GAO Schedule Assessment Guide

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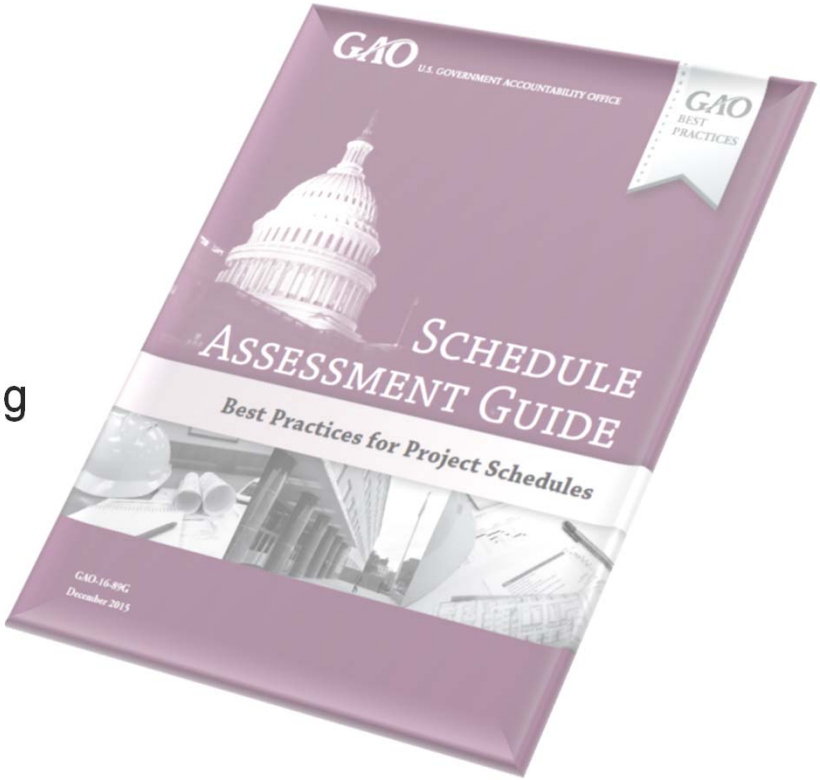
Outline

- Background
- The Guide's Layout
- GAO's 10 Scheduling Best Practices
- Four Characteristics of a Reliable Schedule
- Past GAO Assessments

Background

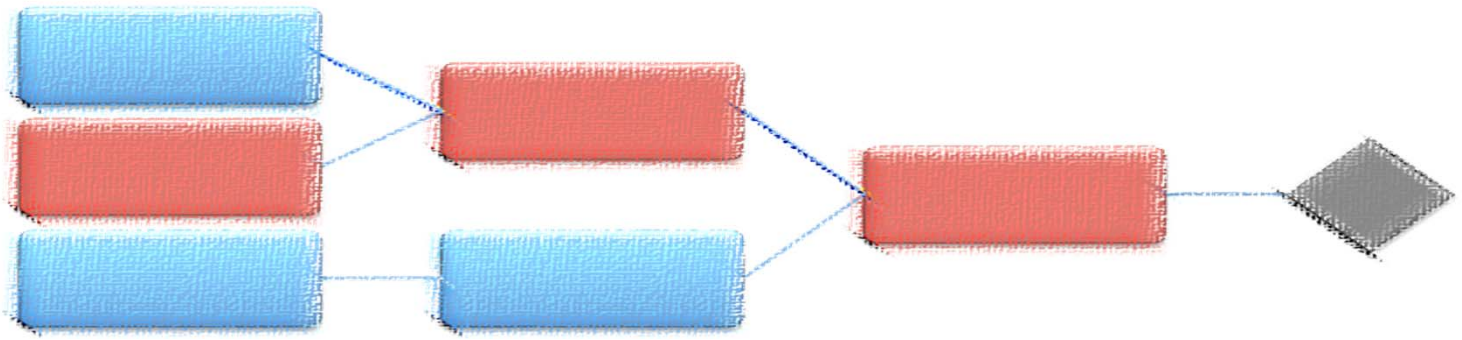
Scheduling Basics

- GAO first identified nine scheduling best practices in Chapter 18 of the GAO Cost Estimating and Assessment Guide
- The GAO Schedule Assessment Guide develops the scheduling concepts introduced in the Cost Guide
  - Outlines scheduling best practices for developing and maintaining high-quality schedules that forecast credible dates.
  - Contains explanatory text, illustrations, and detailed case studies to help program staff identify a schedule's appropriate schedule logic and risk elements.
  - Includes appendices that list key questions, documentation, etc.
- The Guide is available for free at: http://www.gao.gov/assets/680/674404.pdf



