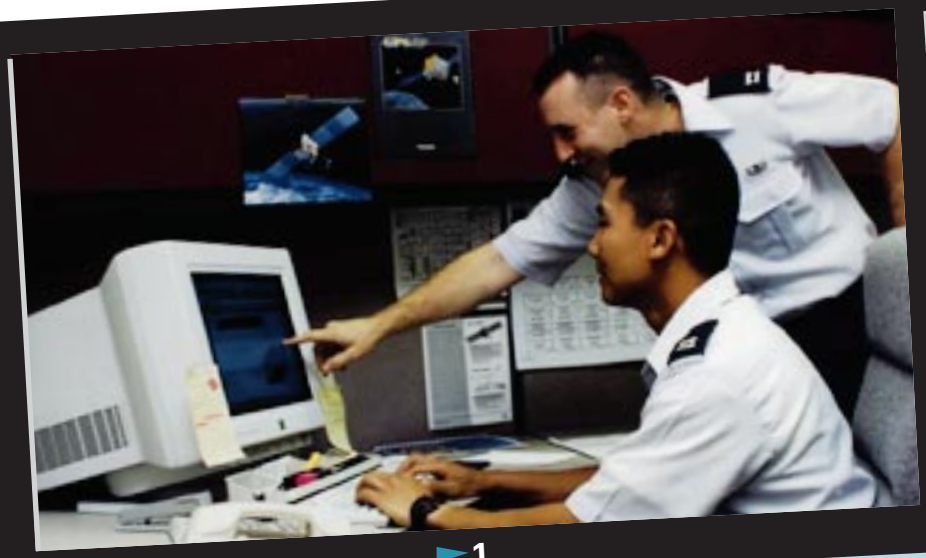
NAVSTAR GEMS Project — A Total Digital Environment Success Story

Paper-Driven Environment for Acquisition Programs a Relic of the Past

LON MEHLMAN



►1

►2

The Global Positioning System (GPS) Engineering Management System (GEMS), currently under development by the NAVSTAR GPS Joint Program Office (JPO) is an innovative approach to JPO business process automation that combines the DoD's Joint Continuous Acquisition and Life Cycle Support (JCALS) system, best-of-breed industry standard Commercial Off-the-Shelf (COTS) software and hardware, and electronic delivery and access to all unclassified program data to the JPO.

The project began in early 1993 as a means to develop an information infrastructure that would support three primary DoD initiatives:

- **Integrated Weapons Systems Management (IWSM)** – an all-encompassing, cradle-to-grave weapon system management concept.
- **Acquisition Reform** – a newer philosophy for weapon system procurement that emphasizes government *insight* into contractor processes rather than *oversight*.[1]
- **Digital Acquisition and Operations Across DoD by 2002** – DoD's initiative to move forward to a fully digital environment in all acquisition program and support offices.[2]

The JPO, by implementing an electronic link called CITIS (Contractor Integrated Technical Information Service) for all prime contractors who participate in GPS JPO programs, established an electronic link between its GEMS and the information systems used by GPS contractors. CITIS also includes the use of standard data formats, the GEMS shared data service client software, GEMS workstation client software, and other mutually agreed-to COTS software tools.

After developing program data (test reports, engineering drawings, schedules, and other documents), GPS contractors then make that data available for viewing or deliver it into the JPO's Reference Library via CITIS.

The Reference Library is a shared electronic library that maintains version control, access control, and status of the data. Once the JPO receives the data, the JPO Integrated Product Team (IPT) members start the coordination of the documents electronically by routing pro-

Mehlman is a Senior Computer Scientist with Computer Sciences Corporation, Moorestown, N.J. His career experience includes over 15 years in the Information Technology (IT) industry. Mehlman holds B.A. degrees in Economics/Computer Science and Sociology from the University of California at Los Angeles; and an M.B.A. from Pepperdyne University.

