Overview of GAO Best Practices Guides

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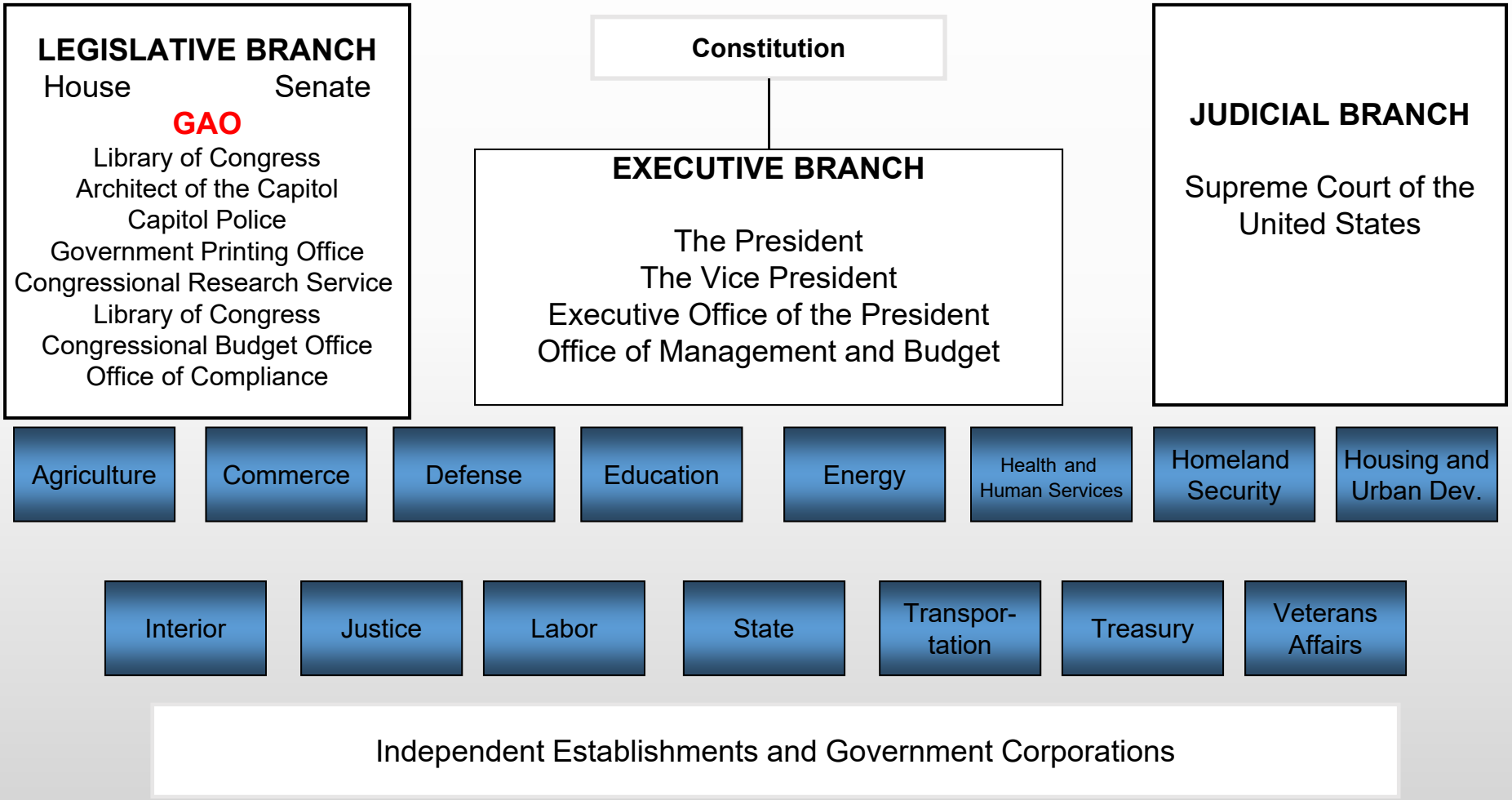
Learning Objectives

About GAO: A Legislative Branch Agency Known As Congress' Watchdog



About GAO

- An independent, nonpartisan agency serving the Congress
- Helps to improve the performance and ensure the accountability of the federal government
- Core values include Accountability, Integrity, and Reliability
- To ensure its 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.

Oversight, Insight, Foresight

About GAO – Its Products

- Average of 875 products each year (reports, briefings, testimonies, and special publications)
- 300 to 400 legal decisions each year
- 96% of work requested or mandated by Congress
- 4% of work initiated under Comptroller General Authority

Importance of 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 finished
- Developing reliable program cost and schedule estimates are critical to
  - Effectively using public funds
  - Meeting OMB's capital programming process
  - Avoiding cost overruns, missed deadlines, and performance shortfalls

GAO Best Practice Guides

- Purpose of the Guides are to
  - Address best practices for ensuring credible program cost and schedule estimates for both government and industry
  - Provide a detailed link between cost estimating, scheduling, and EVM
    - OMB has endorsed EVM for measuring cost, schedule, and technical performance
    - Guide demonstrates how realistic cost and schedule estimates are necessary for setting achievable program baselines and managing risk

Development of Best Practice Guides

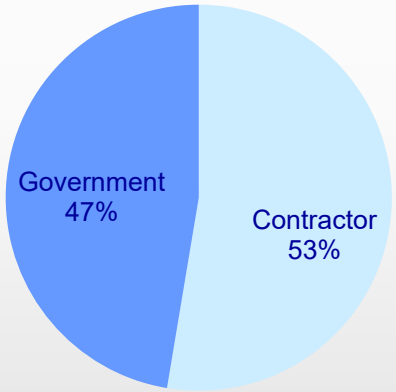
- GAO seeks input from a wide range of experts, starting with planning and design through report development.
- Guides are developed through an iterative, consultative process which involves a committee of experts in the related domain(s).
  - Members are from government agencies, private companies, independent consultant groups, trade industry groups, and academia.
- Expert meetings are open to anyone with the requisite experience and interest in the topic.
  - Meeting minutes are extensively documented and archived after review by the GAO team and all participants.

