Cost Reasonableness Review: A Tailorable Approach for Assessing Unique Projects

Marc Hayhurst, Uzair Irfan, Raymond Woods
The Aerospace Corporation

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Agenda

- The Aerospace Corporation
  - Experience and Evolution of Cost Reasonableness Review Process
- Cost Reasonableness Review Overview
  - Example Criteria and Scorecard
  - Flow Chart of Methodology Process
- Example Scope and Tailoring
  - Comprehensive vs. Tailored Reviews
  - Tailoring Examples
- Conclusion

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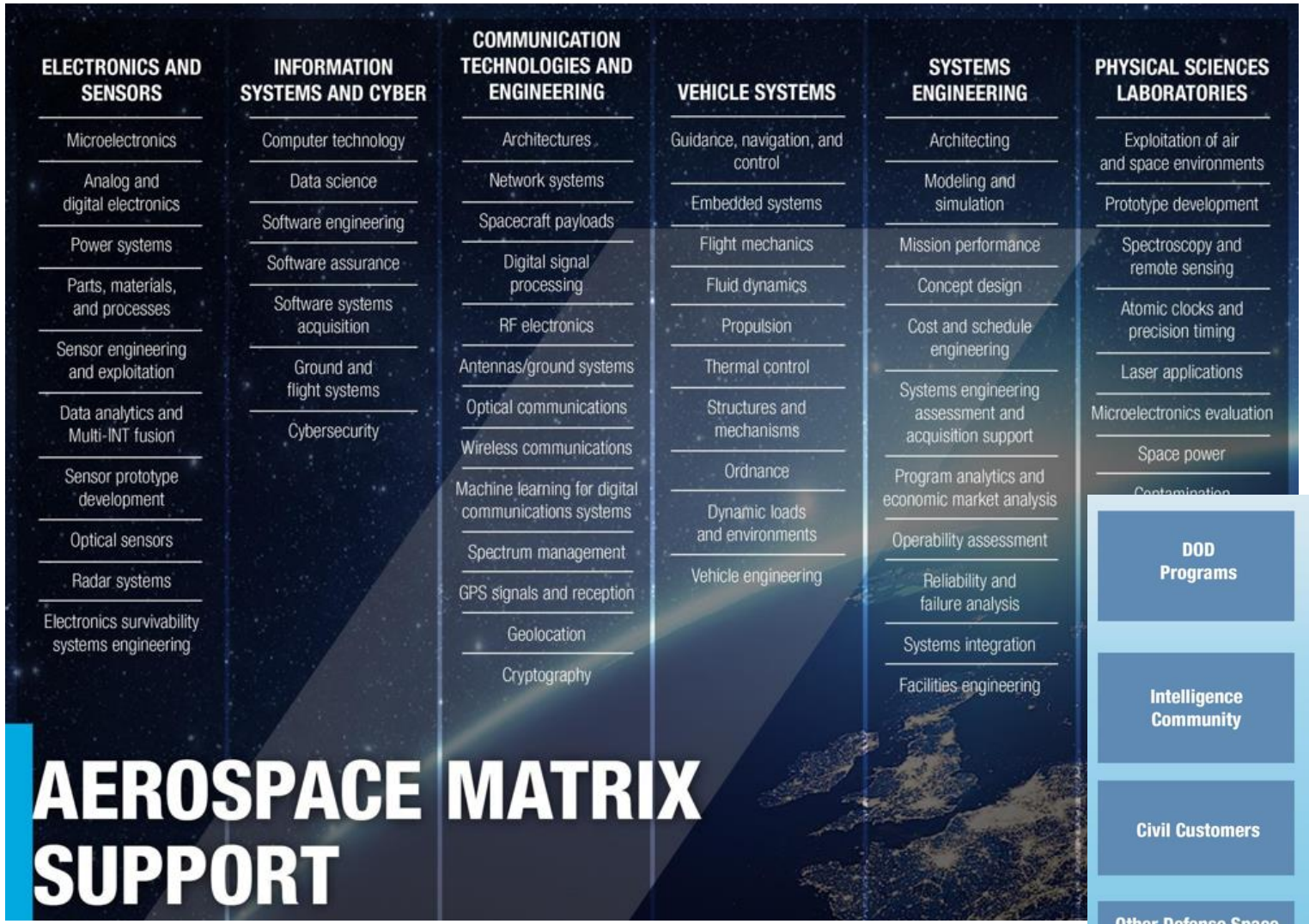
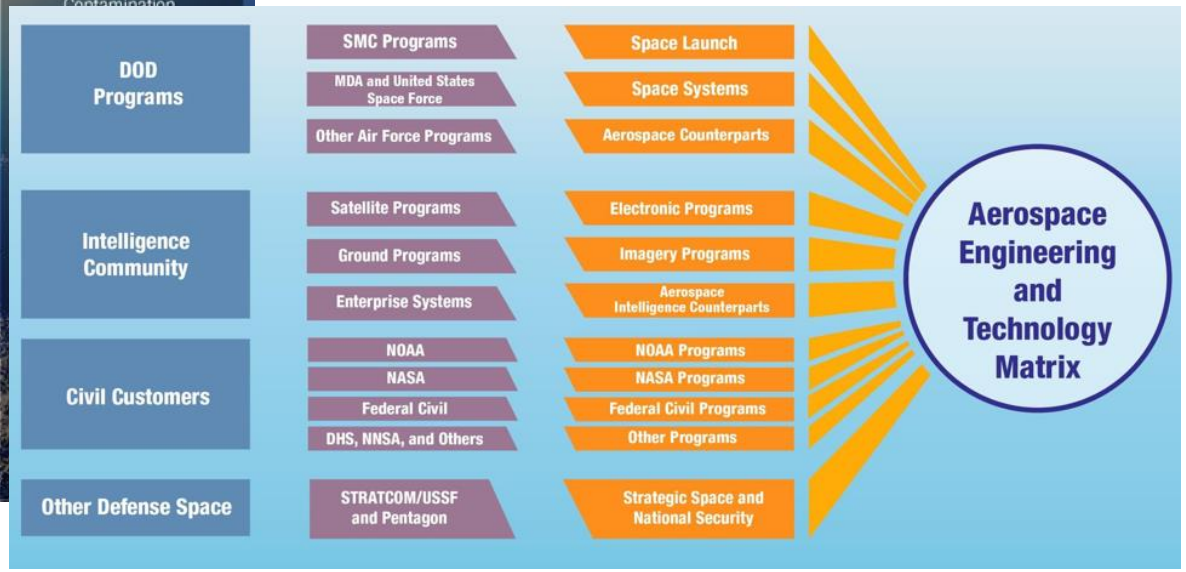


