Implementing the UID Policy

The CH-47 Approach to Parts Marking

Col. William T. "Tim" Crosby, USA • Fred C. "Chris" Sautter

Over the past several years, the Cargo Helicopter Program Management Office (PMO) has been actively developing a life cycle management capability within the CH-47 Chinook fleet. This effort has been in response to the DoD 5000 requirement, which states that PMOs will be the total life cycle managers for their weapon systems. In the Cargo PMO, we expanded the guidance to focus all our efforts on reducing the burden on our soldiers. Thus we have named our logistics transformation effort "soldier-focused logistics" (SFL). To that end, our program consisted of adopting a fleet wide automatic information system (AIS) that would allow us to manage with the "power of facts." One of the key enablers for this AIS was the ability to interface with Automated Identification Technology (AIT) to provide error-free documentation of our aircraft and components across the fleet.

Soldier using the Advanced Maintenance Aid Concept (AMAC) maintenance management software.

Photo courtesy Reno National Guard

This article documents the path taken and the lessons learned by the Cargo PMO over the past several years in laying the groundwork for a parts-marking program, which is a key and essential part of our fleet management efforts. We will take you through the various steps leading to a proof of principle [*Editor's note: proof of principle is an engineering term describing areas of technical stretch in a design*] where we brought all the parts of the program together to demonstrate a seamless, end-to-end data solution. This capability has provided the warfighter with an effective tool for fleet management while at the same time, it has directly answered the guidance of the current UID policy to provide "intelligent data" to the Department of Defense (DoD) financial managers.

Cargo PMO Approach

When the Cargo PMO initiated its total life cycle management efforts several years ago, there was no one within the PMO or Army Aviation who had not recognized the common problem. We were a large organization with virtually no financial understanding of what we owned or what it cost us to maintain that extensive inventory because numerous agencies were tracking metrics without synchronization. Accentuating the problem was the realization that the commercial sector had long ago solved these same issues. This was dramatically illustrated each time we went through a checkout line in our local grocery store or Wal-Mart: not only did they have the processes in place to provide us with our bill automatically, but they understood the impact our shopping cart had on their inventory and need to re-order. With a mindset focused on change, we launched a program to totally revamp the way we were doing business within the Cargo PMO.

Requirement: Process Change

A new management system enabled through AIT and parts marking could not be implemented without major

Crosby *is currently serving as project manager for the Army's Cargo Helicopter Program, where he has been leading the efforts of Army Aviation to move into the digital logistics world.* **Sautter**, *an aerospace engineer who made the tough transition to logistician and life cycle manager, is currently working with the Cargo Helicopter PMO.*

First successful marking of an aircraft component in the field using 1D and 2D bar codes.
Photo courtesy Reno National Guard

process re-engineering. While a bar code affixed to an item might seem to be an easy solution for identification, the implementation of this "new" capability within our existing acquisition and information systems required new thinking and new processes. Changes were required in government tech data, vendor and OEM engineering drawings, contract language, and—most important—our information systems. All our legacy processes required modification to accept this new form of data and provide it to the enterprise in a seamless fashion.

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In order to address these issues, we took a focused approach to parts marking that included the following:

- Understanding how to mark parts and the costs of those marks;
- Defining the automated environment for this new information system;
- Obtaining a new AIS with the ability to deal with seamless data collection across the enterprise;
- Demonstrating through a proof of principal, the necessary process changes that were required to adopt this new effort.

Part Marking: Methodology and Costs

The first step along the path was to determine exactly the cost and effort to mark parts. While these requirements can be covered in contractual language for a development program, they can be an extremely expensive proposition for legacy weapon systems. As an example, a "simple requirement" imposed on our OEM to change a drawing can incur cost—anywhere from 40 to 80 billable hours. This single factor made previous efforts at legacy parts-marking programs prohibitively expensive. Because our fleet management effort required parts marking as a key enabler, another solution was necessary. We turned to the best commercial practices of the aviation sector, which had previously resolved this issue. Through a close working relationship among manufacturers, operators, and the FAA, process changes were adopted that reduced the billable hour requirements in most cases to less then 4 hours per part number.

