Design-Build
Smart Lab Renovations

January 30, 2019

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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)

- Building Walks
- Scope Brainstorming Meeting
- User Interviews
- Prioritization
- Defining base scope and alternate packages
- Collecting owner-furnished materials
- Assembly of pre-qualification and bid package
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

• 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

**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. Issues electronically on the “Requests for Proposals” CD (Located behind the first tab of this binder).

**PREVAILING WAGES**

General Prevailing Wage Determinations and information can be accessed at [www.dfl.ca.gov](http://www.dfl.ca.gov) or by contacting University's principal Facility office.

Use Bid Advertisement Date: June 29, 2017

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>No.</th>
<th>Title</th>
<th>Prepared by:</th>
<th>Date:</th>
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<tbody>
<tr>
<td></td>
<td>B.</td>
<td>Biohazard Facility Room B254, B256 &amp; B260</td>
<td>UCI Office of Physical Planning &amp; Construction</td>
<td>1979</td>
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<tr>
<td></td>
<td>C.</td>
<td>Renovations for Radiology Department</td>
<td>UCI Office of Physical Planning &amp; Construction</td>
<td>1979</td>
</tr>
</tbody>
</table>

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

Conformed September 20, 2017
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)
Proposal Evaluation

Maximum Points Available (Med Sci C)

- Building Mechanical System: 10 points
- Roofing System: 5 points
- Energy Savings: 8 points
- Alternates, Project Enhancements, and Added Value: 8 points
- Mitigation of Negative Construction Impacts, …: 6 points
- Project Schedule: 5 points
- Quality Control and Staffing Plan: 3 points
- Oral Presentation: 5 points

• 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

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

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

**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

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**MEETING MINUTES**

| SUBJECT: | S112079 - Med Sci B Major Building Maintenance  
S112080 - Med Sci D Major Building Maintenance  
Shoulder-to-Shoulder 50% DD Review |
|---|---|
| ATTENDEES: | UCI: Amir Ansivvosseli, Fred Beckmiller, Bill Cowdell, Joseph Fleshman, Matt Gudorf  
PPC: Dale Mohr, John Mohr, Rich Zajic  
Subs: Ric Herber (Siemens)  
P&S: Shadi Abouseif, Aaron Chee, Nathan Ho, David Landsau, 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.

<table>
<thead>
<tr>
<th>Page</th>
<th>Discussion Item</th>
<th>Decision/Action</th>
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<tr>
<td>N/A</td>
<td>Heat load calculations for new heat exchangers sizing. P&amp;S Project Load Calculation Memorandum.</td>
<td>P&amp;S to adjust safety factor inlet/outlet temperatures. With corrections, UCI accepts project load calculations.</td>
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<tr>
<td>C-stack, M-002</td>
<td>Water control valves</td>
<td>Provide Fisher valves per spec.</td>
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<tr>
<td>C-stack, M-002</td>
<td>Water control valves</td>
<td>Steam generator 3” valve may be oversized. P&amp;S to investigate.</td>
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<tr>
<td>C-stack, M-002</td>
<td>Isolation valve</td>
<td>Butterfly valves are prohibited. P&amp;S to look at other options. No ductile iron valves.</td>
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<tr>
<td>N/A</td>
<td>HTW shutdown schedule</td>
<td>Joseph to send HTW shutdown schedule to PPC.</td>
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<tr>
<td>C-stack, M-402</td>
<td>HTW shutdown schedule</td>
<td>P&amp;S/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.</td>
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<tr>
<td>C-stack, M-404</td>
<td>HTW exchanger height</td>
<td>P&amp;S to look at different height exchanger configurations. No need to match existing regarding heat exchanger configuration.</td>
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<tr>
<td>C-stack, M-404</td>
<td>Steam generator</td>
<td>Concern on how to actually get the steam.</td>
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</table>
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

- 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

- Point allocation updated to reflect additional focus on construction impacts

<table>
<thead>
<tr>
<th>Medical Sciences C Scoring Criteria</th>
<th>Max Points</th>
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<tr>
<td>Executive Summary</td>
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<td>Building Mechanical System</td>
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<td>Roofing system design</td>
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<td>Energy savings</td>
<td>16</td>
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<td>Alternates, project enhancements and added value</td>
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<td>Mitigation of negative construction impacts, phasing and safety</td>
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<td>Project schedule</td>
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<td>Quality control and staffing plan</td>
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<td>Oral presentation</td>
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<td><strong>Total</strong></td>
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<td>Building Mechanical System</td>
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<td>Roofing system design</td>
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<td>Energy savings</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
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</table>

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

- 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

• Airflow and energy consumption was dramatically reduced through all three buildings through Smart Lab measures:
  – VAV conversion and upgrade of airflow control valves
  – Installation of Centralized Demand Control Ventilation
  – Reduced laboratory air volumes (drop ceilings in Med Sci C)
  – Optimization through static pressure resets

OVERALL SAVINGS OF 67,000 CFM

<table>
<thead>
<tr>
<th>Building</th>
<th>Exhaust HP Before</th>
<th>Exhaust HP After</th>
<th>Exhaust Flow Before</th>
<th>Exhaust Flow After</th>
<th>Airflow Reduction</th>
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<tbody>
<tr>
<td>Med Sci B</td>
<td>32.5 HP</td>
<td>30 HP @ 70%</td>
<td>34,004 CFM</td>
<td>~18,000 CFM</td>
<td>47%</td>
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<td>47 HP</td>
<td>30 HP @ 85%</td>
<td>54,816 CFM</td>
<td>~22,500 CFM</td>
<td>59%</td>
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<tr>
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<td>45.5 HP</td>
<td>50 HP @ 69%</td>
<td>43,532 CFM</td>
<td>~24,500 CFM</td>
<td>44%</td>
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</table>
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
Smart Lab - HVAC Optimization

- Static pressure resets are possible due to flow feedback from the DDC valves and airflow feedback.
- On January 15, we enabled resets from a Niagara supervisor:
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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