Design-Build
Smart Lab Renovations

January 30, 2019

Joseph Fleshman, P.E.
UC Irvine Facilities Management

Agenda

- Project Background and Building History
  - Med Sci B, C, and D
- Design-Build Project Delivery
  - Detailed Project Program
  - Proposal Development and Evaluation
  - Design Refinement
  - Occupant and Internal Communication
- Med Sci C vs. Med Sci B & D
- Smart Lab Aspects of Project
- Closing Summary

Quick Facts: Med Sci B

- Constructed in 1976
- 35,864 Square Feet
- Two Floors
- Research Labs and Offices

Quick Facts: Med Sci C

- Constructed in 1976
- 55,853 Square Feet
- Three Floors
- Research Labs and Offices

Quick Facts: Med Sci D

- Constructed in 1976
- 56,349 Square Feet
- Three Floors
- Research Labs and Offices

Med Sci Mechanical Equipment

- Air handlers rusted through.
- Ductwork damaged and deteriorating.
- Equipment at the end of their useful lives.
- Individual exhaust fans lack redundancy.

Med Sci Roofs

- Roofs last replaced in 1988, designed for 15 year life.
- Water intrusion into laboratories, classrooms, and offices.
- Inadequate drainage/slope
- No overflow roof drains
- Staff routinely removed water manually with squeegees after rainstorms.
- Condensation from deteriorated air handlers contributes to roof failure.

Existing Conditions

Existing Conditions

Project Order

- Med Sci C
  - 2016-2017
  - MAC: $7,425,000

- Med Sci B & D
  - 2018
  - MAC: $16,757,000

Selecting Design-Build

- Known funding limit for construction
- Insulate University from Risk
  - e.g. Unworkable design drawings, conflict between design/contractor, coming in over bid
- Large number of desired enhancements/alternates
- Creativity in approach
- Extremely fast project delivery for public sector

Formulating Detailed Project Program

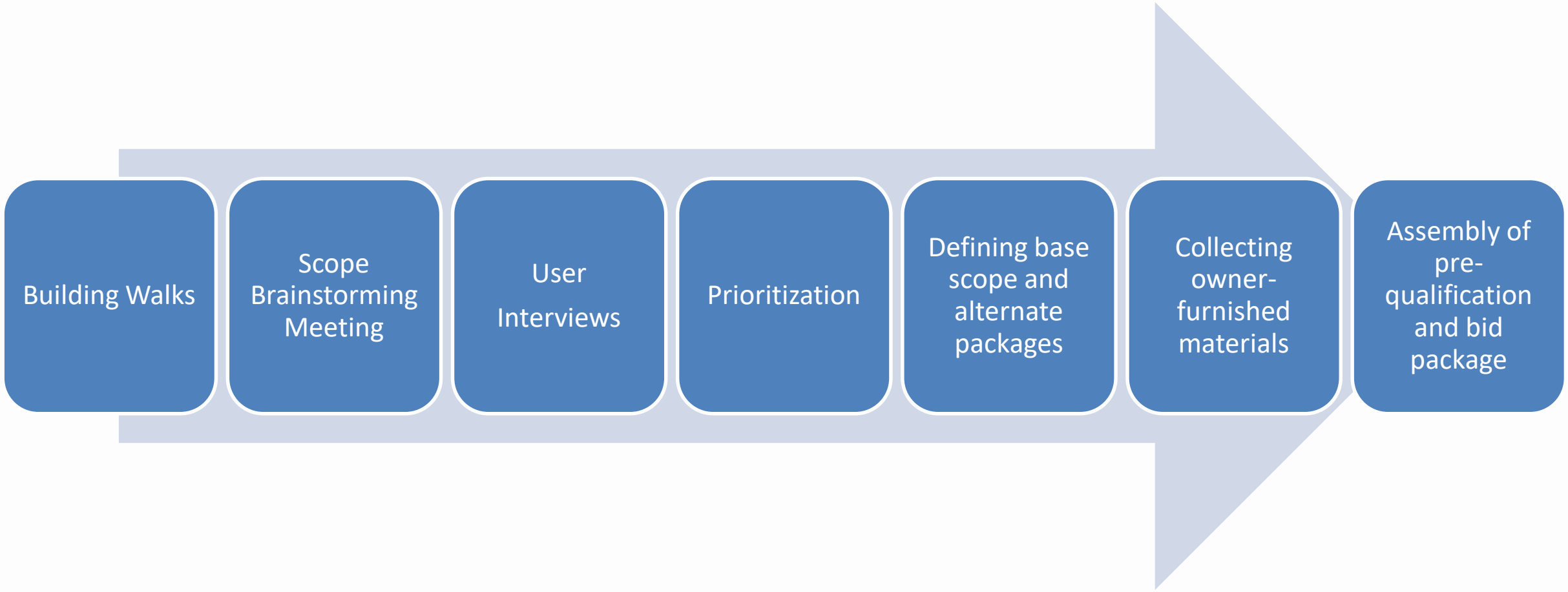
- Build the sandbox for contractors to play in

Detailed Project Program - Prescriptive only where necessary

Schedule - Define extent of construction impacts acceptable to owner and users

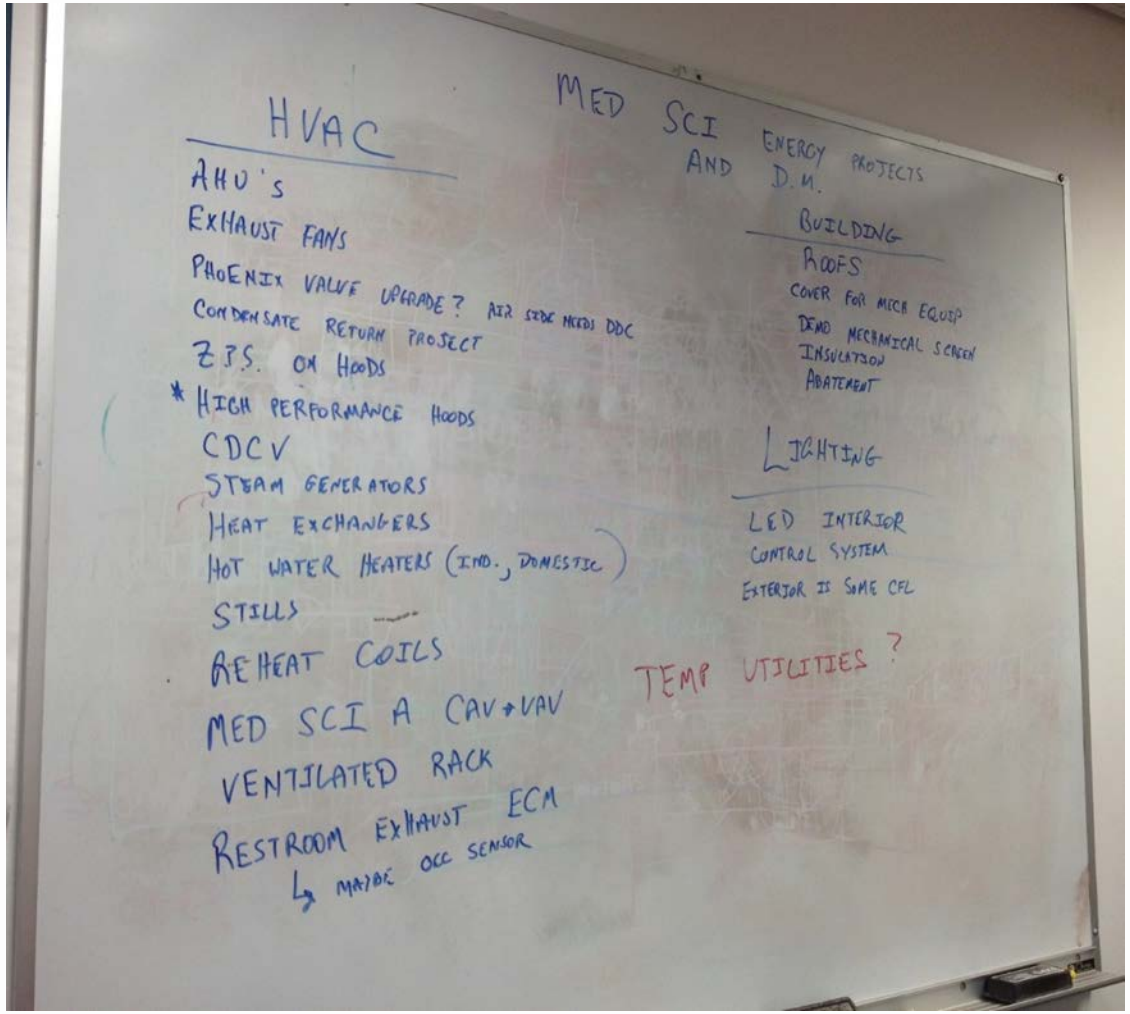
Budget - Maximum acceptance cost

Formulating Detailed Project Program (DPP)



