Interpreting the results/outputs of an SRA

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Introduction

While most Schedulers and Project Managers are familiar with the concepts of a schedule risk analysis (SRA) and the fact that it considers estimate and event uncertainty, there is less clarity around the likely results beyond expecting a histogram of some sort.

But what does that histogram mean? Why does the histogram look like it does? What can we do to improve unacceptable results?

Uncertainty

A quick recap: Schedule uncertainty is caused by two factors. Estimate Uncertainty and Event Uncertainty. Estimate uncertainty includes duration and cost. We don't know exactly how long something will take in the future and we don't know what it will exactly cost. In the schedule risk analysis, we model estimate uncertainty by specifying a range of likely values – most commonly referred to as a three-point estimate. We specify optimistic (best case), most likely, and pessimistic (worst case) estimates and a probability distribution (Normal, Beta, Triangular etc..) that tells the software where we think the actual value is more likely to fall between the three points.

Event uncertainty (Risks/Threats/Opportunities) is modelled using techniques like Task Existence and Probabilistic Branching. This allows us to incorporate additional work or time that may or may not need to be performed based on a probability of occurrence.

Monte Carlo Simulation

This is the technique we use to assess the impact of uncertainty on forecast dates. It is called a simulation because we effectively simulate the execution of the project thousands of times, substituting in different sample values for the task durations from within the three-point estimate for each simulation. The software tabulates the various start/finish dates for all the tasks and milestones during the simulations and can then predict the probability of any task/milestone finishing by a specific date.

Level of Confidence

A typical single-point estimate of the duration of a task represents the Most Likely duration. However, everything is subject to some uncertainty and if we assume, in the absence of any knowledge regarding risks that may affect the execution, that a task might finish a little sooner or a little later than estimated, then we can see the typical Most Likely estimate represents a 50% chance of completing the work in the estimated time. However, nobody wants only a 50% chance of delivering on time. That's a 50% chance of delivering late – also known as failure. Many organizations require their forecast finish dates to be presented with an 80% level of confidence. Do NOT pad task duration estimates in an attempt to achieve this goal. The task estimates should always be based on your best or most likely assessment. In the context of an SRA levels of confidence are based on the percentage of simulations that predict a finish date on or before the relevant date.

Number of Simulations

As with any statistical process, the more data you have, the more reliable the results will be. Full Monte is very fast but even so running thousands of simulations on a large project can take several minutes. During schedule development, we recommend finding out how many simulations you can perform in a reasonable amount of time, for example around 1 minute. Use that number as you develop the logic and start to see where the forecast finish dates will be. However, when preparing your final analysis or producing reports, add a zero or two to the number of simulations and go to lunch. Bear in mind that the average result isn't going to change much BUT we aren't interested in an average (50/50 chance of success). We are going to be interested in the 80, 85, or 90 percent confidence values and these need more data to be reliable.

Finding the Results

So, we have entered our three-point estimates and performed the simulation. With Full Monte, any date that is affected by uncertainty can be viewed as a histogram. If there's no available histogram for a date, then it has no uncertainty. Figure 1 shows the default Task Edit pane layout.

ID	Task Name	Remaining Duration	Duration Distribution Type	Duration Optimistic	Duration Most Likely	Duration Pessimistic	Duration Confidence Interval (%)	Finish Histogram
4	⊟ Hardware	480 hrs	Triangular	75%	100%	125%	100%	NA
5	HW Task 1	160 hrs	Triangular	75%	100%	125%	100%	NA
6	HW Task 2	160 hrs	Triangular	75%	100%	125%	100%	NA
7	HW Task 3	160 hrs	Triangular	75%	100%	125%	100%	NA
8	HW Task 4	160 hrs	Triangular	75%	100%	125%	100%	NA
9	HW Complete	0	Triangular					NA
10	⊟ Software	432 hrs	Triangular	75%	100%	125%	100%	NA
11	SW Task 1	144 hrs	Triangular	75%	100%	125%	100%	NA
12	SW Task 2	144 hrs	Triangular	75%	100%	125%	100%	NA
13	SW Task 3	144 hrs	Triangular	75%	100%	125%	100%	NA
14	SW Task 4	144 hrs	Triangular	75%	100%	125%	100%	NA
15	SW Complete	0	Triangular					NA
16	⊟ Integration	40 hrs	Triangular	75%	100%	125%	100%	NA
17	Integration	40 hrs	Triangular	75%	100%	125%	100%	NA
18	⊟ Marketing	120 hrs	Triangular	75%	100%	125%	100%	NA
19	Brochure Development	80 hrs	Triangular	75%	100%	125%	100%	NA
20	Brochure Printing	40 hrs	Triangular	75%	100%	125%	100%	NA
21	Delivery	0	Triangular					NA

22 rows | No Filter | No Highlight | Sorted on ID | Simulations: Risk Analysis Required

Figure 1

Note that the Finish Histogram column is currently displaying NA for all tasks. This indicates a Risk Analysis has not yet been performed. Let runs the analysis.
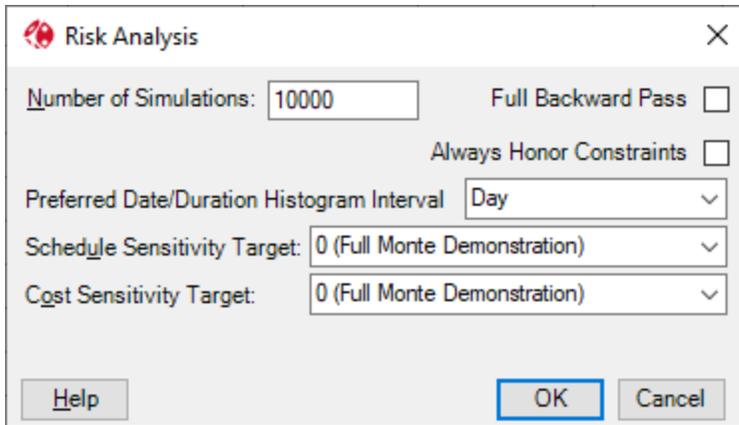
Figure 2

Figure 2 shows typical settings for the Risk Analysis dialog. We are going to perform 10,000 simulations on the schedule. We have turned off the 'Full Backward Pass' and 'Always Honor Constraints' options. Turning off the 'Full Backward Pass' saves time during the simulation by not calculating CPM Late Dates and Floats. This allows us to run more simulations in a given amount of time. It would be unusual to report Late date or Floats as part of a schedule risk analysis, so we don't need them calculated. The 'Always Honor Constraints' option mimics the same feature in Microsoft Project and by turning off the option so called 'Hard Constraints' like Start No Later, Finish No Later, Finish On, and Start On will not be allowed to prevent dates moving into the future. This improves the realism of the simulation. Figure 3 shows the Task Edit screen after the analysis is performed.

ID	Task Name	Remaining Duration	Duration Distribution Type	Duration Optimistic	Duration Most Likely	Duration Pessimistic	Confidence Interval (%)	Finish Histogram
4	⊟ Hardware	480 hrs	Triangular	75%	100%	125%	100%	Graph
5	HW Task 1	160 hrs	Triangular	75%	100%	125%	100%	Graph
6	HW Task 2	160 hrs	Triangular	75%	100%	125%	100%	Graph
7	HW Task 3	160 hrs	Triangular	75%	100%	125%	100%	Graph
8	HW Task 4	160 hrs	Triangular	75%	100%	125%	100%	Graph
9	HW Complete	0	Triangular					Graph
10	⊟ Software	432 hrs	Triangular	75%	100%	125%	100%	Graph
11	SW Task 1	144 hrs	Triangular	75%	100%	125%	100%	Graph
12	SW Task 2	144 hrs	Triangular	75%	100%	125%	100%	Graph
13	SW Task 3	144 hrs	Triangular	75%	100%	125%	100%	Graph
14	SW Task 4	144 hrs	Triangular	75%	100%	125%	100%	Graph
15	SW Complete	0	Triangular					Graph
16	⊟ Integration	40 hrs	Triangular	75%	100%	125%	100%	Graph
17	Integration	40 hrs	Triangular	75%	100%	125%	100%	Graph
18	⊟ Marketing	120 hrs	Triangular	75%	100%	125%	100%	Graph
19	Brochure Development	80 hrs	Triangular	75%	100%	125%	100%	Graph
20	Brochure Printing	40 hrs	Triangular	75%	100%	125%	100%	Graph
21	Delivery	0	Triangular					Graph

22 rows | No Filter | No Highlight | Sorted on ID | Simulations: 10000, Sensitivity Targets: 0 (schedule), 0 (cost)

Figure 3

The Finish Histogram column is now populated with Graph buttons.

Note: If the Finish Histogram column is not visible it can be added by Right-Clicking on any visible column heading and choosing either 'Insert Column (before)' or 'Add Column(after)'. Alternatively click the Graphs button on the menu bar to open the Graphs view as shown in Figure 4.

ID	Task Name	Joint Confidence Level	Cost Histogram	Duration Histogram	Early Start Histogram	Early Finish Histogram	Late Start Histogram	Late Finish Histogram	Free Slack Histogram	Total Slack Histogram
0	⊟ Full Monte Demonstration	JCL Plot	Graph	Graph	1/1/18 8:00AM	Graph	NA	NA	NA	NA
1	⊟ Full Monte 2017 Demonstration	JCL Plot	Graph	Graph	1/1/18 8:00AM	Graph	NA	NA	NA	NA
2	Initiate	JCL Plot	Graph	Graph	1/1/18 8:00AM	Graph	NA	NA	NA	NA
3	⊟ Development	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
4	⊟ Hardware	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
5	HW Task 1	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
6	HW Task 2	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
7	HW Task 3	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
8	HW Task 4	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
9	HW Complete		$0	0	Graph	Graph	NA	NA	NA	NA
10	⊟ Software	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
11	SW Task 1	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
12	SW Task 2	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
13	SW Task 3	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
14	SW Task 4	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
15	SW Complete		$0	0	Graph	Graph	NA	NA	NA	NA
16	⊟ Integration	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
17	Integration	JCL Plot	Graph	Graph	Graph	Graph	NA	NA	NA	NA
18	⊟ Marketing		$0	Graph	3/12/18 8:00AM	Graph	NA	NA	NA	NA

Full Monte Demonstration.mpp - Full Monte View: Graphs (Customized)

File   View   Help   Risk Analysis   Search for Name or ID   <<

22 rows | Filter: Has Buttons (22 rows) | No Highlight | Sorted on ID | Simulations: 10000, Sensitivity Targets: 0 (schedule), 0 (cost)

Figure 4

In figure 4, note the Late Start/Finish and Total/Free Slack histograms are not available because we selected to not perform the Full Backward Pass that would have calculated these values. They simply aren't needed. Also note the Early Start Histogram values for tasks 0, 1, and 2 show a specific date rather than graph button. As these tasks are at the start of the project, their start dates have no uncertainty, so the deterministic value is displayed.

Close the Graphs view (if you have it open). Clicking on the Graph button in the Finish Histogram column will display a Histogram as shown in Figure 5.
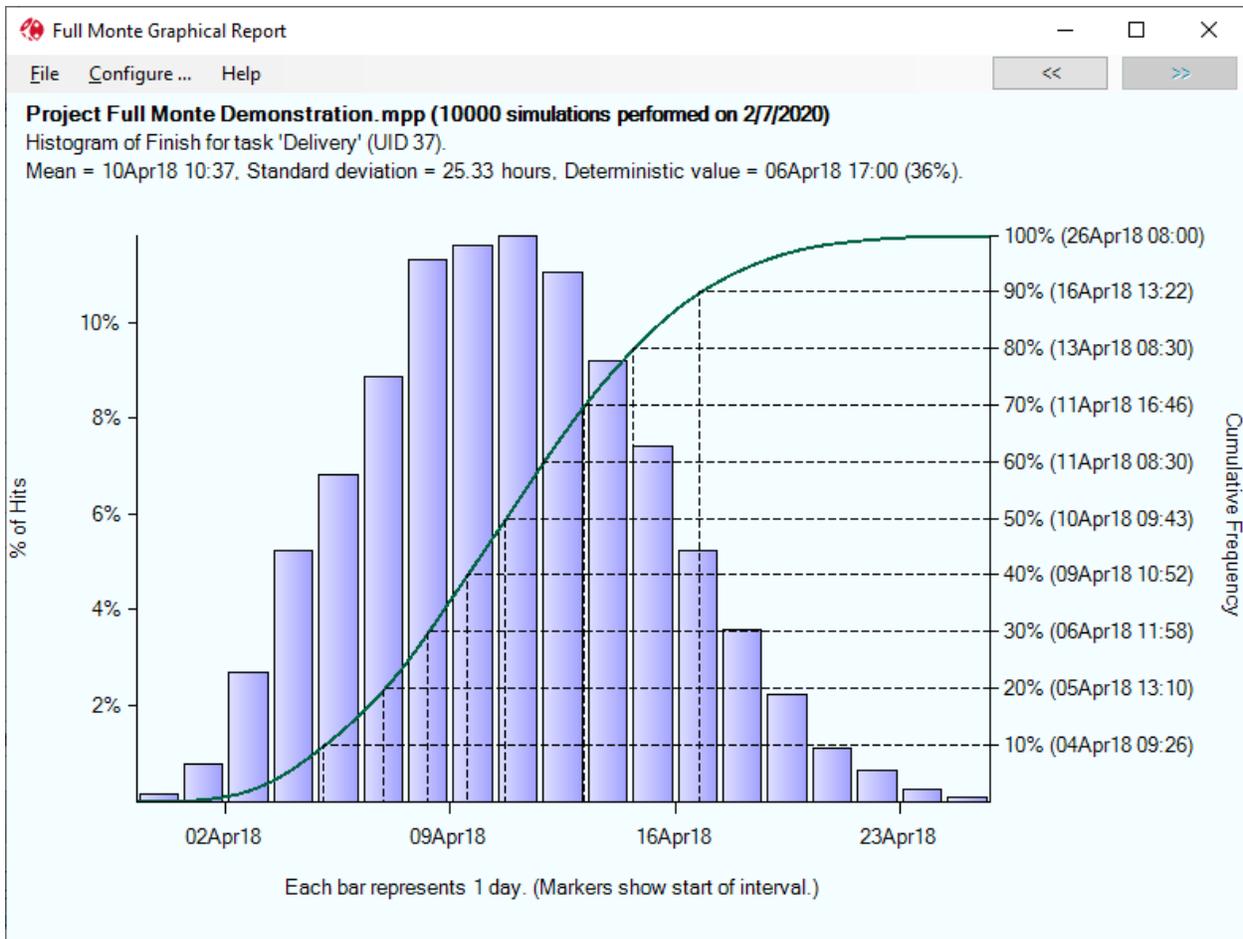
Figure 5

