

CSRA Interest Group Meeting October 25, 2018 Agenda



- Round robin of who is on the webinar
- Ground rules for webinar
- Alternative inputs for CSRA Lead by Brian Putt and Bill Haskett
 - What assessments to ask for
 - Distribution or use of assessments in the CSRA
- Discussion of next webinar date & topics
- Adjourn



Ground Rules for Webinar

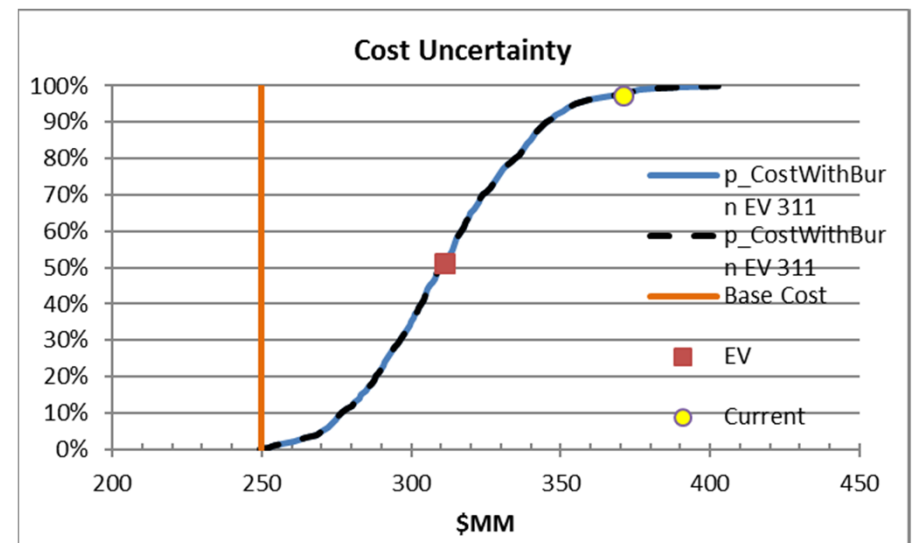
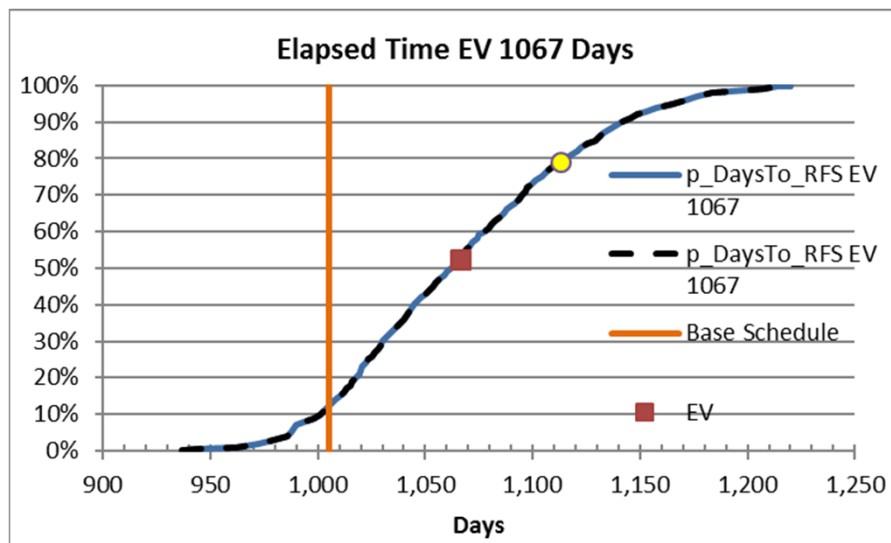
- All participants are encouraged to contribute during the meeting with comments
 - Preferably they comment on the phone although questions can be raised with the Chat. Possibility that Chats comments may not be seen right away.
- Participants are responsible for managing background noise. If your location might be noisy, please mute until you wish to speak.
- Session is being recorded and will be available to the CSRA Interest Group
- We will finish on time!

