March 26, 2003

Calpine’s Innovative Approach to EPC Schedule Development
Assessing Business Challenges

Early 1999 Program
- 12 Projects
- $350 - $500 mm each
- 26 months in duration

Calpine Construct vs. EPC

The executed contracts contained language directing the contracted parties to integrate their project schedules.
Assessing Business Challenges

This contractual requirement was initially considered adequate to protect the owners interest.

Early Schedule Complications
- Separate schedules
- Little if any, integration
- Duplications, missing scope

Without strict guidelines and standards, it became readily apparent that no true schedule integration could occur.
Assessing Business Challenges

3rd Quarter 1999 program expansion
- 50 additional projects
- Over a year period
- Capital program exceeding 20 billion

With the expansion of the program it was now more important to give the parties strict guidelines and standards to “integrate” their schedules.

Many issues had to be considered, in order to structure an effective program….and quick.
Assessing Business Challenges

Raising the Bar for Project Controls

Adding TRUE VALUE

Obtaining Management Support, internally as well as externally

The ability to execute
Assessing Business Challenge

Creation of “CSPASMS”

Considerations included:
- Staffing
- Rate of Execution
- Areas of Risk for the type of work

Really it was nothing more than a low fat version of standard Cost & Schedule Control Systems Criteria, much like what Uncle Sam likes.....
Assessing Business Challenges

Schedule Objectives

- Effective
- Accurate
- Timely
- Reasonable
- Informative
- Independent
Assessing Business Challenges

What we heard internally

– We’re not going there........
– this is a Lump Sum world - we don’t need earned value....
– The contractors and engineers won’t let us get that far into their business
– Way too complicated - let’s not make a science project out of it
– We’ve never done it that way before

Once we secured Internal Management approval and committed support... it was time to implement
Assessing Business Challenges

We sent out proposed contract language to our engineering and construction partners and solicited feedback...
Assessing Business Challenges

Response from Contractors and Engineers ranged from “thank you we needed a guideline” to……
- Outright refusal
- Change orders for anywhere from $80k to $350k
- The old “It’s a Lump Sum…”
- Too complicated
- We’ve never done it this way before
- We use internal systems to do this
Assessing Business Challenges

The road trip to sell to external management
Assessing Business Challenges

Finally we got them to try
- Some willingly
- Some reluctantly
- Others told to sign up or move on
Assessing Business Challenges

They continued to fail

- Struggled in the details
  - good civil works
  - Weak to OK mechanical
  - Miserable electrical / I&C
  - Missing or wrong scope

- No clear transition from Area to System’s

- Integration from E to C lacked P
Assessing Business Challenges

We built tools and set up training
- Spreadsheets vs. schedule software
- Building block templates
  Activity builder
  Duration validation
  Man hour loading
  Commodity distribution
Teambuilding / Partnering
- Lead by example
- Buy In from all Participants
- Demonstrate Time to market value
Assessing Business Challenges

In the last quarter of 2000 the program expanded again adding another 50 projects to the same 5 year timeframe.
Assessing Business Challenges

Year 1 Year 2 Year 3 Year 4 Year 5

Original Program 3rd Qtr of 1999 4th Qtr of 2000
Assessing Business Challenges

The first hurdle
- The Procurement Cycle
The Molecule chart.....

OWNER

Project Scope

Purchase Equipment

Deliver Equipment

Operations

ENGINEER

Process Design & Equipment Specification

Detail Design

CONTRACTOR

Purchase Equipment

Deliver Equipment

Construct
Assessing Business Challenges

Full Schedule Integration
Building the Schedule

Approach to Activity (Standard) Coding
- Process for Task Definition
- Estimating of Task Durations
- Development of Standard Logic
- Identification of Required Resources

Bring it all Together (Tool Set)
The Tools

More than just a Database
- An application that assists in:
  Coordination of Scope Definition inputs
  Development of Standard Logic
  Generating the Schedule

More than just a Spreadsheet
- A customized workbook that:
  Records the Nouns of Scope Definition
  Standardizes Steps as Verb definitions and durations
  Identifies Scope responsibility

More intuitive than a logic diagram or chart
The entire effort ends up in the Primavera Project Planner as a baseline schedule.
The Tools

Schedule Integration Matrix Database

Working with the Matrix Worksheet (MS Excel):
- Select Source
- Open Source
- Load dB

Working with the Master Logic Schedule (P3 3.x):
- Push STEPS into LOGC Sched.

Working with the Primavera Schedule (P3 3.x):
- Retrieve Relationships from LOGC Schedule
- Review Relationships
- Review Tasks
- Load BPES Schedule
- Get seed tasks for Resources
- Load Resources to BPES
# The Tools

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*Notes:*
- **BOP** stands for Basic Operating Procedure.
- **BOP0** is the base level for process design.
- **BOP1** includes additional levels for detailed design.
- **BOP2** and higher levels are used for specialized tasks.
- **Area** indicates the specific area of the project.
- **SYS** denotes the system within the area.
- **Train** refers to the specific train within the system.
- **Pkg** stands for package, indicating the document or set of tasks.
- **Task Description** provides a detailed description of the tasks involved.
- **Categories** are used to organize tasks into meaningful groups for easier reference.