Independent nonprofit corporation since 1960, with nationwide locations, and over 4,000 employees

Operates the only Federally Funded Research and Development Center (FFRDC) for the space enterprise

Provides scientific and engineering services for DoD, IC, and Civil customers



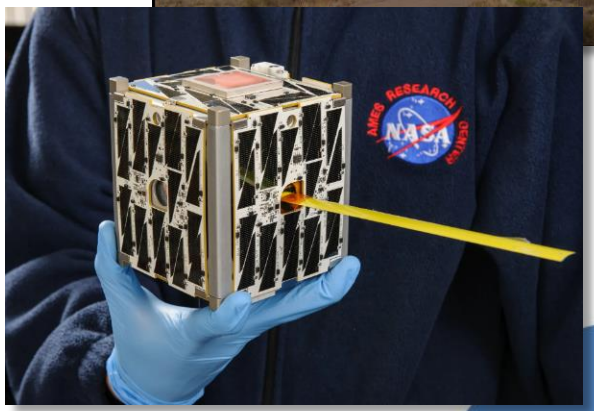
Cost Reasonableness Reviews at The Aerospace Corporation

Evolution of the Process

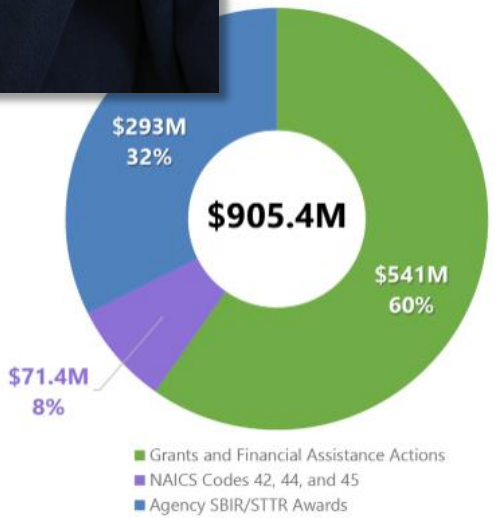
- Government stakeholders typically fund a **diverse portfolio** of projects
  - **Large scale** procurement projects addressing significant scientific questions or unique national challenges
  - **Mid-scale** projects that may upgrade existing capabilities or solve smaller well bounded or short-term problems
  - **Small grants** to individuals to conduct independent research & development, or talent development programs to ensure continuity in the workforce

- They are then faced with the dilemma of evaluating projects of various shapes and sizes with limited budgets, tight timelines, and strained workforce
  - Larger high-risk projects garner the most attention, leaving smaller and perceived lower risk projects and grants possibly overlooked
  - **Methodologies applied to larger projects may be more costly and excessive** than what is needed for smaller/lower risk ones

Very Large Array (VLA), New Mexico (Credit: Aerospace Photo)



PhoneSat 2.5 (Credit: NASA)



FY19 Department of Energy Small Business Funding (Credit: U.S. Department of Energy)

Cost Reasonableness Reviews at The Aerospace Corporation

Evolution of the Process

Based on customer requests to evaluate project cost, schedule, and risk faster and tailored to their specific needs, the Cost Reasonableness Review was developed

- Grew out of Decadal Survey work and the **National Science Foundation (NSF)** needs for evaluating unique facilities that fit their “mid-scale” portfolio

- Experience with a variety of assessments for space science projects and ground-based scientific facilities helped develop this methodology:
  - Evaluation of concepts for numerous Decadal Surveys for **National Academy of Sciences (NAS)**
  - Independent technical and cost assessments across range of unique and complex ground facilities:
    - Launch infrastructure and ground processing facilities for **National Security Space (NSS)**
    - Mobile launch platforms, environmental test facilities for **National Aeronautics and Space Administration (NASA)**
    - Material processing facilities for **National Nuclear Safety Administration (NNSA)**

- Aerospace has performed Cost Reasonableness Reviews of:
  - Mid-scale and large facilities for **NSF**
  - University Consortia Grants for **NNSA NA-22**

What is a Cost Reasonableness Review?

- Two common types of **Independent Cost Reviews (ICRs)** specified by GAO*
  - **Independent Cost Estimate (ICE)**: Independent estimate of total project cost, executed by an organization external to the project, based on same technical information used to develop baseline project estimate
  - **Independent Cost Assessment (ICA)**: Independent assessment of the quality and accuracy of the baseline project estimate, executed by an organization external to the project, based on the project's stated technical approach, risk, and acquisition strategy

- A Cost Reasonableness Review is a **type of ICA** that is used to assess the overall quality and accuracy of a project plan. It can be **comprehensive or highly tailored** to satisfy the needs of the stakeholder.
  - It differs from an Independent Cost Estimate (ICE) in that it **does not produce an estimate of total project cost**
  - It **focuses on evaluating the projects plan and its consistency** with the project's stated technical approach, risk, and acquisition strategy
  - Usually applied to **lower risk projects and grants**
    - e.g., low total project cost, renewal projects, upgrade projects, update/review of existing estimate

***GAO Cost Estimating Guide (GAO-20-195G)**

Reasonableness Review Scorecard

Using Reasonableness Ranges to Create Scorecard

- A scorecard summarizes quantitative analysis via a qualitative system, with color ratings to enable easy interpretability and use by program management
  - "How close" the project cost for a given WBS item is to its tailored reasonableness range is typically a percentage range that is specific to a given item
    - Example: "Travel costs within +/- 5% of the reasonableness range bounds are considered very reasonable (5-10% reasonable, 10-20% marginal, and exceeding 20% unreasonable)
  - Qualitative assessment of the quality of the estimate, such as whether it has the GAO characteristics of a reliable cost estimate, is also incorporated into the color ratings
  - Criteria also created for flowing up lower WBS level ratings to determine parent WBS level ratings (see Back Ups for Example)

