

## **ICEAA 2019- GAO Best Practice Guides**

### **Introduction**

#### Who is GAO?

The Government Accountability Office (GAO) is an independent, nonpartisan agency serving the Congress. GAO works to help improve the performance and ensure the accountability of the federal government. To ensure independence, the Comptroller General (CG) is appointed to a 15-year term by the President. Other than the CG, there are no political appointees at GAO.

GAO's work is primarily done at the request of Congress. Specifically, congressional committees or subcommittees request additional insight into federal programs or mandate additional insight through public laws. Our work includes auditing agency operations to determine whether federal funds are being spent efficiently and effectively, investigating allegations of illegal and improper activities, reporting how well government programs and policies are meeting their objectives, performing policy analyses and outlining options for congressional consideration, and issuing legal decisions and opinions (e.g. bid protest rulings and reports on agency rules). GAO also does research under the authority of the Comptroller General.

In Fiscal Year 2018 (FY18) GAO published 620 audit products (e.g. reports, briefings, testimonies, and special publications). GAO also closed 2,642 legal cases (e.g. bid protests, cost claims, etc.). Typically, 96% of our work is done at the request or mandate from Congress and the remaining 4% of our work is initiated by Comptroller General Authority. GAO's development of best practice guides are work initiated by CG Authority.

#### Overview of GAO's Current Best Practice Guides

Legislators, government officials, and the public want to know whether government programs are achieving their goals, what these programs are expected to cost, and when they will be completed. Developing reliable program cost and schedule estimates are critical to effectively use public funds, meet Office of Management and Budget's (OMB) capital programming process, and avoid cost overruns, missed deadlines, and performance shortfalls. GAO has identified and documented best practices and leading practices in a number of key agency-and office-management functions. We developed a series of guides that assist federal managers in implementing best and leading practice methodologies and use these practices as criteria to ensure that government programs are using program control tools effectively to manage their programs.

To develop these guides, GAO relies heavily on experts from the federal government, private industry, and academia to provide comments on exposure drafts. Once an exposure draft has been released to the GAO website, the public has one year to comment on the guides' content. GAO personnel then vet the comments received, make appropriate changes to the draft, and finalize the best practice guide. Additionally, GAO has held semi-annual expert meetings since 2005 to foster communication among practitioners and to assist in updating best practice guides. Currently, GAO has published best practices related to cost estimating, scheduling, and technology readiness assessments.

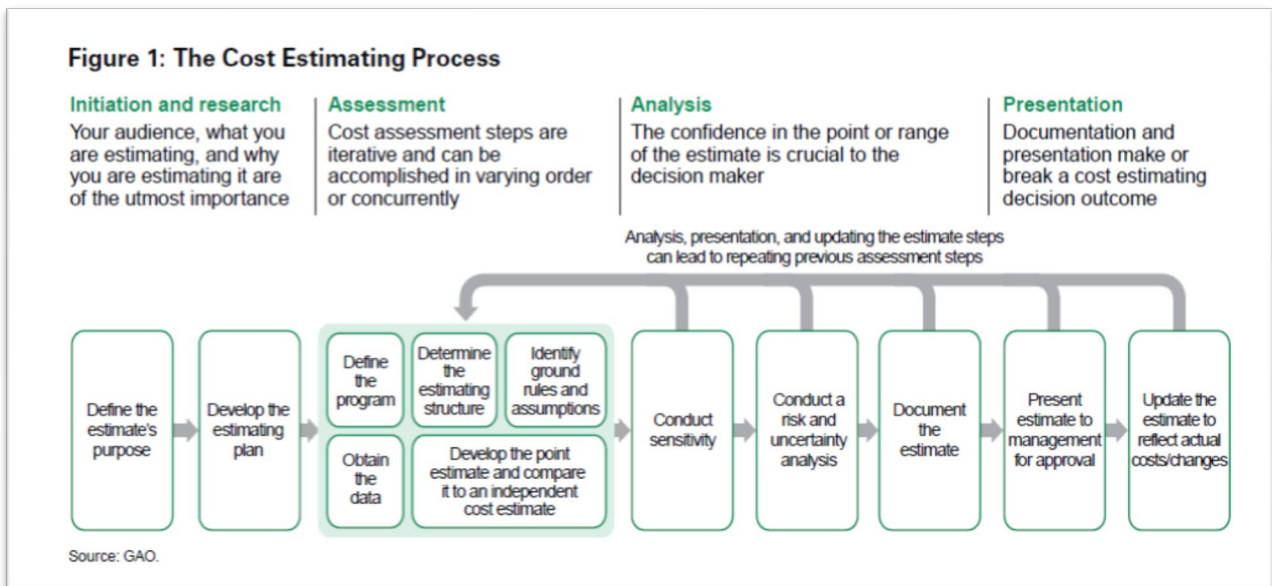
There is also international interest in GAO's best practice work. For example, the Cost Guide was translated into Japanese and used as a guide to develop cost estimates in both the public

