PACIFIC 2015
DECISION MATRIX - WINTER

ICEPLANT

WATER FLOW

Water Challenge Concept

Big Idea Incorporation throughout Building

STV Results

Constructability

Costs

Structural efficiency

Aesthetics

- DD+STEEL + VAV w/Reheat
- DD + Composite + Radiant
- Waterflow: Diagrid + B Bubbledeck/PT + UFAD
- Waterflow: Eccentricity Bracing + Bubbledeck/PT

Pacific 2015
EQUATION FOR SUCCESS

Design
Integration
EQUATION FOR SUCCESS

Design

Integration

Water
EQUATION FOR SUCCESS

Design Integration

Water Flow
EQUATION FOR SUCCESS

Design

Integration

Water

Flow
EQUATION FOR SUCCESS

Swinerton Water Challenge + DPR Latency Challenge

WATER + FLOW
TEAM PROCESS

Healthy Team Balance
Leave comfort zone & learn!

Responsiveness

Transparency

I & My → We & Our

http://www.innovatrium.org/about/who-we-are/
TEAM PROCESS: W→SPRING

Integration Flow

Google Drive
Facebook
WhatsApp
GoToMeeting by Citrix
Box
Dropbox
TERF
Slack
Streamlined
LATENCY

Streamlined

Coordination
Collaboration
Communication

Integrated in
One Place
Timeliness
carloma 10:15 AM
@dcohen174: I strongly recommend us getting together for the clarification of the diagrid system.

dcohen174 10:18 AM ★
@carloma: I completely agree, there are some details we need to fine tune. @adampekala @jiachengli @jiewu Are you available to meet right now?

adampekala 10:18 AM
I'm available @dcohen174 @carloma!

jiewu 10:18 AM
WORKS FOR ME!!

jiachengli 10:18 AM
Sounds good! @dcohen174 @carloma

GoToMeeting  BOT 10:19 AM
carloma has started a meeting for this channel. Click here to join
Renate Fruchter
April 11 at 2:11pm

Importing your latest and greatest 3D bldg BIM models into TERF:
If you use sketchup 6 make sure you are saving the file as Google Earth 4 format. Otherwise you can try saving as a collada .dae or wavefront .obj file and import that. Look forward to an informative walkthrough your TERF model Sunday, Monday, Wednesday, and Thursday with the respective teams. - have it as an agenda activity for your weekly meeting.
SITE CONTEXT
North - Slope
SITE CONTEXT

West - Lake/Forest
South - Sports Facilities
USGS Output: $S_{DS} = 2.184 \text{ g}$, $S_{D1} = 1.040 \text{ g}$

Seismic Zones (Ground Acceleration)

- Zone 0 = 0.0g
- Zone 1 = 0.075g
- Zone 2A = 0.15g
- Zone 2B = 0.20g
- Zone 3 = 0.30g
- Zone 4 = 0.40g

37.72°N, 122.48°W

AVERAGE MINIMUM AND MAXIMUM TEMPERATURE OVER THE YEAR

Average min and max temperatures in San Francisco, United States of America  Copyright © 2015 www.weather-and-climate.com
Humidity (due to fog):
- Daily average high = 84%
- Daily average low = 60%

Annual Rainfall:
- 68 days/year
- Total 23.64 in
LAKE VIEWS
TWISTING BUILDING

Pacific 2015
ARCHITECTURE EVOLUTION

2/20 Crit Session
4/10 Fishbowl
5/8 Final Presentation
ELEVATIONS S/E

EAST

SOUTH
SECTION 2

Integration

Flow

Water

Design
VERTICAL CIRCULATION

CIRCULATION

Design
Integration
Water
Flow
Big Idea: Water Flow

Challenges: Twisting Building, Expanding Floor, Earthquake

Solutions: Tilt Columns, Diagrid
STRUCTURE EVOLUTION

3/13 Winter Presentation

Diagrid + Regular Columns

BRBFs + Curved Columns

Decision Matrix
STRUCTURE EVOLUTION

4/10 Fishbowl

Diagrid + Light Shaft Columns

Diagrid + Tilt Columns

Combination - Efficient Structure
STRUCTURE EVOLUTION

5/8 Final Presentation

Diagrid + Tilt Columns (Perimeter & Atriums)
18'' Concrete columns in the perimeter & shafts
- 16'' PT bubbledeck slab
HSS10\times0.375 Diagrid in the perimeter
18" Tilt columns

