

GAO: Best Practice Guides and Their Influence on Data Collection and Analysis

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Background



Overview: About GAO

- GAO is an independent, nonpartisan agency serving the Congress to help improve the performance and ensure the accountability of the federal government.
- Core values are Accountability, Integrity, and Reliability.
- 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.



Oversight, Insight, Foresight

Overview: About GAO (Our Work)

- GAO work is primarily done at the request of congressional committees or subcommittees or is mandated by public laws or committee reports. We also undertake research under the authority of the Comptroller General.
- Some examples of our work include:
 - Auditing agency operations to determine whether federal funds are being spent efficiently and effectively
 - Investigating allegations of illegal and improper activities
 - **Reporting on how well government programs and policies are meeting their objectives**
 - **Performing policy analyses and outlining options for congressional consideration**
 - Issuing legal decisions and opinions, such as bid protest rulings and reports on agency rules
- In 2018, Congress directed the formation of the Science, Technology Assessment, and Analytics (STAA) team, recognizing that the accelerating pace of innovation has created a need for more and deeper analysis of science and technology.

More information about GAO can be found at www.gao.gov



Best Practice Guides



Overview: Best Practice Guides

- **Cost Estimating and Assessment Guide**
 - Issued: March 2020, GAO-20-195G
- **Schedule Assessment Guide**
 - Issued: December 2015, GAO-16-89G
- **Technology Readiness Assessment Guide**
 - Issued: January 2020, GAO-20-48G
- **Agile Assessment Guide**
 - Issued: November 2023, GAO-24-105506



Overview: Best Practice Guides

Why develop best practice guides?

- Legislators, government officials, and the public want to know whether government programs are achieving their goals and what these programs are expected to cost and when they are expected to be finished.
 - Best practice guides provide clear criteria to establish the quality of program artifacts and whether they provide managers and oversight organizations enough information to make informed decisions.
- Developing reliable program cost and schedule estimates is critical to:
 - Effectively using public funds
 - Meeting OMB's capital programming process
 - Avoiding cost overruns, missed deadlines, and performance shortfalls
- The Guides help provide a framework for managing the government's acquisition efforts and ensuring the successful development and integration of cutting-edge technologies and their integration into large and complex systems.



Developing the Guides



Best Practice Guide Development Process: Agile Guide Example

Research

Industry and government implementation guides, technical publications, and presentations
Interviews with government and private industry practitioners

Consult with Experts

In 2016, we convened a group of Agile experts from the government, private industry, and academia

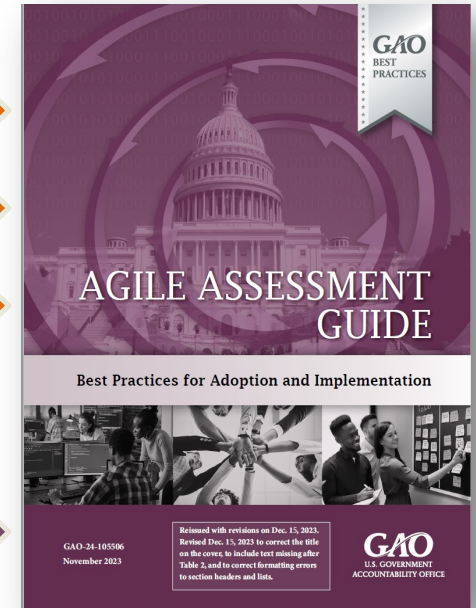
Issue Exposure Draft

From 2016-2019, we circulated draft sections of the Guide and reviewed and updated those sections based on comments from the Agile Expert Group

In 2020 we issued an "exposure draft" (GAO-20-590G)
With the issue of the exposure draft, we also initiated a 1-year comment period from the public

Finalize Guide

From 2021-2023 we reviewed comments, performed additional research, and consulted with experts to issue the final Agile Guide (GAO-24-105506)



What is an Exposure Draft

- An exposure draft is an initial product, published with a 1-year open comment period, providing an opportunity for anyone to comment on the guide's contents.
- After the comment period is over, GAO reviews the comments received and updates the guide based on those inputs and additional insight we have from audits.
- Quantity of comments often dictates how long it takes to update the exposure draft.