and private sector in that country. Furthermore, since its 2009 publication, GAO has traveled to brief the Cost Guide in Canada, Australia, Great Britain, Portugal, and Columbia.

## The Cost Guide

In 2005, GAO began developing the GAO Cost Estimating and Assessment Guide (Cost Guide) to both provide criteria for GAO to use when performing audits and provide guidance for agencies. In 2007, GAO released the Cost Guide as an exposure draft, with an open comment period to elicit comments from the public to ensure that the Cost Guide captured all cost estimating best practices and was applicable to a wide variety of programs and projects. In 2009, GAO published an updated and finalized version of the Cost Guide.

The Cost Guide describes GAO's criteria for assessing cost estimates during audits. It established a 12-step process to develop a high-quality, reliable cost estimate. The following shows an overview of the 12-step estimating process from the guide:



The Cost Guide also discusses estimating best practices. These best practices are grouped into four characteristics of a high-quality, reliable estimate: comprehensive, well-documented, accurate, and credible. To be considered reliable, the estimate should substantially or fully meet all four characteristics.

The Cost Guide also discusses Earned Value Management (EVM). EVM is an important management decision support tool that measures past performance and develops parameters that assist in predicting future performance. The Cost Guide describes a 13-step EVM process and establishes best practices for using EVM system data. These can be grouped into three characteristics: comprehensive, accurate, and informative. To assess these characteristics the auditor answers the questions (1) Is the EVM system certified and comprehensive? (2) Is the EVM data reliable? and (3) Is management using the EVM data?

In recent audits, GAO has found that program offices typically do not include all life-cycle costs, do not break costs down into sufficient detail, and rarely use a standardized product-oriented WBS with common support elements. GAO has also found that programs often do not

document the cost estimate to a level that would allow an analyst unfamiliar with the program to replicate the results. Additionally, programs typically do not account for risk or uncertainty while developing the estimate and fail to crosscheck estimating methodologies. GAO has found that one potential cause for these problems is that many government program offices lack effective internal controls. Specifically, they do not have a centralized cost estimating organization; they have no cost policy or guidance; there are no established databases or data collection processes; or there is no organization to conduct an independent estimate.

Since its publication in 2009, the Cost Guide has been used in more than 100 reviews of government projects to identify the extent to which agencies are following cost estimating best practices. Those reviews have improved cost-estimating policies and guidance at such agencies as the Departments of Energy and Homeland Security, the Federal Railroad Administration, the Missile Defense Agency, the National Aeronautics and Space Administration, and the National Science Foundation. In addition, GAO's oversight of preparations for the 2010 and 2020 census has helped the Census Bureau strengthen its cost estimates. For example, based on GAO's recommendation, the Bureau updated cost assumptions related to areas, such as miles driven, pay rates, and hours worked, and reduced its budget requests for the 2010 Census by nearly \$900 million. Finally, the guide gained government-wide prominence when OMB based its cost estimating guidance for federal capital acquisition projects on the guide.

