Schedule Analysis Techniques

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Polar Operational Environmental Satellites Program
Schedule Analysis

Schedule Analysis is the process of evaluating schedule results and assessing the magnitude, impact, and significance of actual and forecast variations to the baseline and/or current operating schedules. It begins with the re-calculation of the critical path and the determination of any change in the completion date of the project. Analysis continues by diagnosing the health of the project schedule and its direction.

INPUT
- Baseline Schedule
- Schedule Performance
- Current Schedule
- Changes
- Potential problems

PROCESS
- Schedule Analysis Techniques (See Next 2 Pages)

OUTPUT
- Critical Path
- Analysis Reports
- Analysis Metrics
- “What-If” Schedules
- Forecasts
Focus of Schedule Analysis

**Critical Path:** What is driving the project’s completion?

**Accuracy:** Is the schedule data correct?

**Integration:** Are activity relationships properly defined?

**Realism:** Is the schedule achievable?

**Performance:** Are activities being accomplished in an efficient and timely manner?

**Variances:** Are differences from the baseline significant?

**Trends:** Is the schedule’s direction favorable or unfavorable?

- Performance
- Slack
- Reserve/contingency
Focus of Schedule Analysis

(Cont’d)

**Forecasting:** What is the predicted future schedule performance?

**What-If:** What is the impact on the project’s schedule objectives of potential problems and changes?

**Risk:** Is there a significant likelihood of not meeting the project’s schedule objectives?

**Resources:** Have sufficient resources been planned to efficiently accomplish the project’s schedule activities and achieve its objectives?
Why Perform Schedule Analysis?

- A baseline schedule is just a starting point
- Project teams need information to help keep the project on track in order to meet objectives
- Schedule analysis provides that information and aids in:
  - Determining if objectives can be accomplished on time
  - Monitoring the adequacy of schedule slack and reserve
  - Assessing the likelihood of potential schedule problems
  - Reallocating resources to where they are needed most
  - Identifying project schedule priorities
  - Highlighting the likelihood of overrunning the project schedule
  - Evaluating the effect of new scope changes
  - Understanding the cause of schedule problems, their impact and what corrective action is needed to mitigate or avoid them
## ALPHA Project Critical Path: has it changed and why?

<table>
<thead>
<tr>
<th>ID</th>
<th>Activity</th>
<th>Dur</th>
<th>Early Start</th>
<th>Early Finish</th>
<th>Total Slack</th>
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<td>Procure VEI Instrument</td>
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<td>12/3/01</td>
<td>10/4/02</td>
<td>4 days</td>
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<td>7/12/02</td>
<td>59 days</td>
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<td>4</td>
<td>Integrate RCI to Spacecraft</td>
<td>5 days</td>
<td>9/9/02</td>
<td>9/13/02</td>
<td>19 days</td>
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<td>5</td>
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<td>4 days</td>
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<tr>
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<td>120 days</td>
<td>10/14/02</td>
<td>3/28/03</td>
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<tr>
<td>8</td>
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<td>60 days</td>
<td>3/29/03</td>
<td>5/27/03</td>
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<td>9</td>
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**Critical Path as of 10/31/01**
## ALPHA Project Schedule
### as of 11/30/01

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<thead>
<tr>
<th>ID</th>
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<th>Early Finish</th>
<th>Total Slack</th>
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<td>Procure Spacecraft Bus</td>
<td>200 days</td>
<td>10/8/01</td>
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<tr>
<td>4</td>
<td>Integrate RCI to Spacecraft</td>
<td>5 days</td>
<td>11/14/02</td>
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<tr>
<td>5</td>
<td>Develop RCI Instrument</td>
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<td>Launch</td>
<td>0 days</td>
<td>8/1/03</td>
<td>8/1/03</td>
<td>-41 days</td>
</tr>
</tbody>
</table>

**Notes:**
- VEI started ahead of schedule
- S/C Bus is on schedule
- RCI delivery delayed
- Negative Total Slack
- 8/1/03 launch threatened