The height of the individual bars shows the percentage of simulations that finished in each period.

Hovering the mouse over a specific bar will display the detail information for a bar as shown in Figure 6.
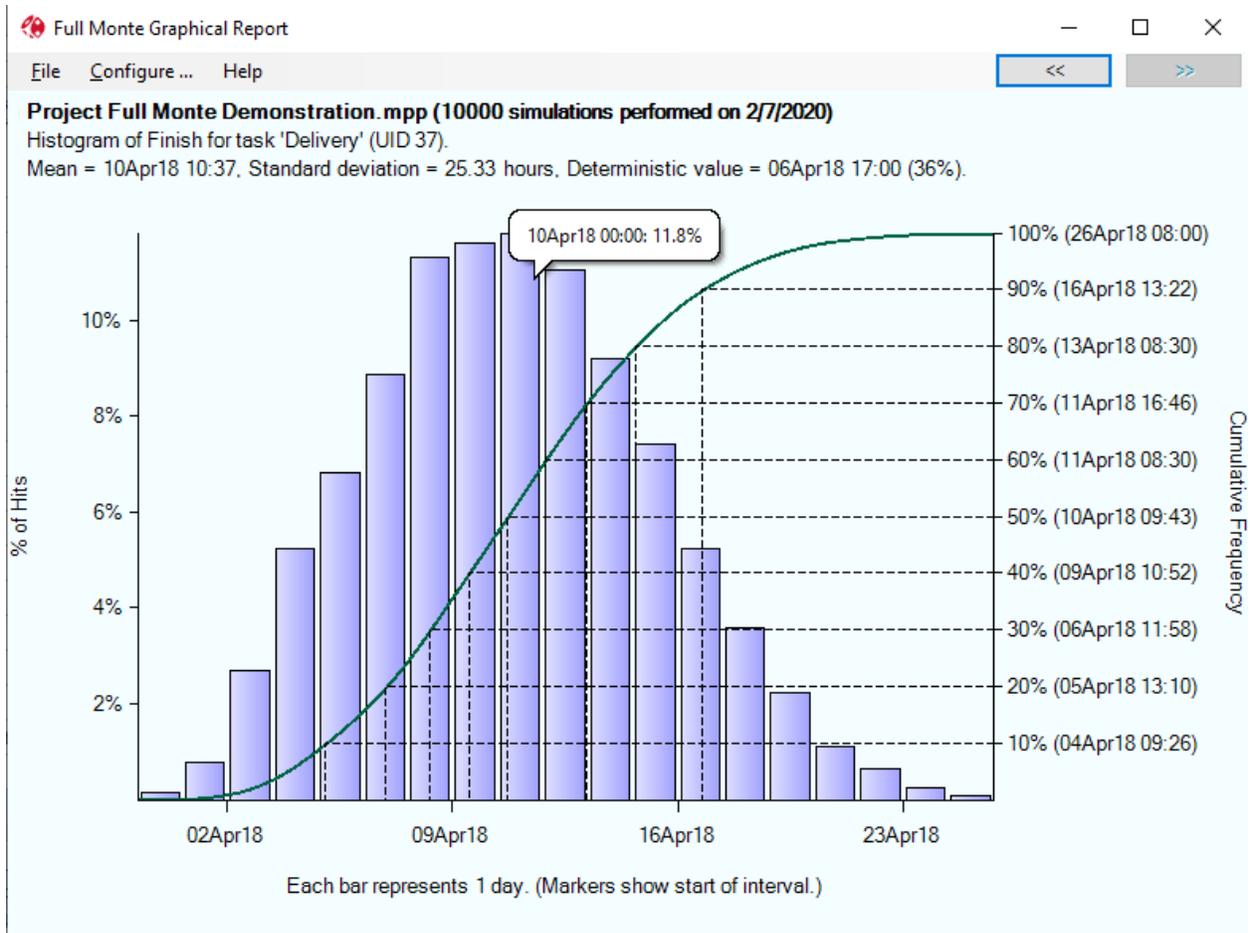
Figure 6

In Figure 6 we can see that 11.8% of the simulations finished in the period beginning 10Apr18. Since we ran 10,000 simulations this means that 1,180 of the simulations finished **on** 10Apr18.

This is not useful information.

However, the S-Curve shows the cumulative probability of finishing **by** a specific date. Reading off against the right-hand Y-Axis we can see that 80% of the simulations finished **by** 13Apr18. This means we have an 80% chance of the 'Delivery' task completing by 13Apr18.

This is more useful information.

However, looking in the heading information for the chart we can see the Deterministic value forecast for 'Delivery' by Microsoft Project was 6Apr18. The software has calculated we only have a 36% chance of delivering by this date. This means that only 36% of the simulations finished on or before 6Apr18.

If we have the luxury of telling the client when we will deliver, then it would be safer to commit to 13Apr18 as the simulations suggest an 80% chance of achieving that date. But **what do we do** if we already committed to 6Apr18, based on the forecast from Microsoft Project, and we now suspect this is unlikely to happen?

Sensitivity Analysis

Sensitivity Analysis shows us which tasks are creating uncertainty in a selected outcome. The selected outcome might be the entire project or an interim deliverable. Understanding the potential impact of each task on the outcome helps us focus management effort and perhaps identify opportunities for schedule compression.

In order to create uncertainty in the outcome the task must have two attributes: It must appear on the critical path to the selected outcome at least some of the time in the simulations and it must have some duration uncertainty. If a task never appears on the critical path to a selected outcome or does not have any duration uncertainty it will not appear on the Tornado chart.

