Is My Schedule Ready for Risk Analysis?

Mario Fountano
April 16, 2012

Table Of Contents

Introduction

- In project management, the schedule should be a central tool that effectively communicates the state of the project and provides team members with a means to make informed decisions
- However, scheduling is often under utilized due to the following reasons:
  - Schedules are overlooked by team members
  - Schedule inception and baseline are flawed
  - Correct usage and status of the schedule is incorrect
  - Schedule reports may be developed that hide reality
- When these factors are true, a schedule is not viable as a platform for risk analysis
- This study discusses methods ensuring validity of project schedules prior to integrating risk

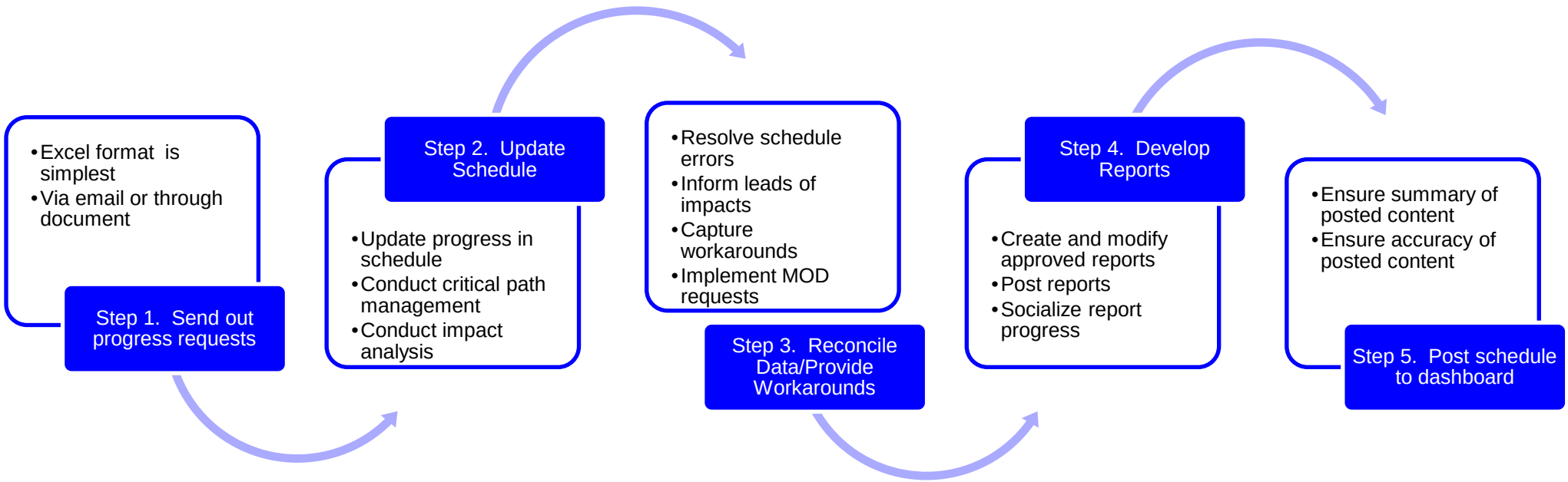
Table Of Contents

Stakeholder involvement

- A schedule assessment should first begin during a stakeholder analysis
- An analyst should focus on the following:
  - Who is developing and maintaining the schedule?
  - How much interest does leadership have in the schedule?
  - Is the schedule communicated clearly to team members?
  - Are project roles identified in the schedule?

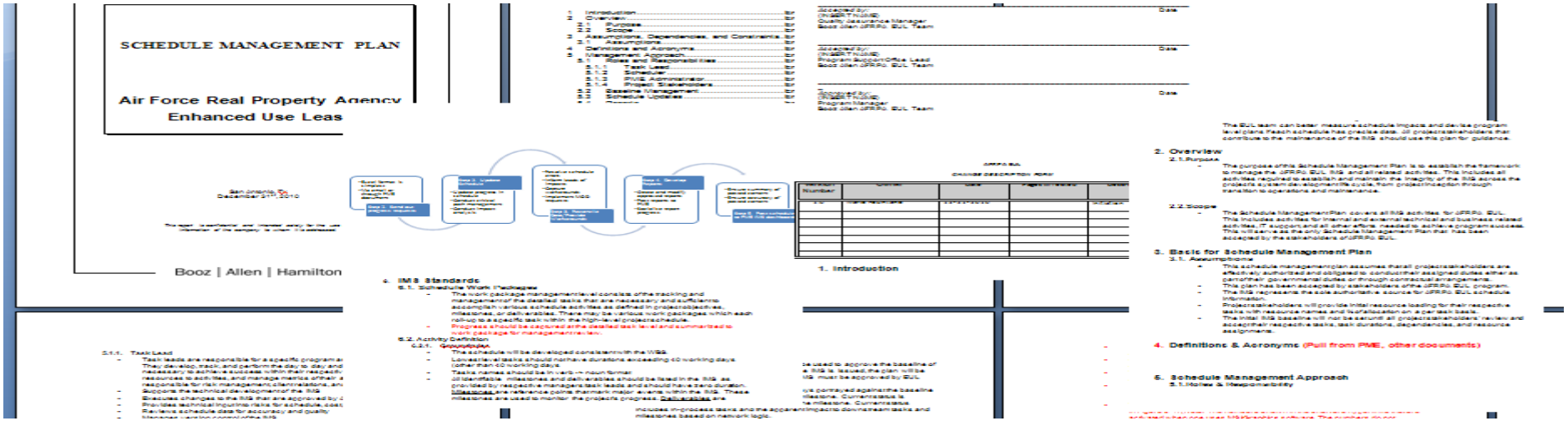
Next, how does the scheduler/planner communicate the schedule?