U.S. Air Force photos

1 Air Force Captains Andy Pham (seated) and Mike Swart review an Engineering Change Proposal (ECP) online in GEMS.

2 Air Force Maj. John Morris (seated), Program Manager, Current Satellites, and Charlie Golden, Deputy Program Manager, Block IIF use GEMS to compare engineering data.

3 The NAVSTAR GPS Block IIF Integrated Product Team (IPT).

gram data through the JPO via the JCALS Workflow Manager.

Through this process, the JPO achieved electronic delivery of data to and from its GPS contractors in a *totally paperless, digital environment.*

A Brief History

The NAVSTAR GPS JPO is a joint-Service, multi-national organization with over 375 personnel. The office develops, acquires, and sustains a 24-satellite constellation, a worldwide satellite control network, over 80,000 receiver systems, and a nuclear detonation detection system. Designated a priority DoD force enhancement program, the system provides the capability to precisely determine position, velocity, and time, and to pinpoint nuclear events.

The JPO is physically located at four primary sites: Los Angeles AFB, Calif.; Peterson AFB, Colo.; Robins AFB, Ga.; and Patrick AFB, Fla.

In mid-1992, the GPS JPO faced a major problem. At that time, the 375 users comprising the program office used numerous PC-based applications to accomplish various tasks. They also shared printers through serial data switch boxes.

Computer support consisted of several people transgressing the building all day in a futile attempt to "standardize" the software on users' systems and keep the various printers and printer interfaces operational. Systems support was becoming exceedingly difficult, and in fact was spiraling hopelessly out of control.

End-users would access a myriad of various mainframe applications to accomplish their job functions. Although several proprietary systems hosted on proprietary hardware and operating systems were in place (IBMs VAXs, WANGs, HP 3000s, etc.), each system and application was its own "island of information." As a result, even though a physical network was in place, no communication existed between systems. Because users could not send data from one system to other systems or other users, they had no option other than continuing to use paper.

At the same time, the program office continued generating thousands of pages of paper-based documents and information daily. Air Force leadership, anxious to implement Acquisition Reform initiatives, pressed the leadership of all its program offices to introduce cross-functional IPTs. This created the need for information sharing among geographically dispersed individuals, the need to open new lines of communication, and the requirement for greater and faster access to all program data.

Where Are We Headed?

To document and chart the progress of the GEMS project, the IPT established firm goals and objectives. Its primary objective, however, remained redesign of the GPS JPO's information systems infrastructure to directly support four critical concepts:

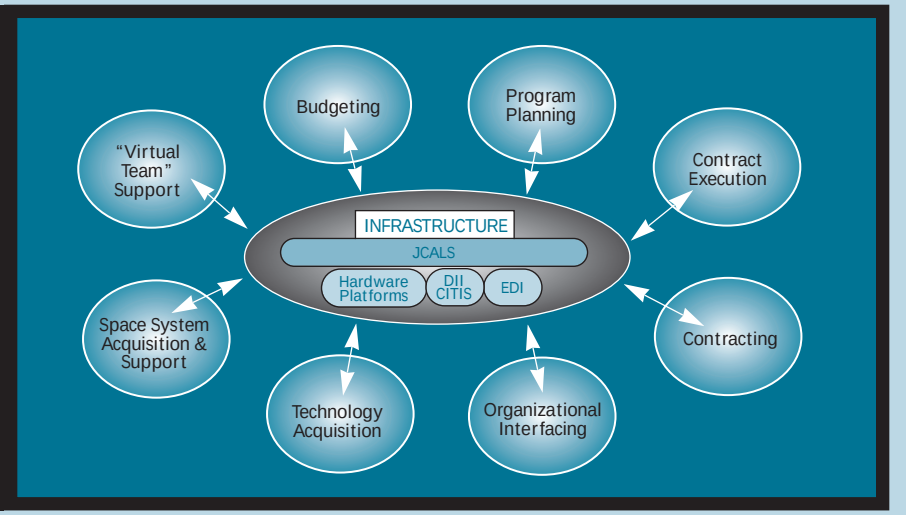


FIGURE 1. Business Processes and the GEMS Project

- IWSM
- Integrated Product Development
- Concurrent Engineering
- Acquisition Reform

All of these concepts, the team believed, were critical to the seamless integration of JPO business processes that could span across the program office and its contractors.