Background
Critical Path Method

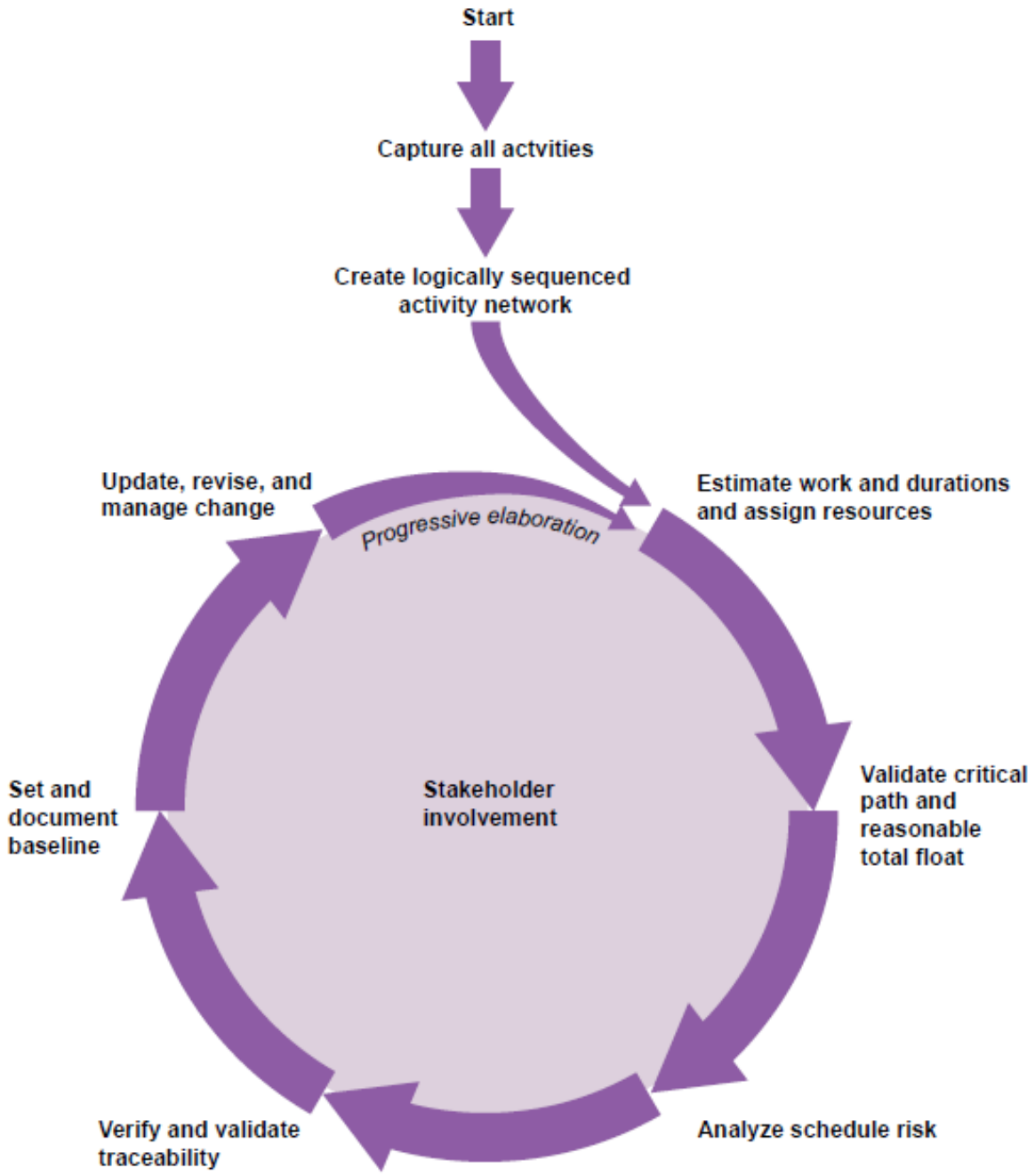
- The success of a program depends, in part, on having a reliable and integrated master schedule
- A schedule is a roadmap for project execution
  - It defines when and how long work will occur and how each activity is related to the others
  - It provides a time sequence for the duration of a program's activities
  - It provides the means by which to gauge progress
- The critical path method is used to derive the critical activities—that is, activities that cannot be delayed without delaying the end date of the program. The amount of time an activity can slip before the program's end date is affected is known as "total float."



