

HEAT — Army Innovation in Action

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Imagine being in a combat environment taking enemy fire when, suddenly, your vehicle flips over violently from the force of an improvised explosive device (IED), caved road or impact from another vehicle. Your vehicle is now upside down and water is rapidly filling the inside of the cab. How do you survive? Could you effectively respond to a similar situation and live to talk about it? Could you unfasten your seat belt, recover from being hit by radios, ammunition cans and other equipment flying around in the vehicle, while remaining calm so you can reorient yourself and egress from the vehicle?

The 4th Squadron, 73rd Cavalry Regiment, 4th Brigade Combat Team, 82nd Airborne Division, patrols in Ghazni Province, Afghanistan, July 17, 2007. Driving in the rough terrain depicted here is one of the reasons Soldiers developed the HEAT. This innovation has saved countless Soldiers' lives since being deployed overseas to the theater of operations and at training centers around the Army. (U.S. Army photo by SPC Matthew Leary.)

Teaching Soldiers how to react in rollover situations had been impractical until a group of Soldiers collaborated in creating the High-Mobility Multipurpose Vehicle (HMMWV) Egress Assistance Trainer (HEAT).

Why HEAT?

Before HEAT, Soldiers were not trained how to properly exit a vehicle that had turned over on its side or top because of a rollover incident. During these exit attempts, Soldiers were experiencing various problems including:

- *Disorientation.* The violence and speed of a rollover caused Soldiers to become disoriented, thus losing precious reaction time that may have meant the difference between life and death.
- *Loose equipment.* Equipment not properly secured inside the vehicle became dangerous projectiles in a rollover, causing injury to Soldiers.
- *Unlocking seat belts.* Soldiers found it difficult to unlock seat belts, which prevented rapid egress.
- *Unlocking doors.* Soldiers were having difficulty opening the single-action combat locks that are standard on

HMMWVs in theater. Since unlocking combat locks in a rollover situation could not be simulated prior to the HEAT, Soldiers could not practice opening the combat locks.

The Army needed a solution to properly prepare Soldiers to survive a vehicle rollover. The solution to this problem was found in current technology used to train pilots — the dunker trainer. Army Soldiers created the HEAT by adapting and applying the idea of the pilot dunker trainer to the HMMWV. They combined key ideas to create a lifesaving device that increases the likelihood of survival for Soldiers involved in rollovers.

HEAT History

In response to numerous casualties resulting from HMMWV rollovers, the U.S. Army Forces Command (FORSCOM) developed the first HEAT in 2005. Combined Forces Land Component Command-Kuwait (CFLCC-K) built 31 first-generation HEATs for use in Iraq and Afghanistan and, to date, has trained thousands of Soldiers. CFLCC-K built the first-generation systems using government

labor and parts from battle-damaged HMMWVs, resulting in tremendous cost savings for the government.

The Army decided that a standard HEAT design was needed for U.S.-based units so that Soldiers could receive egress training prior to deployment. The common design's key component would be its increased safety features and its ability to be mass-produced quickly.

As the standardized design effort's sponsor, Program Executive Office (PEO) Combat Support and Combat Service Support's Program Manager (PM) Tactical Vehicles, selected PEO Simulation, Training and Instrumentation's (STRI's) PM Ground Combat Tactical Trainers (GCTT) to serve as the HEAT standard design effort's materiel developer in August 2006. This critical decision led to the stand-up of an integrated product team (IPT) to define the HEAT standard design requirements.

Getting HEAT Off the Ground

The HEAT startup process posed its fair share of challenges. PM GCTT and the U.S. Army Transportation School co-chaired bimonthly meetings to determine the requirements. The meetings' purpose was to define the system requirements by creating a Technical System Requirements Document and to gain buy-in from the user community and institutional training organizations. This document served as the foundation of what HEAT's capabilities would be. The IPT used Operational Needs Statements from CFLCC-K and FORSCOM to establish an initial baseline. The intent was to develop a trainer that matched the M1114 HMMWV's form, fit and function.

Who Would Design and Manufacture the HEAT?

With the assistance of PEO STRI leadership, the IPT made two key



The HEAT Army Standard was displayed during the prototype unveiling, operational test and safety certification at TARDEC, Warren, MI, on Jan. 24, 2007. (U.S. Army photo courtesy of Jim Revello, TARDEC.)

decisions that had a huge impact on the program's overall success:

- Selecting the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) to design and build the HEAT prototype.
- Selecting Red River Army Depot (RRAD) to produce and manufacture the HEAT production systems.

TARDEC provided engineering design expertise that resulted in an initial design being completed in 1 month and prototype production within 4 months. RRAD provides lean manufacturing and production capability that resulted

in tremendous cost savings to the government. In addition, RRAD provided 23 battle-damaged cabs for the HEAT's initial production run.

Funding HEAT

One of the biggest challenges was to secure funding to build 53 HEATs. After the Army validated the HEAT requirement, PM Tactical Vehicles provided initial startup capital to produce the first 23 systems. Remaining funding was provided from the main supplemental in June 2007 based upon the Army Requirements and Review Board identifying the HEAT as a valid requirement.

The Materiel Developer IPT

As the requirements IPT continued to define system requirements, PM GCTT established a materiel developer IPT that allowed us to effectively integrate the requirements into a safe and producible materiel solution. The materiel developer IPT's primary purpose was to develop, safety certify and test the HEAT prototype.