The GPS Block IIF Program, responsible for the procurement of the next generation of GPS satellites, foresaw the critical need for GEMS and fully supported GEMS objectives.

Air Force Lt. Col. Al Moseley, the GPS Block IIF Program Manager, stated, "The Block IIF Program would be the first IPT in GPS, and one of the first in the Air Force and the DoD, to implement a paperless system to meet program and acquisition reform objectives."

Implementation for GPS Block IIF

The GPS JPO implemented its GEMS Information Systems infrastructure in a modular fashion, one process at a time, and rolled it out incrementally to each IPT within GPS. Over the past year, GEMS expanded from a pilot process to receive and review Engineering Change Proposals electronically, to one that now allows users to perform all configuration and data management online, and integrate the cost and schedule management process (Figure 1).

The GEMS configuration and data management tools integrate and automate the JPO data management process. By automating the JPO data management process, users gain access to valuable data management tools capable of generating AF Forms 585 and AF Forms 1423; conducting data calls; conducting data scrubs; and tracking all Contract Data Requirement Lists (CDRL) under review. Moreover, by extracting the required data from the GEMS database, the tools make it easier to board documents at the JPO Configuration Control Board and report on data metrics.

Acquisition Reform, which encompasses reengineering of many acquisition management processes and procedures, calls for a reduction of the number of Contract Data Requirements Lists (CDRL) for a program. One of the management principles of the IIF program is electronic access to all unclassified program data. The GEMS data management tools, originally used to determine which CDRLs the JPO placed on a contract, now help the JPO determine the specific program data generated by its contractors for which it requires electronic access via GEMS/CITIS.

The use of GEMS allowed the GPS Block IIF program to reduce the number of CDRLs placed on contract *from 339 to 3* (Figure 2).

The GEMS integrated cost and schedule management tools allow the JPO IPT leads to receive Electronic Data Interchange (EDI) transactions over the CITIS link for cost and schedule data. This data can then be tracked and analyzed from a user's workstation without redundant data entry. Progress on JPO contracts can be viewed from both an individual IPT's perspective or "rolled-up" to give a JPO-wide perspective.

Benefits

GEMS allows the GPS Block IIF and related programs to immediately begin doing things *better, faster,* and *cheaper.* In terms of the quality of JPO business processes, measurable improvements have been noted in the following areas:

Shortening the Process Cycle. Prior to GEMS, the processing cycle for authentication of a system specification was 18 to 24 months; the new authentication process is now six months. The reasons for most delays can be immediately detected via the workflow and corrective action taken.

Standardizing JPO Processes. The prior, paper-based JPO processes varied greatly; now the JPO documents most JPO processes, not only in Operating Instructions, but also in GEMS workflow templates. The workflow templates show the proper routing of documents and tasks to the proper offices for each type of process. When action is required on an electronically delivered document, an individual in the office of primary responsibility can select the appropriate workflow process template for a given function, make any necessary adjustments, start a "job," and accurately track the status of the document.

Empowered Team Orientation. The reengineered Block IIF IPT business processes use GEMS. This results in a largely matrixed organization, grouped by IPTs, where each team is responsible for a product and given sufficient decision-making authority. In the old system, JPO employees circulated documents among functional departments. Now, cross-functional project teams handle documents, and the JPO business processes are very well defined and easier to manage.

Facilitation of "Process Change." GEMS paved the way for the creation of "virtual teams" that consist of contractor as well as IIF IPT members working side-by-side in the contractor's plant and in multiple locations. Users quickly communicate issues throughout the group via the infrastructure.

An important byproduct of this enhanced communication is that the organizational culture has become much more receptive to change, and information technology provides the necessary channels to disseminate information and facilitate change.