- Dark Green – Very Reasonable
- Light Green – Reasonable
- Yellow – Marginal
- Red – Unreasonable
- Gray – Not Applicable/ No Cost

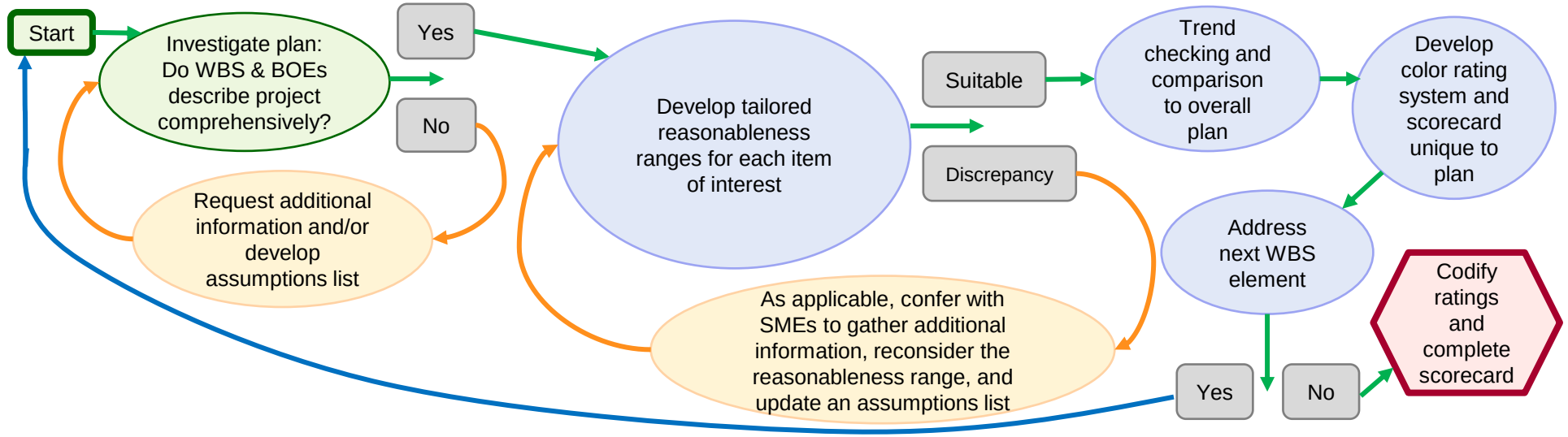
	Labor					Equipment	Travel	Materials & Supplies	Information Technology	Sub- Contractors	Total Direct Costs
	Project Management	Technicians and Scientists	Graduate and Undergraduate Students	Administrative	Facility Support						
1.0 Program Management											
1.1 Director's Office											
1.3 Business Services											
2.0 Facilities					Low						
2.1 Observatory Facilities					Low						
3.0 Primary Scientific Hardware			$820K			$12,500K		$1,230K			$23,480K
3.1 Telescope		$5000K									
3.2 Scientific Instrument 1						$980K		$152K			
3.3 Scientific Instrument 2											
3.4 Implementation			$150K								
3.5 Community Sci Program			$100K								
4.0 Data Management and Computing		$10,200K							$1,500K		$15,300K
4.1 Data Managment											
4.2 Computing Hardware											
4.3 Computing Software		$590K							$1,500K		$3,632K
5.0 Systems I&T and Commissioning											
5.1 Systems I&T											
5.2 Commissioning											
6.0 Operations											
6.1 Operations and Maintanence											
6.2 Education and Outreach											

*Note: This scorecard uses fictional data

Methodology for Assessing Cost Reasonableness

Process

- Iterative process of developing tailored reasonableness ranges and investigating lower WBS level items of interest
  - – Investigation of program plan Ground Rules & Assumptions (GR&A), Bill of Materials (BOMs), Bases of Estimate (BOEs), escalation, etc.
    - Is the picture complete? Are costs comprehensive to the overall plan?
  - – Reasonableness range = the set of crosschecks that outline an applicable bounds of costs, from Low to High, tailored to a type of cost (budget category) and for use against specific WBS activities that contain those costs
  - – Trend checking and comparing with proposal
  - – Developing color rating system and score card
  - – Codifying ratings with tailored scorecard GR&A, to ascribe “reasonableness”