Expert Group Process

- To develop the expert guides, GAO compiles a list of experts in that area to discuss topics
- The first expert group was established in 2005 and has since grown
  - Includes cost, schedule, risk, and earned value management experts
  - Meets twice a year to discuss a variety of related topics
  - Next Meeting: September 20, 2018
- GAO has also established an Agile expert group
  - Next Meeting: August 23, 2018

Cost Expert Group

Vast Public and Private Experience



AACE International	Dept. of Interior	Johns Hopkins APL	Parsons Brinckerhoff
Aberdeen Proving Ground	Dept. of Treasury	Johnson Space Center	Performance Results Corporation
Accenture	DNDO	Kaiser Permanente	Pinnacle Management Systems, Inc.
Acumen	DOT	Kalman & Company, Inc.	Pratt & Whitney
AFCAA	Edwards Project Solutions	Kearney & Company	Price Systems
Agilekiwi	FAA	KPMG	Price Waterhouse Coopers
Department of the Army	FLOUR	L-3 Stratis	Project Pro
AzTech International	Galorath Incorporated	Learning Tree	Rand
Bath Iron Works	George Mason University	Legis Consultancy	Raytheon
Battelle	German Aerospace Center	Lockheed Martin	Robbins Gioia
Boeing	Grant Thornton	ManTech Team	Rockwell Collins
Booz Allen Hamilton	GSA	Marathon Oil	SAIC
CDC	GWU	MBP	ServQ
Census	Herren Associates	MCR Federal, LLC	Sikorsky
Center for Naval Analysis	HNTB Corporation	MDA	SPAWAR
Chevo Consulting	HPTI	Microsoft	SRA International
Computer Sciences Corp.	HUD	Ministry of Defense - Japan	SSA
DAU	IntePros Federal	MITRE	Steelray
DCMA	iParametrics	NASA	TASC - DNDO support
Deloitte Consulting LLP	IRS	National Defense University	Technomics
Deltek	GWU	National Science Foundation	Tecolote Research, Inc.
Department of Education	Herren Associates	NAVAIR	Textron
Department of Interior	HNTB Corporation	Naval Center (NCAA)	The Rehancement Group, Inc.
Department of Navy	HPTI	NAVSEA	Transportation Security Administration
Department of State	HUD	Navy Postgraduate School	UK MOD
Department of Veterans Affairs	IntePros Federal	NNSA	US Army Corps of Engineers
Dept of Energy - Oakridge	iParametrics	NOAA	US Coast Guard
Dept of Labor	IRS	Northrop Grumman	USPS
Dept. Homeland Security	Japan Defense Research Center	OMB	VA
Dept. of Commerce	JAXA - Japan	OSD PARCA	Wyle

Best Practice Guides Process

Develop Initial Guides

- GAO collects names to determine extensive contact list of experts in the field
- GAO researches various topics and develops draft chapters
- Expert Panel reviews GAO draft chapters
- GAO vets expert comments and those agreed to are incorporated into the draft guide
- Exposure Draft guide is published on the Internet and an open comment period is established for one year
- GAO speaks at various conferences to request comments which if accepted make it into the final version of guide

Update Existing Guides

- GAO adds names to the contact list to ensure that the list of experts is inclusive
- GAO attends conferences/meetings to determine topics that should be discussed at meetings
- Broad Expert Meetings are held twice a year at GAO in March and September; agendas are sent out one month prior and GAO compiles and disseminates detailed meeting minutes
- GAO updates the chapters based on updated policies and research
- An open comment period is established and GAO vets and incorporates comments
- GAO issues an updated Guide

Currently Published Guides

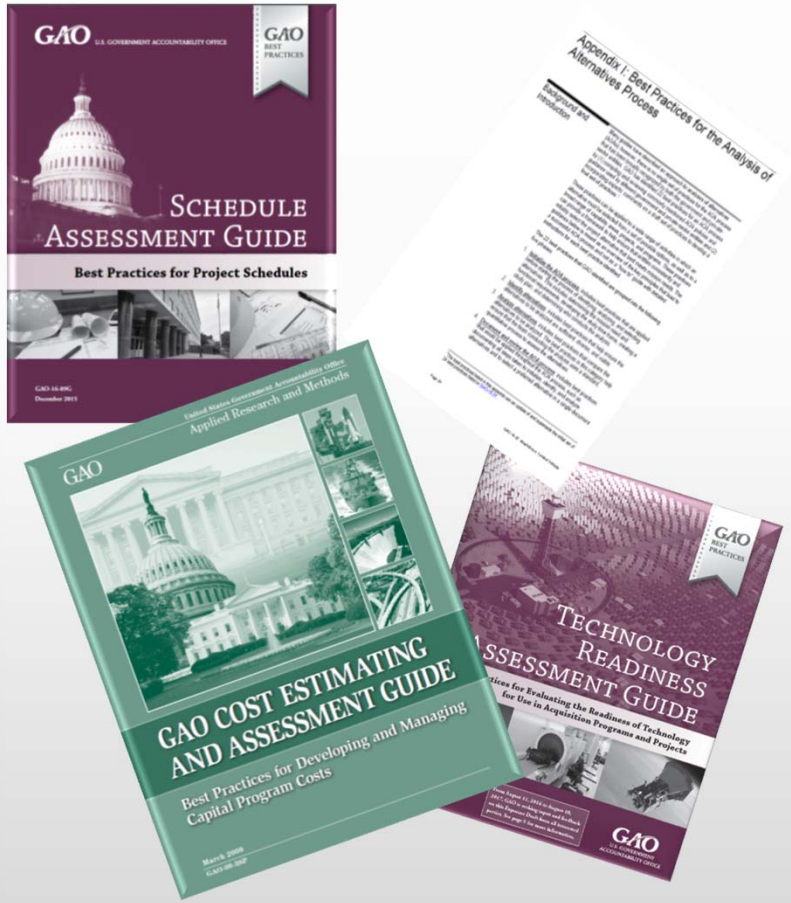
- Purpose of these documents is two-fold:
  - Provide criteria for GAO to compare when performing audits
  - Provide guidance for agencies
- GAO has published the following
  - Cost Estimating and Assessment Guide (March 2009)

    http://www.gao.gov/new.items/d093sp.pdf
  - Schedule Assessment Guide (December 2015)

    http://www.gao.gov/assets/680/674404.pdf
  - Best Practices for the Analysis of Alternatives Process (October 2015)

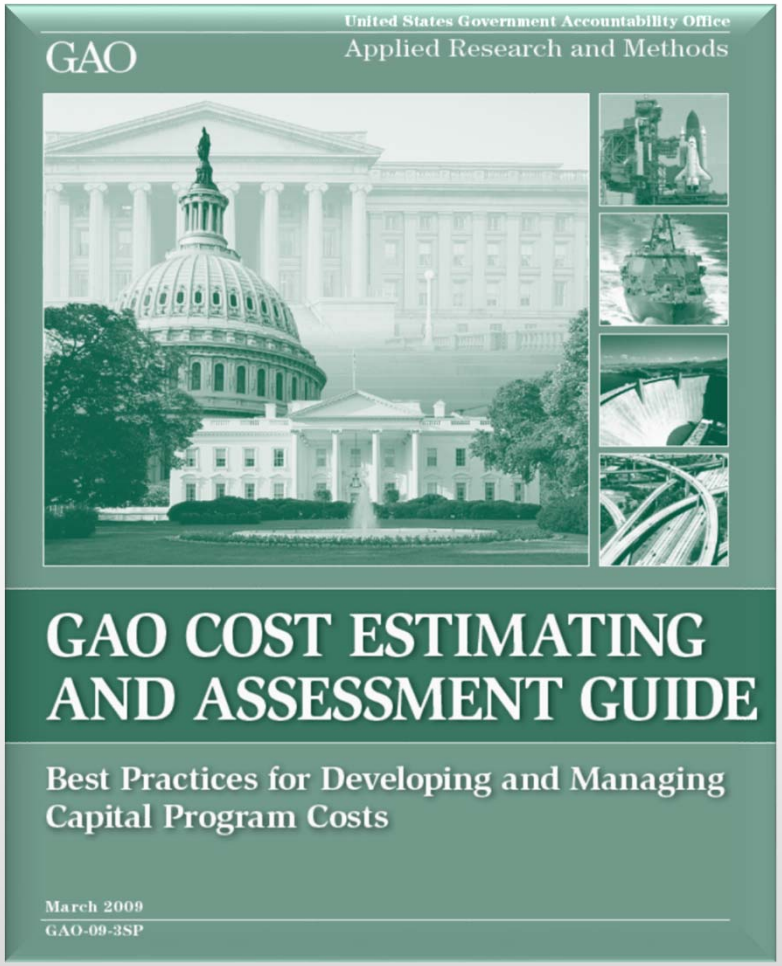
    Appendix 1 in GAO-16-22
    http://www.gao.gov/assets/680/673405.pdf
  - Technology Readiness Assessment Guide (August 2016)