- The following should be identified:
  - Frequency and timeline (data should be updated every two weeks at a minimum, every week at a maximum, or at client's request)
  - Are there any efficiencies that can improve the process
  - Most Importantly for risk: Where does risk fit in??



A Schedule Management Plan should exist and must be approved by program officers

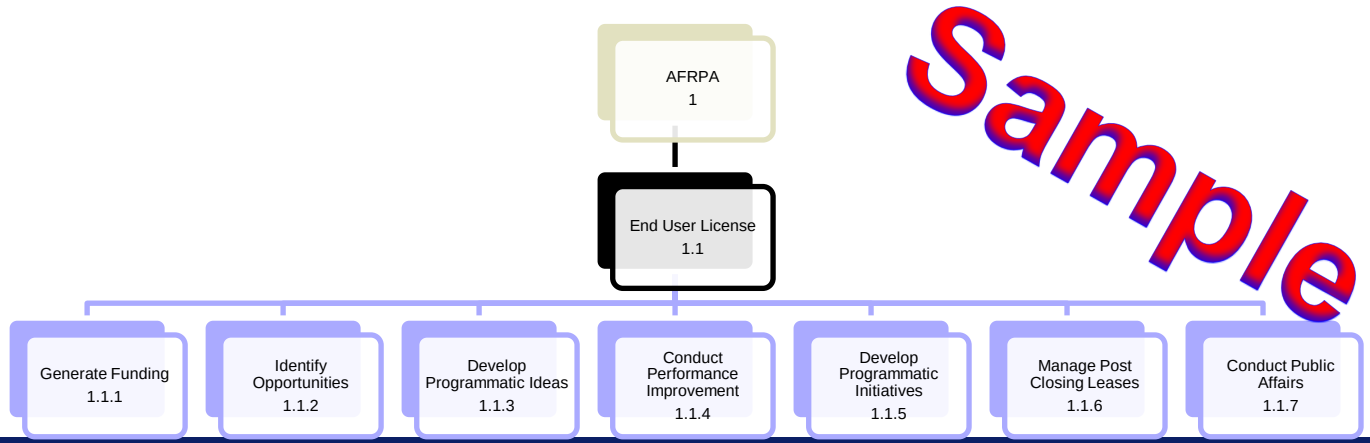
- The schedule management plan details the processes, standards, tools and techniques required for schedule development
- Standardizes approach to new schedules
  - Helps prevent negative auditing from external agencies
  - Defines schedule roles for team
- Clearly states how risks should be handled in the schedule



A schedule should follow a rigid Work Breakdown Structure

- The WBS is a hierarchical breakdown of the work to be performed by the project team to accomplish project objectives using required deliverables
  - A schedule should be organized from the WBS into a lower level that can be planned, managed, and controlled (work package)

- A WBS should be deliverable oriented, not organizationally based
  - The WBS should describe what is going to be delivered, produced, completed, etc
  - Teams or offices should not make up the WBS elements
  - Schedule milestones should trace back to the WBS



Developing an OBS will assist in project management and control

- An Organizational Breakdown Structure helps define roles and serves as the basis for responsibility relationships in the program
- This needs to be a preliminary step in process improvement so that the team can formally designate work, and begin to take ownership of schedules and resources

Once the WBS and OBS have been decomposed, the two tools can be merged to form a Responsibility Assignment Matrix

- The RAM integrates the lowest level WBS and the OBS
  - The RAM assigns specific responsibility to project offices
  - Each “X” indicates the intersection of the deliverable and the resource, providing clear expectation of who will perform what work
  - From this activity, risks can be assigned and directly linked to the schedule

WBS (Products/Services)

OBS(Resources)

Office	Lead	Generate Funding 1.1.1	Identify Opportunities 1.1.2	Develop Programmatic Ideas 1.1.3	Conduct Performance Improvement 1.1.4	Develop Programmatic Initiatives 1.1.5	Manage Post Closing Leases 1.1.6	Conduct Public Affairs 1.1.7
Foundation	Mark Smith			X		X		
Post Closing Management	Jane Doe							
Innovation	John Doe			X				
Business Development	Larry Davis	X	X					
Performance	Michael Hall				X	X		
Advocacy	David Jones		X					X
Project Execution	Buzz Aldrin	X						

Note: the further a WBS is decomposed, the better the distinction between work responsibility

Why do the WBS/OBS/RAM matter in a schedule assessment?