Stable Configuration Management. The heart of the GEMS system is the Reference Library, which holds most of the GPS program data. Catalogued by several factors (project, organization, type, subtype, date, etc.), the Reference Library allows users easy search and retrieval. In addition, the archive feature of the Reference Library ensures safe, long-term storage of all program data.

Since the Reference Library is the single location for current copies of all program data, multiple versions of documents in circulation is no longer a problem. Authorized individuals gain fast access to the latest version of a document, including updates, from one centralized location.

Flexible Implementation and Usage. The nature of GPS JPO business forces GPS IIF team members to conduct business in many places other than their offices. The wide area network and the CITIS will permit users to view the same data from an equipped contractor's facility or remote JPO office location.

Based on their account privileges, these users retain the same capabilities as if they were sitting in their home office. Because of these capabilities, collocated IIF team members in the contractor's plant are achieving unprecedented partnerships.

Management *Insight* vs. *Oversight*. The flexibility of GEMS permits IIF IPT leads to task any GEMS user no matter where they are physically located. GEMS makes all the necessary tools and data readily available for all users to accomplish their work, even when they are not in the home office. The IIF IPT leads have the same insight into job progress as if they were right down the hall.

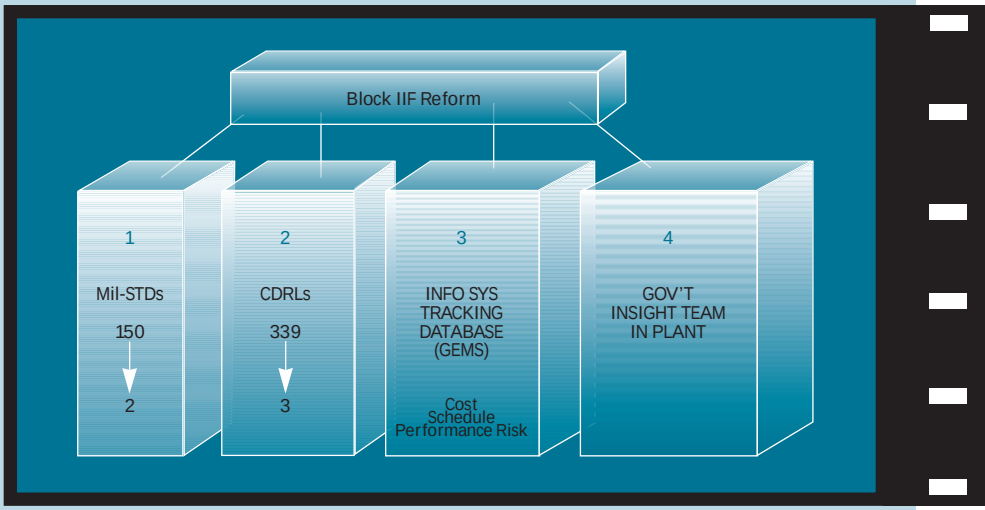


FIGURE 2. GEMS Impact on IIF Program

Authenticating a Block IIF Specification

Authenticating a specification is the process of reviewing the specification for accuracy and completeness by the government and contractor's engineering teams.

An example of how GEMS is streamlining GPS operations is the authentication of the GPS Block IIF System Specification for the new GPS Block IIF satellite. Serving as the technical backbone of the IIF program, this document is the starting point for thousands of derived requirements.

Before GEMS, the authentication process has always been long and costly. Typically, engineers passed paper copies of the specification from one engineer to the next. To stay on top of the process, they continually coordinated comments, scheduled meetings, and checked status. However, this created duplication of effort in that different groups of engineers would review issues that others had already resolved.

Just the cost for reproduction of the document would run into the thousands of dollars before approval of even a draft set of system specifications.

Because of this inability to track and manage the review process, the paper-based method of authenticating system specifications would normally take one to two years after contract award.