Sensitivity data is often depicted using a 'Tornado' chart, named after the typical shape of the bars. An example is shown in Figure 7. The view is opened by selecting the 'View' menu, choosing 'Open named View…' and then 'Tornado (Schedule with Index)'.

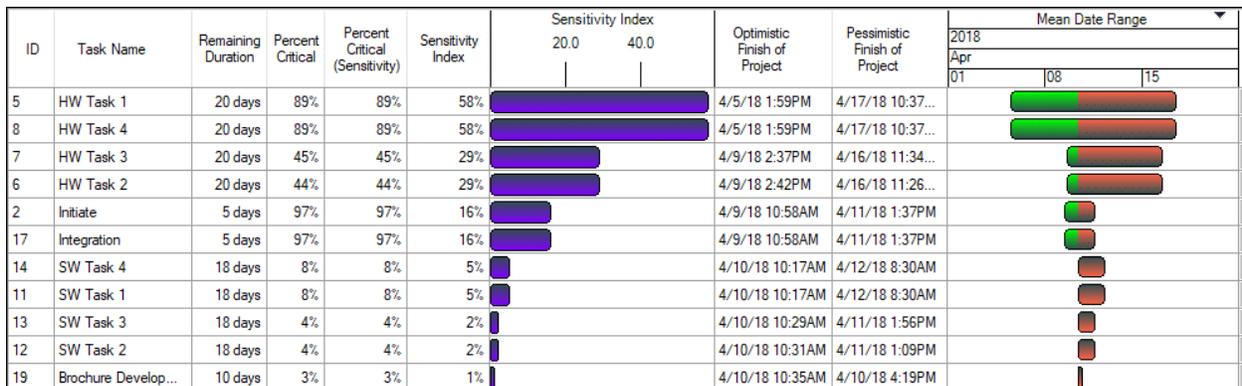| ID	Task Name	Remaining Duration	Percent Critical	Percent Critical (Sensitivity)	Sensitivity Index	Sensitivity Index 20.0 40.0	Optimistic Finish of Project	Pessimistic Finish of Project	Mean Date Range
5	HW Task 1	20 days	89%	89%	58%		4/5/18 1:59PM	4/17/18 10:37…	
8	HW Task 4	20 days	89%	89%	58%		4/5/18 1:59PM	4/17/18 10:37…	
7	HW Task 3	20 days	45%	45%	29%		4/9/18 2:37PM	4/16/18 11:34…	
6	HW Task 2	20 days	44%	44%	29%		4/9/18 2:42PM	4/16/18 11:26…	
2	Initiate	5 days	97%	97%	16%		4/9/18 10:58AM	4/11/18 1:37PM	
17	Integration	5 days	97%	97%	16%		4/9/18 10:58AM	4/11/18 1:37PM	
14	SW Task 4	18 days	8%	8%	5%		4/10/18 10:17AM	4/12/18 8:30AM	
11	SW Task 1	18 days	8%	8%	5%		4/10/18 10:17AM	4/12/18 8:30AM	
13	SW Task 3	18 days	4%	4%	2%		4/10/18 10:29AM	4/11/18 1:56PM	
12	SW Task 2	18 days	4%	4%	2%		4/10/18 10:31AM	4/11/18 1:09PM	
19	Brochure Develop…	10 days	3%	3%	1%		4/10/18 10:35AM	4/10/18 4:19PM	

Figure 7

Note the typical 'funnel' shape of the bars with longer bars at the top.

The Sensitivity Index ranks the tasks in order of their contribution to uncertainty to the outcome and clearly shows that HW Task 1 and 4 are having the greatest effect. The split between green and red areas in the time scaled bar chart shows the potential impact relative to the **mean** (average) finish for the outcome. This highlights that when tasks HW Task 1 and 4 finished early, then the finish date for the outcome tended to finish earlier than its expected mean. Conversely, if the tasks finished late then the outcome moved later. By managing these tasks well during execution, the chance of an on-time delivery increases.

I always suggest caution when sharing the information from the Sensitivity Analysis Tornado Chart because it can easily be misinterpreted. For example, there are two columns labelled 'Optimistic Finish of Project' and Pessimistic Finish of Project'.

> Note the column names would change if you selected an interim milestone as the focus of the sensitivity analysis.

The dates in those two columns represent the **mean** (average**)** optimistic/pessimistic finish for the selected outcome when each task finishes at its most optimistic duration and pessimistic duration. For example, considering the first row (HW Task 1), on average the project finished on 5Apr18 when task

'HW Task 1' finished at its most optimistic duration. Conversely, on average, the project finished on 17Apr18 when task 'HW Task 1' finished at its most pessimistic duration.

It cannot be stressed enough that these are averages; they are not best/worst case dates for the project. Best/Worst case dates always come from the Histogram. Referring to Figure 6, we can see the actual best/worst case for the 'Delivery' are 29Mar18 and 26Apr18 respectively.

The Tornado chart is useful for the following reasons:

- We can use it to verify that major tasks we expect to impact the outcome appear on the view.
- We can verify that tasks we do not expect to affect the outcome do not appear on the view.
- It can help identify opportunities for schedule compression (improving our chance of finishing earlier) by highlighting tasks that cause the project to, on average, finish earlier when they finished closer to their optimistic estimated duration.

Risk Path Analysis

As mentioned above, one of the shortcomings of sensitivity analysis and the Tornado chart is that tasks with no uncertainty will never create uncertainty in the outcome and so will not appear on the Tornado chart even if they are always/often on the critical path to the selected outcome.

Along with the sensitivity data for the Tornado chart, Full Monte also calculates a series of possible critical paths to the selected sensitivity outcome. This information is stored in a Full Monte field call 'Risk Path' and it can be mapped or exported to a Microsoft Project custom field to create reports as shown in figure 8.
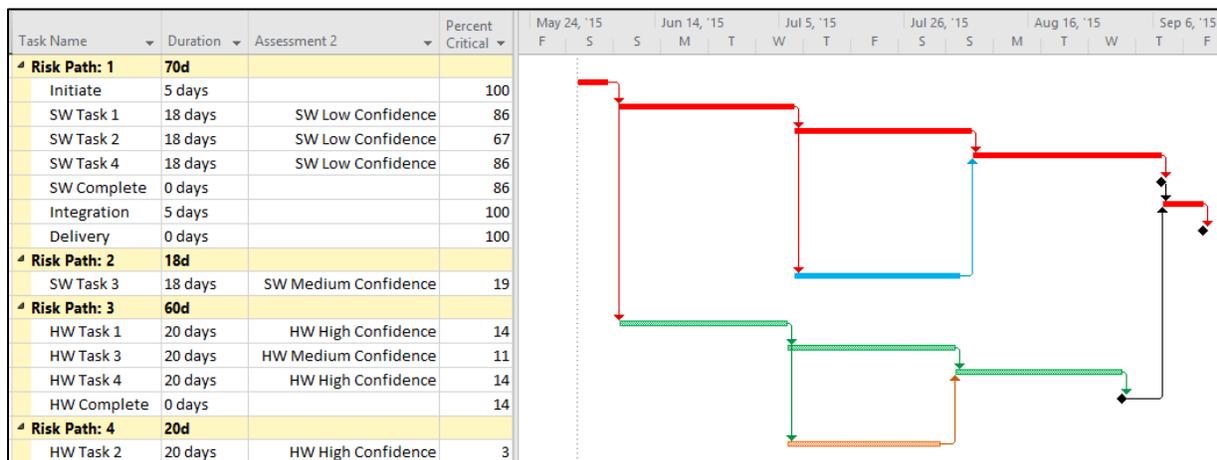

Figure 8

The Risk Path report can make it easier to understand the most likely critical path to any outcome and hence identify opportunities for schedule compression or risk reduction by changing logic between the tasks.

