

---

# The GAO and Accountability in Technology Programs

---



**June 2010**

---

- I. OVERVIEW OF THE U.S. GOVERNMENT**
  - II. THE CONGRESS**
    - A. Organization**
    - B. The Legislative Process**
    - C. The 111<sup>th</sup> Congress**
  - III. The U.S. Government Accountability Office**
    - A. Organization**
    - B. Accountability in Technology Development**
-

# I. OVERVIEW OF THE U.S. GOVERNMENT

## A. The Three Branches

1. Executive branch: Enforces laws
2. Legislative branch: Makes laws
3. Judicial branch: Interprets laws

## B. Checks and Balances

1. Congress: Appropriations, oversight, filibuster
2. Executive: Privileges, foreign policy
3. Judicial: Jurisdiction & The Courts, nomination & confirmation

## C. Modus operandi: Government accountability and transparency

## II. THE CONGRESS

### A. Organization

1. Senate: 100, 2 from each state: advise and consent
2. House: 435, from districts based on populations: power of the purse
3. Committees with jurisdictions. Some committees are more important than others: Appropriations, Budget, Ways and Means, Armed Services, etc.
4. Senate confirmation hearings of federal judges and executive officials, House's "power of the purse"

## B. The Legislative Process

- Legislation (bill) to take place in both houses
- Conference resolves differences between Senate's and House's bills
- Conference report sent to the President
- If signed, bill becomes law; if not,
  - If vetoed, 2/3 votes needed to override in both houses
  - If not vetoed, law takes effect after 10 days if Congress is in session; if Congress has adjourned, "pocket veto"!
- Give-and-take between lawmakers during drafting/markup or conference of legislation
- Constituents' interests and professional lobby weigh heavily in deliberation and resultant legislation

## C. The 111<sup>th</sup> Congress:

- House: 435 members: 255 Democrats; 177 Republicans; vacancies: 3; majority needed to pass a bill: 218 ayes
- Senate: 100 senators; 41 Republicans; 57 Democrats, 2 Independent; majority: 51, VP votes if tied 50-50! Majority decides agenda
- Compromise essential to pass bills
- An administration's agenda depends on the composition of the Congress
- Some legislations become laws with 1 vote difference.

### **III. The Government Accountability Office (GAO)**

#### **A. Organization:**

- **Mission: The U.S. GAO is an independent agency in the legislative branch of the federal government. It exists to help Congress improve the performance and accountability of the federal government for the benefit of the American people.**
- **On July 13, 2004, law was passed changing its name from the General Accounting Office to the Government Accountability Office.**
- **Most GAO's work is done at the request of committees or members, mandated by public laws or committee reports. GAO also undertakes its own research and development work under Comptroller General's authority.**

- **Core Values:**
    - **Accountability: Helping the Congress oversee federal programs and operations to ensure effective and efficient government**
    - **Integrity: Ensuring our work is professional, objective, fact-based, nonpartisan, non-ideological, fair and balanced**
    - **Reliability: Providing high-quality information that is timely, accurate, useful, clear, and candid**
  - **GAO staff issue reports, brief Members of Congress and their staff, and testify at congressional hearings**
-

- **A GAO audit normally assesses the business case:**
  - **Requirements management**
  - **Technology maturity**
  - **Realistic cost estimates**
  - **Risks management, and**
  - **Stability of funding**
  
- **In sum, GAO's work:**
  - **Oversight: Ensuring performance**
  - **Insight: Deep knowledge of programs and operations**
  - **Foresight: High-risk issues, emerging challenges**

## B. Accountability in Technology Programs

- Audits of defense acquisition programs involve assessment of science and technology developments
- The focus is on applied technology being implemented in federal computing and information systems
- Accountability in technology development is assessed through maturity, or technology readiness levels (TRLs)
- For software developments and acquisitions, the framework to assess maturity is the Capability Maturity Model (CMM)
- Both frameworks emphasize tests and evaluations.

## TRLs and CMM

- TRL framework was developed at NASA in 1990s with the focus on quality control of space systems, especially in hardware qualifications
- DARPA adopted and refined the framework for both hardware and software
- In general, TRLs are structured framework for quality control, adopting common sense approaches such as Total Quality Management
- CMM framework can be characterized as the model for software quality control. It is developed by CMU's Software Engineering Institute (SEI) for the DoD. It is now integrated with system engineering approaches.

## Technology Readiness Levels:

- 1. Basic principles observed and reported:** Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology basic's properties.
- 2. Technology concept and/or application formulated:** Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative, and there is no proof or detailed analysis to support the assumptions. Examples are limited to analytical studies.
- 3. Analytical and experimental critical functions and/or characteristic proof of concept:** Active research and development are initiated, which include analytical and laboratory studies to physically validate analytical predictions of separate technology elements. Examples include components that are not yet integrated or representative.

## Technology Readiness Levels:

4. **Component and/or breadboard validation in laboratory environments:** Basic technology components are integrated to establish that they will work together. This is a relatively low fidelity compared to the eventual system. Examples include integrating *ad hoc* hardware in the laboratory.
  
5. **Component and/or breadboard validation in relevant environments:** Fidelity of breadboard technology increases significantly. The basic technology components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include high fidelity integration of components in a laboratory.
  
6. **System/subsystem model or prototype demonstration in a relevant environment:** Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment, which represents a major step up in the technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory or simulated operational environment.

## Technology Readiness Levels:

7. **System prototype demonstration in an operational environment:** Prototype is near or at planned operational system. This is a major step up from TRL 6 and requires demonstrating an actual system prototype in an operational environment such as an aircraft, vehicle, or in space. Examples include testing the prototype in a test-bed aircraft.
8. **Actual system completed and “flight qualified” through test and demonstration:** Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL is the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to see if it meets design specifications
9. **Actual system “flight proven” through successful mission operations:** Actual application of the technology in its final form and under mission conditions such as those encountered in operational test and evaluation. In almost all cases, this is the end of the bug-fixing aspect of true system development. Examples include using the system in operational mission conditions.

## Capability Maturity Model (CMM):

- **Developed by SEI for software quality control**
- **Establish a 5-level maturity framework in software development and acquisition**
- **Integrating with system engineering practices, the model is currently known as CMM-I**
  - **Level 0: Ad-hoc, incomplete**
  - **Level 1: Performed**
  - **Level 2: Managed**
  - **Level 3: Defined**
  - **Level 4: Quantitatively managed**
  - **Level 5: Optimizing**
- **Each level has its own goals and practices**
- **Emphasis is in process management**

## Accountability in Technology Development:

- **Focus on the TRLs and risk reduction programs**
- **Tests and evaluations form the basis of TRL designation and risk management**
- **Technology maturity may be a component of project risks, i.e., schedule delay, technical challenges and cost overrun**
- **Technical risks could be the basis for recommendation to terminate or restructure programs, e.g., need breakthroughs in some discipline or incremental progress is too costly**
- **The GAO proposes, Congress disposes!**