



Figure 2. A sample 2-D CAD drawing of a relay-circuit breaker box bracket from the M113 FOV that was converted to a parametric 3-D model.

while achieving cost reductions in managing and supporting the Army's systems. Storing engineering data in a homogenous electronic data format can provide significant improvements to the Army's ability to manage data within its repositories; change, update or modify the data by engineering support activities; distribute engineering information for parts acquisition purposes and to manufacture parts by component vendors. In this role, the Army, like industry, can capitalize on advanced technology to reduce total ownership costs.

Accomplishments

The TACOM conversion team has exceeded the planned targets for drawing conversion goals by prudently managing and successfully converting 19,500 drawings into digitized 2-D format. In most cases, this was accomplished under budget. In addition, these digitized drawings are being made available to vehicle manufacturers for their respective uses in reducing the acquisition, engineering and logistics costs through the Automated Configuration Management System.

TACOM fully supports DOD's vision and acquisition reform strategy to convert to a paperless environment. Consequently, TACOM maximized its conversion funding by initiating bulk document conversion and data management projects. This will help ensure that data are available in the proper formats throughout product life cycles, and process and infrastructure changes are being made to universally share intelligent forms of digital data.

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Moving Technology Forward – Mobile Parts Hospital Manufactures Replacement Parts in Kuwait

Meg Williams



Soldiers in theater in Iraq identified a need for Squad Automatic Weapon gun mounts on their HMMWVs and the MPH Rapid Manufacturing System supported force protection by fabricating the mounts on short notice.

"We must constantly work to discover what we can bring forward from the future to the current force to increase our capability – now!"

GEN Peter J. Schoomaker
Army Chief of Staff

The Mobile Parts Hospital (MPH) operating in support of *Operation Iraqi Freedom* is a real-world example of bringing technology forward to increase Soldiers' capabilities now. The MPH's mobile manufacturing system



The MPH RMS team manufactures pintle assemblies and attaching locking pins for .50 cal SAW gun mounts on HMMWVs. These gun mounts allow a 180-degree turning radius.

produces parts rapidly at or near the point of need in the battlespace.

“Deploying the MPH with its advanced manufacturing capability to the front lines in Kuwait is evidence of how fast we are moving to develop and field future technologies as we continue to transform America’s Army,” said GEN Paul J. Kern, Army Materiel Command (AMC) Commanding General.



HMMWV outfitted with a SAW gun mount.

The MPH is a research and development program managed by the National Automotive Center (NAC), which falls under the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC), part of AMC’s Research, Development

and Engineering Command (RDECOM).

The MPH consists of two distinct system-of-systems (SoS):

- A self-contained, C-130 transportable mobile-manufacturing SoS that can efficiently fabricate standard and unique parts at or near the point of need. The equipment components of the Rapid Manufacturing System (RMS) being used in Kuwait are a lathe manufacturing module and an engineering work station that makes reverse engineering possible.
- A CONUS-based fixed manufacturing SoS that supports the deployed mobile-manufacturing SoS and the national supply base. An Agile Manufacturing Cell contains a machining center similar to the one in use in Kuwait in addition

to other components with enhanced manufacturing capability. A Communication and Control Center (C3) provides data storage for parts specifications, a communications link to the RMS system in Kuwait and technical experts. The parts database is managed by Wind-Chill™ product data management software. The C3 uses current infrastructure resources and has a two-way satellite system with audio, video and data exchange capabilities to communicate among the RMS in Kuwait, the Agile Manufacturing Cell and the Army’s established logistics systems.

In late summer 2003, with GEN Kern’s direction, the Forward Repair Activity (FRA) at Camp Arifjan, Kuwait, requested that the MPH be brought to

Kuwait via an Operational Needs Statement. The MPH arrived at Camp Arifjan and began operations in October 2003. Housed in the container it was shipped in, the MPH sits on a concrete pad outside the FRA.

As of March 2004, the RMS has manufactured 1,618 piece parts. It has fulfilled requests to manufacture bolts, brass studs, pulleys and much more. These parts are used in repairs to M88/1790 engines, M2 Bradley engines, HEMTT 8V92TAs and HMMWV engines and differentials.

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Kevin Green (left), RMS manufacturing technician, hands the needed collar and pin for a D7 dozer made by the RMS team to SGT Beauregard.

customers are the 368th Engineering Battalion, the 514th Maintenance Company and the FRA. MPH also supports the 1083rd Transportation Company and the 3rd PERSCOM Maintenance Office just to name a few.”

SAW Machine Gun Mounts

The RMS also supports fabrication of items not typically stocked or readily available through the supply system. One such request resulted in the production of a unique item to support a force protection need. Soldiers in theater identified a need for gun mounts for their HMMWVs. The RMS was able to fabricate the mounts on short notice without detailed designs. Kevin Green, an RMS-Kuwait Manufacturing Technician, recounted how MPH supports Soldiers in an e-mail he sent from Kuwait.