Full Monte allows both Sensitivity and Risk Path analysis to be focused either on the entire project or a selected interim deliverable. Figures 9 and 10 show the Sensitivity and Risk Path analysis focused on the SW Complete milestone.

ID	Task Name	Remaining Duration	Percent Critical	Percent Critical (Sensitivity)	Sensitivity Index	Sensitivity Index 50.0	Optimistic Finish of Milestone ID 15	Pessimistic Finish of Milestone ID 15	2015 Aug 23 / 30	Sep 06 / 13
14	SW Task 4	18 days	86%	100%	61%		8/28/15 3:57PM	9/14/15 1:45PM		
11	SW Task 1	18 days	86%	100%	61%		8/28/15 3:57PM	9/14/15 1:45PM		
12	SW Task 2	18 days	66%	75%	46%		9/3/15 11:50AM	9/14/15 11:33...		
13	SW Task 3	18 days	20%	25%	8%		9/7/15 8:23AM	9/9/15 3:18PM		

Figure 9

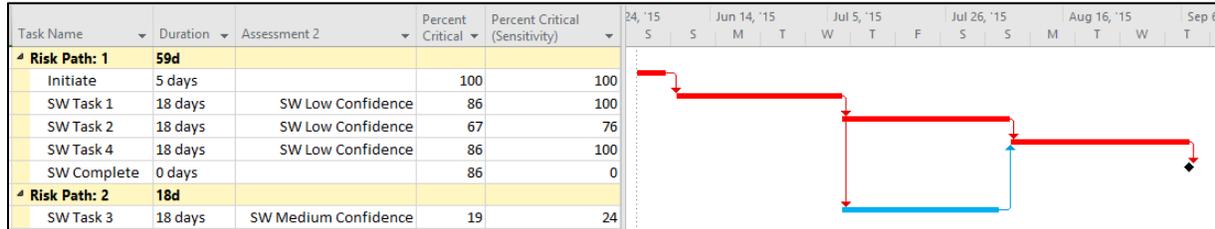| Task Name	Duration	Assessment 2	Percent Critical	Percent Critical (Sensitivity)	24, '15 S	Jun 14, '15 S / M / T	Jul 5, '15 W / T	Jul 26, '15 F / S	Aug 16, '15 S / M / T	Sep 6 W / T
◢ Risk Path: 1	59d									
Initiate	5 days		100	100						
SW Task 1	18 days	SW Low Confidence	86	100						
SW Task 2	18 days	SW Low Confidence	67	76						
SW Task 4	18 days	SW Low Confidence	86	100						
SW Complete	0 days		86	0						
◢ Risk Path: 2	18d									
SW Task 3	18 days	SW Medium Confidence	19	24						

Figure 10

Note in Figure 9, Full Monte calculates a Percentage Critical both to the Project Completion and the Selected Sensitivity target. In figure 10, we can see that task SW Task 1 is 100% on the critical path for SW Complete while only on the critical path to project completion 86% of the time.

Red Flags

The Standard Deviation appears too small.

Consider the histogram shown in Figure 11.
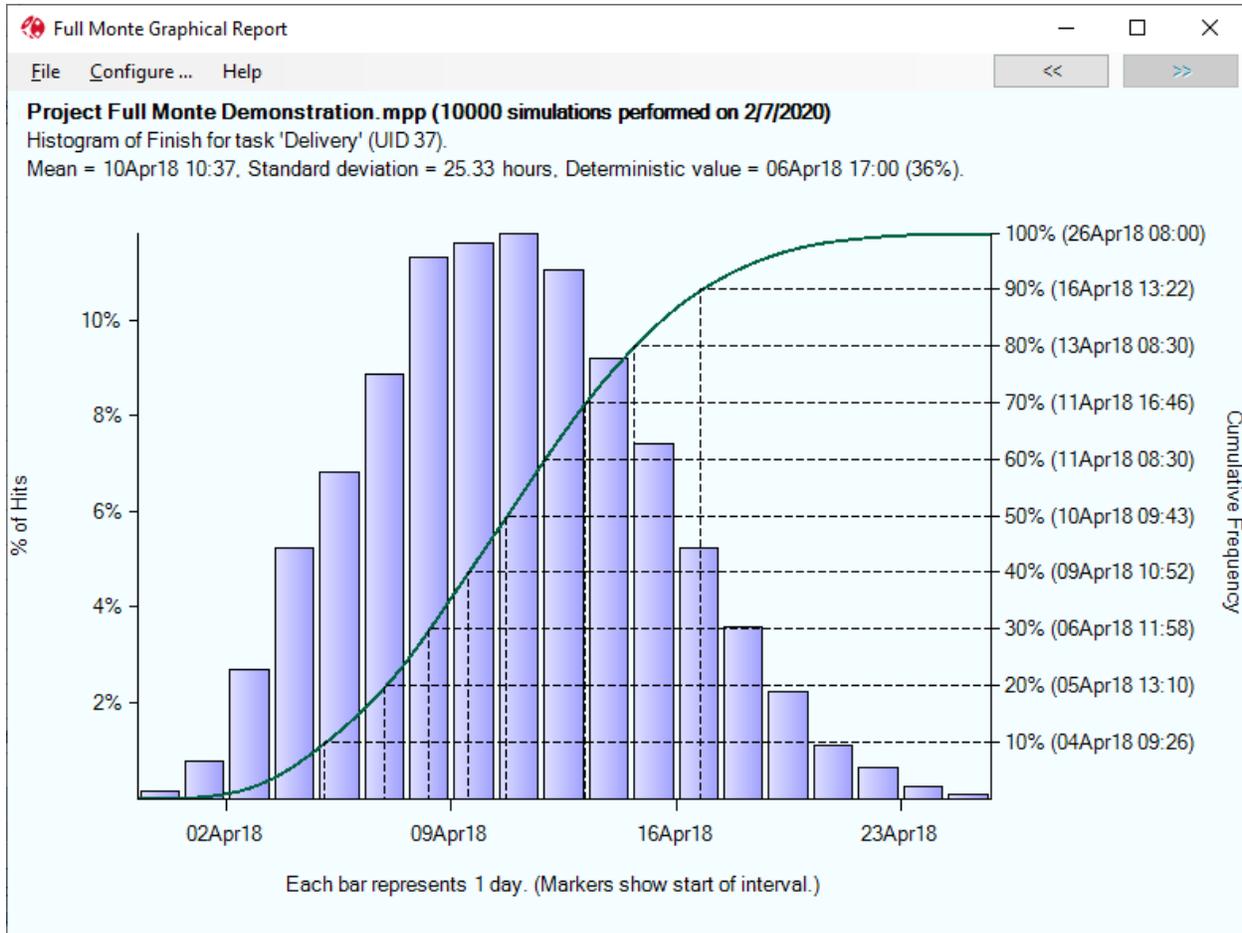

