DOE Front End Planning (FEP) and Project Definition Rating Index (PDRI)

Matthew “Zac” West
HQ DOE

G. Edward Gibson, Jr
Professor, Arizona State University
In 2017, I asked you....

what if I could?
what if...

6 to 25% average cost savings through effective front end planning

6 to 39% average schedule savings through effective front end planning
what if...

3 - 10:1

average return through effective front end planning
what if...

I could bring 1000s of years of industry and government experience with me on each project?
par·a·digm

"a typical example or pattern of something; a pattern or model”
–Oxford English Dictionary

“the set of practices that define a scientific discipline at any particular period of time”
–Thomas Kuhn
big ideas
build the right project
scope
the right
things
set the stage for successful execution
1.5 - 5%

average cost of effective front end planning depending on type and complexity
...defined as the process of developing sufficient strategic information with which owners [Government] can address risk and make decisions to commit resources in order to maximize the potential for a successful project.
April 2008 Root Cause Analysis Contract and Project Management

Number one issue from 143 identified:

- “DOE often does not complete front-end planning (project requirements definition) to an appropriate level before establishing project baselines.
  - Insufficient number of personnel
  - Lack of personnel with the appropriate Skills
  - Inadequate time dedicated to front-end planning
  - Reliance on the management and operating (M&O) contractor
  - Lack of defined benchmarks
  - Lack of effective interdepartmental integration
  - Insufficient planning budget resources”
Planning is still not new...

The plans of the diligent lead to profit as surely as haste leads to poverty

--Proverbs 21:5
27 years of front end planning (FEP) research
Planning for a major baseline change needs good front end planning too!
Construction Industry Institute...

front end planning gated process

0 Feasibility 1 Concept 2 Detailed Scope 3 Design and Construction

Generally
30% Design Effort
Complete
Where PDRI tools benefit the most...
examples
Replace and update surface infrastructure to extend facility life of SPR sites for 25 years. $1 billion total project cost estimate

- front end planning process was performed jointly by the government and contractor as an IPT
- conducted before & after CD-1
- added second dimension
- accurate FEP
- mature scope definition
- challenge with change in strategic objectives
- gap list used to generate actions

### Quadrant Cost Change Orders

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>Cost*</th>
<th>Change Orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM/HA</td>
<td>2% Below</td>
<td>4% of budget</td>
</tr>
<tr>
<td>HM/LA</td>
<td>7% Above</td>
<td>9% of budget</td>
</tr>
<tr>
<td>LM/LA</td>
<td>22% Above</td>
<td>16% of budget</td>
</tr>
<tr>
<td>LM/HA</td>
<td>No Projects Observed</td>
<td></td>
</tr>
</tbody>
</table>

*C at completion as compared to total project cost established at FEP 3

Legend:
- High Maturity = HM
- Low Maturity = LM
- High Accuracy = HA
- Low Accuracy = LA

The FEED targets are to achieve accuracy greater than 76% and maturity greater than 80%. Research by the Construction Industry Institute identifies that organizations which reach these levels in the FEED component of Front End Planning, the organization sets the project up to succeed in terms of meeting scope, cost and schedule at completion.

FEED MATERs is a Front End Planning Tool developed by Construction Industry Institute
NA – Tritium Production Capability

Establish new and update current facilities and process equipment to provide tritium to customers. Total project cost estimate:

- Front end planning process was performed jointly by the government and contractors as an IPT
- Conducted at CD-1
- Added second dimension
- Accurate FEP
- Mature scope definition
- Gap list to generate actions
NA – Tritium Production Capability cont.
### Assessment Gaps

(Maturity - Default Set to Definition Levels 3, 4, and 5; Accuracy - Default Set to Definition Levels "Meets Some", "Needs Improvement"

**FILTER - Use this filter option to adjust to your needs**

<table>
<thead>
<tr>
<th>Element</th>
<th>Level</th>
<th>Comment</th>
<th>Minimum</th>
<th>Score</th>
<th>Maximum</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>D5. Lead/Discipline Scope of Work</td>
<td>3</td>
<td>WBS will be modified between CD-1 and CD-2/3.</td>
<td>1</td>
<td>7</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>E2. Design &amp; Material Alternatives - Considered/Relected</td>
<td>3</td>
<td>Open issues on constructability for various facilities (all but building 1).</td>
<td>0</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>F2. Survey &amp; Soil Tests</td>
<td>4</td>
<td>Will update during preliminary design.</td>
<td>1</td>
<td>10</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>F4. Permit requirements</td>
<td>3</td>
<td>Stack and diesel and construction permitting will be required.</td>
<td>1</td>
<td>5</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
LMLA example project

Refinery upgrade. Baseline of $135 million, private owner, renovation.

