

# Quaternion Consulting Inc.

## 10 Cost Estimating Observations

Innovative & Defendable Solutions

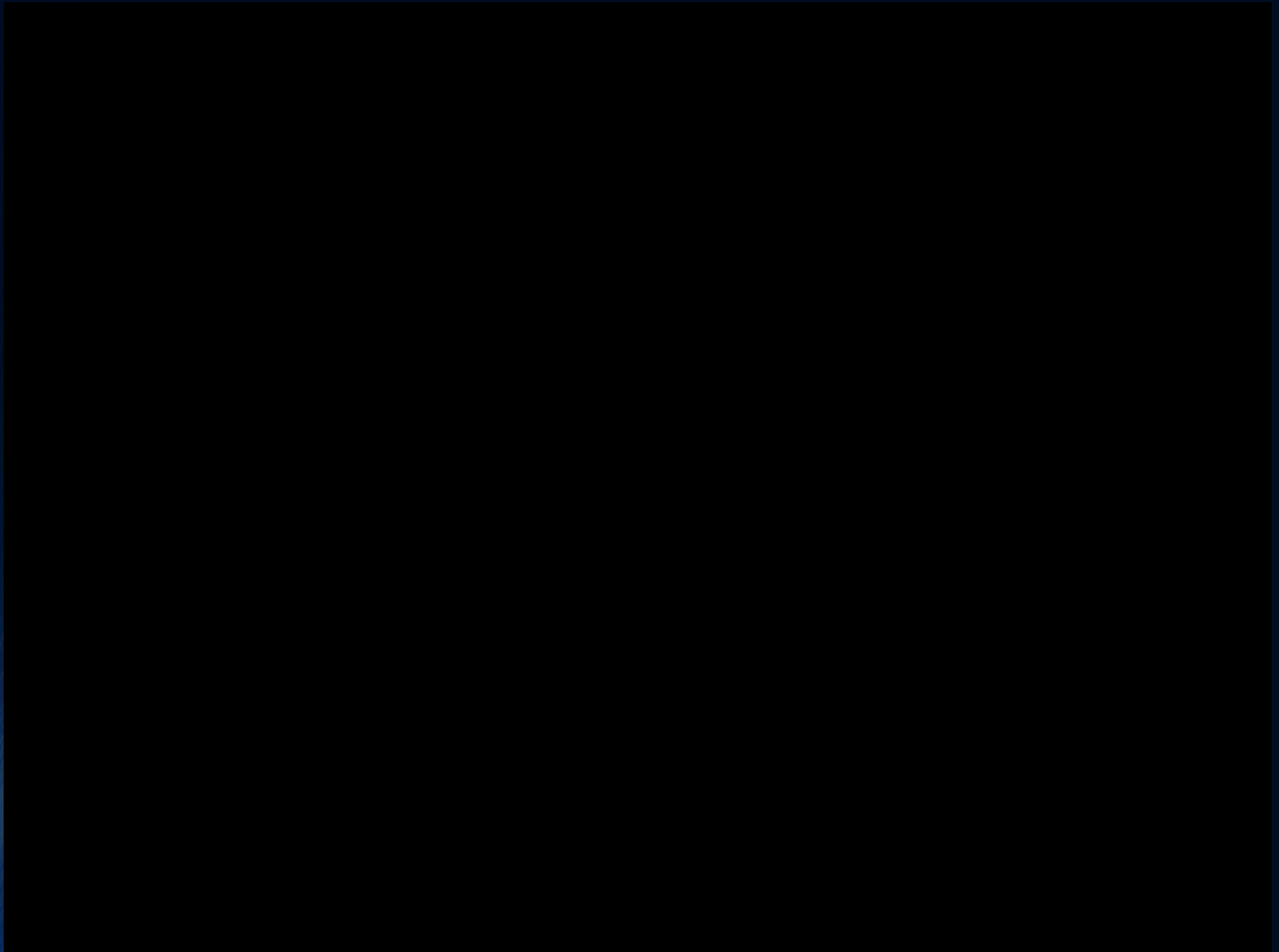
# The Cost Estimate is Wrong

- It's just a matter of how wrong
- Influenced by:
  - Assumptions
  - Design maturity
  - Inflation
  - Locality
  - Others
- A cost estimate is a Management Tool

