The Art of Developing an Aircraft Operation and Support (O&S) Cost Estimating and Pricing Model for Reimbursable Agreements

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Reimbursable Cost Estimating & Pricing Model

The focus of this presentation is to share the high level concept of design and development of a reimbursable cost estimating and pricing model for government type reimbursable agreements for Aircraft Operating & Support (O & S) Services.

*The Art:* Developing cost estimating tools is more of an art form than actual science. Ingenuity is required as there is no singular method to successfully develop a model that addresses all pricing requirements. The artistic challenge in developing the reimbursable Aircraft O & S Cost and Pricing model was integrating cost/budget data, and aircraft/flight data, with a model capable of accommodating a myriad of unique customer requests. It also had to comply with federal reimbursable and appropriation laws, and produce a defensible estimate.
Motivation

- NASA Ames Research Center (ARC) was requested to develop a Reimbursable Pricing model for interested domestic and international customers and partnerships to one of NASA’s most heavily invested portfolio of an aircraft observatory.

- Currently, there is no officially recognized cost model or cost estimating guidance available at NASA for Aircraft O & S.

- Goal was to develop, implement, and establish a standardized process for Aircraft O & S Cost Estimating.
Approach

- Recover Direct Operating and Support (O & S) Cost
- Ensure no budget augmentation when seeking reimbursement for services
- Comply with federal reimbursable and appropriations laws:
  - GAO-06-382SP Appropriations Law
  - Economy Act (1932)
  - Space Act Agreement (1958)
  - OMB Circular No. A-126 Revised
- Research and leverage best practices from other US federal agencies:
  - Primarily utilized the DoD standardized Cost Per Flying Hour (CPFH) cost estimating methodology which is recognized by OMB, IG Audits and GAO as valid. (DoD Reimbursable Aircrafts and US Presidential Air Force One CPFH)
Cost Estimating Methodology

- Bottoms-up / Grass-Roots Cost Estimate
  - Most ideal method for reimbursable purposes (compared to analogous and parametric)
  - Actual costs of labor, materials, and all other related costs to the program are captured as opposed to parametric/predictive costs
NASA ARC Aircraft O & S Cost Model
Design Requirements

- Sustainable and maintainable
- Easy to Use: Simplicity in design, navigation, and usage of tool
- Provide traceable and transparent calculations
- Capable of accommodating a myriad of unique customer scenarios
- Account for all fixed and variable costs
- Ability to quickly generate cost and pricing estimate
- Based on proven cost estimating methods
- Ability to meet reimbursable agreement administrative requirements such as inclusion into forms
NASA ARC Cost Tool Development
Addressing Design Requirements

- Sustainable and maintainable
  The modeling tool is built on Microsoft Excel Application

- Easy to Use: Simplicity in design, navigation, and usage of tool
  Three simple steps: Input data, estimate cost, and output pricing

- Provide traceable and transparent calculations
  Calculation steps and variables viewable on separate sheet in tool

- Capable of accommodating a myriad of unique customer scenarios
  Ability to capture additional unique costs
Addressing Design Requirements (continued)

- Account for all fixed and variable costs
  
  Built into the model and processed through estimating formula

- Ability to quickly generate cost and pricing estimate
  
  Model allows for quick time turnaround as a result of structured entry

- Based on proven cost estimating methods
  
  Incorporated best practices and cost formula from other gov’t agencies

- Ability to meet reimbursable agreement administrative requirements such as inclusion into forms
  
  Pricing estimate populated on applicable form and readily available for center management review and signature
Data Collection, Cost Estimating, & Pricing Process

1. Gather the Cost/Budget Data
   · Gather all cost data, normalize, and set ground rules (identify applicable costs)

2. Cross-Walk the Cost/Budget Data
   · Crosswalk cost data to the O & S Cost Structure for use in O & S Cost formula

Example:

3. Use the O & S Cost Estimating formulas to generate the O & S CPFH rates and output pricing to applicable form

4. Work with center CFO Office to ensure pricing accuracy and compliance with laws/regulations
O & S Cost Per Flying Hour (CPFH) Formulas

- **CPFH\(_j\) (High Level Concept)**

\[ CPFH\(_j\) (High \ Level \ Concept) = \frac{\text{Total Operating and Support Costs}}{\text{Total Research Flying Hours}} \]

- **CPFH\(_j\) (Basic)**

\[ CPFH\(_j\) (Basic) = \frac{\text{Flight Crew/Operators + Operation Support + Engineers} + \text{Fuel + Consumables + Depot Level Reparables (DLRs) + Depot Maintenance} + \text{Variable Contractor Logistics Support}}{\text{Total Research Flying Hours}} \]

- **CPFH\(_j\) (Other US Federal Agency)**

\[ CPFH\(_j\) (Other \ US \ Federal \ Agency) = CPFH\(_j\) (Basic) + \frac{\text{Allocation of Crew Salary Cost}}{\text{Total Research Flying Hours}} \]