A Look Inside the Guides



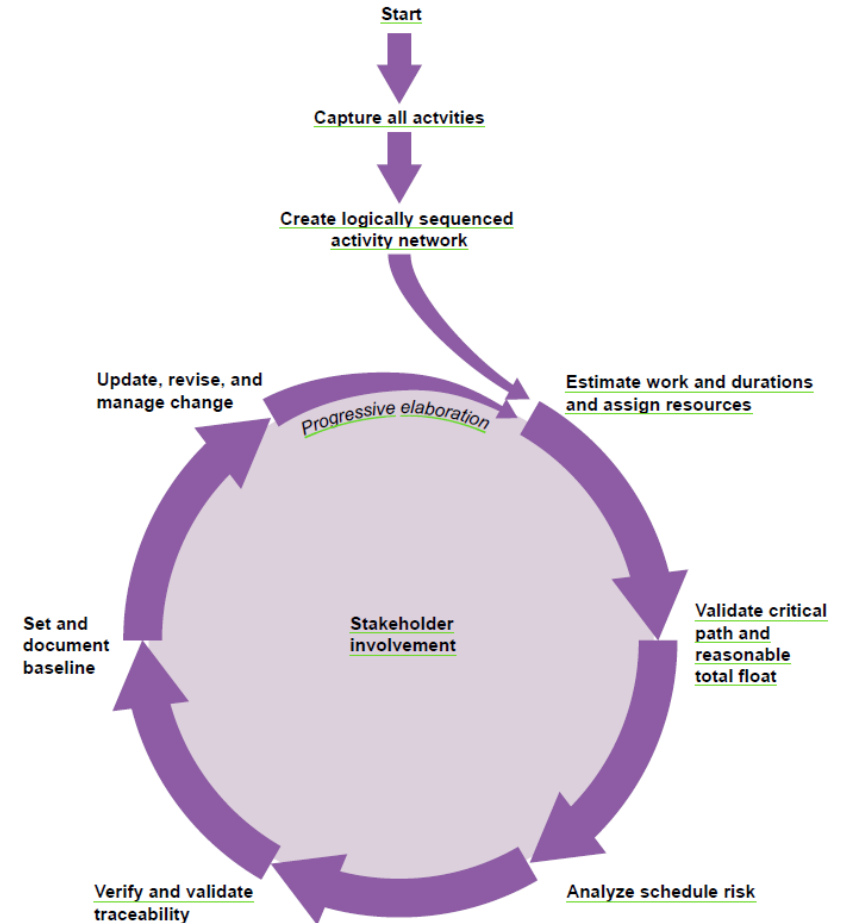
Cost Guide (GAO-20-195G)

- The Cost Guide consists of 20 chapters and 13 appendixes. It provides best practices for:
 - Cost Estimating (Chapters 1-16)
 - Earned Value Management (Chapters 17-20)
 - Analysis of Alternatives Processes (Appendix XI)
- The Cost Guide also includes Case Studies, which are summaries from published GAO reports that reinforce the importance of the best practices.

Schedule Guide (GAO-16-89G)

- The Schedule Guide consists of 12 chapters and 11 appendixes. It discusses 10 best practices related to the development of high-quality, reliable schedules.
- The best practices in the Schedule Guide, while presented in no particular order, can also be mapped to an overall process to establish methods to develop high-quality schedules.
- Similar to the Cost Guide, the Schedule Guide includes Case Studies that are used to reinforce the importance of the best practices.

Figure 1. A Process for Creating and Maintaining Reliable Schedules



Source: Adapted from Keith D. Hornbacher. | GAO-16-89G

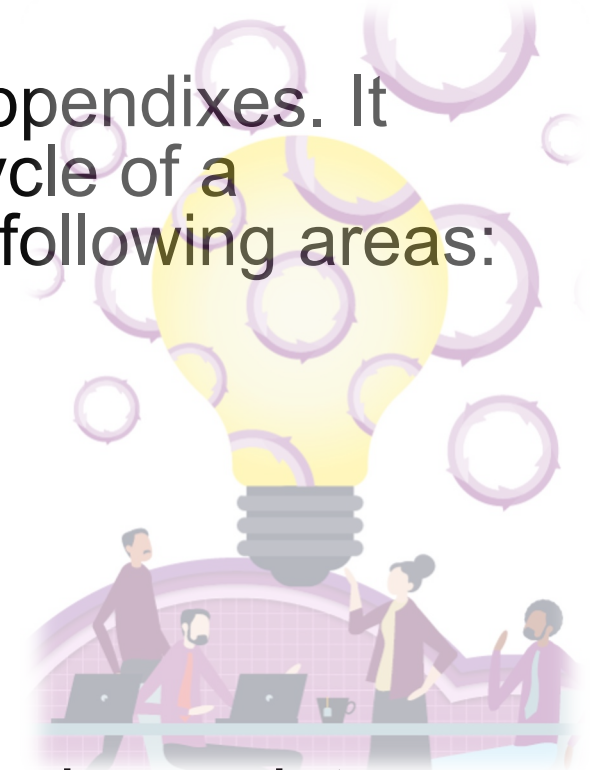
Technology Readiness Assessment (TRA) Guide (GAO-20-48G)

