How to Satisfy GAO Schedule Best Practices

By

Dr. Mohamed Hegab, PE, PMP
Executive Vice President

November 2010
How to Satisfy GAO Schedule Best Practices

Copyright © 2010 EyeDeal Tech. All rights reserved.
This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published, and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this section are included on all such copies and derivative works. However, this document itself may not be modified in any way, including by removing the copyright notice or references to The Open Group, without the permission of the copyright owners. This document and the information contained herein is provided on an "AS IS" basis and THE EYEDEAL TECH DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY OWNERSHIP RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

SCHEDULE CRACKER™ is a trademark of EyeDeal Tech.

Published by EyeDeal Tech, November 2010
Any comments relating to the material contained in this document may be submitted to EyeDeal Tech 3943 Irvine Blvd #127, Irvine, Ca 92602, USA or by email to support@schedulecracker.com.
# Table of Contents

## Introduction

Why Do I need it? ................................................................. 4

## GAO Scheduling Best Practices

Schedule Risk Analysis (SRA) ........................................... 5
GAO’s Criteria for Reliable Schedule ................................. 5
GAO’s Criteria vs DCMA 14-point Check ......................... 6

## How Schedule Cracker Helps you with GAO’ Requirements

Capturing all activities ...................................................... 8
Sequencing all activities ................................................... 8
Assigning resources to all activities ................................. 10
Establishing the duration of all activities ......................... 10
Integrating schedule activities horizontally and vertically .... 10
Establishing the critical path for all activities .................... 10
Identifying float between activities .................................... 11
Conducting a schedule risk analysis ................................... 12
Updating the schedule using logic and duration to determine the date .............................................................. 12
References ..................................................................... 13

## About US

Schedule Cracker ............................................................... 14
Author ............................................................................. 15
Contact Us ....................................................................... 15
Introduction

The U.S. Government Accountability Office (GAO) is an independent agency that supports the Congressional efforts by watching and investigating the expenditure of the federal government. The GAO helps the Congress by auditing agency operations to conclude whether federal money are being spent expeditiously and effectively; investigating allegations of extrajudicial and improper activities; validating the compliance of government programs and policies to their objectives; analyzing policies and suggest options for the Congress; and issuance judicial decisions and opinions, such as bid protest rules and reporting. It is known as the “Congressional Watchdog”. As part of GAO’s auditing process, program’s cost and schedule are checked. Schedule auditing is the interest of this white paper. GAO assesses program schedules in relation to 9 “scheduling best practices”.

Why Do I need it?

Being involved in a program that is federally funded, you will be subjected to GAO’s auditing either as an agency representative or contractor and your schedule should meet GAO’s best practices and metrics. In both cases you have to make sure that your schedule is ready for the GAO’s schedule assessment. Understanding the requirement of the GAO metrics and performing them can be a challenge specially since the metrics can be required with each schedule revision.
GAO Scheduling Best Practices

As method for evaluating a program's schedule, GAO is considering schedule risk analysis (SRA) as the best practice to evaluate the program's completion date.

Schedule Risk Analysis (SRA)

SRA is a method of determining the possibility of meeting the program's completion date by performing statistical analysis over the critical and near critical activities as they are most likely to influence the program's completion date. Schedule risk analysis studies the possibility of increasing schedule duration due to a number of issues such as technical issues, lack of expertise, or less resources. Schedule risk analysis checks the consequences of extending the duration of critical or near critical activities on the overall program duration. Delay of a schedule will have financial consequences that can be physical or social. Schedule risk analysis is applied by identifying the three possibilities of optimistic, pessimistic, and most likely for the critical and near critical activities. Under the effect of risk events and expected impact, probabilistic distributions are used to present the uncertainty of the activity duration. Uncertainty can be determined by a number of techniques such as statistical techniques, Monte Carlo simulation, cost growth factor, adjusted expert opinion, risk cube (P-I matrix) method, or risk scoring.