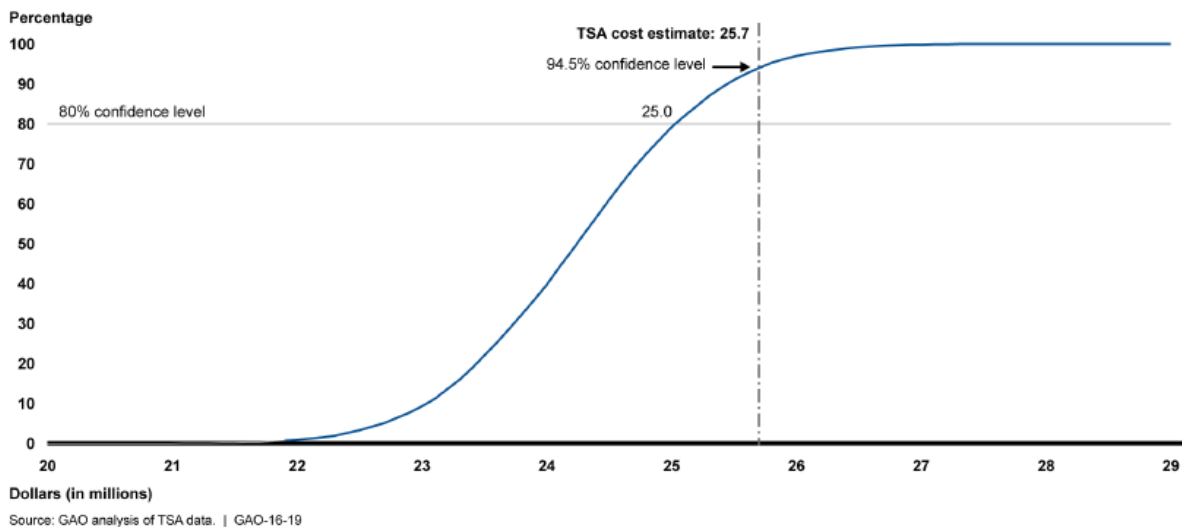
In 2016, GAO reviewed the Transportation Security Authority (TSA) Screening Partnership Program (SPP) (GAO-16-19). The SPP allows any airport authority to request a transition from federal screeners to private, contracted screeners to screen passengers and checked baggage. As part of this review, GAO examined the extent to which TSA has developed and reported reliable cost estimates. GAO found that the SPP cost estimates were not reliable because they only partially met the best practices associated with the accurate and credible characteristics. For example, TSA's approach to risk and uncertainty analysis did not account for risks specific to each airport, had contingency reserves calculated as high-level factors of the total cost based on airport category, and did not provide decision makers with information about the probability associated with the point estimate costs.

As part of the review, and to further illustrate the importance of a risk and uncertainty analysis, GAO conducted a limited cost risk and uncertainty analysis for one SPP airport. The limited analysis accounted for variability in the assumptions for wages, staffing, and attrition. While conducting this analysis, GAO interviewed SPP personnel about these variables and followed the steps identified in the Cost Guide to develop a risk assessment for an estimate. These steps are:

1. Determine the program cost drivers and associated risks
2. Develop probability distributions to model various types of uncertainty
3. Account for correlation between cost elements to properly capture risk
4. Perform the uncertainty analysis using a Monte Carlo simulation model
5. Identify the probability level associated with the point estimate
6. Recommend sufficient contingency reserves to achieve levels of confidence acceptable to the organization
7. Allocate, phase, and convert a risk-adjusted cost estimate to then-year dollars and identify high-risk elements to help in risk mitigation efforts

The following shows the S-curve associated with GAO's analysis:

**Figure 5: Confidence Level Results of the Transportation Security Administration's (TSA) Cost Estimate of an Example Airport**



