Project Management Institute
1st Annual Professional Development Day

Schedule Risk Assessment

Greg Smith, EVM/Schedule Specialist
Project Management Team, Business Services
Jacobs Sverdrup MSFC Group
MSFC Project Analysis Office (RS40)

October 24, 2003
Schedule Risk Assessment – Why Do It?

➢ To determine the likelihood of finishing on time
  ➢ Tasks in a schedule typically reflect the “most likely” duration for each task
  ➢ In reality, each task is different and has a varying degree of probability of finishing within or after the duration specified
  ➢ Schedule risk assessment quantifies these probabilities by assigning values to each task
Schedule Risk Assessment – Basic Process

1. Obtain schedule for analysis
   - Are prerequisites met?
     - No constraints?
     - Complete logic?
     - All work included?
     - Detailed enough?
     - Task durations realistic?
2. Set minimum, maximum, most likely durations
3. Assign probability distribution curves
4. Evaluate for / assign values as required for special conditions (probabilistic branching, conditional processing, correlated risk factors)
   - Correct problems
     - Perform risk analysis calculations
6. Analyze Results
Schedule Risk Assessment
Special Conditions

➢ Probabilistic branching considers the situation where the outcome of a task can result in two or more possible courses of action

➢ Conditional branching addresses the impact of external influences, such as weather

➢ Correlated risk exists when two or more tasks are affected by some other event

➢ A negative correlation suggests that what happens to one will cause the opposite to happen in the other

➢ A positive correlation suggests that what happens to one is likely to happen to the other
Schedule Risk Assessment
Calculations

➢ A random method is used for selecting possible values in a range

➢ Monte Carlo – Speedier method, but has a larger possibility of sampling error

➢ Latin Hypercube Sampling (LHS) – Slower method, reduces sampling error

➢ An iteration is selecting one sample point from each task and calculating the outcome

➢ These calculations are performed by software – the user specifies the number of iterations
Schedule Risk Assessment
Results Analysis

Date: 07/25/2002 9:58:36 AM
Samples: 500
Unique ID: 0
Name: 

Completion Std Deviation: 22.09 d
95% Confidence Interval: 1.94 d
Each bar represents 10 d

Completion Probability Table

<table>
<thead>
<tr>
<th>Prob</th>
<th>Date</th>
<th>Prob</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>Mon 07/19/04</td>
<td>0.55</td>
<td>Fri 09/03/04</td>
</tr>
<tr>
<td>0.10</td>
<td>Mon 07/26/04</td>
<td>0.60</td>
<td>Wed 09/08/04</td>
</tr>
<tr>
<td>0.15</td>
<td>Fri 07/30/04</td>
<td>0.65</td>
<td>Tue 09/14/04</td>
</tr>
<tr>
<td>0.20</td>
<td>Thu 08/05/04</td>
<td>0.70</td>
<td>Fri 09/17/04</td>
</tr>
<tr>
<td>0.25</td>
<td>Wed 08/11/04</td>
<td>0.75</td>
<td>Fri 09/24/04</td>
</tr>
<tr>
<td>0.30</td>
<td>Tue 08/17/04</td>
<td>0.80</td>
<td>Wed 09/29/04</td>
</tr>
<tr>
<td>0.35</td>
<td>Thu 08/19/04</td>
<td>0.85</td>
<td>Wed 10/06/04</td>
</tr>
<tr>
<td>0.40</td>
<td>Tue 08/24/04</td>
<td>0.90</td>
<td>Thu 10/14/04</td>
</tr>
<tr>
<td>0.45</td>
<td>Fri 08/27/04</td>
<td>0.95</td>
<td>Wed 10/27/04</td>
</tr>
<tr>
<td>0.50</td>
<td>Tue 08/31/04</td>
<td>1.00</td>
<td>Mon 12/13/04</td>
</tr>
</tbody>
</table>

Initial Analysis (Duration -5% to +40%)

NASA
Schedule Risk Assessment
Results Analysis

➢ Critical Path Analysis – indicates whether or not a task is “risk critical” (i.e. during iterative calculations, whether or not it becomes a critical task)

➢ If critical, indicates percentage of time during simulation

➢ Sensitivity Analysis – indicates the potential impact an activity has on the overall project or program completion

➢ Task duration

➢ Minimum and maximum durations
Schedule Risk Assessment
Prerequisites

- Constraints (artificially induced dates) affect risk calculations – takes probability out of the equation
- Incomplete logic networks (missing relationships between tasks in a schedule) lead to incorrect representations
- Missing tasks create incomplete and incorrect results
- Descriptions should be complete and clear to better enable the assignment of risk parameters
- Tasks that are too large (i.e. have large durations) lead to results with large ranges.
Schedule Risk Assessment
Duration Assignment

- The original duration specified in the schedule is assumed to be the "most likely"
- The minimum, or optimistic, duration is the least amount of time required or allowed to complete the task, if everything goes perfectly
- The maximum, or pessimistic, duration is the greatest amount of time required or allowed to complete the task, if everything goes wrong
- A quick method - One can assume a "baseline" range for all tasks or a group of tasks in a schedule (one example, -5% to +40%) in lieu of evaluating each task separately
Schedule Risk Assessment
Duration Assignment

- One must consider specific risks in making optimistic and pessimistic value assignments
  - Nature of the work
  - Past history
  - Technology Readiness Level (TRL)
  - "Knowns" and "Unknowns"
  - Project or Program risk evaluations

- One method used is to assign a "base" range and modify tasks using a project/program specific risk matrix
Schedule Risk Assessment
Sample Risk Matrix

Likelihood

Low

Severity

High
Schedule Risk Assessment
Probability Distribution Curves

- The PDC is a way to indicate the likelihood of values between the optimistic and pessimistic values

- A PDC can be:
  - Uniform (flat)
  - Normal (bell shaped)
  - Beta (skinny bell shaped)
  - Triangular (pyramid shaped)
  - Customized (other user defined shapes)