Now, using GEMS, the reengineered process is significantly streamlined. Distribution to the entire GPS engineering team is virtually immediate. As soon as users input comments into GEMS, all the reviewers can see the comments on a system specification document at once.

In addition, workflows allow for the management and tracking of the document through the review cycle. GEMS automatically notifies key reviewers if their input is overdue. This keeps the authentication review running smoothly.

Review managers no longer need to sit down with stacks of the same document, note everyone's comments in the margins, and then try to consolidate them. Managers can now review, consolidate, approve, and transmit the results back to the contractor for incorporation.

Further, the streamlined process using GEMS allows the GPS Block IIF IPT to authenticate the IIF system specification six months after contract award. The time savings not only saves substantial money, but also gives the government, as well as contractors, a solid baseline for building the IIF program much sooner than would have been possible with the paper-based process. This, in

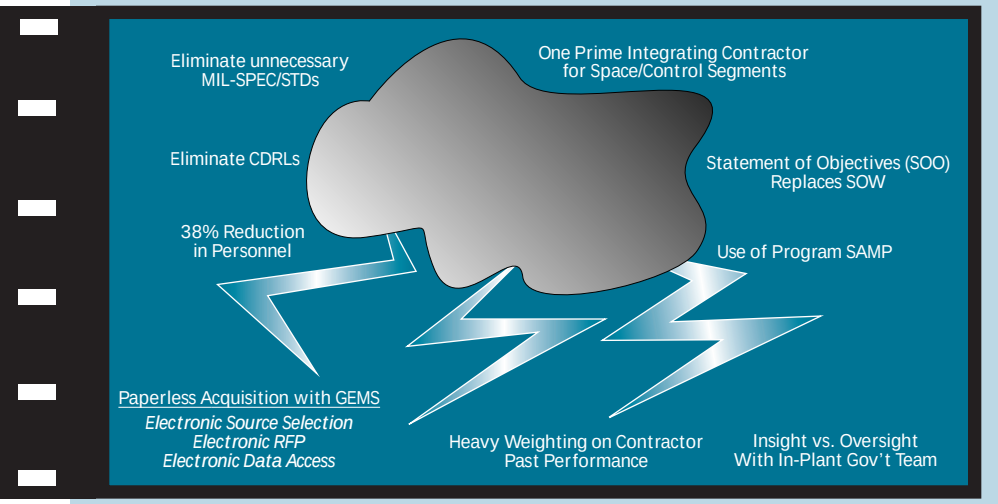


FIGURE 3. GPS IIF and SAF/AQ Lightning Bolts

turn, will help prevent requirements creep, which may save the government even more money in the future by preventing cost overruns.

Lessons Learned

A key factor in the success of the GEMS project was senior management commitment. This is a well-documented success factor for any program that requires cultural change.

Another key success factor was user involvement in the early stages of the project, which helped ensure acceptance of the system.

To ensure clear, consistent communication, a program or project office should eliminate variations in the desktop computer environment to the fullest extent possible. This will accelerate rollout and training, and greatly reduce the burden on the system help desk.

After a program or project office completes design and development of new systems and processes, management should resist the desire to roll out the new systems too quickly for instant payback. A well-managed rollout to individual functional groups will allow for better and more targeted training and will contribute to a smoother implementation.

Implementing electronic access to program data creates several issues related to the "ownership" of program data and who maintains the data of record. For the IIF program, this was resolved by the concept of a shared data environment between the contractor and the program office databases. Essentially, government as well as contractor IPT members can view data in each database. IPT members can also easily transfer data to be retained by the program office from the contractor's database to the GEMS Reference Library via the electronic link.

Credit also belongs with the implementation methodology: System development and deployment should not be implemented piecemeal during the process reengineering effort (risky integration), nor a monolithic, all-at-once approach (too long to see results), but instead implemented in a modular, layered, bottom-up approach to minimize risk exposure and maximize flexibility.