Some data is needed to perform schedule risk analysis. Anticipated risks, the probability of their existence, probability of occurrence and the probability distribution of impact if occurred, and any correlation between activities should be identified. Monte Carlo Simulation is used to create a number of iterations by randomly changing the data variables and calculating the corresponding program duration. A cumulative graph is created to identify the probability to finish the program on time or on a certain date.

GAO's Criteria for Reliable Schedule

Success of governmental programs is part of GAO’s interest. Robust program planning and scheduling are key items to achieve such goal. The schedule is simply represented by the time of occurrence of activities and milestones, their durations, and their relationships. Accordingly, a reliable schedule is needed to deliver a plan for execution of a program, a way to measure progress, and a means to detect possible issues. GAO identified 9 criteria to achieve a reliable schedule:

1. Capturing all activities: As a basic requirement, a program’s schedule should include all activities under the work breakdown structure (WBS) and all critical dates.

2. Sequencing all activities: Activities should be linked with relationships similar to the order it is intended to follow in execution per their successors and predecessors. Constraints, lags, and lead time should be logic and needed.

3. Assigning resources to all activities: Schedules should be resource loaded (with labor, materials, equipment) to make sure of their availability during
How to Satisfy GAO Schedule Best Practices

execution and identify any time or funding constraints.

4. **Establishing the duration of all activities:** Schedules should maintain duration that realistically match the cost estimate’s plan.

5. **Integrating schedule activities horizontally and vertically:** Schedules should use realistic predecessors and successors and should allow concurrent occurrence of unrelated activities. Activity interdependencies should be recognized and logical.

6. **Establishing the critical path for all activities:** With the help of scheduling software, the critical path (longest path) should be identified to check its accuracy and the effect of slippage of program activities on its finish date.

7. **Identifying float between activities:** The free float between related activities should be determined to figure the effect of slippage of activities on its successors. The float should be reasonable.

8. **Conducting a schedule risk analysis:** A schedule risk analysis should be performed to identify the risk of potential delays, the probability of meeting the planned completion date, and the needed schedule contingency to complete the program with a certain confidence level.

9. **Updating the schedule using logic and duration to determine the date:** The logic and actual start and finish dates of activities should be monitored to identify the actual completion date and confirm its compliance with the planned completion date. Logic override and unnecessary constraints should be prevented.

**GAO’s Criteria vs DCMA 14-point Check**

There is some similarity between the GAO criteria and DCMA schedule assessment 14-point check. However, GAO has some additional, more demanding requirements. In the following section, similarities and differences will be better identified with implementation of GAO’s criteria into metrics. A number of statistics are calculated as an input to the check process. These statistics are:

**Total Tasks:** They are all the tasks except tasks that represent summary, subprogram, level of efforts, zero duration, or milestones

**Complete Tasks:** They are the tasks among the “Total Tasks” that are 100% complete and with an actual finish date before the status date.

**Incomplete Tasks:** They are the tasks among the “Total Tasks” that do not have 100% completion and with an actual finish date before the status date.

**Baseline Count:** They are the tasks among the “Total Tasks” that should have been completed before the status date in the original baseline schedule.
How to Satisfy GAO Schedule Best Practices

How Schedule Cracker Helps you with GAO’ Requirements

The previously mentioned criteria require considerable time and effort to calculate through data processing. Schedule Cracker’s rules engine delivers orders of magnitude improvement compared to manual methods of calculating GAO metrics; coupled with the peace of mind of repeatable/consistent reporting. The process takes moments from time of loading the schedule until assessment completion as shown in figure 1 & 2.

Figure 1: Screenshot of the Dynamic Pareto Analysis of Active Metrics

Figure 2: GAO Compliance Module
How to Satisfy GAO Schedule Best Practices

Each of the GAO criteria is met by a number of metrics or solutions.