Objective is to understand the uncertainty in Cost and Schedule

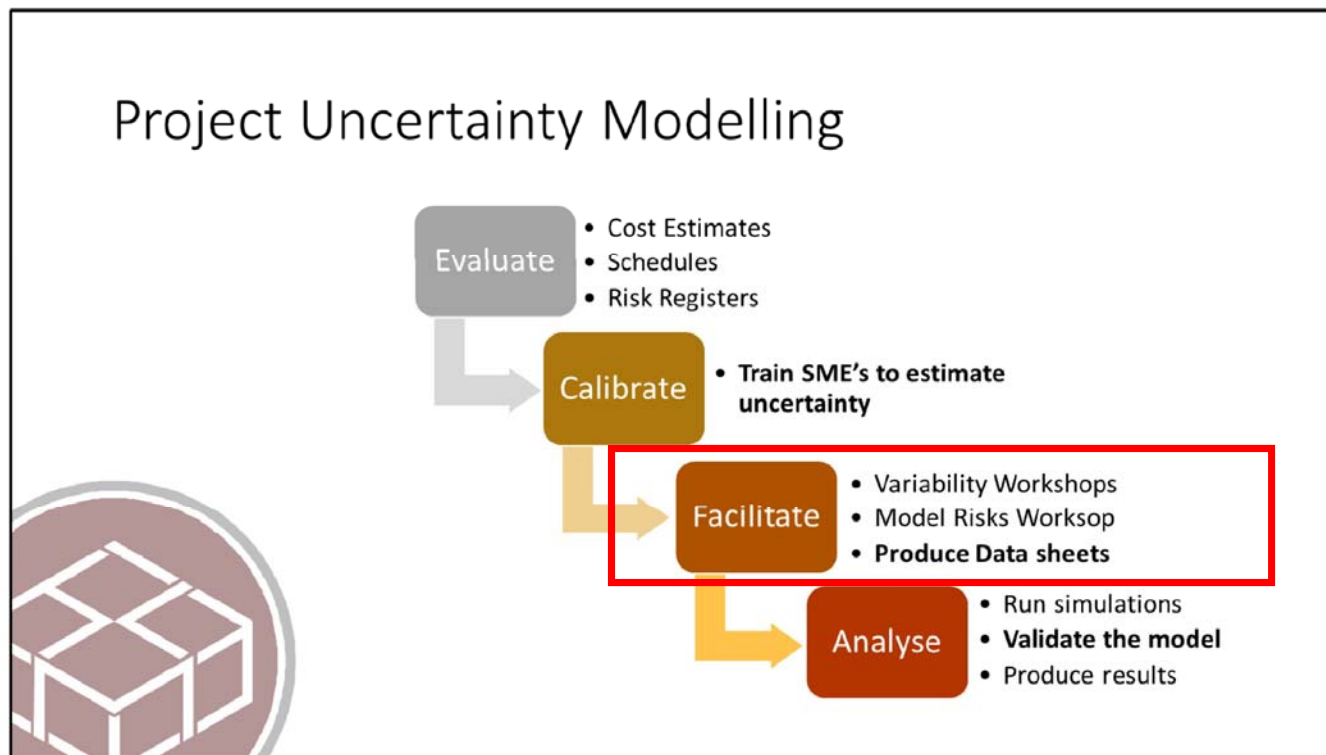


For many reasons, estimates often underestimate

- Time required
- Cost required



Steps to Conducting a Cost and Schedule Risk Analysis



Benefits of using Probabilities to Communicate



- Reduces ambiguity
 - ✓ Listener understands what was said
 - ✓ Explicit assumptions for assumptions are communicated
- Helps to resolve differences
 - ✓ Experts may dispute point estimates but more easily agree on a range
 - ✓ Sharing of assumptions often resolves differences among SMEs
 - ✓ Use sensitivity analysis to test the impact on decisions





Step when interviewing a SME to make an estimate

1. Explain why assessing the uncertainty is important. How will it be used?
2. Clarify what is to be assessed. Is the description specific enough that a clairvoyant could answer the question.
 - How high will be Stock Market be in in 2020? --- is not specific. What will be the Dow Jones Industrial Average on Dec 31, 2020 as quoted in the Wall Street Journal.
3. Ask the SME to think of all the things that would generate the extreme high estimate. Write them down. Then do the same for the lower estimate.



Alternatives Discussed at the August Meeting

- Minimum, Most Likely , Maximum
- P10, Most Likely, P90
- Low, Most Likely, High
- Historical data only

The inclusion of “Most Likely” in every estimation option is troubling. It is exceedingly difficult to obtain and is very often confused by the source for expected or median.



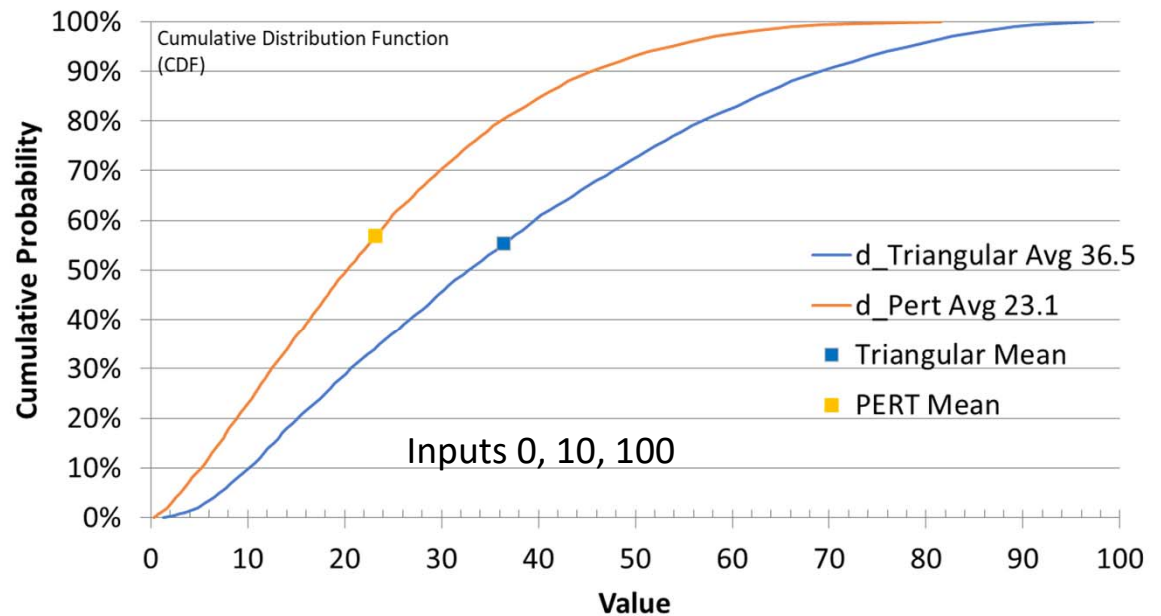
What distribution to use in the analysis

- Triangular distribution
- Pert Distribution
- Metalog distribution
- No distribution ??
- Adjustments to the SME assessments base on historical data

Triangular has a larger mean value & higher uncertainty



- Academia promotes the use of the PERT distribution
- Triangular considered as a distribution when we don't know anything
- Both typically use Min, Most Likely, Max as inputs.