**Schedule Analysis Techniques**

**REV:** Baseline 8/15/01
Schedule Accuracy: *is the schedule data correct?*

**Schedule Accuracy** - The primary data used to develop the schedule should be correct and based on reality:
- Activities capture the entire work scope
- Durations are realistic and feasible, not “success-oriented” or “fat”
- Assumptions are sound and true
- Constraints are legitimate

**Analysis Approach:**
- Verification of activity traceability to project data such as:
  - Statements Of Work
  - Work Breakdown Structures & dictionaries
  - Drawing trees, document trees, specifications
  - Basis of Estimate
Schedule Accuracy (Cont’d)

Analysis Approach – cont’d.:

- Comparison of current schedule durations to:
  - Baseline durations
  - Prior period’s forecast durations

- Comparison of baseline activity durations to:
  - “Actuals” from similar projects
  - “Actuals” from previous units, builds, tests, etc.
  - Basis-Of-Estimates
  - Supplier lead time quotes

- Verification of schedule assumptions with external agreements
  - Memorandums of Understanding
  - Letters Of Agreement
  - Technology Assistance Agreements
  - Contracts and subcontracts
  - Government Furnished Equipment Lists
Schedule Integration: *are activity relationships properly defined?*

Schedule Integration

- **Horizontal Integration:** the logical sequencing of work that ensures task interdependencies; establishes a rational basis for the critical path
- **Vertical Integration:** the top-down alignment of activities, milestones and status from the master schedule to the lowest detailed schedule; help ensures schedule completeness and accountability; includes subcontractor schedules

Analysis Approach:

- **Horizontal Traceability:** determined through end-to-end activity tracing to verify project logic (e.g. “build” before “test”)
- **Vertical Traceability:** determined by comparison of baseline, actual and forecast schedule dates among various levels of schedules
- Logic networking and activity flagging/coding features of scheduling software tools help automate schedule integration & traceability
Logic Networks = Horizontal Schedule Traceability

Logic Network Diagram

Specify Power Rqts.
Activity 101

S/A Design
Activity 102

S/A Build
Activity 103

S/A Test
Activity 104

Integ. S/As to S/C
Activity 406
Vertical Schedule Traceability

- **Master Schedule**
- **Intermediate / Summary Schedule**
- **Detail Schedule**
- **Cost Account / Work Package Schedules**
Schedule Realism: *is the schedule achievable?*

**Schedule Realism:** an achievable schedule is accurate, integrated, “reasonable”, and contains sufficient slack and reserve in case of potential problems.

**Analysis Approach:**

- Are activities properly identified and do durations have a rational basis (“Accuracy”)?
- Do activities logically trace, end-to-end (“Integration”)?
- Have assumptions and constraints been verified (“Accuracy, Integration”)?
- Have sufficient resources been identified and allocated?
- Does the implementation of the schedule seem reasonable: slow start-up, faster acceleration in the middle, and taper off at completion (“S” curve)?
- Is there free slack between deliverables and need dates?
- Has schedule reserve/contingency been identified?
"S" Curve Check

ALPHA Project "Early Finish" Date Baseline Schedule Plan
As of May 30, 2002

"S" Curve = Realism

<table>
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<tr>
<th></th>
<th>Oct '01</th>
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<th>Dec '01</th>
<th>Jan '02</th>
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Schedule Analysis Techniques
Schedule Performance: are activities being accomplished on time?

Schedule Performance: measurable schedule progress evidenced by the completion of activities and milestones

Analysis Approach:
- Comparison of activities’ actual start and finish dates to the baseline schedule start and finish dates
- Ratio analysis of the baseline schedule (plan) and actuals
- Evaluation of the Schedule Performance Index (SPI) on projects using Earned Value Management
Schedule Performance Illustrated

ALPHA Project "Early Finish" Date Schedule Performance
As of May 30, 2002

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<th>Nov '01</th>
<th>Dec '01</th>
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Software Schedule Performance
Ratio Analysis Example

ASTRO Project Software Module Code & Checkout Completion: As of 5/31/02

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<tr>
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<th>2002</th>
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<tr>
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</table>

**TO DATE**

30 modules ÷ 8 months = 3.75 (actual rate)
40 modules ÷ 8 months = 5 (baseline rate)
3.75 ÷ 5 = 75% efficiency-to-date

