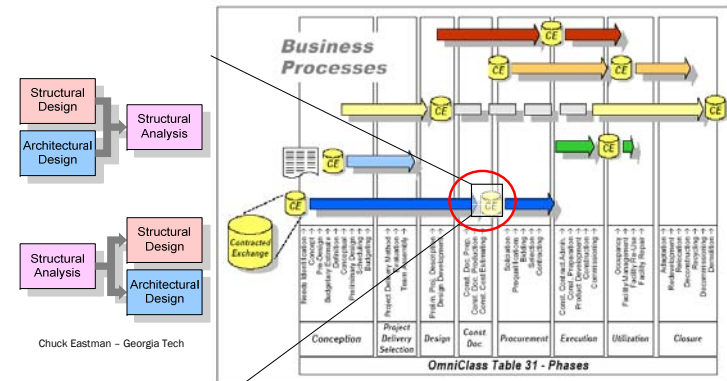
Alan Edgar – FacilityGenetics, L.L.C.

Slide 3

Architect to Structural Design Engineer (Multiple Applications)

Workgroup: Architectural Design to Structural Design (Sample)
Business Process Map: Design Development - Structural

Design Development

Architect
- (1) Architectural Design Model
- (2) Preliminary Design - Structural

Send Preliminary Design — Concrete

Structural Engineer PC Concrete
- (4) Structural Design PC Concrete

2 Send Preliminary Design — Steel

Structural Engineer Steel
- (3) Structural Design Steel

Slide 4

Economic Value of Exchange Standards

Typical Systems Integration Without Data Standards

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

Copyright 2005 © OSCRE America

Number of Components to Integrate	Formula/Calculation (See Last Slide for Calculation Details)	Cost of Integration (FTE's)	Labor Cost ($50,000/FTE)
20	N(N-1) 20(19)=380	38	$1,900,000
20	N=2.0 20(2.0)=40	4	$ 200,000
NET SAVINGS	**340 CONNECTIONS**	**34 FTE's**	**$1,700,000**

Study performed by the Open Application Group (OAGi)

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.

© NIBS 2007

Digital Rights Management

- Key to shared data resource
- Manage access to provide and retrieve data.
- Based on contracted relationships.
- Has been in use for years in Banking Industry.

© NIBS 2007
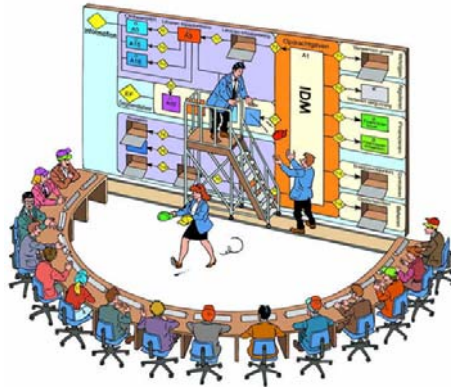
BIM Capability Maturity Model – A Self Assessment

1. **Data Richness** – How complete is the model?
2. **Life-cycle Views** – How many phases are included?
3. **Roles Or Disciplines** – How many players?
4. **Business process** – Are business processes defined?
5. **Change Management** – Is change management process in place?
6. **Timeliness/ Response** – How long does it take you to respond to RFI's or Change Orders?
7. **Delivery Method** – Is it single platform or SOA and web?
8. **Graphical Information** – Are you using 3D models?
9. **Spatial Capability** – Is it tied to geospatial or spatially aware?
10. **Information Accuracy** – Do you use information assurance for input and output?
11. **Interoperability/ IFC Support** – Do you use IFC's as a primary tool?