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“Today was a good day,” Green wrote. “A Soldier came to the MPH to get us to make some parts for his hummer. He drives the gun truck in the Heavy Equipment Transporters unit that takes supplies to the troops in Iraq. He said he goes to Basra nightly and the convoy gets ambushed a lot, so they are beefing up the hummer to deal with the problem. He wanted us to make new gun mounts for two .50 cal Squad Automatic Weapon (SAW) machine guns. Since it was time for me to get off, I told him to come back the next day. I thought I saw tears in his eyes. Obviously, this Soldier was both brave and scared at the same time. We stayed late and made his parts.”

The entire MPH team was instantly motivated to produce the parts needed to complete the retrofitted HMMWV. The Soldier went to get some sleep and the RMS team stayed to design and

manufacture two pintle assemblies and attaching locking pins. The MPH team further modified the assembly to enable a 180-degree turning radius for the swivel on the pintle assembly. The swivel action on the pintle assembly enables the SAW machine gun to protect Soldiers on either side of the vehicle.

The entire pintle assembly, consisting of six parts, was designed, manufactured and delivered within 5 hours. The soldier picked up the parts the next morning, installed them and went on to execute his mission on time and with the additional firepower capable of deterring and repelling enemy attacks on board his retrofitted HMMWV. Another soldier, one of the main gunners for the M249 Machine Gun, commented on the performance of the retrofitted HMMWV SAW mounts swivel action, saying it was like spraying a water hose back and forth, hitting all targets in site.

In his e-mail, Green continued, “I looked in the Soldier’s eyes as he thanked us for the gun mounts and the reality of this deployment hit me like a rock. It is very possible that by installing this retrofit system we are saving American lives. This Soldier needed us to help him. I was proud to be able to contribute to our brave Soldiers.”

Agile Manufacturing Cell

The MPH works closely with the FRA to determine which parts will be made on site in the RMS and which parts will be manufactured at the Agile Manufacturing Cell, which is located in Detroit, and shipped to the FRA in Kuwait when they’re completed. The Agile Manufacturing Cell has access to a wider range of raw materials and can manufacture increased quantities and larger-sized parts. Enhanced manufacturing capabilities range from high-speed machining and welding to heat treating and plating.

The MPH Program continues to push technology to benefit the Soldier and will apply these technological advances to the fielded RMS module in the near future. Another piece of fabricating equipment, a Directed Material Deposition® (DMD) machine, is being transformed and evaluated. A DMD machine uses a patented process called Laser Engineered Net Shaping® developed by Sandia National Laboratories. This machine can create a fully dense metal part from a computer-aided design model that is converted to a standard triangulation language file. After the part is built with this process, it can be sent to a machining module for final finishing and dimensioning.

NAC worked with prime contractor Alion Science and Technology Corp. and partners Focus:HOPE of Detroit, MI, and CAMP of Cleveland,

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OH, to bring the MPH concept to fruition. Alion, a research and development company based in McLean, VA, led the team that developed the initial plan for MPH development 4 years ago. Focus:HOPE is a civil and human rights organization with an advanced manufacturing operation that provides experiential education for engineering students. The MPH's Agile Manufacturing Cell and the C3 are operating from Focus:HOPE's Detroit campus. Kevin Green, a Focus:HOPE colleague, is deployed to Kuwait on the MPH operations team.

CAMP was founded as the Cleveland Advanced Manufacturing Program and is a nonprofit organization that delivers engineering, business and training services to manufacturers and

other technology-based partners.

CAMP's for-profit subsidiary, the Performance Improvement Corp. (PIC), was chartered to work on DOD and other government programs. PIC provides advanced engineering support to the MPH including candidate part selection, 3-D modeling and N-STEP part translation and verification. All of these partners have worked closely together on the MPH Program with the intention of transitioning MPH technology to an Army project or program manager.

The MPH's ultimate goal is to increase the combatant commander's effectiveness. The MPH demonstrates every day that it is a valuable force enabler for the deployed Current Force. It began manufacturing parts within hours of being set up in Kuwait and has, to date, produced nearly 1,600 parts that were not in stock in the battlespace. These capabilities increased the operational readiness of units and reduced time needed to procure spare parts. Being able to manufacture parts at or near the point of need also reduces the Army's logistics transportation requirements and associated forward footprint.



The MPH works closely with the FRA in Kuwait to determine which parts will be made on site. Kevin Ksiazek (left), Alion Science and Technology, and Kevin Green (right), Focus:HOPE, are machinists deployed to Camp Arifjan, Kuwait, in support of the MPH. They work with Army civilian Jason Haney from Anniston Army Depot, AL.

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