

BIM in Teaching and Research

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The Sonny Astani Department of Civil and Environmental Engineering

Outline

New BIM Focus

Integrating BIM into Curriculum

Research in BIM

Student Activities

USC FM

Building Information Management

A Focus on Integrated Practice

- First course offered on BIM at the Civil & Environmental Engineering Dept.
- 20 students from Architecture, Civil Engineering, Construction Management & Business Administration
- 2 Undergrad, 18 Grads
- Combination of lectures, research papers, case studies and hands on software training

BIM Exploration

BIMStorm

BIMstorm Alexandria Federal Friendly Zones






About New Features Help Log Out Hamid Hajian



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Studios **Project List** Site Plan Floor Plan Space Plan Map View Add New Project Reports Settings Attachments Bugs and Comments


View: ☒ All ☐ Favorites ☐ Recent Days

Key:       Last Updated Scheme Owner   

Search Projects / Schemes By Name / ID:

Search

Team 4 - USC

	Name of Scheme					Last Updated	Scheme Owner	\$0	My Project
☆	(001A) Campus DoD - Hoffman Block 2 - Class A 500,000 SF 10-15 story office building	I				09-11-2008	Hamid Hajian	\$65_365	  
☆	(001A) Multi or Single Building GSA - Hoffman Block 2 - Class A 500,000 SF 10-15 story office building	I				09-12-2008	Hamid Hajian	\$65_366	  
☆	(001B) Campus GSA - MRP Realty Landbay H Potomac Yard - Class A, 1 million SF campus with 2-4 buildings (Landbay H)	I				09-11-2008	Hamid Hajian	\$65_367	  
☆	(002A) Multi or Single Building DoD - Hoffman Block 2 and 3 - Class A 1 Million SF office building and parking structure	I				09-11-2008	Hamid Hajian	\$65_369	  
☆	(002D) Multi or Single Building GSA - Duke Mark Center - Class A 1 million SF office building	I				09-11-2008	Hamid Hajian	\$65_377	  
☆	(004A) Historic - Washington Masonic Temple	I				09-11-2008	Hamid Hajian	\$65_370	  
☆	(004E) Historic - City Hall	I				09-11-2008	Hamid Hajian	\$65_371	  
☆	(004E) Historic - Gadsby Tavern	I				09-12-2008	Hamid Hajian	\$65_372	  
☆	(005E) Cultural Resource - Contraband and Freedmen's Cemetery Memorial	I				09-11-2008	Hamid Hajian	\$65_373	  
☆	(007A) Transit - King Street Train and Metro Station	I				09-12-2008	Hamid Hajian	\$65_374	  
☆	(009E) Hotel on Waterfront Old Town - 4 or 5 Star, dock access, combined retail or mixed use	I				09-11-2008	Hamid Hajian	\$65_378	  
	Add Empty Scheme								
	Add Template Scheme								

SHARED SCHEMES : NA - Church LDS	\$2,800,000	Shared
SHARED SCHEMES : NA - Food For Thot Alexandria - Michael	\$0	Shared
SHARED SCHEMES : NA - Water Front Test	\$0	Shared
SHARED SCHEMES : NA - Water Front Test	\$0	Shared

Internet | Protected Mode: On

100%

BIM Exploration

BIMStorm

BIMstorm Alexandria Federal Friendly Zones Owner: Hamid Hajian

About New Features Help Log Out Hamid Hajian



Project: Team 4 - USC

Scheme: (S65_366) (001A) Multi or Single Building GSA - Hoffman Block 2 - Class A 500,000 SF 10-15 story office building



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Studios Project List **Site Plan** Floor Plan Space Plan Reports Settings Attachments Bugs and Comments

3D View Print Edit Mode View Mode

ft -3000 -2000 -1000 0 1000 2000 3000

1000
0
-1000

N
↑

Hotkeys: Spacebar + Drag = Pan | Z = Zoom In
Shift + Z = Zoom Out | X = Extent

Buildings

	Floors
1 (B65_932) Office Class A 250K	8
2 (B65_935) Transparent Structure: Open Standards	5
3 (B65_939) 80 Housing Units	6
4 (B65_942) Hotel	9
5 (B65_943) Hotel	9
6 (B65_944) Conference Center	2
7 (B65_945) Office 27 Floor + 3B	30
8 (B65_948) Office 27 Floor + 3B BIMblob	39
9 (B65_952) Building C - 20 Classroom	2

