

CENTER FOR EDUCATION AND RESEARCH IN CONSTRUCTION

W Department of Construction Management, College of Built Environment



Innovation Through Practice

The Messy Work of Making Technology Useful for Architecture, Engineering and Construction Firms and Teams

By Dr. Laura Osburn and Dr. Carrie Sturts Dossick



CERC: Multiple Labs - single purpose

To Inspire discovery in the Construction Industry

CTOP: Communication, Technology, and Organizational Practices

ESC: Energy & Sustainability in Construction

LCR: Lean Construction Research

SHARE: Safety & Health Advancement through Research & Education

Project Delivery: Design-Build & Public Private Partnerships



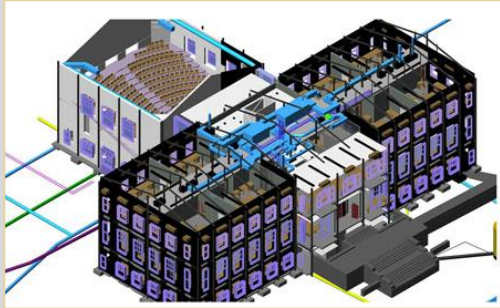
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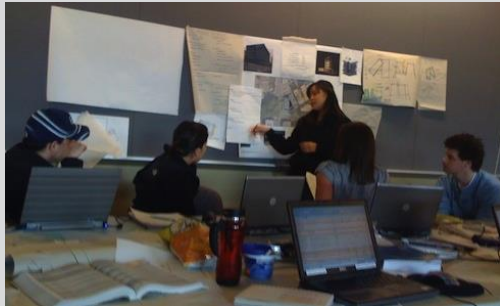


CERC where Theory meets Practice

Communication Technology and Organizational Practices Lab



Information Technology

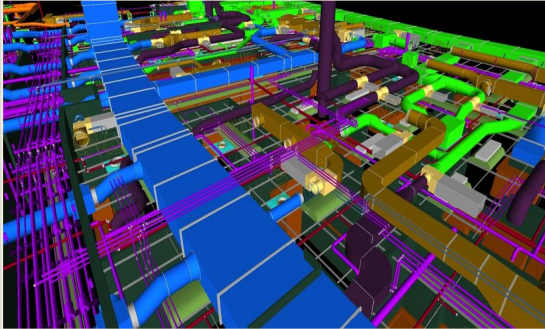


Collaboration



What we've learned from a decade of CTOP Research

BIM & Energy Modeling
2007 – 2016



Organization needs to
mirror technology

Globally Distributed Teams
2010-2017



Need for multiple types
of media

Information Exchange
2008 - 2017



Human work to make
technology work

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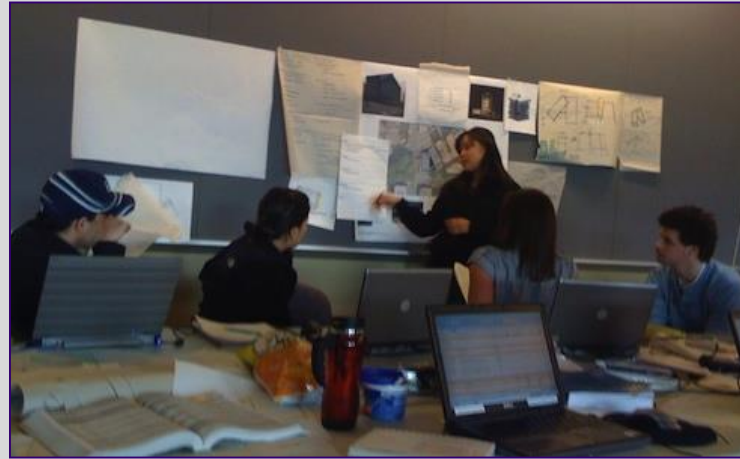


