Collaborative Design and Scoping

CH2M’s practice of Target Value Design
Purpose of the Collaborative Design and Scoping Process

How does the CDS relate to Target Value Delivery?

CDS outcome: the integrated team’s promise to the Owner

Flow of the CDS

Scope development why and how

Your questions
Takeaways

In CDS the integrated team develops their offer to the Owner, with the Owner:

- CDS creates flow in decisionmaking of what will be built and how it will be built.
- CDS sets the basis for subsequent final design and construction production control.

CDS is a means to learn early if the project can be viably built with available funds:

- Scope activities are the foundation for target costing AND for an integrated, flow-based project management system.
- Shared understanding, ambition, and trust are essential outcomes of the CDS.
Purpose of Collaborative Design and Scoping (CDS)
An integrated project delivery approach eliminates unnecessary, iterative loops.

- **Select A/E**
  - Programming
    - Note potential for delay
    - Fit budget?
      - yes
      - no
      - yes
      - no
  - Estimation (not firm)
    - Fit budget?
      - yes
      - no
    - Detailed design
      - Contractor Bidding
        - Semi-firm cost
      - Semi-firm cost
        - Begin change control process

**Traditional approach**
- Select A/E
- Prequalify and select trade contractors
- Collaborative Design Session: Establish scope list
- Contractor pricing
- Begin change control
- Price validation and negotiation
- Detailed design
- Firm facility cost

**Integrated approach**
- Select A/E
- Programming
  - Note potential for delay
  - Fit budget?
    - yes
    - no
    - yes
    - no
  - Estimation (not firm)
    - Fit budget?
      - yes
      - no
    - Detailed design
      - Contractor Bidding
        - Semi-firm cost
      - Semi-firm cost
        - Begin change control process

- Firm cost is identified much sooner and is much more reliable.

- Integrated approaches can offer substantially reduced risk due to much better understanding of scope and owner requirements.
Alignment drifts and integration errors

Integration Errors
- Add risk and contingency
- Create rework that becomes more disruptive the longer it remains unrecognized
- Disrupt the flow of work
- Create misunderstanding & unnecessary conflict
- Represent the root cause of many project issues
  - And the best place to focus remedies

“It ain’t what you don’t know that gets you into trouble. It’s what you know for sure that just ain’t so.”
— Mark Twain
A project is a promise

Request: “Can you help me?”
“We’d love to!”

Declaration: “We will...!”
Owner’s vision and ambition.

Challenge: “I have limited time and funds or this won’t fly.”
“Sounds like fun. We’re in.”

Innovate: “Let’s explore how we might create what you need.” Curiosity.

Offer: “How’s this?”
Negotiate. Further innovate.

Conduct:
“Thank you! Let’s innovate together in the future.”

Conditions of Satisfaction

Commit: “I promise I will.”

Promise: “We will do it!”
Set targets. Ambition. Trust.

Deliver: “We can only succeed together!”
Ongoing learning and innovation.

Declare complete:
“How are we doing?”
Ongoing assurance

Declare satisfaction: “Thank you.”

Negotiate. Further innovate.

CH2M Confidential Do not reproduce without permission
A project is a promise.

1. **Request**
   - "Will you?"

2. **Commit**
   - "I promise I will."

3. **Declare Complete**
   - "I’m done."

4. **Declare Satisfaction**
   - "Thank you."

**Conditions of Satisfaction**

- Preparation
- Negotiation & clarification
- Assurance
- Performance
Flow of the CDS

1. Develop Owner’s program, CDS make-ready
2. Conceptual cost-based decision-making
3. Scope development and master scheduling
4. Develop target cost estimate
5. Negotiate target values
6. Final design to target values
Flow of the CDS: getting ready

• Owner’s baseline program defined
• Value-based team selection complete
• Owner is prepared to speak to their business needs, affordability constraints, and values
• Logistics coordinated.
• Reference materials on hand.

• Participants’ commitment to engage fully
  – Owner project stakeholders prepared to make timely, reliable decisions
  – Trade partners' conceptual cost estimators and construction means-and-methods knowledge
  – Key vendors and suppliers
  – A&E participants secured
Flow of the CDS: **assemble in Big Room**

- Assemble key stakeholders and performers in one place; co-locate in a “Big Room”
- Conduct the CDS as a whole team in a concentrated time frame
Flow of the CDS: **uncover value**

- What does mean for the client’s future?
- How will the project enhance the owner’s ability to achieve more of the organization’s goal?
- How does the client create value for their customers?
- How does the customer make money?
- What must be ‘true’ when the project is done?
Flow of the CDS: understand the current condition

- Develop major issues, opportunities, decisions needed
- Site visits and field walks
- Fully comprehend field conditions in all decision-making
Flow of the CDS: generate options

• Generate multiple, competing alternatives

• “Three options: two less $ than the first”
Flow of the CDS:

CDS

‘working style’