Tailoring Examples

Possibilities

Notional Comprehensive 3-Month Review

- **Single Large Proposal** for Review
- Overview Evaluation of Cost
- Evaluation of BoEs
- Reasonableness Ranges of **(nearly) all** cost categories
  - Personnel (Labor)
  - Fringe
  - Equipment
  - Travel
  - Participant Support
  - Materials & Supplies
  - Publications
  - Consultants
  - Computer Services
  - Subawards
  - Other Direct Cost
  - Indirect Cost
- Technical/Cost Coupled Review
- Schedule Consistency Checks
- Need Specific Metrics
- Other Directed Investigations

Notional Tailored 3-Week Review

- **Multiple Small Proposals** for Review!
- Overview Evaluation of Cost
- Evaluation of BoEs*
- Reasonableness Ranges of **some** cost categories
  - Personnel (Labor)*
  - ~~Fringe~~
  - Equipment
  - Travel*
  - Participant Support*
  - ~~Materials & Supplies~~
  - ~~Publications~~
  - Consultants*
  - Computer Services*
  - Subawards**
  - Other Direct Cost*
  - ~~Indirect Cost~~
- ~~Technical/Cost Coupled Review~~
- Schedule Consistency Checks*
- Need Specific Metrics
- Other Directed Investigations*

*Limited review

**Subawards must be decomposed into other budget categories

- Comprehensive review preferable for higher dollar awards
- Tailored review will use many of the same techniques
  - Scope limited in shorter time frame
  - Overview characterization of the cost is beneficial regardless scope
  - Evaluation of BoE is necessary for both
- Need specific metrics and focused investigations may be more beneficial in the shorter time frame

Example Tailored/Directed Investigation

Technical/Cost Coupled Evaluation

- A focused **technical/cost coupled review** can be a useful tool to avoid downstream issues, particularly in resource limited projects
  - Consists of a review of technical baseline & project risk list
  - Technical SMEs review materials in concert with Cost SMEs and iterate together
  - Identifies additional potential risks the project may not have
  - Not a complete probabilistic risk estimate

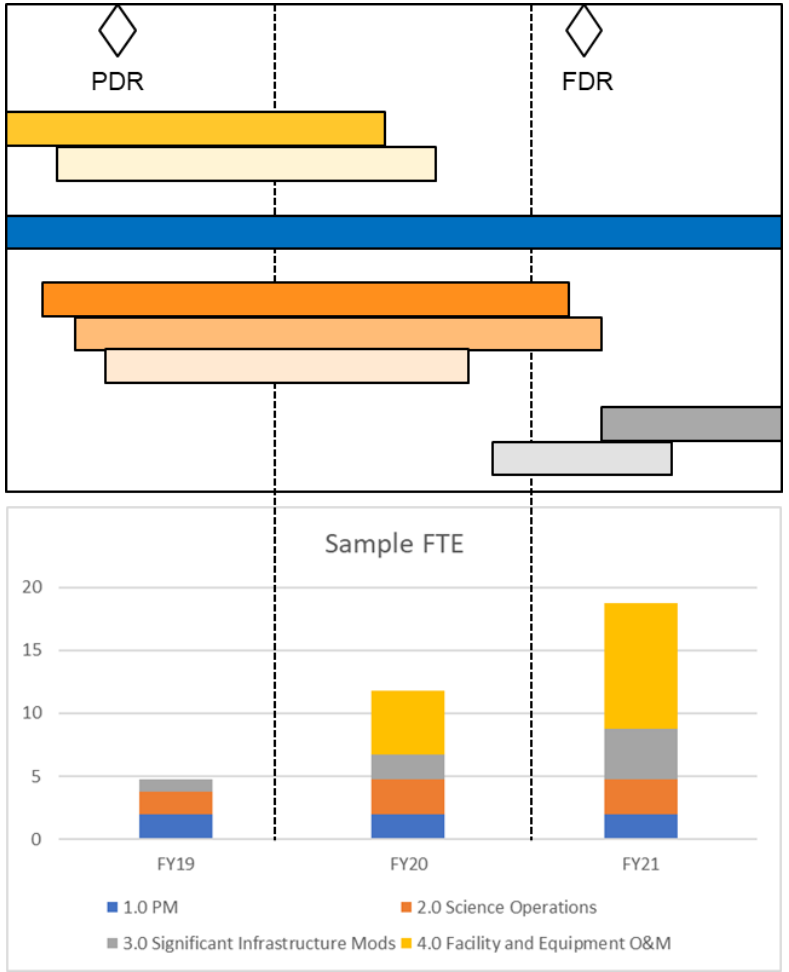
- **Example Benefits**
  - A project was planning to purchase a photovoltaic array to supply power at a remote site
  - A technical review was conducted along with the cost review
  - Review of the vendor quote revealed that a buried transmission cable would not have adequate shielding to supply the proper power
  - Late discovery of this issue would have resulted in costly changes later in the project