Organization needs to mirror Tech

Information exchange does not replace dialog



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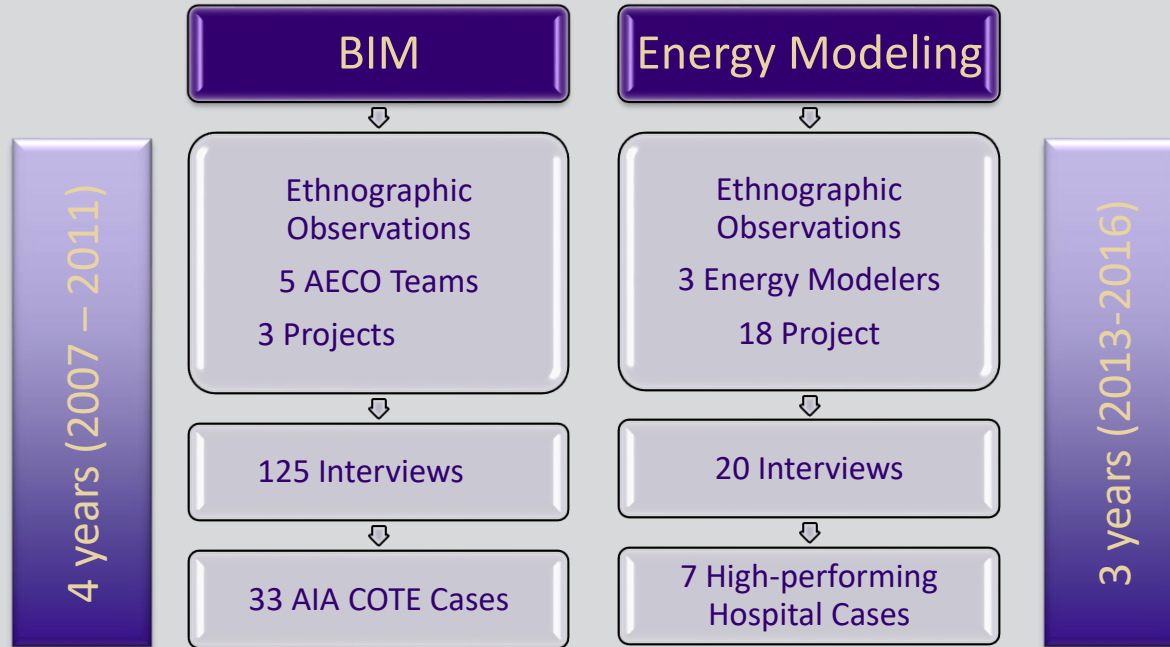
Information tech require teams to work more closely together

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Technology and Collaboration Studies



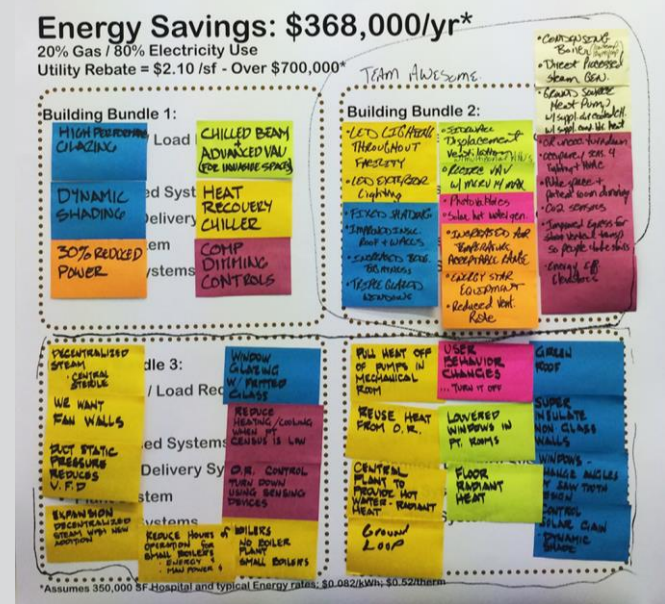
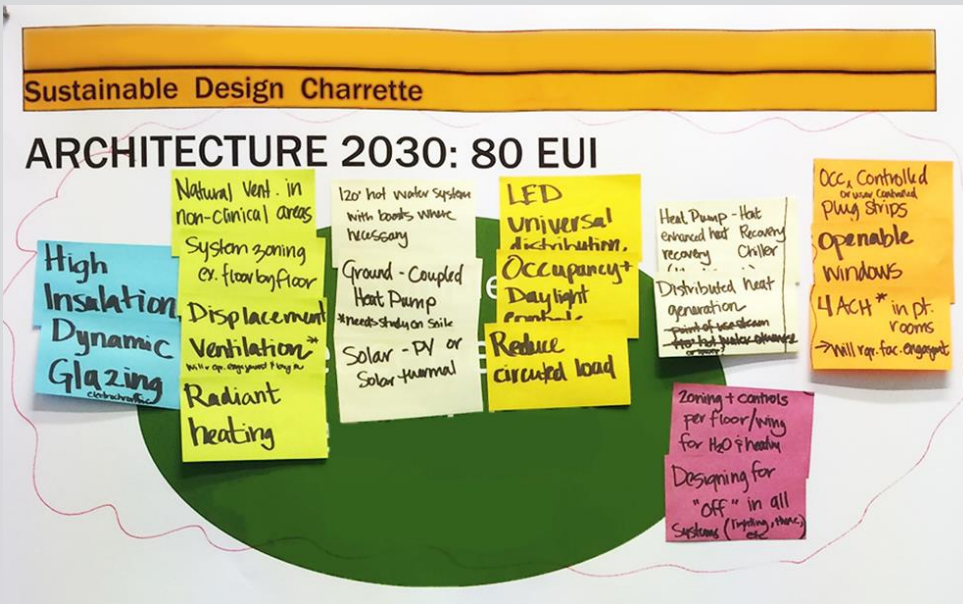
The Context of Project Teams