Article: http://www.aecbytes.com/viewpoint/2007/issue_33.html

Download: http://www.facilityinformationcouncil.org/bim/pdfs/BIM_CMM_v1.8.xls
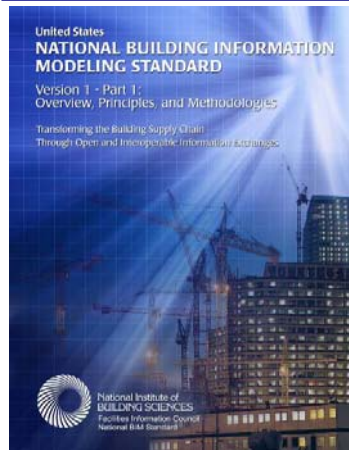
Massachusetts General Hospital

© NIBS 2007

National Building Information Modeling Standard Committee

S100 Overview of the National BIM Standard
Wed. 8:30-9:30a

Slide 1

United States
NATIONAL BUILDING INFORMATION MODELING STANDARD

Version 1 - Part 1:
Overview, Principles, and Methodologies

Transforming the Building Supply Chain
Through Open and Interoperable Information Exchanges

National Institute of
BUILDING SCIENCES
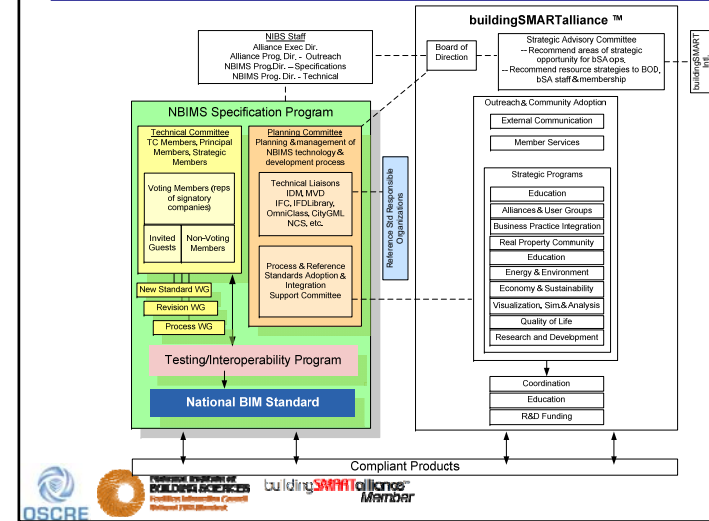Facilities Information Council
National BIM Standard

© NIBS 2008

- Delivered Dec 27, 2007
- International Core
- National Specific
  – OmniClass™
- Information Exchange Concepts
- Standard Development Process
- Information Assurance
- Capability Maturity Model
- References and Appendices
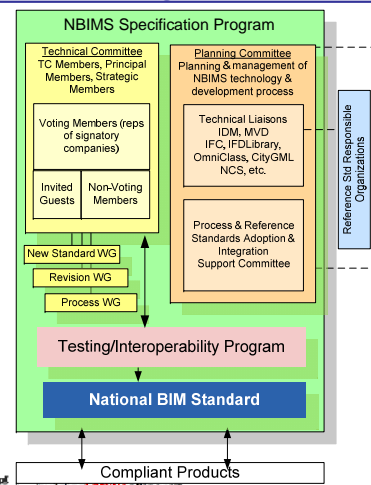- Over 30 contributors
- **190,000 Downloads**

© NIBS 2007

Slide 2

buildingSMARTalliance ™

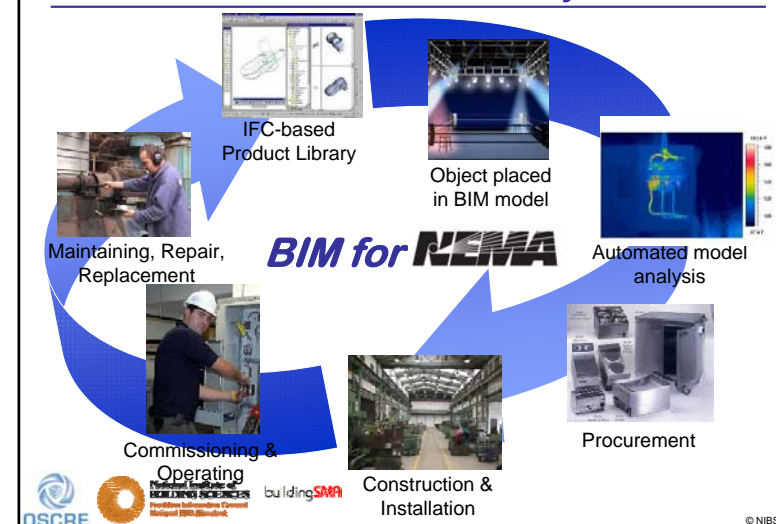NIBS Staff
Alliance Exec Dir.
Alliance Prog. Dir. – Outreach
NBIMS Prog.Dir. – Specifications
NBIMS Prog. Dir. - Technical

Board of Direction

Strategic Advisory Committee
– Recommend areas of strategic opportunity for bSA ops.
– Recommend resource strategies to BOD, bSA staff & membership

buildingSMART Intl.

