Performing Independent Government Cost Estimates (IGCEs) on Engineering Change Proposals (ECPs)

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Agenda

- Agency use of Firm Fixed Price Contracts for Services
- The need for Independent Government Cost Estimates (IGCEs) on Engineering Change Proposals (ECPs)
- ECP IGCE Process and Methodologies
- Lessons Learned

Firm Fixed Price Contracts

- NASA shifted in recent years toward a different contracting model
  - Public Private Partnerships
  - Firm Fixed Price Contracts
    - Use milestone based fixed-price contracts

- New idea: NASA pays for a service instead of hardware
  - Trend started with successes in the Commercial Cargo and Commercial Crew missions to ISS
    - SpaceX, Boeing
  - Intuitive Machines (February 22, 2024), Commercial Lunar Payload Service (CLPS)
    - Delivering payloads to the lunar service

Agency Trend

- Acquisition approach has been adopted by other programs across the agency
  - Elements of Gateway
  - Human Landing System (HLS) for Artemis
  - Spacesuits

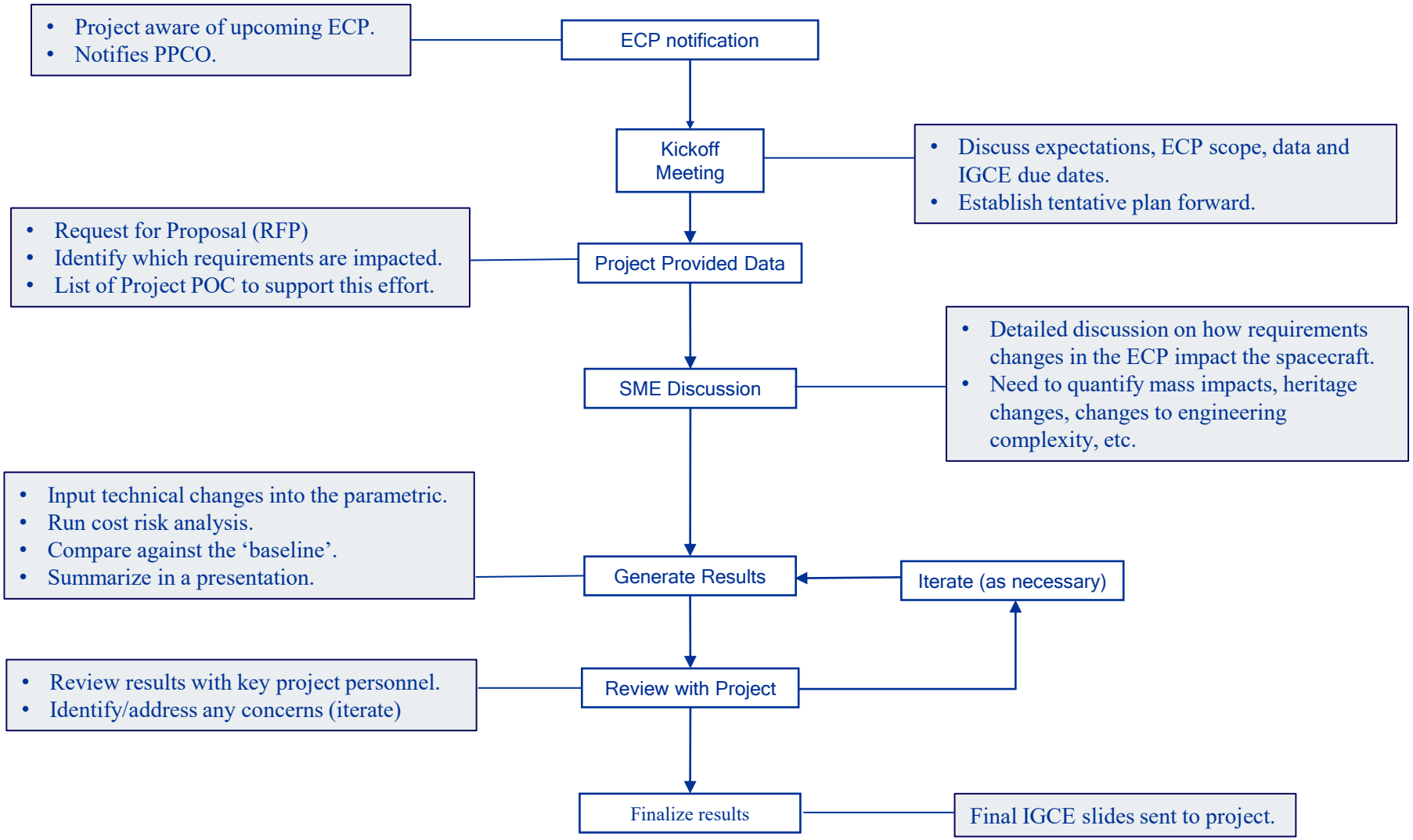
- FFP Contract structure works best for well defined projects with few anticipated requirements changes

- But the original ‘service’ needs to change due to:
  - Interdependencies between systems
  - Technical difficulties
  - Previously unidentified requirement
  - Any number of additional reasons

How to change the ‘service’?