# The Need for an Independent Review

- Typical internal project estimates are:
  - Bottoms Up
  - “Should Cost”
  - Engineering analysis
  - Success driven
- Typical Independent Cost Estimates (ICE) are:
  - Top Down
  - “Will Cost”
  - Historical experience
  - Risk inclusive

# Ten Cost Estimating Observations



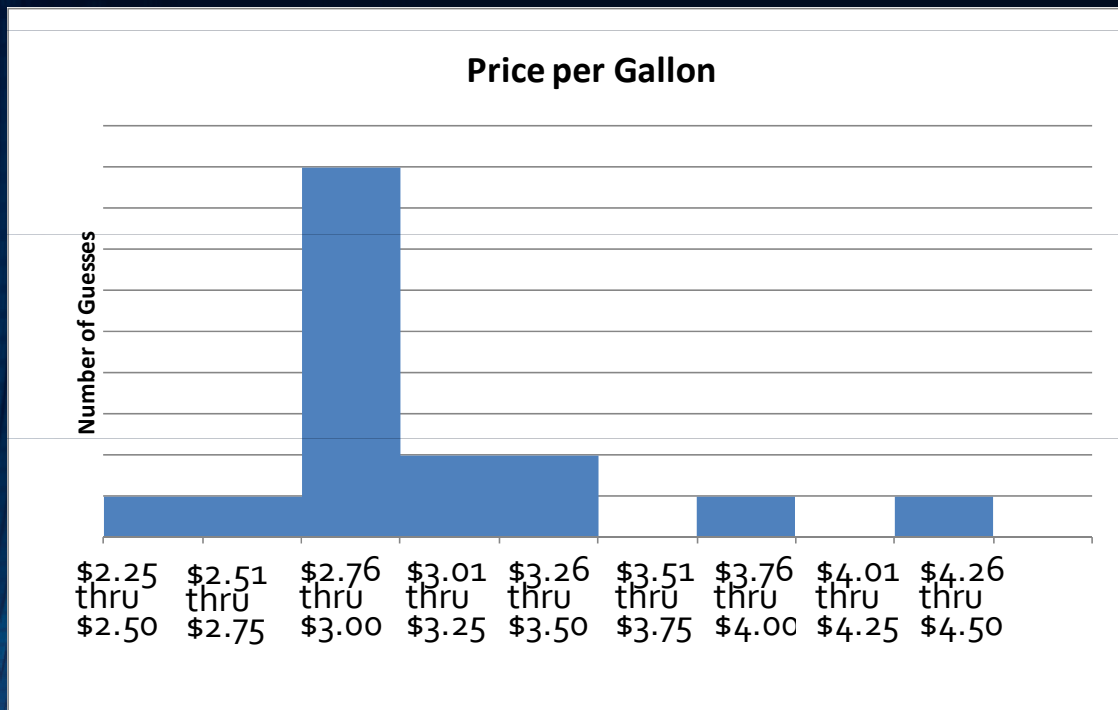


## #10 – Ground Rules & Assumptions Matter



“Please provide an estimate for the price of a gallon of gas on 01 January 2014.”