NBIMS Specification Program

Technical Committee
TC Members, Principal Members, Strategic Members

Voting Members (reps of signatory companies)

Invited Guests | Non-Voting Members

New Standard WG
Revision WG
Process WG

Planning Committee
Planning & management of NBIMS technology & development process

Technical Liaisons
IDM, MVD
IFC, IFDLibrary, OmniClass, CityGML NCS, etc.

Process & Reference Standards Adoption & Integration Support Committee

Reference Std Responsible Organizations

Outreach & Community Adoption
External Communication
Member Services

Strategic Programs
Education
Alliances & User Groups
Business Practice Integration
Real Property Community
Education
Energy & Environment
Economy & Sustainability
Visualization, Sim & Analysis
Quality of Life
Research and Development

Coordination
Education
R&D Funding

Testing/Interoperability Program

National BIM Standard

Compliant Products

© NIBS 2007

Slide 3

NBIMS Specification Program

Technical Committee
TC Members, Principal Members, Strategic Members

Voting Members (reps of signatory companies)

Invited Guests | Non-Voting Members

New Standard WG
Revision WG
Process WG

Planning Committee
Planning & management of NBIMS technology & development process

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Testing/Interoperability Program

National BIM Standard

Compliant Products

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Slide 4

IFC-based Product Library

Object placed in BIM model

Automated model analysis

Procurement

Construction & Installation

Commissioning & Operating

Maintaining, Repair, Replacement

BIM for NEMA

© NIBS 2007

22

Electrical Manufacturing Lifecycle Value Chain

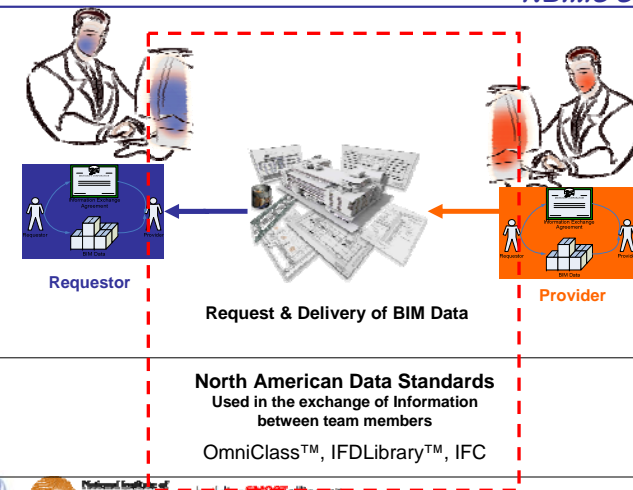| PHASE	VALUE ADD
Standards and Manufacturing Specifications	Basic physical & performance characteristics
Virtual Design/Engineering	Design requirements Product Selection Planned cost, quantity Geometry placed into model Systems integration Conflict resolution Performance Analysis
Procurement & Installation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

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NBIM Standard Product

- 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.
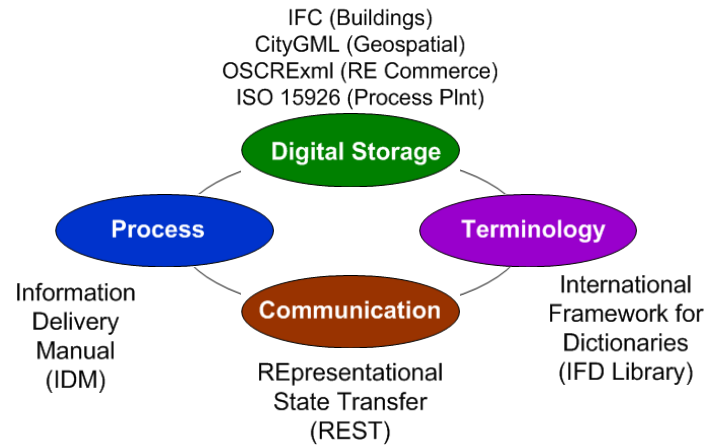
© NIBS 2007