Background

Process for Creating and Maintaining a Reliable Schedule

Figure 1. A Process for Creating and Maintaining Reliable Schedules



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

The Guide's Layout

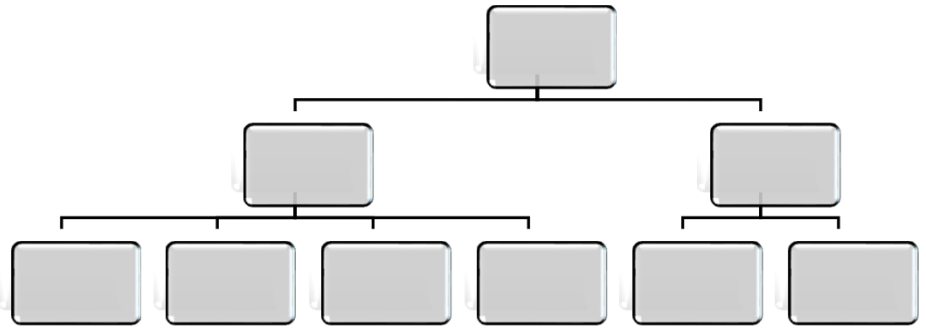
- The GAO Schedule Assessment Guide consists of 11 chapters and supporting appendixes
  - All the chapters address the importance of credible schedule estimating
  - Case studies are provided throughout the guide to provide real life examples that highlight the topics discussed in the guide
  - The Appendixes provide
    - Valuable tools for auditors regarding how to review a schedule
    - Additional technical and background information

GAO's 10 Schedule Best Practices

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

Best Practice 1: Capturing All Activities

- The schedule should reflect all activities as defined in the program's work breakdown structure (WBS), which defines in detail the work necessary to accomplish a program's objectives, including activities both the owner and contractors are to perform

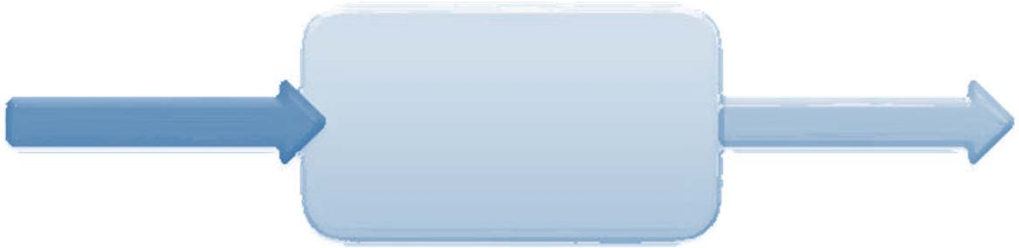


- If activities are missing from the schedule, then other best practices will not be met. If all activities are not accounted for, it is uncertain
  - Whether all activities are in the correct order
  - Resources are properly allocated
  - Missing activities will appear on the critical path
  - A schedule risk analysis can account for all risk

Best Practice 2: Sequencing All Activities

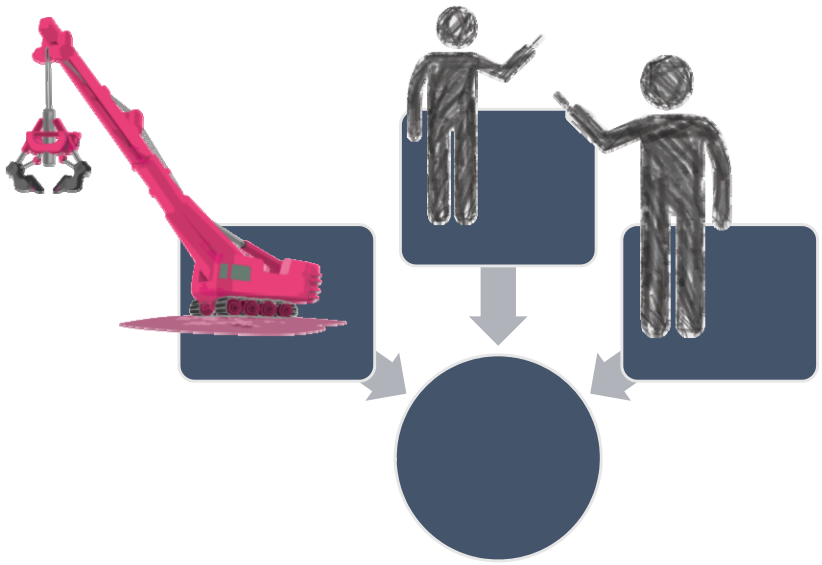
- Activities must be logically sequenced and linked– that is, listed in the order in which they are to be carried out and joined with logic. In particular, a predecessor activity must start or finish before its successor.
  - Logical sequencing promotes a realistic workflow. If logic between activities is missing, program team members can misunderstand one another, especially regarding receivables and deliverables