0%  - - - - - - - - - - - - - - - - - - - - - - - - - - 50%  - - - - - - - - - - - - - - - - - - - - - - - - - - 100%

Less Efficient  | 50%  | More Efficient

To date, schedule efficiency is 75% - the ASTRO software development team is accomplishing, on average, 3/4 of what it planned to do.
Schedule Variances: *are differences from the baseline significant?*

**Schedule Variances:**
- The difference between the baseline schedule and actual schedule performance (actual results)
- The difference between the baseline schedule and the current or forecast schedule (expected results)

**Analysis Approach:**
- Comparison of activity planned start and finish dates to actual start and finish dates
- Comparison of activity planned start and finish dates to forecast start and finish dates
- Diagnosis of the cause and identification of the impact are needed in order to develop a corrective action or workaround
Schedule Variance Illustrated

ALPHA Project "Early Finish" Date Schedule Performance
As of May 30, 2002

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<tr>
<th>Oct '01</th>
<th>Nov '01</th>
<th>Dec '01</th>
<th>Jan '02</th>
<th>Feb '02</th>
<th>Mar '02</th>
<th>Apr '02</th>
<th>May '02</th>
<th>Jun '02</th>
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Schedule Analysis Techniques
Example
Variance Analysis Report

**WBS:** 1.1.2 C&DH Subsystem

1.1.2.2 RTT “B” Assembly

**MILESTONE:** CDH6022 RTT “B” Ready for Observatory Integration & Test

**BASELINE:** 5/28/01

**FORECAST:** 6/7/01

**CAUSE & CORRECTIVE ACTION:**

• Memory anomaly during final test caused a 10 day slip in delivery to I&T, putting the RTT B on the critical path at -5 days total slack.

• A 2nd shift will be added to finish testing.

• I&T Manager can modify I&T work flow to accommodate this delay if necessary.
Schedule Trends: is the schedule’s direction favorable or unfavorable?

Schedule Trend(s):
- Indicate the schedule’s future direction based on historical results
- Provide a means to indicate the extent to which actual and predicted performance are diverging from the baseline schedule

Analysis Approach:
- Performance trends: track actual completion of activities and milestones over time to determine if progress is being made
- Slack trends: track slack depletion over time to assess if sufficient spare time is available or if resources should be reallocated
- Reserve trends: track reserve consumption over time to determine if it is still sufficient
Delivery Trend vs. Need Trend

**SEM FM6**

*Instrument Delivery vs. I&T Need*

Planned Use:
- MetOp-2

Forecast:
- 6/21/01
- 12/31/99
- 12/1/01
- 6/21/01

Month Ending:
- Contract Delivery
- I&T Need
- Planned Use
- Contract Delivery

Schedule Analysis Techniques
# ALPHA Project Total Slack Summary

## As of April 30, 2001

<table>
<thead>
<tr>
<th>Structure</th>
<th>Delivery</th>
<th>March 2001</th>
<th>April 2001</th>
<th>Driver</th>
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<td></td>
<td>1/5/01</td>
<td>+67</td>
<td>Complete</td>
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<td>Propulsion</td>
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<tr>
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<td>Instrument B</td>
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<td>2/15/02</td>
<td>+89  2/15/02 +89 Focal Plane</td>
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<td>8/2/02</td>
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<td>8/1/01</td>
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Example Schedule Reserve Trend

ALPHA Project Schedule Reserve Consumption Trend
As of: March 31, 2001
Schedule Forecasting: *what is the predicted future schedule performance?*

**Forecast**

- An estimate or projection of when:
  - Activities already underway will be completed
  - Activities that have not yet begun will start and finish
- A prediction of future schedule performance

**Analysis Approach**

- Linear projection of actual performance
- Calculation of when project could finish based on extrapolation of schedule performance efficiency-to-date
Linear Projection of “Actuals”

ALPHA Project "Early Finish" Date Schedule Performance
As of May 30, 2002

<table>
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<th>Oct '01</th>
<th>Nov '01</th>
<th>Dec '01</th>
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<td>57</td>
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## Projection Based on Efficiency-To-Date