Caution Semi-Technical Content Ahead

Nikon School®
Sometimes technology can seem overpowering

© NIBS 2007

NBIMS Scope

Requestor

Provider

Request & Delivery of BIM Data

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

OmniClass™, IFDLibrary™, IFC

© NIBS 2007

Slide 1: Interoperability Through Standards

Interoperability Through Standards

IFC (Buildings)
CityGML (Geospatial)
OSCRExml (RE Commerce)
ISO 15926 (Process Plnt)

Digital Storage

Process — **Terminology**

Communication

Information Delivery Manual (IDM)

REpresentational State Transfer (REST)

International Framework for Dictionaries (IFD Library)

Based on work by Janne Aas-Jakobsen, Jotne EPM Technology AS. IFD Library is a trademark of CSI, OSCRExml is a trademark of OSCRE Americas, Inc.

© NIBS 2007

Slide 2: NBIMS Production and Use Process

NBIMS Production and Use Process

PROGRAM
- Workgroup Formation
- Process Map
- Exchange Requirements and Business Rules
- **Standard Requirements**

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.

many purposes by certified software.

BIM Data Reuse and Extension

Use in Industry

Version 1.0 - © NIBS 2007

© NIBS 2007

Slide 3: Streamlining What Can be Streamlined

Streamlining What Can be Streamlined
User-Facing Knowledge Capture for IDM Development

National BIM Standard™
a product of the Facility Information Council – a NIBS Council

Login IDM Information Database

Please sign up for a password if you don't have a Username yet.
Please contact us if encounter any difficulties with the login.

Sign in:
Username
Password

Remember Username and Password
(For this Computer to "forget" this information you can use the "logout" link at the top right.)

Forgot your password?

Login   Clear

Cookies and JavaScript must be enabled to use this system.

(In Windows IE, instead of allowing all cookies you can also specifically add the domain "bimsmart.com" to a list of "allowed" websites –>Tools –>Internet Options –>Privacy –>Edit)

Username and Password are not case sensitive.

Architect **Engineer**

Tell me and I'll forget.
*Show me and I'll remember. Involve me and I'll understand.*
Confucius

© NIBS 2007

Slide 4: Business Case Development – Aligning OmniClass™ to BIM Process

Business Case Development –
Aligning OmniClass™ to BIM Process

IDM Business Case Development — **For Example:**

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/fulfills 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

1. (Table 34) Architect aka: 34-25 21 00
2. (Table 32) Conception services, Designing, Prelininary 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)
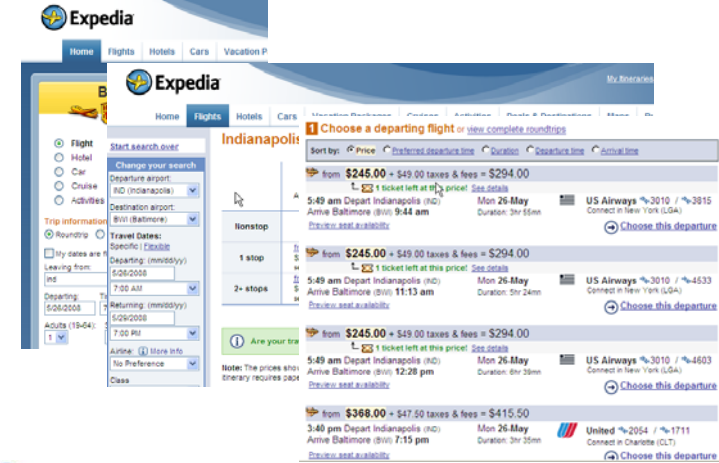7. (Table 36) Building Envelope Design Information:36-21 17 21