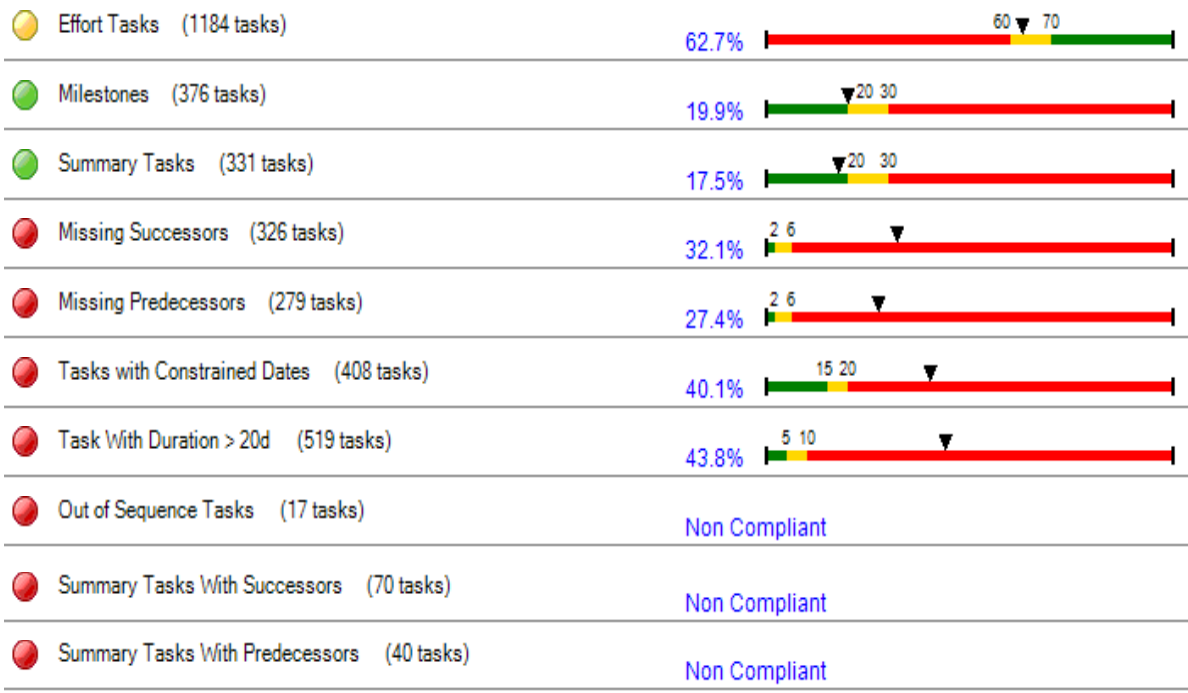
- In a schedule assessment, auditors must determine whether the schedule reflects how overall scope is impacted
  - A well-defined, deliverable oriented WBS provides the framework for schedule and cost fidelity
  - Managers have better traceability to project scope, ensures that all scope is captured
  - The quality of schedule summaries is increased
  - Helps distinguish project goals and establish deliverables and milestones
- For risk managers: does each risk correspond to an area in the schedule?

When a schedule file has been received, an analyst must then conduct a schedule health assessment

- What is schedule Health?
- Schedule health is the notion that a project schedule contains a fluid, logical activity network, discernable criticality, and accurate duration estimates that enables a project team to confidently plan for the achievement of project finish.
- Validating schedule health is a necessary precursor to conducting schedule studies such as risk sensitivity analysis, schedule performance metrics (EVM), and baseline change management
- Below are the factors that should be checked in a schedule health assessment
  - Use of constraints
  - Existence of open-ended activities
  - Valid activity network/logic
  - Broken logic (out of sequence activities)
  - Valid activity durations (including lead, lag, and float)
  - Understandable critical path
  - Representative of project scope and relative to WBS

How are schedules benchmarked?

- Results of a schedule check report should be reviewed with the project team
- The fields listed here are the top concerns from a recent schedule health assessment. These are elements of scheduling that need to be sound in order to study the critical path, and eventually risk exposure
  - Other items include negative lag, SPI, CPI, resource assignments, etc.