- Date constraints and lags should be minimized and justified.
  - Constraints interfere with the results of a schedule risk analysis because they prevent activity dates within the schedule from dynamically responding to changed in predecessor dates



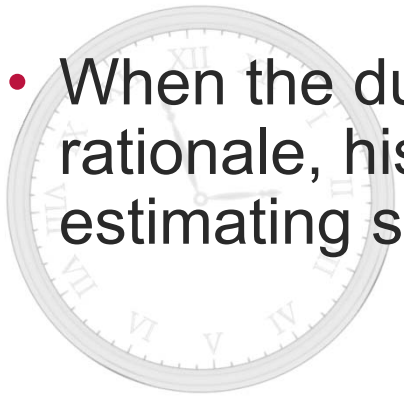
Best Practice 3: Assigning Resources to All Activities

- The schedule should reflect the resources (labor, materials, travel, facilities, equipment, and the like) needed to do the work, whether they will be available when needed, and any funding or time constraints.
  - If the current schedule does not allow insight into the current or projected allocation of resources, then the risk of the program's slipping is significantly increased.
  - Over allocated resources result in inefficiency or program delay from unavailable resources



Best Practice 4: Establishing the Duration of All Activities

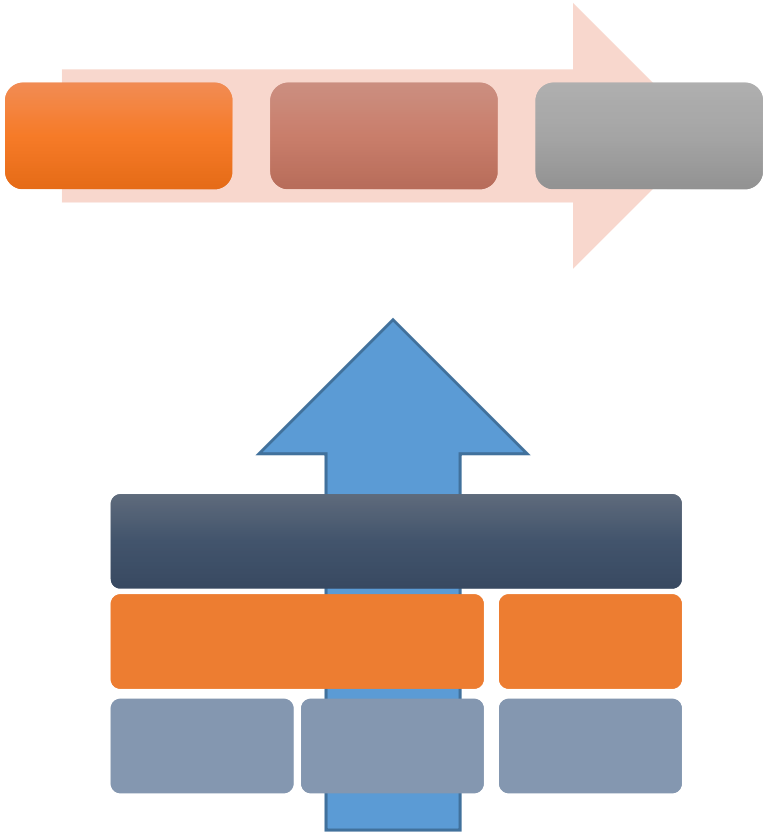
- The schedule should realistically reflect how long each activities will take.
  - If activities are too long, the schedule may not have enough detail for effective progress measurement and reporting
  - If activities are too short, the schedule may be too detailed which may lead to excessive work in maintaining the logic, updating the status of activities and managing the many short-duration activities
- When the duration of each activity is determined, the same rationale, historical data, and assumptions used for cost estimating should be used.




Best Practice 5: Verifying that the Schedule can be Traced Horizontally and Vertically

- The schedule should be *horizontally traceable*, meaning that it should link products and outcomes associated with other sequenced activities. Such links are commonly referred to as “hand-offs” and serve to verify that activities are arranged in the right order for achieving aggregated products or outcomes.

- The schedule should also be *vertically traceable*– that is, varying levels of activities and supporting sub-activities can be traced.