[Diagram: Flowchart showing the process of Design, Conceptually Together, Look Together, Verify CoS, Decide as a Team, Draw + Model + Analyze]
Flow of the CDS: create flow of decisionmaking

• Prioritize decisions and conduct a series of work sessions (iterations)
• Teams self-form, members choosing where they can add the most value
• Breakout team chooses a leader to keep the session on focused on producing iteration deliverables
Flow of the CDS: synchronize frequently

• Follow each session with a check-in to keep the entire team coordinated

• Use flip charts, white boards, and ‘sketchy BIM’ to develop work session deliverables

• Record decisions, risks, uncertainties, and assumptions in real time
Flow of the CDS – develop and coordinate scope

- Kanban Method to create flow in scoping and estimating
- Develop, refine, and validate scope list as a team
- Pull-plan project master schedule
- Set the target cost for completing the project
Flow of the CDS: learn and improve every day

• Learn and improve continually, incessantly, relentlessly

• Tightly couple learning with action
Expect results
CDS track record – since 1997

• Project costs are lower – sometimes much lower
  – Eliminating unneeded scope and unnecessary requirements is the key to lowering costs
  – Creating reliable workflow in the field is the key to improving labor productivity
  – Numerous examples of breakthrough cost reductions

• Cost certainty is much better – and available much sooner
  – Change order rates sharply reduced – including one retrofit delivered with $0 in changes to Owner
  – 90%+ reductions in RFI s and disruptive scope gaps have been common

• Significant schedule improvements are available
  – Duration of subsequent detailed design can often be substantially reduced
  – Long lead items can be ordered earlier, and more accurately
  – Sequencing is more refined and streamlined

• Participants are much more engaged and satisfied
  – Shared understanding is the foundation for future action together
Example CDS deliverables
Basis of estimate (BoE) design deliverables
Basis of estimate (BoE) **design deliverables**

**Option 2: Routing concept**

- **Too congested to run through this area**
- **Create chase in this area**
- **Route above walkway in Mod 1**
- **Create pipe chase in stairwell**
- **Route out to level 1 perimeter room**
- **Create lid over stairwell**
- **Route over then south and up to level 2**

**Scope overview: 3 location options**

- **Option 1**
- **Option 2**
- **Option 3**
Master schedule **pull plan**

- Demonstrate the feasibility of completing the work within available time
- Develop and display execution strategies
- Determine work packaging and when long lead items will be needed
- Identify milestones important to client or stakeholders
- Master schedule specifies phases, their durations, and target completion dates
Scope development
Why and how
The scope list: creating a “common currency” for project understanding

• Comprehensive list of work (scope activities) to complete the facility

• Scope list line items are unique to:
  – Specific performer (Scope Owner)
  – System
  – Design Discipline
  – Area

• Highly flexible, yet common, baseline for major information systems

• Database platform, or spreadsheet guides the essential conversations
Lean Work Breakdown Structure
scope activities and fundamental scope blocks

** separate FSB
**Risks and Uncertainties**

1. Risk/Uncertainty: Might be able to use surplus unit from Timbucktwo

**Scope Activities**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Install</td>
<td>New 40 Ton MAU</td>
<td>Top Mechanical</td>
<td>Mechanical</td>
<td>HVAC</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Install</td>
<td>Power feed from Panel to MAU</td>
<td>Sparky's Electrical</td>
<td>Electrical</td>
<td>Electrical - Power distribution</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Install</td>
<td>Low voltage Alarm wiring and smoke detection</td>
<td>Sparky's Electrical</td>
<td>Electrical</td>
<td>LSS</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Furnish &amp; Install</td>
<td>20' x 40' concrete pad to set MAU</td>
<td>ACME Concrete</td>
<td>Structural</td>
<td>utility pads</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Furnish &amp; Install</td>
<td>Supply and Return duct work from unit to Main headers</td>
<td>Top Mechanical</td>
<td>Mechanical</td>
<td>HVAC</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Install</td>
<td>Chilled water Supply and return</td>
<td>Top Mechanical</td>
<td>Mechanical</td>
<td>HVAC</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Install</td>
<td>New &amp; Screen wall for MAU</td>
<td>Wally's Walls and Exteriors</td>
<td>Architectural</td>
<td>1</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Furnish</td>
<td>New 40 Ton MAU</td>
<td>OUNVME corp</td>
<td>Mechanical</td>
<td>HVAC</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Install</td>
<td>new condensate drain</td>
<td>Top Mechanical</td>
<td>Mechanical</td>
<td>4</td>
<td>In Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Scope Activity Information

**Scope Activity ID#** 2  
**Action** Install  
**Scope Owner (Company)** Sparky's Electrical  
**Design Discipline** Electrical -  
**Secondary System** Electrical- Power distribution -  
**Detailed Factory Coordination?** No  