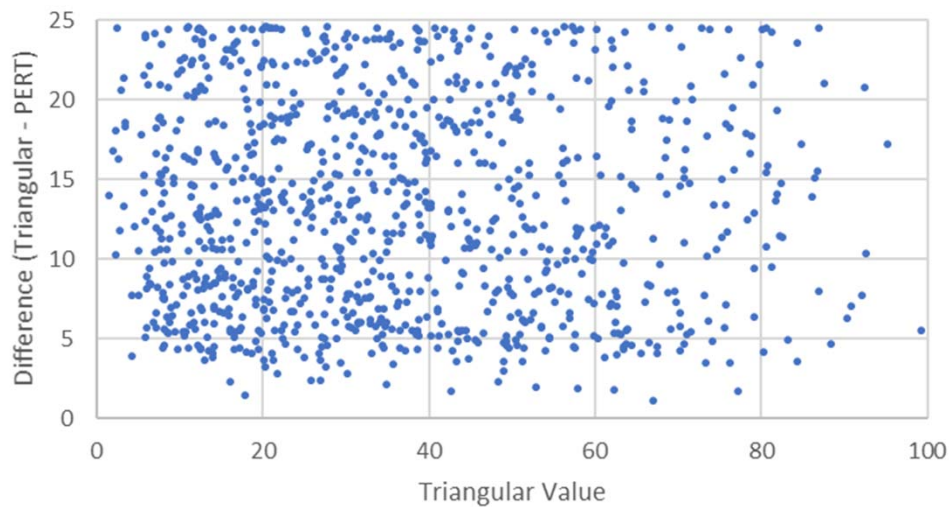


	EV	StdDev	min	max	EV Percentile	10%	50%	90%
Triangular	35.72	21.10	1.44	99.34	55.4%	10.59	32.77	66.83
PERT	22.56	14.81	0.30	90.23	56.7%	5.54	20.17	43.64

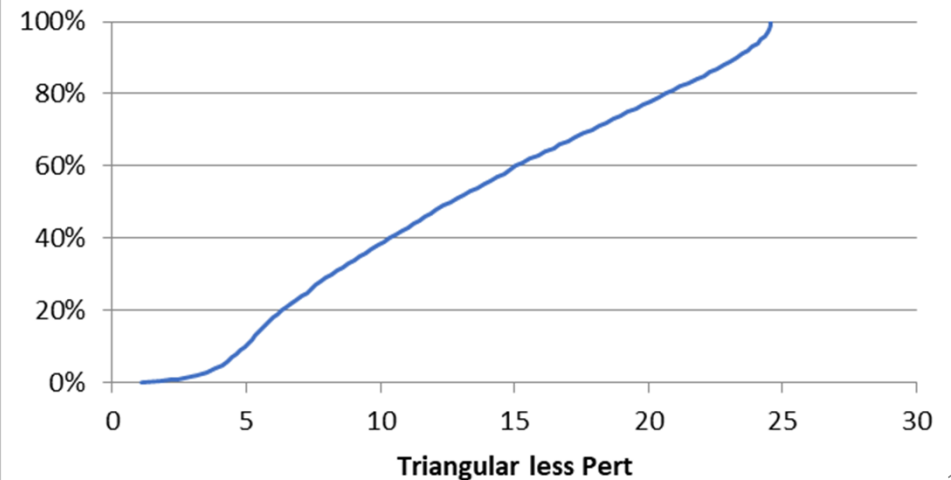
Difference in distributions ranges widely (Not a constant)

Inputs 0, 10, 100	EV	StdDev	min	max	EV Percentile	10%	50%	90%
Triangular	35.72	21.10	1.44	99.34	55.4%	10.59	32.77	66.83
PERT	22.56	14.81	0.30	90.23	56.7%	5.54	20.17	43.64

Non-Symmetrical differences



d_Difference Avg 13.31



The Trouble with Tribbles *Triangles*



Triangular distributions are not found in nature.

Though, yes, most of the distributions we use are also not *fully* found in nature, Triangular has one of the worst fits.

But the important question is “Does it matter?”

Our objective is to gain insight and will the use of Triangular impede that?

The Trouble with Tribbles



Estimation of the Absolute Max and Absolute Min, even though they often feel good to the provider, are of questionable reliability.