Such mapping or alignment of levels enables different groups to work to the same master schedule

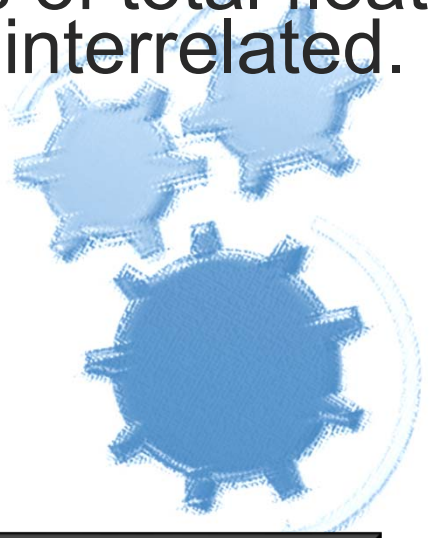
Best Practice 6: Confirming that the Critical Path is Valid

- The schedule should identify the program's critical path–the path of longest duration through the sequence of activities.
- Establishing a valid critical path is necessary for examining the effects of any activity's slipping along this path.
- The program's critical path determines the program's earliest completion date and focuses the team's energy and management's attention on the activities that will lead to the project's success.

Best Practice 7: Ensuring Reasonable Total Float

- The schedule should identify reasonable total float (or slack)–so that the schedule's flexibility can be determined.

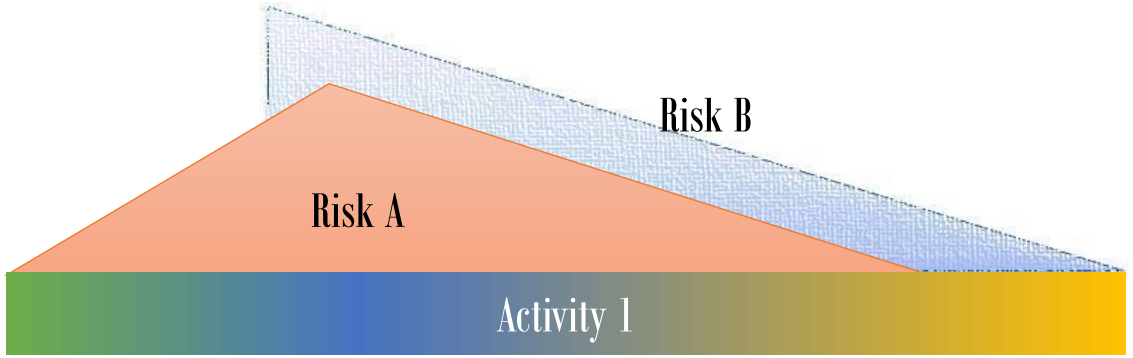
- The sequencing of logic, reasonableness of total float, and the validity of the critical path are all interrelated.



Too little float build in to the schedule may indicate insufficient time to recover from delay without the program's completion date slipping

Best Practice 8: Conducting a Schedule Risk Analysis

- A schedule risk analysis (SRA) predicts the level of confidence in meeting a program's completion date.
- If a schedule risk analysis is not conducted, the following cannot be determined:
  - The likelihood of the program's completion date
  - How much schedule risk contingency is needed to provide an acceptable level of certainty for completion by a specific date
  - Risks most likely to delay the program
  - The path or activities that are most likely to delay the program



Best Practice 9: Updating the Schedule Using Actual Progress and Logic

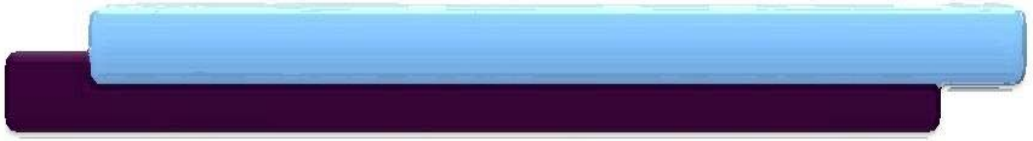
- Progress updates and logic provide a realistic forecast of stat and completion dates for program activities.
- Maintaining the integrity of the schedule logic is necessary to reflect the true status of the program.
- To ensure that the schedule is properly updated, people responsible for the updating should be trained in critical path method scheduling.

If the schedule is not continually monitored to determine when forecasted completion dates differ from planned dates, then it cannot be used to determine whether schedule variances will affect downstream work

Best Practice 10: Maintaining a Baseline Schedule

- A baseline schedule is the basis for managing the program scope, the time period for accomplishing it, and the required resources.

- A corresponding basis document explains the overall approach to the program, defines custom fields in the schedule file, details ground rules and assumptions used in developing the schedule, and justifies constraints, lags, long activity durations, and any other unique features of the schedule.