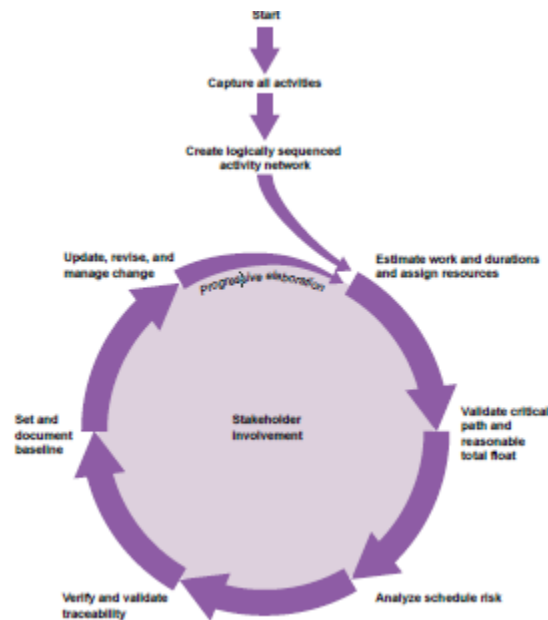
This analysis placed TSA's estimate at the 94.5% confidence level. In DHS's response, they stated that they were "pleased...GAO found the estimate to have an exceptional high [confidence] interval...it is likely that similarly high confidence intervals exist for all cost estimates..." While GAO only examined one airport, TSA could use future cost risk and uncertainty assessments to make funding decisions for airports that are a part of the SPP and ensure that TSA uses all tools available to establish an upper bound for proposal evaluations that relates specifically to the contract for negotiation rather than relying on unrelated information. Since publication of the report, GAO found that TSA made steps to improve their cost estimating process. Specifically, TSA stated that they conduct a risk and sensitivity analysis for every SPP estimate using Crystal Ball in Excel and including variables to cover approximately 89% of the estimated costs.

GAO has published additional best practice guides since producing the Cost Guide.

### The Schedule Guide

GAO published an exposure draft of the GAO Schedule Assessment Guide (Schedule Guide) in 2012 which expanded on the scheduling best practices described in the Cost Guide. After an open comment period, GAO vetted and incorporated comments and released the final version of the Schedule Guide in December 2015. The Schedule Guide describes best practices for developing and maintaining high-quality schedules that forecast credible dates. It contains explanatory text, illustrations, and detailed case studies.

The Schedule Guide describes ten best practices that are organized into four characteristics of a reliable schedule: comprehensive, well-constructed, credible, and controlled. In recent audits, GAO has found that schedules often do not include resources, durations are determined by a target or mandated date, are missing sequencing logic, do not have a valid critical path, have not performed a risk assessment, and are updated without setting and managing a baseline for comparison. The following is an illustration of how the 10 best practices are related to the overall cyclic process for creating and maintaining reliable schedules.



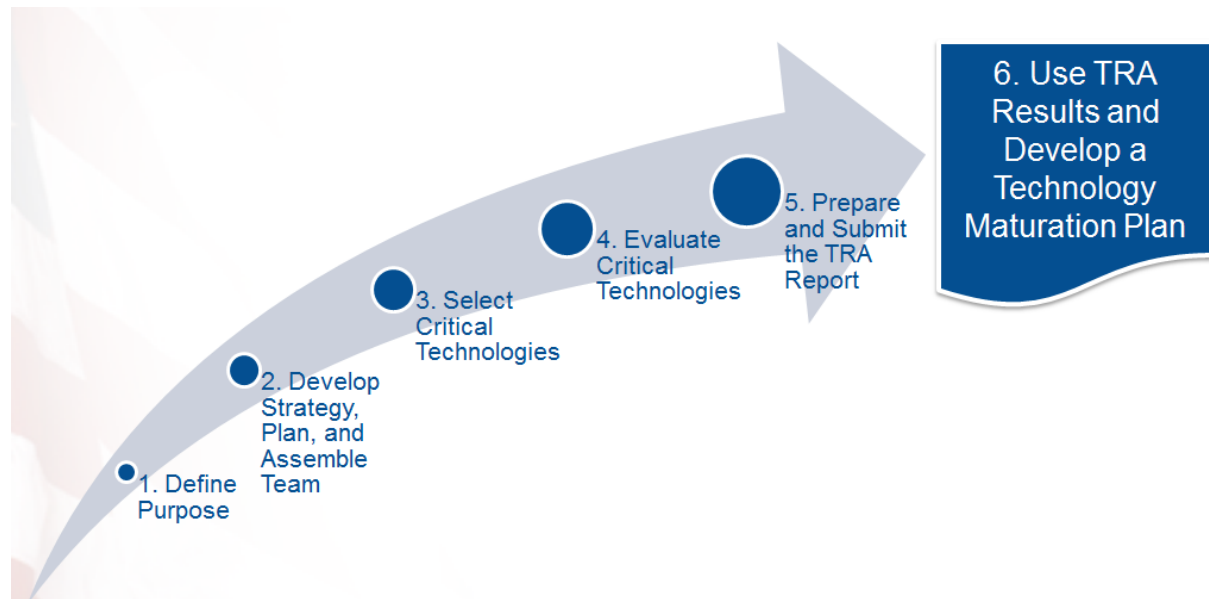
In 2014, GAO reviewed the schedule for the Department of Homeland Security (DHS) Headquarters (HQ) building. Established in 2003, DHS began planning a headquarters building for its agencies dispersed throughout the National Capital Region (NCR) in 2005. In 2007, DHS employees in the NCR were located in 85 buildings and 53 locations; accounting for nearly 7 million gross square feet of government owned or leased office space. As of July 2014, DHS employees in the NCR were located in 94 buildings at 50 locations; accounting for approximately 9 million gross square feet of government owned or leased office space. The General Services Administration (GSA) is the landlord for the federal government and acquires space on behalf of the federal government through leases and new construction. GSA had the task to select the site for the new, consolidated DHS HQ and is responsible for awarding and managing the contracts associated with the design and construction of the DHS HQ facility.