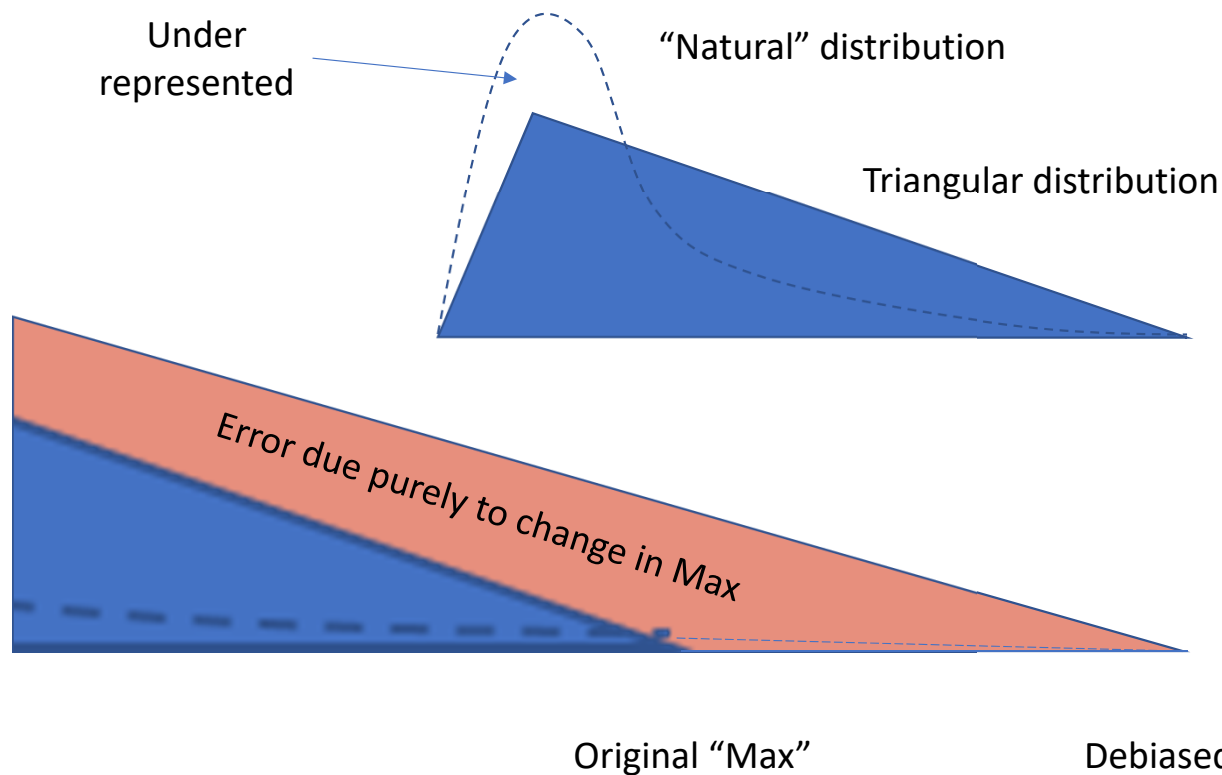
A few simple de-biasing questions can have a huge impact.

P10-P90 is far more stable and reliable after de-biasing

Does it matter?

Yes... the error generated by a straight line from the upper end of the distribution to the mode ends up significantly increasing the mean.

The Trouble with ~~Tribbles~~ *Triangles*



Upper-end subjective uncertainty error contaminates the full Triangular distribution but has little effect on the

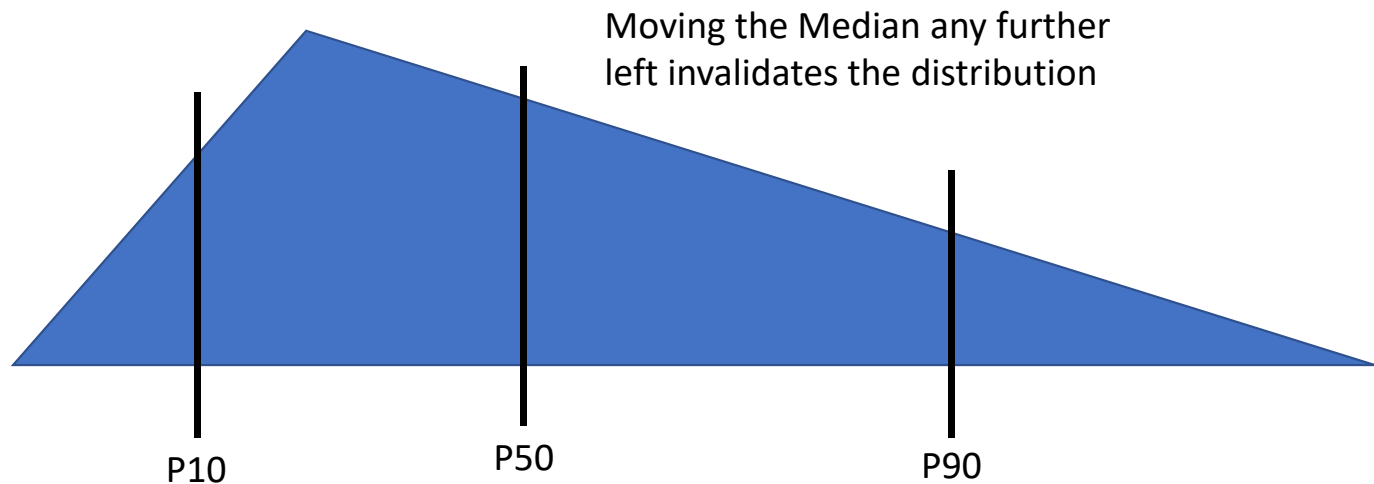
The Trouble with Tribbles *Triangles*



You can't get there from here...

Most of us like the better stability of P10-P50-P90 estimations (“surprising results” interview method).

Triangles run into problems on skewed distributions of P10-P50-P90 as there is a maximum skewness a P10-P50-P90 triangle can handle.



The Trouble with ~~Tribbles~~ *Triangles*



False Security

Many proponents of Triangular Distributions cite that if other skewed distributions in a model are replaced by Triangulars, there is little change in the expected, aggregated result.

They are correct. Of course this works, particularly in models with many uncertainties. This is not proof that Triangles are appropriate.

The Triangle fails on its creation reliability. Substituting “matching” distributions does not cover the failing point... reliable identification of the mode.

What does “most likely” mean to an interviewee?

The Trouble with Tribbles *Triangles*



Mode Identification

It is not the P50.

This is the most common error when using triangular distributions. People get tempted to put the “most likely” as the P50. Yes... Those on the call are unlikely to do that...

Ask people what think the “most likely” is and you often get...