DPP - Brainstorming

- Internal team members (project managers, engineers, building managers) walk the building and roof
- Everyone's notes go up on the dry erase board
- Categorize the results
- Initial prioritization of results



DPP - User Interviews (Med Sci C)

- Met with Department Chairs and School of Medicine Dean's Office to identify priorities and concerns
- Aesthetic of laboratories and corridors to help recruitment
- Noise and lighting
- Floor-to-floor leaks
- HVAC comfort
- Casework
- Construction Impact

DPP - Prioritization (Med Sci C)

Base Scope

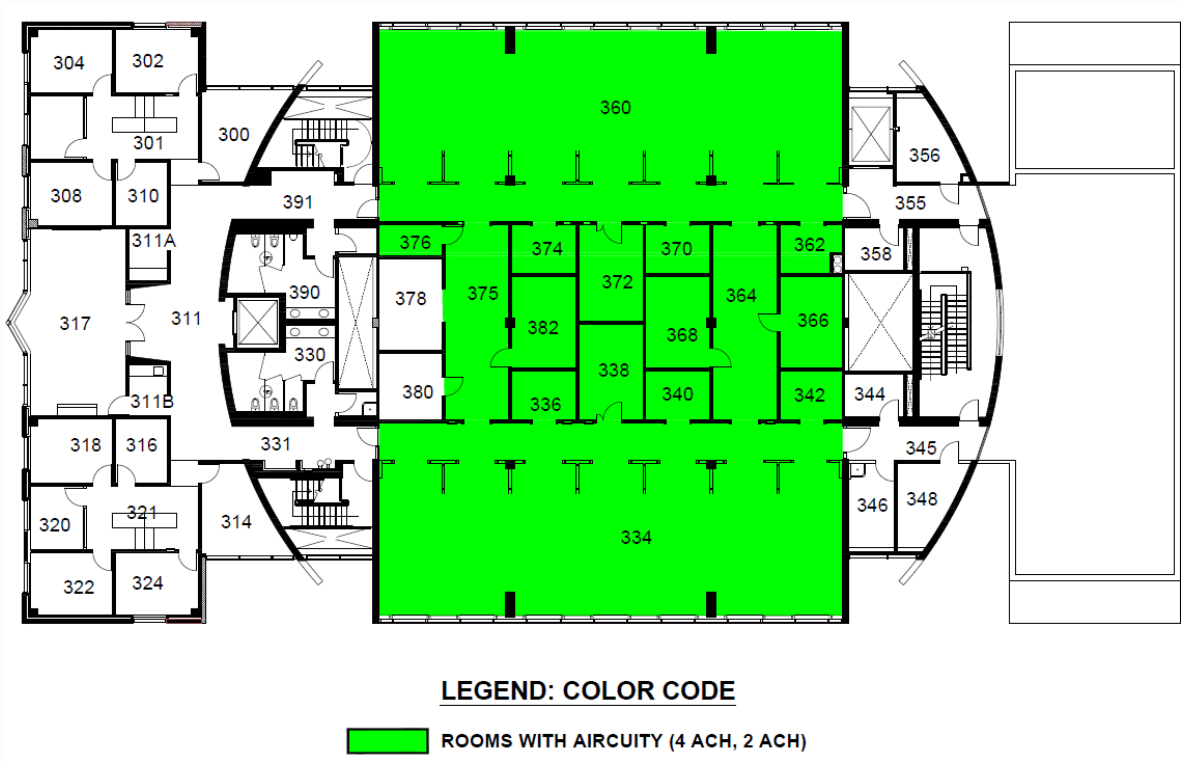
- Replace air handlers and exhaust fans
- Replace roof

Alternates (in order of priority)

1. CAV to VAV, Pneumatic to DDC, Centralized Demand Controlled Ventilation
2. LED lighting with whole building lighting control system
3. Hallway refurbishment – paint and flooring
4. Installation of drop ceilings
5. Mechanical room equipment (heat exchangers, steam generators)

DPP - Owner-Furnished Materials

- Hazardous materials assessment
- Current air balance / TAB report
- Campus Standards and Specifications
- Building record drawings and submittals
- Building renovation documentation
- Work order history for the building
- Lighting audit
- Approved laydown area
- Historical energy use
- EH&S laboratory air change rate assessment



Prequalification

University of California, Irvine

CRII - 3 2017 Med Sci Major Building Maintenance
Project No. 5110405

NOTICE INVITING GENERAL CONTRACTOR PREQUALIFICATION

The **University of California, Irvine (UCI)** requests the qualifications of Contractors with a General Building (B) license wishing to submit **Design Build** proposals for the **CRII - 3 2017 Med Sci Major Building Maintenance, Project No. 5110405.**

Prequalification questionnaires will be accepted from Contractors with a General Building (B) license teamed with a Warm-Air Heating, Ventilating and Air-Conditioning (C-20) Contractor and a Design Firm (Mechanical Engineer) that have completed comparable projects as described in the questionnaire. The General Building (B) Contractor may elect to self-perform the warm-air heating, ventilating and air-conditioning trade work if they possess a current and active C-20 California Contractors State License.

DESCRIPTION: The proposed project will replace the roofs and all major rooftop mechanical equipment in Medical Sciences buildings B and D. The work will include: 1) Demolition and removal of existing roofs and mechanical equipment; and 2) The installation of: a) single-ply roofs, insulation, drains and other components; b) rooftop chilled water air handling units; and c) rooftop exhaust fan systems. Work will also include the abatement of all asbestos-containing materials affecting the roof and HVAC equipment. Project alternates may include, but are not limited to: 1) Interior laboratory controls upgrades with centralized demand control ventilation and ductwork replacements; 2) Interior and exterior lighting upgrades; and 3) Interior upgrades such as painting, flooring, and drop ceilings.

Project completion time: 14 months

PROJECT DELIVERY: Design Build

ESTIMATED DESIGN AND CONSTRUCTION COST: **$14,000,000 – 16,000,000** (funding approval pending)

PROCEDURES: **Prequalification questionnaires** will be available electronically at **2:00 pm on 1/12/17** from UCI Facilities Management.

Mandatory Prequalification Conference begins promptly at **10:00 am on 1/24/17** at UCI Facilities Management, Conference Room 122, 19172 Jamboree Road, Irvine, CA 92697-5444.

Prequalification questionnaires must be received by **2:00 PM on 2/7/17** only at UCI Facilities Management, Contract Services Office, Room 144, 19172 Jamboree Road, Irvine, CA 92697-5444.

REQUIRED PROJECT EXPERIENCE: Prequalification questionnaires will be accepted from General Building (B) Contractors teamed with a Warm-Air Heating, Ventilating and Air-Conditioning (C-20) Contractor and a Mechanical Engineer that have completed comparable projects as described in the questionnaires; *each* having completed comparably sized projects as follows:

Projects completed in the past 7 years that meet the criteria listed below and demonstrate the Contractor's ability to successfully complete the project with respect to project size, scope, cost, use, complexity, etc.

- At least three (3) projects located in the **State of California** for which the construction cost was at least $14 million each for the General Building (B) Contractor and $8 million each for the HVAC (C-20) Subcontractor.
- At least two (2) **design build** projects that included the **replacement of an HVAC system in a laboratory or similar facility** for which the construction cost was at least $14 million each for the General Building (B) Contractor and $8 million each for the HVAC (C-20) Subcontractor.

