

# ***Headquarters U.S. Air Force***

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*Integrity - Service - Excellence*

## **Hanscom Mini-PDI Cost Estimating 101**



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- **Intro to SAF/FMC & AFCAA**
  - **Cost Estimating 101**
  - **Cost Estimating Examples**
  - **Why Good Estimates Should Matter to You**

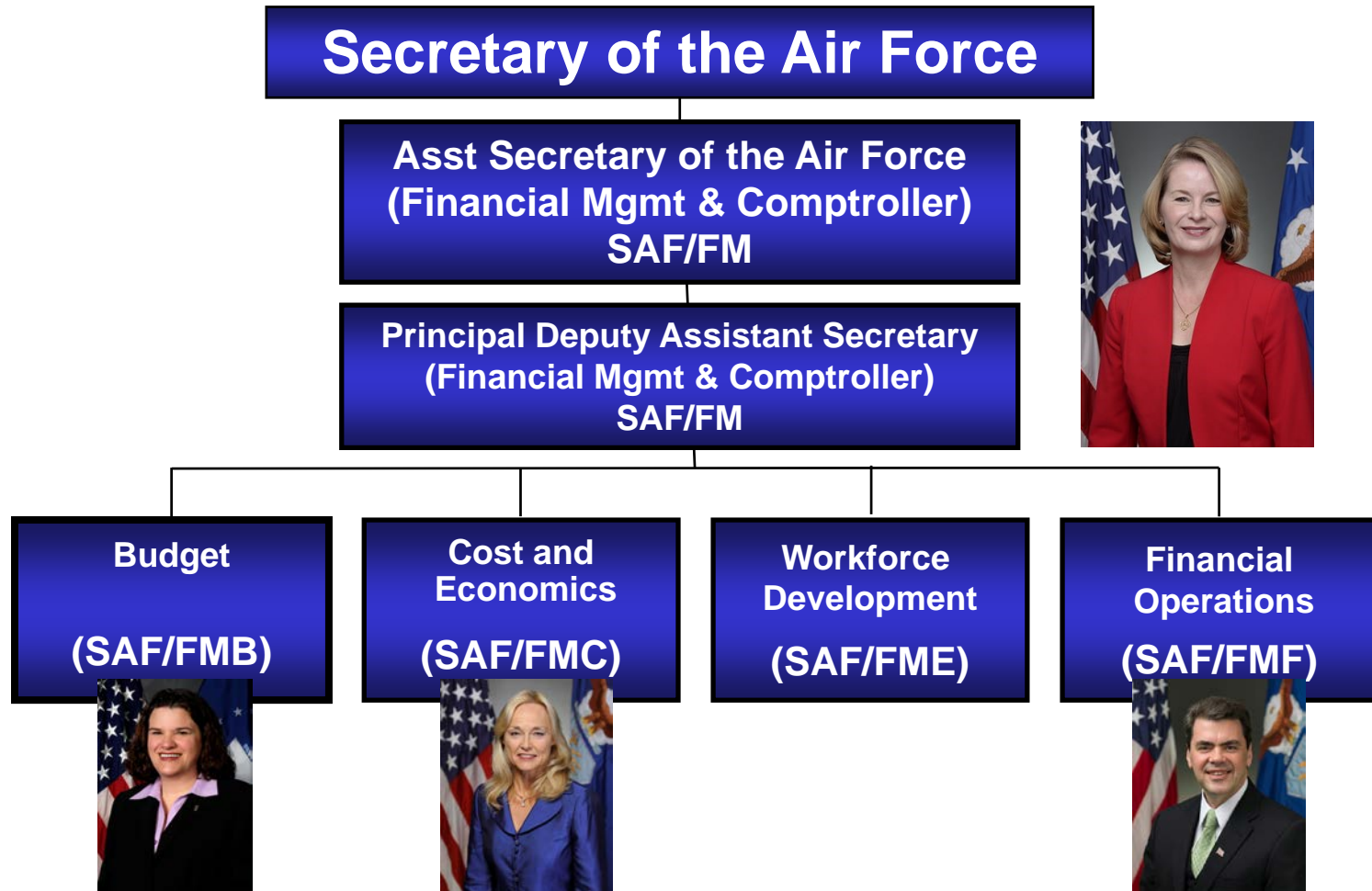


