# Program Affordability Tradeoffs

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# Introduction

- **In today's fiscal environment, federal programs must be postured to conduct on-going tradeoff analyses to stay affordable**
  - As budgets are reduced, need to re-scope wisely
  - As capabilities change or become more challenging to implement, need to stay within the budget in the life-cycle
- **Our research focuses on recommended practices for conducting economic resource-constrained tradeoffs**
  - Part 1 was designed to understand how government offices currently conduct these affordability tradeoffs, where there is need for improvement
  - Part 2 will be to develop guidance for recommended approaches and develop a software tool to help programs implement these recommended approaches
- **This paper describes our findings for Part 1**

# Want versus Need – Fuel Efficiency*


Tesla Model S accelerates from 0 to 60 mph in as little as 2.8 seconds.

Prius Model 2 fuel economy (MPG): 54 - 58 city | 50 - 53 highway

## Trade-Off Analysis

| | | |
|---|---|---|
| Costs: | $80,000 | $22,000 |
| Risks: | Speed | Few |
| Benefits: | Neighbor envy | MPG bragging rights |

*Sources: Wikipedia and auto manufacturer websites



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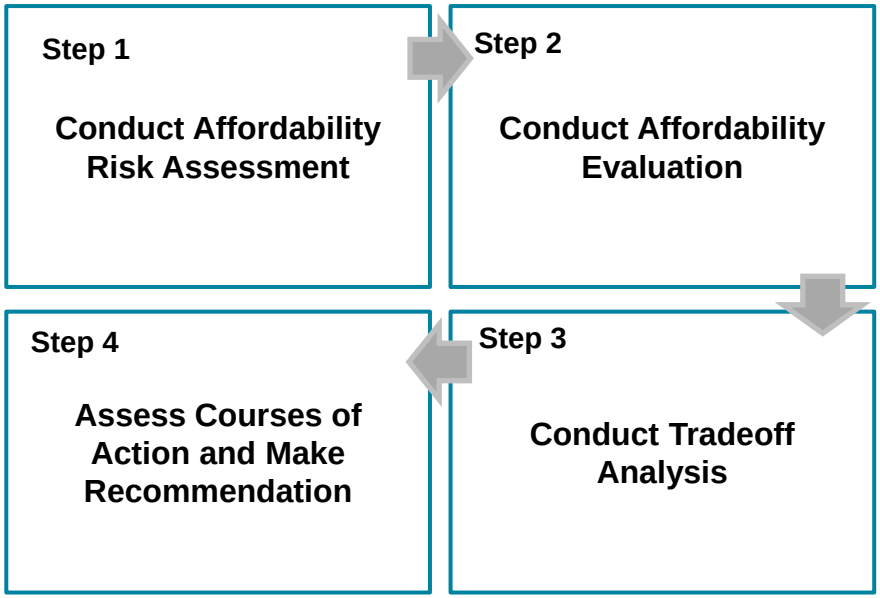
# Background

- Over the years there have been major efforts within the federal government to reduce the cost of acquiring systems
- The Government Accounting Office (GAO) has shown repeated problems in meeting program milestones and keeping programs within cost and schedule requirements
- Since 2010, the Department of Defense (DoD) has issued three versions of “Better Buying Power” for the DoD acquisition community, emphasizing the need for “affordability.” [1], [4], [5] (See slide 12 for references)
- In response to these challenges, The MITRE Corporation developed the Affordability Engineering Framework (AEF) [9], which provides a structured framework with approaches and tools to address program affordability challenges over the life-cycle

# The Affordability Engineering Framework (AEF)

- **The MITRE-developed AEF framework [9] is a continuous process that consists of four steps:**
  - Step 1 guides programs through a self-assessment of risks to affordability based on where they are in the life-cycle
  - Step 2 is a comparison of the Program Office Estimate (POE) with the budget
  - Step 3 provides guidance for conducting tradeoffs to ensure affordability and/or improve efficiencies and effectiveness
  - Step 4 is the selection of the best course of action and summarizing for decision-makers




***The research in this paper is intended to facilitate Step 3 of the AEF***

# Part 1 Approach: Program Interviews

- **Part 1 of this research consisted of 19 interviews with government sponsors**
- **Main topics of the interviews were:**
  - What affordability tradeoff analyses are typically conducted and what decisions are supported by the analyses
  - What factors (inputs) are considered and how
  - What resources (time, people, tools) are available to conduct these analyses
- **The information gained from these interviews will help in the development of the guidance document and tool**
- **Of the findings, three were prevalent:**
  - Poor practice in choosing benefits metrics and measuring benefits
  - Combining metrics limited to linear methods
  - Risk not considered or considered incorrectly

# Finding 1: Benefits Metrics and Measurement

- **Problem: Often the measure of benefit was technical performance (e.g., the speed of an aircraft) and the measures were not linked to extent of achieving goals/mission/objectives**
  - Leads to a “more is better” outlook
  - Does not allow for exploring affordability trades
    - What is the impact to goals/missions/objectives of pursuing a lower cost, lower performing alternative? Is this impact acceptable?
- **Problem: Numerical scores for benefit were not given clear interpretations**
- **Solution: Ensure that technical measures are linked to mission-level metrics, and adhere to established decision analysis methods for rating value or utility [11, Chapter 7]**

# Finding 2: Combining Benefits Metrics

- **In studies that combined the scores of several metrics, weighted averages were almost always used**
- **Although the weighted average is the correct function to use when certain independence conditions hold, there are cases where these conditions do not hold [7], [3]**
  - E.g., a classic study of Mexico City Airport found that weighted average was not appropriate [3, Chapter 8]
- **The inappropriate choice of a function can lead to misleading assessments of overall benefit**
  - E.g., an alternative that improves the overall benefit score may be one that is improving metrics already at an acceptable level, while leaving other metrics below acceptable levels
- **Solution: Analysts should be aware that the weighted average is not always appropriate and be aware of alternative functions for combining benefits metrics**
  - E.g., exponential average and max-average [8], [10]

# Finding 3: Alternative Risk Assessments

- **Problem: The risk of achieving the measured benefits for the estimated costs is not often considered, or considered improperly**
  - Must consider risk from all sources (e.g., technical maturity, interoperability, statutory/regulatory), not just the standard sources of cost, performance and schedule
- **Solution: Consider what we refer to as the "execution risk framework" [2]**
  - Evaluate risk for each alternative across a number of risk sources using a utility-like scale
  - Scores can be combined using methods discussed under Finding 2
  - Understanding the risk of an alternative can lead to new alternatives which contain mitigation efforts and the cost of those mitigations

# Summary and Next Steps

- **Part 1 of our research efforts found a few key areas where improvement is needed as program offices are challenged to understand how to keep programs affordable**
- **The next step (part 2) will be to construct a guidebook on recommended practices, leveraging work done for the MITRE AEF, and development of a software tool to help programs make analytically-driven tradeoff decisions on a regular basis**
- **The intent is that all federal agencies, DoD and civilian, will gain from findings on this research and the products that will become available**

# Want versus We Think We Need – Stealth*

**Lockheed Martin F-35 Lightning II**

F-35A Cost: $85M, full production in FY2018

Sometimes you just need a nice ride

The F-117 Nighthawk stealth attack aircraft

The B-2 Spirit strategic stealth bomber

The F-22 Raptor fifth generation stealth air superiority fighter

F-22 $150M/Unit
F-117 $111M/Unit
B-2 $737M/Unit

*Sources: Wikipedia



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