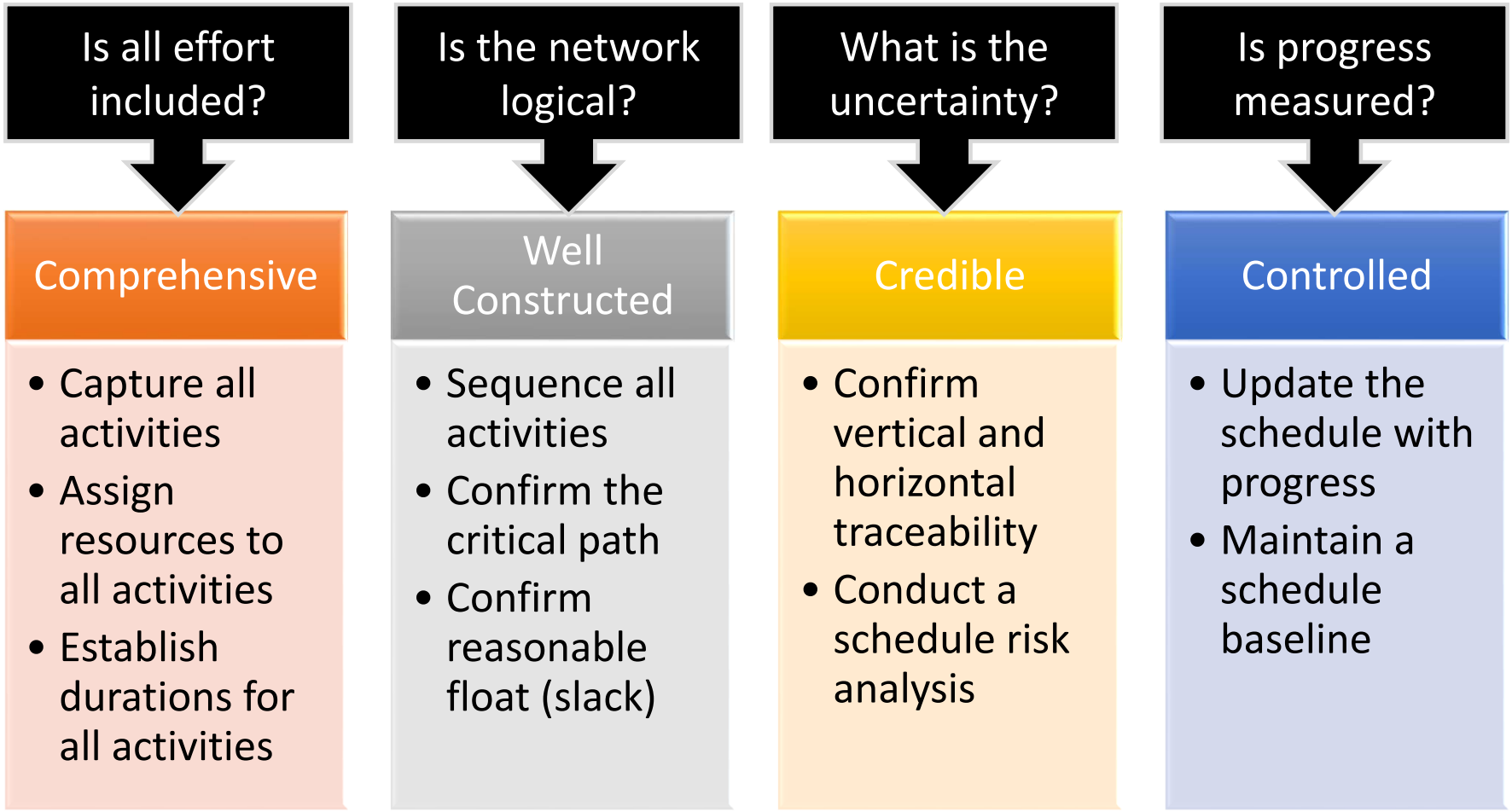


Four Characteristics of a Reliable Schedule

- Four characteristics identified by the GAO Schedule Assessment Guide reflect a reliable schedule:
  - **Comprehensive**: the schedule includes all activities for both the government and its contractors necessary to accomplish a program's objectives as defined in the program's WBS.
  - **Well-Constructed**: all of the schedule's activities are logically sequenced with the most straightforward logic possible.
  - **Credible**: the schedule reflects the order of events necessary to achieve aggregated products or outcomes and data about risks are used to predict a level of confidence in meeting the program's completion date.
  - **Controlled**: trained schedulers update the schedule regularly using actual progress and logic, based on information provided by activity owners, to realistically forecast dates for program activities.