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# INTRO TO SAF/FMC & AFCAA



# SAF/FM Structure





# SAF/FMC and AFCAA

## Mission & Vision

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### Mission

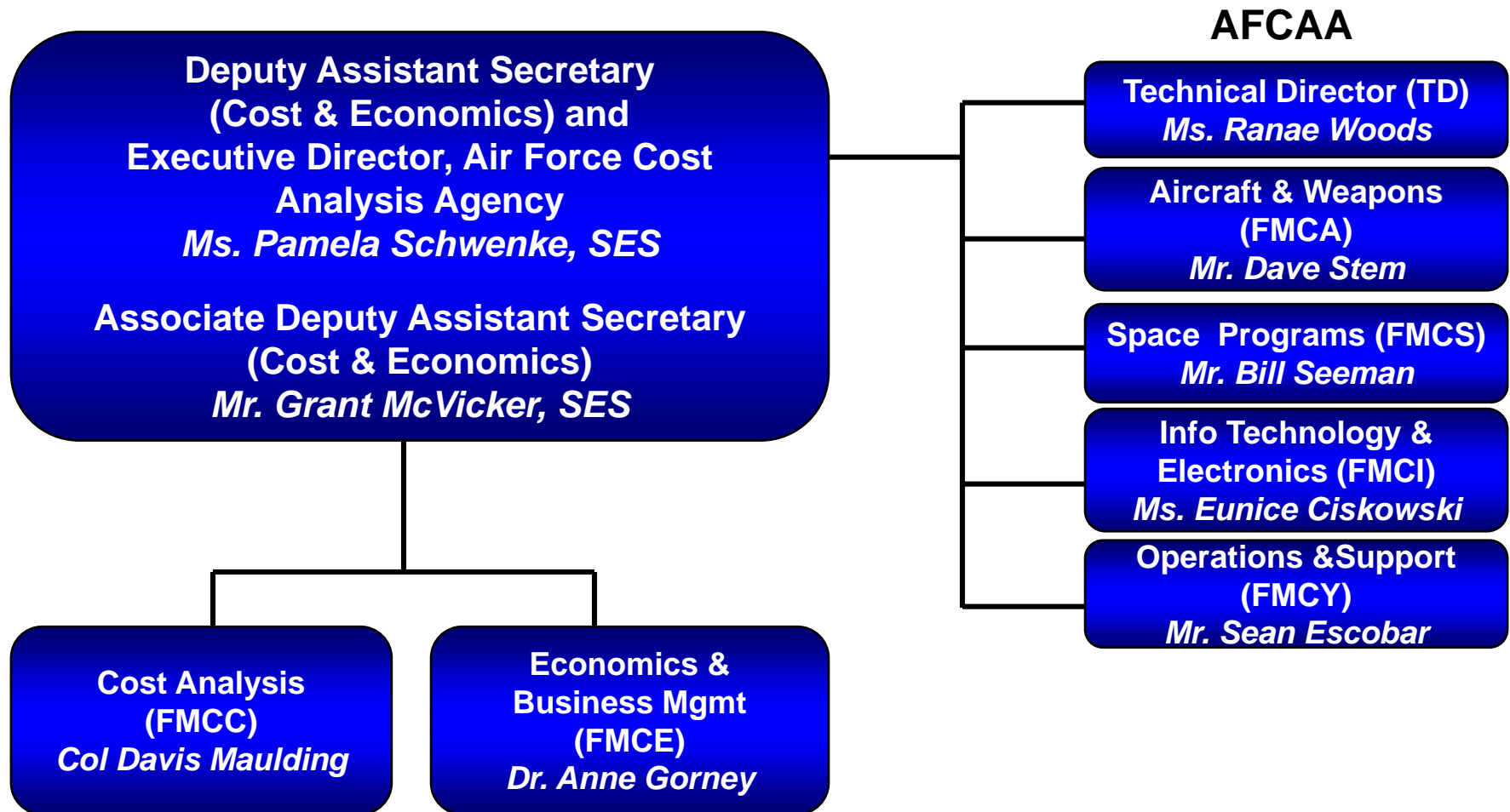
**“Provide expert cost, economic and financial decision support to the Air Force, DoD and Congress enhancing Air Force warfighting capabilities and maximize available resources”**