Other issues that needed to be addressed before we could fully understand the cost of parts marking of a legacy weapon system were:

- At what physical location (depot, flight line) can parts be marked?
- Where do you place machine-readable code on parts?
- What techniques are required to create part marks for each family of parts?
- How do you control the data included on the marks?

To determine the information necessary to answer these questions, we contracted for the U.S. Army Aviation Parts Marking Demonstration Program (Contract: DAAH10-00-C-0043, completed in September 2001) with the U.S. Army Aviation Applied Technology Directorate (AATD) at Fort Eustis, Va. This effort laid the foundation for weapon system managers to move forward with an understanding of the real effort they would need to invest in a parts-marking program to make it truly viable. The output of this demo was:

- A determination of the engineering effort required to obtain approval and air worthiness qualification to mark parts.
- A cross section of sample parts that were marked based upon a range of criteria, including different materials, paint, locations, and environment.

- A determination of the appropriate marking capabilities, from labels to direct part marks.
- The identification of four prime approaches to the marking of parts—
  1. Opportunistic (in the field);
  2. Gateways (supply and transport centers);
  3. Seek and Mark (mark a single type part world wide);
  4. Vendors and OEMs.
- An accounting of the costs to mark parts in legacy environment.

Parts Marking and the Larger Digital Environment

As we contemplated the move from our legacy, paper-based world into an automated maintenance environment (AME), it was necessary to fully understand the impact that changes like these could mean for the warfighter and the AIS. We wanted to get away from the historical approach (where agencies developed single-path solutions) and to adopt a more holistic approach that merged AIT, AIS, and the logistics processes across the environment. To that end, we requested and received funding from the Logistics Integration Agency, now called the Logistics Transformation Agency, to produce a concept of operations for AIT. Contracting with the Logistics Management Institute produced a report entitled "Concept of Operations for AIT in an Automated Maintenance Environment for Army Weapon Systems," AR130T1, March 2002 (referred to as the Con Ops). This document assisted us in defining the focus of our AIT implementation strategy, and it pointed to the critical aspect of that plan as we moved forward.

Data are the Key

The "I" in AIT is "identification." It was critical that each machine-readable code affixed to a part include the minimum data elements necessary to uniquely identify that part across the logistics environment. In the commercial sector, many organizations have different processes and different data elements that define "uniqueness." The Con Ops pointed out that within the DoD AME, there needed to be a clear and precise definition that could be enforced across the logistics community. This definition would register the unique identity for each component that equated to an individual "social security number."

The business rules that defined the uniqueness standard include the following:

- The mark must remain with the part for the life of the part.
- The mark must not change over the life of the part.
- The complete description of the mark has three data elements—
  —Serial number;
  —Enterprise ID (CAGE Code);
  —Part number.

The consistent application of these business rules was fundamental to permitting communication within the enterprise AIS.

AIS and AIT: Avoiding Confusion

There are many data-rich marking capabilities available today, among them contact memory buttons, RFID tags, and 2D bar codes. It is essential, therefore, when selecting the appropriateness of a particular marking technology, to separate the requirement for unique identification from the requirement to store large amounts of data. In the former case, you are looking to exploit the capabilities of the technology to support consistent and repeatable extraction of the part's unique identity. In the latter case, you are looking to exploit the storage capabilities of the technology in support of a focused, homogeneous process environment. Within the Con Ops, this gave rise to definitions of two purposes for AIT: **Primary**, which is to host the part unique identity and **Supplemental**, which is to store additional process-related data. The key point was that the Primary AIT was the UID criteria and would be the common medium across the logistics environment.

Interim Solution Most Critical

The most difficult aspect of a successful implementation of an AIT and AIS environment exists during the interim phase between today's legacy standards and the fully integrated objective system. As we ramp up our AIT program and start utilizing parts with machine-readable code, we are going to have to live for an extended period of time with a fleet that is not fully marked and an AIS that is not fully fielded. We must, therefore, be prepared to live with a mixed system, and the accepted wisdom is that this period will continue for roughly 10 years after the decision is made to mark all legacy parts.