Constraints are key to understanding project reality

- A major finding from the example is that 40% of activities in the schedule (408 activities) are constrained
  - Overuse of constraints disrupts the logical flow of the schedule, and impacts may not be realized
- The constraint feature in scheduling tools should be used as optimally as possible, and should address the following
  - Factors that will limit the project team's options such as schedule milestones with imposed completion dates either by management or contract
  - Environmental factors inherent to the project
- Goldratt's theory of constraints is often cited as a method to understand project constraints, not necessarily related to activity constraints in the schedule
  - Project activities are affected by at least one constraint at any given time, but the actual number of constraints on a given project is fairly low

The critical path can become disjointed due to use of constraints

- The dates here are maintained by “must finish on” constraints
- Once the constraint is changed to “start no earlier than,” the dates slip out by two months due to the logic in the schedule
- Scheduling software has difficulty accounting for true criticality in this case. This type of constraint forces the achievement of a date, rather than showing impact and reality of completing on time

189	FAA Certification	0%	307 days	Mon 3/2/09	Wed 4/28/10	As Soon As Possible
190	Demo C1 FAA Reentry Package Submission	100%	0 days	Mon 3/2/09	Mon 3/2/09	Start No Earlier Than
191	Demo C1 Reentry Package Certified	0%	6 mons	Mon 3/2/09	Tue 8/11/09	As Soon As Possible
192	Demo C2 FAA Package Submission	0%	0 days	Mon 7/6/09	Mon 7/6/09	Start No Earlier Than
193	Demo C2 package finalization	0%	48 days	Mon 7/6/09	Mon 9/7/09	As Late As Possible
194	Demo C2 Certified	0%	6 mons	Mon 4/27/09	Mon 10/5/09	Must Finish On
195	Demo C3 FAA Package Submission	0%	0 days	Tue 9/1/09	Tue 9/1/09	Start No Earlier Than
196	Demo C3 package finalization	0%	42 days	Tue 9/1/09	Wed 10/28/09	As Late As Possible
197	Demo C3 package processing	0%	130 days	Thu 10/29/09	Wed 4/28/10	As Late As Possible
198	Demo C3 Certified	0%	0 days	Mon 2/1/10	Mon 2/1/10	Must Finish On

189	FAA Certification	0%	307 days	Mon 3/2/09	Wed 4/28/10	As Soon As Possible
190	Demo C1 FAA Reentry Package Submission	100%	0 days	Mon 3/2/09	Mon 3/2/09	Start No Earlier Than
191	Demo C1 Reentry Package Certified	0%	6 mons	Mon 3/2/09	Tue 8/11/09	As Soon As Possible
192	Demo C2 FAA Package Submission	0%	0 days	Mon 7/6/09	Mon 7/6/09	Start No Earlier Than
193	Demo C2 package finalization	0%	48 days	Fri 7/31/09	Fri 10/2/09	As Late As Possible
194	Demo C2 Certified	0%	6 mons	Mon 10/5/09	Fri 3/19/10	Start No Earlier Than
195	Demo C3 FAA Package Submission	0%	0 days	Tue 9/1/09	Tue 9/1/09	Start No Earlier Than
196	Demo C3 package finalization	0%	42 days	Tue 9/1/09	Wed 10/28/09	As Late As Possible
197	Demo C3 package processing	0%	130 days	Thu 10/29/09	Wed 4/28/10	As Late As Possible
198	Demo C3 Certified	0%	0 days	Wed 4/28/10	Wed 4/28/10	Start No Earlier Than

Open ended activities require further development of the schedule

- In the data, 32% of activities are missing successors, 27% are missing predecessors, ie., left “open”
  - Open ended activities destroy logic in a schedule, and should lead to a milestone (completion, delivery, handoff), otherwise, the existence of these activities are in question
- Findings such as these will drive a “deep dive” into the schedule logic
  - Missing logic must be reviewed, otherwise, the impact of a logical path could not be realized
  - New logical relationships must be imposed after discussions with a Subject Matter Expert
  - Often, activities will need to be removed from the schedule, this also must be done carefully
- “Out of sequence” or items with “broken logic” are activities that are not updated after their predecessor completes
  - It is recommended that any broken logic be removed or corrected to ensure the logic flows as expected

Duration estimates and activity types need to accurately capture work

- In the example, the length of duration is in question – 519 activities are greater than 20 days
- What type of duration estimation method was used?
  - Expert Judgment
  - Analogy Estimate
  - Parametric Estimate
  - *3-Point Estimate
  - Reserve/Contingency Estimate
- In order for an activity to capture the nature of the work being performed, it must reflect the correct level of effort that is required to deliver a product or service
  - Long duration may be acceptable in activities that are “Level of Effort,” where work is more routine
  - Activities that are “discrete” need to reflect what is being performed in a manner that shows impacts of delays, changes in course of direction, and accomplishments
- In the sample schedule, the ratio of milestones to duration activities is acceptable, at 19%
  - A general rule of thumb is less than 20% of the activities marked as milestones
  - This promotes the possibility that logically linked paths are feeding milestones as end products
  - Activities must be separated into events and duration bearing items