### Vision

**“Air Force decisions empowered by objective analysis.”**

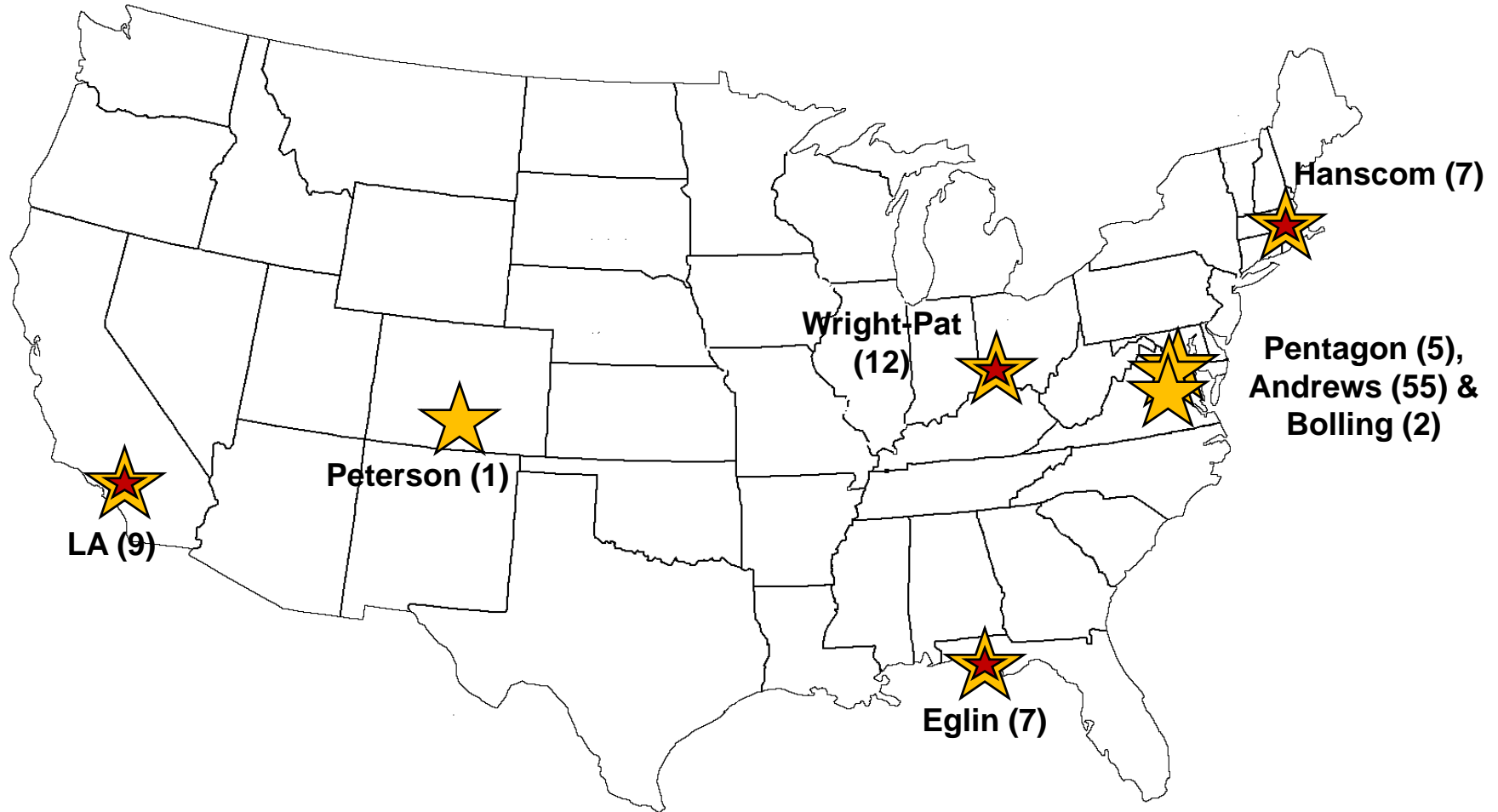


# SAF/FMC and AFCAA





# AFCAA Operating Locations



 AF Cost Analysis Agency (AFCAA) Operating Locations



# AFCAA

## *Roles and Responsibilities*

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- Reports to SAF/FMC
- Operates independently from Acquisition Program Offices
- Produces annual estimates to support 5 year budget request/plan (POM)
- Supports Major program's milestone decisions
  - Independent Cost Estimate for ACAT IC
  - Component Cost Analysis for ACAT 1D
- Conducts cost research, database and tool development
- Provides decision makers with:
  - Unbiased cost estimates and assessments