Figure 11

The standard deviation in the title bar shows 25.33 hours. Standard deviation is a measure of the 'spread' or 'range' of the results. +/- 3 times the standard deviation will encompass 99.7% of the results from the simulation. So, 6 * 25.33hours is roughly 152 hours which equates to roughly 19 days. The x-axis in figure 11 is scaled in days and there are, as predicted, 19 bars for 19 days.

> Note: Standard Deviation is based on working periods on the appropriate task calendar and the chart in Figure 11 has been configured to hide non-working periods.

The sample project used to produce this histogram was 70 days long. So, we are seeing a range of 19 days uncertainty on a 70-day duration project. This could be considered reasonable.

But what if our schedule represented a 3-year program. Would 19 days of uncertainty in the final delivery still be reasonable? Probably not. So, with a longer the project we would expect there to be a greater range of uncertainty. For a 3-year program, a range of several months uncertainty in the outcome might be reasonable.

Use the Tornado Chart and Risk Path analysis to help understand what is driving uncertainty in the outcome and verify all important tasks have valid three-point estimate and appear on the critical path to the outcome.

Unlikely Probability of On-Time Delivery.

Consider again the histogram shown in Figure 11. Note the Deterministic Value shown in the title block:

<div align="center">

Deterministic value = 06Apr18 (36%).

</div>

Based on the uncertainty applied to the tasks, Full Monte is predicting a 36% chance of delivery by 6Apr18 (the deterministic finish date calculated by Microsoft Project). It is not unusual for this probability to be close to or exactly 0%.

If the value is close to 50% and especially if it is greater than 50% then the data is suspicious. Has unrealistic uncertainty been applied (perhaps a greater chance of finishing early compared to late has been applied to task duration uncertainty)?

Do not be despondent if the value is 0%. Knowing the issue now gives you an opportunity to resolve it.

The Histogram is the Wrong Shape

Again, referring to the histogram in 11, observe the 'shape' of the histogram is somewhat like a Normal (bell) shaped distribution. This is the expected shape even if all the 3-point task duration estimates were specified with, for example, a triangular distribution. This is described by the Central Limit Theorem.

> *In probability theory, the central limit theorem (CLT) establishes that, in some situations, when independent random variables are added, their properly normalized sum tends toward a normal distribution (informally a "bell curve") even if the original variables themselves are not normally distributed.*
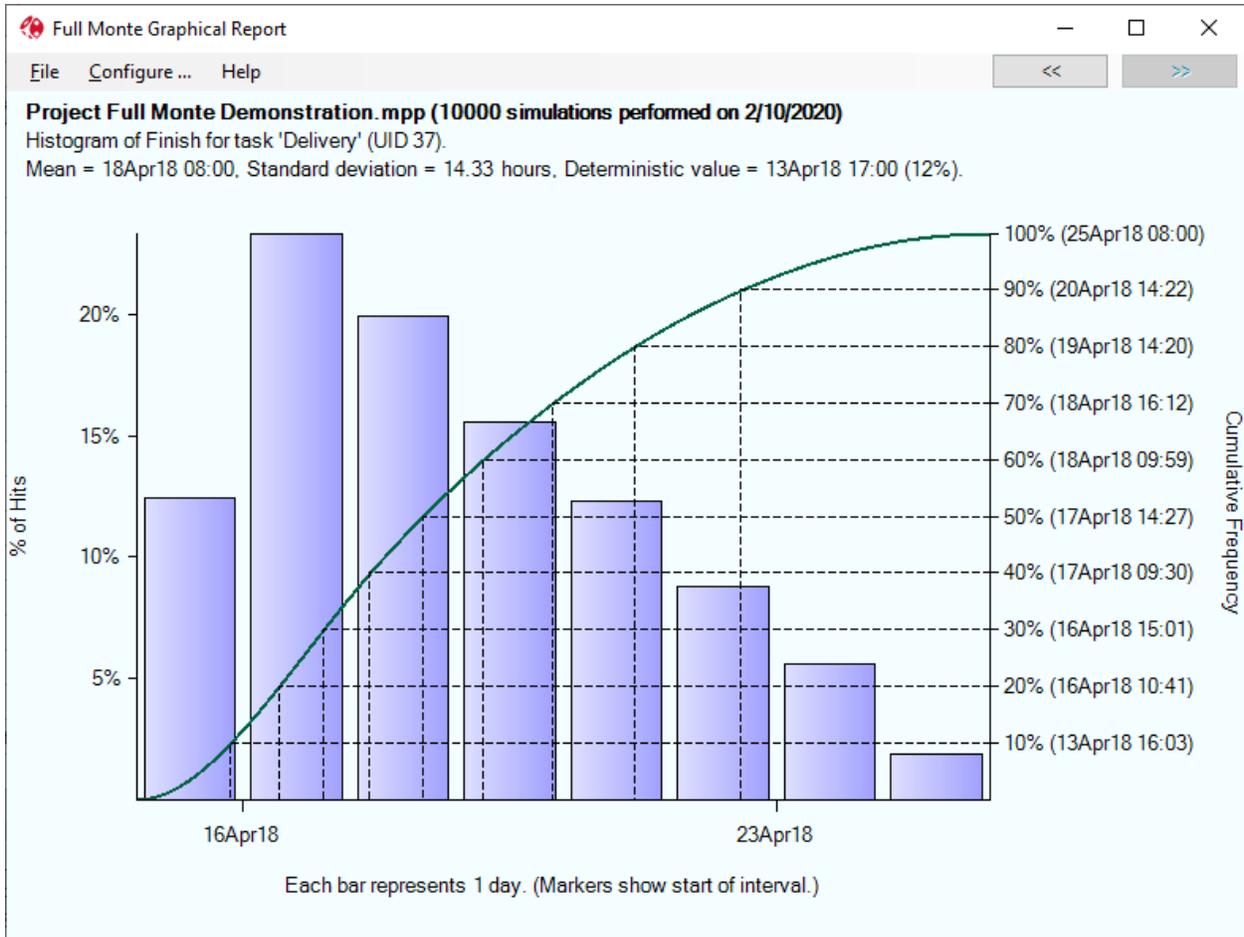
Consider the histogram shown in Figure 12.