Schedule Assessment Software

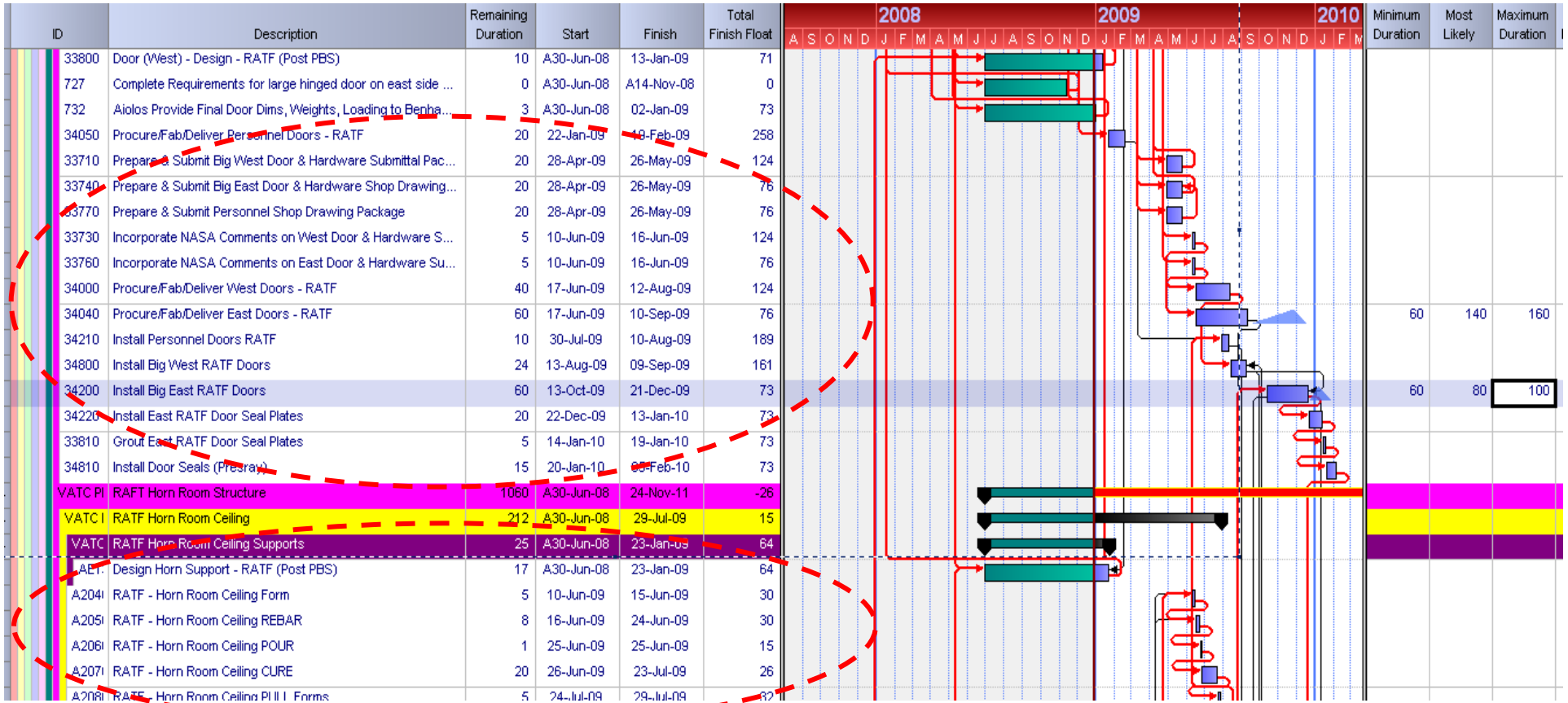
- There are a number of software that will provide a fast schedule health check
- Those results need to be communicated with the team, and used as a guideline into deeper issues
  - Any software can only present a certain level of insight into a project; it is the job of the analyst to identify the root cause of project issues

A “deep dive” into the schedule should be a thorough look into the activity network sequence

- The interviews for dependency definition must be conducted with the proper technical leads of each work package, these points of contact should be subject matter experts, and have vested knowledge in the objectives of the project
  - Dependencies need to be divided into mandatory, preferred, and external
- To provide meaningful results, the work content must be evaluated
  - Despite resolving schedule health issues, the focus must still remain on the work content in the schedule
  - This involves researching key technologies and the impacts they could have on the project

Below is an example of why work content needs to be reviewed

- In this schedule, more detail was found in construction activities, with less detail in technologically challenging sections (vaporizer, door, ACS, noise generation, etc.)