Conflicting Obligations

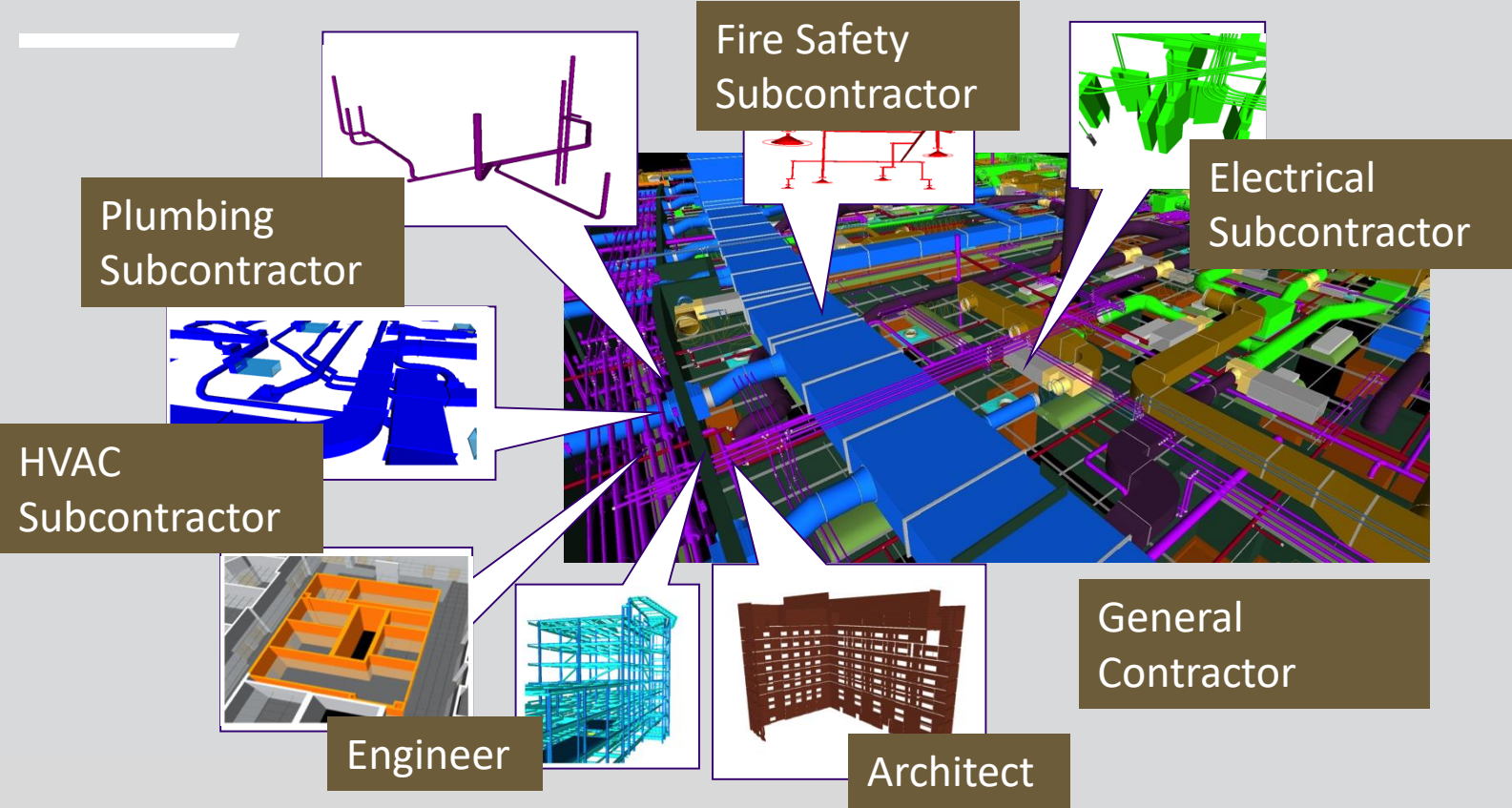
MEP Coordination		<i>Scope</i>	<i>Project</i>	<i>Company</i>
Who	■	Detailers	General Contractor	Management
Level	■	Individual	Temporary Team	Firm
Mission	■	Produce Documents	Produce Building	Balance Projects
Approach to Collaboration	■	Exchange Information	Solve Problems	Avoid Exposure