Example Tailored/Directed Investigation (Continued)

Schedule Consistency Checks

- **Schedule consistency checks** are another useful method to assess the realism of the project schedule and its potential executable
  - The Project schedule can also be assessed along with the project cost to determine its quality and the consistency between schedule/cost
  - Commercial software tools can be used to evaluate the schedule for proper linkages and logic
  - Phasing of cost, staffing, and schedule can also be evaluated to ensure they are not disconnected from each other, and funding will be available when it is needed

- **Example Benefits**
  - A projects staffing plan was evaluated next to its schedule
  - The staffing plan was found to be heavily backloaded, while the schedule showed many of the same activities starting earlier in the project
  - It was recommended to improve project controls so staffing and scheduling were not being done independently from each other



Example Tailored/Directed Investigation (Continued)

Need Specific Metrics

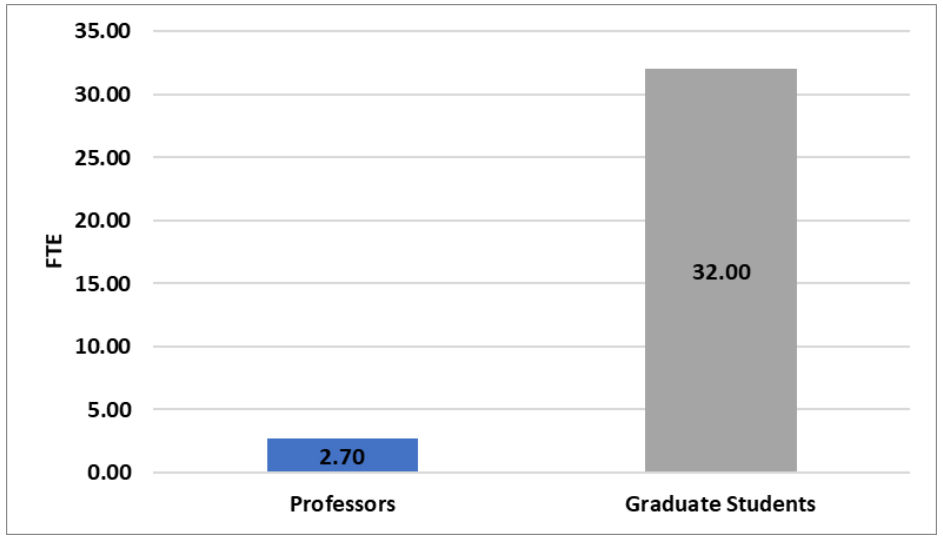
- **Custom metrics** can help assess the quality of a proposal or compare across multiple proposals
  - Should be designed to align to the **goals of the proposal call**
  - Can be relatively simple ratios

- **Example Benefits**
  - A project was interested in identifying how many students would benefit from grant dollars
  - Specific metrics were developed to assess ratio of professor time per student and other related cost/value metrics
  - The metrics helped to compare multiple proposals to each other to see which students would benefit most

$$FTE\ Ratio = \frac{Student\ FTE}{Professor\ FTE}$$

$$Cost\ Ratio = \frac{Student\ Cost}{Professor\ Cost}$$

- **Personnel Observations**
  - *Annual Student positions **32.0***
  - *Student/Professor Cost Ratio: **1.73***
  - *Student/Professor Individual Ratio: **1.5***
  - *Student/Professor FTE* Ratio: **11.85***