Capturing all activities

All activities and their associated data elements are presented in the “Schedule Viewer” module. In addition to being a viewer, it is also a powerful filtering tool as it allows custom logical conditions to be built on demand. While the default view is show all, the Schedule Cracker can easily assemble a filter condition an example would be: Show all completed tasks with actual finish before 1/1/2009 and an actual cost > 10000. Furthermore, a graphical navigation pane exists that shows the selected activity as green and displays all its predecessors and successors.

Sequencing all activities

This criterion matches to some DCMA checks.

Leads Checks: The “leads check” is used to detect any leads in the schedule since they may lead to disturbance of the critical path and resources. The “leads check” is performed by identifying any activity where its predecessor has a lead, an “Incomplete Task”, and a “Total Task”. The “leads check” value is calculated as the number of tasks that have a lead. For the “leads check” to be acceptable, its value should be zero.

Lags Checks: The “lags check” is used to check the existence of any lags in the schedule since they may lead to disturbance of the critical path.
The “lags check” is performed by identifying any activity where its predecessor a lag, an “Incomplete Task”, and a “Total Task”. The “lags check” value is calculated as the number of tasks that have a lag divided by the number of incomplete tasks. For the “lags check” to be acceptable, its value should not exceed 5%.

**Relationship Type Checks:** The “relationship type check” is used to check the type of the relationship between the task and its predecessor assuming that most activities are tied by Finish to Start (FS) relationship and a much lesser percentage of tasks are linked by Finish to Finish (FF), Start to Start (SS), or Start to Finish (SF) relationships. The “relationship type check” is performed by identifying the relationship type of any task that has a predecessor, an “Incomplete Task”, and a “Total Task”. The “relationship type check” value is calculated as the number of tasks that has FS, FF or SS relationships. The “relationship type check” percentage is calculated as the number of tasks that have FS, FF or SS relationships divided by the number of incomplete tasks. For the “relationship type check” to be acceptable, the percentage of tasks with FS relationships should not be less than 90% and tasks with SF relationships its value should not exceed 0%.

**Hard Constraints Checks:** The “hard constraints check” is used to identify any activity that has a hard constraint (such as Must-Finish-On, Must-Start-On, Start-No-Later-Than, and Finish-No-Later-Than) because hard constraints do not allow the logic to drive the schedule. The “hard constraints check” is performed by identifying any task that is an “Incomplete Task”, “Total Task”, and has a hard constraint. The “hard constraints check” value is calculated as the number of activities with hard constraint divided by the number of incomplete tasks. For the “hard constraints check” to be acceptable, its value should not exceed 5%.

**Missed Task Checks:** The “missed task check” is used to identify any activity that had a scheduled finish date before the statused date but did not finish or finished after the baseline finish date because it shows how the updated schedule is in compliance with the baseline schedule. The “missed task check” is performed by identifying any task that is a “Total Task”, and has a scheduled finish before the statused date and an actual finish or forecasted finish date after the baseline scheduled date. The “missed task check” value is calculated as the number of activities that are missed task (has a scheduled finish before the statused date and an actual finish or forecasted finish date after the baseline scheduled date) cost divided by the baseline count. For the “missed task check” to be acceptable, its value should not exceed 5%.
**Assigning resources to all activities**

This criterion is matching to a DCMA check.

**Resources Checks:** The “resources check” is used to identify any activity that does not have resources or cost. The “resources check” is performed by identifying any task that is an “Incomplete Task”, “Total Task”, and does not have resources or cost. The “resources check” value is calculated as the number of activities that does not have resources or cost divided by the number of incomplete tasks. For the “resources check” to be acceptable, its value should not exceed 0%.

**Establishing the duration of all activities**

This criterion is matching to a DCMA check in addition to more requirements.

**High Duration Checks:** The “high duration check” is used to identify any activity that has an original duration more than 44 working days (2 month) since high duration may indicate the need to further breakdown to enhance the cost and task control. The “high duration check” is performed by identifying any task that is an “Incomplete Task”, “Total Task”, and has an original duration exceeding 44 working days. The “high duration check” value is calculated as the number of activities that has high duration (more than 44 working days) divided by the number of incomplete tasks. For the “high duration check” to be acceptable, its value should not exceed 5%.