“It is what I think will happen”

“It is what usually happens.”

“It is what people should expect.”

Its probability location will be dependent on skewness, often surprisingly so.

The Trouble with Tribbles *Triangles*



When does it not matter (or at least matter less)?

- When Skewness is low – Mean Median, and Mode cluster
- If you have low skewness *and* can modify the lower end of the distribution for truncation.
- When Min and Max are well defined *and* Decision remains unchanging across the distribution
- A triangular distribution is created by contract terms.

We've concentrated on Triangular Here, but...



Other distributions have similar problems if not managed correctly

- Lognormal – Upper-end non-lognormality must be managed
- Normal – Negative delivery time is a strange concept
- Uniform – Sometimes seen to be used by otherwise educated people because they “don’t know what distribution it really is”.

Remember, all distributions may, and usually are truncated at the lower end. Limit, do not truncate, the upper ends to match reality.

So what does Bill Haskett use in his consulting?

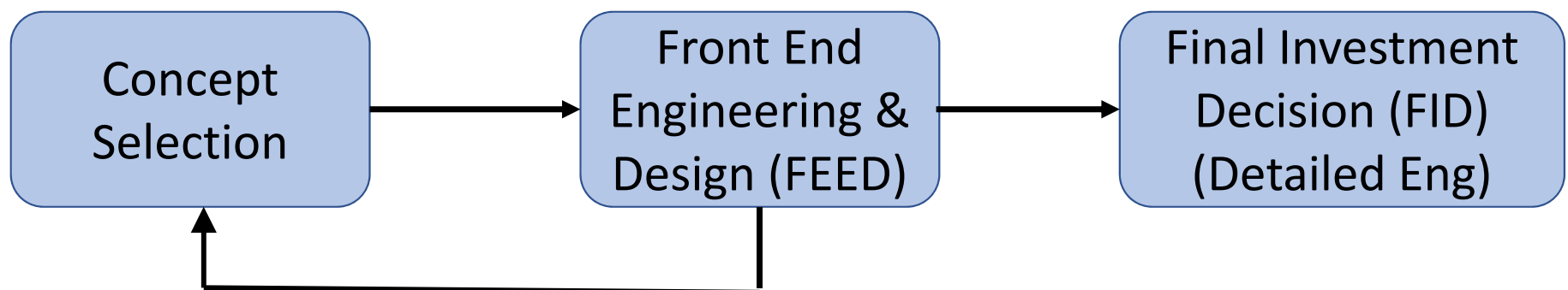


Next Meeting?

- Feedback on today's Meeting Time
- Topics for next meeting
 - CSRA Models
 - Calibration facilitated by Jason Mewis & John Coodie
- Possible Dates / time for the next meeting
 - ???

When Should a CSRA be Conducted?

- CSRA is appropriate at any time and is applicable to all projects
- Conducting a CSRA early in project conception and updating from time to time will provide perspective to the project.
- Ability for a project team to do a self assessment will promote early assessment and augment the CSRA as the project develops.

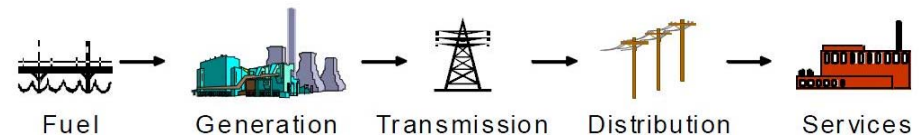


Initial Steps in preparing for the CSRA



- Make sure the Project Manager is aligned on the frame of the CSRA

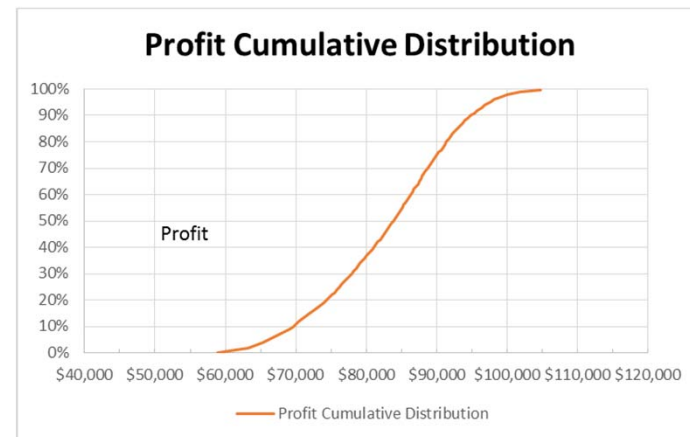
- ✓ What is the start date of the of the CSRA schedule?
- ✓ What is the key schedule objective?



- Will the results of the CSRA be used in an economic evaluation? How so?
- Who are the subject matter experts (SME's) who should participate in the CSRA
- Should external unbiased consultants participate in the CSRA.
- Review the deterministic cost estimates and schedule plans. Consolidate to an appropriate number of higher level categories as needed.
- Build the CSRA model with the cost and schedules identified initially assessed.