- Mechanically, changes to the original FFP contract are conducted through an Engineering Change Proposal (ECP) process
  - Government determines what requirements need to be updated to the original contract and drafts up that scope of work
  - Government submits a Request for Proposal (RFP) to the Prime
  - Prime reviews the scope of work and proposes back
- Effectively becomes a new round of negotiations
  - Impacts one or many milestones in terms of technical, cost and schedule
- 2023 – GRC Procurement Office:
  - Requested an Independent Government Cost Estimate (IGCE) to be conducted before releasing an RFP
  - Program Planning & Control Office at GRC to implement
    - New line of work for the office

ICGE Process for an ECP



IGCE Initial Question List

- A detailed understanding of what is changing in the FFP Contract for each element/category
  - What requirements are changing? What is the current baseline that we are changing from? What are they changing to?
  - Is this 'new work' that NASA asking them to perform?
  - Does it require them to undo work that's already been performed?
  - What will the Prime have to do to meet this new requirement?
    - What activities does the Prime need to perform to meet this? Duration?
    - What personnel mix will the Prime need accomplish this work? How much time for each?
    - Are there any procurements necessary by the Prime to accomplish this? Travel? Other costs?
    - If the work is accomplished by a subcontractor to the Prime, what do they need to do to accomplish the work? Does the Prime have any overhead to manage this effort?
  - Can we quantify the requirements change with an impact to flight hardware?
    - Mass impact, delta to the Master Equipment List (MEL)
  - What data do you have to provide?
    - Statement of Work (SOW)? RFP? Requirements impacted?
    - Relevant data from previous ECPs

IGCE Implementation Options

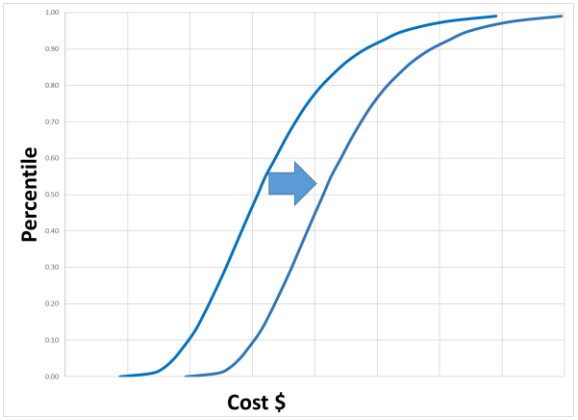
- Determined by the scope of work and data availability:
  - Each of the method below can be used as a cross-check for one another
  - Most cases, a hybrid solution can be put forward
  - Highly individualized process

- **Two Parametric Options:**
  1. Parametric Deltas: establish a baseline
     - Conduct Deltas to determine ROM estimate
  2. Parametric Component Estimates: technical detail at low enough level
     - Narrowly scoped requirement
     - Need specific technical information: mass, qty, heritage, etc

- **Engineering Build Up Option**
  - Builds estimates for higher-level cost elements by summing or “rolling up” detailed estimates for lower-level cost elements
  - Based on estimated required labor and anticipated required procurements

Parametric Deltas: Two-Step Process

1. Model Set-up and Calibration
   - Establishing a 'baseline' parametric cost model
     - Master Equipment List (MEL) for the system
     - Prime Contractor Rate information
   - Scope: estimate what's currently under contract



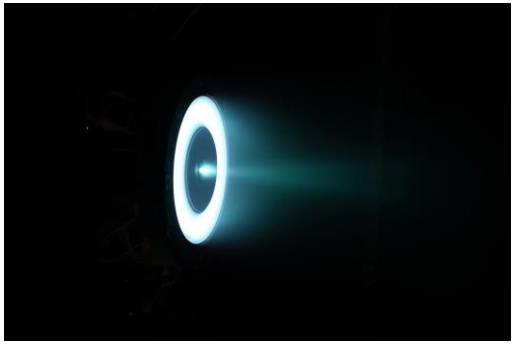
2. Meet with the project
   - Discuss and quantify all the deltas impacted by the requirements changes
     - mass changes, integration complexity changes, etc
   - Input into the model
   - Resulting delta between these two models is the estimate