# Rice E&C Forum Survey Estimate (Nov 2013)



- Minimum = \$2.50
- Mean = \$3.09
- Maximum = \$4.50
- Std. Dev. = \$0.49
- Log-normal

- The answer: *It depends...*

# What Were Your Assumptions?

- Provider - Shell, Sunoco, Exxon, Phillips 66, or Gulf?
- Grade - Regular, Plus, Premium, or Diesel?
- Local - Houston, TX or Chantilly, VA

- Minimum = \$3.09
- Mean = \$3.59
- Maximum = \$3.99
- Std. Dev. = \$0.24

- My answer: \$3.39

01 JAN 2014 fuel prices			
Virginia	Shell	Regular	\$3.43
Virginia	Shell	Plus	\$3.63
Virginia	Shell	Premium	\$3.83
Virginia	Shell	Diesel	\$3.89
Virginia	Sunoco	Regular	\$3.39
Virginia	Sunoco	Plus	\$3.63
Virginia	Sunoco	Premium	\$3.78
Virginia	Sunoco	Diesel	\$3.99
Virginia	Exxon	Regular	\$3.47
Virginia	Exxon	Plus	\$3.76
Virginia	Exxon	Premium	\$3.89
Texas	Shell	Regular	\$3.19
Texas	Shell	Plus	\$3.48
Texas	Shell	Premium	\$3.74
Texas	Shell	Diesel	\$3.79
Texas	Phillips 66	Regular	\$3.29
Texas	Phillips 66	Plus	\$3.55
Texas	Phillips 66	Premium	\$3.65
Texas	Phillips 66	Diesel	\$3.79
Texas	Gulf	Regular	\$3.09
Texas	Gulf	Plus	\$3.29
Texas	Gulf	Premium	\$3.49
Texas	Gulf	Diesel	\$3.55



# #9 – Multiple Potential Cost Drivers Need to be Explored

- Let's look at TVs
  - Typical performance measure is screen size – generally, the larger the screen the more expensive the TV

	1958 RCA Color	2013 Samsung	2012 Panasonic 3D Plasma
Screen (inches)	21"	19"	55"
Cost (2013\$)	\$2,673	\$250	\$2,599
\$/Inch	\$127	\$13	\$47
Weight (lbs.)	60	6.4	69
\$/Pound	\$45	\$39	\$38

- Explore alternatives
- Look at stratification:  $\text{Cost} = (\text{Weight}) * (41) * (0.75)^{\text{LED}}$

# #8 – More Detail Does Not Mean More Accurate

- Don't use a micrometer to measure if you're going to cut with a chainsaw
- Estimates should reflect the maturity of the project
  - Early, Rough Order of Magnitude (ROM) should be sufficient
- A high-level Cost Estimating Relationship (CER) is more suitable early on in a project's life
  - Many details are still unknown
- Is \$2,267,431 really different than \$2,268,695?
  - \$2.3M will do nicely