Add Empty Building

Add Template Building

Add Shared Building

Site Components

Building Attributes

Background Setting

Unlock

Sketch

Unlock

Import / Export

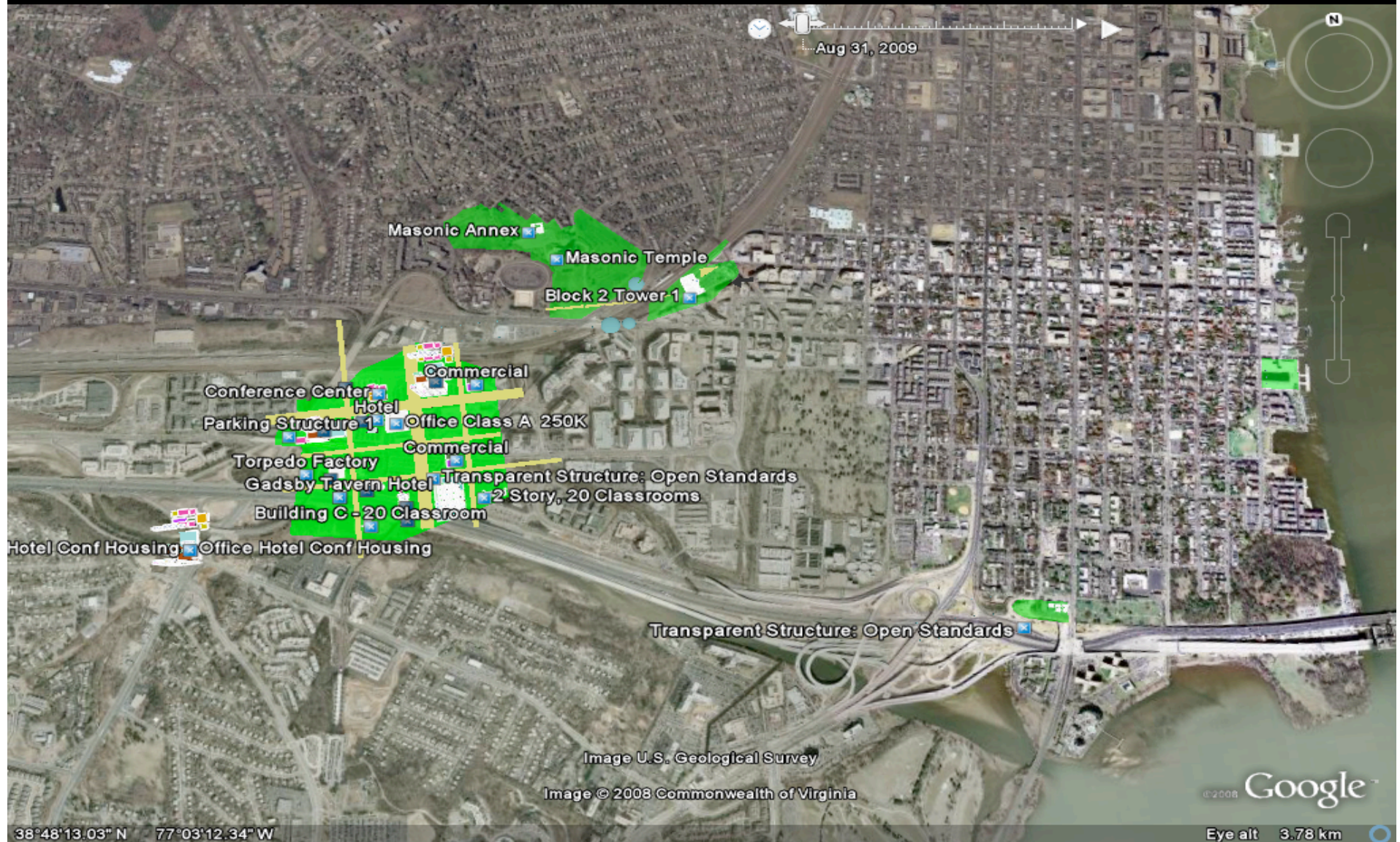
Done

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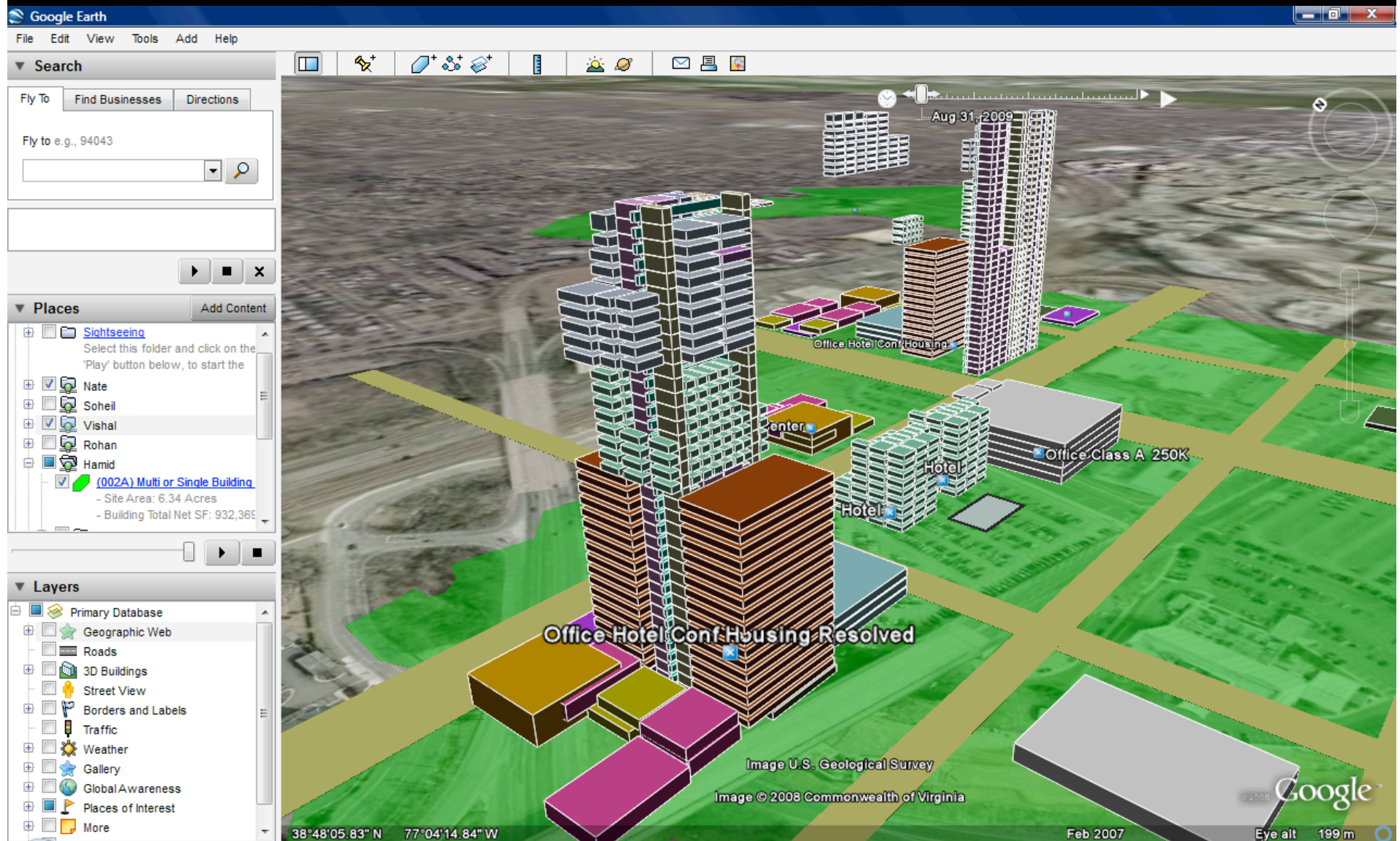
BIM Exploration