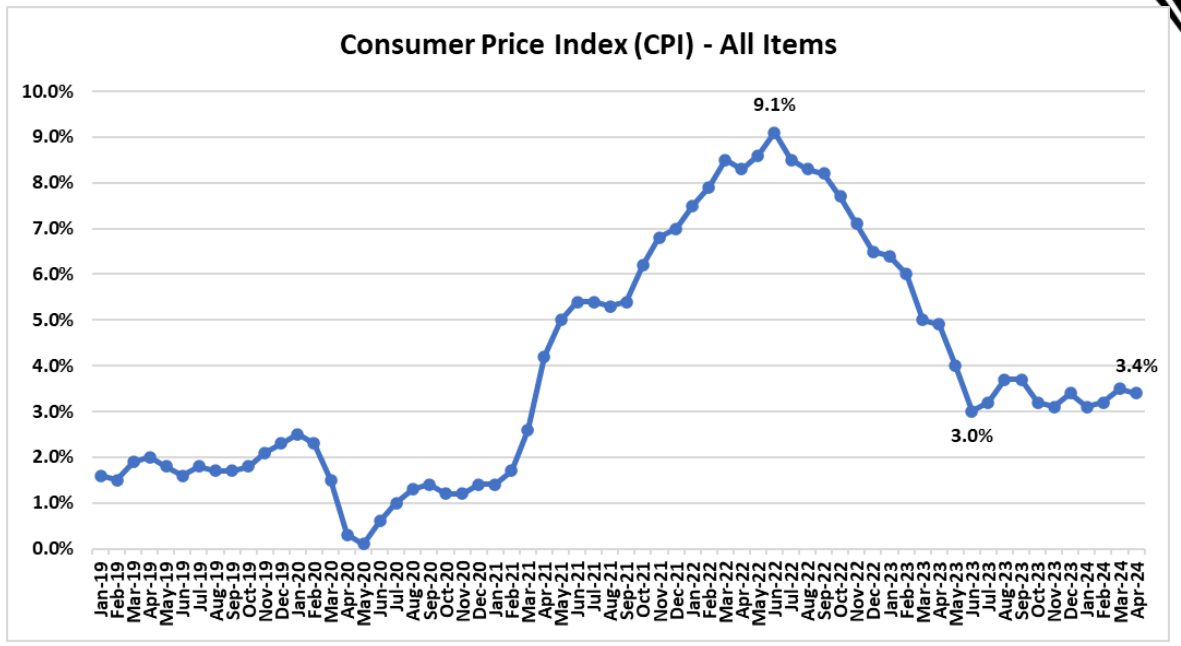


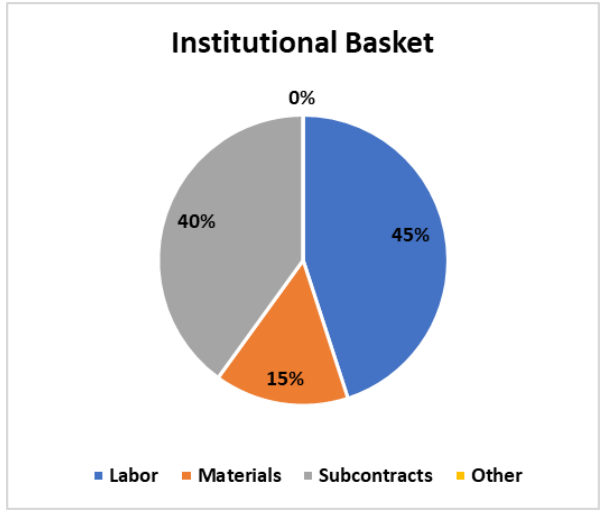
Example Tailored/Directed Investigation (Continued)