Four Characteristics of a Reliable Schedule

Characteristics and Best Practices



Case Study: Arizona Border Surveillance Technology Plan

Report: GAO-14-368

Testimony: GAO-14-411T

Case Study
Background

- GAO was asked to address the extent to which the Department of Homeland Security's (DHS) Customs and Border Protection (CBP)
  - Developed schedules and life-cycle cost estimates for the plan in accordance with best practices
  - Followed aspects of DHS's acquisition management guidance in managing the Plan's programs and
  - Identified mission benefits and developed performance metrics for surveillance technologies to be deployed under the Plan

The following slides will look at the first point, highlighted in red

Case Study

Background

- In 2005, CBP launched the Secure Board Initiative Network (SBInet)
- In 2010, after spending nearly $1 billion, SBInet was deployed along 53 miles of Arizona's 387-mile border with Mexico
- The program was cancelled in January 2011
  - CBP developed the Arizona Border Surveillance Technology Plan (the Plan) for the remainder of the Arizona border
  - The Plan consists of seven programs (described briefly on the next slide)

Case Study

Background: Seven Programs that make up the Plan

Technology program	Description
Integrated Fixed Towers (IFT)	Camera and radar equipment mounted on stationary towers
Remote Video Surveillance System (RVSS)	Cameras and antennas mounted on towers and buildings
Mobile Surveillance Capability (MSC)	Camera and radar equipment mounted on trucks
Mobile Video Surveillance System (MVSS)	Camera and target illuminator equipment mounted on trucks
Agent Portable Surveillance System (APSS)	Portable surveillance equipment deployable by border patrol agents
Thermal Imaging Devices (TID)	Cameras for dimly-lit and dark areas
Unattended Ground Sensors and Imaging Sensors	Sensors placed in ground to detect, track, and identify humans

Case Study
Results

- Since there was no Integrated Master Schedule for the Plan, GAO examined schedules from the three highest-costing programs (IFT, RVSS, and MSC)
- The following table shows the results of GAO's assessment:

Schedule characteristic	IFT	RVSS	MSC
Comprehensive	Partially	Partially	Partially
Well constructed	Substantially	Partially	Partially
Credible	Partially	Partially	Minimally
Controlled	Partially	Partially	Minimally

Case Study

Results: Comprehensive and Well-Constructed

- Comprehensive
  - IFT and RVSS did not map all activities to a WBS, and MSC did not map any activities to a WBS
  - IFT and RVSS did not include a level of detail expected to conduct adequate oversight of construction work
  - Each schedule had some resources assigned to activities, but no schedule was fully resource loaded

- Well-Constructed
  - IFT had few missing or incorrect logic links, and the critical path was valid
  - RVSS and MSC had no missing or incorrect logic links, but critical paths were not valid
    - Paths were not continuous from status date to finish milestones
  - None of the schedules exhibited reasonable amounts of total float

Case Study

Results: Credible and Controlled

- Credible
  - MSC schedule did not always recalculate key dates when activity durations were greatly extended
  - OTIA performed a risk analysis on IFT and RVSS, but did not include all risks and did not calculate contingency
  - OTIA did not perform a risk analysis on the MSC schedule

- Controlled
  - Each schedule was well maintained, updated periodically by trained schedulers, and contained no out-of-sequence activities
  - MSC schedule contained 13 activities with planned start and finish dates in the past
  - None of the schedules were properly baselined or had associated baseline documentation

Case Study

DHS Response

- CBP officials believed the schedules were generally reliable but agreed they did not fully meet all best practices
- Officials stated each program was to be re-baselined after contract awards and negotiations
  - GAO agreed that re-baselining would help OTIA address some best practices, but would not address all issues
- CBP officials stated an IMS was not necessary because the Plan contains individual acquisition programs as opposed to a plan consisting of seven integrated programs

Case Study

Recommendations

- **Recommendation**: When updating the schedules for the IFT, RVSS, and MSC programs, ensure that scheduling best practices, as outlined in our schedule assessment guide, are applied to the three programs' schedules. (DHS concurred)