The Context of Project Teams

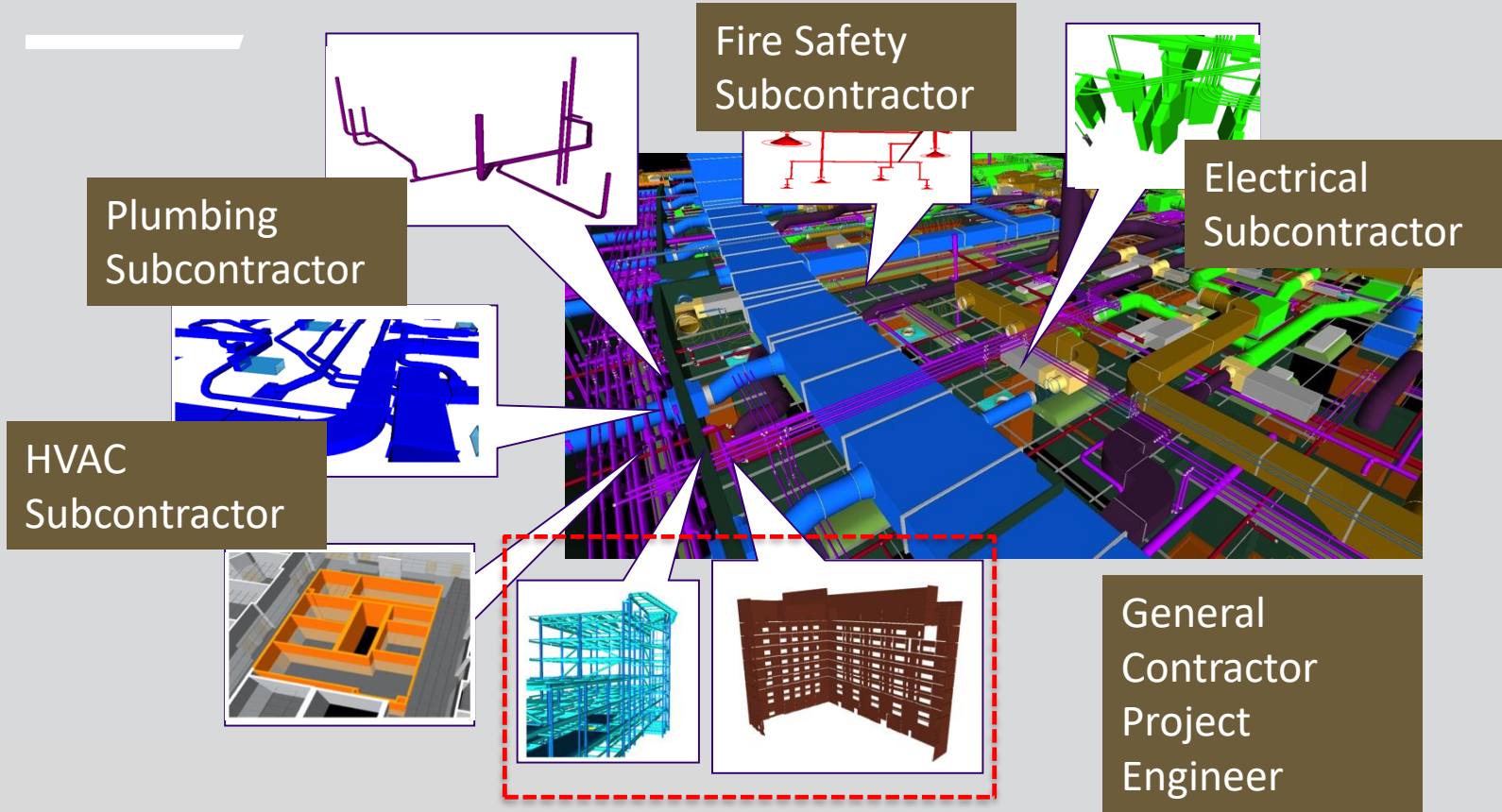
The Constructed Nature of Data



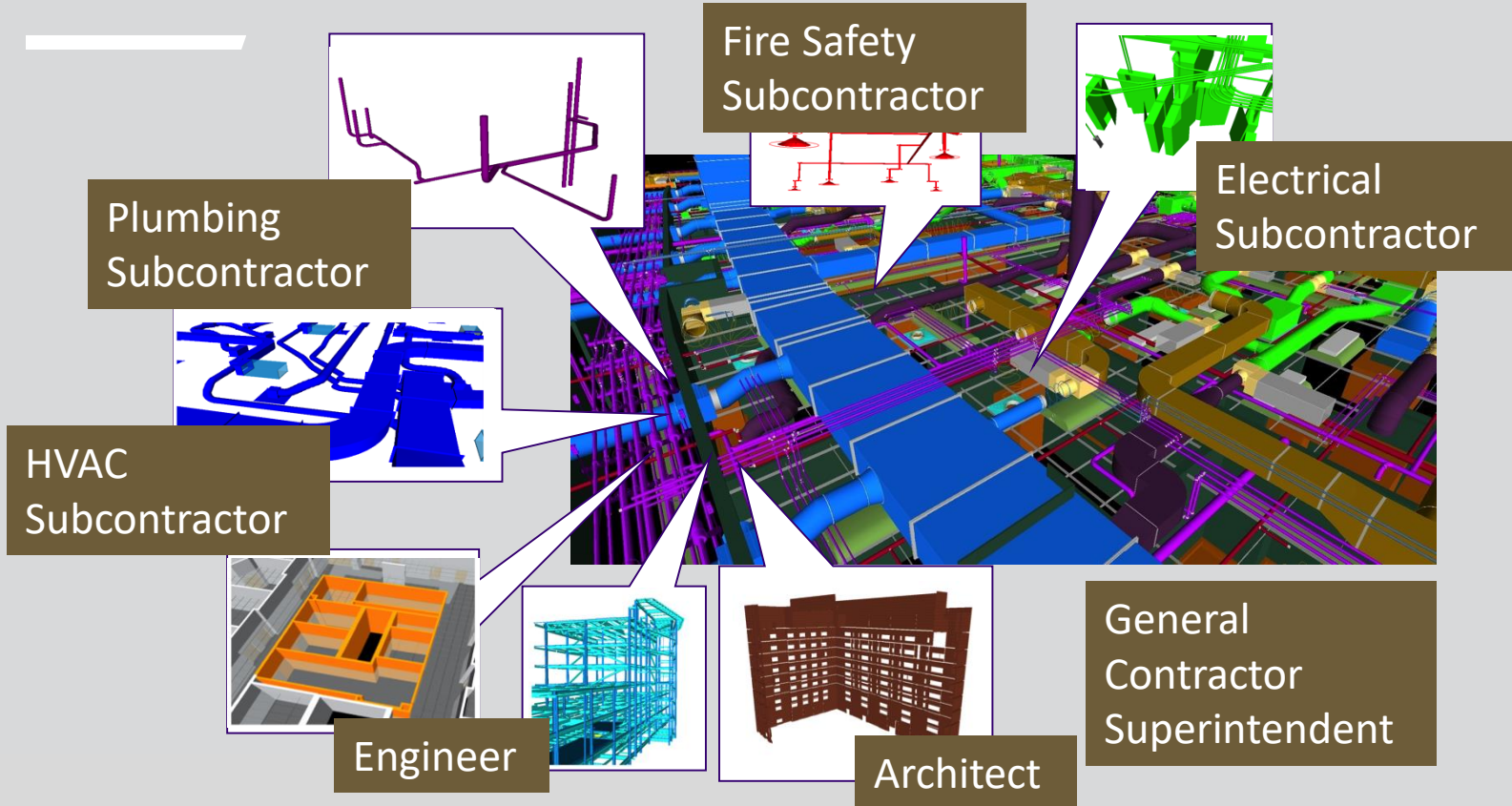
MEP 3D Coordination Team Example



Isolated MEP Teams



Integrated MEP Teams



Energy Modeling Team Requirements

BUILDING ENCLOSURE STRATEGIES

Architect

- FI SH
- TR WINDOWS
- SOUTH EXPOSURE W EXTERIOR SHADING
- DYNAMIC EXTERIOR SHADING
- IMPROVED ROOF INSULATION
- IMPROVED EXTERIOR WALL INSULATION
- INCREASED AIR TIGHTNESS OF BUILDING SKINS
- DAYLIGHT HARVESTING
- GREEN ROOF