### ASTRO Project Software Module Code & Checkout Completion: As of 5/31/02

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
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</thead>
<tbody>
<tr>
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<td>Oct</td>
<td>Nov</td>
</tr>
<tr>
<td>CUM Baseline</td>
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<td>2</td>
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<tr>
<td>CUM Actual</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CUM Forecast</td>
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</table>

### TO DATE

- 30 modules ÷ 8 months = 3.75 (actual rate)
- 40 modules ÷ 8 months = 5 (baseline rate)
- 3.75 ÷ 5 = 75% efficiency-to-date

### TO GO

- Actual rate to date = 3.75 modules
- 40 modules ÷ 6 months = 6.7 (forecast rate)
- 6.7 ÷ 3.75 = 178% efficiency-to-complete!

To date, schedule efficiency is 75%. To go, the forecast-to-complete efficiency of 178% is probably unrealistic - unless something has changed (e.g. new technical approach, add more programmers, descope work, etc.)
“What-If” Schedule Analysis: how will changes affect the schedule?

“What-If” Schedule
- Projects the effect on the baseline or current operating schedule of a potential problem, new constraint, or changed assumption
- Provides the project team with an early-warning of the impact on the project’s schedule objectives due to potential changes

Analysis Approach
- Develop a “What-If” schedule by modifying the baseline and/or current operating schedule to reflect a schedule change
- Examples:
  - Change a key assumption
  - Late parts or GFE delivery
  - Descope of work
  - Funding shortfalls
  - Staffing shortages
NOAA M-N’ Integration & Test Summary
Schedule As of 3/31/01
*Based on Preliminary LMMS Rev S Schedule

NOAA-M

NOAA-N

NOAA-N*

* = Not yet in LMMS Master Schedule

Foot Notes:
1. A303 Removal; Installation of Mass Models*
2. A303 Re-Integration & IPF/DET*
3. SEM & SBUV* Removal
4. SEM & SBUV* Re-Integration
5. SARR Delivery 6/15/01
6. A303 Installation on N’ 5/13/01
7. SBUV Delivery 7/6/01
8. SARP/ADCS Delivery 4/30/02
9. SARP & ADCS Integration*
### NOAA M-N’ Integration & Test Summary Schedule: 6/30/02 M Launch

*Based on Preliminary LMMS Rev S Schedule*

<table>
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<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

#### NOAA-M

- **PLD:**
- **Call-Up:**
- **Titan II Closure:**
- **9/30:**

#### NOAA-N

- **Instr:**
- **Prep:**
- **Vib/Acou:**
- **SEPET:**
- **Post Vib**
- **B152:**

#### NOAA-N’

- **DR:**
- **SEPET:**
- **Bus:**
- **Instr:**
- **Pre-Vib:**

---

**Possible delays in completing remaining Spacecraft + EOC extension**

---

**Foot Notes:**

1. SEM, SBUV, AVHRR & H303 Removal
2. SEM, SBUV, AVHRR & H303 Re-Integration
3. A303 Removal; Installation of Mass Model*
4. A303 Re-Integration & IPF/DET*
5. SEM & SBUV* Removal
6. SEM & SBUV* Re-Integration
7. SARP & ADCS Software Upgrades*
8. SARP/ADCS Delivery 4/30/02
9. SARP & ADCS Integration*

* = Not yet in LMMS Master Schedule
Schedule Risk Analysis: what is the likelihood of delaying the schedule?

**Risk:** a threat or uncertainty that could adversely impact the project’s schedule objectives

**Risk Analysis provides a framework for:**

- Reducing, mitigating, avoiding or accepting the schedule risks
- Verifying the project’s overall schedule duration as calculated by the critical path
- Highlighting the areas of greatest schedule risk
- Identifying schedule reserve or contingency
- Early warning of potential schedule problems
- Quantifying the probability of risks occurring and the extent of the possible schedule delays
- Managing the project
Some Sources of Schedule Risk:

- Lack of a logical, realistic schedule that identifies the total work scope
- Improper or poor change control
- Inadequate or incorrect resource planning
- Uncertainty in the work scope (e.g. new design)
- Insufficient schedule reserve or contingency
- Inexperienced or inadequate project management
- External factors (e.g. weather, gov’t. regulations, labor relations)
- Complex organizational interfaces (e.g. foreign partners)
- Poor or inaccurate activity duration estimates:
  - Padded by the estimator to keep a hidden contingency
  - Reduced by the estimator to be optimistic
  - Arbitrarily cut by management
Analysis Approach:

- Multi-disciplined subgroup of the project team lists and ranks qualitative or “gut feel” risks based on past experience early in the project life cycle.
- Formal Risk Management Systems: establish and track schedule risks with parameters using alert zones or thresholds that when triggered lead to corrective action planning.
- Simulation Analysis: mathematical modeling which translates the uncertainties associated with activity durations into their potential impact on the project’s overall duration and schedule objectives ("Monte Carlo" technique).
Example Project Risk Listing

- $10-$15 million dollar funding reduction in FY 02
- Major failure of DSL subsystem during thermal vacuum testing
- Radiative cooler failure resulting in late Government Furnished Equipment (GFE) instrument delivery to spacecraft
- Supplier plant closure resulting in late parts delivery
- Technology Assistance Agreement (TAA) will not be approved by U.S. State Department in time for foreign partners to support testing
- Rebuild of replacement filters will not meet specification
Example Slack Trend With Thresholds

WBS 1.1.2.2 RTT B Assembly Risk Indicator

Days Total Slack

Status Date

Jun '95 Jul '95 Aug '95 Sep '95 Oct '95 Nov '95 Dec '95 Jan '96 Feb '96 Mar '96 Apr '96 May '96 Jun '96 Jul '96

Replace cracked DRX-002

Test chamber availability delay

Troubleshoot noise anomaly

Alert Zone 1

Alert Zone 2

Alert Zone 3
## Example Risk Report

### Schedule Analysis Techniques

<table>
<thead>
<tr>
<th>Risk Tracking</th>
<th>Archived Risks</th>
<th>Risk Plan</th>
<th>Risk Matrix</th>
<th>GSC Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On Time</strong></td>
<td><strong>Status</strong></td>
<td><strong>Update</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**8. ADCS & SARP Delivery for NOAA-N**

- **Description:** CNES delivered dates for ADCS & SARP for NOAA-N are later than needed. Could result in extending the N completion and prevent CNES from being available as a backup to N launch.

  - **Prob:** 100
  - **Impact:** 2
  - **Identified:** 12/17/89
  - **Risk Date:** 9/15/2000
  - **Responsible:** J. Markall
  - **Risk:** P

**47. NOAA-N Date Collection System Isolate from CNES**

- **Description:** The Data Collection System (DCS) is not referenced on the TDRMS-N Blanket Custom Data. This is required to support the CNES demand entry of the DCS from CNES, for NOAA-N.

  - **Prob:** 100
  - **Impact:** 2
  - **Identified:** 6/3/01
  - **Risk Date:** 6/1/2001
  - **Responsible:** J. Frost
  - **Risk:** P

**5. Foreign Partner Signature of TAA Agreements**

- **Description:** Refusal of foreign partners to sign technical assistance agreements, could result in the refusal by CNES to interface with foreign partners, difficulty in resolving technical issues and impacting overall schedule.

  - **Prob:** 100
  - **Impact:** 1
  - **Identified:** 12/17/89
  - **Risk Date:** 6/1/2001
  - **Responsible:** J. Frost
  - **Risk:** P

---

**Notes:**
- 3/27/01: CDR originally scheduled for 12/00, rescheduled for 4/01. It has now been shipped to TEO.
- Delivery of instrument in time for NOAA-N SEPET.
- CNES working with contractors on recovery plans for CNES delivery (internal knowledge).
- 3/1/01: CNES indicated that reduced engineering models available 10/01. Flight models 4/22.
- 6/30/mustered UMMS to conduct SEPET without SARP or DCS. 4/10: Instruments to be delivered April 2001.
- No instruments on SEC list for SEPET. Will use stress models for vibration testing. May not be possible to use simplified EMs for test ATM/SES.