- The TRA Guide consists of 12 chapters and 8 appendixes. It presents a five-step process comprised of 29 best practices. Each best practice is linked four distinct characteristics of a high-quality TRA (credible, objective, reliable, useful).
- It also discusses technology maturation plans and how TRAs are used in software development.
- Similar to the Cost and Schedule Guides, the TRA Guide uses Case Studies from other GAO reports to reinforce the importance of the best practices.



Agile Guide (GAO-24-105506)

- The Agile Guide contains eight chapters and nine appendixes. It provides sets of best practices throughout the life cycle of a program. These best practices are organized in the following areas:
 - Agile adoption
 - Requirements Development and Management
 - Federal Acquisition Process
 - Program Control and Monitoring
 - Metrics
- Similar to the other guides, the Agile Guide illustrates key points through Case Studies and graphics. It also includes “Agile in Action” to highlight positive examples that were observed throughout the government during our effort to develop the Agile Guide.





Using the Guides in Audits

Data Collection

- We request original documents in their native software format.
 - Often, we discuss which is the appropriate file to use. For example:
 - We want to ensure that we're looking at the most recent information in case of rebaselines.
 - We want to ensure that we are reviewing a schedule that encompasses and integrates the entire program, rather than a contractor schedule or a single project schedule.
 - We also request all relevant supporting data and documentation to help inform the analysis.
-

Interviews

- After we collect the data, we meet with agency personnel to get additional context.
 - Ideally, we talk directly to the people responsible for the development and maintenance of the files we assess.
-

Analysis

Develop

- An analyst develops a detailed write up for our analysis based on the data provided and information from interviews. This analysis includes scores for each best practice and characteristic.
- The analysis is indexed to the source documentation, the indexes are traced and verified by a second analyst, and technical review is provided by an assistant director.

Share

- We share the detailed analysis with the agency. Sharing these details provides insight into the logic and reasoning behind the best practice/characteristic scores.
- We encourage agencies to send written responses and meet with us to discuss these detailed analyses.

Update

- After we have discussed our findings with agencies, we update our analysis to provide additional context.
- If we have received additional documentation, we will consider updating the scores for the best practices based on the information we receive.

From Analysis to the Report

- Often, a full analysis will be ~60 pages long. However, this will be summarized in ~3 pages in a GAO report.
- We work closely within GAO to pull out the key points from the detailed analysis to provide a balanced look at the program.

Characteristics of a high-quality, reliable cost estimate	GAO assessment of the B61-12 program cost estimate				
	Not met	Minimally met	Partially met	Substantially met	Met
Comprehensive					
Well-documented					
Accurate					
Credible					

Source: GAO analysis of NNSA information, based on GAO's Cost Estimating and Assessment Guide (GAO-09-3SP). | GAO-18-456

Appendix I: Results of GAO's Assessment of the B61-12 Life Extension Program Cost Estimate Compared with Best Practices

Characteristic	Overall assessment	Best practice	Individual assessment
Comprehensive	Substantially met	The cost estimate includes all life cycle costs.	Partially met
		The cost estimate completely defines the program, reflects the current schedule, and is technically reasonable.	Substantially met
		The cost estimate work breakdown structure—a hierarchical structure that subdivides the work necessary to accomplish the program's objectives into smaller elements—is product-oriented, traceable to the statement of work/objective, and at an appropriate level of detail to ensure that cost elements are neither omitted nor double-counted.	Substantially met
		The estimate documents all cost-influencing ground rules and assumptions.	Partially met
Well-documented	Substantially met	The documentation should capture the source data used, the reliability of the data, and how the data were normalized.	Partially met
		The documentation describes in sufficient detail the	Partially met

Thank you

Guides Available Online and Downloadable in PDF:

GAO Cost Estimating and Assessment Guide:

<https://www.gao.gov/products/gao-20-195g>

GAO Schedule Assessment Guide:

<https://www.gao.gov/products/gao-16-89g>

GAO Technical Readiness Assessment Guide:

<https://www.gao.gov/products/gao-20-48g>

GAO Agile Assessment Guide:

<https://www.gao.gov/products/gao-24-105506>



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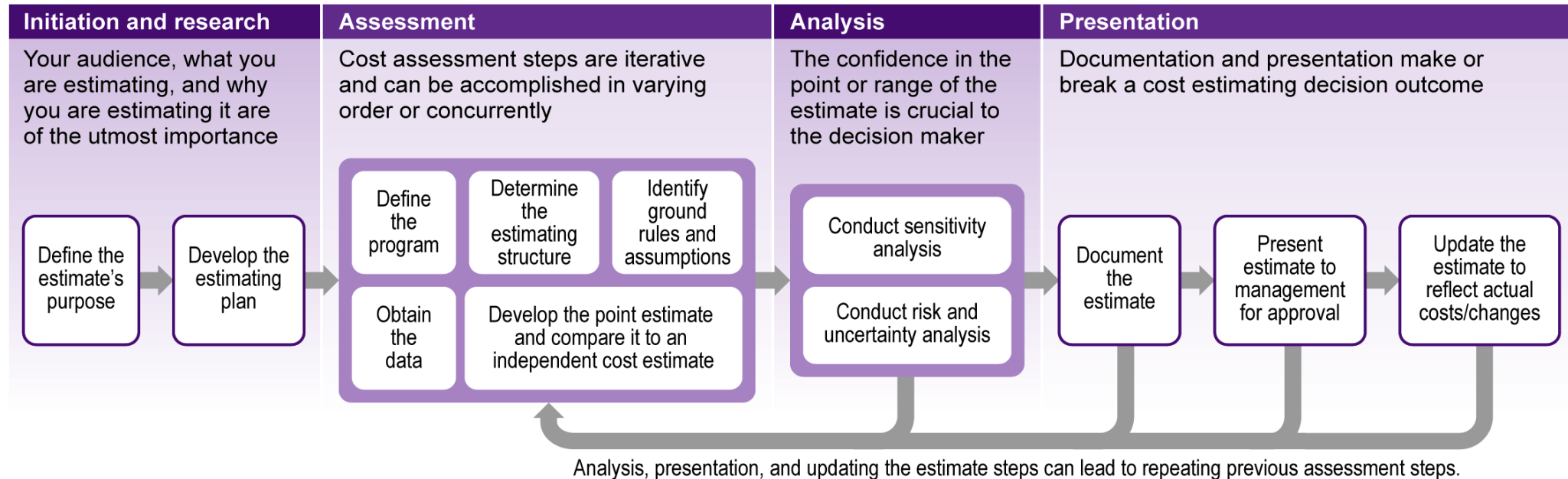
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Back Up



Cost Estimating

Source: GAO. | GAO-20-195G

- The Cost Guide discusses a 12-step process to develop reliable cost estimates.
- The Cost Guide also discusses 18 best practices organized into four characteristics (comprehensive, well-documented, accurate and credible) that can be used to validate whether an estimate is reliable. Each of the 12 steps are covered in the best practices/characteristics (excluding step 2).

Earned Value Management

Back

Process

- The Cost Guide provides a 13-step process of fundamental EVM activities:
 1. Define the scope of effort with a WBS
 2. Identify who in the organization will perform the work
 3. Schedule the work to a timeline
 4. Estimate resources and authorize budgets
 5. Determine the objective measures of earned value
 6. Develop the performance measurement baseline (PMB)
 7. Execute the work plan and record all costs
 8. Analyze EVM performance data and record variances from the performance measurement baseline plan
 9. Forecast estimates-at-completion using EVM
 10. Conduct an integrated cost-schedule risk analysis
 11. Compare EACs from EVM with EAC from risk analysis
 12. Take management action to respond to risks
 13. Update the PMB as changes occur

Best Practices

- **Comprehensive**
 - The program has a certified EVM system
 - An IBR verified that the baseline budget and schedule captured the scope of work, risks were understood, and available and planned resources were adequate
 - The schedule reflects the WBS, the logical sequencing of activities, and the necessary resources
 - EVM system surveillance is being performed
- **Accurate**
 - EVM system data do not contain anomalies
 - EVM system data are consistent among various reporting formats
 - EACs are realistic
- **Informative**
 - EVM system data are reviewed on a regular basis
 - Management uses EVM system data to develop corrective action plans
 - The PMB is updated to reflect changes