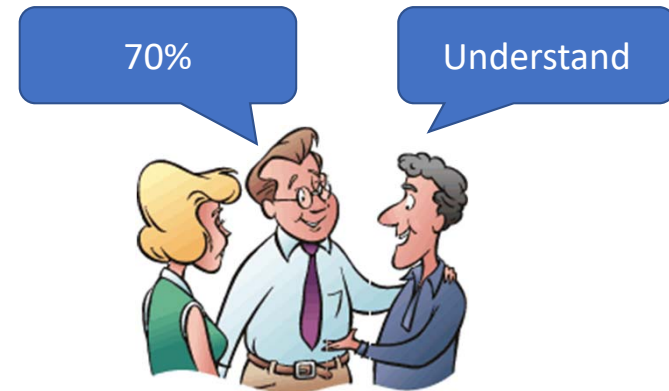
Why Calibration Training

- Making decisions considering uncertainty requires an assessment of uncertainty
- Empirical data may be available for some uncertainties
- Subject Matter Experts (SMEs) may have to assess others

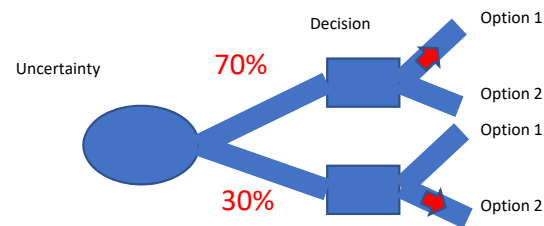


Assessing Probabilities is important to Improve Communication & Facilitate Analysis

- People understand when uncertainties are communicated as probabilities



- Probabilities are included in the analysis to make a decision(s)



Calibration Training

- Developed by Doug Hubbard
- Area of research - JDM Psychology
- Most people are weak at estimating uncertainty
- Measuring your own uncertainty can be taught.
- **“Calibrated” – if you say you are 90% confident, you will be right 90% of the time.**





Sample Calibration Questions

What is your P10 – P90 Range for:

1. When did the last hurricane hit Hawaii?

A: 1992 – Hurricane Inki

2. What was the cost to replace the eastern span of the San Francisco Bay Bridge completed in 2013? Or what was the percent overrun?

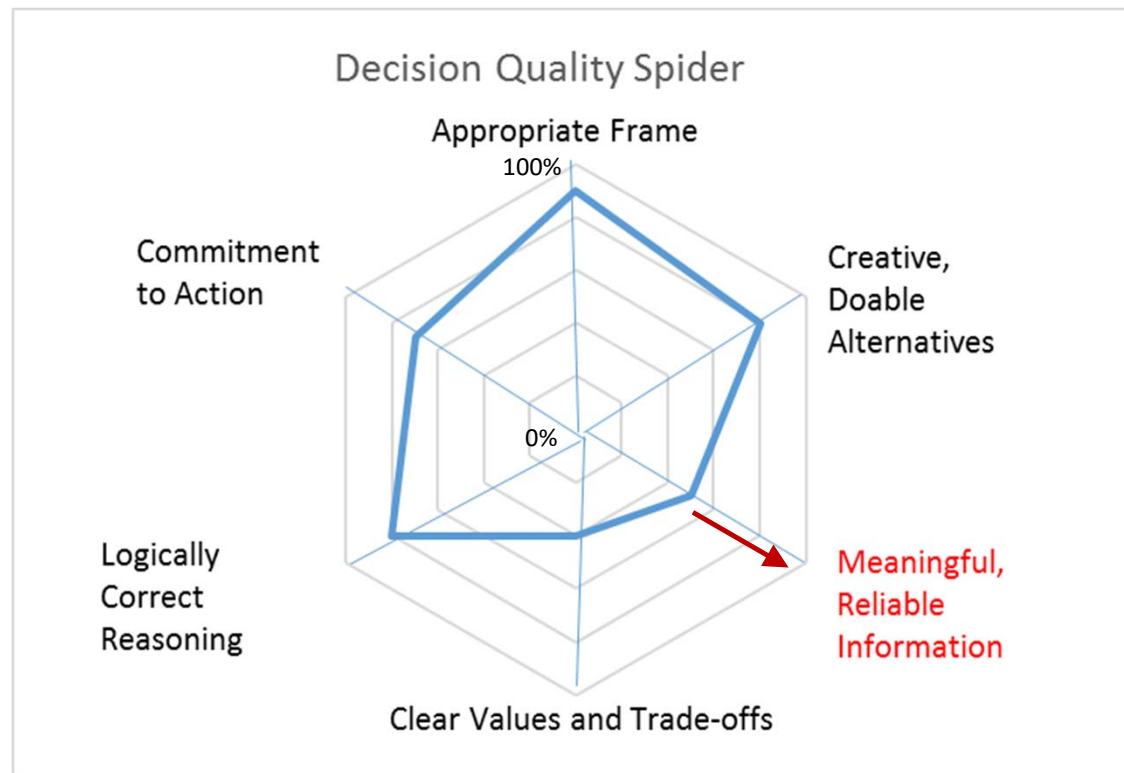
A: The eastern span replacement is the most expensive public works project in California history, [\[5\]](#) with a final price tag of \$6.5 billion, a 2,500% cost overrun from the original estimate of \$250 million