- **CPFH\(_j\) (Public)**

\[ CPFH\(_j\) (Public) = CPFH\(_j\) (Other \ Federal \ Agency) + \frac{\text{Depreciation + Allocation of Unfunded Retirement Cost**}}{\text{Total Research Flying Hours}} \]

*Apply only if applicable

**11.1% of Federal Employees/ FTE Cost, Reference from Federal Employees' Retirement System: Budget and Trust Fund Issues, 2016 Congressional Research Service Doc# 7-5700, RL300:*
Mock Scenario *

**Aircraft Type:** NASA X-48

**Program/Flight Info:**
Annual Planned Flight Hours: 500 Hours
Annual Budget to support program: $15.3M

**Reimbursable Request Info:**

- **Customer:** United States Air Force
- **Synopsis:** Study of Blended Wing Body (BWB) aerodynamic efficiencies for future Unmanned Aerial Vehicle (UAV) combat aircraft designs. Customer installs various pressure and vortices measuring instruments on various parts of aircraft which requires NASA to hire outside independent contractor experts (Boeing and Phantom Works) to inspect, evaluate instrument install and airframe structure integrity at an additional rate not captured in the annual budget of $1,500/hour.

**Flight Time Request:** 1 hour

*All Flight, Cost, and Customer Data are notional and used for example purposes only*
Mock Scenario* (continued)

1. Collect Cost/Budget Data and Create Ground Rules

Ground Rules to Reimbursable Pricing:
- Exclude costs:
  - New Development (instruments, aircraft, etc.)
  - Reserves
  - Grants
- Include All Other costs:
  - (such as flight controllers, ground data, etc.)

2. Crosswalk the Cost/Budget Data to O & S WBS

*All Flight, Cost, and Customer Data are notional and used for example purposes only

Total: $11M
Mock Scenario* (continued)

3. Use the O & S Cost Estimating formulas to generate the O & S CPFH rates and output pricing to applicable form

- CPFH (Basic)

\[
CPFH_{\text{Basic}} = \frac{\text{Flight Crew}+\text{Operators}+\text{Operation Support} + \text{Engineers}+\text{Fuel}+\text{Consumables}+\text{Depot Level Reparables (DLRs)}+\text{Depot Maintenance*}+\text{Variable Contractor Logistics Support}*}{\text{Total Research Flying Hours}}
\]

\[
CPFH_{\text{Basic}} = \frac{11M}{500 \text{ hours}} = 22,000/\text{hour}
\]

- CPFH (Other US Federal Agency)

\[
CPFH_{\text{Other US Federal Agency}} = CPFH_{\text{Basic}} + \frac{\text{Allocation of Crew Salary Cost}*}{\text{Total Research Flying Hours}}
\]

*All Flight, Cost, and Customer Data are notional and used for example purposes only
Mock Scenario* (continued)

In this scenario, the applicable form is the NASA Estimated Pricing Report (EPR) Form

- Data is automatically pulled from the Cost Model Tool
- EPR Form includes all costs (from tool and other center specific costs)
- Captures customer scenario details

4. Work with center CFO Office to ensure pricing accuracy and compliance with laws/regulations

*All Flight, Cost, and Customer Data are notional and used for example purposes only
Lessons Learned

- Ensure key stakeholders are kept up to date
  - This allowed for timely resolution of disconnects
  - Ensured management buy in reference to tool development and schedule

- Ensure all requirements are shared in advance of tool development
  - At several junctures, the requirements changed, causing re-work

- Develop a system/process commensurate with magnitude of customer base
  - Our tool accounts for a myriad of customer scenarios

- Identify core team
  - Identified a core team early on which facilitated tool development
  - Include Subject Matter Experts (SMEs) from areas such as Legal, Reimbursement, etc.
Lessons Learned (continued)

- Document processes along the way
  - Processes were clearly documented which facilitated understanding of tool
  - Documentation assisted as new team members were introduced to the tool

- Leverage best practices
  - Research and incorporate best practices from other industry leaders
  - Reach out to SME’s from other Centers
  - Accelerates tool development and adds credibility

- Gain in-depth knowledge of operations and associated funding
  - Understand overall operations in order to capture appropriate cost elements
Summary

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Acknowledgments

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Thank You

Questions, Discussion and Feedback

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• Federal Laws and Regulations:
  · Economy Act (1932)
  · Space Act Agreement (1958)
  · GAO-06-382SP Appropriations Law—Vol. II (Misc. Receipts)
  · OMB Circular No. A-126 Revised – Improving the Management and Operating of Government Aircraft

• O & S WBS Guides and Definitions
  · Secretary of Defense Operating and Support Cost Estimating Guide

• O & S CPFH Examples:
  · DoD Reimbursable Aircrafts:
  · United States Air Force One, Presidential: