CAD/PAD Requirements Determination in the Air Force

A Joint Logistics Success Story

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Cartridge Actuated Devices (CADs) and Propellant Actuated Devices (PADs) are explosive items used in aircraft ejection, life support, weapons release, and fire-suppression systems. The Department of Defense uses about 3,100 different configurations. Most are man-rated, requiring a very high level of reliability. All have defined service lives and must be replaced periodically. Some CAD/PAD are expended in normal operations, such as those used for weapons release; others are used only in emergencies. CAD/PAD that are needed for safety of flight can cause the grounding of aircraft if they are defective or over-age.

CAD/PAD are normally developed as a component of a weapon, egress system, or life-support system. For example the 112 CAD/PAD in the B-2 and the 129 CAD/PAD in the F/A-18 were designed and developed along with the other systems in those aircraft. In keeping with the cradle-to-grave concept, overall responsibility for sustainment activities remains with the program manager when a system is fielded. However, day-to-day responsibility for sustainment activities has been delegated within each Service to a central entity to benefit from economies of scale.

In 1998, the Air Force and Navy agreed to form a joint program office (JPO) to manage the sustainment of CAD/PAD for both Services. A major business improvement initiative of the CAD/PAD Joint Program has been adoption of an automated system for determining Air Force CAD/PAD requirements, using as a basis, the existing Navy system, the Material Planning Study (MPS). The Air Force version is called the Requirements Determination Module (RDM) and is believed to be the first joint use of a sustainment system.

Genesis: The Navy's Material Planning Study

CAD/PAD are different from other aircraft components because they are perishable. The requirement for replacement is based on time (service life) rather than variables commonly used in the Navy-wide logistics system, such as flight hours or takeoff and landing cycles. Furthermore, there is a long lead time (typically 18 months) associated with buying replacement inventory.

A successful F-16 Thunderbird pilot ejection at a Mountain Home AFB air show in 2003 illustrates the importance of reliable CAD/PAD.

U.S. Air Force photograph by SSgt Bennie J. Davis III

To deal with these factors, the Navy has long relied on centralized planning, using the MPS to predict the quantities of CAD/PAD needed each year to replace over-age and expended items. Initially, the Navy system was manual, requiring many hours of labor-intensive calculations. Usage was calculated on predicted average replacements

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without regard to the impact of aircraft maintenance and deployment schedules. The MPS also suffered from the lack of detail needed to predict precisely the effect of proposed budget cuts on operational aircraft.

As computer technology evolved, the Navy recognized the opportunity to apply technology to improve procurement and inventory planning. The result was automation of MPS and inclusion of several features that improved just-in-time procurement based on actual fleet needs, while making the budget highly defendable. The improved model scheduled change-out of each part in each aircraft based on individual service life and maintenance-scheduling criteria. With the automated MPS, program managers have a powerful tool to respond successfully to budget what-ifs. They have been able, for example, to predict accurately which CAD/PAD would go over age and consequently, which aircraft (by tail number) would be grounded if the budget were cut by a specific amount. The model also provided them with the ability to determine the impact of service life changes on operational aircraft and to document the fleet impact of late deliveries.

MPS works with a key supporting system known as Virtual Fleet Support (VFS) CADPAD (formerly TRACE), which was developed because Navy-wide logistics systems did not track the expiration dates and related aircraft installation schedules for these critical components. VFS CADPAD tracks each item installed in the fleet. It also works with a procurement tracking system that accounts for "due-ins" and a core data system that provides key technical and logistics information, such as service life and how many items are in each aircraft. Together, these systems have given the Navy the ability to know precisely how many CAD/PAD to buy each year.

Cost, Schedule, and Performance Benefits

The projection of requirements produced by MPS was significantly more accurate, basing need on real requirements, including aircraft maintenance data, rather than on perception. Smarter buying enabled an overall 30 percent reduction in inventory, which, in turn, meant reduced inspection and storage costs. It also made possible the elimination of waste in the form of items in local stockpiles that went over age on the shelf.

Having replaced a just-in-case acquisition system with just-in-time, it became necessary to adjust the sustainment end of the process to make it just-in-time as well. The result was a toll-free 800 system (later a Web-based feature of VFS) for filling orders from the fleet for replacement CAD/PAD. These systems achieved dramatic savings, reducing the time from order to delivery in the United States to about eight days from what had taken as much as four months previously (an accomplishment that was recognized by the Packard Award in 2001).

Performance in a sustainment program is measured largely by cost-efficiency. The alignment of acquisition and sustainment, inventory reductions, and precise procurements have all contributed to this measure.

The Air Force Gets Interested

Formation of the Joint Program led to interest among Air Force CAD/PAD managers in improving the Air Force requirements-determination process. Until that time, the Air Force had relied heavily on decentralized planning—forecasts of projected needs assembled by field organizations. These estimates suffered from some of the same limitations as the early MPS. The estimates were often inflated because of a concern with having enough to support the mission. The forecasting process was labor-intensive, with hundreds of using organizations, thousands of aircraft, and multiple items on each aircraft. The data developed were difficult to verify because reports included only the total number of items needed by each organization. In many cases, it was discovered that some requirements were duplicated; in others, the forecast from a unit could be missing entirely.

Adaptation Challenges

There were multiple challenges in adapting the basic concepts in the Navy's MPS to Air Force use. Some were data- and programming-related; others were institutional. First, there was a need to obtain data on installed items (similar to the function performed by the Navy's VFS CADPAD system). Air Force field organizations use a variety of different systems to gather and record maintenance data. Most of these feed the Reliability and Maintainability Information System (REMIS). In many cases, the data needed by RDM for projecting future sustainment requirements could be obtained from online data queries to REMIS; however, in other instances, that was not possible, and specific RDM workarounds had to be devised.

Initially, another issue was data accuracy. When data are rolled up to REMIS, they are edited, sometimes causing a record to be rejected. Duplicate and expired records were also a problem. Software routines written during the development of RDM have largely eliminated such problems.

Another problem was a lack of visibility into data generated by the Air Mobility Command (AMC), which employs a system for gathering and recording maintenance data that differs from that used by most other commands. As a result, the query method noted above did not provide data needed by RDM. Initially, workarounds were created in RDM to compute requirements based on service life of the items and total number of installed assets. More recently, an agreement was reached in which AMC is pro-

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viding maintenance data directly to the JPO, enabling RDM to compute accurate forecasts.

Perhaps even more significant was a range of institutional challenges, such as the need to build the trust necessary to adopt a not-invented-here system. In general, the Air Force and Navy have many differences in their business practices. Fortunately, the JPO has operated successfully for several years, implementing a number of joint process improvements. This initiative was widely supported by Air Force managers as just another step forward along this continuum.

Another challenge arose because of the nature of CAD/PAD, which are both an aircraft spare and a munitions item. Accordingly, they tend to fall into a no-mans-land between these two worlds. As a result, the separate systems designed to manage aircraft spares and munitions do not handle CAD/PAD well. This is true of the legacy systems in both Services. Even a prospective Air Force system for managing aircraft spares will have many of the old shortcomings. For this reason, the cost-effective solution was deemed to be to adapt the Navy principles and concepts to Air Force use.

Results and Future Opportunities

RDM was used successfully to determine Air Force requirements starting in fiscal year 2006, after a test run in fiscal 2005 in which RDM was run in parallel with the legacy method. Despite a lingering need to require field forecasts for a few part numbers (primarily life-support and survival-equipment items), JPO estimates a reduction in field workload of about 80 percent. The accuracy of out-year budget requirements has been significantly improved. And most important, RDM has greatly increased confidence that the right items are at the right places at the right time to support the warfighter.

As the Air Force gains experience with RDM, it expects to further streamline its acquisition and sustainment processes. Administrative workload will be reduced because of the improvement in the accuracy of requirements, the alignment of Navy and Air Force buying cycles, and the consolidation of procurements for similar items. On the sustainment side, the Air Force will begin to use VFS as a tool for ordering replacement CAD/PAD for its T-6 aircraft, a first step that may lead to much wider use for other aircraft in the future.

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