  - Independent technical and schedule assessments





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# Cost Estimating 101



# *Cost Estimating Myths*

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- Cost estimating is difficult due to...
  - Higher level math (Calculus and/or Statistics)
  - Large amounts of data to sort through
  - Too many technical details...engineering heavy
  
- Cost estimators just make numbers up



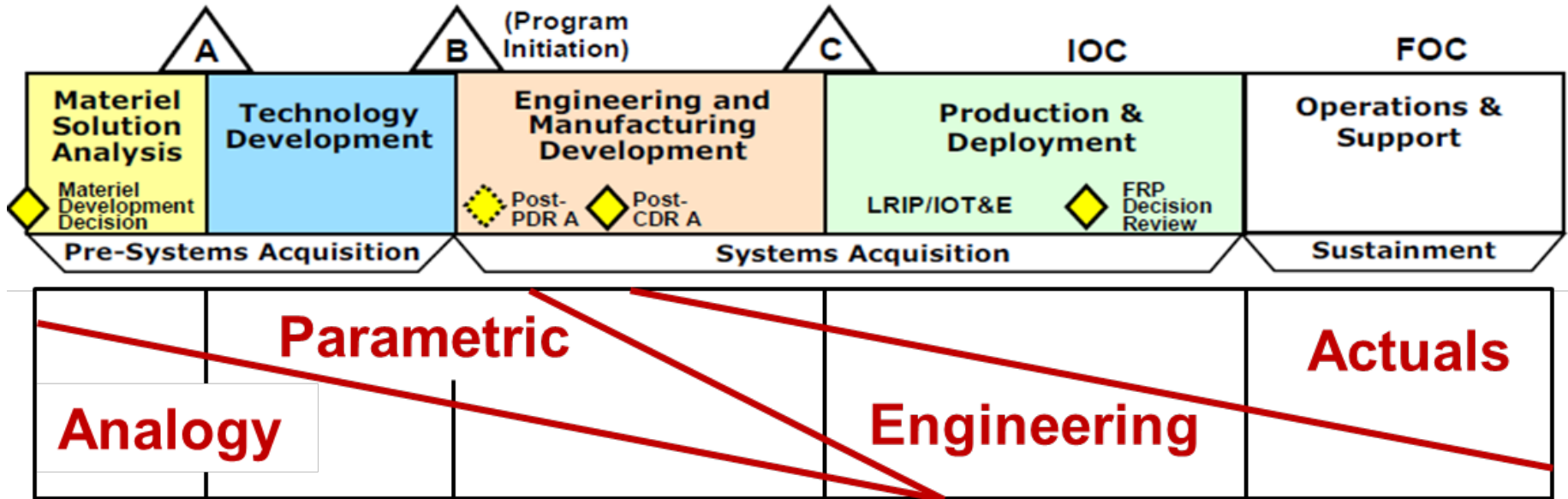
# *Cost Estimating Definition*

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- What is cost estimating?
  - The process of collecting and analyzing historical data and applying quantitative models, techniques, tools, and databases to predict the future cost of an item, product, program or task
  