ID	Description	Remaining Duration	Start	Finish	Total Finish Float	Minimum Duration	Most Likely	Maximum Duration
33800	Door (West) - Design - RATF (Post PBS)	10	A30-Jun-08	13-Jan-09	71			
727	Complete Requirements for large hinged door on east side ...	0	A30-Jun-08	A14-Nov-08	0			
732	Aiolos Provide Final Door Dims, Weights, Loading to Benha...	3	A30-Jun-08	02-Jan-09	73			
34050	Procure/Fab/Deliver Personnel Doors - RATF	20	22-Jan-09	18-Feb-09	258			
33710	Prepare & Submit Big West Door & Hardware Submittal Pac...	20	28-Apr-09	26-May-09	124			
33740	Prepare & Submit Big East Door & Hardware Shop Drawing...	20	28-Apr-09	26-May-09	76			
33770	Prepare & Submit Personnel Shop Drawing Package	20	28-Apr-09	26-May-09	76			
33730	Incorporate NASA Comments on West Door & Hardware S...	5	10-Jun-09	16-Jun-09	124			
33760	Incorporate NASA Comments on East Door & Hardware Su...	5	10-Jun-09	16-Jun-09	76			
34000	Procure/Fab/Deliver West Doors - RATF	40	17-Jun-09	12-Aug-09	124			
34040	Procure/Fab/Deliver East Doors - RATF	60	17-Jun-09	10-Sep-09	76	60	140	160
34210	Install Personnel Doors RATF	10	30-Jul-09	10-Aug-09	189			
34800	Install Big West RATF Doors	24	13-Aug-09	09-Sep-09	161			
34200	Install Big East RATF Doors	60	13-Oct-09	21-Dec-09	73	60	80	100
34220	Install East RATF Door Seal Plates	20	22-Dec-09	13-Jan-10	73			
33810	Grout East RATF Door Seal Plates	5	14-Jan-10	19-Jan-10	73			
34810	Install Door Seals (Prebray)	15	20-Jan-10	05-Feb-10	73			
VATC PI	RAFT Horn Room Structure	1060	A30-Jun-08	24-Nov-11	-26			
VATC I	RATF Horn Room Ceiling	212	A30-Jun-08	29-Jul-09	15			
VATC	RATF Horn Room Ceiling Supports	25	A30-Jun-08	23-Jan-09	64			
AE1	Design Horn Support - RATF (Post PBS)	17	A30-Jun-08	23-Jan-09	64			
A204	RATF - Horn Room Ceiling Form	5	10-Jun-09	15-Jun-09	30			
A205	RATF - Horn Room Ceiling REBAR	8	16-Jun-09	24-Jun-09	30			
A206	RATF - Horn Room Ceiling POUR	1	25-Jun-09	25-Jun-09	15			
A207	RATF - Horn Room Ceiling CURE	20	26-Jun-09	23-Jul-09	26			
A208	RATF - Horn Room Ceiling PULL Forms	5	24-Jul-09	29-Jul-09	82			

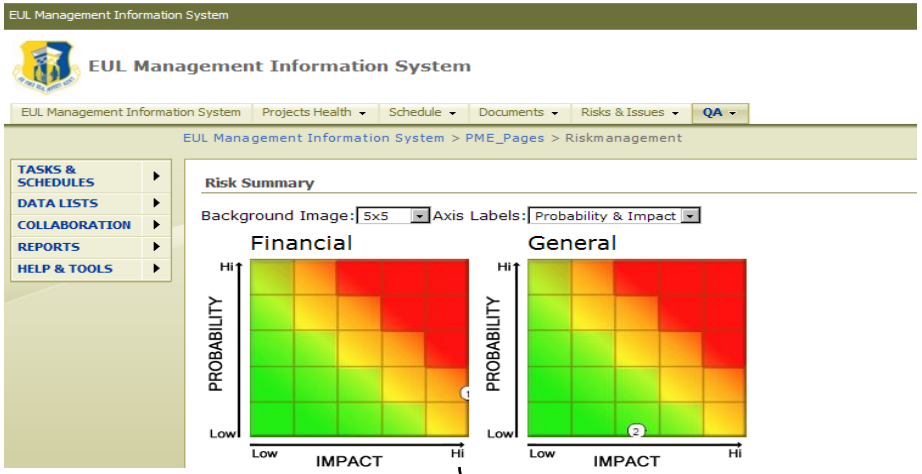
Evaluation of the critical path helps understand the project