- Contractor and designer team up to prequalify as a single team
- Define criteria to prequalify the top teams
  - Similar size
  - Similar type
  - Similar building systems
- University evaluators review paper submissions to narrow down teams
- Top 3-5 teams are invited for an interviewed then narrowed down to top three, who move on to the proposal stage

Bid Advertisement Package

- Detailed Project Program / Scope of Work
- Scoring Criteria
- Campus Master Specifications
- Campus Standards and Design Criteria
- General Requirements
- General Conditions
- Contract Forms

Detailed Project Program

CRII - 3 2017 Med Sci B Major Building Maintenance
Contract No. 999471 / Project No. 5112079

CRII - 3 2017 Med Sci D Major Building Maintenance
Contract No. 999472 / Project No. 5112080

UCI Facilities Management
19172 Jamboree Road
Irvine, CA 92697-5444

Conformed September 20, 2017

University of California, Irvine
CRII – 3 2017 Med Sci B Major Building Maintenance — Contract No. 999471 / Project No. 5112079
CRII – 3 2017 Med Sci D Major Building Maintenance — Contract No. 999472 / Project No. 5112080

UNIVERSITY FURNISHED INFORMATION

The following information is made available for the convenience of Proposers and is not a part of the Contract. The information is provided subject to the provisions of subparagraph 3.1.1 of the General Conditions.

Issued electronically on the "Request for Proposals" CD
(Located behind the first tab of this binder)

PREVAILING WAGES

General Prevailing Wage Determinations and information can be accessed at www.dir.ca.gov or by contacting University's principal Facility office.

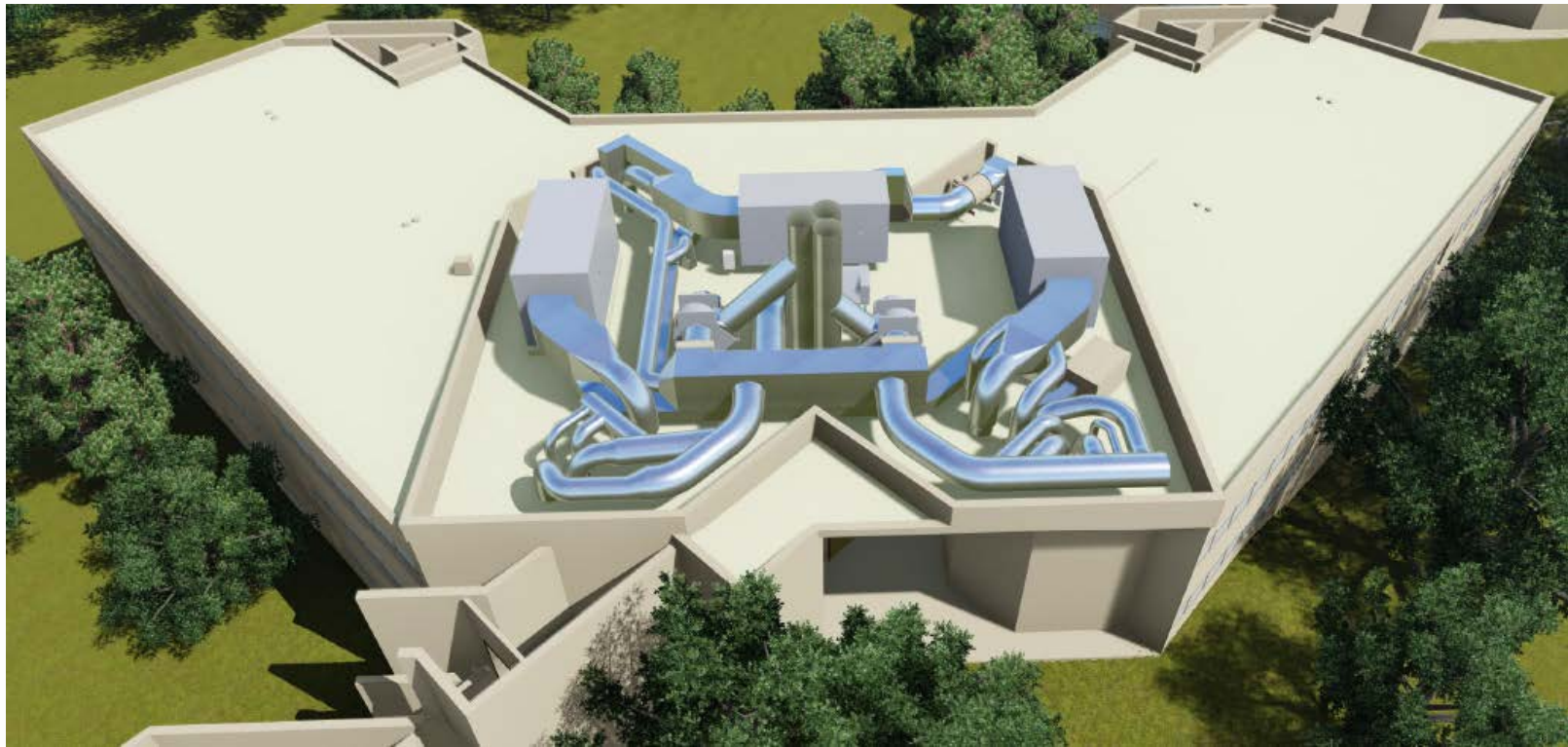
Use Bid Advertisement Date: June 29, 2017

DESCRIPTION

No.	Title:	Prepared by:	Date:
1.	**Med Sci B**		
A.	Radiology Department Stack B Level 1	UCI Office of Physical Planning & Construction	197X
B.	Biohazard Facility Room B254, B256 & B260	UCI Office of Physical Planning & Construction	1979
C.	Renovations for Radiology Department	UCI Office of Physical Planning & Construction	1979

Bid Development

- Design-builders schedule site visits with a University escort to document existing conditions
- Compare as-built documentation to field conditions
- Submit requests for information
- Laser scans
- Field measurements
- Schematic design development



Proposal Evaluation

- Blind scoring of technical proposals
- Oral Interviews / Presentations
- Bid Opening
- Best-value Calculation ($/point)

UC Irvine

BEST VALUE CALCULATION SPREADSHEET

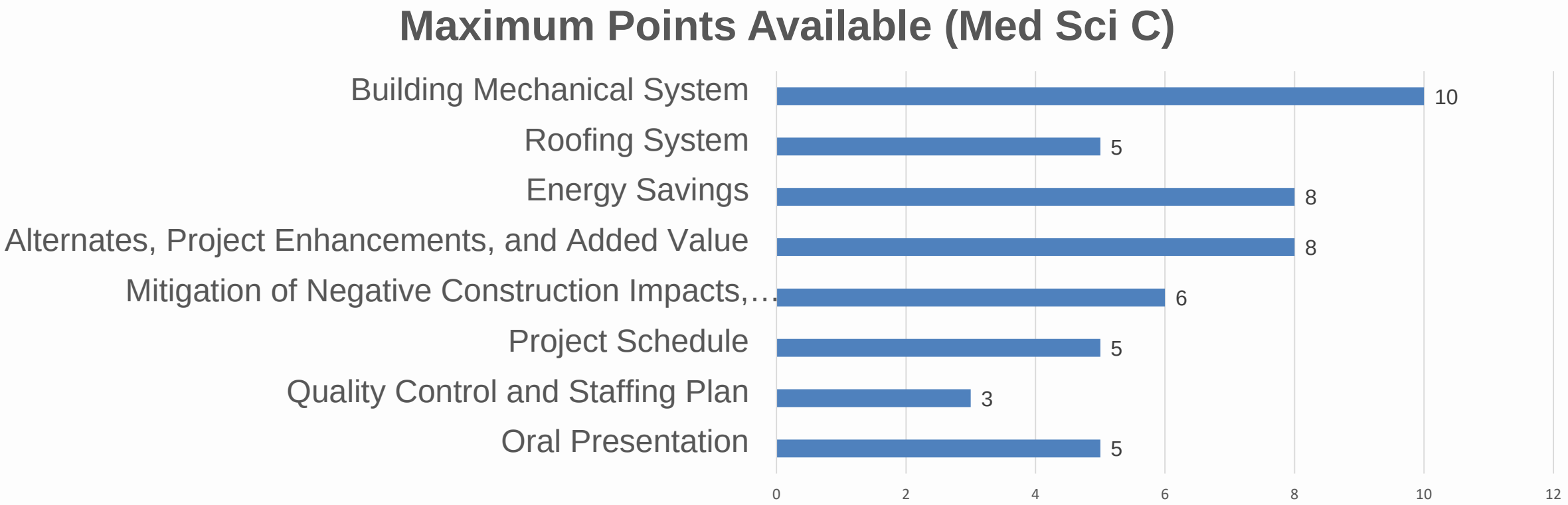
CRII-2 2015 MED SCI C MAJOR BUILDING MAINTENANCE
CONTRACT # 9929290 PROJECT # 5109723