GAO was asked to assess how well the schedule estimate for the consolidated facility followed best practices. GAO found that the 2008 schedule estimate was unreliable because it minimally conformed to each of the characteristics for a high-quality schedule and the updated 2013 schedule estimate from GSA was incomplete and satisfied even fewer best practices.

In their response, GSA stated that they were following their own policies and guidance rather than GAO best practices. However, comparing GSA's schedule estimating policies and guidance to the best practices established in the Schedule Guide, GAO found that five of the ten scheduling best practices were at least partially aligned with GSA's scheduling policy and guidance. Further, GSA's schedule estimate failed to meet the standards set by their own scheduling policy—it did not capture all project activities, did not include a complete schedule baseline document, and was not updated to reflect the most recent programmatic assumptions. By tying this process analysis to the DHS HQ's schedule assessment, GAO was able to show that not only was GSA not meeting industry established best practices, they were not following their own schedule estimating policies and guidance. Since this report, DHS and GSA have not provided an updated schedule for this effort and so GAO has not had the opportunity to see if the current schedule follows the best practices outlined in the GAO Schedule Guide.

## The Technology Readiness Assessment Guide

GAO also developed an exposure draft for a Technology Readiness Assessment Guide, which was released in August 2016 as an exposure draft. The TRA Guide outlines GAO's criteria for evaluating technological readiness assessments and provides an outline of a reliable TRA process and its associated best practices. The TRA process discussed in the Guide has six steps: define the purpose, develop the strategy, plan and assemble the team, select critical technologies, evaluate critical technologies, prepare and submit the TRA report, and develop a technology maturation plan. The guide also discusses four characteristics of a high quality TRA: that it is credible, objective, reliable, and useful. The following shows a high level illustration of the six steps discussed in the TRA guide to develop a high-quality TRA:



Recently, GAO reviewed the Navy's technology readiness assessment for the Columbia class submarine (GAO-18-158). The Columbia class submarine is a ballistic missile submarine that is planned to replace 14 Ohio class submarines that are slated to begin retiring in 2027. The program is considered a top Navy priority with an expected cost of \$267 billion over its life-cycle; including \$128 billion to research, develop, and buy 12 submarines. As part of this program, the Navy is introducing new technologies to improve capabilities where required. At the same time, the Navy is leveraging systems from existing submarine programs to ensure commonality with the submarine fleet and reduce development needs for the Columbia class to limit technical risk.

As part of their technology readiness assessment, the Navy identified several key technology efforts. These include a common missile compartment, integrated power system, stern area system, and propulsor. GAO reviewed the Navy's technology readiness assessment, technology development plan, and status of key prototyping efforts and compared them with GAO's TRA best practices. GAO found that the Navy did not follow best practices for identifying the critical technologies for the program, resulting in an underrepresentation of the technical risks. The Navy used a more restrictive definition of critical technology elements than GAO. This caused the Navy to categorize some critical technologies as engineering challenges.