    http://www.gao.gov/assets/680/679006.pdf



Cost Estimating and Assessment Guide

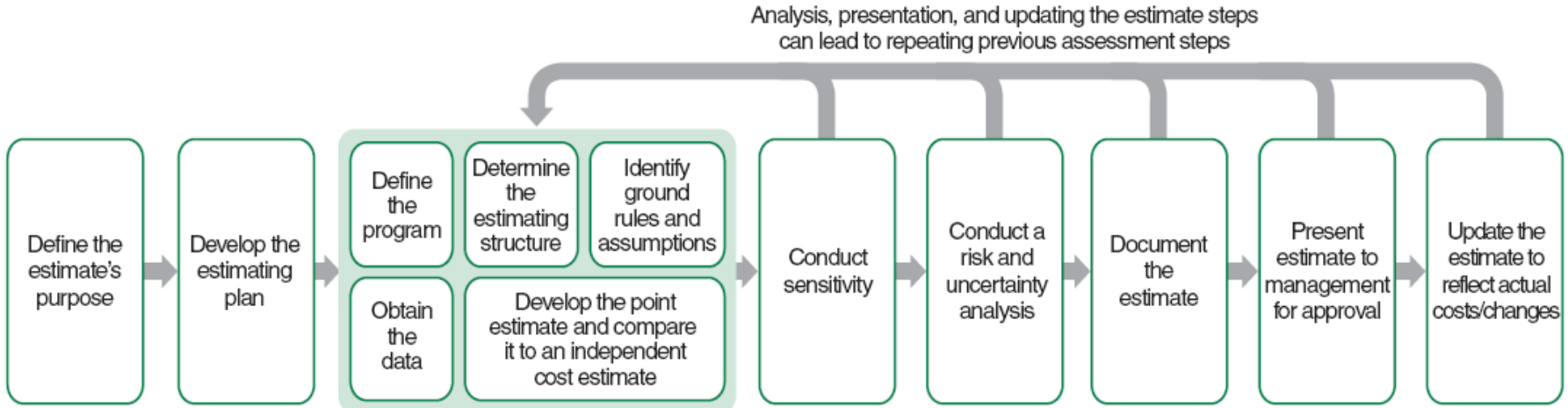
- Drafted 2005-2007, published in 2009
- Outlines GAO's criteria for assessing cost estimates during audits
- Contains 20 chapters with supporting appendixes
- Chapters 1-17: developing credible cost estimates and the 12-step cost estimating process for developing high quality cost estimates
- Chapters 18-20 address managing program costs once a contract has been awarded and discuss Earned Value and risk management
- Also provides case studies of prior GAO audits to show typical findings related to the cost estimating process



The Cost Guide is in the process of being updated now

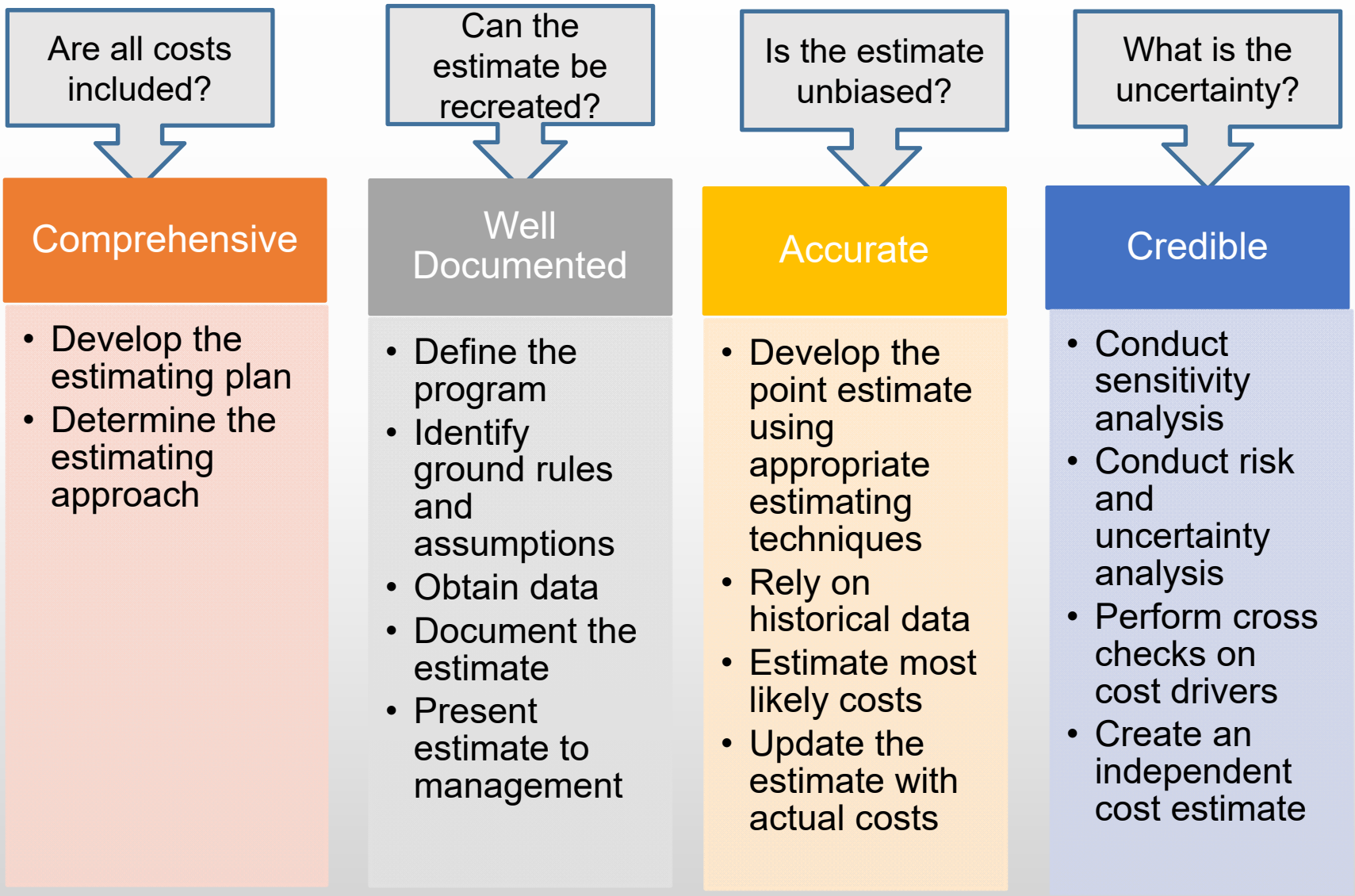
A Reliable Process for Developing Credible Cost Estimates

- Certain best practices should be followed if credible cost estimates are to be developed.
- These best practices represent an overall process of established methods that, if followed correctly, will result in high-quality cost estimates that are comprehensive, accurate, and easily updated / replicated.