BIMStorm



BIM Exploration

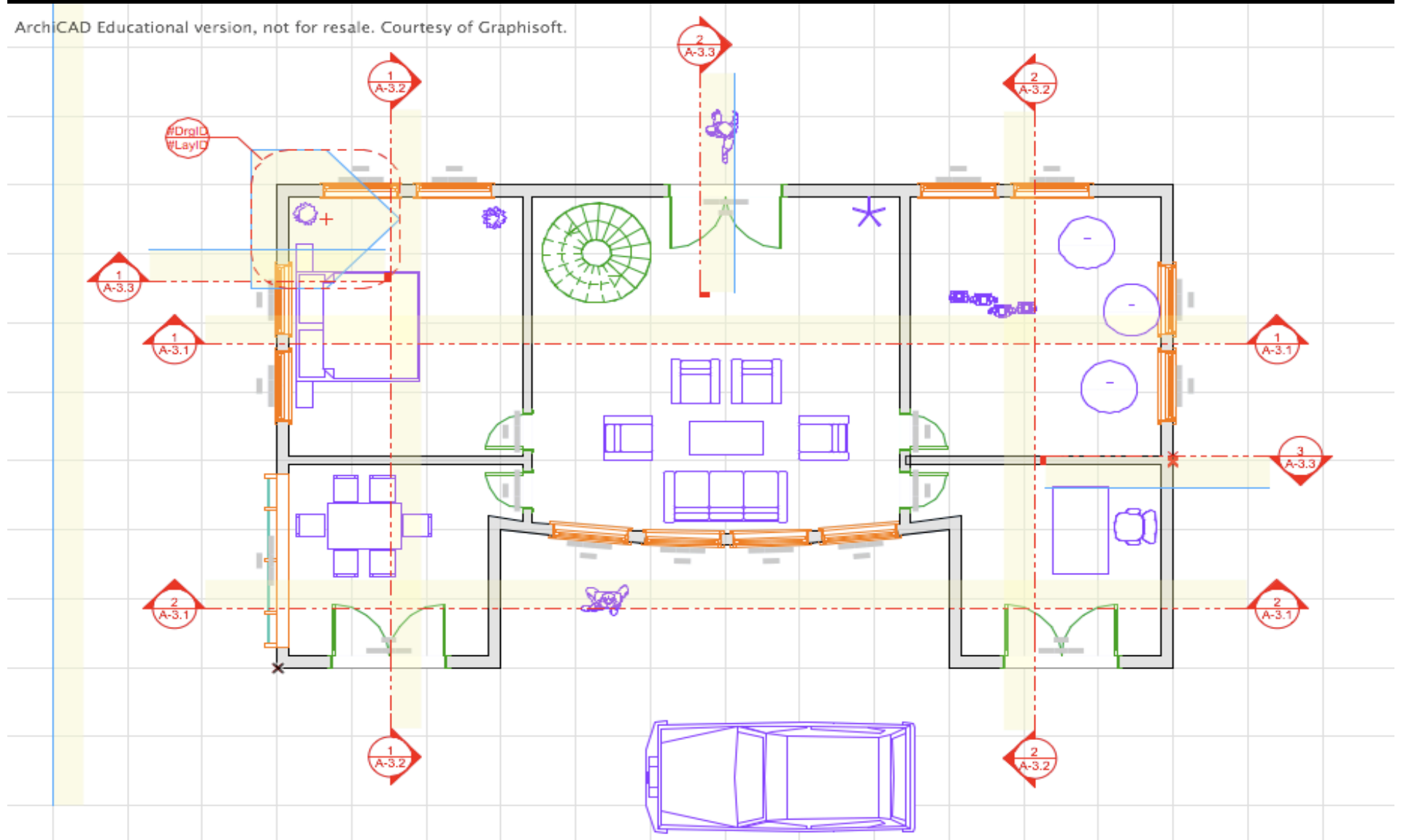
BIMStorm



BIM Exploration

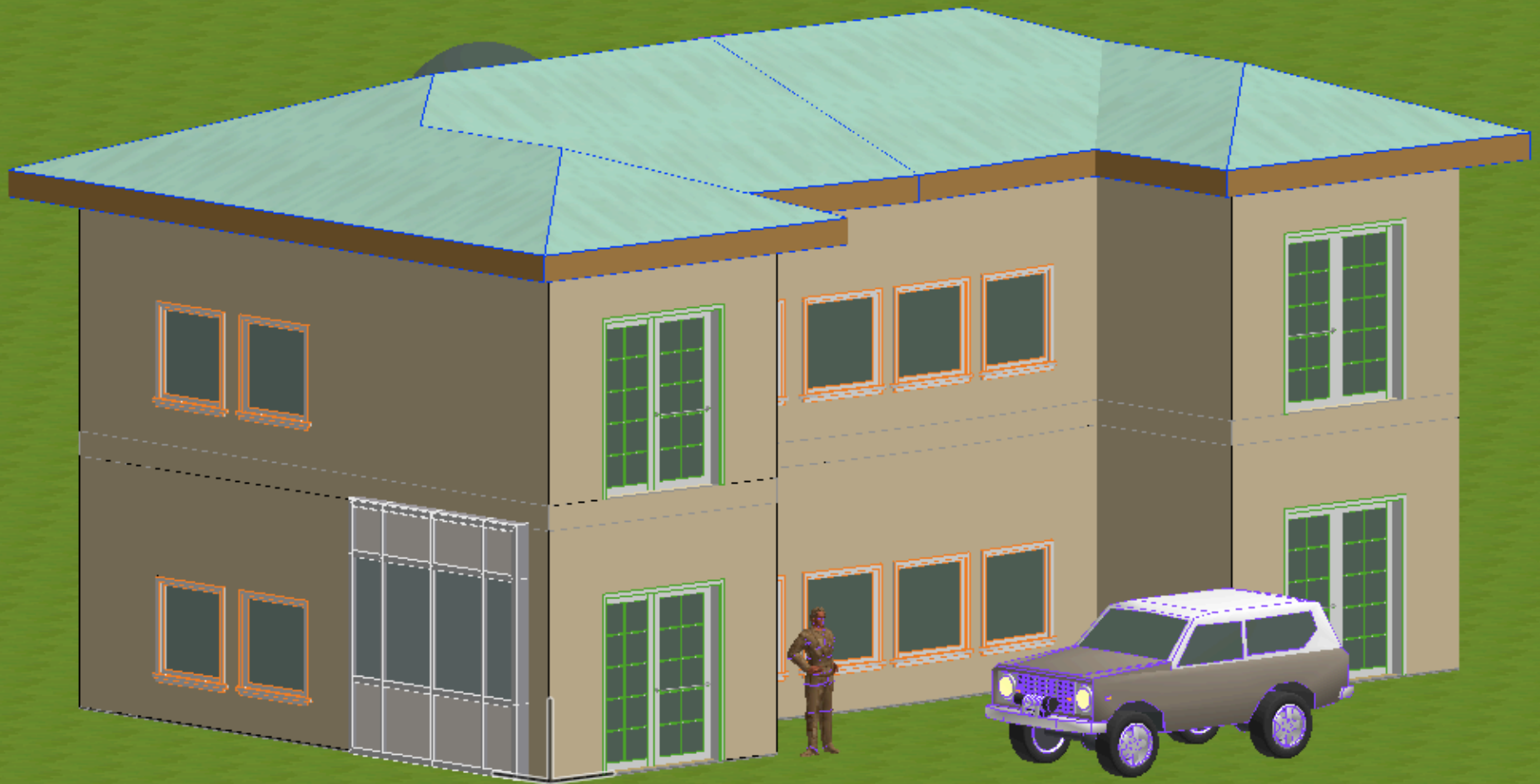
ArchiCAD

ArchiCAD Educational version, not for resale. Courtesy of Graphisoft.