© NIBS 2007
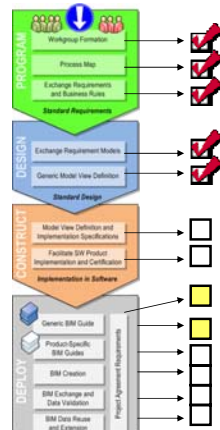
- Precast Design (MVD)
- GSA Spatial Validation
- COBIE
- ICC Automated Code Checking
- Specifiers' Property Information Exchange
- Sheet Metal
- Owner's Deliverable
- Structural Steel
- Early Design

Architectural Precast Concrete - Architect to Detailer
Funded by Charles Pankow Foundation

© NIBS 2007

© NIBS 2007

Content and Service Standards deliver:

- Federated databases
- Service interfaces
- Contracted exchanges
- Resource requirements and costing.
- Transparent interfaces to 3rd parties.
- Analysis

© NIBS 2007

Related Industry Activities

25

BIG BIM little bim

Individual initiative and ad hoc agreements now leading to consensus-based standardization and open interoperability .

- Manufacturer Objects
- Education
- Code Compliance
- Best Business Processes
- International Standards
- National Standards
- Certification

© 4SitePress 2007

Most Comprehensive BIM Text Available

© Wiley & Sons 2008

- BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, Wiley, 2008

Charles M. Eastman, Rafael Sacks, Paul Teicholz, Kathleen Liston

"This is clearly the most comprehensive book to date on the subject of building information modeling. It covers the entire spectrum and provides many comparative analyses of existing products, to help you make an educated choice of tools."

Deke Smith

AIA Integrated Project Delivery
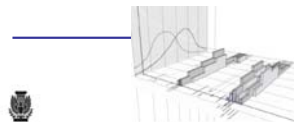
AIA National | AIA California Council
The American Institute of Architects

2007
version 1

Integrated
Project Delivery:
A Guide

http://www.aia.org/ipdg

- 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.

AIA Integrated Project Delivery
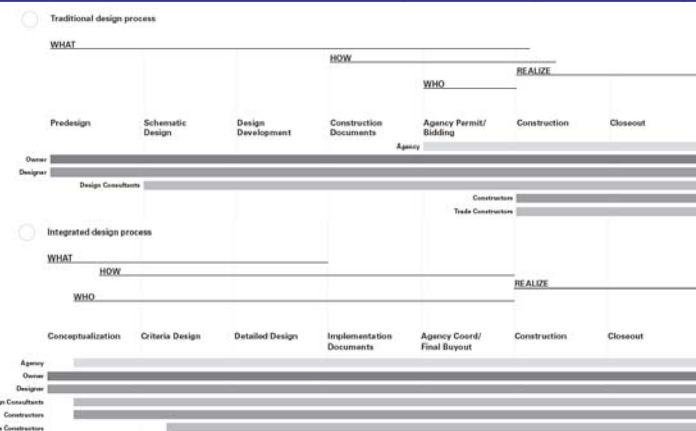
AIA California Council's "Integrated Project Delivery: Working Definition", See http://www.aia.org/ip_default

- 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.

© NIBS 2007

- 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.

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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.)

Digital Data	Data Format	Transmitting Party	Transmission Method	Receiving Party	Permitted Uses	Notes *(Enter #)*
3.1.1 Project Agreements and Modifications						
3.1.2 Project communications						
General communications						
Meeting notices						
Agendas						
Minutes						
Requests for information						
Other:						

§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

docinfo@aia.org

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

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Transitional approach to IPD[1]:

- A295™-2008 – General Conditions of the Contract for Integrated Project Delivery.
- B195™-2008 – Standard Form of Agreement Between Owner and Architect for Integrated Project Delivery.
- A195™-2008 - Standard Form of Agreement Between Owner and Contractor for Integrated Project Delivery
- GMP Amendment to A195-2008

The more novel approach[1]:

- C195™-2008 – Standard Form Single Purpose Agreement for Integrated Project Delivery

See: http://content.aia.org/www/SiteObjects/files/0516b_ipd.pdf
[1] Howard G. Goldberg, Esq. Goldberg, Pike & Besche, P.C., *The Newest of the New AIA's Integrated Project Agreements*, AIA, 2008.
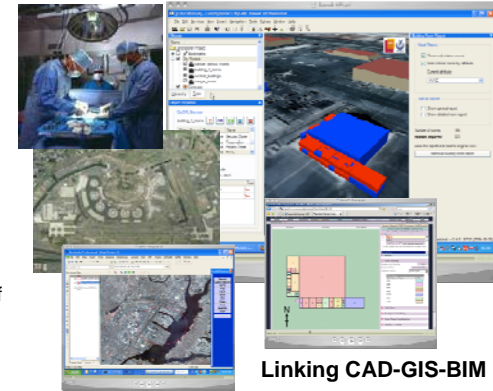
© NIBS 2007

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.