Source: GAO.

Characteristics of Reliable Cost Estimates



EVM is an Important Management Tool

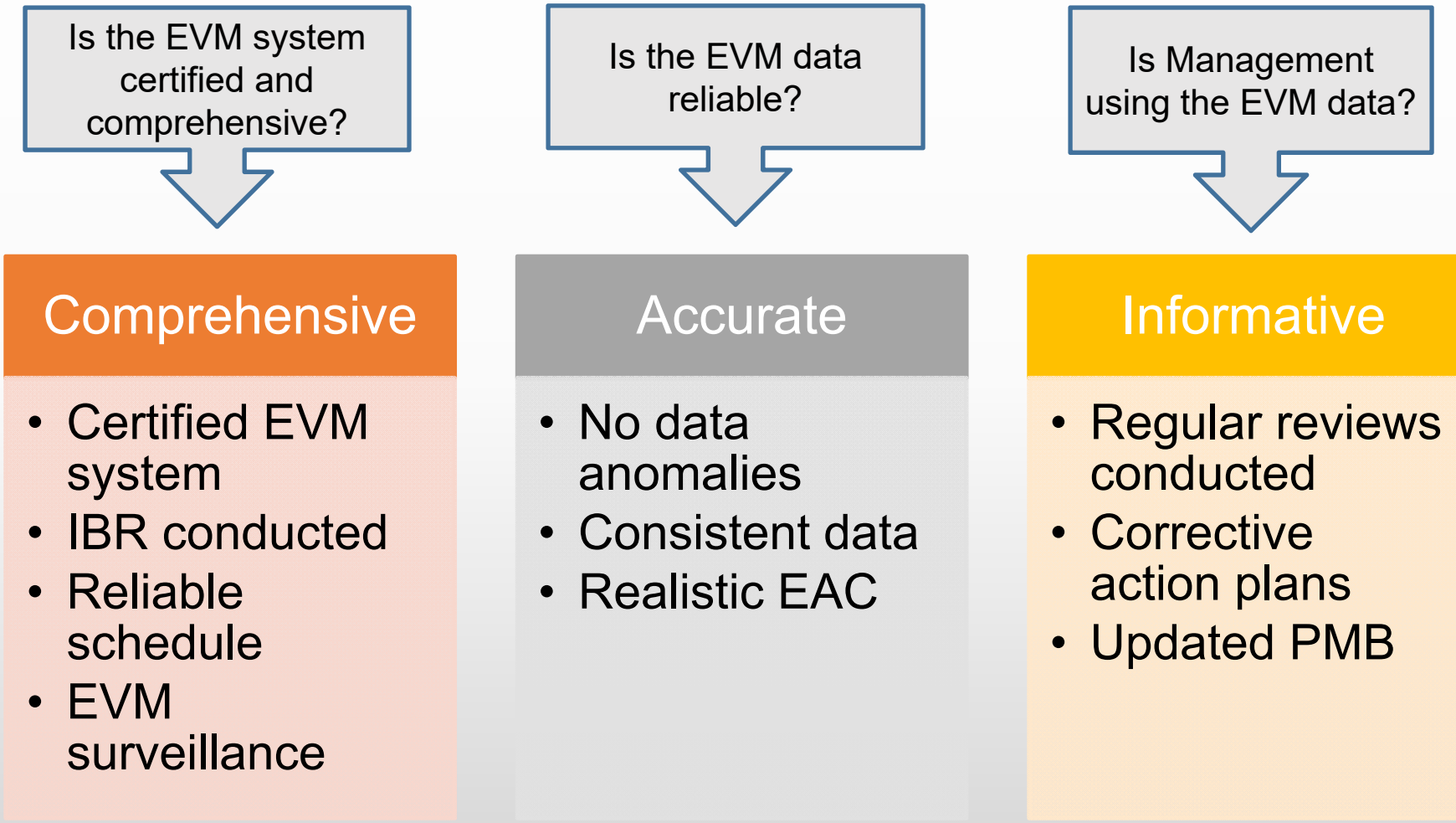
- EVM indicates how past performance may affect future performance
  - The data isolates cost and schedule variances by WBS elements allowing for:
    - An understanding of technical problems
    - Opportunities to reallocate effort to mitigate risk
- The two main purposes for implementing an EVM system are to:

1. Encourage the use of effective internal cost and schedule management controls
2. Allow the customer to rely on timely and accurate data for determining contract performance

The Thirteen Steps in the EVM Process

1. Define the scope of work using a WBS
2. Identify who in the organization will perform the work
3. Schedule the work
4. Estimate the labor and material required and authorize budgets including MR
5. Determine objective measure of earned value
6. Develop the performance measurement baseline
7. Execute the work plan and record all costs
8. Analyze EVM performance data and record variances from PMB plan
9. Forecast EACs using EVM
10. Conduct an integrated cost-schedule risk analysis
11. Compare EACs from EVM in Step 9 with EAC from risk analysis in Step 10
12. Take management action to mitigate risks
13. Update the PMB as changes occur

Characteristics of Reliable EVM System



GAO's Schedule Assessment Guide

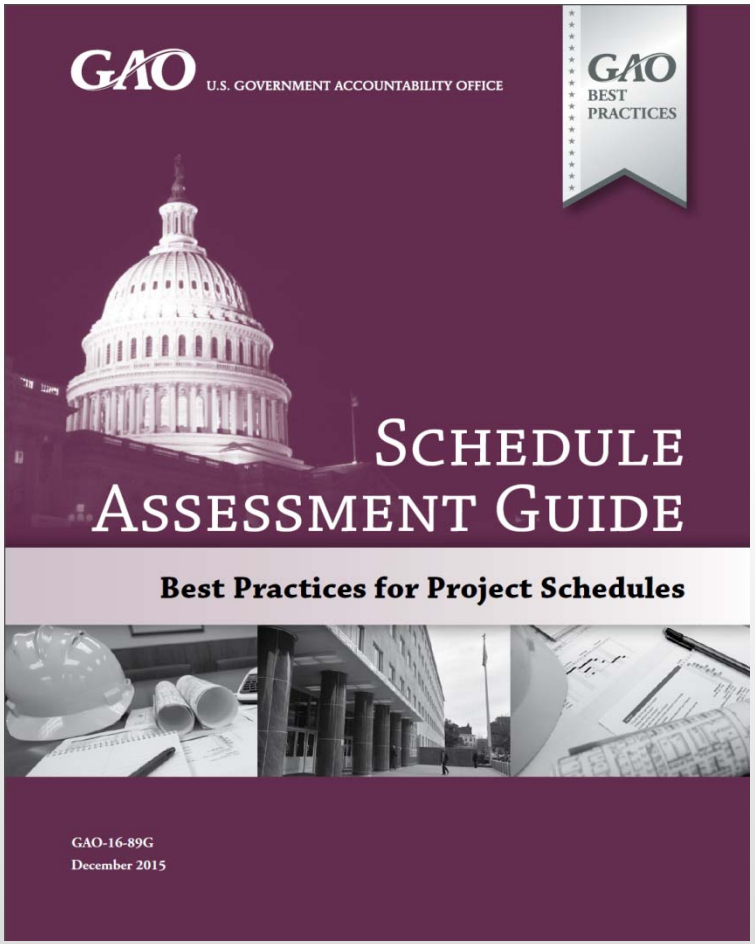
The GAO *Schedule Assessment Guide* develops the scheduling concepts introduced in the GAO *Cost Estimating and Assessment Guide*.