This interim period imposes the requirement on our logistics information systems to retain a seamless link to the old and new data systems. For our parts-marking capabilities, this means that we must include "human-readable" marking with all machine-readable code. On the information side, it requires that our chosen AIS be capable of containing sufficient software intelligence to accept the data elements from both systems.

Defining Uniqueness in a Legacy World

The CH-47 Chinook was first fielded over 40 years ago. When we queried the Army agency responsible for serial number tracking, they informed us that they could not guarantee uniqueness of the data elements (CAGE code, serial number, and part number) that are currently on the components in the field. Searching through some of their databases yielded scores of suspected duplicate parts. The message was clear: we could not duplicate the existing data on our legacy parts using machine-readable code and hope to maintain the uniqueness standard.

Web-enabled mobile parts marking facility, capable of marking and registering parts in the field. Photo courtesy Reno National Guard

Army Aviation was not unique in having this problem. The commercial aviation industry had faced and solved a similar difficulty. Their approach to guarantee uniqueness involved re-marking legacy parts with a new set of data elements to replace the legacy information. These elements were a Unique Component Number replacing the current serial number and a new Enterprise ID which took the place of the CAGE code. This solution provided the Cargo PMO with a path forward that fit within the Con Ops, provided a viable interim solution, could fit within our legacy databases, and guaranteed uniqueness across our fleet. Additionally, this solution fully complied with the DoD UID policy.

Dealing with the Information System

AIT means little without the information system to manage the useful data available in the machine-readable code. For the Cargo PMO, the effort to obtain a viable AIS was a parallel path to our parts-marking program. We had been on track to provide meaningful input into our life cycle management model for several years. The resulting AIS was designed to accept all types of data, but it contained additional software intelligence that helped filter the normal errors inherent in hand-entered information. Thus we were positioned to accept the capabilities of error-free AIT data when the capability of parts marking was fielded. We firmly believe that this up-front work on an AIS is what provided us with the ability to capitalize fully on the enabler of AIT articulated in the UID policy.

Proof of Principle

The proof of principle was a culmination of our individual efforts to exercise the required business process changes within our fleet management program. The core piece of the puzzle was to demonstrate that our AIS was capable of handling and documenting the change from legacy "hand-entered" data to machine-readable code with a guaranteed uniqueness standard. The demonstration took place at our test site at the National Guard Chinook unit in Reno, Nev., where we are fielding a fully functional maintenance management system that is the backbone of our fleet management capability.

To create the marks and register the parts in our database, we contracted with ID Integration for a parts-marking facility that was the follow-on of the one developed during the earlier demo by AATD. This mobile facility was able to mark our selected parts and its web connectivity allowed us to register and document the uniqueness standard across our fleet.

The final element of the equation was the establishment of the necessary Web links to the Logistics Support Activity (LOGSA) and AMCOM at Redstone Arsenal. These two organizations are the Army agencies responsible for effecting and managing the necessary process changes to deal with a new automated environment. With all these elements together for the first time in August 2003, the Cargo PMO was able to successfully mark the first aircraft component in the field, using 1D and 2D bar codes and capture that data as part of the aircraft build structure. These first pieces of data are currently being used to exercise the necessary process changes to link the flight line to AMCOM in our UID process.

With help and guidance from the DoD UID policy group, the Cargo PMO validated the costs and demonstrated the process changes required for a weapon system manager to implement a parts-marking program that is part of the end-to-end connectivity required to provide "intelligent data" from the flight line to the DoD. While there remain processes within the financial architecture that require resolution, the uniqueness standard and the ability to mark parts in the field has been demonstrated and achieved. With UID as our critical enabler, we are well on our way to linking all the stakeholders in the life cycle management process, transforming logistics management with the power of facts.

Editor's note: The authors welcome questions and comments. Crosby can be reached at william.crosby@peoavn.redstone.army.mil and Sautter at chris.sautter@peoavn.redstone.army.mil.