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Unit-Level Ammunition Status (Or No More Meatballs, Please!)

by Capt Dennis G. Zarnesky, USMC(Ret)

An accurate munitions status may be readily available to force commanders.

According to the commander's logistics situation report, Class V(W) (ground ammunition) is "green." Given the green status, what logistics actions are required? An "amber" status would imply some cautions in logistics capability and likely require a logistics action, but the available data at most logistics levels would be insufficient to cause an action for either a green or an amber indicator. These subjective forms of assessment, rendered as a stoplight, or "meatball" chart, provide little clarifying insight other than to establish the need either to obtain additional information or to wait.

Current ammunition data collection and reporting pro-cesses do not enable *anticipatory* logistics. Another shortfall of current pro-cesses is that battlefield awareness of the ammunition situation cannot be determined from a single source. The commander needs to consult several sources to obtain the required information and, even then, it is likely aged information, perhaps several days old, and of questionable value. A single information source is required, one that provides timely visibility of all ammunition held by the force across the entire battlespace and that is universally available to employment and logistics decisionmaking authorities. This single source should contain actionable ammunition information data in forms that become enablers for expeditionary maneuver warfare. The Marine Corps' ongoing logistics transformation effort is creating just such an environment, concentrating on actionable information, rather than mass, to focus support to the Operating Forces. Enabling this environment requires changes in tactics, techniques, and procedures to make logistics anticipatory vice reactive.

The Inventory Management and Systems Division (IMSD) of the Program Manager for Ammunition (PMAM), Marine Corps Systems Command (MarCorSysCom), with the financial support of the Department of the Navy (DoN) eBusiness Operations Office, conceived a proof-of-concept pilot project known as unit-level ammunition status (ULAS). The ULAS tool was a technology innovation initiative. The DoN eBusiness Office is a self-described DoN "venture capitalist" focusing on short-term (less than 180 days) projects with significant potential for identifying or exploiting new or emergent technologies that can be applied to Department of Defense (DoD) deficiencies. In most cases a proof-of-concept demonstration is also required. The PMAM promoted the ULAS as a candidate venture to address Marine Corps and joint munitions reporting deficiencies identified during the initial phase of Operation ENDURING FREEDOM.

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Selected from among 167 submitted initiatives, the ULAS pilot project utilized commercial-off-the-shelf (COTS) software and COTS technologies to enable timely collection and aggregation of ammunition data into a single, accessible, and actionable data store. CACI International, Inc., a defense contractor with indepth knowledge of current DoN ammunition automated information systems combined with systems development experience, was selected as the principal ULAS developer. To introduce technology stressors on the ULAS, it was decided to conduct the proof-of-concept demonstration at the Marine Air-Ground Task Force Training Center (MAGTFTC) at Twentynine Palms during Combined Arms Exercise 10-02 (CAX 10-02).

One of ULAS' primary roles is intended to provide near-realtime asset visibility of in-theater ammunition issued to the Operating Forces and held at ammunition supply activities in the area of responsibility. At present, ground ammunition is issued from accountable records to the Operating Forces, whether in a tactical operation or in garrison. Until it is actually expended in combat, ground ammunition remains available but is essentially invisible to the commander. The ULAS will enable the force commander and others the ability to accurately produce a variety of logistics reports as well as the daily munitions status report (MuRep) required by the unified combatant commander.

Among the requirements for ULAS was that the tool had to be scalable, not be hardware specific, and capable of use with a variety of media

and platforms. The rationale underpinning these requirements was that, if scalability as well as aggregation of actionable and readily accessible ammunition data were incorporated at the beginning, the ULAS could potentially be operated from currently fielded tactical equipment and many future platforms.