- Best practices for developing and maintaining high-quality schedules
- Contains explanatory text, illustrations, and detailed case studies
- Includes appendixes that list key questions, documentation, and technical guidance

Public exposure draft released 2012-2013 and over 1,000 comments received

The Final version of the GAO Schedule Guide can be downloaded for free at

www.gao.gov/products/GAO-16-89G



GAO Schedule Guide

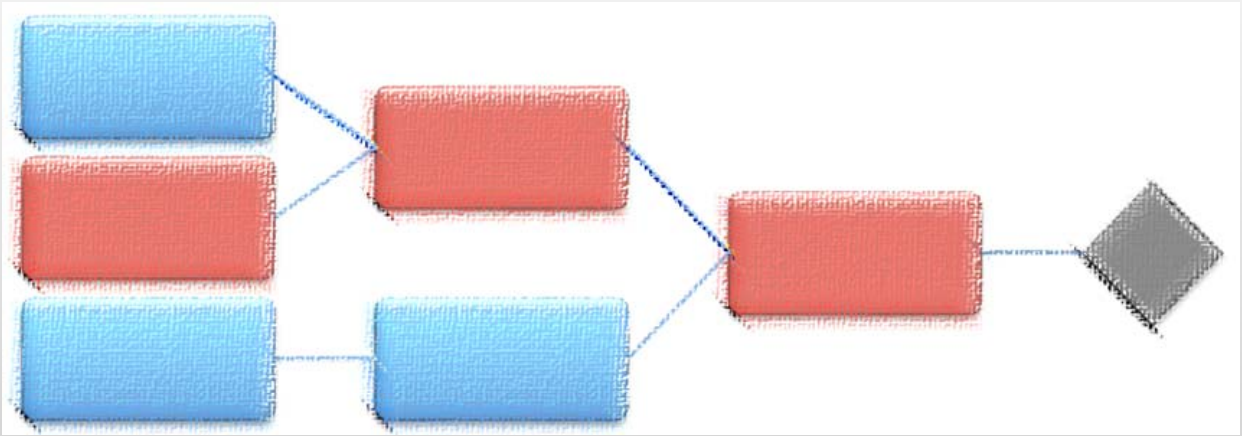
- Origin
  - Expands on the scheduling concepts introduced in the Cost Guide
  - Intended to be an appendix to an updated version of the Cost Guide, but became its own publication
- Purpose
  - Allow GAO auditors to assess the reliability of reported program dates through an assessment of project schedules
  - Useful for agencies to create or append existing policies and guidance on creating and maintaining project schedules

The Importance of Scheduling

The success of a program depends in part on having an integrated and reliable master schedule

A schedule is the roadmap for project execution by:

- Defining when and how long work will occur and how each activity is related to the others
- Determining a time sequence for the duration of a program's activities
- Providing the means by which to gauge progress

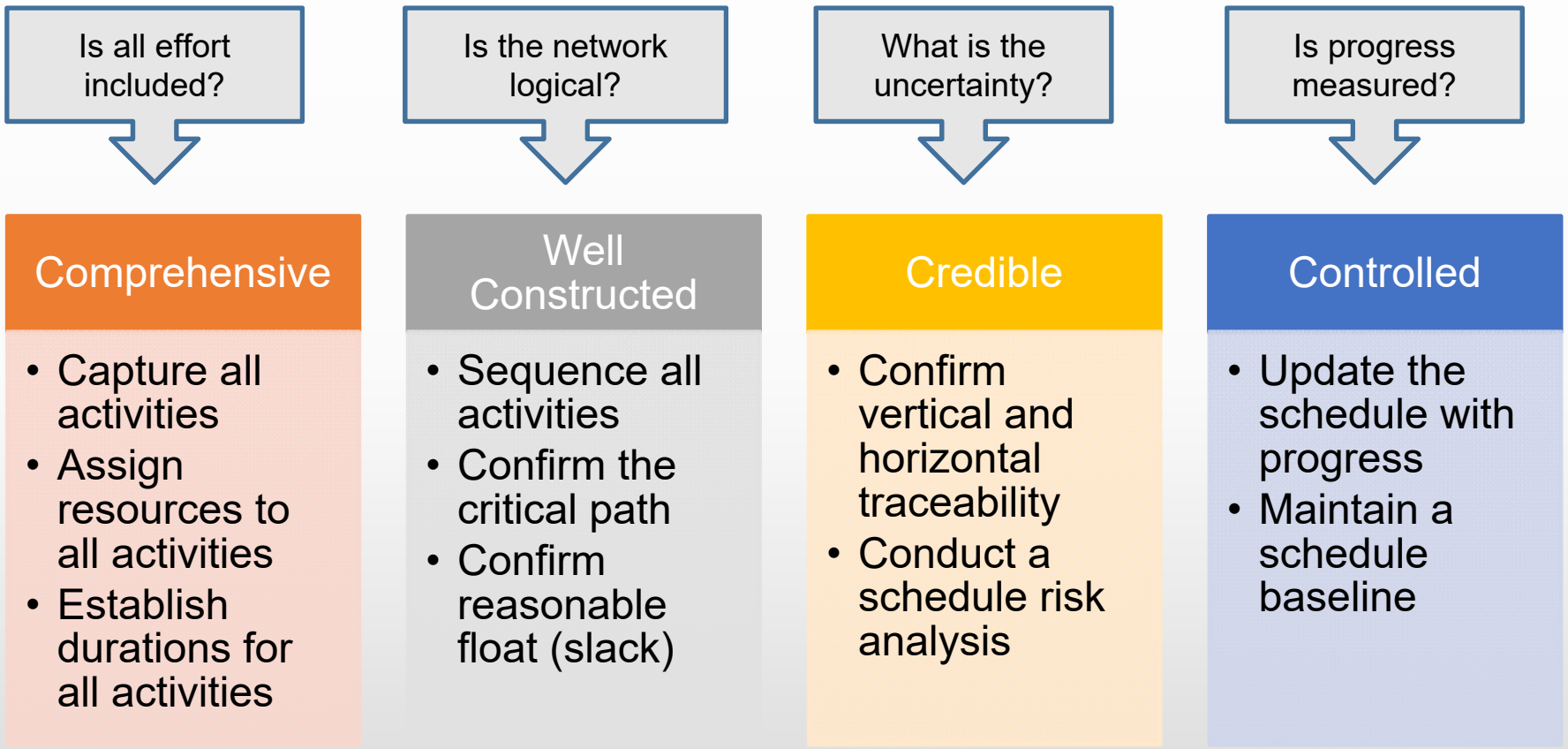


Scheduling Best Practices

Our research has identified ten best practices associated with developing and maintaining a reliable schedule