SMEs Need Training -- Calibration

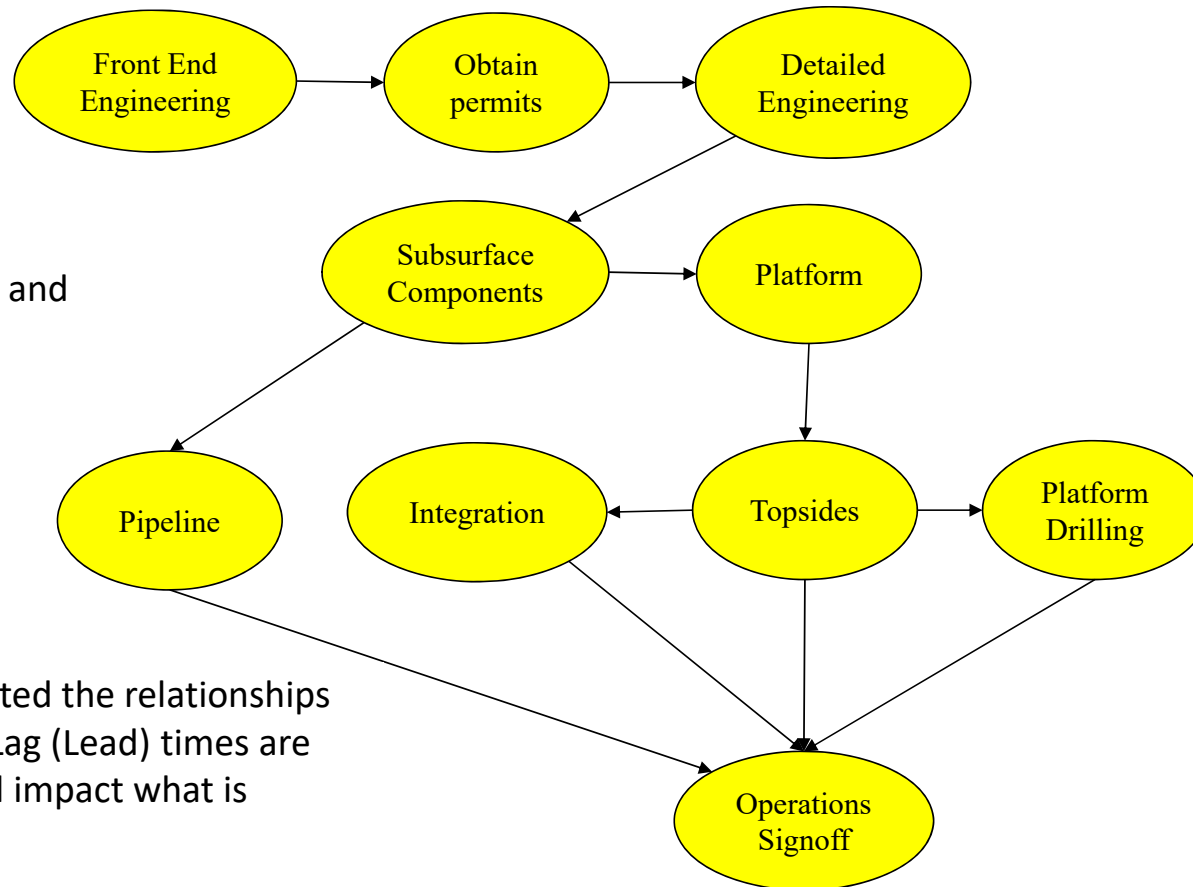
- SMEs are historically optimistic and think they know more than they do or..... feel they need to give “accurate” answers
- SMEs consistently under-estimate ranges for uncertainties
- With training SME’s can learn to correct for natural biases and improve their estimates
- Who would you expect to be the best at setting Ranges?



Decision Quality requires Meaningful, Reliable Information



Schedule Relationships Reflected in PERT Diagram



PERT = Project Execution and Review Technique

Unless otherwise stated the relationships are Finish to Start. Lag (Lead) times are not shown and could impact what is critical.

SME assessments Needed for both Schedule and Cost uncertainty components



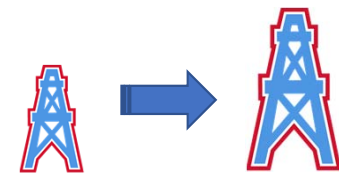
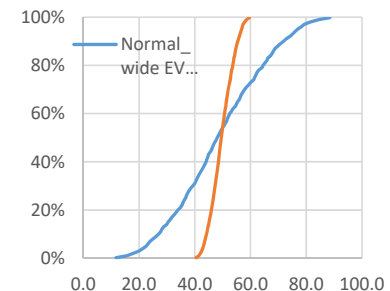
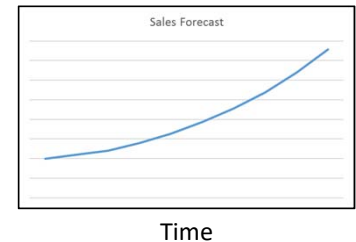
- Agree on what type of assessment will be make
 - Triangular – Min, Most Likely, Max
 - P10-P50-P90
 - Simulated as discrete outcomes
 - Fitted to a continuous curve such as the Metalog or Myerson or PERT distribution
 - P10-Most Likely-P90
 - Low - ?? – High
 - Surprising Up side and Low side then use as P10 & P90
 - Focus on the shape

Motivational and Cognitive Biases

Prevent good assessments

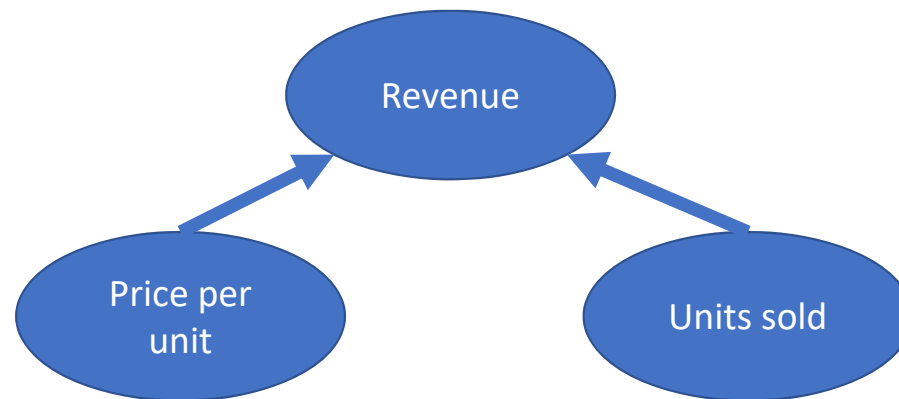


- Motivational biases occur because SME has a personal stake in the assessment
 - ✓ Assessing my sales forecast
 - ✓ Need to look like an expert and provide pin-pointed assessments
 - ✓ Done this before and the assessment must be the same as last time
 - ✓ Assert my performance with a low cost or schedule estimate



