Schedule Risk and Uncertainty Management.

Hints and Tips from Real Life Experience.

Presentation to the APM Knowledge Share.

June 2011

Guy Hindley

With grateful thanks and acknowledgements to all those colleagues I have worked with, both within BAE Systems, the APM SIGS, Branches and elsewhere who have shown me the light, highlighted alternatives or just challenged the status quo and way of doing things – thank you.
Agenda

- Some Initial Thoughts
- The place of Schedule Risk Analysis in Integrated Planning
- What is Schedule Risk Analysis?
- Do We Learn from Our Experiences?
- Master Schedule Logical Process
- 3 Point Input
- Ownership – Buy In
- What Schedule to Use
- Input to MSP slide
- Pertmaster slides
- Summary of Process
- Sample Outputs for Multiple Milestones
- SRA Toolsets
- Pertmaster
- Concluding Remarks
- Final Thoughts
- Any Questions.

Health Warning – Examples used are from historical work – not the current situation
Some Initial Thoughts:

“Planning is an unnatural process. It is much more satisfying to do something, and the nicest thing about not planning is that failure comes as a complete surprise rather than being preceded by a long period of worry and depression”

…John Harvey-Jones.

A plan should be treated like a map -
It is showing the way, so don’t concentrate on what has gone,
Focus on the future and how to get there!

“Use project management software as a tool –
Not as a substitute for effective planning or interpersonal skills.”

…Harold Kerzner.

“There is no doubt that there is a definite correlation between inadequate project planning,….. at the outset and subsequent project failure.”

….. Richard Trim
Integrated Planning - a logical sequence

Key:

1. 2x OBS structures recognising:
   - Internal structure
   - Sub-contractor structure

2. NO fixed Milestones:
   - Network-driven milestones

- - - Shows alternative route
What is Schedule Risk Analysis?

Two areas to consider:

**Uncertainty**
The natural variation around an event.
Journey to work usually takes 10 minutes. Variation around this.
Tolerate a variation around an activity duration.
N.B. Need to challenge the 3 points to ensure that risk is not embedded in there, either as an opportunity or a threat.
What is Schedule Risk Analysis?

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**Risk**
Something “out of the ordinary happens”.
An accident occurs and causes a delay to your journey – a risk*
You “tail gate” a police car on emergency response which removes all delays to your journey – an opportunity
– N.B.. this is illegal, so don’t do it!

*Both APM and PMI define this as a “threat” where a risk can be either positive or negative, i.e. an opportunity or a threat.
Do we learn from our experiences?

**Resource**

- "Eleven minutes late, staff difficulties, Hampton Wick."
- "Eleven minutes late, seasonal manpower shortages, Clapham Junction."
- "Eleven minutes late, staff shortages, Nine Elms."

**Weather**

- "Twenty-two minutes late, black ice at Norbiton."

**Parts Shortages**

- "Eleven minutes late, somebody had stolen the lines at Surbiton."

**Product Reliability**

- "Eleven minutes late, signal failure at Vauxhall."
- "Eleven minutes late, overheated axle at Berrylands."
- "Seventeen minutes late, defective bogey at Earlsfield."
- "Seventeen minutes late, water seeping through the cables at Effingham Junction."

**Supply Chain**

- "Eleven minutes late, derailment of container truck, Raynes Park."
- "Twenty-two minutes late, obstacles on the line at Berrylands."

**External Influences**

- "Twenty-two minutes late, badger ate a junction box at New Malden."

**Mitigation Action**

- "Twenty-two minutes late, fed up by train delays, came by bike. Slow puncture at Peckham."

"Twenty-two minutes late, escaped puma, Chessington North."
Requirements:

• Logical – free flowing network.

• No target dates. No constraint dates.

• Progress is up to date. Respects timenow. No tasks “out of sequence”
3 Point Input

3 point input to duration:

Minimum – Most Likely – Maximum.