Figure 12.

The histogram is exhibiting the characteristics of a Triangular Distribution (straight rise to the most likely and another straight line back down to the worst-case value. This suggests that not many tasks are contributing to the uncertainty in the outcome.

We can quickly use the Sensitivity Tornado chart to verify which tasks are affecting the outcome as shown in Figure 13.

ID	Task Name	Remaining Duration	Percent Critical	Percent Critical (Sensitivity)	Sensitivity Index	Sensitivity Index 50.0	Optimistic Finish of Milestone ID 21	Pessimistic Finish of Milestone ID 21	Mean Date Range 2018 Apr 08 15 22
19	Brochure Develop...	10 days	100%	100%	99%		4/13/18 8:15AM	4/25/18 8:02AM	

Figure 13.

In this case we can see only a single task was creating uncertainty for the delivery.

Cliff Edges
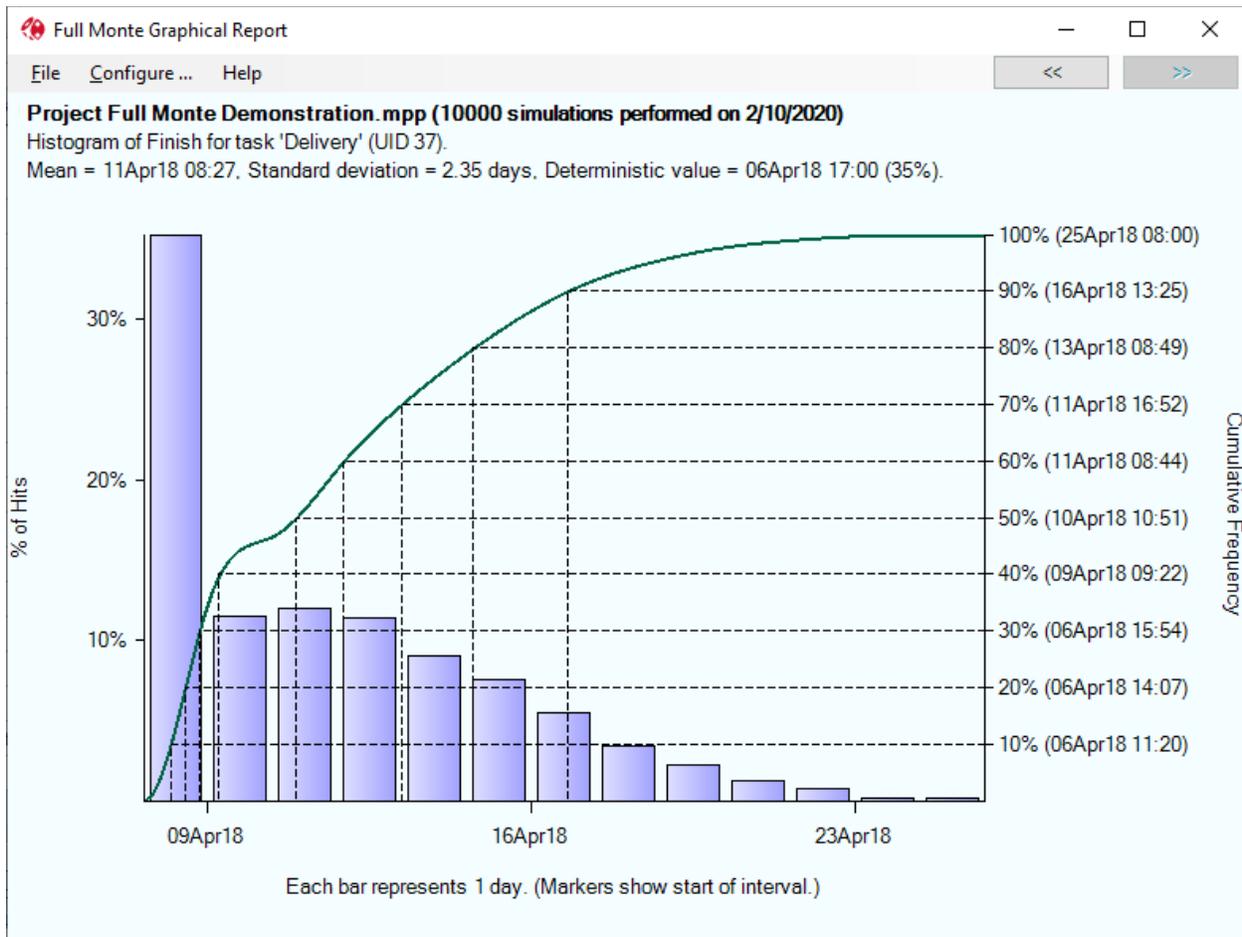
Consider the histogram shown in Figure 14.

Figure 14.

We would generally expect a histogram for a project delivery to resemble a Normal (bell) shaped distribution. In the example in Figure 14, the histogram is clearly lopsided with a high initial peak.

This typically means that something is preventing the delivery from occurring early. There are two typical reasons for this:

- A Start No Earlier (or similar) constraint is preventing the task from starting earlier even if its predecessors finish early.
- A task with no uncertainty is preventing the delivery from occurring earlier. Is a task representing Level of Effort (LOE) overhead work incorrectly driving the critical path?

