

The Investment Analysis and Planning (IP&A) Division within the Federal Aviation Administration (FAA) “strive to ensure that solid business cases support acquisition decision-making within the FAA”. (Hall, 2017). As two participants in this organization, it is in IP&A’s best interest to have quality, objective data sources that help create more precise budgets. IP&A constantly strives to improve cost practices and enhance data repositories in a data starved environment.

The Government Accounting Office (GAO) states “Data are the foundation of every cost estimate. How good the data are affects the estimate’s overall credibility. Depending on the data quality, an estimate can range anywhere from a mere guess to a highly defensible cost position.” (GAO, 2009). Further, the GAO recommends sources for data collection, shown below.

Data type	Primary	Secondary
Basic accounting records	x	
Data collection input forms	x	
Cost reports	x	x
Historical databases	x	x
Interviews	x	x
Program briefs	x	x
Subject matter experts	x	x
Technical databases	x	x
Other organizations	x	x
Contracts or contractor estimates		x
Cost proposals		x
Cost studies		x
Focus groups		x
Research papers		x
Surveys		x

Source: (GAO, 2009)

Unfortunately, IP&A and FAA program office cost estimators have a difficult time finding reliable data. The availability of comparable data is rarely abundant, many times the data are from sources that were not meant for cost analysis, and the data that is used is frequently misinterpreted. In fact, if looking at the table above, interviews and subject matter experts are the primary sources for most cost estimation elements reviewed by IP&A, and IP&A does not have an objective data source to validate the program office estimates. Why aren’t the cost accounting systems or data input forms used at the FAA? Furthermore, are programs maintaining cost actuals themselves. As the GAO states “Data collection is a lengthy process and continues throughout the development of a cost estimate and through the program execution itself.” (GAO, 2009) Since IP&A strives to pioneer a pro-data culture for ease of estimation and analysis, it is in IP&A’s best interest to address this issue.

In this paper, we will first describe the FAA Acquisition Management System (AMS) process at a high level and its relationship to a program's cost estimate. Then we will identify the cost accounting system used by the FAA and the data it holds. We will then look at some other possible data sources to address the shortfalls in the cost accounting system. Finally, we will walk through the general process of normalizing the cost accounting data from the system using all the data sources available.

I. FAA AMS Process

The AMS Process was implemented on April 1, 1996 in response to a Congressional Mandate asking for a "more timely and cost-effective acquisitions of equipment, services, property, and materials" (United States Congress, 1996). It was generally designed similarly to the Department of Defense Acquisition process, whereby there are several milestones as the program matures to ensure that the investment is worthwhile. At Concept Review Decision (CRD), the products are primarily technical in nature. From a cost estimation standpoint, what is required is

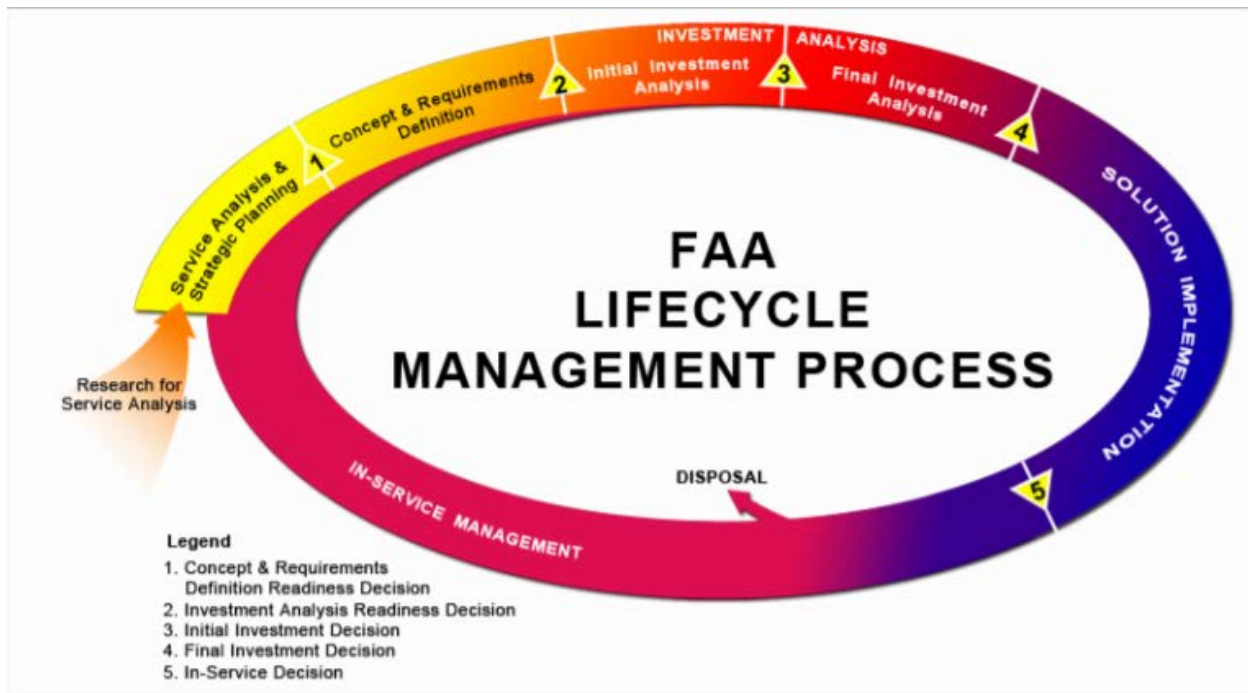
"Plan for Investment Analysis. The plan for investment analysis: (1) defines scope and assumptions; (2) describes alternatives and their associated rough lifecycle costs; (3) describes planned activities and specifies how tasks will be accomplished; (4) defines output and exit criteria; (5) establishes a schedule for completion; (6) defines roles and responsibilities of participating organizations; and (7) estimates resources needed to complete the work. By signing the plan for investment analysis, the organizations that will conduct the analysis agree to provide the resources necessary to complete the work. This activity includes development of the investment analysis readiness decision package and pre-briefings to decision-makers."
(Acquisition Management Policy, 2013)

This results in an Investment Analysis Readiness Decision (IARD), where decision makers look to see if the overall problem/shortfall is significant enough to warrant further investigating the alternatives based on the general magnitude of costs. This decision typically requires a very high-level cost estimate to be completed to enter into the Capital Investment Plan (CIP). It is at this decision point that the decision making body at the FAA called the Joint Resource Council (JRC) will decide if the program is ready to undergo investment analysis. (Acquisition Management Policy, 2013). From there, the program enters an Initial Investment Decision (IID), where the decision makers review a set of at least three technical alternatives to downselect to a preferred method of fulfilling the requirements. In short, IID is essentially an Analysis of Alternatives. Further,

"The business case focuses on those key factors that demonstrate value and worth of a proposed investment initiative to the FAA and the aviation industry. This includes updating the preliminary requirements document to reflect any changes resulting from the investment analysis. For new investments (in accordance with the ACAT determination form), the test organization develops a preliminary test and evaluation master plan based upon the concepts and functions documented in the preliminary requirements document to support the initial investment decision. When the investment initiative is an increment necessary to achieve an operational capability, the impact on achieving the capability is also a key factor of the business case. See the Business Case Analysis Guidance for more details. FAA Finance assesses the budget impact and relative contribution to agency goals of each alternative against other ongoing and proposed Acquisition Management Policy - 1/2018 30 investment programs in the FAA financial baseline. The impact assessment may shape subsequent deliberations of the investment analysis team." (Acquisition Management Policy, 2013)

At the Final investment decision (FID), the decision makers approve a budget for the program if they see a positive rate of return on their investment. At this stage, the technical requirements are fully flushed out and the cost estimate is at its most mature. In fact, many times the cost estimate is populated with solicited offers from prime contractors. As stated by the Acquisition Management Policy:

“The business case and supporting documents are prepared according to the ACAT designation for the solution. These requirements are found in the appropriate business case template located on the investment analysis page in FAST. This includes preparation of the final requirements document.” (Acquisition Management Policy, 2013)



(Acquisition Management Policy, 2013)

- II. FAA Data resources
 - a. Cost accounting System

Not long ago, there were several cost accounting systems tracking different types of costs, but it was consolidated into one large uniform system used across the Department of Transportation called Delphi. Delphi captures all appropriations including direct contracting costs, government costs, operational costs, development costs, and even interest on the FAA “Credit card”. However, the purpose of the system is meant for accounting, not cost estimation of future programs. As stated on the Department of Transportation website: “The Delphi eInvoicing System is a real-time invoicing tool that improves efficiency and data transparency by reducing the time between invoice submission and payment and by providing grant recipients with accurate invoice status

reporting capabilities.” (Department of Transportation CFO , 2017). No where in that mission statement does Delphi regard anything of cost estimation. It was not implemented to help with forecasting, it was meant for bookkeeping and ease of invoice input and payment.

With regards to a cost accounting system, the AMS states:

“Cost categories include all activities necessary for full lifecycle management of service delivery, including research, service analysis, concept and requirements definition, investment analysis, solution implementation, operations and support, and decommissioning. The FAA standard lifecycle work breakdown structure, cost accounting system, and labor distribution report are aligned to use the same cost categories and activities.” (Acquisition Management Policy, 2013)

Clearly the AMS system assumes that the cost accounting system will be completely in line with the Investment Planning team, despite the clear mission of the cost accounting system not valuing the cost estimation process as one of its priorities. In fact, the AMS’s assumption as stated above is not true. The FAA has had a standard WBS meant to be used across the agency since the inception of the AMS. Since then, that standard WBS has changed several times. Due to the laborious effort it would take to change the WBS system in the FAA’s cost accounting system and reclassify all invoices to a new WBS, the standard WBS that FAA’s cost accounting system uses is outdated from the AMS’s standpoint, likely because it is not a priority of Delphi to assist in cost estimation services. In addition, the WBS classification within Delphi depends on the input. On the first level of the WBS, which is largely dependent on the appropriation type of the money spent is traceable. Below the first level, where the WBS is tracking the purpose of the money spent is not implicitly traceable, and relies solely on the input and diligence of the account manager. Since this isn’t emphasized in the cost accounting culture, that level of assiduousness is not rewarded and therefore the account manager has little incentive to classify each invoice in accordance with the standard WBS.

This brings me back to the table of data sources in the table above as produced by the GAO. The FAA cost accounting system does not include cost data collection for the purpose of estimating future programs as a part of their mission. At this point, it would be easy to rebut the table’s recommendation with the argument above and consider cost accounting data incongruent with cost estimation. However, as also stated in the introductory paragraph, data collection is a difficult task; subject to inexact data, time constraints, and assumptions. For this reason, we have decided to dig deeper into the cost accounting data and attempt to use other data sources to make the data useable for the investment planning group.

b. Programmatic Earned Value Management (EVM) Data

In the search for a data source that emphasizes the allocation of funding to emphasize the purpose of the funds, the first consideration was EVM data. According to the Defense Acquisition University (DAU), “Earned Value is a management technique that relates resource planning to schedules and to technical cost and schedule requirements”. (DAU, 2017) Since the FAA requires EVM on their larger programs, it made sense to look into EVM as a source for cost data. However, the EVM data is collected and reported in an inexact manner. Sometimes Actual Cost of Work Performed (ACWP) is based on obligated dollars. Other times ACWP is only based on budget dollars. Furthermore, the only data that is collected is the ACWP on the management budget, not the total costs of the program.

