

Lessons Learned From Product Manager (PM) Infantry Combat Vehicle (ICV) Using Soldier Evaluation in the Design Phase

MAJ Todd Cline

Soldiers from A Co., 1st Battalion, 27th Infantry Regiment, 2nd Stryker Brigade Combat Team, exit their M1126 Stryker ICV. PM ICV's systems engineering approach to vehicle design will ensure that Soldiers have better ingress/egress capability. (U.S. Army photo by MC1 Daniel N. Woods.)

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In September 2007, the PM for the Manned Ground Vehicle (MGV) XM1206 ICV, Future Combat Systems (Brigade Combat Team) (FCS(BCT)) conducted an ingress and egress demonstration to optimize squad configuration and verify ICV platform design characteristics. The demonstration was conducted using Soldiers from the Army Evaluation Task Force and a vehicle mock-up of the ICV mission module area. Demonstrations using mock-ups or prototypes often prove to be cost-effective ways to focus on certain requirements and bring valuable data and a unique real-world perspective to the design team. Mock-up demonstrations also assist PMs in prioritizing limited resources to important system areas.

PM ICV is using the systems engineering approach with this valuable Soldier feedback to incorporate design changes while balancing any cost, schedule and performance impacts. The objectives of this demonstration were to evaluate ICV mission module seating configuration and evaluate the time it took Soldiers for ingress/egress via ramp and door. The mock-up was constructed with the ability to reconfigure to different seating arrangements, as well as different ramp and door configurations.

The ICV is one of eight MGVs being designed for the FCS(BCT) and is being built centered on the 9-man dismountable infantry squad. This Soldier-centric design allows for the ICV to meet its mission requirement of transporting 11 personnel (2-man crew and 9-man squad) on the battlefield. The ICV delivers the dismounted force to the close battle and supports the infantry squad by providing self-defense and supporting fires.

Soldiers from the 1st Combat Arms Battalion, 5th Brigade, 1st Armored Division, traveled to Santa Clara, CA, to take part in the demonstration. The Soldiers' time in service ranged from only 16 months to combat veterans with about 12 years' experience. The Soldiers' ages ranged from 18 to 38, and their heights and weights ranged from 5'4" to 6'5" and 140 pounds to 250 pounds. During the demonstration, Soldiers carried Rapid Fielding Initiative equipment and Mission-Oriented Protective Posture (MOPP)

gear, which provided realistic combat weight and added 100-120 pounds of weight to each Soldier.

During the 2-week demonstration, the squad conducted more than 200 trial runs. Soldiers ran scenarios wearing their MOPP gear and protective masks, and with MOPP gear stored in their assault packs. Human factor, design and test engineers received and reviewed more than 300 questionnaires, which encompass the bulk of the final report. This Soldier feedback, which ranged from comments on seat design, safety belts, seating arrangements, Soldier space, ramp and door opening to identifying obstacles in design and safety-related issues, proved invaluable in optimizing the ICV design.