MAXIMUM ACCEPTANCE COST: $7,425,000

Technical Proposal DUE June 29, 2016, 4:00pm
Lump Sum Base Price Proposal DUE June 30, 2016, 4:00pm
Bid Opening Date: July 6, 2016, 2:00pm

GENERAL CONTRACTOR/DESIGN BUILDER:	PPC Air Conditioning, Inc. 5950 Lakeshore Dr. Cypress, CA 90630 MSC-63	PCL Construction Services, Inc. 500 North Brand Blvd., Suite 1500 Glendale, CA 91203 MSC-12
LUMP SUM BASE PRICE PROPOSAL	$ 7,425,000.00	$ 7,416,741.00
UNIT PRICES (Specification Section 01 2200)		
Unit Price No. 1 Daily Rate for Compensation for Compensable Delay	$0	$0
Compensable Delay per Day x 60 Calendar Days	$0	$0
Unit Price No. 2 Item: Lead Paint Removal Not Found in Asbestos and Lead Reports	$17	$10
Unit Price No. 2 Item x 1,200 Square Feet	$20,400	$12,000
Unit Price No. 3 Item: Removal of Amosite Asbestos Containing Material Not Found in Asbestos and Lead Reports	$55	$326
Unit Price No. 3 Item: x 40 Cubic Feet	$2,200	$13,040
Unit Price No. 4 Item: Removal of Chrysotile Asbestos Containing Material Not Found in Asbestos and Lead Reports	$55	$139
Unit Price No. 4 Item x 40 Cubic Feet	$2,200	$5,560
Unit Price No. 5 Item: Removal of Crocidolite Asbestos Containing Material Not Found in Asbestos and Lead Reports	$45	$75
Unit Price No. 5 Item x 40 Cubic Feet	$1,800	$3,000
Unit Price No. 6 Item: Epoxy Injection of Concrete Roof Deck	$35	$301
Unit Price No. 6 Item x 600 Linear Feet	$21,000	$180,600
TOTAL OF ALL EXTENDED UNIT PRICES	$47,600	$214,200
ALTERNATES (Division 1 Section 01 2300)		
Alternate No. 1 - Airflow Valves, Demand Control Ventilation and Ductwork Upgrades	$0	$0
Alternate No. 2 - Seal And Polish Existing Concrete Flooring	$0	$300,661
Alternate No. 3 - LED Interior Lighting and Advanced Controls	$0	$1,654,710
Alternate No. 4 - Interior Architectural Upgrades	$558,100	$720,650
Alternate No. 5 - Mechanical Room Equipment Replacement	$1,258,000	$3,157,235
TOTAL OF ALL ALTERNATES	$1,816,100	$5,833,256
TOTAL PROJECT COST = Lump Sum Base Price Proposal + Extended Unit Prices + Alternates	$ 9,288,700.00	$ 13,464,197.00
AVERAGE TECHNICAL POINTS	44.10	33.23
BEST VALUE SCORE = TOTAL PROJECT COST / AVERAGE TECHNICAL POINTS	$210,628	$405,182

Proposal Evaluation



- Assign the total possible points to focus design-build team efforts.
- For Med Sci C we placed a higher value on energy savings and project enhancements than on the roof design by weighting more points in those areas.

Winning Proposal (Med Sci C)

Base Bid

- New air handlers
- New exhaust fans, N+1 design
- New roof and flashing
- New roof insulation >R20 average
- New lab air control valves, reheat coils, DDC controls, CDCV system, fume hood zone presence sensors
- New LED lighting with networked controls
- Corridor flooring and paint, sealing of penetrations between floors, polishing lab flooring

Alternates in the RFP included by design-builder in the base bid at no additional cost

Add Alternates

- T-Bar Ceilings in Lab Zones and offices
- Replacement of Heat Exchangers, Steam Generators, pumps

Alternate added to the project at additional cost resulting in significant energy savings

Design Refinement Post-Award

- Shoulder-to-shoulder design review led by project manager with the engineer of record, contractor, UCI Facilities Management, fire marshal, and EH&S
- Multiple 2-4 hour review sessions to address owner and stakeholder comments in real-time
- Discuss targeted topics such as major equipment for submittal
- Goal is a dynamic, speedy review leading to sign-off of key submittals with comments