Analysis of Alternatives

Well-Documented

- 9. Describe alternatives
- 12. Identify significant risks and mitigation strategies
- 14. Tie benefits/effectiveness to mission need and functional requirements
- 18. Document AOA process in a single document
- 19. Document ground rules, assumptions, and constraints

Comprehensive

- 1. Define mission need
- 2. Define functional requirements
- 3. Develop AOA time frame
- 8. Develop list of alternatives
- 11. Assess alternatives' viability
- 15. Develop life-cycle cost estimates (LCCEs)

Unbiased

- 4. Establish AOA team
- 6. Weigh selection criteria
- 7. Develop AOA process plan
- 13. Determine and quantify benefits and effectiveness
- 20. Ensure AOA process is impartial
- 22. Compare alternatives

Credible

- 5. Define selection criteria
- 10. Include baseline alternative
- 16. Include confidence level or range for LCCEs
- 17. Perform sensitivity analysis
- 21. Perform independent review

- The appendix consists of 22 best practices that are organized into four characteristics: comprehensive, well-documented, unbiased, and credible.
- The best practices are also the process steps (step number indicated above).

Schedule Best Practices

Comprehensive

- 1. Capturing all activities
- 3. Assigning resources to all activities
- 4. Establishing the durations of all activities

Well-Constructed

- 2. Sequencing all activities
- 6. Confirming that the critical path is valid
- 7. Ensuring reasonable total float

Credible

- 5. Verifying that the schedule can be traced horizontally and vertically
- 8. Conducting a schedule risk analysis

Controlled

- 9. Updating the schedule using actual progress and logic
- 10. Maintaining a baseline schedule

- The 10 schedule best practices are grouped into four characteristics.
- The best practices are also the process steps (step number indicated above).

Technology Readiness



Source: GAO. | GAO-20-48G

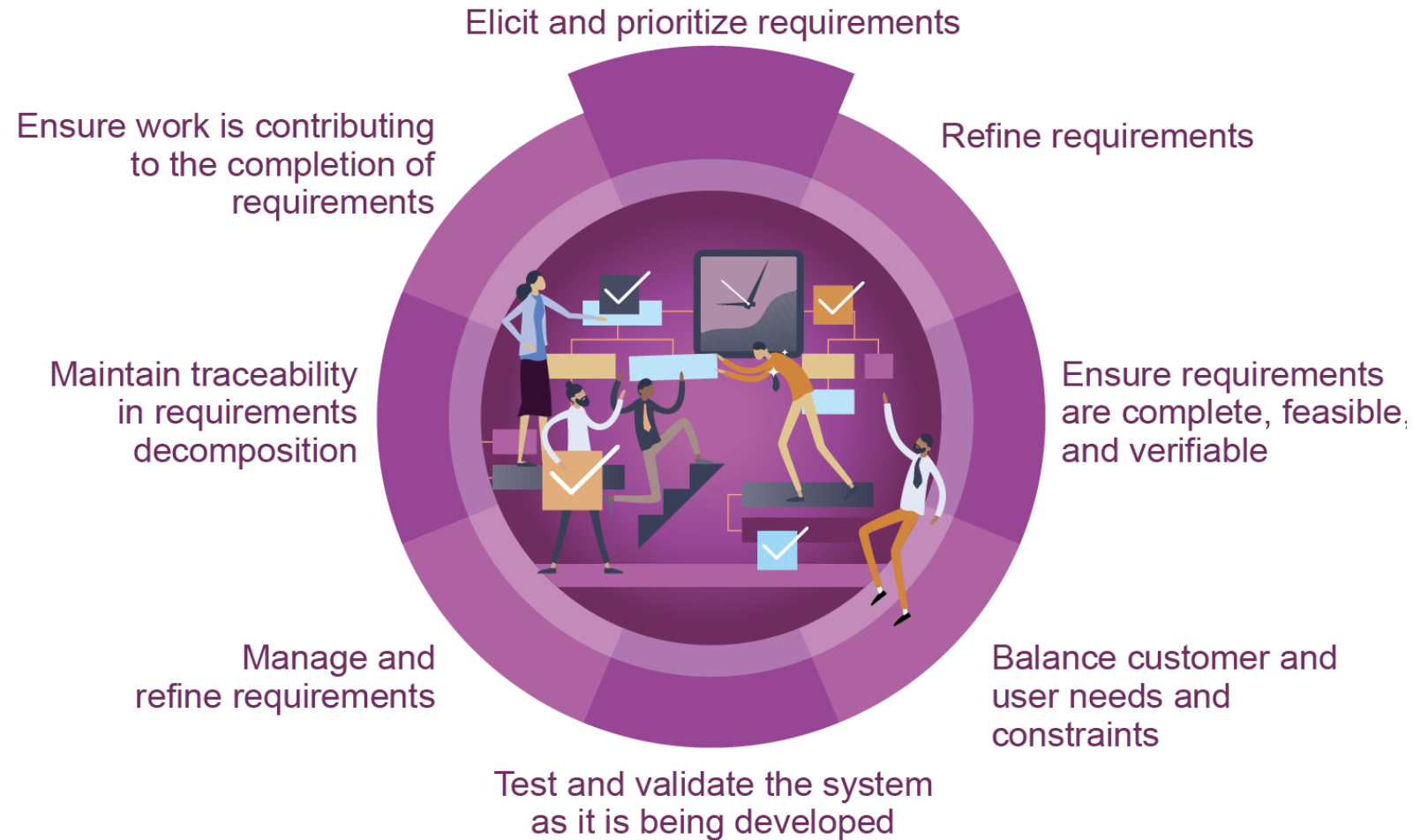
- The figure shows the 5-step TRA process described in more detail in the TRA Guide.
- The TRA Guide also discusses four characteristics of a high-quality TRA. That is, that TRAs are Credible, Objective, Reliable, and Useful.