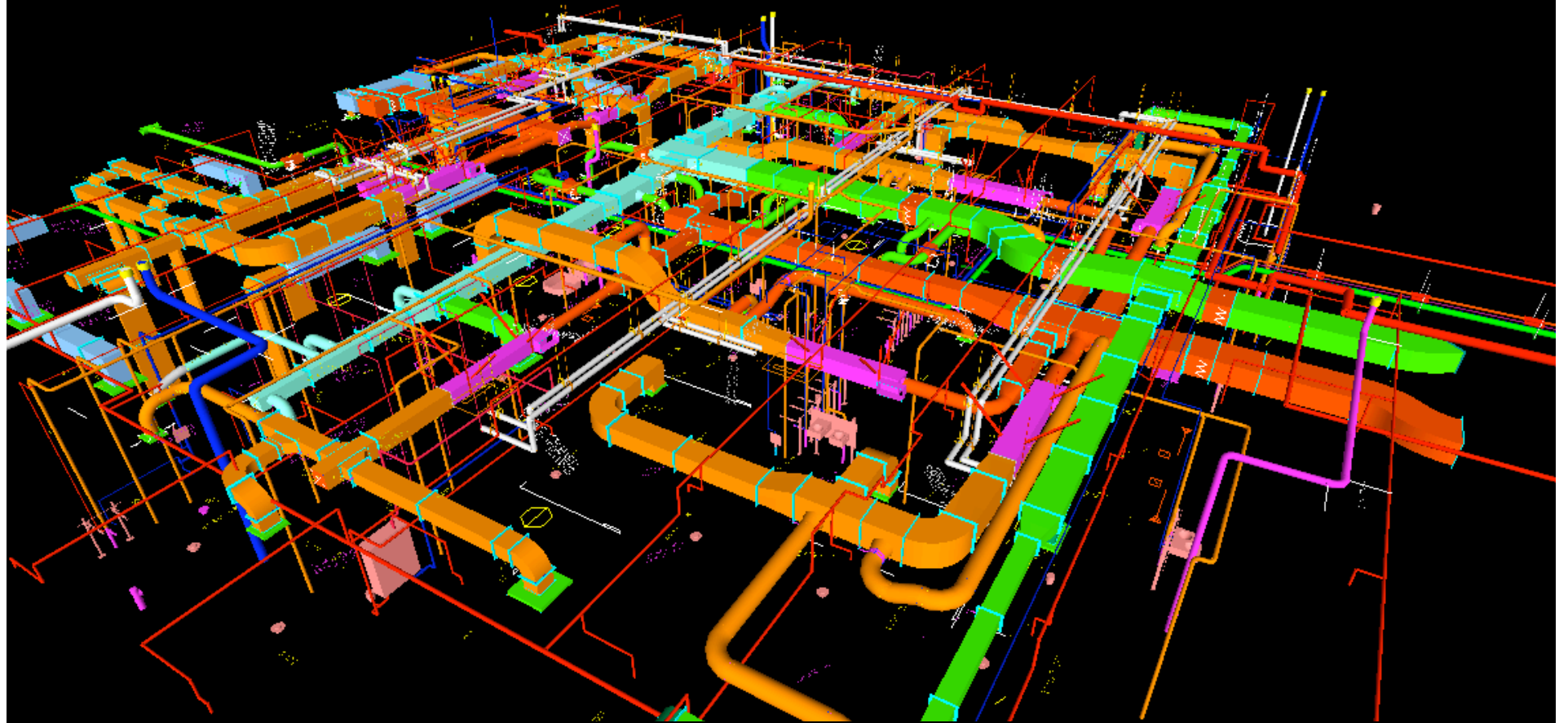
BIM Exploration

ArchiCAD



BIM Exploration

NavisWorks



BIM Exploration

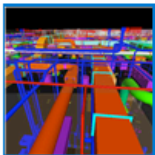
NavisWorks

Clashes

Report Batch

MECH-PLUMB Clash

Tolerance 0.00ft
Simulation
linkage none
Simulation step
size