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

Linking CAD-GIS-BIM

http://www.opengeospatial.org/pub/www/ows4/index.html

AECOO-1 Testbed

Decision Support Communications

Costing

OGC®
Open Geospatial Consortium, Inc.

Energy Analysis

AECOO Testbed

Green Buildings

buildingSMART alliance™ & OGC - AECOO -1 Testbed

- Build upon the **BIM** concept
  - IDM, MVDs
- Develop **service interfaces using IFCs** to articulate BIM-centric messaging between domains
- Decision support across energy and costing business practice

1. Decision Communications
   – Information needed between parties
   – How integrated with BIM
   – Authoring vs exchanging
   – File and web services
   – Study current workflows

© NIBS 2007

2. Energy Analysis
   - Information between design and analysis
   - Lifecycle costing and decision support
   - Enhance utilization of IFCs for variety of platforms, uses, and model server tech.
   - IFC-based document management,
   - IDM to organize project teams & Info
   - test common analysis based on energy codes and tie to possible best practices.
   - include gbXML and look to harmonize w/IFC.
   - Improve exchange w/ DOE2 & Energy Plus

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3. Examine exchanges between BIM and cost estimating software
   - Compile best practice document w/building type scenarios and demos.
   - Mapping of BIM objects and costing databases
   - Investigate challenges to costing interoperability.
   - Finer-grained building system definitions for improved cost quantification.
   - Standardized QTO method needed.

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Coordinating Object Definitions

ISO/PAS 16739
(Industry Foundation Class)

ISO 15926
(Process Industry)

© NIBS 2007

OSCRE Space Classification Code List

OSCRE Space Classification ©2007 OSCRE Americas, Inc.

Comparison of Space Use Classifications to IFMA/BOMA Unified Space Measurement Standard

© NIBS 2007

2006 International Energy Conservation Code®

SmartCodes demo: http://www2.iccsafe.org/io/smartcodes/

S202 SMARTCodes – Automating Code Compliance
Wed 10:00a – 11:00a

S410 Developing the High Performance Building Standard
Tr. 8:30a – 9:30a

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Intelligent Buildings

"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: **BUILDING INTELLIGENCE** GROUP LLC

© NIBS 2007

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: **BUILDING INTELLIGENCE** GROUP LLC
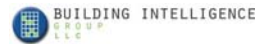
© NIBS 2007
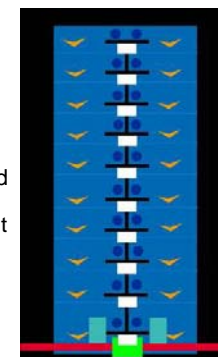
Technologies and Systems

- 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

Courtesy of Paul Ehrlich: **BUILDING INTELLIGENCE** GROUP LLC

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: **BUILDING INTELLIGENCE** GROUP LLC

How To Proceed

- Need for real systems integrators (not just ATC contractors)
- Need to know:
  - HVAC, Security, Fire Alarm, Business Systems and IT, Lighting Control, Energy Management
- 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