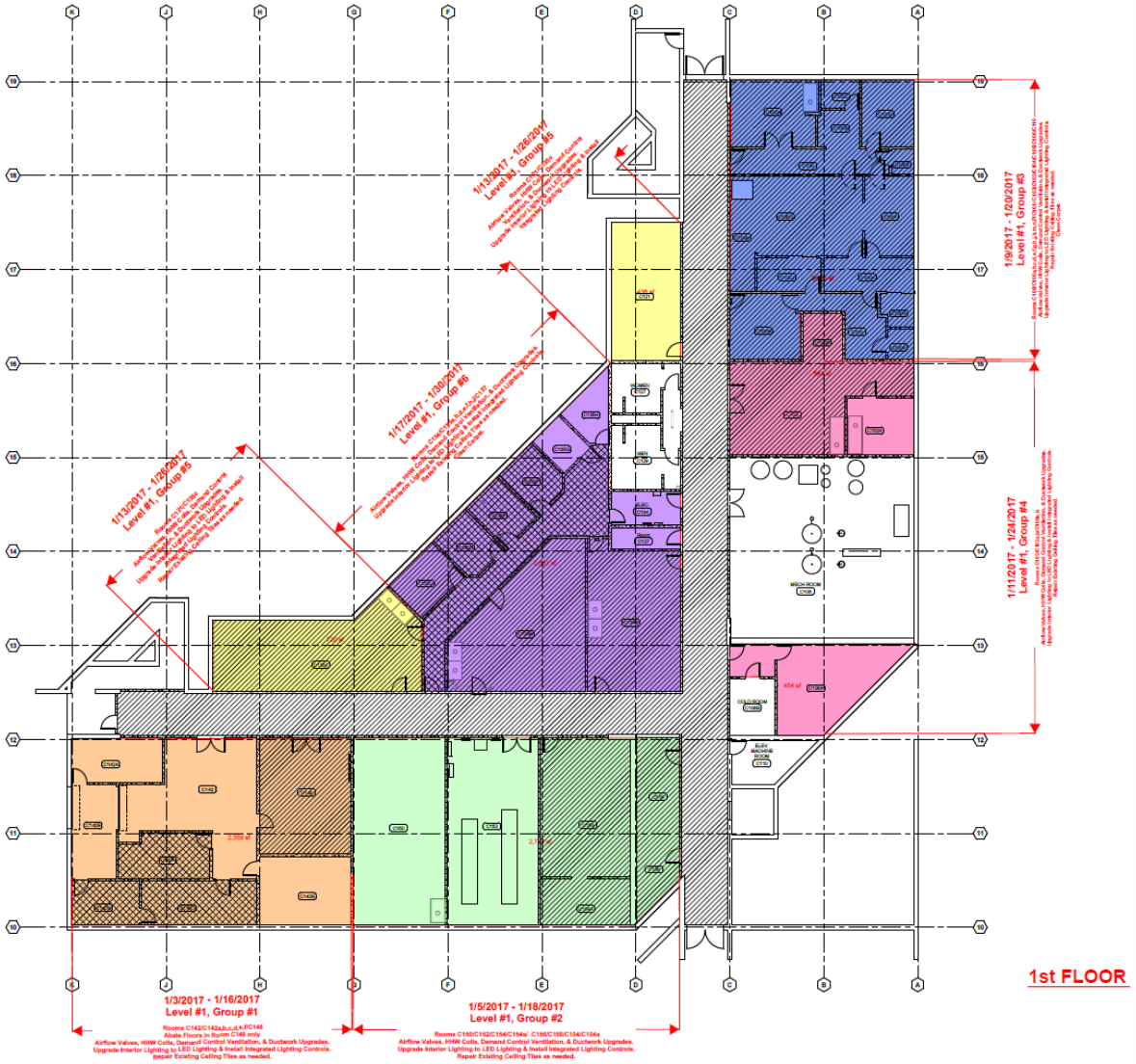
MEETING MINUTES

SUBJECT:	5112079 - Med Sci B Major Building Maintenance 5112080 - Med Sci D Major Building Maintenance Shoulder-to-Shoulder 50% DD Review
ATTENDEES:	UCI: Amir Anvarhosseini, Fred Bockmiller, Bill Cowdell, Joseph Fleshman, Matt Gudorf PPC: Dale Mohr, John Mohr, Rich Zajic Subs: Ric Herber (Siemens) P2S: Shadi Abouseif, Aaron Chee, Nathan Ho, David Landau, Shuni Mao, Margaret Peterson
DATE:	December 4, 2017

These are my notes from our shoulder-to-shoulder meeting on December 4, 2017. Please note any corrections. Decisions are in **BOLD**. Highlighted items are highest importance for 50% backcheck meeting leading up to release for major submittals. The next shoulder-to-shoulder meeting is scheduled for December 12, 2017.

Page	Discussion Item	Decision/Action
N/A	Heat load calculations for new heat exchangers sizing, P2S Project Load Calculation Memorandum.	**P2S to adjust safety factor inlet/outlet temperatures. With corrections, UCI accepts project load calculations.**
C-stack, M-002	Water control valves	**Provide Fisher valves per spec.**
C-stack, M-002	Water control valves	Steam generator 3" valve may be oversized, P2S to investigate.
C-stack, M-002	Isolation valve	Butterfly valves are prohibited, P2S to look at other options. No ductile iron valves.
N/A	HTW shutdown schedule	Joseph to send HTW shutdown schedule to PPC.
C-stack, M-402	HTW shutdown schedule	P2S/PPC to look at doing HTW work on or around scheduled HTW shutdowns and removing phased work for HTW heat exchanger and any unnecessary isolation valves.
C-stack, M-404	HTW exchanger height	P2S to look at different height exchanger configurations, no need to match existing regarding heat exchanger configuration.
C-stack, M-	Steam generator	Concern on how to actually get the steam

Construction Schedule



- DPP permitted design-builder to occupy each space no more than two weeks
- Teams developed their own phasing plan complying with this requirement
- Winning team developed a cascading phasing with a color-coded phasing plan
- Copies distributed to building occupants electronically and hard copies posted at each floor

Building Occupant Communication

- Key to success: Communication!
- Town Hall meeting at least 3 months in advance of construction
- Individual user meetings at least 2 months in advance of their phase
- Project management and EH&S met with every individual lab researcher for 2-4 hours
- Reviewed project schedule and scope with users
- Walked every space with users to assess lab needs and hear questions and concerns
- Determined any material relocation or protection in place required
- Provided daily update emails during whole-building outage

FM and EH&S Partnership

- Environmental Health and Safety is a critical partner
- EH&S provided spill-proof containers for chemical storage
- EH&S participated in individual user meetings
- Industrial Hygiene cleared fume hoods and spaces prior to turnover
- Radiation Safety cleared fume hoods and equipment prior to turnover where applicable
- Industrial Hygiene monitored air quality before and during asbestos abatement
- EH&S coordinated waste disposal drives for hazardous materials
- EH&S school coordinator assisted users struggling to prepare for construction

Med Sci C vs. Med Sci B & D

- Lab users and Facilities Management had new priorities for Alternates

Med Sci B&D Base Scope

Replace air handlers, exhaust fans, and roof

Alternates (winning bidder provided all of these under the MAC)

1. CAV to VAV, Pneumatic to DDC, Centralized Demand Controlled Ventilation
2. Autoclave replacements (later replaced with corridor LED lighting)
3. Cold room upgrades
4. Laboratory safety upgrades
5. Mechanical room equipment (heat exchangers, steam generators)
6. Flooring and painting

Med Sci C vs. Med Sci B & D

- Point allocation updated to reflect additional focus on construction impacts

Medical Sciences C Scoring Criteria	Max Points
Executive Summary	0
Building Mechanical System	20
Roofing system design	10
Energy savings	16
Alternates, project enhancements and added value	16
Mitigation of negative construction impacts, phasing and safety	12
Project schedule	10
Quality control and staffing plan	6
Deviations from request for proposal	0
Oral presentation	10
Total	**100**

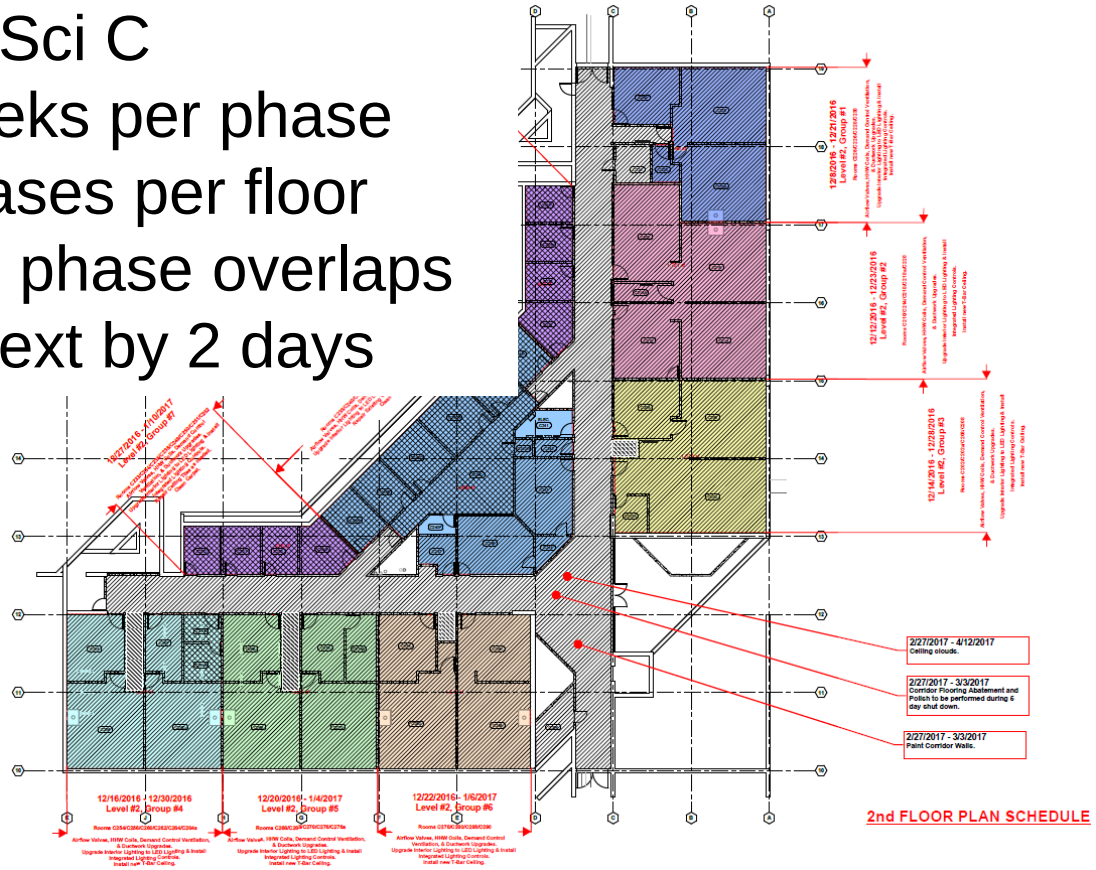
Medical Sciences B&D Scoring Criteria	Max Points
Executive Summary	0
Building Mechanical System	24
Roofing system design	10
Energy savings	15
Alternates, project enhancements and added value	16
Mitigation of negative construction impacts, phasing and safety	15
Project schedule	5
Quality control and staffing plan	5
Deviations from request for proposal	0
Oral presentation	10
Total	**100**

On a $17MM project, each point is effectively $170,000!