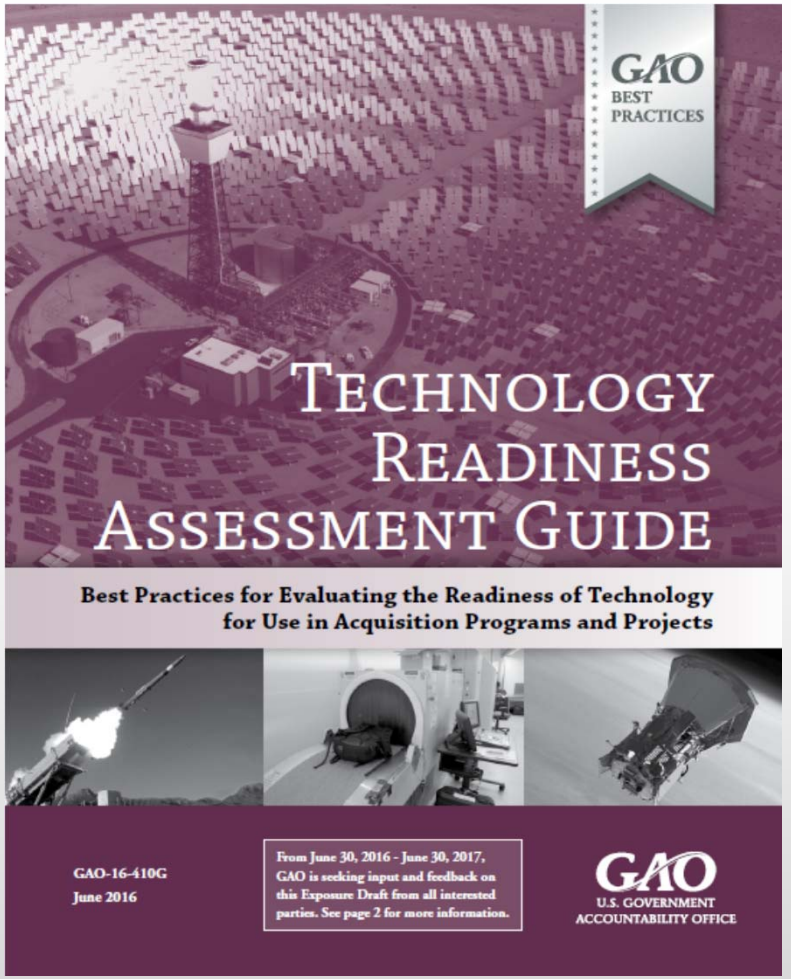
1. Capturing all activities
2. Sequencing all activities
3. Assigning resources to all activities
4. Establishing the duration of all activities
5. Verifying that the schedule can be traced horizontally and vertically
6. Confirming that the critical path is valid
7. Ensuring reasonable total float
8. Conducting a schedule risk analysis
9. Updating the schedule using actual progress and logic
10. Maintaining a Baseline Schedule

Characteristics of a Reliable Schedule



Technology Readiness Assessment Guide

- Drafted from 2015-2016 with the release of public exposure draft in June 2016
- Outlines GAO's criteria for evaluating technological readiness assessments
- Contains 10 chapters with supporting appendixes
  - Chapters 1 & 2 define TRAs and describe their importance and limitations
  - Chapter 3 outlines a reliable process for conducting TRAs
  - Chapters 4-10 address the associated best practices
- Provides case studies of prior GAO audits to show typical findings related to technology readiness



Technology Readiness Assessment Guide

- Fills criteria void for “performance” in the “cost-schedule-performance” trio of management elements of capital acquisition programs.
- Designed to bring understanding and practice of technology readiness assessments
  - Invented decades ago by NASA
  - Utilized extensively in DOD, and
  - Available to other agencies without a large technical staff.
- Allows GAO auditors to assess the reliability of the identification and management of technologies critical to the success of a given capital acquisition program.
- Useful for agencies to create or append existing policies and guidance on creating and maintaining technology readiness assessments
  - Can be applied to ongoing, day-to-day project management or to support major milestone decision points.

Six Steps to Develop a High Quality TRA

Define Purpose	• Determine purpose, level of detail, scope, TRL definition • Obtain pertinent information • Align assessment strategy to SE management plan
Develop Strategy, Plan, and Assemble Team	• Develop schedule and events • Determine specific team members and needed expertise • Outline the approach • Identify a plan for handling dissenting views
Select Critical Technologies	• ID purpose, system, and performance characteristics in a technology baseline document • Use a Work Breakdown Structure that characterizes the system to select critical technologies • Use key questions and environment to determine if a technology is critical

Six Steps to Develop a High Quality TRA

Evaluate Critical Technologies

- Determine TRL definitions and required evidence prior to assessment
- Determine acceptability of test articles and environments
- Determine if testing results are sufficient and acceptable
- Document all relevant information

Prepare and Submit the TRA Report

- Prepare an official report that documents actions from previous steps
- Obtain report comments and explain dissenting views

Use TRA Results and Develop a Technology Maturation Plan

- Use TRA results to make decisions about the program's development priorities
- Program management identifies TRA-related concerns and risks, including potential effects on cost and schedule estimates
- Develop a technology maturation plan to track progress

Agile Development

- Agile methods are being widely used by federal agencies to shorten development timeframes and deliver functionality in smaller segments.
  - Continuous software delivery and the use of automated testing enable agencies to keep pace with ever changing technology
  - Regular feedback from users ensures that the most important features are delivered first
- Agile approaches invert the traditional cost, schedule, and performance triangle by holding cost and schedule fixed while performance can vary.
  - This radical approach helps agencies adjust to uncertain budgets
  - Agile allow for an agency to constantly update and change requirements based on user needs
    - Does not lock an agency into developing requirements that are not necessary

Agile Assessment Guide

- GAO has previously reported on the challenges agencies face when transitioning from traditional waterfall to Agile development
  - Issues with contracting, documentation review, measuring progress, stakeholder support, coaching and training, etc. have occurred
  - A lack of guidance has contributed to these problems
- GAO is developing the Agile Software Development and Implementation Guide that provides best practices to ensure that
  - A high quality and reliable Agile implementation framework is established and
  - An agency is following program management best practices when using Agile

Agile Assessment Guide – In development

- **Purpose**: to identify and address leading practices and structural barriers to overcome when implementing Agile methodologies at the agency level and to discuss the relationship of those methodologies to common program control disciplines.