# #7 – Independence Brings Honesty

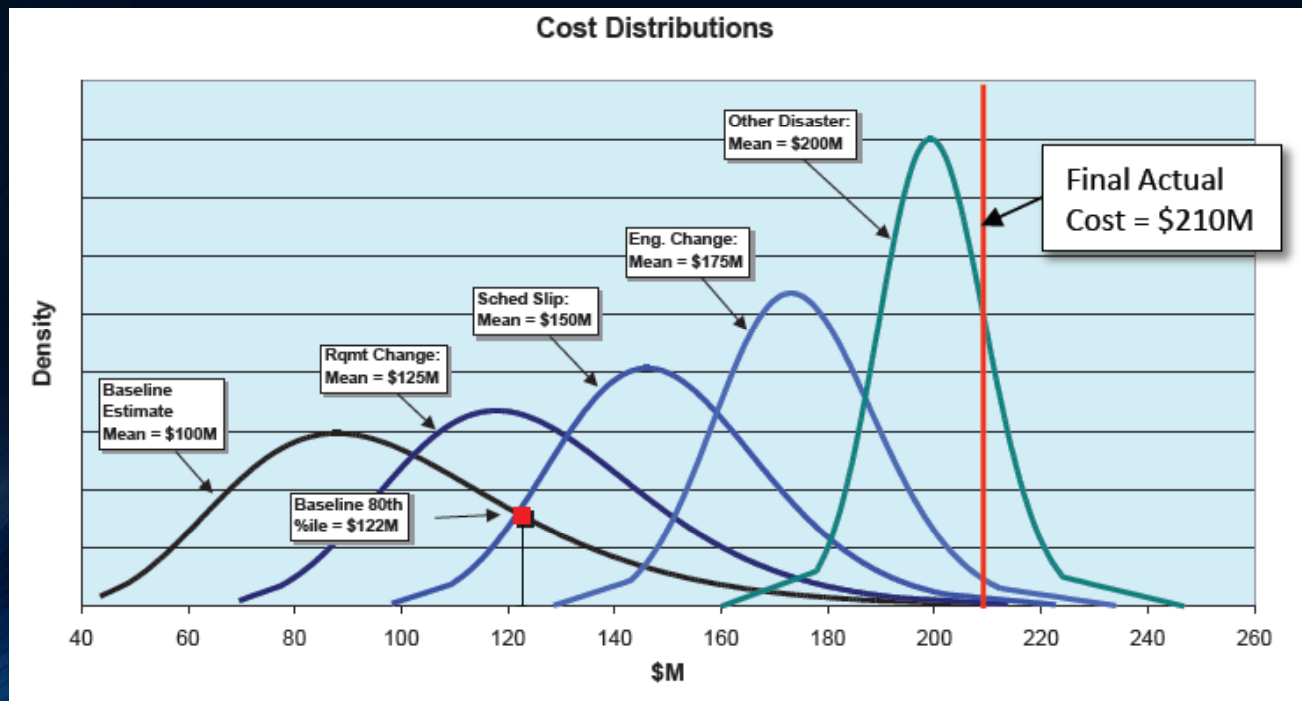
- No Kool-Aid
- No stakeholder influence/pressure
- More likely to include schedule/funding volatility
- Typically anticipate design changes and associated costs
- Knowledgeable at the macro level
- Willingness to include 'bad news'

**Honesty is a very  
expensive gift. Do  
not expect it from  
cheap people.**

- Anonymous

## #6 – Change is Constant

- Not all risks and uncertainties can be anticipated
  - Unknown unknowns
- A snapshot in time
- Projects are 'living' things
  - The length of some projects necessitate change
  - New technologies become available
- The closer to the end, the more accurate the estimate



## #5 – Oops

- Your Work Breakdown Structure (WBS) probably missed something
- Need to include *ALL* costs
  - What about investments?
  - Commercial Off The Shelf (COTS) is not free
  - Re-use is not free (e.g. Space Shuttle)
  - Ensure integration costs at all levels are included
- Keeping the WBS product-oriented will help (*not* Integrated Product Team (IPT)-oriented)



MISSED IT BY THAT  
MUCH!