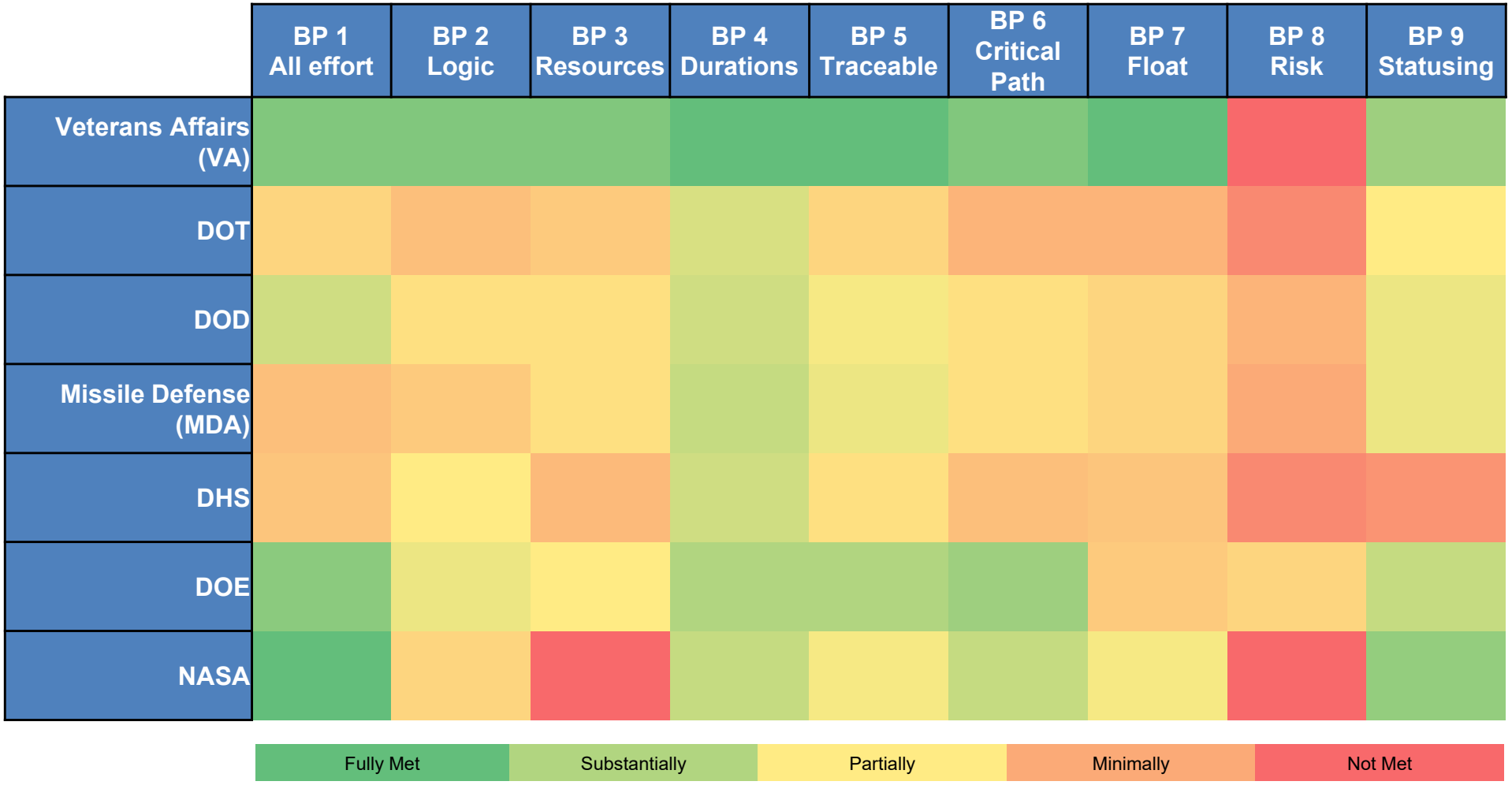
- **Recommendation**: Develop and maintain an Integrated Master Schedule (IMS) for the Plan that is consistent with scheduling best practices.
  - DHS did not concur
  - DHS stated that an IMS "undermines the DHS-approved implementation strategy for the individual programs making up the Plan and that a key element of the Plan has been the disaggregation of technology procurements."

Overall

Overview of the schedule best practices assessment scores from past GAO audits

Best Practices Assessed by GAO

Displayed by Agency



Schedule Assessments

High Level Findings

- In general, government program offices tend to fail to
  - Include all effort in the IMS for the entire program or 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 (e.g., missing relationships and dangling activities)
  - Use constraints and lags moderately to force activities to occur on predetermined dates
  - Document their justification
  - Include activities of long duration that are difficult to objectively status and manage
  - Perform schedule risk analysis
  - 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
  - Miss distinct start and finish milestones.

Back Up Slides

Schedule Assessments

Additional 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
- Program offices resource-load schedules only at the prime and subcontractor levels, believing that resource loading a schedule is overkill
- Government program office IMSs 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.

Schedule Guide Exposure and Final Draft

Examples of changes and additions between the exposure draft (GAO-12-120G) and the final draft

- Process for creating and maintaining reliable schedules
- Consolidation schedules
- Resource loading through external financial systems
- Removed “44-day” rule of thumb for durations
- Discussion of soft constraints and resource calendars
- Effect of calendars on total float and continuous critical paths
- Program and project-level critical paths
- Updated graphics and case studies
- Gap analyses, glossary, EVM, and date constraint appendixes

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