HSS 10 × 0.375 Diagrid at perimeter
First Floor

18” Tilt columns

HSS 10 × 0.375 Diagrid at perimeter
SECONDS FLOOR

18" Tilt columns

HSS 10 × 0.375 Diagrid at perimeter
GRAVITY LOAD PATH

18” Circular Tilt Columns
16” PT Bubbledeck Slab
HSS10×0.375 Steel Beams for Diagrid
FLOOR SYSTEM

- Enable larger span - no beams
- Eliminate concrete weight
- Save cost and energy

From deflection: $P = 28 \text{ kip/ft}$
PT cable 0.6” (46.9kip) every 1.5ft
<table>
<thead>
<tr>
<th>Room Function Type</th>
<th>Total Area [sf]</th>
<th>Minimum LL [psf]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty Lounge</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>Faculty Offices</td>
<td>3600</td>
<td>50</td>
</tr>
<tr>
<td>Student Offices</td>
<td>1200</td>
<td>50</td>
</tr>
<tr>
<td>Classrooms</td>
<td>3600</td>
<td>40</td>
</tr>
<tr>
<td>Storage Rooms</td>
<td>1000</td>
<td>150</td>
</tr>
</tbody>
</table>
### LATERAL LOADS

<table>
<thead>
<tr>
<th>Lateral System</th>
<th>Base Shear</th>
<th>Overturning Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagrid</td>
<td>1442 kip</td>
<td>42300 kip-ft</td>
</tr>
</tbody>
</table>

![Design Response Spectrum](image)

\[
S_s = 2.184 \text{ g} \\
S_1 = 1.040 \text{ g}
\]
18” Circular tilt concrete columns at Light Shafts & Perimeter
16” Concrete Slab with 30% reduced weight
Slab simplified to 16”x48” beam - we’re on the safe side
HSS10 × 0.375 Steel brace at Diagrid
16” Concrete Slab with 30% reduced weight
Slab simplified to 16”x48” beam - we’re on the safe side
Maximum Deflection:
UY = -1.5 in
Maximum Interstory Drift Ratio: 0.13
Gravity Load

Maximum Deflection:
UY = -1.50 in
Maximum Deflection: \( UZ = -1.83 \text{ in} \)
Maximum Deflection: $UX = -1.91$ in
### Soil Profile

<table>
<thead>
<tr>
<th>Soil Condition</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGS Soil</td>
<td>Site Class C</td>
</tr>
<tr>
<td>Soil Type</td>
<td>Well sorted fine to medium sand</td>
</tr>
<tr>
<td>Bearing Capacity</td>
<td>3500 psf</td>
</tr>
<tr>
<td>Liquefaction Zone</td>
<td>No</td>
</tr>
<tr>
<td>Water Table</td>
<td>14 ft below grade</td>
</tr>
</tbody>
</table>

- **Soil Type**: Well sorted fine to medium sand
- **Bearing Capacity**: 3500 psf
- **Liquefaction Zone**: No
- **Water Table**: 14 ft below grade
Strip Footings at
- Light shafts tilt columns
  Depth = 1ft
  Width = 3ft

Spread Foundations at
- Perimeter tilt columns
  Depth = 1ft
  Width = 6ft x 6ft
Maximum forces:
M\text{max} = 220 \text{ kip ft}
F\text{max} = 88 \text{ kips}
DIAGRID CONNECTIONS

Inspirations

Connections between Diagrid

Our Model

Pacific 2015
Connections between Diagrid

Assembly

Front View

Side View
Diagrid Anchors

Inspirations

Diagrid to Slab Anchor

1" - 10" wedge anchor

16" Bubbledeck slab

Spiral reinforcement
Reinforcement:

- 8 No 10 Bars

- No 3 spiral @ 2"

Punching Prevention:

- Design Integration

- Ø = 46

- 5 x 1x HDB-25/355-2520
- 2 x 1x HDB-25/355-3780

- 117
- 26
- 26
- 26
- 26
- 13
STRUCTURE INTEGRATION

SE

Diagrid  Aesthetics

Diagrid  Constructibility

Structure  Floor Height

A

CM

MEP
- 18” Concrete columns in the perimeter & shafts
- 16” PT bubbledeck slab
- HSS $10 \times 0.375$ Diagrid in the perimeter
WINTER QUARTER DESIGN

Water Flow - Diagrid - UFAD
Underfloor Air Distribution

+ User flexibility and control

- Dirt/dust in floor plenum
- High cost (more material)
- Potential air leakage
REEVALUATION

Radiant

Floor Sandwich

Active Chilled Beams

Water Flow Big Idea
<table>
<thead>
<tr>
<th>Criteria</th>
<th>UFAD</th>
<th>Active Chilled Beams</th>
<th>Radiant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>🟢</td>
<td>🟥</td>
<td>🟢</td>
</tr>
<tr>
<td>Innovation</td>
<td>🟢</td>
<td>🟥</td>
<td>🟢</td>
</tr>
<tr>
<td>Ductwork (STV + Cost)</td>
<td>🟢</td>
<td>🟥</td>
<td>🟢</td>
</tr>
<tr>
<td>Airflow Requirements</td>
<td>🟥</td>
<td>🟥</td>
<td>🟢</td>
</tr>
<tr>
<td>Constructability</td>
<td>🟥</td>
<td>🟢</td>
<td>🟥</td>
</tr>
</tbody>
</table>
MEP FINAL DESIGN

Main Building Solution

VAV + Radiant Heating & Cooling

Auditorium Solution

Underfloor Air Distribution

Pacific 2015
Radiant + VAV Schematic

Embedded Radiant Slab Temperature Sensor (One per Radiant Zone)

VAV Box

Average Zone Air Temperature

Radiant Slab Setpoint Adjust

Radiant Manifold Valve Command (Open/Close)

Pulse Width Modulation (PWM) Controller (One per Radiant Zone)

Interior Wall

Courtesy of Integral Group
Radiant + VAV Setpoint Control

Minimum Required Ventilation (VAV Airflow)

- VAV Heat to 68F
- VAV Cool to 76F

Zone Air Temperature:
- 68F
- 72F
- 76F

Radiant Slab Setpoint:
- 73F
- 69F
- 65F

Comfort Band
UFAD Auditorium
MEP - TYPICAL LAYOUT

Radiant Heating and Cooling + VAV w/ reheat

Auditorium UFAD
MEP INTEGRATION

Transfer Return → Ceiling Height
Transfer Return → Material Costs
Radiant Layer → Protect Bubbledeck
MEP - TYPICAL LAYOUT

Auditorium UFAD

Radiant Heating and Cooling + VAV w/ reheat
1. Winter Presentation; very little detail
2. Fast-Track Project Development
3. Steel → Concrete Columns
4. Glass Curtain Wall → ETFE paneling
SUSTAINABLE TARGET VALUE

STV Water Target Attainment

- Mar I
- Mar II
- April I
- April II
- FINAL

1. Mar I
2. April I
3. April II
4. FINAL
1. Title 24 standards alone
2. Waterless Urinals
3. Water-Efficient Fixtures and Fittings
4. Greywater Recycling System & Fog Mesh
FINAL RESULTS

99% Carbon (kgCO2e)
1.2 E8 MJ

100% Water (kgH2O)
3.7 E6 kg

55% Energy (MJ)
1.2 E8 MJ
## TARGET VALUE DESIGN

<table>
<thead>
<tr>
<th></th>
<th>Estimated Value</th>
<th>Target Value</th>
<th>Value Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$10,060,000</td>
<td>$9,930,000</td>
<td>$(130,000)</td>
</tr>
</tbody>
</table>