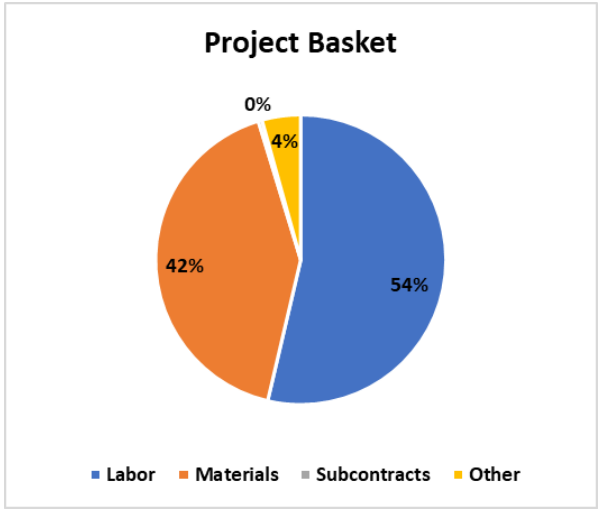
Escalation Assumptions

- Review of **specific assumptions** or aspects of a project's methodology can also be beneficial
  - Given the diverse nature of projects and grants, the **recipients may have varying levels of experience with costing practices** and make different assumptions than a SME would

- **Example Benefits**
  - Recent inflation concerns led a project to apply conservative escalation factors to its cost
  - Evaluation of the project's 'basket of goods' revealed that it may be inconsistent with the escalation factors applied
  - More appropriate escalation factors were recommended resulting in cost savings







Conclusion

- Cost Reasonableness Review can be an effective tool to assess a diverse portfolio of projects and grants
  - Flexible framework can tailor to many project types
- Assess the overall quality and accuracy of a project plan
  - Ensures a project of any size receives some level of review to be successful
- Quicker and less costly than an ICE when appropriate
- Can have additional benefits beyond simply reviewing the cost that contribute to a project's success

Other Useful Publications:

- **"Methodology for Assessing Reasonableness of Large Scientific Facilities' Costs" by Ray Woods and Valerie - ICEAA 2023 Workshop**
- **"Addressing Challenges in Costing Unique Large Scientific Facilities" by Marc Hayhurst, Matthew Marshall, Vera Scheidlinger, and Valerie Rockwell – ICEAA 2021 Workshop**
- **"Independent Cost Estimates for Scientific Facilities – Approaches and Benefits" by Matthew Marshall, Marc Hayhurst, Vera Scheidlinger, Denise Castro-Bran, and Justin Yoshida – NSF Large Facilities Workshop 2019**

Marc Hayhurst, Senior Project Leader
marc.r.hayhurst@aero.org

Uzair Irfan, Senior Project Engineer
uzair.Irfan@aero.org

Raymond Woods, Senior Engineering Specialist
raymond.d.woods@aero.org

Backup

Scorecard Ratings (Continued)

Color Rating for high-level WBS item and fictional example Scorecard

- Example color ratings for a scorecard
  - **Dark Green – Very Reasonable**: Project information is complete comprehensive, accurate, and strongly credible for the project purposes, with cost falling well within the reasonableness range
  - **Light Green – Reasonable**: Project information is complete comprehensive, accurate, and generally credible for the project purposes, with cost falling within the reasonableness range
  - **Yellow – Marginal**: Project information may not be entirely complete, comprehensive, accurate, or credible for the project purpose, with cost falling near the reasonableness range
  - **Red – Unreasonable**: Project information is insufficient, inaccurate, unreasonable, or unallowable, with cost not near the reasonableness range
  - **Gray – Not Applicable/ No Cost**
- Example criteria for higher level WBS items (e.g. WBS 1.0)
  - *If the majority of items within WBS 1.0 are a single rating then WBS 1.0 is that rating, unless:*
    - If a WBS item contains 2 or more unreasonable items, then it is also unreasonable.
    - If a WBS item contains 1 unreasonable item that is not the majority, then the WBS item is marginal.
    - If the majority of items within a WBS are very reasonable but it contains 1 or more marginal items, then the WBS is reasonable.
  - *If there is a combination of reasonable, very reasonable, and marginal items, count all very reasonable items as reasonable when determining the majority.*
  - *If there is a tie for the majority, the lower rating wins*

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