• LMLA project; maturity score of 75 and accuracy score of 44
• 26% over baseline budget
• 20% behind schedule

• **Maturity issues**: client specs, fire protection studies, no pipe stress analysis, poor equipment procurement management, waste disposal, instrument and electrical design non-existent in planning and so forth

• **Accuracy issues**: key stakeholders not involved in FEP; lack of commitment of planning personnel; team turnover; leadership team’s resistance to change during planning; poor leadership
Low Activity Waste Pretreatment System (LAWPS)

• LAWPS is front end system to pretreat waste prior to delivery to the LAW vitrification facility

• LAWPS IPR Feb 2015 for approval of CD-1:
  o STEP 1: Project Contractor, WRPS is asked to perform a self assessment prior to review
  o STEP 2: ORP asked to perform an assessment
  o STEP 3: IPR Team reviewed the WRPS self assessment and ORP assessment, then performed their own assessment

➤ EM uses PDRI as a tool to identify project gaps or potential risks, more so than a numerical score
### DOE G413.3-12 APPENDIX D PDRI Nuclear Construction CD-1 - ORP Low Activity Waste Pretreatment System Project IPR

<table>
<thead>
<tr>
<th>Element</th>
<th>Designation</th>
<th>Weighting Factor</th>
<th>Target Score</th>
<th>WRPS Self Assessment</th>
<th>ORP Self Assessment</th>
<th>IPR Team - Initial Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maturity Value Score</td>
<td>Maturity Value Score</td>
<td>Maturity Value Score</td>
</tr>
<tr>
<td>Conceptual Design (CD-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1 Cost Estimate</td>
<td>H</td>
<td>7.5</td>
<td>2.0</td>
<td>15.0</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Conceptual Design Cost Estimate is Class 4, level of project definition is estimated at 25% - see RPP-RPT-57121, Low Activity Waste Pretreatment System (T5L01) Conceptual Design Cost Estimate and Schedule</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scored Values For CD-1 Project Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maturity Value</td>
<td>Score</td>
<td>WRPS Comments</td>
<td>Maturity Value</td>
<td>Score</td>
<td>ORP Project POC</td>
<td>ORP Comments</td>
</tr>
<tr>
<td>A1 Cost Estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 Cost Risk Contingency Analysis</td>
<td>P</td>
<td>3.0</td>
<td>2.0</td>
<td>6.0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>RPP-PLAN-57024, Low Activity Waste Pretreatment System (Project T5L01): Risk Analysis and Impact Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**A. COST**

At CD-1 (conceptual design) a Class 3 cost estimate is required. The contractor's level of project definition should qualify the estimate as Class 3, but their documentation states, "Class 4". PDRI suggested maturity value for a Class 4 estimate is 1, and ORP has selected this more conservative value.

Cost, Schedule & Risk Team

The cost estimate reflects that it is submitted as a an AACE class 4 estimate. The PDRI criteria for CD-1 requires a class 3 estimate. ORP continues to consider it a class 4. The IPR team evaluation concludes that it is a class 3 estimate.
how to improve
number of front end planning decision support tools at DOE
CII Suite of Best Practices Management Tools Available
CII PDRI/FEED MATRS Suite of Tools

- Building 1999
- Infrastructure 2010
- Small Infrastructure 2016
- Industrial 1996
- Small Industrial 2015
- FEED MATRS 2017
>7,000

years of industry experience in the individuals involved in development of the CII PDRI/FEED MATRS tools
In-House PDRI/FEED MATRS Suite of Tools

CII Industrial 1996

- EM General Construction
- EM D&D
- EM Environmental Restoration

DOE/NNSA PDRI for Traditional Nuclear and Non-Nuclear Construction Projects 2009

Released 2000 – 2016 Update Effort Started

Tool not being updated at this time
par·a·digm

"a typical example or pattern of something; a pattern or model”
–Oxford English Dictionary

“the set of practices that define a scientific discipline at any particular period of time”
–Thomas Kuhn
As mentioned last year...

in the 2010’s

our projects are different; we don’t have the time or resources to put into effective front end planning; we’ll fix it on the fly

Result: Bad projects and broken careers are a norm
Today?

effective front end planning processes are still critical, but it is all about people and execution.

Result: government (owners), designers and contractors need to foster and invest in front end planning capabilities
Why?
What?
When?
How?
What we have done and what are we doing...

• **Update Guide** – IPT formed in 2017, IPT Charter in place and working to complete this summer – Focus on FEP and tools

• **PMCDP** – FEP / FEP tools pilot course conducted with course moving into development for deskside delivery

• **Project Leadership Institute** includes a course on the use of FEP Tools taught by Edd Gibson during Session 3.

• **PDRI Certified Facilitators** – DOE programs and PM working to increase certified facilitators to support PDRI use at DOE – Next classes for facilitators are in November 2018 at Arizona State University, Del E. Webb School of Construction – [https://osha.asu.edu/https/osha.asu.edu/page-1860936/](https://osha.asu.edu/https/osha.asu.edu/page-1860936/). Course also available for groups.
27 years of front end planning (FEP) research

See you at the social this evening for questions!