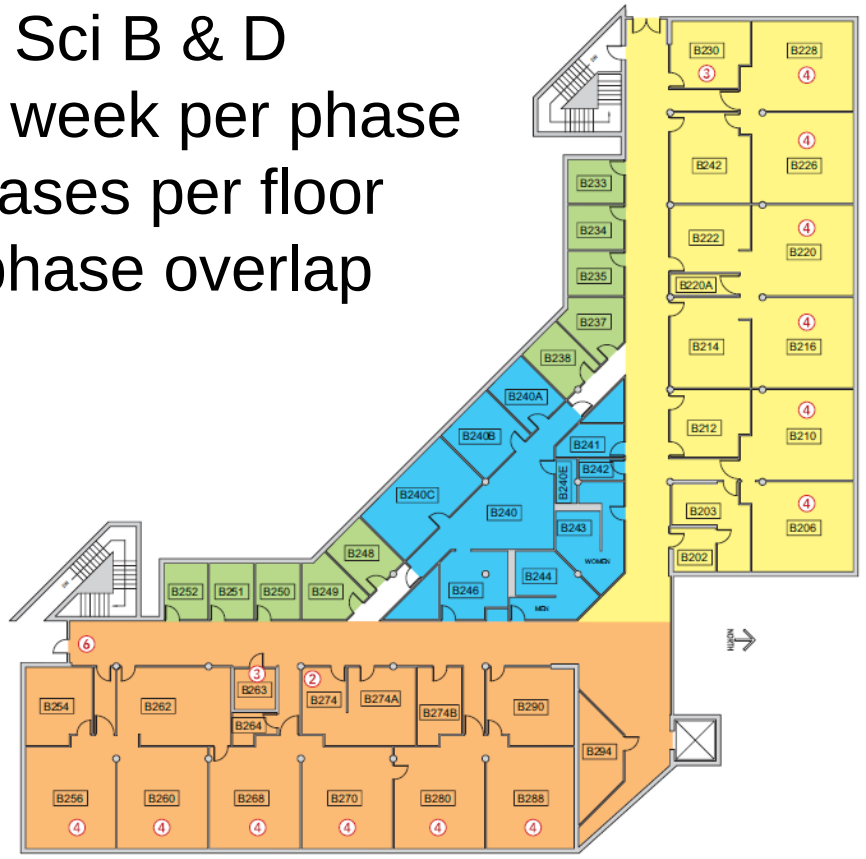
Med Sci C vs. Med Sci B & D

- Less focus on drop ceilings, more focus on reducing disruption
- Scope inside labs decreased, so time allotted per phase reduced

Med Sci C
2 weeks per phase
8 phases per floor
Each phase overlaps the next by 2 days



Med Sci B & D
One week per phase
4 phases per floor
No phase overlap



Interior Corridor - After

Lab Interior - After (Med Sci C)

Rooftop Equipment - After

Smart Lab Features

HVAC

- VAV with DDC
- Variable volume reheat
- Centralized demand controlled ventilation
- Occupancy on each hood for face velocity setback
- Occupancy based dilution ventilation setback from 4 occupied / 2 unoccupied
- Wind study with design for no bypass air / cluster stack design.

Lighting

(Med Sci C Only)

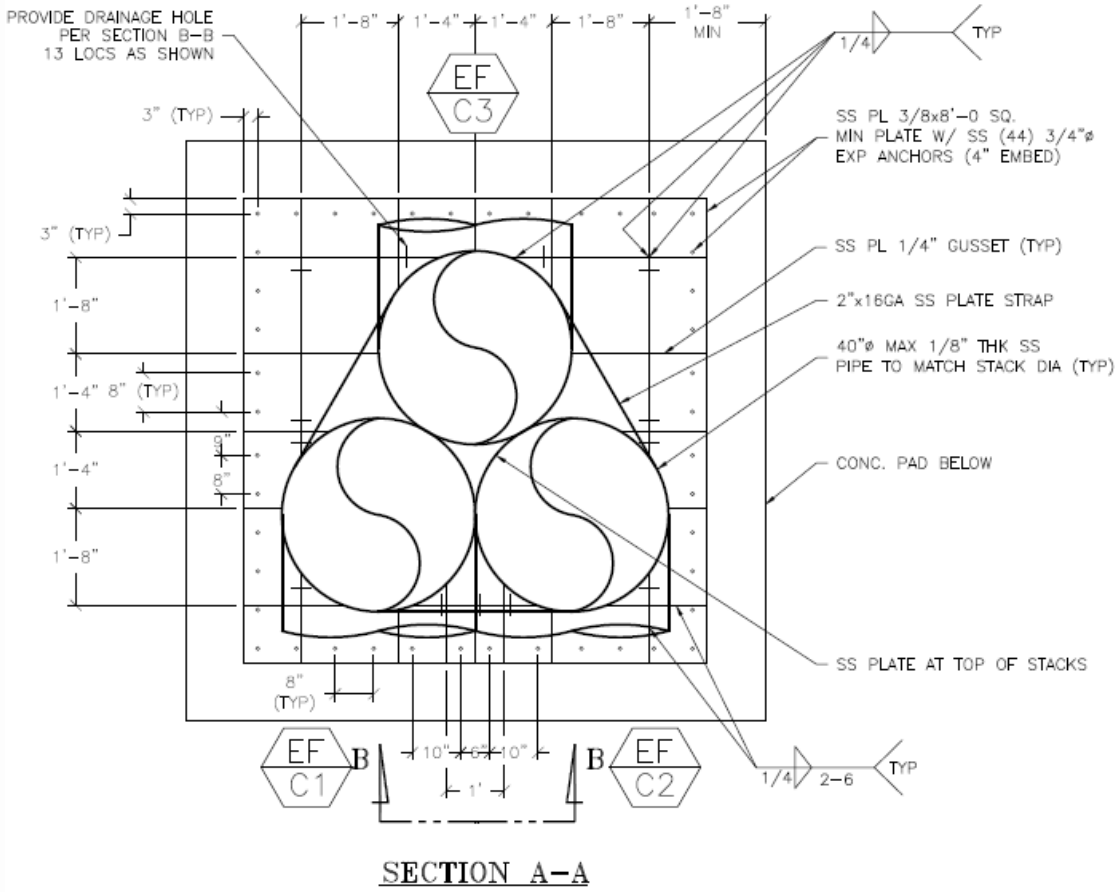
- LED lighting 3500k CRI90
- Occupancy / vacancy
- Daylighting
- Trim and lumen maintenance
- Web based scene control and configuration

Information Layer

- Full automated fault detection to the zone level
- Complete sub-metering of utilities
- BACNET integration of lighting and HVAC system
- ULT freezer monitoring

Smart Lab - HVAC

- Clustered exhaust design, no bypass air required under any scenario
- Fine-tuned exhaust stack height based on wind tunnel testing



Smart Lab Results - HVAC Airflow

OVERALL SAVINGS OF 67,000 CFM

Med Sci B	
Exhaust HP Before	32.5 HP
Exhaust HP After	30 HP @ 70%
Exhaust Flow Before	34,004 CFM
Exhaust Flow After	~18,000 CFM
Airflow Reduction	**47%**

Med Sci C	
Exhaust HP Before	47 HP
Exhaust HP After	30 HP @ 85%
Exhaust Flow Before	54,816 CFM
Exhaust Flow After	~22,500 CFM
Airflow Reduction	**59%**