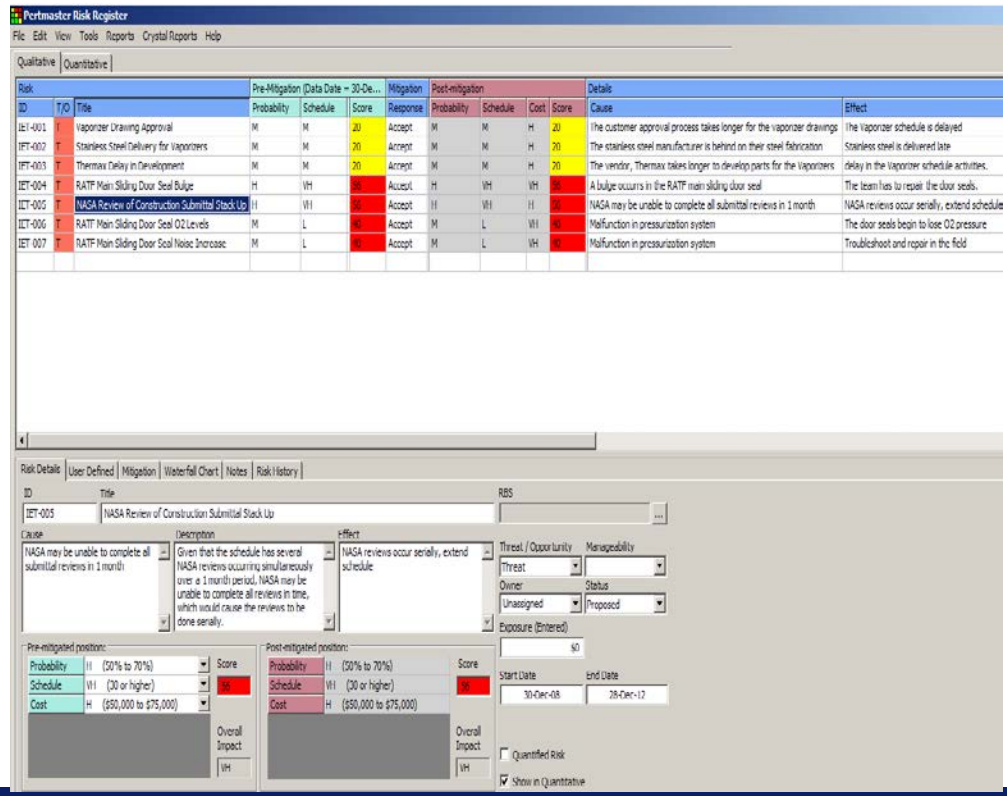
- Once content is validated in the schedule, communicating the critical path to the client becomes simpler, and a more accurate ability to exploit risks in the critical path exists

- Sample Critical Path Statement:
  - *"The critical path in the schedule follows Qualification testing for the DRACO thrusters and FAA certification. This leads into C2/C3 Hot fire testing, feeding the propulsion system fabrication/testing/integration, finally culminating to final integration, targeting the fall of 2010 for the Demo flight"*
  - *"…However, the DFI deferred activities only contain 13 days of total float in the path to the Demo flight and the critical path will change if the DFI deferred items begin to slip more than 13 days*
  - *…This small amount of float is realistically becoming smaller, which will push the DFI installation onto the critical path*

Below, risks are loaded into a dashboard; this can be sent to a risk analysis tool

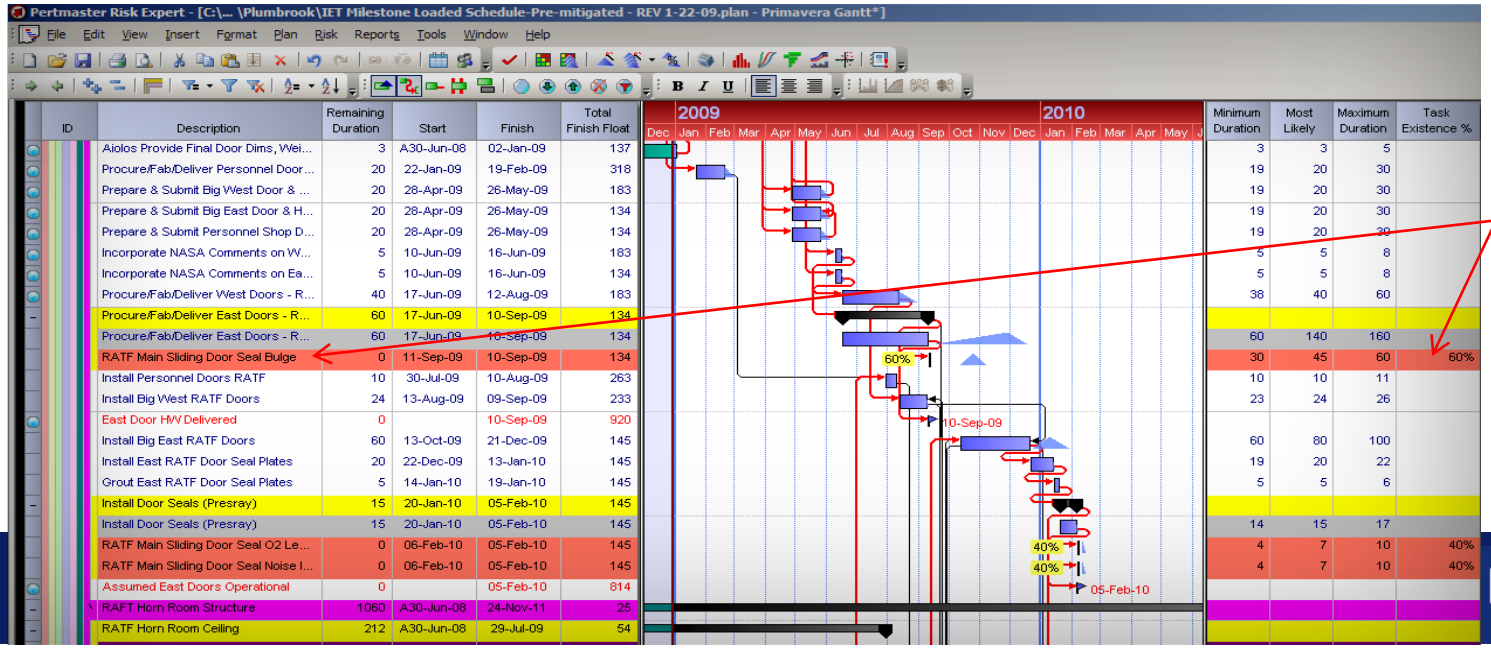
- Risk scoring data is captured in one tool, then exported to another tool for further analysis