### COST DISTRIBUTION

- **G Building Sitework** $250,000 (2%)
- **F Specialty Construction** $480,000 (5%)
- **E Equipment and Furnishing** $190,000 (2%)
- **D Services** $2,600,000 (26%)
- **H General Conditions** $1,780,000 (18%)
- **A Substructure** $140,000 (1%)
- **B Shell** $3,100,000 (31%)
- **C Interiors** $1,520,000 (15%)
TVD - TRACKING TARGET OVER TIME

ESTIMATE
DELTA

Target
RS Means Original
27-Feb
6-Mar
13-Mar
20-Mar
27-Mar
3-Apr
10-Apr
17-Apr
24-Apr
1-May
TARGET VALUE DESIGN

1. Early design
2. Intermediate design
3. Eliminated Steel Columns
4. Developed Estimate
5. Collaborative Challenges Solved
6. Developed Final Estimate
## Quotation Report

**Uponor Company** 5925 148th Street West Apple Valley, Minnesota 55124  
Prepared By: Scott Hellendrung Phone: (800) 321-4739 Ext. 4254 Fax: (952) 997-1731 Email: scott.hellendrung@uponor.com

### Tubing

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>A1210625</td>
<td>5/8&quot; Wirsbo hePEX, 400-ft. coil</td>
<td>$1,224.20</td>
</tr>
<tr>
<td>A1220625</td>
<td>5/8&quot; Wirsbo hePEX plus, 1,000 ft. coil</td>
<td>$7,648.75</td>
</tr>
<tr>
<td>A1250625</td>
<td>5/8&quot; Wirsbo hePEX plus, 300 ft. coil</td>
<td>$71,137.25</td>
</tr>
</tbody>
</table>

Subtotal: $80,010.20

Total Quote Price: $143,007.40
Reduction of concrete = Reduction of water

- 35% less in bubbledeck
- 60 less deliveries
CONSTRUCTION ERECTION

- Floor by floor
- Concrete columns
- Elevated floor slab
- n-1 for the diagrid
## CONSTRUCTION METHOD

<table>
<thead>
<tr>
<th>Method 1: ABC</th>
<th>Method 2: Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td></td>
</tr>
<tr>
<td>Time saving</td>
<td></td>
</tr>
<tr>
<td>Cost Efficiency</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td></td>
</tr>
</tbody>
</table>
## PREFAB OPTIONS

<table>
<thead>
<tr>
<th>Prefabrication</th>
<th>Modularisation</th>
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<tbody>
<tr>
<td>ETFE-panels (Fig. 1)</td>
<td>Bathrooms (Fig. 3)</td>
</tr>
<tr>
<td>Bubbledeck slabs</td>
<td></td>
</tr>
<tr>
<td>Joints of diagrid system (Fig. 2)</td>
<td></td>
</tr>
<tr>
<td>Staircase of atriums</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of ETFE-panels](image1)

![Diagram of bubbledeck slabs](image2)

![Diagram of joints of diagrid system](image3)

![Diagram of bathroom](image4)
<table>
<thead>
<tr>
<th>Benefits</th>
<th>Obstacles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved health and safety on site</td>
<td>Increase collaboration required</td>
</tr>
<tr>
<td>Time and cost savings</td>
<td>Closeness to site from factory</td>
</tr>
<tr>
<td>Error minimization</td>
<td></td>
</tr>
<tr>
<td>Quality improvement</td>
<td></td>
</tr>
</tbody>
</table>
1 Steel:
SCAFCO Steel

2 Concrete:
Bode Concrete

3 Equipment:
BlueLine Rental

4 Crane:
Coast Crane Company

5 ETFE:
Novum Structures

6 HVAC:
Critchfield Mechanical Inc.
Mobile crane (Liebherr)  Excavator (Cat)  Trailer (Equipment supplier)

Skid steer (Equipment supplier)  Compactor (Equipment supplier)
MAJOR GOALS:

1. HEALTH & SAFETY
2. REDUCE CONSTRUCTION SITE FOOTPRINT
3. FLOW OF DELIVERY
SITE LOGISTICS - 3D
## CRITICAL PATH

<table>
<thead>
<tr>
<th>CRITICAL PATH and MILESTONES</th>
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<tbody>
<tr>
<td><strong>2019</strong></td>
</tr>
<tr>
<td>Aug</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>Site mobilization</td>
</tr>
<tr>
<td>Substructure &amp; Foundation</td>
</tr>
<tr>
<td><strong>M1: FOUNDATION</strong></td>
</tr>
<tr>
<td>M1</td>
</tr>
<tr>
<td>External works &amp; Ground slab</td>
</tr>
<tr>
<td>Superstructure</td>
</tr>
<tr>
<td>Roofing</td>
</tr>
<tr>
<td>Building enclosure</td>
</tr>
<tr>
<td><strong>M2: BUILDING ENCLOSURE</strong></td>
</tr>
<tr>
<td>M2</td>
</tr>
<tr>
<td>Finishes</td>
</tr>
<tr>
<td><strong>M3: LAB INSTALLATION</strong></td>
</tr>
<tr>
<td>M3</td>
</tr>
<tr>
<td>Services</td>
</tr>
<tr>
<td><strong>M4: APPROVAL MEP-equipment</strong></td>
</tr>
<tr>
<td>M4</td>
</tr>
<tr>
<td>Equipment &amp; Furnishing</td>
</tr>
<tr>
<td>Landscaping</td>
</tr>
<tr>
<td><strong>M5: HANDING OVER</strong></td>
</tr>
<tr>
<td>M5</td>
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</tbody>
</table>