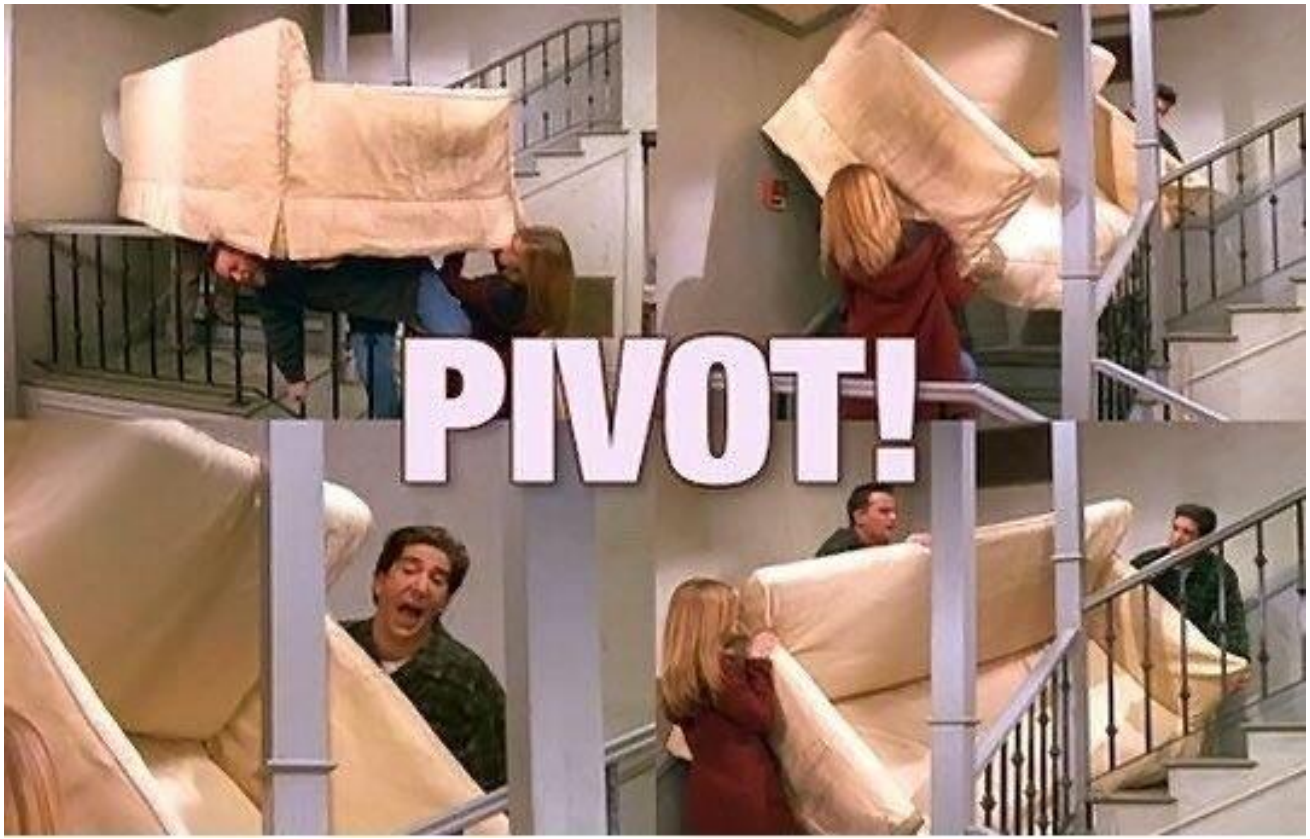
Output: Rough-Order-of-Magnitude (ROM) estimate

This type of parametric approach also can account for uncertainty
- Good for less defined requirements (gov't has less visibility into work being done)
  - Adjustments to qualitative inputs (Degree of Difficulty, Team Experience, etc.)
- Can capture the impact of downstream activities

Parametric Component Estimate

- Software Tools: TruePlanning and SEER
  - Two different tools also helps with range estimates
- Enables us to address ECP changes for narrowly defined changes such as:
  - Additional flight spares
  - Additional Engineering Models or test hardware
  - Inclusion of additional hardware
- Effective methodology for very specific instances
  - Requires low-level technical details




PIVOT!