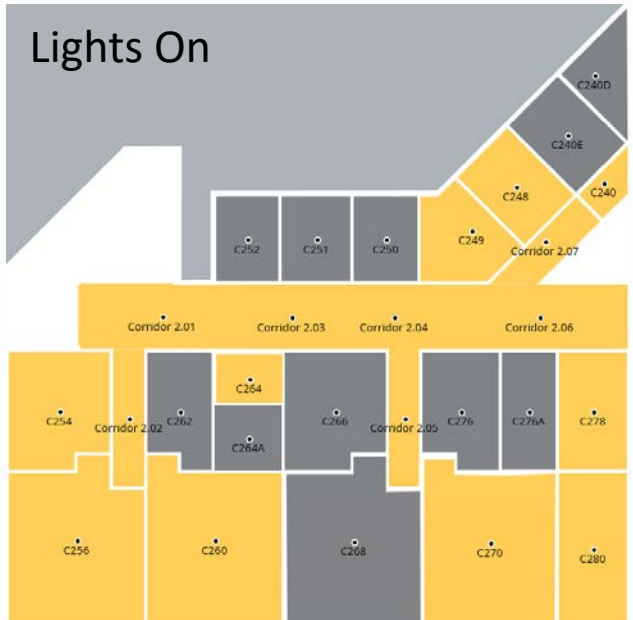
Med Sci D	
Exhaust HP Before	45.5 HP
Exhaust HP After	50 HP @ 69%
Exhaust Flow Before	43,532 CFM
Exhaust Flow After	~24,500 CFM
Airflow Reduction	**44%**

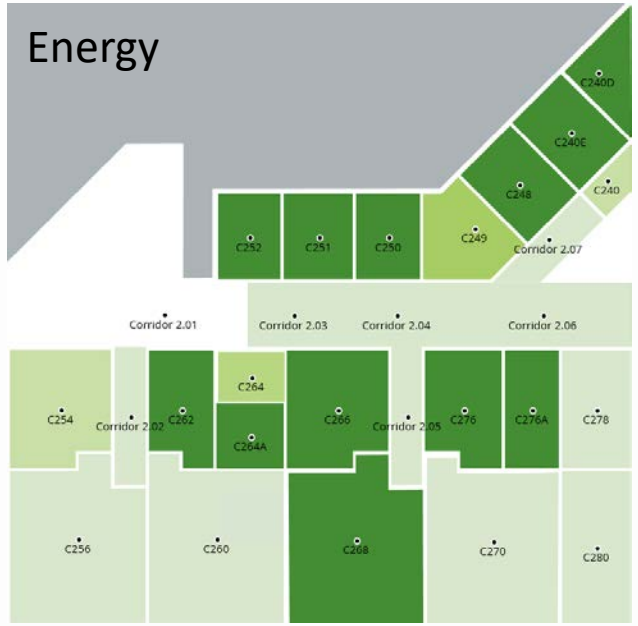
Smart Lab Results - Drop Ceilings

- Lab ceiling heights reduced from 14' to 9' AFF
- Effective room volume and minimum ventilation per ACH was reduced by 35%
- Huge energy savings combined with reduction to 2 and 4 ACH

Smart Lab - Lighting

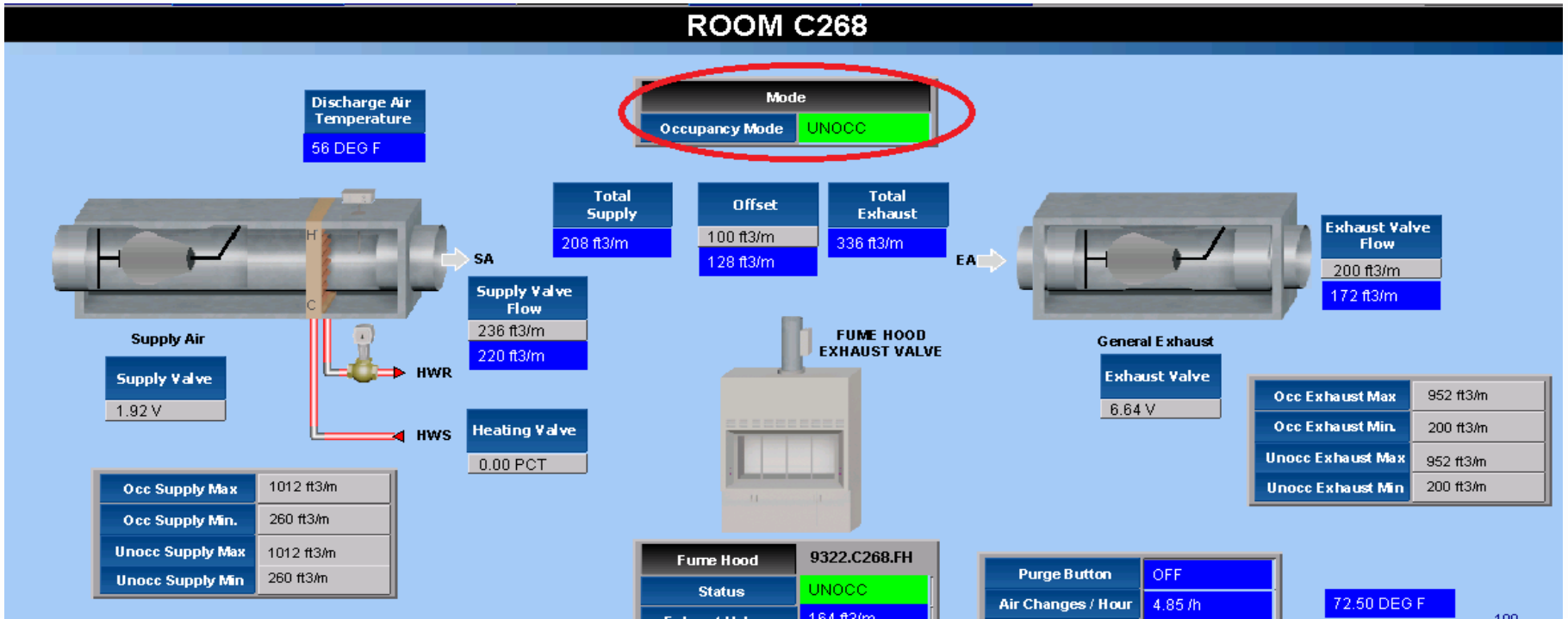
- Med Sci C is the first UCI lab with centralized networked lighting controls
- Remotely view:
  - Light levels
  - Occupancy
  - Energy Consumption
- Remotely adjust:
  - Trim levels
  - Occupied/unoccupied behavior
  - Daylighting aggressiveness

