

# Patriot Fratricides:

*The Human Dimension, Lessons of Operation Iraqi Freedom Soldiers and Not the Automated System Must be the Ultimate Decision Makers in Air and Missile Defense Engagements*

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Nearly everyone in the air and missile defense (AMD) community is aware of, and has formed opinions about, the Patriot fratricide incidents that occurred during Operation Iraqi Freedom. The U.S. Army has done much to address the perceived causes of these incidents. Now, more than two years after the fact, and with numerous hardware, software, training and procedural changes in the offing, there is a natural tendency to view the problem as "fixed," give a sigh of relief and get on with business as usual. However, before declaring the case closed, it may be instructive to look again at what the various official inquiries and the Defense Science Board (DSB) actually said about the fratricide incidents and explore the longer-term implications of those findings.

Personnel from the Army Research Laboratory's Human Research and Engineering Directorate started looking into Patriot system performance at the invitation of MG Michael A. Vane, then commander of the U.S. Army Air Defense Artillery Center, Fort Bliss, Texas. MG Vane was interested in operator vigilance and situation awareness<sup>1</sup> as they relate to the performance of automated AMD battle command systems. Following discussions with MG Vane, we structured an effort termed Patriot Vigilance with the charter to explore four broad topic areas: (1) vigilance and situational awareness; (2) trust in automation; (3) Patriot and AMD training effectiveness and efficiency; and (4) AMD leader development. We spent most of the summer and fall of 2004 reading documents, interviewing knowledgeable personnel from around Fort Bliss, and observing training and operations. Our initial report went to MG Vane in October 2004<sup>2</sup>. Less than a month later, we were gratified to learn that several of our conclusions were mirrored almost exactly by the DSB.

Prior to continuing the present discussion, I must express one caveat concerning using hindsight in problem solving: Studying incidents such as the Operation Iraqi

Freedom fratricides does create opportunities for rapid learning and organizational change. However, hindsight is not foresight. After an incident, we have all of the critical information necessary to understand most of what happened.

But that information was not available to participants before the fact. In looking back, we tend to oversimplify the situation that the actual participants faced. This "hindsight bias" can block our ability to see the deeper story behind the events. Our objective in the Patriot Vigilance project was not to conduct another exercise in Monday morning quarterbacking. Rather, we wanted to look into the deeper story behind events leading to the fratricides from a human performance perspective. Our focus is on the path forward rather than a further dissection of the incidents of the past.

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## The Story Behind the Inquiry Conclusions

Two recommendations from the DSB report on Patriot system performance summarize the path forward from a human performance perspective. Although the full report is classified, the following extracts are not:

- *"The Patriot system should migrate to more of a 'man-in-the-loop' philosophy versus a fully automated philosophy—providing operator awareness and control of engagement processes."*
- *"Patriot training and simulations should be upgraded to support this man-in-the-loop protocol, including the ability to train on confusing and complex scenarios that contain unbriefed surprises."*

The central notion in the first DSB recommendation is captured in the phrase "providing operator awareness and control of engagement processes." Simply put, soldiers



*Patriot batteries shot down every Iraqi tactical ballistic missile that threatened U.S. forces, but were involved in friendly fire incidents involving U.S. and British aircraft.*

and not the automated system must be the ultimate decision maker in AMD engagements. Decisions to shoot or not to shoot must be made by crews having adequate situational awareness for the situation at hand and the expertise to understand the significance of the information available to them.

Putting human decision makers back into the control loop does not mean that we try to turn the clock back to the good old days of Nike Hercules and Hawk and merely re-emphasize traditional control strategies and procedures. The situation with Patriot is too complex for that simplistic solution. Driven by advances in technology and mission changes, Patriot crewmember roles have evolved from traditional operators to supervisors of automated processes. The job of supervisory controller is different from that of traditional operator, and these differences must be reflected in system design, performance support features (decision aids), and training and professional development. Moreover, system designers and users are not free to opt for or against casting operators as supervisory controllers. Operators must be augmented by technology in the form of automation. The contemporary AMD environment is simply too complex and demanding to consider any other approach.

Stakeholders across the AMD community have not ducked these issues. Various organizations have conducted considerable work on the problem of developing an effective man-in-the loop strategy. Specific products in this regard include Post Deployment Build 6, a new software build, that emphasizes and facilitates positive human control, including tactical standard operating procedures and

tactics, techniques and procedures revisions to complement software changes. The next step in this change process will be to validate and debug the resulting revisions in a series of operational tests and usability assessments. Human Research and Engineering Directorate staff members will be lending their technical expertise to these events.

The second DSB recommendation having major significance for human performance in contemporary AMD operations concerns training. Here, the DSB was reacting to the AMD community's own conclusion that it is necessary to re-look the "level of expertise necessary to operate such a lethal system on the modern battlefield." The AMD community has responded to this challenge with the new Master Gunner and Top Gun Courses. Other training changes are also in process or under consideration.



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<sup>1</sup> *Situational awareness is defined technically as the perception of elements in the environment within a volume of space and time, the comprehension of their meaning, and the projection of their status in the near future.*

<sup>2</sup> *We also prepared a companion report titled "The Human Side of Automation: Lessons for Air Defense Command and Control" (ARL-TR-3468). This report is available from the Army Research Laboratory's Fort Bliss Field Element or through the Defense Technical Information Center.*

## SCANNING

### SLAMRAAM Completes Two Successful System Reviews

#### Surface-Launched Advanced Medium-Range Air-to-Air Missile System Moves Closer to Eventual Fielding

**TEWKSBURY, Mass.**— The Raytheon Company received authorization to continue Surface-Launched Advanced Medium-Range Air-to-Air Missile (SLAMRAAM) software build and fire unit development following a successful system/software requirements review and a successful critical design review. The SAMRAAM system of systems will provide commanders a tailorable, state-of-the-art air defense system that can defeat the current and emerging cruise missile threat and a wide range of air breathing threats.

"These reviews were the result of close collaboration with our government partners to provide an effective and fully-integrated mobile air defense solution to the warfighter," said James Wells, Raytheon Integrated Defense Systems' SLAMRAAM program manager. "This system is very important to our joint warfighter because it maximizes the warfighter's capability against the current and evolving low-altitude cruise missile threats, improves system survivability and provides growth capabilities through an open architecture-based integrated fires control network."

Members from the U.S. Army, Marine Corps and Raytheon Joint Product Team conducted the two-day system/software requirements review. After the review, the SLAMRAAM program received authorization to proceed with Software Build 2, which will provide SLAMRAAM integrated fire control network capabilities.

"We're very, very satisfied where the program is to date," said LTC Walt Jones, U.S. Army SLAMRAAM product manager. "The successful reviews are a reflection of committed teamwork to ensure our warfighters get the system they need."

Following the system/software requirements review, the SLAMRAAM development team conducted a successful two-day fire unit critical design review, resulting in approval to proceed into fabrication, assembly and testing of five SLAMRAAM prototype fire units. The SLAMRAAM fire unit, derived from the Marine Corps' Complementary Low-Altitude Weapons System Program, is designed to integrate into the SLAMRAAM open architecture-based integrated fire control network to provide enhanced capability against the cruise missile and unmanned aerial vehicle threats for Army and joint forces.