Once schedule assessment is complete, risk and uncertainty can help account for unexpected work and potential threats

- Using historical data, we can model a sensitivity analysis
  - Identify which work areas expanded the most
  - Identify the frequency in which the client requests ad hoc work
  - Identify how milestone completion was impacted by ad hoc work
- The results of the analysis can help the team develop an uncertainty/risk impacted schedule
  - Provides a better confidence level in achieving milestones
  - Carries burdened schedule items that allow for slippage throughout project lifecycle



►Minimum, Most Likely, and Maximum Duration and Cost uncertainties are both loaded in the sensitivity model

►Risks are loaded into the schedule, and given a minimum, most likely, and maximum impact against a probability of existence

Next steps should be to validate a mitigation strategy for the schedule

- The risk register must be validated
  - Mitigation steps should be built into the schedule
  - Cost for mitigation must be considered
- Opportunities must be captured in the schedule

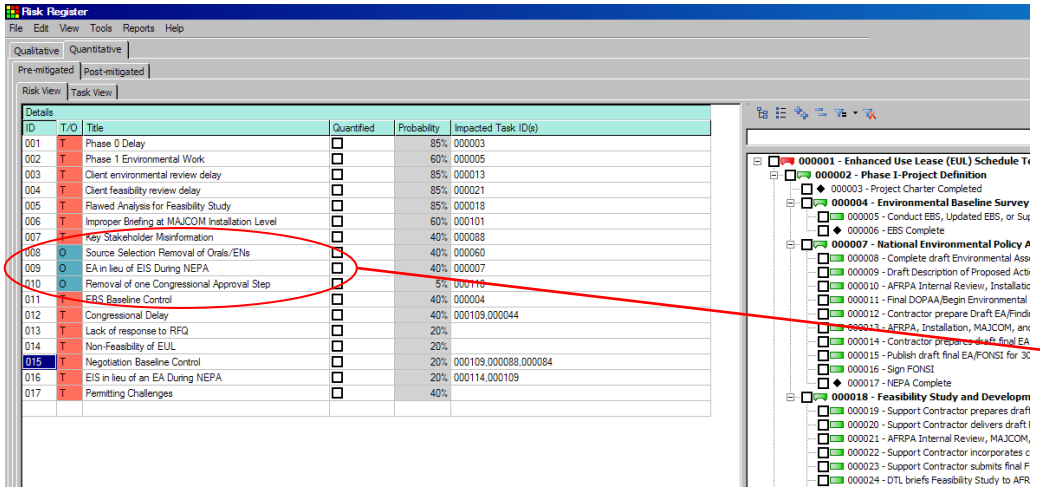


Table Of Contents

Schedule assessment helps determine other issues in the project

- A poor schedule could be a result of a systemic issue in the project or organization, and could include lack of data, lack of management support, poor communication, or poor process
- Through the course of client interviews, it is imperative to learn their scheduling process
  - How often is the schedule updated
  - Who provides input
  - Which scheduling tools are used, and are they used efficiently
  - Does the schedule produce valuable data to management
  - Is the schedule used as a planning tool
  - Has the schedule been vetted with project SME's
- Once these statements are true, or to some degree, acceptable – the schedule can be trusted to produce effective metrics and reports