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Lessons Learned

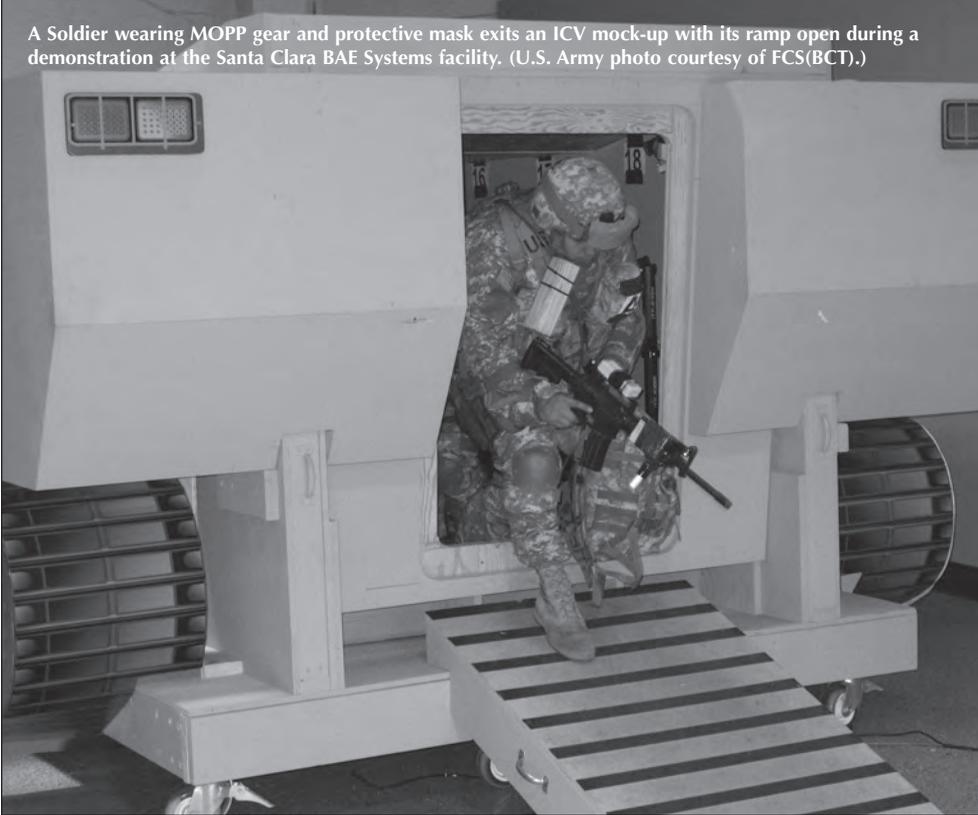
The ICV ingress/egress demonstration not only provided the FCS(BCT) program useful data, but also emphasized the importance of demonstrations, tests and user juries early in the system development process. FCS ICV ingress/egress demonstration lessons learned may benefit other defense acquisition programs planning similar events. Successful demonstrations require written plans, identification of resources and involvement of the test and safety communities. Here are some of the important lessons learned during the ICV's ingress/egress demonstration:

- *Establish a written test or demonstration plan.* A written plan helps the fabricators, testers, human factor engineers, design engineers and users understand the demonstration scope as well as the objectives and end data. The plan also helps to prevent others from adding scope to the event without proper time or funding resources.
- *Identify and schedule required resources.* Mock-ups may require the fabrication of surrogate items. The important

During the 2-week ICV mock-up demonstration, an infantry squad conducted more than 200 trial runs. Soldiers ran scenarios wearing their MOPP gear and protective masks, and with MOPP gear stored in their assault packs. (U.S. Army photo courtesy of FCS(BCT).)



A Soldier wearing MOPP gear and protective mask exits an ICV mock-up with its ramp open during a demonstration at the Santa Clara BAE Systems facility. (U.S. Army photo courtesy of FCS(BCT).)



point is to strive to make the demonstration as realistic as possible to enable best possible data collection.

- *Don't forget the Soldier.* Soldier requests take time to process, and some units require several months' advance notice for their approval process. Ensure to plan for Soldier equipment because some equipment is too bulky and heavy for commercial flights and may require special shipping. Sensitive items, such as night vision goggles, weapons, etc., may require additional site security for storage. Contact your test community for required safety documentation before letting Soldiers use any developmental equipment. The Developmental Test Center at Aberdeen Proving Ground, MD, provides

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Safety Releases and is a valuable resource in identifying additional approvals. Safety Releases provide commanders and PMs important information on risks of

using the prototype or mock-up equipment and establish any limitations to the test or demonstration.

- *Review AR 70-25, Use of Volunteers as Subjects of Research.* Depending on the test or demonstration scope, a Human Use Committee (HUC) and Institution Review Board (IRB) may

be required. Establish enough time in the schedule for the board and committee to review, comment on and approve the demonstration or test plan. Additional rules govern Soldiers being used on nongovernmental test sites or at a contractor's facility. One key point is that major changes to

the approved plan will require another set of reviews and could delay the start of the event.

- *Be prepared for equipment to break, causing unwanted demonstration or test downtime.* The key to keeping a schedule moving is to have noncritical events that can fill space and do not require physical mock-up use. Examples include demographic questionnaires, measurements of Soldiers and their equipment in various configurations and design facility or test range tours. If you plan ahead, other demonstration excursions can be added, with prior approval from a HUC or IRB (if required), to collect additional data.

The FCS(BCT) ICV ingress/egress mock-up has led to PM and engineering design decisions that helped to optimize seating configuration, identify hazards and bring unforeseen design limitations to light that have aided in developing a Soldier-centric vehicle. The key to running a successful demonstration is to have clear objectives with a desired end-state or outcome (the plan), identify the participating Soldiers and equipment as early as possible, include outside organizations or agencies and ensure that the data being obtained will assist in the design (not just data of results).

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