Courtesy of Paul Ehrlich: **BUILDING INTELLIGENCE** GROUP LLC

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buildingSMARTalliance™

W21 buildingSMARTalliance®Projects in Progress,
Tu 1:30p - 4:30p
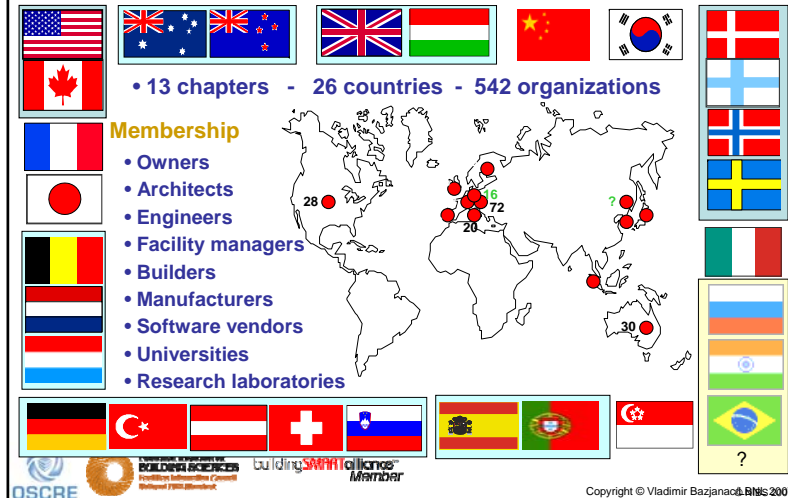
Alliance Vision and Mission

- **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

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BuildingSMART Global Organization

- 13 chapters - 26 countries - 542 organizations

Membership
- Owners
- Architects
- Engineers
- Facility managers
- Builders
- Manufacturers
- Software vendors
- Universities
- Research laboratories

Copyright © Vladimir Bazjanac, LBNL   © NIBS 2007

---

buildingSMART alliance: Emerging Projects

- Industry Foundation Classes (ifc) (Alliance Technical Committee)
- Information Delivery Manuals (IDM) (Alliance Technical Committee)
- Model View Definitions (MVD) (Alliance Technical Committee)
- Industry Framework Dictionary (IFD) (Alliance Technical Committee)
- National BIM Standard (NBIMS) (NIBS FIC)
- National CAD Standard (NCS) (NIBS FIC)
- AECOO Testbed (OGC/buildingSMART/IAI)
- Architectural Precast (Pankow)
- Automated Code Compliance Checking (AC3) (ICC)
- Construction to Operations Building Information Exchange (COBIE) (NASA/COE)
- Early Design Information Exchange (COE)
- Structural Design (Pankow)
- Geospatial Integration (Alliance)
- Object Standards Harmonization (ISO 16739-ISO 15926) (FIATECH)
- Distance Learning (Alliance)
- Continuing Education Principles (Alliance)
- University Education Coordination (Alliance)
- Project Execution Planning for BIM (Pankow)

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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®.

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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 – track KPIs - 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®, OmniClass™, BAS technology, engineering.

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.

Slide 1

- 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.
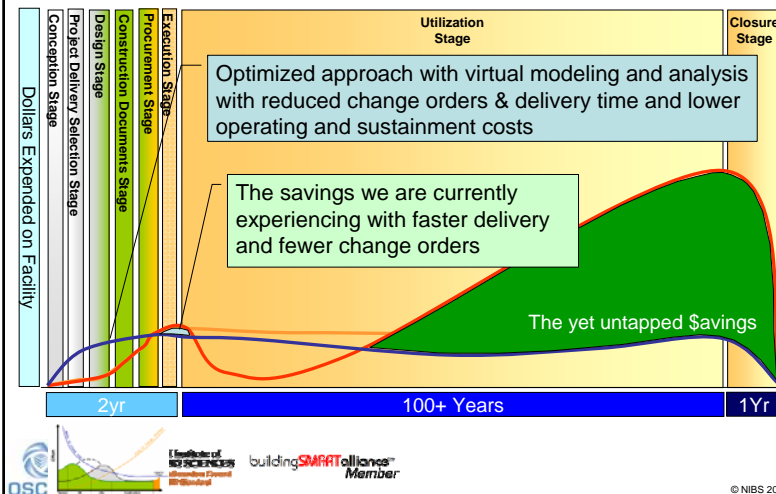- Re-invest short-term gains in long-term transformation.