---

**POES Risk Tracking Log**

**Home Page | Clear Search | Refresh | Job Info | Submit New**

**Start | Document Scene | EOD/POE Progress [in]**

**Exploring | Scheduling |**

---

**Notes:**
- 6/28/00: Did not need NOAA-5/100 - No new info available 10/20/00. Waiting for call back from NOAA/Naval Affairs Office 11/22/00...
- 11/27/00: No response, suggest going with more formal approach 12/17/00: Nothing new from int office 1/8/01: Nothing new. Jim will contact today 1/23/01: Finally, reminder on DCS. July insert could be a problem if not resolved. 3/13/01: Working with NOAA/National Affairs Office 3/20/04: Need to engage NOAA international strategy on adding CNES to report East 4/20/04: Still going strong.
Quantifying Schedule Risk

- “Monte Carlo” risk analysis software can augment project scheduling software tools by randomly selecting durations from user-defined distributions for each uncertain activity.

- Numerous iterations of the overall project duration is automatically simulated based on the uncertainty associated with the activities in the logic network.

- High risk activities appear on the critical path in the largest percentage of iterations during the Monte Carlo simulation.

(See Training Track E, “Advanced Schedule Risk Analysis,” for more on quantifying schedule risk.)
Resource Analysis: have resources been considered?

Resources: the project schedule may not be achievable or efficient unless all necessary resources are considered
  - Some key resource constraints can be included in the network’s logic
  - Resources that are scarce, in surplus, inefficiently utilized or out of phase with requirements should be examined
  - Some activities can happen early or later since they are not critical to the completion of the total project - the project team can assess their priority and redirect resources as needed

Analysis Approach:
  - Resource identification, allocation, analysis and leveling
Realistic schedules must account for resource availability – which help define an accurate cost estimate and budget.
Resource Identification & Allocation

Resource Identification: the selection and definition of resource categories that are needed to accomplish the project’s activities (e.g. people, equipment, funds)

Resource Allocation: assigning and “loading” activities with the amounts of resources estimated to accomplish them

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Duration</th>
<th>Work</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Award Contract</td>
<td>0 days?</td>
<td>0 hrs</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fab Housing</td>
<td>10 days?</td>
<td>80 hrs</td>
<td>Mech Tech II</td>
</tr>
<tr>
<td>3</td>
<td>Fab Side Panels</td>
<td>5 days?</td>
<td>40 hrs</td>
<td>Mech Tech II</td>
</tr>
<tr>
<td>4</td>
<td>Prep Module</td>
<td>2 days?</td>
<td>16 hrs</td>
<td>Mech Tech II</td>
</tr>
<tr>
<td>5</td>
<td>Assemble Unit</td>
<td>1 day?</td>
<td>8 hrs</td>
<td>Mech Tech II</td>
</tr>
<tr>
<td>6</td>
<td>Deliver Unit</td>
<td>0 days?</td>
<td>0 hrs</td>
<td></td>
</tr>
</tbody>
</table>

Schedule Analysis Techniques
The shortage or over-commitment of resources is determined by profiling the requested resources and comparing them to their availability or capacity.
Resource Analysis

**Resource Analysis:** resolution of inconsistencies between resource supply and demand in a specific period of time including:
- Add more of the resource (e.g. 2nd shift)
- Find a substitute for the resource (e.g. subcontract)
- Delay some activities (examine free slack)
- Perform some activities earlier than planned (examine logic)
- Combination of the above

**Resource Leveling:** the “smoothing” of resources so planned utilization matches availability in the most efficient manner while still meeting the project schedule’s objectives if possible
- Schedule slack is a key consideration in leveling
- Leveling most useful for critical, near-term activities
The “leveling” or smoothing of the “Mechanical Tech II” resource allocation to fit the available capacity of one MTII.
Resource-Constrained Schedule

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
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<tr>
<td>6</td>
<td>Deliver Unit</td>
<td>0 days</td>
<td>0 hrs</td>
<td></td>
</tr>
</tbody>
</table>

“Leveling” the resources results in a more realistic schedule, but delivery can not occur on 4/25/01 as currently planned.
Summary

- A baseline schedule is just a starting point
- Project teams need information to help keep things on track in order to meet objectives
- Schedule analysis techniques can augment earned value analysis by:
  - Evaluating schedule results
  - Assessing the magnitude, impact, and significance of actual and forecast variations to the baseline schedule and/or current operating schedule