The materiel developer IPT allowed us to successfully integrate TARDEC into the planning process by translating requirement IPT decisions into materiel solutions. This process allowed the IPT to fine-tune requirements and resulted in excellent cross-talk and communication between both the requirements and materiel IPTs.

A key process component was to define the costs to build the prototype, as well as the costs to produce, field and sustain 53 trainers worldwide. The other key materiel developer IPT piece was that TARDEC and RRAD were able to coordinate design and manufacturing issues in real-time. The IPT overcame an early challenge by securing 33 additional cabs from CFLCC-K to RRAD to support HEAT production.

Training Soldiers how to set up, operate and maintain the HEAT was another challenge tackled by the materiel developer IPT. With Combined Arms Support Command assistance, we identified and selected a contractor to develop the HEAT operator manuals and to develop and conduct regional new equipment training (NET) train-the-trainer courses.

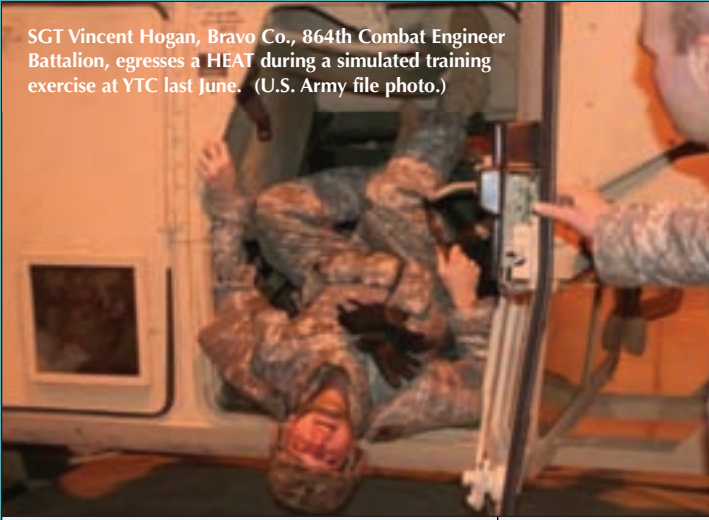
Prototype Design

TARDEC designed the HEAT using first-generation systems as the baseline and used the best in design technology to produce the HEAT prototype.



SSG Sefo Talia secures the doors on a HEAT before it rotates during vehicle safety training conducted at Yakima Training Center (YTC), Yakima, WA, last February. The HEAT trainer teaches Soldiers to respond quickly after a HMMWV rollover accident. (U.S. Air Force photo by SSGT Thomas J. Doscher.)

SGT Vincent Hogan, Bravo Co., 864th Combat Engineer Battalion, egresses a HEAT during a simulated training exercise at YTC last June. (U.S. Army file photo.)



Some key innovations included:

- Design focused on parts that can be readily procured by any Army organization.
- Electrical and drive motor assembly used the same motor that drives car assembly lines, thus providing high reliability with low maintenance.
- Upper and lower support frames allowed the cab to be replaced at the installation level.
- Simulated components including ammunition cans, weapons, water bottles and radios were made of foam material.
- Plexiglass was used for windows and windshields instead of ballistic glass.
- Durable cage over gunner's hatch allowed gunner training and provided added safety.
- Sliding rail platforms on either side of the vehicle provided a compact shipping configuration and added safety.
- Video and audio capability was included for after action review purposes.
- External training door locks allowed the instructor-operator to simulate a door being jammed while training Soldiers.

This training will help Soldiers overcome the natural fear and panic associated with rollover incidents.

to the cab and conducting a final system test.

Unveiling and Producing HEAT

The HEAT prototype was officially unveiled at TARDEC on Jan. 24, 2007. The Army Test and Evaluation Command conducted the HEAT prototype safety certification and assessed the system as an overall low risk.

After unveiling the HEAT prototype, the program moved into the production phase. Our focus shifted to the following:

- Producing the HEATs.
- Developing NET train-the-trainer courses.
- Fielding the HEATs.

RRAD leadership engineered program success by allocating the necessary funds and resources to set up the production line, even before program funds arrived to pay for labor and parts acquisition.

The transformation of a battle-damaged cab into a HEAT is an amazing process. RRAD starts with an M1114 cab that must be rebuilt from the ground up because of the extensive damage it received from IEDs, mines or rockets in theater. The process included removing the engine, removing the cab's front and rear portions, repairing any damage to the cab body, sandblasting the cab to remove all rust and paint, repainting the cab, installing wiring and electrical systems, building the frame, joining the frame

to the cab and conducting a final system test.

RRAD set up its production facility and started 24-hour operation on Jan. 5, 2007. By implementing lean manufacturing processes, RRAD expects to produce the HEATs faster and more efficiently as it produces more systems. Each major component is inspected by a quality assurance team followed by a final quality control check of the entire system after assembly, assuring that all components work as required. The first two systems were produced and shipped to installations starting in April 2007.

Fielding the HEAT

PEO STRI personnel will conduct on-site acceptance tests on each system prior to it being turned over for use by the receiving installation. Personnel from each installation will learn how to set up, operate and maintain the HEAT when they attend the HEAT NET train-the-trainer course to be conducted at various installations across CONUS and OCONUS.

HEAT Army Standard is an outstanding example of innovation in action exemplifying the best in collaborative acquisition excellence. This trainer represents a great idea — for Soldiers, by Soldiers — that allows individual Soldiers and crews to rehearse and physically execute the necessary steps required to survive a vehicle rollover. This training will help Soldiers overcome the natural fear and panic associated with rollover incidents.

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