SelfIntersect 0
SelfIntersect 0
Total 3
New 0
Active 3
Approved 0
Resolved 0
Type Hard
Status OK



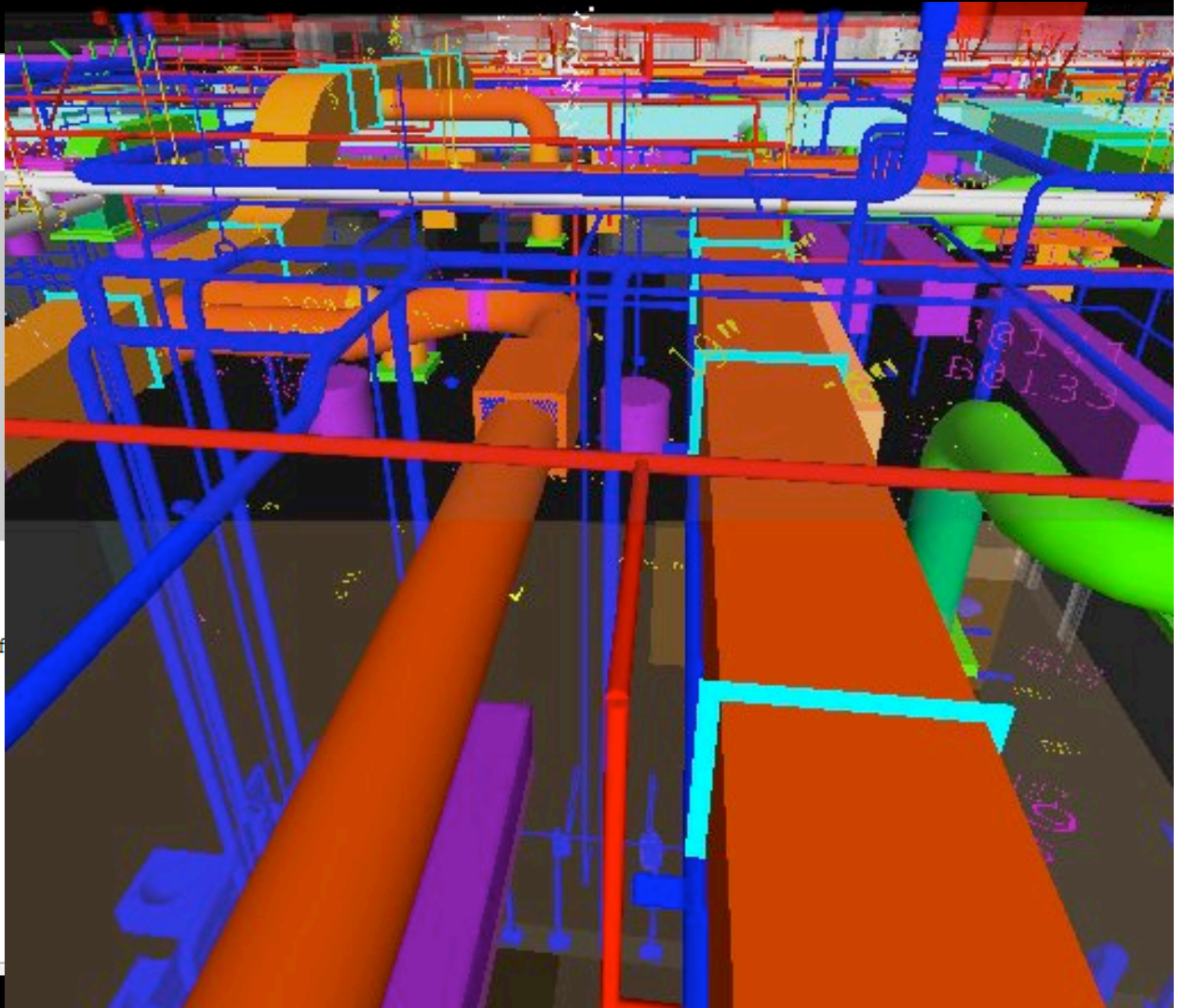
Name	Clash1
Distance	-0.12ft
Description	Hard
Status	Active
Clash Point	597.43ft, 781.50ft, 234.74ft
Date Created	2008/10/25 21:40:35