Filling the Gap

The GEMS-based enterprise infrastructure fills the gap between ordinary office automation and the automation of JPO business processes. Using the DoD's JCALS infrastructure allowed the IPTs of the NAVSTAR GPS JPO to concentrate on deploying modular, process-based applications that can share enterprise data. Unlike systems that do not take advantage of CALS and industry standards, GEMS places no constraints on data reuse, the longevity of data, or the amount or types of data (records, documents or graphics) the system can manage, route, and warehouse. Thus, the organization retains its investment in applications, business processes, and data.

Because the GEMS business process applications are developed on DoD's JCALS infrastructure, are modular, and use CALS and industry standard data formats, the GPS JPO can easily update the applications and process workflows as it continuously improves its business processes. In addition, the GPS JPO can customize and deploy the applications to other System Program Offices that use the JCALS infrastructure.

Further, GEMS has allowed the GPS Block IIF program and the GPS JPO to immediately implement Acquisition Reform initiatives by permitting fast, timely access to all unclassified program data.

Because of initiatives such as GEMS, the GPS Block IIF program won the 1995 Defense Standardization Program award as well as the Office of the Assistant Secretary of the Air Force for Acquisition's Lightning Bolt Acquisition Reform award – both for leading the way in Acquisition Reform excellence. At this writing, the GPS JPO and the GPS Block IIF team continue their self-imposed challenge to do business better (Figure 3).

The GPS JPO has only just begun to explore the potential for improved organizational efficiency and resulting quality of output using the GEMS infrastructure. A future article will expand on the actual metrics of individual process improvements as the GEMS JPO adds and deploys even more business process modules to the GEMS infrastructure.

Editor's Note: The author welcomes your comments concerning this article. Contact him via E-mail at **mehlmald@gps1.laafb.af.mil** on the World Wide Web. The Point of Contact for GEMS is Ernestine Reed, SMC/CZEC, (310)363-2943, Los Angeles AFB, El Segundo, Calif.

ENDNOTES

1. See January-February 1997 *Program Manager* Special Edition on Acquisition Reform.
2. See November-December 1997 *Program Manager*, pp. 62-63.

PAPERLESS REPORTING

WASHINGTON — One idea in Defense Secretary William S. Cohen's Defense Reform Initiative has already saved the Department money. Moving to Internet publishing was one aspect recommended in the report, and officials started with the Defense Reform Task Force report. Officials estimate DoD saved more than $340,000 since they issued the report Nov. 10.

The written report was 90 pages long. In hypertext markup language — html — the report broke into eight files. In portable document format — pdf — the report was one big file.

Those wishing to read the report can download it through DefenseLINK, the official DoD Website. During the first week of online publication, the report was downloaded 26,243 times. Through four weeks, it was downloaded 57,046 times.

DoD is still saving money, said Air Force Capt. Jim Knotts, DefenseLINK project manager. The report remains on the Internet, and people are still downloading it.

If you are interested, look at **http://www.defenselink.mil/pubs/dodreform/report.html** [on the World Wide Web].

Editor's Note: This information is in the public domain and may be accessed from the American Forces Press Service Home Page at **http://www.dtic.mil/afps/news** on the World Wide Web.

Photo by Richard Mattox

SENIOR MEMBERS OF DSMC'S NAVY CONTINGENT RECENTLY HAD AN OPPORTUNITY TO MEET THE NEW BOSS, NAVY REAR ADM. LEONARD VINCENT, WHO BECAME DSMC'S 14TH COMMANDANT EFFECTIVE DEC. 30, 1997. PICTURED FROM LEFT: NAVY CAPT. ROBERT VERNON, DEAN, SCHOOL OF PROGRAM MANAGEMENT DIVISION; VINCENT; RETIRED ARMY BRIG. GEN. RICHARD A. BLACK, FORMER DSMC COMMANDANT; RICHARD H. REED, PROVOST AND DEPUTY COMMANDANT; NAVY CMDR. WILLIAM VAUGHAN, PRINCIPLES OF PROGRAM MANAGEMENT DEPARTMENT, FACULTY DIVISION.