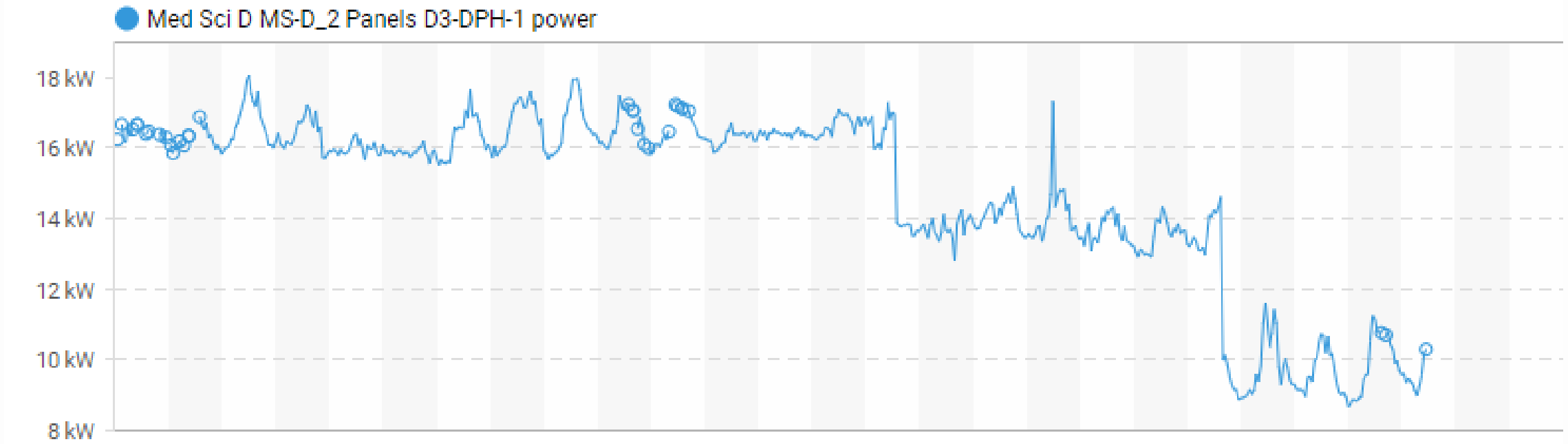


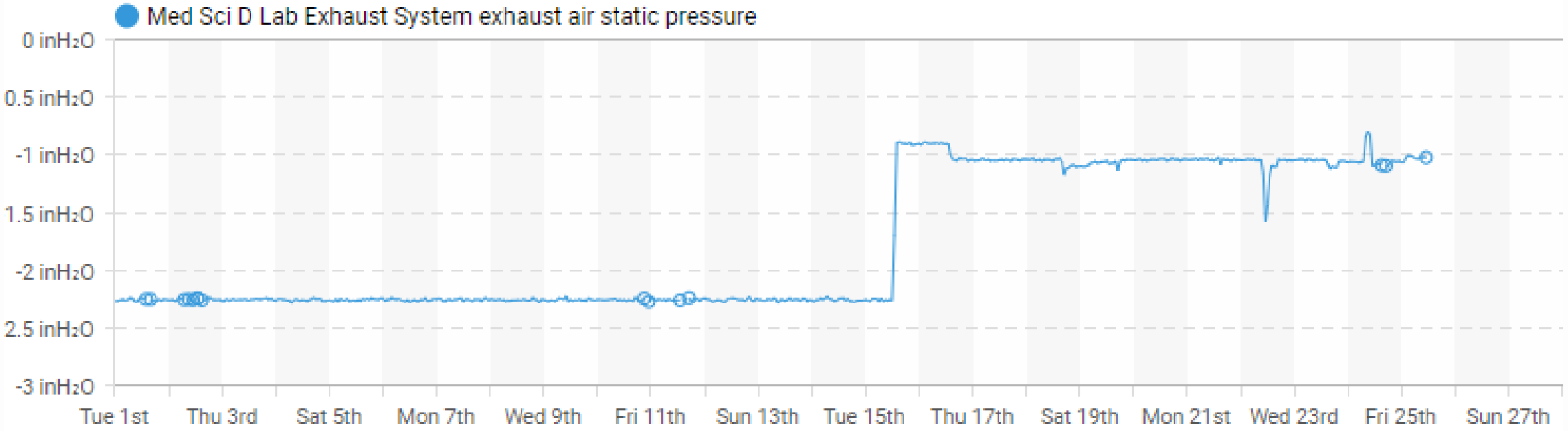


Smart Lab - Lighting and HVAC

- Main lighting controllers are networked over ethernet
- Occupancy information is retrieved by the automation system via BACnet protocol (BACnet over ethernet/IP)
- Building automation adjusts airflow setpoints based on occupancy
- No need for different sensors for HVAC and lighting

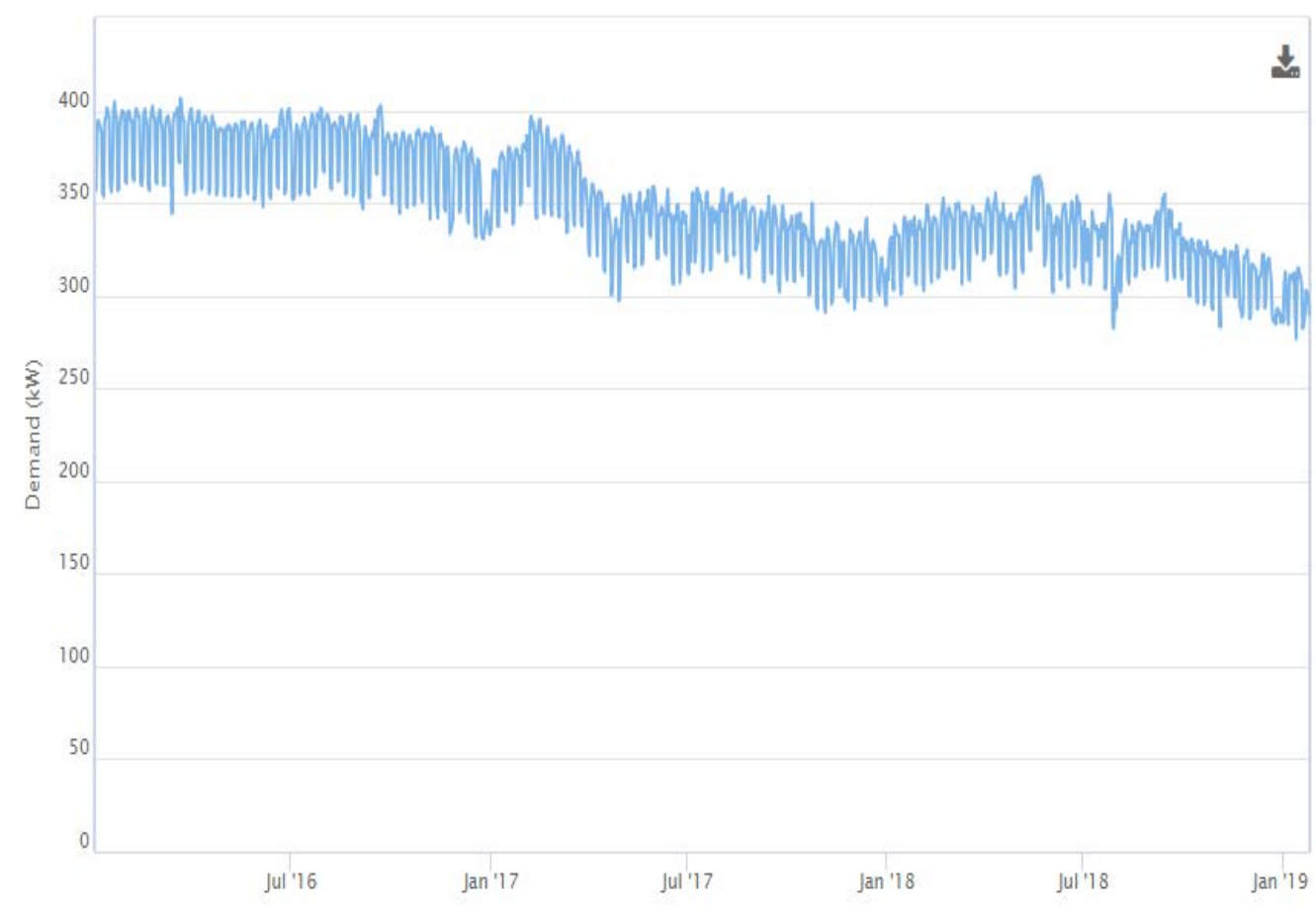



Med Sci D MS-D_2 Panels D3-DPH-1 power
18 kW
16 kW
14 kW
12 kW
10 kW
8 kW


Med Sci D Lab Exhaust System exhaust air static pressure
0 inH₂O
0.5 inH₂O
-1 inH₂O
1.5 inH₂O
-2 inH₂O
2.5 inH₂O
-3 inH₂O
Tue 1st
Thu 3rd
Sat 5th
Mon 7th
Wed 9th
Fri 11th
Sun 13th
Tue 15th
Thu 17th
Sat 19th
Mon 21st
Wed 23rd
Fri 25th
Sun 27th

Summary

- Design-build delivery method
- $24,000,000 of construction
- Less than 18 months per project
- 1,438,479 kWh saved (calculated)
- 12,955 therms saved (calculated)
- 75-100 kW saved (at the meter)
- 67,000 CFM saved
- 30% better performance vs. Title 24
- Lab exhaust airflow reduced by 51%



Questions?

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