Item 1

Entity Handle	F3D1
Layer	E-Lite-Std
Item Name	E-Lite-Std
Item Type	3D Solid

Item 2

Entity Handle	89
Layer	P-STRUT
Item Name	P-STRUT
Item Type	3D Solid



Research Papers

Product Life Cycle Management + BIM

Lean Design & Construction + BIM

Spatial Information Systems + BIM

Facilities Management + BIM

Mobile Field Technologies + BIM

Product Content Integration + BIM

Automation of Construction + BIM

Integrated Project Delivery + BIM

Gaming + BIM

Case Studies

Two buildings with same program: BIM vs. No-BIM

Cost/Schedule/Quality Comparison

LEED Factor

Learning Curve

Inflation

of RFIs

& \$ of Change Orders

Case Studies

Use of BIM in steel design, detailing and fabrication

Delivery in 23 months

Steel fabricator the main force behind BIM implementation

7 Steel structure packages – every 2-4 weeks

Collaboration between engineer, detailer, and fabricator

Case Studies

Complex and large structures

Large scope work – required BIM coordination

Live digital master model

Versioning process

Case Studies

Use of BIM in Construction and FM

Integration of FM software with BIM

Attach digital drawings and documents to model from intranet

Link real time building monitoring system to the model

Integration of BIM to Curriculum

- Project Controls: Budgeting and Estimating
- Project Controls: Scheduling
- Sustainable Design
- Building Information Management
- Special Topics on BIM for Integrated Project Delivery

Research in BIM

- Number of NSF proposals in progress
- BIM -> CIM
 - Buildings to Regions to Cities
 - Building specific information as an input to complexity of cities
 - Natural resource consumption (fuel, electricity, water) and waste (wastewater, carbon footprint, recycling)
 - Research in collaboration with Architecture, Engineering and Public Policy & Dev.
- Use of field data acquisition systems for monitoring construction progress and for creating as-built BIMs
- Return on Investment of BIM
- Use of BIM in FM

Student Activities

Competitions > Sparks > AGC Student Competition > BIM Competition

Reno, Nevada – Feb 11-14, 2008

Organized by AGC's Student Chapter

Students from engineering, architecture, business and PPD

50 students; 8 teams across 7 competitions (2 grad teams)

USC competes in: Graduate, Design-Build, Commercial, Residential/Multi-Family, Heavy Civil, LEED and BIM

Graduate team won 1st place in 2006 and 2nd place in 2008

http://www.asc67.org/competition_2009.html

Student Activities

Competitions > Sparks > AGC Student Competition > **BIM Competition**

Value through Innovation

Teams are required to create complete BIM and utilize it to solve construction problems

Vico Constructor, Revit, Tekla, Navisworks

Vico Control, MS Project, Primavera

Navisworks, Synchro, 5D Presenter

Project documents in 2D and a project description provided

Criteria:

LOD, CPM and Line of Balance schedules, LEED, Production control and schedule management, Architectural and structural coordination, logistics planning, civil/utilities coordination, estimate derived from quantities

Deliverables:

BIM, Model based estimate & schedule, logistics plan, LEED credit analysis, coordinated utility relocation plan, constructability report

Student Activities

Competitions > Sparks > AGC Student Competition > **BIM Competition**



Student Activities

15th AGC Symposium on **BIM and Integrated Practice**

USC, Galen Center, April 21, 2009

Focus on design (architects), construction (builders) and management (owners) of buildings

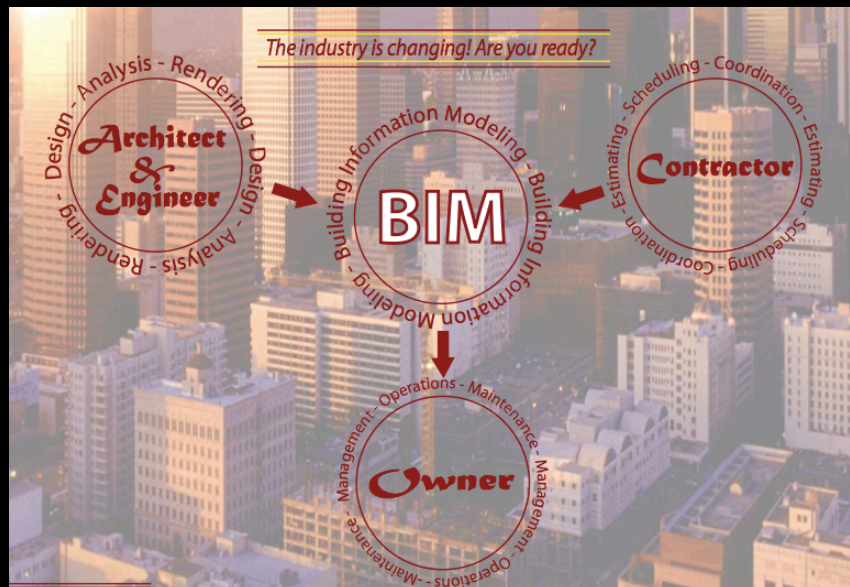
Topics:

Benefits of BIM through Integrated Practice ~ Applied Use of BIM for Design, MEPS

Coordination, Scheduling, Estimating, Sustainable Design and Facilities Management ~

IPD Contracts ~ Lean Building with BIM ~ Changing Workflow and Deliverables ~ Return on Investment ~ Future of IPD with BIM - - - - -