- What is the purpose?
  - Translate system/functional requirements associated with programs, projects, or proposals into budget requirements



# Estimating Approaches at Different Milestones



## ■ Estimating Approaches

- Analogy: Comparison to previous program(s) or subprogram
- Parametric: Data driven model that adjusts for key parameters
- Engineering Assessment: Expert opinion usually detailed bottoms up
- Actuals: Comparison to system's prior units



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# Cost Estimating Examples



# *Cost/Schedule Estimate Example*

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- Program Manager stops by and requests an estimate:

**How long does it take a random person to run a 5K race (3.1 miles)?**

- What do you do?
  - Ask more questions
  - Internet research
  - Your opinion/expert opinion
  - Collect actual results from similar races



# MS A

## *Analogy Approach*

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- You collect race results from a previous 5K race
  - 203 runners (observations)
  - Min 18:50.4 minutes / Max 57:15.7 minutes
  - Average time (mean) was **32:03.0 minutes**
    - 125 runners below & 78 above average
    - $125/203 = 62\%$  confidence level
  - 37:03.3 minutes or less at the 80% confidence level
  
- What other info would you want to improve the estimate?
  - What influences (correlates) to speed or time?



# *Additional Parameters*

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- Known
  - Age: (0-9, 10-15, 16-19, 20s, 30s, 40s, 50s, 60s, 70s, 80s)
  - Sex: Male or Female
  - State of residency
  - Weather conditions: Normal (60 degrees & clear)
  - Date of the race: Sept 2017
  - Location of the race: Nashua, NH
  - First and Last Name
  
- Unknown
  - How frequently they run
  - Height
  - Weight
  - How they felt prior to the race





# Additional Parameters

(cont.)

Age		
0 to 9	33:55.6	4
10 to 15	35:00.8	13
16 to 19	24:40.4	2
20s	29:20.3	22
30s	29:55.4	46
40s	31:42.5	40
50s	32:27.3	41
60s	34:21.3	22
70s	37:25.9	12
80s	39:52.7	1

Sex		
Male	30:12.8	89
Female	33:29.0	114

Location		
IL	52:30.1	1
MA	32:18.6	18
NH	31:44.8	174
NY	40:56.6	3
OH	37:15.0	1
UNK	31:20.1	6



# MS B

## Parametric Approach

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- The PM now requests the estimated time to run a 5K for a male in his 30s under normal conditions
  - Time (minutes) =  $32:03.0 - (01:50.2 * M) - (02:07.6 * A)$ 
    - M = 1 if Male and A = 1 if Age is 30 to 39
    - Time = 28:05.2 minutes
- Same question above except 2K or snowy conditions?
  - Find a better dataset (2K race or snowy conditions)
  - Adjust 2K to be faster and poor conditions to be slower