Because this review was recent, GAO has not had the opportunity to see if the Navy has begun to implement our recommendations.

### Updates to Best Practice Guides: 2019

As of the beginning of 2019, GAO is in the process of updating the Cost Guide, finalizing the TRA Guide, and developing an exposure draft for an Agile Assessment Guide.

#### **Cost Guide Update**

GAO is committed to updating the Cost Guide to ensure that the information contained in the guide is relevant. To that end, GAO has been working on updating the Cost Guide and plans to release it in 2019. The revised guide will

- improve the alignment of best practices, cost estimate characteristics, and cost estimating steps,
- clarify some of the best practices and their related criteria,
- provide additional and revised content in technical appendices,
- update case studies and references to legislation and rules, and
- modernize the guide format and graphics.

We developed one new chapter and significantly revised another to better describe the alignment of best practices to the characteristics of a reliable cost estimate and the process for creating reliable estimates. This chapter introduces the four characteristics: comprehensive, well-documented, accurate, and credible. It also introduces the eighteen best practices and shows how the best practices align to the four characteristics. Finally, it introduces the twelve steps of the cost estimating process that produces reliable estimates and shows how the best practices align to the twelve steps. Another new chapter describes the characteristics and best practices in the context of auditing and validating a cost estimate. It describes each characteristic and its associated best practices, and includes effects that may occur if a best practice is not met. The chapter also explains how to determine the reliability of a cost estimate from an auditing perspective and how to assess the extent to which an organization's cost estimating guidance incorporates best practices. In addition, we added a survey of each cost estimating step at the end of its associated chapter. The survey describes the cost estimate process tasks and associated best practices. It also includes likely effects if the associated criteria are not fully met.

We have clarified some of the best practices. For example, the original guide states that it is a best practice to present the estimate to management in a briefing. We recognize that organizations may use other methods to inform management and have updated the best practice by generalizing the requirement, so that any form of presentation to management is a valid means of meeting the best practice. Additionally, we previously described the technical baseline as a single document that included detailed technical, program, and schedule information about a system. We have found that some programs, particularly complex infrastructure programs, describe this system information in a collection of documents. Thus, we have generalized our description of the technical baseline to be a single document or several documents stored in one location.

We have added three new appendices that discuss best practices for analysis of alternatives (AOAs), methods for allocating contingency to the work breakdown structure as part of the risk and uncertainty analysis process, and the relationship of the cost estimating process to an organization's internal control system.

### **Finalizing the Technology Readiness Assessment Guide**

The TRA Guide exposure draft was released in August 2016. After receiving several hundred comments from experts during the one year open comment period, GAO is reviewing and incorporating comments received. Based on the comments reviewed so far, GAO does not expect any significant changes to the guide prior to it being finalized. The final version of the TRA guide is expected to be issued in the Fall of 2019.

### **GAO Agile Assessment Guide Release**

GAO began research on Agile adoption, execution, and program controls for software programs in 2015 and held a kick-off meeting for the GAO Agile expert group in August 2016.

To develop the Agile Guide, GAO has been working with this expert group and has sent out iterations of the draft guide to elicit comments. Similar to previous best practice guides, the Agile Guide will include explanatory text, illustrations, and detailed case studies, as well as appendices that list key questions, documentation, etc. In addition to an introduction and discussion of Agile implementation challenges, the current compiled draft Agile Guide contains ten Agile adoption best practices sorted into team activities, program processes, and agency environment. There are also three best practices related to contracting for Agile projects that focus on integrating the program office and development teams and tailoring contract structures and inputs with Agile practices and metrics. The Agile Guide also relates the program control best practices established in the Cost Guide and Schedule Guide to Agile processes and artifacts.

We expect that the Agile Guide exposure draft will be released to the GAO website for comment in October 2019.

### **Conclusion**

GAO has developed best practice guides to establish criteria for audits and provide guidance for agencies. These guides have been used in audits of various federal programs; where GAO has found that best practices have not been met, we have made recommendations aimed at improving oversight to keep projects on cost and schedule and to manage critical technologies in complex acquisitions. GAO plans to continue developing guides as new topics emerge and to update current guides to ensure that the best practices therein are representative of the most up-to-date information.

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