Agile Guide: Agile Adoption Best Practices (Chapter 3)



Source: GAO analysis of agency and private sector information (data); Vectormine/stock.adobe.com (images). | GAO-24-105506

Agile Guide: Requirements Management Best Practices (Chapter 5)



Source: GAO analysis of CMMI v. 1.3, PMI and SEI documentation (data); Vectormine/stock.adobe.com (images). | GAO-24-105506

Agile Guide: Acquisition Best Practices (Chapter 6)



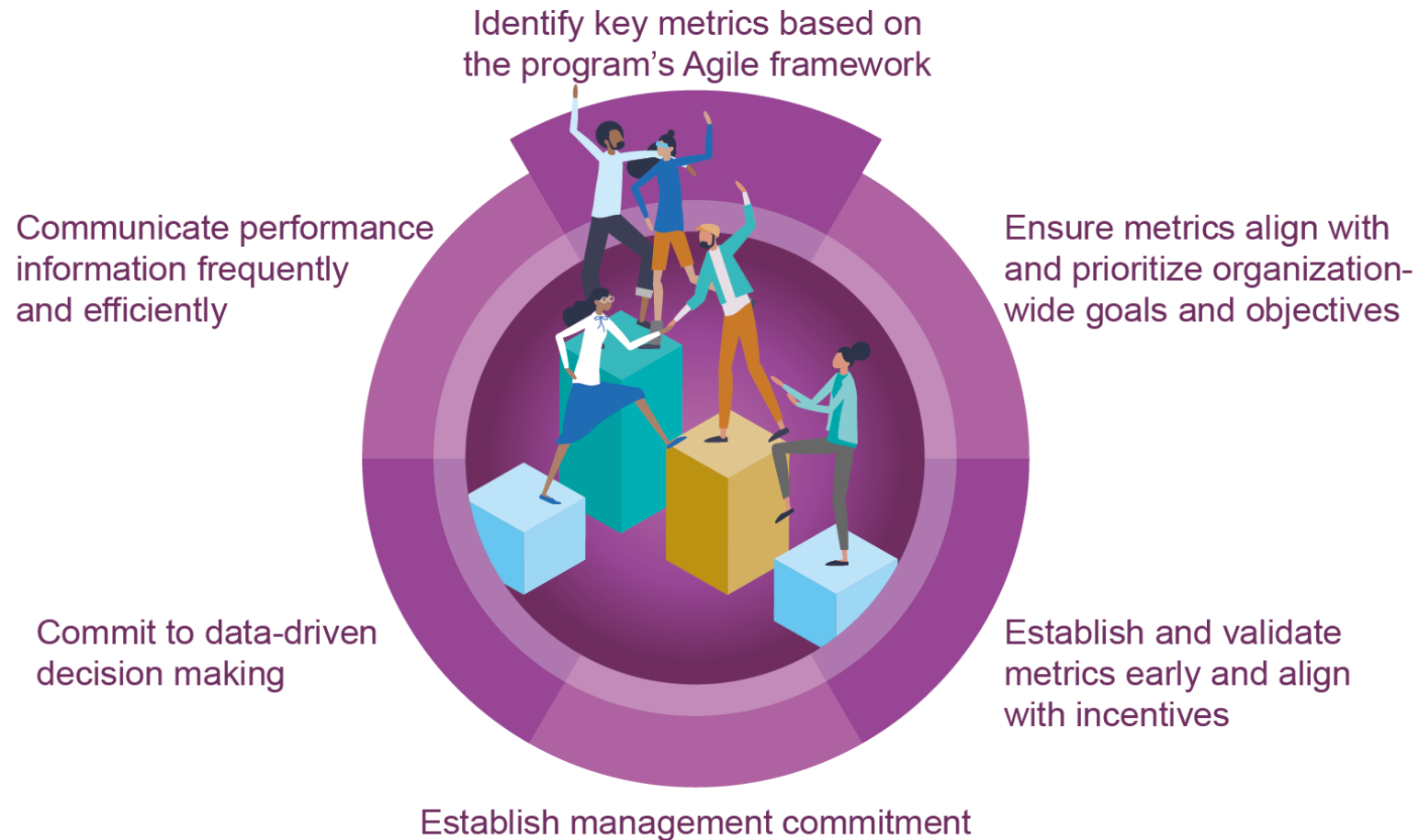
Source: GAO analysis of agency and private sector information (data); Vectormine/stock.adobe.com (images). | GAO-24-105506