A core feature of ULAS development was the use of portable electronic devices (PEDs) (also commonly referred to in the commercial sector as a personal digital assistant or PDA). Within DoD a distinction is made between PED and PDA. While both the PDA and PED are capable of receiving and storing information, the PED is distinguished by its ability to transmit information using a variety of methods. The PEDs were procured as factory-standard COTS products. Two different PED models were used to support the project and were chosen because both were designed for the pocket personal computer 2002 operating system. The devices used were the Compaq (now Hewlett-Packard) iPAQ Series 3835 and Symbol Technologies' PPT-2800. Both PEDs have a one-quarter video graphics array display window and a 206 megahertz (MHz) chip set. (Later PED models are equipped with the new industry standard 400MHz chip set.)

The PED used SQL Server CE for the onboard database, and it used embedded visual basic (eVB) for the scripts to manage the data on the PED and to manage and control the data transmission when reporting. The database worked well and remained stable. The eVB scripting tools are rich and allowed development of scripts to execute all of the tasks to control PED data operations.

The servers for the ULAS pilot project were chosen specifically for their processing power and scalability for future use. To ensure compatibility with the Marine Corps hardware suite (MCHS) standards and the Marine Corps Enterprise Network, the servers procured were identical to those specified on the MCHS approved hardware list.

Early in the development phase, discussion centered on the advantages and disadvantages of various server configurations, with the final choice eventually being primarily between an Oracle solution and Microsoft's SQL Server 2000. The decision quickly became driven by two elements: complexity and schedule. The Microsoft environment was less technically challenging for the time available—experienced developers are legion—and an extensive support infrastructure and familiarity with the Microsoft products were already in place. The team decided on SQL Server 2000 as the database of choice. The ULAS was designed for deployment on servers using the Windows 2000 advanced server operating system. However, in accordance with Marine Corps policies, the ULAS implementation does not require use of any active, directory-based services. In addition, no Windows 2000-unique features were incorporated that would preclude use of ULAS in a Windows NT 4.0 environment.

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Considering the software decisions made for the PED and the servers, it was easy to decide on active server page and HTML (Hyper Text Markup Language) running on a Microsoft Internet information server to present the data into a browser-based environment. User menus were created dynamically based on the permissions assigned to various types (echelon of command) of users. From the defined menus, authorized users can select a variety of situational awareness oriented views, depending on their need.

The truly novel component of what became a "marriage" of dissimilar technologies is the Iridium modem. Although the pilot project did not set out to demonstrate an emerging communications capability, once identified, the Iridium Model 9500 modem became an instant hit and enhanced the project's technology exploitation value. The modem was designed and developed by the NAL Research Corporation of Manassas, VA. Originally designed for oceanographic and polar research concerns in both the public and private sector, more recently the modem has been flown on the Hunter unmanned aerial vehicle and experimentally on the Navy's P-3C.

The benefits of an Iridium-based solution are that it enjoys significant DoD support and interest, is presently under-subscribed, and is relatively inexpensive. Another compelling feature of the Iridium solution is that it is untethered from groundbased relays, avoiding challenges experienced with so-called "bent-pipe" solutions, cross boundary political agreements, and frequency changes imposed on other satellite solution providers (ViStar, OrbComm, etc.). The L-Band (1.6 gigahertz) radio frequency signal generated by the modem is transmitted to the closest of 48 Iridium satellites in low earth orbit.

In the ULAS implementation, the satellite receiving the Marine's report from the PED routes it around the Iridium constellation until the report reaches the satellite best positioned over the DoD Iridium gateway in Hawaii. After downlinking the report to the gateway it is routed to a server identified by specific Internet protocol (IP) address using standard transmission control protocol/IP protocols.

Another element of the overall ULAS design was to make it simple enough that no specialized training would be required to employ the tool and that it be usable by Marines of any military occupational specialty (MOS). In order to focus design energies, two subject matter experts (SMEs), one each from Marine Forces Atlantic and Marine Forces Pacific (MarForPac), participated in the design discussions at the earliest possi-

ble moment to capitalize on their perception of need. Early participation of the SMEs in the design and development was crucial to achieving the desired level of simplicity.