- Other terms are also used to bound the uncertainty range, e.g. pessimistic, optimistic, etc.
- It is important that any 3 point used are valid and are owned by the relevant individuals/ engineers, logisticians, project managers, etc.
- Ensure that the uncertainty range is valid and does not include risk, it is purely uncertainty.
Ownership - An example of what can be used:
Sign Off Sheets

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**Approval Sheet**

Baseline LRIP Advanced Manufacturing Makespans & Project Offsets for Workload Planning

Document Ref. BAES-JSF-GEN-1641-07-PP

**Issue 1**

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<tr>
<th>Prepared By</th>
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<td>P. Galloway</td>
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<td>J. Dunstan</td>
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<td>N. Blenkinsop</td>
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<td>Steve Jones</td>
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### Buy In: Use durations people are familiar with

Raw Material Commodity Lead Times

<table>
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<tr>
<th>Commodity</th>
<th>Min</th>
<th>Most Likely</th>
<th>Max</th>
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<tr>
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<td>7m</td>
<td>12m</td>
<td>24m</td>
<td>145d</td>
<td>250d</td>
<td>500d</td>
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<tr>
<td>Ti Sheet (EN3354 –Nozzle Bay Door) – only STOVL</td>
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<td>12m</td>
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<tr>
<td>Titanium Forging (Value Added)</td>
<td>3m</td>
<td>4.5m (20wks)</td>
<td>6m</td>
<td>60d</td>
<td>100d</td>
<td>125d</td>
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<tr>
<td>Ti Tube &amp; Bar</td>
<td>6m</td>
<td>12m</td>
<td>24m</td>
<td>125d</td>
<td>250d</td>
<td>250d</td>
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<tr>
<td>Initial Cut of Titanium Plate</td>
<td>0.5m</td>
<td>0.5m</td>
<td>1m</td>
<td>10d</td>
<td>10d</td>
<td>20d</td>
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<td>Wire Mesh/Gauze</td>
<td>3m</td>
<td>14m</td>
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<td>60d</td>
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<td>14m</td>
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<td>290d</td>
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<td>9m</td>
<td>11m</td>
<td>165d</td>
<td>185d</td>
<td>230d</td>
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<tr>
<td>Ali Tube, Ali Rod Bar, Ali Bronze Bar</td>
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<td>9m</td>
<td>9m</td>
<td>165d</td>
<td>185d</td>
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<td>9m</td>
<td>10m</td>
<td>165d</td>
<td>185d</td>
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<td>0.5m</td>
<td>1m</td>
<td>10d</td>
<td>10d</td>
<td>20d</td>
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M = Months. D = Days
What Schedule to use?

Two approaches to consider:

**Planning Schedule**

- This is a direct import from your planning tool
- Not all tools able to do this with larger networks
- Maybe too much detail – be selective
What Schedule to use?

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**A separate independent Risk Network**
- Summarises the project logic
- Easier to take a more “helicopter” view. See wood from the trees
What Schedule to use?

Two approaches to consider:

Planning Schedule
• This is a direct import from your planning tool.
• Not all tools able to do this with larger networks
• Maybe too much detail – be selective.

A separate independent Risk Network
• Summarises the project logic
• Easier to take a more “helicopter” view. See wood from the trees

N.B. Both approaches are valid. What are you trying to achieve is the key question to ask.
Must also consider the toolset capabilities, as this may influence what approach you may wish to use, in fact are able to adopt.
If the network is in progress the key value is then Remaining Duration. In those instances the 3 points should be based on the Remaining Duration value.
Pertmaster with uncertainty only

Check dates once imported align to planning tool
Adding a Risk to the Pertmaster Register

- **Risk Title:** Risk on ICY machine going down
- **Duration range of the Risk:**
- **Probability of Occurrence:** 5%
- **Impacted Task ID(s):** 00309, 00303

### Impacts for Risk 1

<table>
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<th>Task ID</th>
<th>Description</th>
<th>Shape</th>
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<th>Likely</th>
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<td>Uniform</td>
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### Correlate

- Impact Range
- Event exists
Adding a Risk to relevant Activities from the Risk Register

Risk assigned to individual activities
Several risks added to risk register

Note - Threats (T) and an Opportunity (O)
N.B. Schedule and its associated 3 points can be read directly from MSP.
Pertmaster with several risks added
Pertmaster Histogram report