**Activities with Zero Duration:** this metric identifies activities that are not milestones but have zero target duration

**Integrating schedule activities horizontally and vertically**

This criterion is not required as a part of the DCMA’s checks. It is implemented using the following metrics. The vertical integration of activities can be checked using the “Schedule Viewer” window.

**Activities with No Successor:** this metric identifies activities that have no successors in the program's schedule

**Activities with No Predecessor:** this metric identifies activities that have no predecessors in the program's schedule

**Establishing the critical path for all activities**

This criterion is matching to a DCMA check in addition to more requirements.

**Critical Path Test:** The “critical path test” is used to assess the integrity of the schedule specially the critical path. It is one of the two trip wires that are required by the OSD (Office of Secretary of defense). The “critical
path test” is performed by adding an intentional delay (600 working days) to the remaining duration of a critical task and check if the program completion date is delayed by a proportional duration (600 working days). By adding such delay, any missing predecessor or successor will lead to mismatch between the program overall delay and the intentional one. The “critical path test” will be passed if there is a matching between the program completion delay and the intentional added duration.

**Critical Path Length Index (CPLI):** The critical path length index (CPLI) is used to assess if the program finish date is realistic or not. It is one of the two trip wires that are required by the OSD (office of Secretary of defense). The CPLI is calculated by adding the length of the critical path to the total float of the latest activity and divide the summation by the length of the critical path. For the CPLI to be acceptable, its value should not exceed 5%.

**Critical Activities:** This metric identifies critical activities in the program's schedule

**Identifying float between activities**

This criterion is matching to a DCMA check in addition to more requirements.

**High Float Checks:** The “high float check” is used to identify any activity that has a total float more than 44 working days (2 month) since high float may result from logically inaccurate or missing relationships. The “high float check” is performed by identifying any task that is an “Incomplete Task”, “Total Task”, and has a total float exceeding 44 working days. The “high float check” value is calculated as the number of activities with high float (more than 44 working days) divided by the number of incomplete tasks. For the “high float check” to be acceptable, its value should not exceed 5%.

**Negative Float Checks:** The “negative float check” is used to identify any activity with a total float less than zero because negative float indicate delayed tasks that needs mitigation and/or explanation. The “negative float check” is performed by identifying any task that is an “Incomplete Task”, “Total Task”, and has a total float less than zero. The “negative float check” value is calculated as the number of activities that has negative float (less than zero) divided by the number of incomplete tasks. For the “negative float check” to be acceptable, its value should not exceed 0%.

**Non Critical Activities with Negative or Zero Free Float:** this metric identifies non-critical activities with zero or negative float in the program's schedule
Conducting a schedule risk analysis

A schedule risk analysis should be performed using a software that performs Monte Carlo simulation on schedule. Schedule risk analysis is not required a part of the DCMA checks. Schedule Cracker provides metrics that can help in performing the schedule risk analysis:

**Critical and Near Critical Activities that have a Potential for Delay:** This metric identifies critical and near critical Activities that can be delayed because of their predecessors

**High Dependency Critical & Near Critical Activities:** this metric identifies critical and near Critical Activities that can cause other activities to delay

Updating the schedule using logic and duration to determine the date

This criterion is matching to a DCMA check in addition to more requirements.

**Logic Checks:** The “logic check” is used to identify any activity that is missing a successor or predecessor or both. As a rule of thumb in scheduling, all activities have to be tied with at least one predecessor and one successor. This check does not confirm the correctness of the link which has to be verified manually by the user. The “logic check” is performed by identifying any task that is an “Incomplete Task”, “Total Task”, and missing a successor and/or a predecessor. The “logic check” value is calculated as the number of activities that are missing a logic divided by the number of incomplete tasks. For the “logic check” to be acceptable, its value should not exceed 5%.