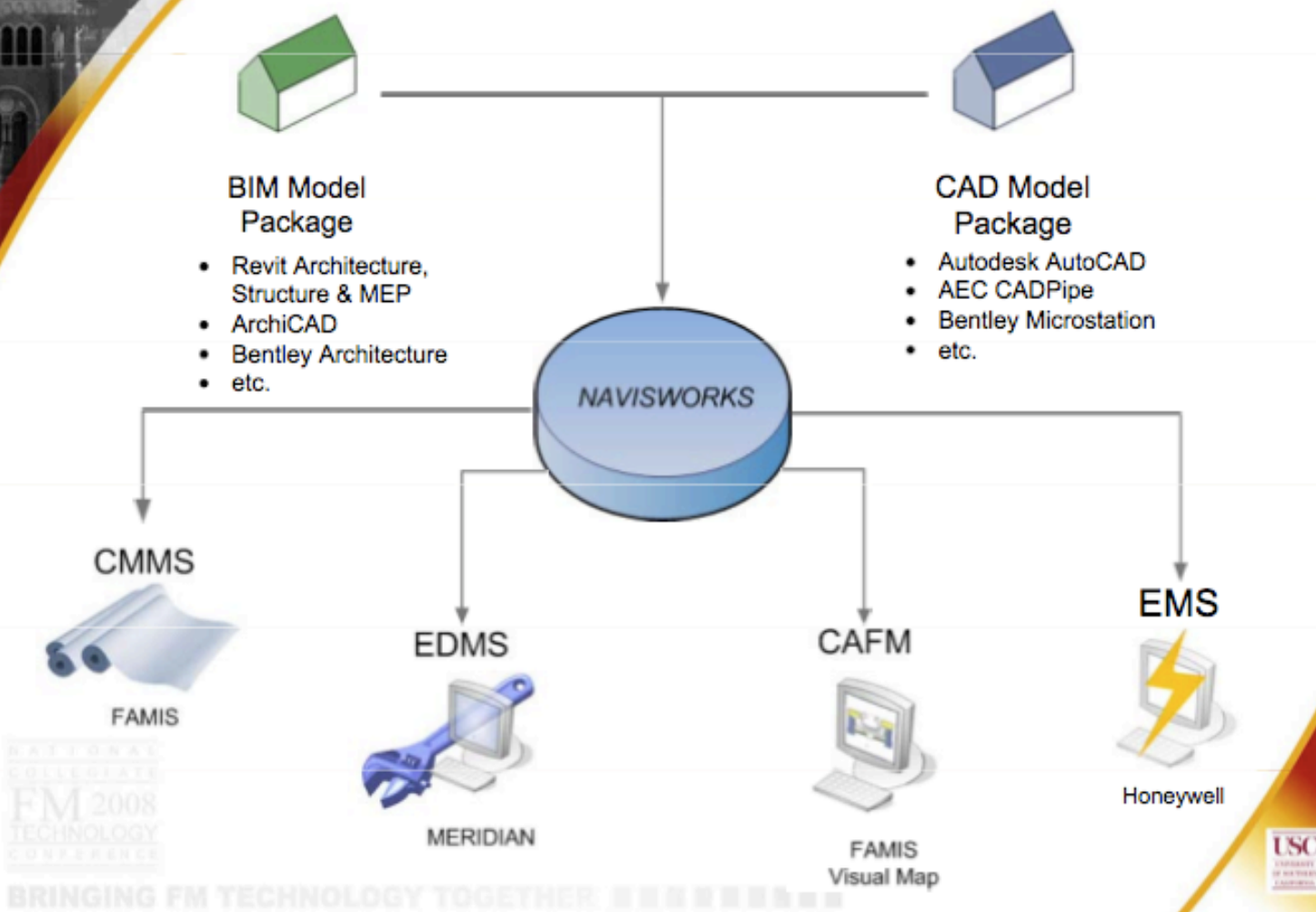
www.uscsymposium.com



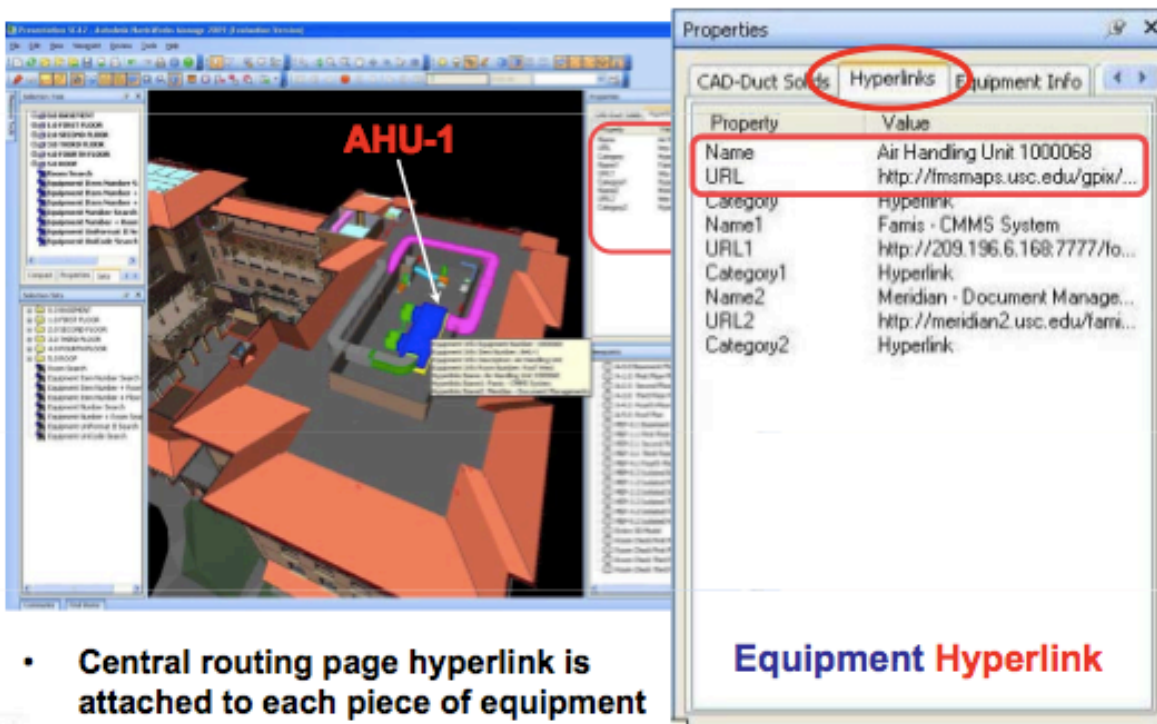
USC FM

- In order to allow USC FM to better maintain the building
 - involvement early in the design and construction stages
 - specify building material and performance standards in the typical building specifications
 - request data requirements in the model files
- Intend to build bi-directional data links; not manual hyperlink
- Objectives:
 - use several databases or interfaces to find an object in the updated model, and proceed to analyze and trace the FM problem
 - populate FM databases from data in the model
 - have the Navisworks or IFC model change based on FM database changes or data from FM sensors in buildings throughout USC's campuses

Idealized BIM-3D Facilities Management System



Equipment



The screenshot shows the USC FM software interface. On the left, a 3D model of a building is displayed with a highlighted equipment unit labeled 'AHU-1'. A red box highlights the 'Hyperlinks' tab in the Properties window, which lists various properties and their values, including a URL for the equipment's location.