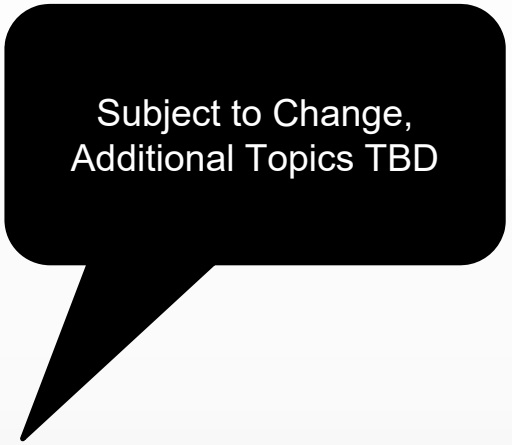
- GAO meets with an Agile Expert Panel three times a year and in between meetings provides draft chapters for review and input prior to releasing an exposure draft
  - To volunteer for the Agile Expert Panel contact Jennie Leotta (leottaj@gao.gov) or Mat Bader (baderm@gao.gov)
  - Exposure Draft Release Date: TBD 2019

- The exposure draft will be released on the GAO website to obtain comments from the general public

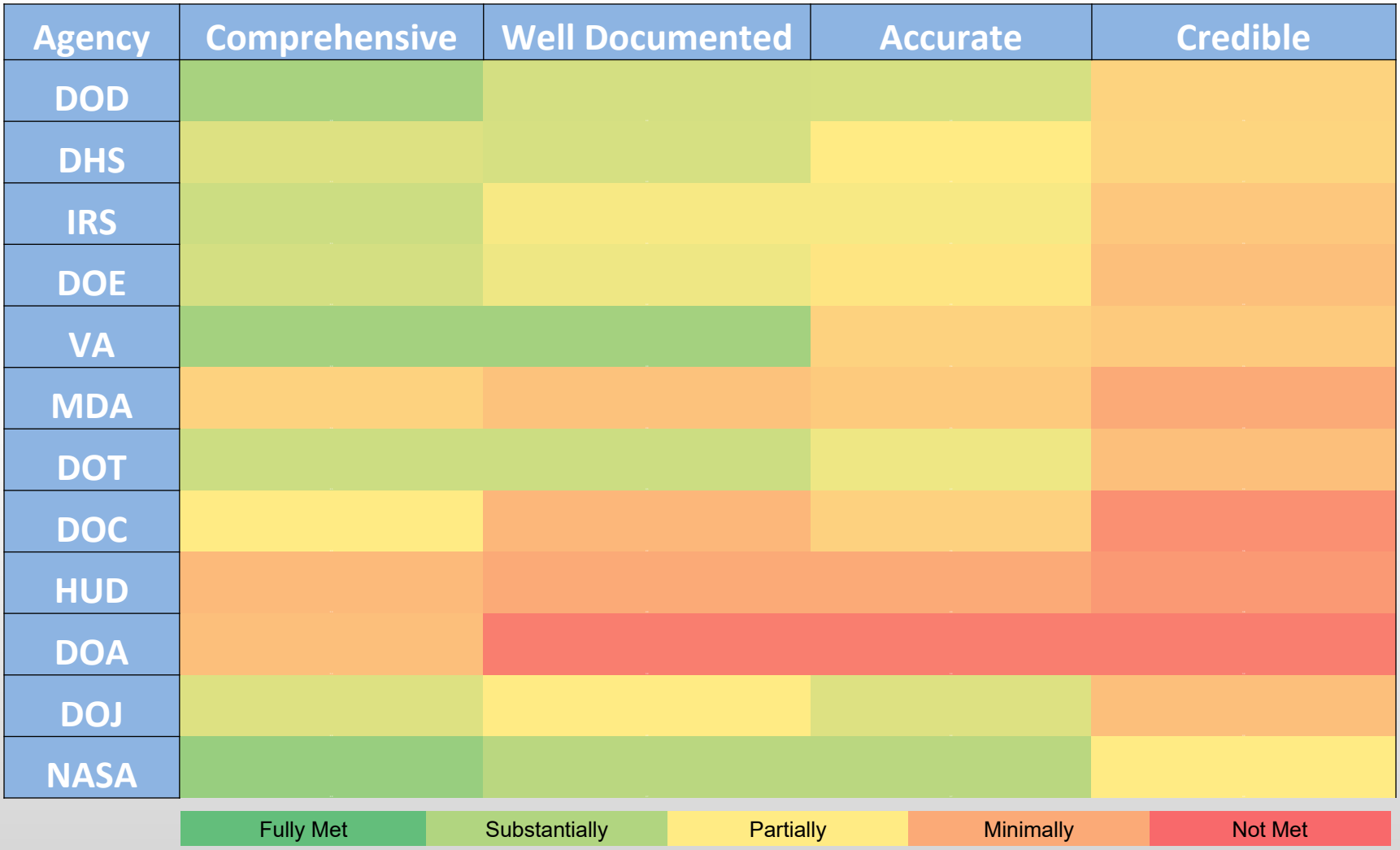
Agile Assessment Guide

Current Outline

- Chapter 1: Background
- Chapter 2: Compliance and Past Work
- Chapter 3: Agile Adoption Best Practices
  - Team Activities, Program Processes, Organizational Environment
- Chapter 4: Agile Implementation Challenges
- Chapter 5: Agile Metrics
- Chapter 6: Requirements Decomposition
- Chapter 7: Agile and the Federal Acquisition Process
- Chapter 8: Agile and Program Management Factors
- Chapter 9: Agile and Program Control Best Practices
  - Cost Estimating, Scheduling, EVM, and AOA Best Practices
- Appendixes
  - Tentative topics: Glossary/Rosetta Stone, Debunking Agile Myths, Agile Methodologies, Questions for Auditors and Managers, Gap analysis with other Agile guides, etc.



How Is The Government Performing in Developing Cost Estimates?



Data based on agencies and departments with three or more GAO cost estimate assessments

High-level Summary of Cost Assessments

In general, government program offices

- Exclude all program life cycle costs and do not break out costs into sufficient detail
- Rarely use standardized product-oriented work breakdown structures with common support elements
- Do not reflect historic or risk data and do not assess the risk impacts if major assumptions fail
- Do not document the cost estimate to a level that would allow a cost analyst unfamiliar with the program to replicate the results
- Conduct limited sensitivity analyses based on engineering judgment rather than historic data
- Do not perform cost risk and uncertainty analysis and fail to document the risks associated with assumptions
- Cannot show that their estimates are unbiased (i.e., do not identify a level of confidence along with contingency)
- Fail to crosscheck estimating methodologies or reconcile with an independent cost estimate
- Cannot demonstrate that management has understood and approved all facets of the cost estimate
- Fail to update the cost estimate to reflect actual costs and reasons for variances

Many government program offices lack effective internal controls

Program offices generally have no

- Centralized cost estimating organization that includes experienced and trained cost analysts to develop high-quality cost estimates
- Policy or guidance for developing high- quality cost estimates that include steps to follow, time that is needed, and how estimates will be updated
- Infrastructure or staff for collecting and storing historic cost and technical data
- Independent cost estimating organization that can test whether the cost estimate is accurate and realistic