**Invalid Dates Checks:** The “invalid dates check” is used to identify any activity that had a scheduled start/finish before the statused date and an actual start/finish date after the statused date because you cannot predict the actual completion date in the future. The “invalid dates check” is performed by identifying any task that is a “Total Task”, and has a scheduled start/finish before the statused date and an actual start/finish date after the statused date. The “invalid dates check” value is calculated as the number of activities that has invalid dates (an actual start/finish date after the statused date while the scheduled start/finish was before the statused date). For the “invalid dates check” to be acceptable, its value should not exceed 0%.

**Baseline Execution Index (BEI):** The baseline execution index (BEI) is used to assess the number of completed activities to date with respect to the planned to be completed in the baseline. It is one of the two Trip Wires that are required by the OSD (office of Secretary of defense). The BEI is calculated by summation of completed tasks (any task that is a “Total Task”, and has an actual finish date before the statused date) and dividing it by the baseline count (any task that is a “Total Task”, and has
How to Satisfy GAO Schedule Best Practices

an forecasted finish date before the statused date). For the BEI to be acceptable, its value should not get below 95%.

Out of Sequence Activities: Activities that are out of sequence in the program's schedule when comparing it to the base program's schedule

References


How to Satisfy GAO Schedule Best Practices

About US

EyeDeal Tech, inc. is in the Information Technology business since 2003. After success in the hardware sector, it added the software development starting with Schedule Cracker.

Schedule Cracker

Schedule Cracker ™ is an enterprise class Business Intelligence tool for Program Management right at your desktop. Providing deep analysis and visualization of a program’s CPM schedule through interactive dashboards and a library of over 200 analytical metrics. Leveraging the latest technology and standards for software development to fully comply with the DCMA, GAO, and EVM’s ANSI 748 standards. Schedule Cracker patent pending procedures analyze and compare program schedules for alerts, trends the program’s performance over multiple schedule revisions, forecasts future performance, and performs full earned value analysis. It features:

- Schedule and comparison analysis to identify characteristics and anomalies.
- Evaluate Schedule Compliance with DCMA, GAO, and Earned Value Analysis for ANSI 748.
- Tornado and Pareto Dashboards for striking visualization of analysis results.
- Alerts for activities that require attention (patent pending procedure).
- Trend analysis and forecasting of metrics across the multiple schedule revisions (patent pending procedure).
- Pre-built reports that cover schedule wide as well as activity centric analysis with support for export to multiple formats.
- State of the art Business Intelligence focused user interface presented through a Ribbon design that supports advanced Drill-Down, Filtering, and Grouping.
- Completely standalone application with self-contained capabilities that do not require pre-existing installations of Scheduling or Spreadsheet software.

Schedule Cracker has accurately analyzed and trended projects with schedules containing >10000 activities. It is the trusted analytical source for several multi-year projects, with budgets in excess of 100M$. Some of our clients include Water Metropolitan District, Los Angeles School District, Sufflok and Wilson construction.
How to Satisfy GAO Schedule Best Practices

Author

Dr. Hegab has over 18 years of diverse range of experience managing the project controls and claims on public, commercial, and construction projects. He has particular extensive expertise in project scheduling, claim analysis, negotiations, and resolution, cost estimating and controls. He has expertise in productivity analysis and improvement, and reengineering business processes.

He taught project management, scheduling, cost estimating, labor productivity, and contract and specifications several times at California State University Northridge, and North Dakota State University.

Dr. Hegab has authored several innovative technical papers that been published in prestigious ASCE journals such as:

- Developing a Complexity Measure for Project Schedules
- Decision Support System for Commencement Delay Claims
- Delay Time Analysis in Microtunneling Projects.
- Contractual Risk Identification and Mitigation in Microtunneling and Trenchless Technology Projects

Contact Us

For more information or questions, please contact us at

EyeDeal Tech
3943 Irvine Blvd, #127
Irvine, Ca 92602

800-958-8647 or +1 949-954-2742

www.ScheduleCracker.com