**Summary** Power feed from Panel to MAU  
**Construction Scope Status** In  
**Design Scope Status** In  
**Secondary System Description**  
**PPMOF**  
**Assumptions and Notes** Included VSD and main disconnect  
**Safety, Constructability & Coord with Other Scope**  

**Scope Activity Details Information**

<table>
<thead>
<tr>
<th>New Scope activity detail</th>
<th>More</th>
<th>1 Scope Activity Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope Detail ID#</strong></td>
<td>Description *</td>
<td>Design Discipline</td>
</tr>
<tr>
<td>1</td>
<td>1&quot; conduit from Panel A to MAU 1</td>
<td>Electrical</td>
</tr>
</tbody>
</table>
# Scope Activities

## Edit Power feed from Panel to MAU

### Design Deliverables (new/under const.)

Use the "Create Deliverable" button to create a new deliverable. Use the table below to link existing deliverables to this scope item.

<table>
<thead>
<tr>
<th>Deliverable Description</th>
<th>Deliverable Type</th>
<th>Owner/Spec Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Progress & Sign-Off

- **Designer Buy-Off**
  - Confirming User: 
  - Buy-Off Date: 
- **Scope Understood**
  - Confirming User: 
  - Buy-Off Date: 
- **Able to Quantify for Estimating**
  - Confirming User: 
  - Buy-Off Date: 

### Expected Cost and Effort

<table>
<thead>
<tr>
<th>Baseline Target Cost (Original)</th>
<th>Baseline Target M-Hrs (Original)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline Target Cost (Updated)</th>
<th>Baseline Target M-Hrs (Updated)</th>
</tr>
</thead>
</table>
## Related CDS & FSE

<table>
<thead>
<tr>
<th>CDS Name</th>
<th>CDS Status</th>
<th>FSE</th>
<th>FSE Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Build Out</td>
<td>Active</td>
<td>Dry Filtration Units &amp; Fans, Condenser &gt; DFU Ducting</td>
<td>7. Refreshed FSE Reviewed By Group</td>
</tr>
</tbody>
</table>

## Risk / Uncertainty Details

<table>
<thead>
<tr>
<th>Risk / Uncertainty</th>
<th>Potential Impact</th>
<th>Resolution</th>
<th>Closed?</th>
<th>Originator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic technology, flow rate and vendor are uncertain as of the time of CDS, Production trials are underway.</td>
<td>Utility requirements for each unit could increase, including duct size</td>
<td><a href="#">Resolution Text</a></td>
<td><a href="#">Closed Status</a></td>
<td>Stickland, John</td>
</tr>
</tbody>
</table>
Example decision for an FSB

### Related CDS & FSB

<table>
<thead>
<tr>
<th>CDS Name</th>
<th>CDS Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package 1</td>
<td>Active</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FSB</th>
<th>FSB Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>603-LV-600V_UNITSUBSTATION</td>
<td>3. Scope Activities Defined &amp; Understood</td>
</tr>
</tbody>
</table>

### Project decision Details

#### Decision Name

Demo Process Piping

#### Relevant Issues or Concerns

There is process piping in the overhead clearance zone for where the new unit substation will sit. All piping/supports below 10'-0" between grid lines AR-13 to AR-16 / AT-13 to AT-16 must be removed to facilitate installation of new electrical equipment.

#### Evaluation

- The piping that must be removed is the piping sub mains for UN2, OFA, SWS, UPWS and UPWR which serve the PCD Room. When this piping is removed, all of these services will be dead for the whole room. Should all this piping be removed in the whole room, or only the piping that interferes with the immediate installation of the new Unit Substation gear?

### Status

**Done**

### Trend Log Prompts

Cost Implications

### Alternatives Considered

1) Remove all the piping in the whole PCD Room that is below 10'-0" AFF, including the (8 each) safety showers in this room and all UPW piping attached to walls.
2) Remove only the piping that interferes with installation of the new Unit Substation equipment.

### Decision

Alternate #2: Remove only the piping that interferes with the new Unit Substation equipment. There will be an additional scope of work at a later date for removing all the rest of the piping in this room (which will eventually be returned to general Subfab space by removal of all walls).

### Decision Recorded By

### Decision Date
Scope activities – ‘the scope list’

Integrated platform for project operations
Advantages and caveats

Advantages to FSB and scope activity development

• Scope of Project Promise is clearly defined
• Cross-trade coordination is “built in”
• Scope gaps & jurisdictional issues systematically eliminated
• Highly flexible & comprehensive “multi-variate” Work Breakdown Structure
  – “Common currency” for project management systems
  – Baseline for flow-based design and construction is created

Caveats

• CDS is a team sport
  – Value comes from the interaction between actual performers
  – Delegates and brokers provide limited benefit
• It’s not about the database
• CDS reaches to the end of the project
  – Think beyond establishing the Target Cost
  – CDS is much more than a design tool
“There are four purposes of improvement:

Easier, Better, Faster, and Cheaper

These four goals appear in the order of priority.”

—Shigeo Shingo