# *MS C &/or Full Rate Production Actuals Approach*

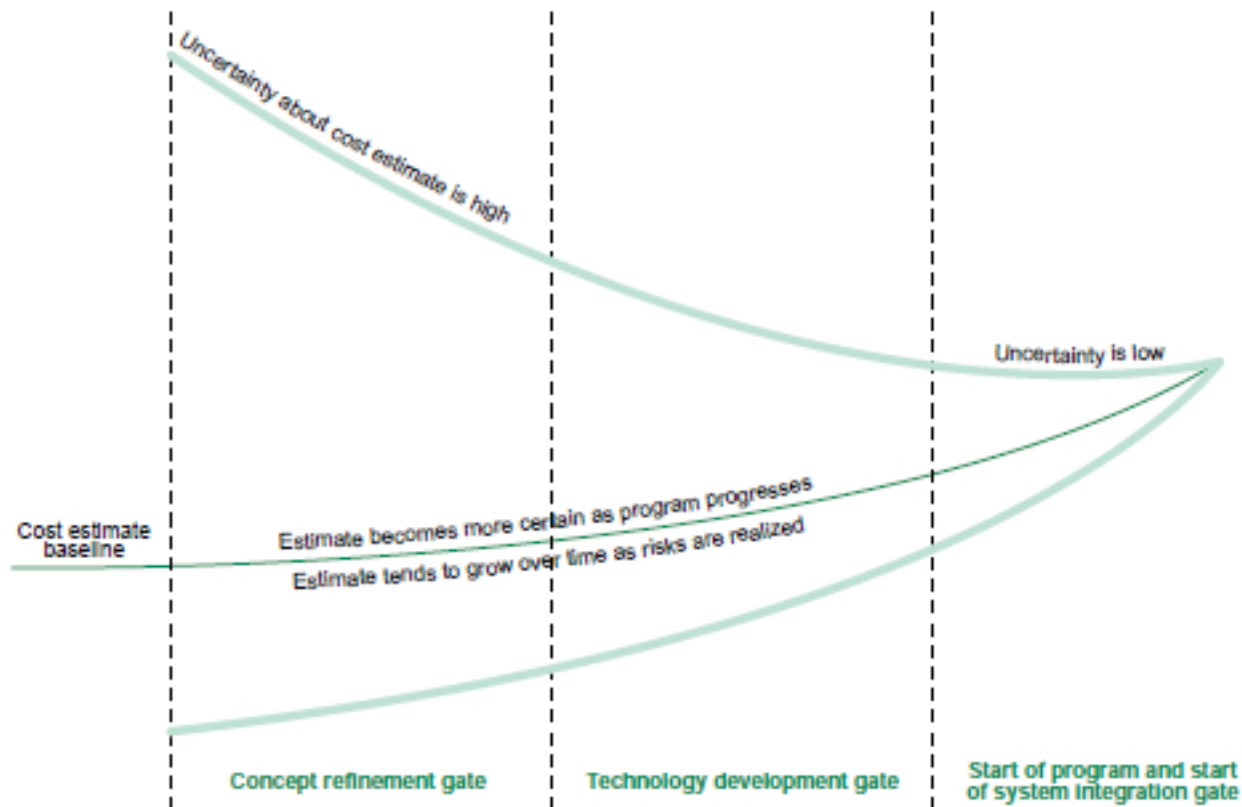
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- The PM now asks for the estimated time it will take James Campbell Jr to run a 5K race in normal conditions two weeks from today
  - What questions would you ask?
    - Average person's time from prior race: 32:03:0 minutes
    - Average age group 0-9 time: 33:55.6 minutes
    - Average male time: 30:12.8 minutes
  - Results from last race
    - In Sept 2017, he completed a 5K in normal conditions in 26:15.5 minutes (#1 runner under 16 years old!)
    - What questions might you ask to adjust that time?



# System Maturity Improves Estimate

Figure 4: Cone of Uncertainty



Source: GAO.



# *Radar Estimating Example*

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- What is the lot cost for 40 ground based mobile radars that transmit 100 kW of power and have an antenna size of 80 square feet
  - Gathered data for 25 ground based mobile radar programs
    - Scale for power (average power out)
    - Scale for size (square feet of antenna)
  - Lot \$M = 3.0 \* (power)<sup>0.47</sup> \* (size)<sup>0.24</sup> \* Qty<sup>0.86</sup>
  - Adjust for the type of materials used to build the radar
    - Material A produces 3x power of Material B but A is more expensive



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# Why Good Estimates Should Matter to You



# *Integrating Cost Estimating into Program's Budget*

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- Understand how the cost estimate was developed
  - What estimating approach, data sources & how many data points?
  
- Cost Estimates should be the foundation for your:
  - Budget/spend plans
  - Budget Docs (R/P Docs)
  - CAM/O&M requests
  - Response to cut drills
  - Should Cost Initiatives
  - Reprogramming action requests
  - Earned value analysis comparisons







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