VERY DEMOTIVATIONAL .com



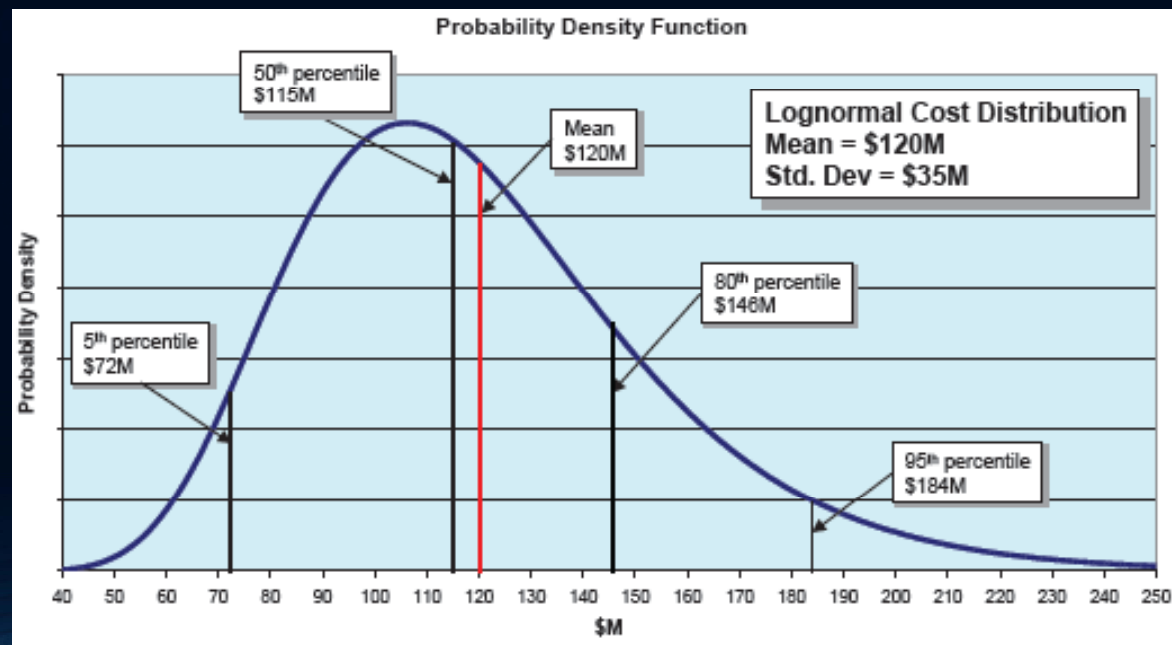
## #4 – The Magic Schedule



- Your first schedule estimate will cost the least
  - If you accelerate the schedule, it will cost more
  - If you delay the schedule, it will cost more
- The schedule and costs must be linked and integrated
- As the schedule changes, so the costs must change (see above)
  - But more resources (money) doesn't necessarily mean a shorter schedule
- Engineering takes time (money)
  - It's less expensive to get it right the first time
  - Sometimes there are no second chances

## #3 – Don't Point, It's Rude

- A point estimate is just a number
  - A Probability Distribution is actionable information
    - Uncertainty is certain
    - Quantifying risk and uncertainty is strategically advantageous
    - Provide a range of negotiation options
    - Do you feel lucky? Price to win?
  - The 20<sup>th</sup>, the 50<sup>th</sup>, the 80<sup>th</sup> – How strongly do you feel?
  - Basis for AOA
  - Stress the trade
- Space – sensitivity analysis



## #2 – But The Estimate is Too High!

- Sticker shock is common
  - Do you really expect a complex project to be successfully delivered on a shoestring budget?
  - Integrated autonomous systems of systems are expensive
- Who's estimate is it?
  - Contractor? Independent? In-house? Sub-contractor?



# #1 – An On-going Concern

- Companies have a fiduciary responsibility to shareholders
  - Perform due diligence
  - Invest wisely
  - Pursue increase in shareholder equity
  - Investigate options
  - Independent audits and reviews
  - Dependencies: outside influences impact the estimate
  - **The estimate should drive the budget, not the other way around**





# What you should do

- Question everything – what are the assumptions?
- Recognize the risks, focus attention on mitigating those risks
- Cost Estimates are tools for Management to use to better understand and execute the program
- Develop Business Case Analysis for each project
- Stress the trade space to see how costs, tech, and schedule parameters are impacted
- Perform lessons learned /post mortems on completed programs. There is a wealth of knowledge to be gained from both “well executed” & “poorly executed” programs
- Monitor the programs progress thru its life cycle and continuously evaluate the basis of the costs
- Continually compare/contrast. Validate assumptions, verify the path your on is the correct one. Identify off ramps where decisions can be made as new technology is made available and possibly implementable in your project.



# Summary

- For a cost estimate, a single number is not the answer
- The probability distribution is the answer
  - It serves as a management tool for decision makers
- There is a lot involved in doing a good cost estimate
- Many things to consider
- Never stop reviewing, improving, learning



# Questions?

## Contact Information

Joe Kabeiseman – 703.967.8212     [jkabeiseman@quaternion-consulting.com](mailto:jkabeiseman@quaternion-consulting.com)

Quaternion Consulting Inc.

13800 Coppermine Road, Suite 211

Herndon, VA 20171

[www.quaternion-consulting.com](http://www.quaternion-consulting.com)