The Marines assigned to support the proof-of-concept demonstration during the CAX were from II Marine Expeditionary Force (II MEF), representing a couple of MOSs, including ammunition technicians, a light armored vehicle (LAV) turret technician, and a Stinger gunner. The training presented to these Marines was approximately 1.5 hours in duration, covering the entire spectrum of ULAS operations on the PED. The training subsequently included 1 hour of hands-on practice with the ULAS application and hardware.

Just 77 calendar days after contract award, the required proof-of-concept demonstration got underway at the MAGTFTC. Data entry operations for the proof-of-concept were scripted. The concept of operations called for each assigned Marine to represent a unit type. Each unit was assigned a predetermined list of DoD identification codes (used to identify ammunition items) against which they would process receipts and expenditures on a daily basis. Each day's quantities were predetermined enabling the project team to verify the accuracy of the reported quantities. The first 2 days of ULAS operations were conducted under the developer's supervision. For the final 2 days of the exercise, the Marines returned to their assigned units and submitted their reports from the tactical area.

Overall, the results were better than expected from inexperienced personnel using a new technology. While not perfectly accurate, the test results confirmed that these Marines adapted quickly to the technology with minimal training, did not require any specialized skills, and could report a high percentage (97 percent) of their records accurately. (Interestingly, the LAV technician proved to be the most adept at using the ULAS having already been socialized to similar applications and tools in his own MOS.) The results also confirmed that incorrect reports could be isolated for corrective actions as appropriate.

Separately, the development team evaluated the ULAS' ability to generate the reports specified in the design documents using the field input data generated by the PED users. The project team used these reports as a means to establish that PED users were submitting unit-level reports as directed and that the values were the expected values. The validity of the quantities reported in the MuRep was unexamined during the proof-of-concept demonstration. A detailed examination of the MuRep was performed during a subsequent limited technical assessment, requested by MarForPac, and conducted during CAX 1-03, October 2002.

Concurrent with the proof-of-concept demonstration, briefings were conducted for the Commanding General, I MEF and, subsequently, members of the MarForPac G-4 (logistics) and the MarForPac experimentation center (MEC). It has been observed at nearly every presentation of the ULAS tool and the underlying technology that, while the ULAS was designed around ground ammunition, the fundamental mechanisms for data collection, reporting, data processing and analysis, and final presentation to authorized users in a browser-based interface are commodity agnostic.

Recently, a logistics command and control focus team was established by the MEC to examine logistics transformation issues. The MEC is also establishing a similar ammunition logistics focus team. During the course of this fiscal year, these focus teams will be examining the multitude of logistics command and control issues facing the Operating Forces, requiring some level of transformation to achieve the envisioned efficiencies. The ULAS technology's applicability to other commodities is a candidate area for further assessment, its applicability to ammunition already established. The ULAS technology could also be assessed with regard to methods for integrating barcode scanning operations in the data collection and reporting process, as well as its utility for tracking and establishing visibility of containers and their contents.

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The true cross-spectrum functional utility of the ULAS technology will remain unexamined for the immediate future. While ULAS is an interesting technology that was successfully demonstrated in field-based testing, it is an immature platform requiring some yet-to-be-determined level of investment and advanced development in order to deploy a robust, sustainable capability multiplier for the Operating Forces.

And the meatballs? Well, *my* appetite is fading. Detailed information, including briefs, presentations, letters of instructions, and pilot charter documents for ULAS, are available for review and downloading from the PMAM web page at <http://www.marcorsyscom.usmc.mil/am/ammunition/index.asp>.

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>Note: The mention of specific contractors and/or vendors (i.e., Microsoft; Oracle; CACI International, Inc.; Compaq; Hewlett-Packard; Symbol Technologies; Iridium; NAL Research Corporation; ViStar; and OrbComm) in this article does not constitute an endorsement by the DoD or the U.S. Marine Corps. Software titles, operating systems, and hardware equipment mentioned herein are the property of and are trademarked by their respective owners.

>>Capt Zarnesky served as the I MEF ammunitions officer prior to his retirement in 1997. He is currently the Head, IMSD, PMAM, MarCorSysCom.