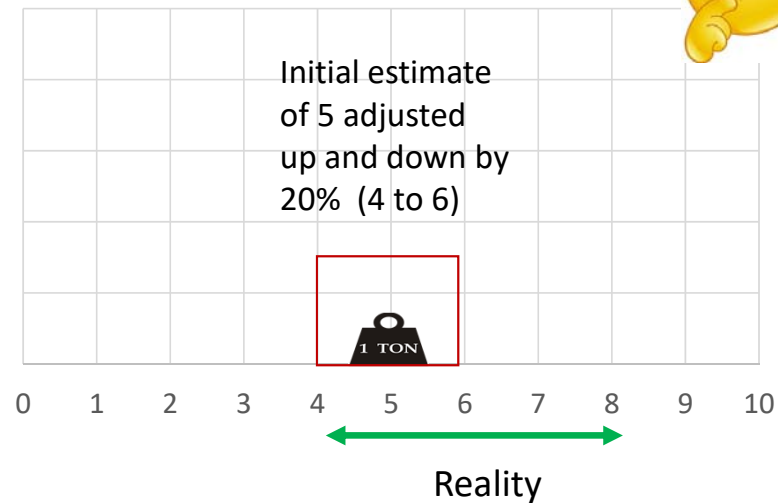
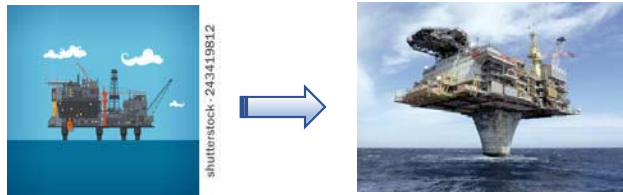
Ways to Mitigate Motivational Biases

- Disaggregate the assessment into components
- Stress “communication” rather than “predictions” or “targets”
- Change incentive awards (long vs short term)



What are Cognitive Biases

- Availability of information
- Implicit Conditioning
- Analogies – similar to something else
- Anchoring and adjusting



Data Sheets

- Uncertainty audit trail
- Define the range item
 - Scope, level of definition, issues & uncertainties
- Capture the range estimate detail
- Identify specific scenarios for
 - P10 & P90
- Use this information to defend the results





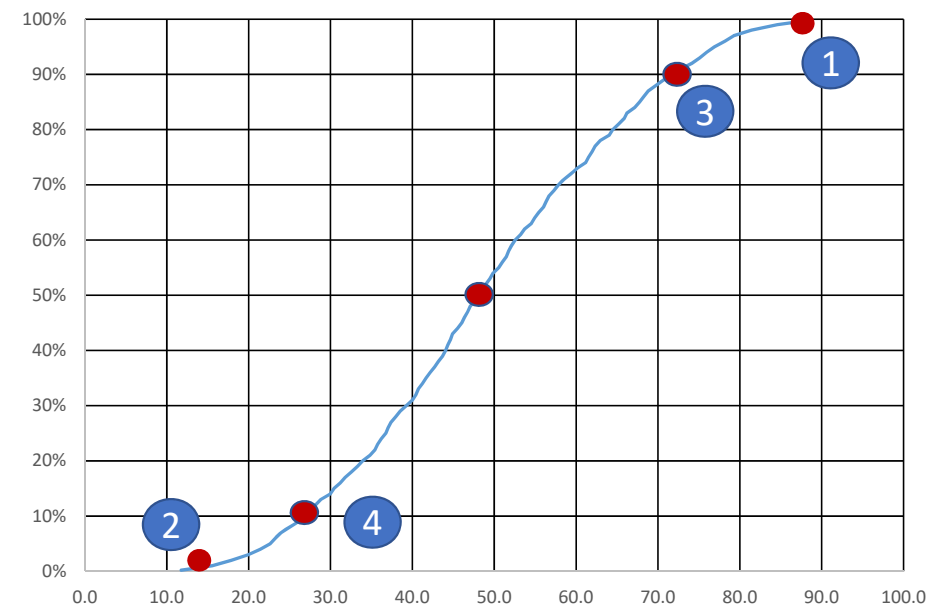
Step when interviewing a SME to make an estimate

4. Assess the end points of the distribution starting with P1 and P99. Ask questions different ways. What is the probability of the value being less than X. What value would have less than a 50% chance of happening? If the distribution has inconsistencies, ask for other points – either a value or a probability.
5. Show the SME the distribution. Does the SME agree that the distribution is consistent with their belief?

Assess Extremes First



- List what could go **right**
- List what could go **wrong**
- Imagine how it might happen
- Assess first the P1 and P99
- Then move towards the center





Final Thoughts

- Be clear about the units.
- Be clear about the implicit assumptions. Make your assumptions visible
- State any conditional assumptions about other variables or uncertainties
- Think about any physical constraints
- Review the results and ask whether you would bet on your range.

Typically 80% Confidence Ranges Are Estimated

- P10 (low estimate) reflects only a 10% chance of being **less** than this number
- P90 (high estimate) reflects only a 10% chance of being **higher** than this number