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Slide 2

Investing in Transformation
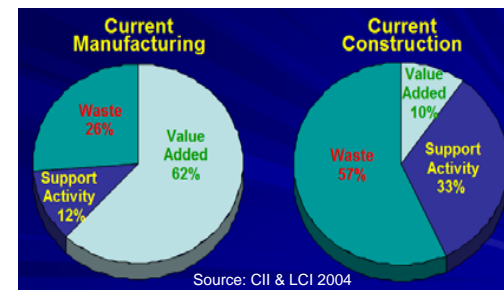
On Leadership and Shrewd Investments

Slide 3

Dollars Expended on Facility

Conception Stage | Project Delivery Selection 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 $avings

2yr | 100+ Years | 1Yr

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Slide 4

Current Manufacturing: Waste 26%, Value Added 62%, Support Activity 12%

Current Construction: Value Added 10%, Waste 57%, Support Activity 33%

Source: CII & LCI 2004

This Does Not Include Operations and Sustainment, Occupation, Renovations, Air Quality Impacts, etc.

- Worldwide Construction Industry 2008 = $4.8T (Source ENR)
- US Construction Industry 2008 = $1.288T (Source ENR)
- 57% - 26% = 31%

- **31% of $1.288T = $399B Annually**

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Slide 1

- "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."
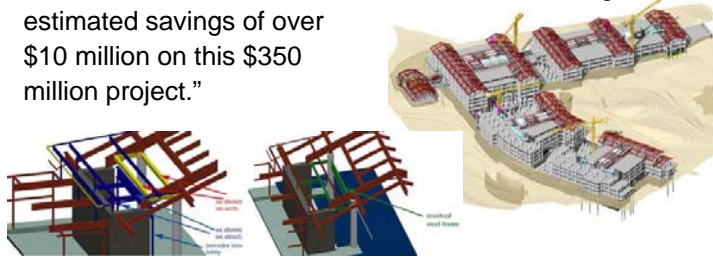
Courtesy of AECbytes "Building the Future" Article (September 30, 2006)
Building Owners Driving BIM: The "Letterman Digital Arts Center"
StoryMieczyslaw (Mitch) Boryslawski, Associate AIA
Founder, View By View, Inc.

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Slide 2

Value Opportunities – Reduce Cycle Time

2005 All Stores	
Store Count	1,234
Gross Sales	$43,200,000,000
Net Income	$2,771,000,000
2005 Avg. Per Store	
# New Stores	150
Net Income	$2,245,543
Net Income per Week	$43,184
Net Income Potential per Week - 150 stores	$6,477,528
2006 Est. New Stores	150

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Slide 3

Value Opportunities

Data Commissioning Cost Reduction	
$50K per building	
x	
150 buildings per year	
= $7,500,000	

Store Count	150
Store SF	50,000
Gross cost per SF	$120
Gross Base Building	$6,000,000
8% Change Orders	$480,000
.5% Change Orders	$300,000
Net savings per store	$180,000
Net savings all stores	$27,000,000

Data Commissioning   Change Orders

- Nearly automatic data commissioning

(**Source: NASA-USACE/CERL COBIE Project**)

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

(Source: *BIM Best Practices, Best Results*, GM Virtual Factory Initiative, Fallon, AIA Convention Presentation May 3, 2007, http://www.aia.org/SiteObjects/files/convention_ces/TH1807.pdf)

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Slide 4

A Culture of Investment

1. Implement integration in homogenous, proprietary teams with 'lean' aims. Gain 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.

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Sample Products of the Alliance

Products coordinated with the Alliance
www.buildingsmartalliance.org

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Inquiring Minds Want to Know

- What is BIM?
- Is BIM software widely available?
- How is BIM different than 2-D CAD programs? And why is 3-D better?
- What type of facility data is (or could be) included in BIM?
- How does BIM benefit the building owner, developer, and facility manager?
- I've heard that BIM saves time and money; why, how, and how much?
- Who among the owner, architect, or contractor is most apt to use/recommend BIM for a project?
- What words of wisdom or advice do you have for building owners and developers who are considering BIM for their next project?
- What are the drawbacks of BIM?
- Why is it important to have a National Building Information Modeling standard? And what has been the progress?

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Key Points To Remember

1. Though it is beneficial, most of today's activity is local, ad-hoc and proprietary.

2. Market-driven Transformation requires industry-wide, open, democratically defined, and interoperable exchange standards.

3. Leveraging today's savings can generate plenty of capital to fund the Transformation – if we choose to pay it forward.

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Thank You

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