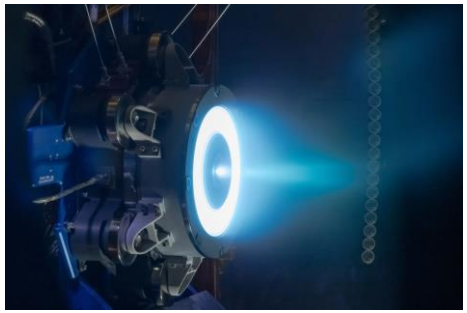
Engineering Build-up

- Facilitated discussions with Project SMEs
  - Define then estimate the anticipated work of the Prime
- Systematically, identify the work for each requirement change
  - Hours
  - Skill level(s) performing the work
  - When work occurs
  - Materials, ODCs, travel
- Blended rates and Prime overheads
- Have the team estimate the work as if they were the contractor
  - Most familiarity with the project

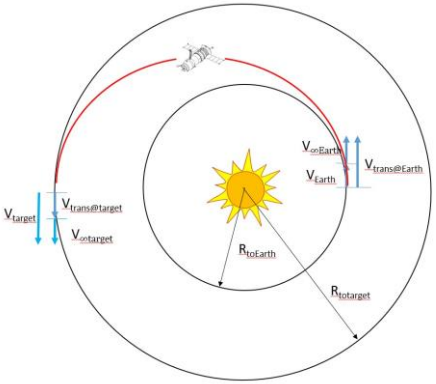
Labor Overhead	
General Administrative	
Fee	

Element 1	FY23	FY24	
Labor Category	**Labor Hours**	**Labor Hours**	**Total Cost**
Engineer			$ -
Project Engineer			$ -
Sr Eng Specialist			$ -
Technician			$ -
Techl Staff & Superv			$ -
Sr Tech Staff & Mgmt			$ -
Direct Labor Totals	$ -	$ -	$ -
Indirect Labor Cost			
Labor Overhead & Fringe; Base is Direct Labor	$0	$0	
Labor Overhead Rate			
Labor Overhead Cost	$0	$0	$0
Total Indirect Labor Cost	**$0**	**$0**	**$0**
Other Direct Costs (ODCs)			
1. Material	$ -	$ -	$ -
2. Misc. ODC	$ -	$ -	$ -
3. Travel	$ -	$ -	$ -
Total Other Direct Costs	$ -	$ -	**$0**
G&A Cost			
1. Base = All Contract Costs	$0	$0	
G&A Rate			
G&A Cost	**$0**	**$0**	**$0**
Subtotal	**$0**	**$0**	**$0**
Fee/Profit			
1. Base = All Contract Costs	$0	$0	
Fee/Profit Rate			
Fee/Profit Amount	**$0**	**$0**	**$0**
Total Estimated Cost/Price	**$0**	**$0**	**$0**

Hits and Misses Examples



- **Hit:** Clearly defined HW changes
  - Additional sparing and test hardware
  - Parametric estimates surprisingly close to RFP
- **Miss:** Software Upgrade on Ground Support Equipment
  - Estimating team interpreted lack of understanding of the requirement as difficult/complex
  - Estimated as new effort using software estimating tools
  - Turned out to be a trivial software upgrade that was commercially available – off by orders of magnitude!
- **Miss (?):** Mission Design Support
  - Team defined and estimated the work by breaking into serial tasks
  - Prime's RFP came back as LOE
  - Missed on cost **<u>but</u>** we understood what was driving the differences

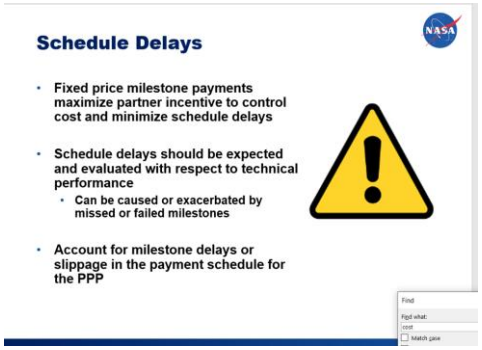


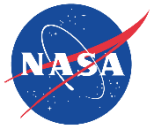
Lessons Learned

- Data drives the process
  - A new process for everyone
  - Be flexible
- Pressure to estimate requirement changes that are extremely difficult to quantify
  - If they can't clearly tell you what it is, how do you estimate it?
- PPCO (CFO): External to the Project
  - Limited insight on current requirements and the impact of these proposed changes
  - Limited insight into the Prime Contractor's 'business rules'
- ECPs are often a group of disjointed requirements under single umbrella
- Time pressure to turn around and limited availability of SMEs
  - Emphasize an iterative process

Forward Work

- Better account for Prime's 'business rules'
  - Do they typically include a Proposal Development Fee?
- How to better handle Cost Risk Analysis and Range estimates
  - Try to provide range estimates but they want a single number
- Study the past:
  - Review Basis of Estimates (BOEs) for previous ECPs
  - Help us to better anticipate how the Prime plans/estimates their work
- Costs are not currently tied to milestones at all
  - Is this even possible?





Questions?