Agile Guide: Program Monitoring and Control (Chapter 7)

- In Chapter 7, we highlight how Agile practices and processes can be used to meet the cost estimating and earned value management best practices in the Cost Guide (GAO-20-195G) and the schedule best practices in the Schedule Guide (GAO-16-89G).
- We start the chapter with a discussion of using a Work Breakdown Structure (WBS) to unite the program's monitoring and control tools.

Release 1	Work Breakdown Structure (WBS)			Release 2	Updated WBS		
	WBS	Title	Release		WBS	Title	Release
Epic 1							
Feature 1.1	1.1	Prime mission product		Feature 1.3	1.1	Prime mission product	
	1.1.1	Epic 1			1.1.1	Epic 1	
Feature 1.2	1.1.1.1	Feature 1.1	R1		1.1.1.1	Feature 1.1	R1 ✓
	1.1.1.2	Feature 1.2	R1		1.1.1.2	Feature 1.2	R1 ✓
					1.1.1.3	Feature 1.3	R2
Epic 2							
Feature 2.1	1.1.2	Epic 2	R1/R2	Feature 2.3	1.1.2	Epic 2	R1/R2
	1.1.2.1	Feature 2.1	R1		1.1.2.1	Feature 2.1	R1 ✓
Feature 2.2	1.1.2.2	Feature 2.2	R1	Feature 2.4	1.1.2.2	Feature 2.2	R1 ✓
					1.1.2.3	Feature 2.3	R2
					1.1.2.4	Feature 2.4	R2
Epic 3							
Feature 3.1	1.1.3	Epic 3	R1	Feature 4.1	1.1.3	Epic 3	R1 ✓
	1.1.3.1	Feature 3.1	R1		1.1.3.1	Feature 3.1	R1 ✓
Feature 3.2	1.1.3.2	Feature 3.2	R1	Feature 4.2	1.1.3.2	Feature 3.2	R1 ✓
	1.1.4	Epic 4	R2/R3		1.1.4	Epic 4	R2/R3
	1.1.5	Epic 5	R3/R4		1.1.4.1	Feature 4.1	R2
	1.2	Program management	All		1.1.4.2	Feature 4.1	R2
	1.3	Hardware	R1		1.1.5	Epic 5	R3/R4
	1.4	Software licenses	R2		1.2	Program management	All
					1.3	Hardware	R1
					1.4	Software licenses	R2

Agile Guide: Metrics Best Practices (Chapter 8)



Source: GAO analysis of agency and private sector information (data); Vectormine/stock.adobe.com (images). | GAO-24-105506