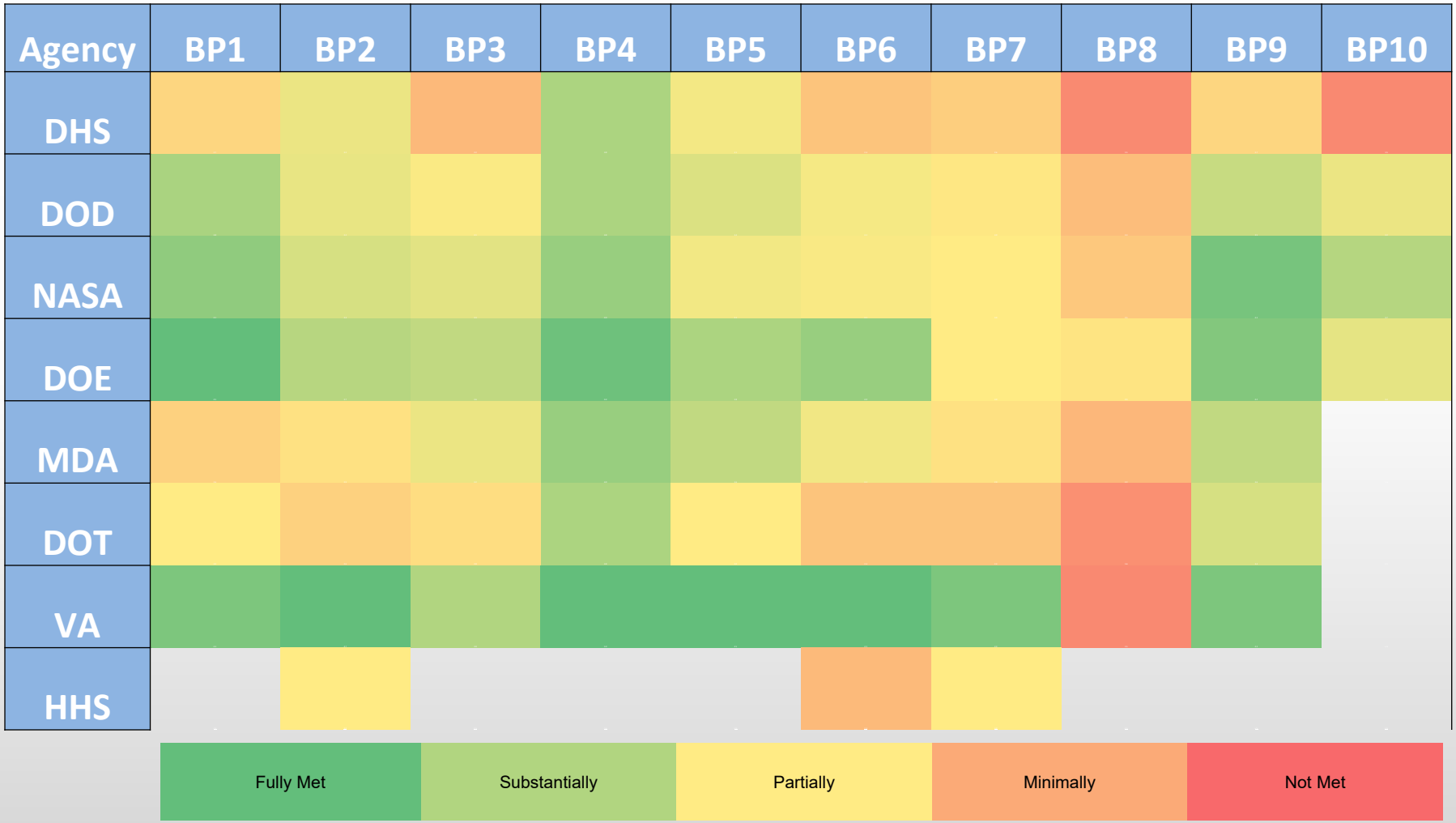
Program offices generally do not

- Link cost and schedule variances to risks in the cost uncertainty analysis
- Update cost estimates regularly (e.g., monthly)
  - with actual cost data from an earned value management system,
  - to capture the reasons for variances with links to risks identified in the risk register,

EVM Findings from Recent Audits

- Many civil agency programs do not use product-oriented Work Breakdown Structures
- Schedules underpinning the EVM system are not meeting many best practices
- IBRs are not occurring in a timely manner and are often not robust reviews
- Programs often re-baseline due to overly optimistic cost and schedule estimates
- EVM data anomalies are widespread and recurring
  - Government program offices are not rejecting the EVM reports
- Format 5 variance analyses are too vague to be useful and do not address corrective actions
- EVM data are not being used to proactively manage the program
- Program managers do not integrate EVM data with the risk management process
- Civil agencies do not have access to independent surveillance functions
- Government and contractor staff need additional training on EVM
- Contractors are not properly implementing their EVM systems

How Is The Government Performing In Developing and Maintaining Schedules?



Results reflect agencies and departments with three or more GAO schedule assessments

High Level Schedule Assessment Findings

In general, government program offices fail to

- Include all effort in the IMS for the entire program
- Provide traceability of activities to the statement of work
- Set a schedule baseline (or track against one)
- Properly sequence activities using correct logic to ensure the schedule is dynamically networked
- Document justification for constraints
- Perform schedule risk analysis
- Identify distinct start and finish milestones.

Further, government program offices

- Appreciate the concept of a critical path but not the consequences of unrealistic float
- Assume unlimited resources by failing to resource load their schedules
- Do not consistently update schedules or record a status/data date
- Use constraints and lags moderately to force activities to occur on predetermined dates
- Include activities of long duration that are difficult to objectively status and manage

Additional Schedule Findings

- Contractor schedules are usually more reliable than government program office schedules
  - Many contract deliverables require an integrated network schedule
  - Government program offices typically have a 1-page IMS developed in PowerPoint
- Government program office IMS's usually fail to span an entire program, regardless of how many increments, steps, blocks, contracts, or milestones the program is divided into
- Activity names in government programs tend to be too general, causing problems when filtering the schedule to look for missing logic or status issues
- Schedules are not created by the critical path method and therefore cannot be
  - Used to conduct schedule risk analysis
  - Relied on by management to evaluate progress and make decisions
- Schedulers -- rather than the program manager -- are too often held responsible for updating and managing schedules.

Key Takeaways

- The GAO Cost, Schedule, and TRA Guides can provide criteria to evaluate many types of large technology-oriented and/or capital acquisition projects.
- Risk assessments such as technology readiness assessments and independent cost and schedule risk assessments are
  - Often not performed, or
  - If done, they tend to be incomplete or too optimistic resulting in significant program risk and cost overruns.
- GAO recommendations have been aimed at improving oversight to keep projects on cost and schedule and to manage risk in complex acquisitions.
- Programs/projects that follow the best practices experience greater success in terms of outcomes and resource utilization.