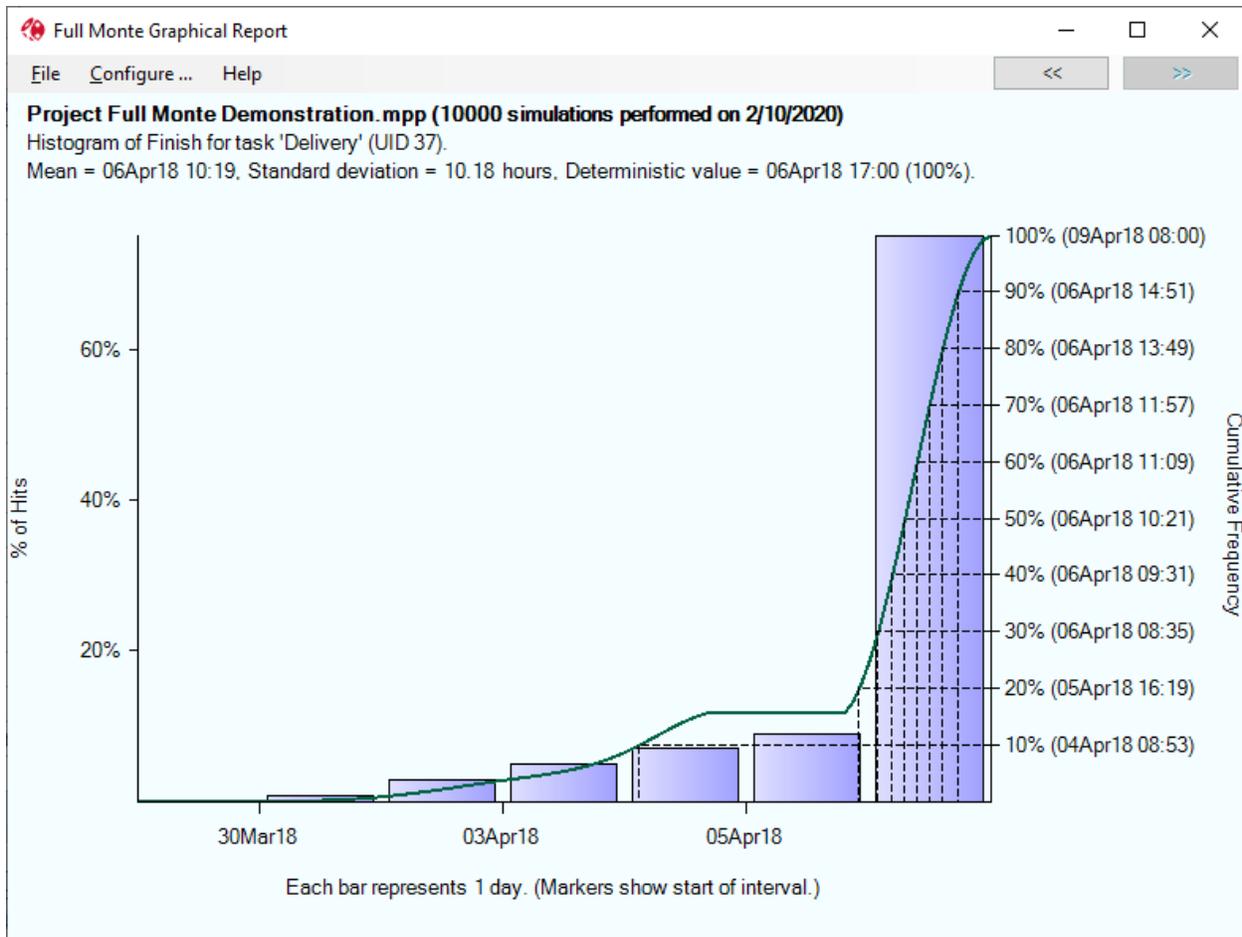Now consider the histogram shown in Figure 15.

Figure 15.

Again, we are not seeing the expected Normal (bell) shaped distribution but this time the peak is to the right of the chart.

The most likely reason for this histogram is a Finish No Later Than constraint (or similar) preventing the dates move into the future when the simulation models longer paths through the schedule.

Diagnostic Aids

Full Monte includes some fields that are designed to help explain the basis for results.

These are:

- Early Start Basis
- Early Finish Basis
- Critical Predecessors
- Critical Successors
- Percent Critical
- Percent Critical (Sensitivity)
- Percent Active

These fields can be added to a Full Monte tabular view or mapped/exported to Microsoft Project custom fields for analysis.

ID	Task Name	Remaining Duration	Risk Path	Early Start Expected Value	Early Finish Expected Value	Early Start Basis	Early Finish Basis	Predecessors	Critical Predecessors
5	HW Task 1	20 days	1	01/08/18 08:01	02/02/18 16:49	Task 2	Early Start	2	2 (97%)
6	HW Task 2	20 days	1	02/02/18 16:49	03/02/18 16:46	Task 5	Early Start	5	5 (89%)
7	HW Task 3	20 days	2	02/02/18 16:49	03/02/18 16:51	Task 5	Early Start	5	5 (89%)
8	HW Task 4	20 days	1	03/06/18 09:07	04/03/18 08:52	Tasks 6 (50%), 7 (50%)	Early Start	6, 7	6 (45%), 7 (44%)
9	HW Complete	0	1	04/03/18 08:52	04/03/18 08:52	Task 8	Early Start	8	8 (89%)
10	⊟ Software	54 days		01/08/18 08:01	03/26/18 08:15	Task 11	Task 15		
11	SW Task 1	18 days	3	01/08/18 08:01	01/31/18 16:56	Task 2	Early Start	2	2 (97%)
12	SW Task 2	18 days	4	01/31/18 16:56	02/26/18 16:36	Task 11	Early Start	11	11 (8%)
13	SW Task 3	18 days	3	01/31/18 16:56	02/27/18 08:05	Task 11	Early Start	11	11 (8%)
14	SW Task 4	18 days	3	02/28/18 08:09	03/26/18 08:15	Tasks 13 (51%), 12 (49%)	Early Start	12, 13	12 (4%), 13 (4%)
15	SW Complete	0	3	03/26/18 08:15	03/26/18 08:15	Task 14	Early Start	14	14 (8%)
16	⊟ Integration	5 days	6	04/03/18 10:19	04/10/18 10:17	Task 17	Task 17		
17	Integration	5 days	1	04/03/18 10:19	04/10/18 10:17	Tasks 9 (91%), 15 (9%)	Early Start	9, 15	9 (89%), 15 (8%)
18	⊟ Marketing	15 days	7	03/12/18 08:00	03/30/18 16:57	Task 19	Task 20		
19	Brochure Develop	10 days	5	03/12/18 08:00	03/23/18 16:56	Target Date: 3/12/2018:8:00 AM	Early Start		
20	Brochure Printing	5 days	5	03/23/18 16:56	03/30/18 16:57	Task 19	Early Start	19	19 (3%)
21	Delivery	0	1	04/06/18 10:19	04/06/18 10:19	Tasks 17 (97%), 20 (3%)	Target Date: 4/6/2018:5:00 PM (64%), Early Start (36%)	17, 20	17 (97%), 20 (3%)

Figure 16.

Figure 16 shows the Early Start and Early Finish Basis fields for the tasks used to produce the histogram in Figure 15. We can clearly see that the basis for the Early Finish for the milestone is largely driven by a Constraint Date of 6/6/2018. (64% of the simulations where constrained by the date). 36% of the time the finish was driven by the Early Start of the milestone which in turn was driven 97% of the time by task 17 (Integration).

Summary

Performing a Schedule Risk Analysis is only valuable if the results confirm an objective is achievable with the required level of confidence and if not then the data is used to go back to the underlying schedule to make changes that increase the probability of success.

It is an unpleasant truth that the underlying schedule will have to show completion dates that are **earlier** than the required delivery date. This is because, once uncertainty is applied, the predicted finish date at a reasonable level of confidence will always be later than the date shown by the scheduling tool.

The difference between the deterministic completion date in the schedule vs the stochastic finish date at the required level of confidence from the SRA is called Schedule Margin. This is effectively a schedule contingency for risk.