But because EVM emphasizes the products created and the functions required to make those products, we can reasonably assume that the categorization of the value is correct. There is also the issue of EVM errors, where we need to speak with the program office to see if their data is useable or not.

c. Prior Estimates

Prior estimates and approved budgets formed thereof are categorized, unlike data from the cost accounting system. They are also in units of cost, unlike EVM data. The issue with estimate data is that they are not actuals themselves. Therefore, the assumptions that possibly undermined the estimates over the life-cycle of the program would undermine all of its data, including the cost and categorization data. When investigated, the categorizations for a majority of the programs were found to be very far off from the EVM data, and the costs were found to not necessarily line up with estimate data despite budgets dictating spending habits and technical baselines remaining intact. Despite skepticism towards prior estimates of other programs to help categorize actual costs, it had to be investigated in order to put that issue to rest. They are currently only used for comparison purposes to help with best practices for estimating future projects.

d. Programmatic Historical timeline

Even though EVM attempts to show an objective programmatic view of a program, there are qualitative data that need to be considered. For instance, if you are trying to estimate a software program, what language is the source program written in? How much reuse of code was there? What complexities existed that may or may not exist for the estimated program? No matter what the type of program the source program is, a qualitative data list must be developed and maintained to put the source data into its proper context, and measure the current data against it.

e. External resources

While we have not yet tried to incorporate data from outside the agency, there are programs that are not within the FAA purview that can be valid data sources. Their cost accounting structure and assumptions must be normalized to the FAA structure, but there can be data sources in foreign governments or within different American agencies that can be applicable, although they may be difficult to get a full scope of data from.

III. Conclusion – Finding the diamonds in the rough

In a culture where investment analysis is not a priority outside the investment analysis group, data is difficult to come by. It is easy to get discouraged and use low-fidelity data to complete estimates with drastic and sometimes unrealistic assumptions that represent the holes in that data. We have decided to use the data we have to create a normalized database with the data we have. This team has created a process to utilize the strengths of each data source to cover for each of their weaknesses.

- We start with the correct numbers, using the cost accounting data as a baseline actual cost for the program. We categorize the costs on a high level using the appropriation type assigned in the cost accounting data.

- We next acquire EVM data from the program offices and apply the functional categorization to the cost accounting data. This distributes the cost accounting data appropriately in the standard FAA WBS (after appropriate mapping).
- We also acquire the program history in order to formulate appropriate assumptions around the data we have. In addition, we normalize for re-baselines and sunk costs.
- Finally, we normalize to a uniform base year.

If any of the data source's integrity is compromised, say by faulty EVM data or misrepresentation of costs in the cost accounting system, we have no choice but to table that program and perhaps revisit when their data integrity is more sound. Once we complete this process on enough programs, we will be able to use these data points to create parametric estimates and applicable analogies for future programs.

Admittedly, we have not completed this process on many programs yet. Further, this database is currently only being used on F&E data, and a subject of further research would be to complete a similar process on operations data. We also need to study how accurate government labor cost data is assigned, both by project and by appropriation. Despite these challenges, serious breakthroughs have been made, and hopefully when the database is mature enough for use by the investment analysis team we can start an intra-agency cultural revolution to be pro-data for investment analysis purposes.

Bibliography

- Acquisition Management Policy. (2013). Federal Aviation Administration.
- DAU. (2017). Retrieved from Defense Acquisition University - Earned Value:
<https://www.dau.mil/training/career-development/evm>
- Department of Transportation CFO . (2017, April 5). Retrieved from Department of Transportation:
<https://www.transportation.gov/cfo/delphi-einvoicing-system>
- Dixon, L. (2016). *Principal Assistant Inspector General*. Washington DC: Department of Transportation.
- GAO, G. A. (2009). *GAO Cost Estimating and Assessment Guide*. Washington DC: Government Accountability Office.
- Hall, K. (2017). *Investment Planning and Analysis Home Page*. Retrieved from <https://www.ipa.faa.gov/>
- United States Congress. (1996). 49 U.S. Code § 40110 - General procurement authority. *U.S Code*. Washington DC.