LIGHTING SYSTEMS

Lighting Designer

- LED LIGHTING FOR PATIENT ROOMS
- PUBLIC SPACE LEDS
- LED LIGHTING FOR SURGERY
- LED LIGHTING FOR CLINICAL SPACES

USER DRIVEN STRATEGIES

Owner Operator

- REDUCED VENTILATION RATES
- ENERGY STAR EQUIPMENT
- AUTOMATIC SHOE COVERING DISPENSERS

COMFORT DELIVERY SYSTEMS

HVAC Engineer

- FILLED BEAMS
- FAN COIL IN CLINICAL SPACE
- DEWALL SPLACEMENT INTILATION
- WATERFALL DISPLACEMENT VENTILATION
- PATIENT RM MIXED MODE W/NATURAL VENTILATION
- INCREASED ZONES TO MATCH SUPPLY AIR NEEDS
- NATURAL VENTILATION IN SELECTED AREAS
- RADIANT HEATING ON WALL OR CEILING
- VAV WITH REHEAT
- RADIANT COOLING
- RECIRCULATING AIR HANDLING UNIT W HEPA
- MULTI-ZONAL VAV WITH REHEAT
- HEPA RECIRC SYSTEM IN PATIENT ROOMS
- FLOOR BY FLOOR MECHANICAL
- 100% OUTSIDE AIR WITH HEAT RECOVERY

CENTRAL PLANT SYSTEMS

- DISTRIBUTED HEAT GENERATION
- EXHAUST AIR HIGH EFFICIENCY HEAT RECOVERY
- HEAT RECOVERY CHILLERS
- WASTE WATER HEAT RECOVERY
- GROUND SOURCE HEAT PUMPS
- HEAT EXCHANGE HOT WATER HEATERS
- CONDENSING BOILERS
- HEAT PUMP ENHANCED HEAT RECOVERY
- WATER COOLED CHILLERS WITH COOLING TOWERS
- INDIRECT EVAPORATIVE COOLING
- AIR COOLED CHILLERS W HIGH EFF. COMPRESSOR
- DISTRIBUTED HEAT PUMPS
- WATERSIDE ECONOMIZER

PLANT GENERATION SYSTEMS

- PHOTOVOLTAIC PANELS
- BIOMASS GASSIFICATION BOILERS
- WIND TURBINES
- SOLAR HOT WATER GENERATION
- COMMUNITY BASED BIO-DIGESTION
- FUEL CELLS FOR ELECTRICAL/HEAT GENERATION
- COGENERATION

CONTROL SYSTEMS

HVAC Engineer

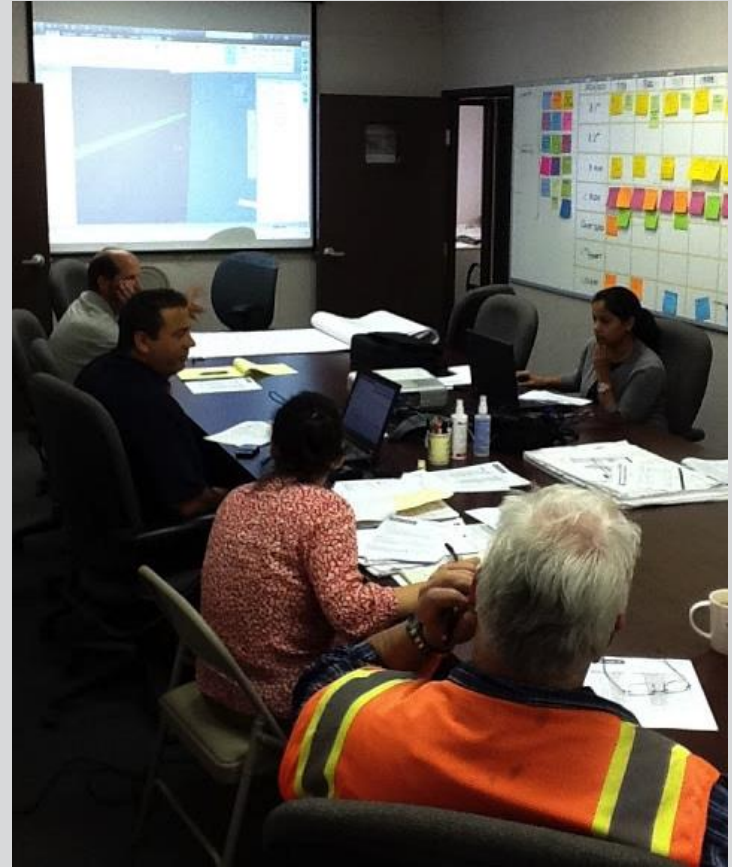
Owner Operator

- LIGHT RIDE
- OR UNOCCUPIED
- HVAC
- PLUG STRIP CONTROLS FOR OFFICES
- ENERGY EFFICIENT ELEVATORS
- CO2 SENSORS IN HIGH OCCUPANCY AREAS

Leadership

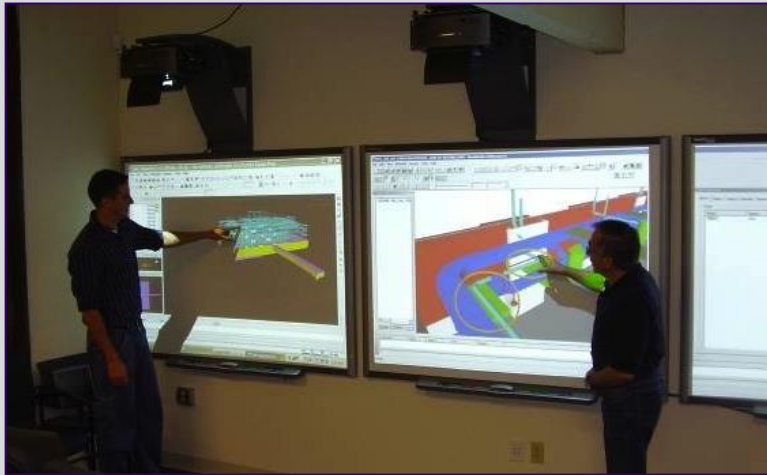
Owner: key leader & active role

- > Goal setting & alignment
- > Organizational champion
 - Get the right people together with the right information
 - Navigate across boundaries when meetings are not feasible



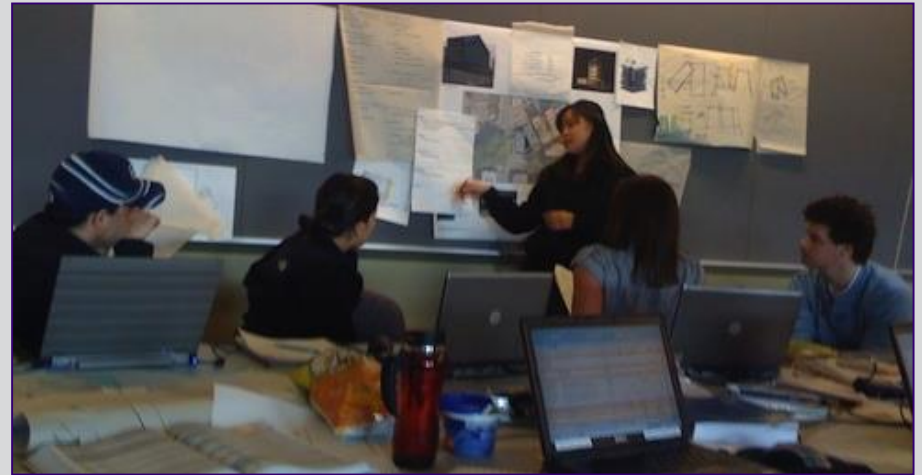
MULTIPLE MEDIA FOR *MESSY*TALK

DISCOVERY



Passive – Formal - Inflexible

DIALOG



Active– Informal - Flexible

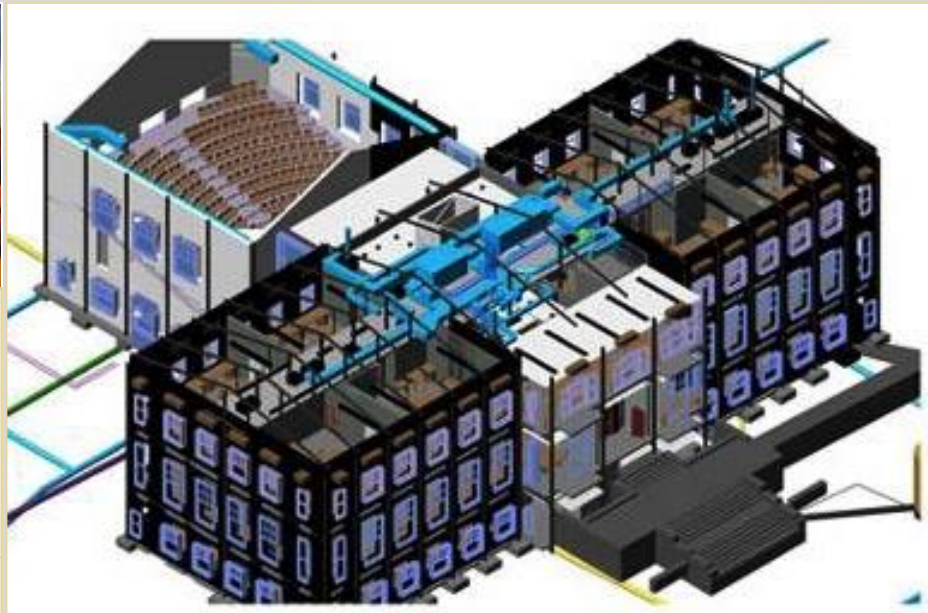
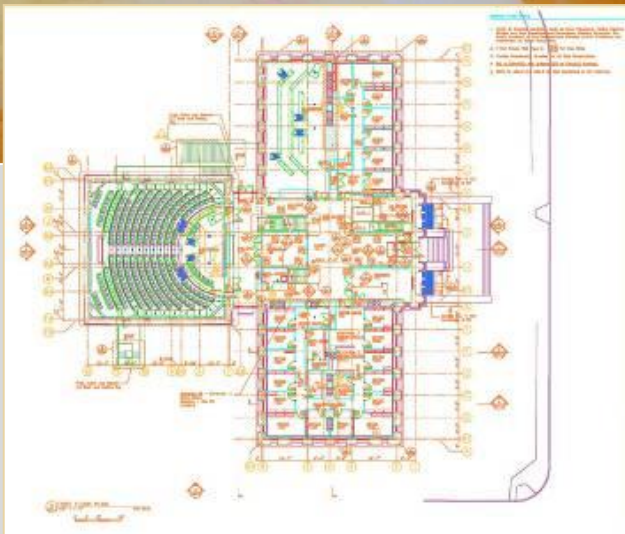
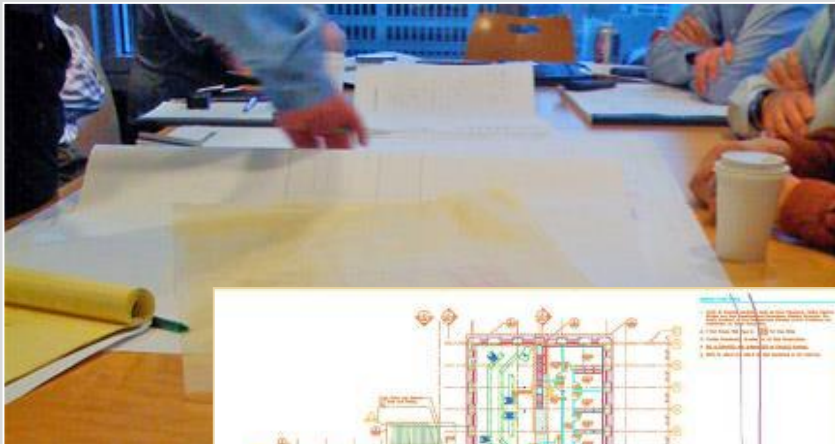
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INTERPRETIVE FLEXIBILITY

SKETCHING – 2D – 3D – SIMULATION



The work needed to make BIM work

How to get organization to mirror tech

- > Avoid information bottlenecks
- > Owners with AEC expertise as team members and champions
- > Use multiple media for messy talk
- > Use visualizations with interpretive flexibility for innovative problem-solving

Questions, Comments

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