Pacific 2015
<table>
<thead>
<tr>
<th>ID</th>
<th>Task ID</th>
<th>Task Name</th>
<th>Duration/Start</th>
<th>Finish</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>Schedule</td>
<td>Schedule_Pacific</td>
<td>303 de 5 Aug</td>
<td>30 Sep</td>
</tr>
<tr>
<td>1</td>
<td>01</td>
<td>Set up the site</td>
<td>14 days 5 Aug</td>
<td>22 Aug</td>
</tr>
<tr>
<td>2</td>
<td>02</td>
<td>Mobilization of crane</td>
<td>3 days 5 Aug</td>
<td>7 Aug</td>
</tr>
<tr>
<td>3</td>
<td>03</td>
<td>Set up Scaffolding</td>
<td>4 days 8 Aug</td>
<td>13 Aug</td>
</tr>
<tr>
<td>4</td>
<td>04</td>
<td>Set up the site (others)</td>
<td>11 days 8 Aug</td>
<td>22 Aug</td>
</tr>
<tr>
<td>5</td>
<td>05</td>
<td>Substructure &amp; Foundation</td>
<td>20 days 26 Aug</td>
<td>20 Sep</td>
</tr>
<tr>
<td>6</td>
<td>06</td>
<td>Excavation</td>
<td>5 days 26 Aug</td>
<td>30 Aug</td>
</tr>
<tr>
<td>7</td>
<td>07</td>
<td>Reinforcement &amp; cast</td>
<td>7 days 2 Sep</td>
<td>10 Sep</td>
</tr>
<tr>
<td>8</td>
<td>08</td>
<td>Pour concrete &amp; cast</td>
<td>8 days 11 Sep</td>
<td>20 Sep</td>
</tr>
<tr>
<td>9</td>
<td>09</td>
<td>Milestone 1: Finishing Foundation</td>
<td>0 days 20 Sep</td>
<td>20 Sep</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>Include underground utilities</td>
<td>11 days 23 Sep</td>
<td>7 Oct</td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>External Works &amp; Ground Slab</td>
<td>24 days 8 Oct</td>
<td>8 Nov</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Shell (Superstructure)</td>
<td>99 days 12 Nov</td>
<td>27 Mar</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>Diagrid system basement floor</td>
<td>9 days 24 Dec</td>
<td>3 Jan</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>Diagrid system first floor</td>
<td>9 days 4 Feb</td>
<td>14 Feb</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>First floor: sequencing A, B and C</td>
<td>30 days 24 Dec</td>
<td>3 Feb</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>Diagrid system second floor</td>
<td>9 days 17 Mar</td>
<td>27 Mar</td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>Second floor: sequencing A, B and C</td>
<td>30 days 4 Feb</td>
<td>16 Mar</td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>Build up roof structure</td>
<td>9 days 30 Mar</td>
<td>9 Apr</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>Mechanical roof equipment</td>
<td>7 days 10 Apr</td>
<td>20 Apr</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>Fog mash panel installation</td>
<td>5 days 21 Apr</td>
<td>27 Apr</td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td>Roof completion</td>
<td>0 days 27 Apr</td>
<td>27 Apr</td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>Milestone 2: Building enclosure</td>
<td>75 days 4 Feb</td>
<td>18 May</td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>Mechanical installations - basement floor</td>
<td>10 days 4 Feb</td>
<td>17 Feb</td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>Mechanical installations - first floor</td>
<td>10 days 10 Mar</td>
<td>23 Mar</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>Mechanical installations - second floor</td>
<td>10 days 14 Apr</td>
<td>27 Apr</td>
</tr>
<tr>
<td>26</td>
<td>26</td>
<td>Basement floor ETFE-panels</td>
<td>25 days 4 Feb</td>
<td>9 Mar</td>
</tr>
<tr>
<td>27</td>
<td>27</td>
<td>First floor ETFE-panels</td>
<td>25 days 10 Mar</td>
<td>13 Apr</td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td>Second floor ETFE-panels</td>
<td>25 days 14 Apr</td>
<td>18 May</td>
</tr>
<tr>
<td>29</td>
<td>29</td>
<td>Finishes</td>
<td>90 days 14 Apr</td>
<td>17 Aug</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>Basement floor: Drywall framing &amp; painting</td>
<td>20 days 14 Apr</td>
<td>11 May</td>
</tr>
<tr>
<td>31</td>
<td>31</td>
<td>Basement floor: Mechanical finishes</td>
<td>10 days 12 May</td>
<td>25 May</td>
</tr>
<tr>
<td>32</td>
<td>32</td>
<td>First floor Drywall framing &amp; painting</td>
<td>20 days 26 May</td>
<td>22 Jun</td>
</tr>
<tr>
<td>33</td>
<td>33</td>
<td>First floor: Mechanical finishes</td>
<td>10 days 23 Jun</td>
<td>6 Jul</td>
</tr>
<tr>
<td>34</td>
<td>34</td>
<td>Milestone 3: Lab Installations begin</td>
<td>0 days 1 May</td>
<td>1 May</td>
</tr>
<tr>
<td>35</td>
<td>35</td>
<td>Second Floor: Drywall framing &amp; painting</td>
<td>20 days 7 Jul</td>
<td>3 Aug</td>
</tr>
<tr>
<td>36</td>
<td>36</td>
<td>Second floor: Mechanical finishes</td>
<td>10 days 4 Aug</td>
<td>17 Aug</td>
</tr>
<tr>
<td>37</td>
<td>37</td>
<td>Milestone 4: Approval of MEP-equipment</td>
<td>0 days 17 Aug</td>
<td>17 Aug</td>
</tr>
<tr>
<td>38</td>
<td>38</td>
<td>Equipment and Furnishing</td>
<td>17 days 18 Aug</td>
<td>9 Sep</td>
</tr>
<tr>
<td>39</td>
<td>39</td>
<td>Landscaping</td>
<td>17 days 18 Aug</td>
<td>9 Sep</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>Site work</td>
<td>6 days 1 Sep</td>
<td>8 Sep</td>
</tr>
<tr>
<td>41</td>
<td>41</td>
<td>Closing Processes</td>
<td>15 days 10 Sep</td>
<td>30 Sep</td>
</tr>
<tr>
<td>42</td>
<td>42</td>
<td>Final Milestone: Project COMPLETE</td>
<td>0 days 30 Sep</td>
<td>30 Sep</td>
</tr>
</tbody>
</table>
Collaborative Challenge I:

FACADE
CHALLENGE I - FACADE
CHALLENGE I - FACADE

A VIEWS

TRANSPARENCY

LIGHT
CHALLENGE I - FACADE

SE

LIGHTWEIGHT

DIAGRID-FACADE CONNECTION
CHALLENGE I - FACADE

- MEP
- INSULATION
- OPERABILITY
- SHADING
CHALLENGE I - FACADE

CM

CONSISTENT PANEL SIZE

SIMPLE INSTALLATION

PREFAB
CHALLENGE I - FACADE

GLASS FACADE
CHALLENGE I - FACADE

GLASS VS. ETFE

Arch
- Various shapes
- Different light transmittance
- Can be lighted up

SE
- Light - small dead load
- Good response to seismic load

MEP
- Sustainable material
- When pressurized with Argon u-value is really small

CMs
- Simple to construct
- Cheaper / cheaper to construct as well
- Suppliers?
ETFE CONCEPT - PILLOW FACADE

Bulky pillows, rhomboid driven

Pacific 2015
ETFE CONCEPT - PILLOW FACADE

+ more cost effective
+ detached from diagrid
+ fewer thermal bridges

- hard to prefabricate
- different shapes

Still not a perfect solution...
CHALLENGE I - FACADE
CHALLENGE I - FACADE

Three layers:
Diagrid/ETFE/Columns

Every discipline satisfied.

Challenge solved.
Collaborative Challenge II: ATRIUM
CHALLENGE II - ATRIUM

Design
Water
Flow

Pacific 2015
CHALLENGE II - ATRIUM

- SE
- CM
- MEP

Design
Water
Integration
Flow
CHALLENGE II - ATRIUM

Floor Plan Arrangement

Light
Gravity Load
CHALLENGE II - ATRIUM

MEP
CHALLENGE II - ATRIUM

CM

Constructability

Minimize cost
CHALLENGE II - ATRIUM

Tilted Columns vs. Changes to Floor Plan

Natural Ventilation
Water in California

In the News

Water Recycling

Water + Energy

Drought Update
The fog mesh is used at Water Flow to make up the additional non-potable water uses, such as the flushing of toilets. Located on the roof, in total, they are estimated to save the building 324,000 gallons per year. This is much better than the rainwater collection potential, as there are only 24 inches of rain per year in the city, but 108 days of fog and generally very high humidity. This brilliant material is based on the behavior of the Namib beetle, which collects water to sustain itself in the middle of the desert. The most recent type of this material was developed at MIT.

Quick Facts:
★ Up to .6 gal/sf/day collected
★ Costs about $15,000
★ Total of 324,000 gal/yr potential
Waterless Urinals

Pervious Pavement

Efficient Fixtures

Rainwater Harvesting

Bottle Fill Stations

Greywater Recycling

Watersense

Fog Mesh

Watersense

Watersense
The greywater recycling approach for Water Flow is to use the SLOAN AQUUS toilet system, which provides instantaneous greywater recycling for toilet flushing. This low-cost option is perfect for the Water Flow SFSU campus building as temporary measure for greywater recycling. The city of San Francisco requires by law that all new buildings have hookups for reclaimed water infrastructure, which should come soon to the SFSU campus!
Today in Water Flow

Total Usage:  gal

- Sinks
- Toilets
- HVAC

Collection:  gal

- Fog Mesh
- Rain Water
- Greywater
EQUATION FOR SUCCESS

Swinerton Water Challenge + DPR Latency Challenge

WATER + FLOW
EQUATION FOR SUCCESS

“Water Flow”

Our Building
Many Thanks to:

Renate Fruchter

Our owners:
 Karolina Ostrowska, Kourosh Salehzadeh, Michael Seaman, Mike Miller

Mentors:

Tak, Thanks, Dziękuję, Danke, Tack, Gracias, 谢谢!
Thank you for your attention!
“Stick to the grid!!!”

“No one is done until everyone is done”

“Even the smallest change from your point of view can impact all members of the team!”

“Be Confident”

“If you really want something, you will find a way. If not, you will find the excuse”

“Work as a team, not just as a specific discipline!!! XD”

“Lessons learned: Effective mechanisms for successful distributed collaboration!”