*Additional Information:*
- The table includes columns for issue, develop, layout, review, design, final issue, and other stages of project planning and execution.
- The columns also indicate the use of precursors and follow-ons, ensuring a well-structured workflow.
- The table is designed to be useable for both process design and soils design phases, with designated sections for each.

*Data Entries:*
- The table contains numerical values that represent the sequence or duration of tasks, aiding in the planning and scheduling of project activities.

*Purpose:*
This table serves as a comprehensive guide for project managers and engineers, facilitating efficient task management and resource allocation throughout the project lifecycle.
Managing the Schedule

Establish Project Team Calendar

- Determine Month End Progress Date
  Engineering firms typically update based on accounting calendars
  Construction contractors usually update weekly.
  Project objectives satisfy other customers

- Define Updating Deadlines
  Allow for timely submittals
Managing the Schedule

Project Team Calendar (continued)

- Establish Onsite or On-Line Team Reviews
  While Onsite (face to face) reviews cost more, they are effective for critical or higher priority issues.
  On-Line reviews cost less and are generally adequate for non-critical lower priority issues.
- Commit to Reporting Cycle
  Effective planning and timing of reports important to management.
Managing the Schedule

2003 - PROJECT CALENDAR

**January**

S S M T W T F
28 29 30 31  1  2  3  4
4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30

**February**

1  2  3  4  5  6  7
8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28

**March**

1  2  3  4  5  6  7
8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28

**April**

S S M T W T F
29 30 31  1  2  3  4
5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25

**May**

26 27 28 29 30  1  2
3  4  5  6  7  8  9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30

**June**

31  1  2  3  4  5  6
7  8  9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27

**July**

S S M T W T F
28 29 30  1  2  3  4
5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25

**August**

26 27 28 29 30  1  2
3  4  5  6  7  8  9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30

**September**

30 31  1  2  3  4  5
6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26

**October**

S S M T W T F
27 28 29 30  1  2  3
4  5  6  7  8  9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30

**November**

1  2  3  4  5  6  7
8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28

**December**

29 30  1  2  3  4  5
6  7  8  9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26

X = Progress Data Date

X = Month End for Actuals and Status
Due @ Noon MT

X = Monthly Reports Due to CPN and
Monthly Meeting

X = Calpine Return CPES @ Noon
MT

X = CPN Monthly Report Due

X = Online Critical Path Meeting @
9:00 AM (MT)

{ } = Monthly Meeting
Managing the Schedule

Gather inputs for updates

- Dedicated E-mail Address
  Used as a back up system for data storage
  Escape hardware and software problems
  Avoid personnel issues

- Uniform Data Storage
  Expedites data mining process
  Allows seamless transitions when re-aligning project control personnel
Managing the Schedule

Merge into Master Schedule

- Standardized Processing Procedures
  Create consistent work flows

- Support Software Tools
  Third party tools that reduce processing time
  Provides more time for analysis
Managing the Schedule

Collaborate with Team

- Maintain Major Milestone Dates
  Represent the start or finish of major events
  Frequently reviewed to analyze schedule variances

- House Keeping on Logic
  Activities that do not progress as planned
  Contain out-of-sequence logic
  Collectively review and make changes to logic strings that do not represent the current work plan
Managing the Schedule

Orderly Progress

Out of Sequence Progress

Pull Cables

Terminate
Managing the Schedule

Collaborate with Team – (continued)

- Maintain integrity of schedule logic
  Ensure that the schedule flows properly

- Short Interval Schedule
  Active part of master schedule
  Weekly on-site reviews
Managing the Schedule

Analyze
Managing the Schedule

Budgeted Quantity of Work Scheduled (BQWS) is the time-phased value of work to be completed (plan).

Budgeted Quantity of Work Performed (BQWP) is the time-phased value of work that has been completed.

- Schedule Variance – Is the difference between BQWS and BQWP as measured in Schedule Duration.

- Progress Variance – Is the difference between BQWS and BQWP measured in the appropriate quantity.
## Managing the Schedule

### Schedule Variance (Sv)
Sv = Plan Date of Current Quantity - Data Date

### Progress Variance (Pv)

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<tr>
<th>Commodity</th>
<th>Progress</th>
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### BQWP - BQWS
- BQWP
- BQWS

Data Date
P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11
Managing the Schedule

- **Change Control**
  Document and control changes to the project baseline
  Incorporate approved changes in a timely manner

- **Implement Corrective or Recovery Plan Based on the Result of the Schedule Variance**

- **Develop Revised Progress Plans Based on Progress Variance**
Managing the Schedule

Report

- Standardized Layouts and Reports

Summary Level Schedule
Commissioning Schedule
Longest Path
Integrated Schedule
Progress Curves
Managing the Schedule

<table>
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| + 364 | Engineering        |         |             |              |
|       | + 362 | Procurement      |         |             |              |
|       | + 365 | Construction     |         |             |              |
|       | + 409 | Commissioning    |         |             |              |

| 361 | Interconnect       |         |             |              |
|     | + 12200 Electrical Substation Contractor |
|     | + 12200 Gas Pipeline Contractor |
|     | + 12200 Water & Discharge Contractor |

Related Activities: Progress Bar Critical Activities
Closing Remarks

Now, the world is a beautiful place.....

What does all this give us

Effective snapshots

Historical views