Property	Value
Name	Air Handling Unit 1000068
URL	http://fmsmaps.usc.edu/gpix/...
Category	Hyperlink
Name1	Famis - CMMS System
URL1	http://209.196.6.168:7777/fo...
Category1	Hyperlink
Name2	Meridian - Document Manage...
URL2	http://meridian2.usc.edu/fami...
Category2	Hyperlink

- Central routing page hyperlink is attached to each piece of equipment

Equipment Hyperlink

Equipment Hyperlink from NavisWorks to CMMS (ex. FAMIS)

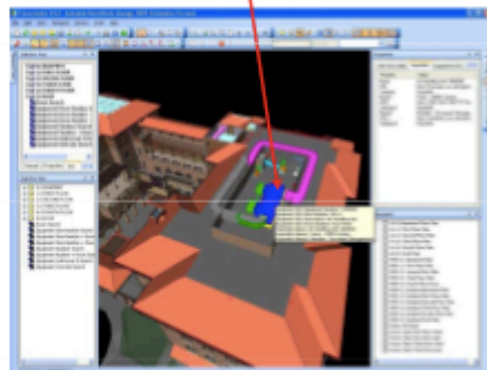
- Hyperlink on each piece of equipment is linked to Equipment Specs and Data in the CMMS system (ex. FAMIS).
- Data fields for equipment for each room is searchable and modifiable within the CMMS interface.



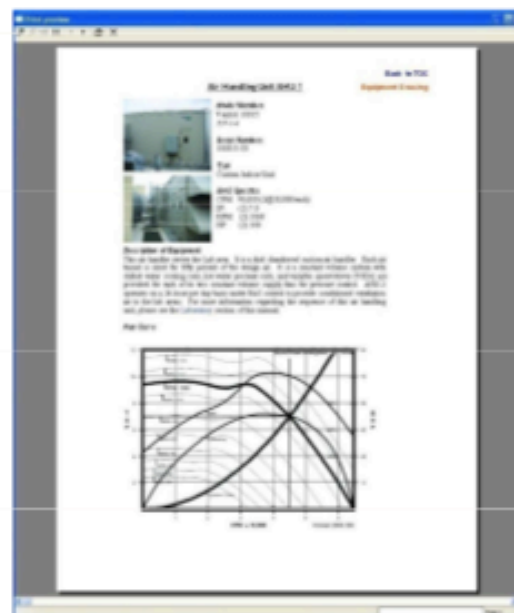
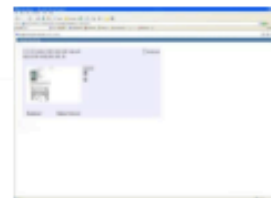
CMMS - FAMIS Database

Equipment Hyperlink from NavisWorks to **EDMS** (ex. Automanager MERIDIAN)

Equipment : AHU-1



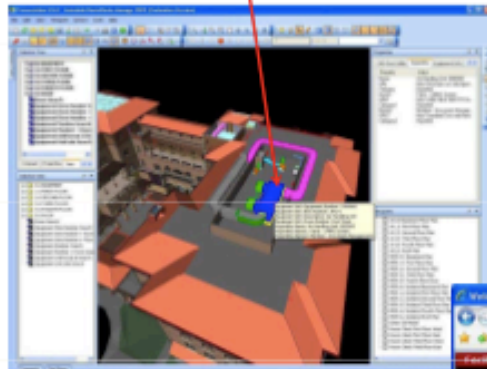
- Hyperlink attached to **each piece of equipment** is linked to a view of the Equipment O&M manual in the **EDMS** system (ex. Meridian)



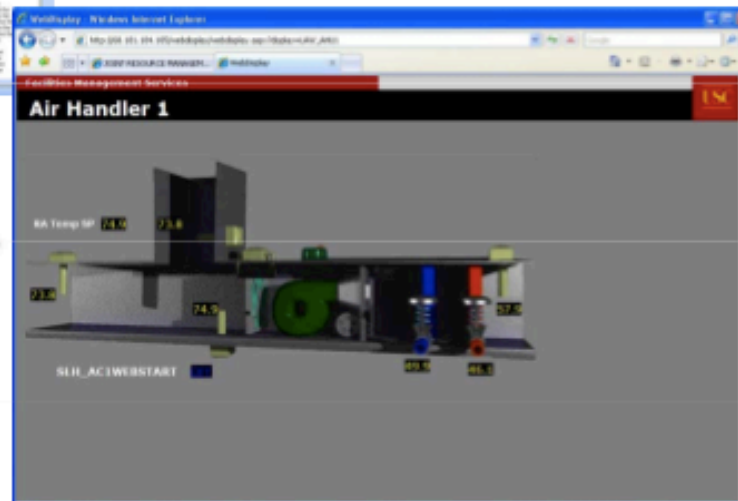
- Equipment manuals can be opened and viewed individually in pdf format

Equipment Hyperlink from NavisWorks to EMS (ex. Honeywell)

Equipment : AHU-1



- Hyperlink attached to **each piece of equipment** is linked to the Energy Management System equipment monitoring interface
- **Equipment** parameters such as temperatures, flow rates, etc. can be monitored.



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