- **Project Finish Date:**
  - Best and Worst Case scenario (min/max)
  - Primavera or MS Project calculated finish date (Deterministic)
  - 5% Chance of achieving deterministic finish date

- **Statistics**:
  - Minimum: 09/Aug/07
  - Maximum: 26/Sep/07

- **Highlighters**:
  - 80% Confidence in achieving 10th September finish date
  - 5% (Deterministic) 21/Aug/07

- **Display Histogram report**
  - Any element of the project e.g. a task or milestone. Show the likelihood of finishing a milestone on time.
Pertmaster Histogram report

Duration uncertainty task analysis
Billet guaranteed and 90 day Assembly.
Pertmaster Tornado (Sensitivity) Chart

- Displays in a ranked order those activities driving the project duration and hence causing delays
- Displays in an easy to interpret manner those activities/risks to mitigate to have maximum effect on the project end date
- Measures how much influence an activity can have on the project end date
- I have used these charts to help understand the key drivers in a project schedule to help build a more robust CPA (Critical Path Analysis) schedule. Tornado Charts show areas to focus attention on
3). Approach
b. Probabilistic Analysis, or Schedule Risk Analysis - so called because the end date is determined by Monte Carlo Modelling and a degree of probability is assigned to the dates generated.

Summary of the Process

Probabilistic Analysis, or Schedule Risk Analysis - so called because the end date is determined by Monte Carlo Modelling and a degree of probability is assigned to the dates generated.

- **Deterministic Model**
  - Import Activities & 3 Point Durations
  - Import Risk Log

- **Probabilistic/ SRA Model**
  - Risks Captured, Performance considered and Reviewed with Programme.

- **SRA Results/ Confidence Levels**
  - At 20/50/80% for key milestones

- **PNR Cost Model**
  - PNR Cost
  - Model – PO Date
  - Asset Avail Date

- **Capacity Models**
  - Capacity
  - Models
  - Asset Avail Date

- **Assembly Schedule**
  - Assembly
  - Schedule
  - Asset Avail Date

- **3 point Results**

- **Actuals included. Uncertainty established from I & IS + Vendor schedules, documentation.**

Schedule Drivers
Define Threats & opportunities
Is this a satisfactory way of presenting data for multiple milestones?
Yes?  No?
There are alternatives options……
Possible Ways of presenting output for Multiple Milestones - 2

Sample Data

- Programme
- Optimistic
- Realistic
- Pessimistic
Possible Ways of presenting output for Multiple Milestones - 3

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Plus many more options.....
Including tabular
SRA Toolsets

**Toolsets:**
- Pertmaster
- Predict! Risk Analyser
- Arrisca
- @Risk
- Crystal Ball
- And many others

Uncertainty capability exists in Open Plan. Limited functionality in MSP.

N.B. All depends on what the business needs are and the level of maturity of the project/programme.
Pertmaster

What is it?

- A Cost and Schedule Risk analysis tool, based on Monte Carlo Analysis which allows Uncertainty and or Risks to be modelled
- Schedules can be directly imported from MSP to Pertmaster
- Part of the Oracle suite of Project Management Toolsets
- Provides easy to read management reports
Schedule Risk Analysis – concluding remarks

The Way Ahead

• Pro-active use, scenario modelling, etc
• Integrate Schedule and Cost risk analysis. This needs to be aligned with other functional disciplines to ensure appropriate synergy and benefits are delivered
• **Require Planning and Risk domain knowledge** to be able to build on the potential benefits that the application of Pertmaster can give to the business
Final Thoughts.

Have we done the job before or similar that is worth comparison?

Do we look for a similar activities and understand what happened on those activities –
  - Was it a success or what caused the delay?
  - How is it comparable or different?
  - Which elements of the task are similar?
  - At what level can this be done?

Overall project level or down at a detailed task level. Be prepared to Analyse the next level down may provide a different story.

Is there one part of the programme that is problematical?
Don’t Forget your own Perception & Prejudices.

Which presenter would you have turned up to listen to?

- Involve all relevant sources of information
- Put your own personal prejudices to one side
- Involve All, Value All, Thank All.
ANY QUESTIONS?