Chief Warrant Officer 4 Mark Davis, an allied trades warrant officer, provides instructor training to Staff Sgt. Gregory Vaughn, an allied trades specialist, on the Haas Automation TM–1 CNC milling machine in the Metalworking Services Division of the Army Ordnance School at Fort Lee, Virginia.(Photo by James Siemen)

Transitioning From Manual to Automated Machining

■ By James H. Siemen

I entered the Army in 1988 as a military occupational specialty (MOS) 44E (machinist) under the Army Civilian Acquired Skills Program. Since I had received industry standard manual machinist training, equivalent to the Army's machinist training, the program exempted me from advanced individual training.

In 2015, 27 years later, the Army Ordnance School at Fort Lee, Virginia, continues to train Soldiers using the same machining technology and equipment for the MOS 91E (allied trades specialist) courses; however, industry standards have expanded.

Background

Allied trades specialists train as entry-level metalworkers, focused on fabricating, welding, repairing, and modifying both metal and nonmetal parts. The metalworkers use machines such as manual lathes, milling machines, and related machine shop equipment.

The manual lathe and milling machines that 91E Soldiers train on can be rather cumbersome to operate. Manual machines take a considerable amount of time to set up. Sometimes setting up takes longer than fabricating the part. Some of these manual machines have digital readouts for accurate movements; however, it is difficult for the machinist to replicate exact dimensions repeatedly.

Computer numerical control (CNC) machining is a machining process in which a computer controls the movements of the lathe or milling machine using a program made up of numerical code called "G code." CNC technology allows the machinist to manufac-

ture single or multiple parts with speed and accuracy that is not achievable on any manual machine.

CNC Machining

The transition to CNC machining for the Army started in 2006 with the MOS 914A Allied Trades Warrant Officer Course at Aberdeen Proving Ground, Maryland. The warrant officers received advanced machine training through an introduction to CNC on manual milling machines retrofitted with a CNC control module. These machines were complex and not an ideal choice for basic CNC training.

In 2008, the Ordnance Center and Schools purchased Haas Automation, Inc., toolroom lathes (TL–1s) and toolroom mills (TM–1s). The Army chose these CNC machines because of their design similarities to the manual machines and their powerful CNC functions.

The machines are easy to use and a popular choice for transitioning from manual to CNC machining. Equipped with the Haas Intuitive Programming System (IPS), the machines can create a part program nearly effortlessly. IPS is a proprietary operating system that guides the operator through the part machining steps using an interactive graphical interface.

Machining processes that are difficult or even impossible on a manual machine, such as compound angles, tapers, profiles, threading, and tapping, are significantly easier using IPS. Haas machines also allow programs to be uploaded from separate computers using computer-aided design and computer-aided manufacturing programs.

The Marine Corps and Air Force identified the benefits of CNC capabilities before the Army did. In addition to training on manual machines, both services have been training on CNC machines for more than 10 years. Using the same machines as the Marines and Airmen creates the possibility of sharing CNC programs among the three services when manufacturing parts in the field.

The Army will begin training on and fielding CNC equipment for MOS 91E Soldiers in fiscal year 2015. The Ordnance Corps and School's Track Metalworking and Recovery Department will receive 24 TL–1 lathes and 16 TM–1 milling machines to replace its manual machines.

Training MOS 91E Soldiers on the CNC machines will benefit not only the Army but also the Soldiers. This new training and equipment will bring allied trades specialists up to date with current CNC machining technology and give them greater employment opportunities when they complete their military service. Fielding CNC equipment alongside trained metalworkers will also allow field and sustainment maintenance units to fabricate single or multiple parts to exact specifications and more quickly.

NIMS Certification

The National Institute of Metalworking Skills (NIMS) offers 91E Soldiers certification for the metalworking courses that they complete during their military training.

The 91E currently has the opportunity to earn two metalworking skill certifications in the areas of manual milling and lathe operations. Under the new CNC program of instruction, the 91E could earn four additional level I certifications: CNC lathe operator, CNC mill operator (setup/programming), CNC turning, and CNC milling level I projects.

The Way Ahead

Although the TL–1 and TM–1 are necessary additions, training the new equipment brings about certain challenges, such as developing lesson plans, scheduling pilot classes, and training instructors.

Lesson plans will be developed to provide instruction for 91E Soldiers who have no prior knowledge of machining. Once lesson plans are finished and equipment has arrived, pilot classes will be scheduled to validate training strategies.

Military and civilian instructors within the Metalworking Services Division are receiving training on the Haas Automation CNC machines at the Ordnance School as the new equipment arrives. The instructors report that the transition from manual to CNC machining is straightforward because of the design of the TL–1 and the TM–1.

To complement the CNC training that the 91E will receive, the Army will start fielding the metal working machine shop set (MWMSS) in fiscal year 2015. The MWMSS consists of two expandable mobile containers, types 1 and 2. Type 1 contains the Haas TL–1, multiprocess welding equipment, an assortment of tools, and a mobile electric power source. Type 2 provides supplemental metalworking capabilities, including the Haas TM–1 and Torchmate CNC plasma cutting station. When fielded together, the MWMSS will create a metalworking and repair complex for the field and sustainment maintenance support levels.

Once the CNC training curriculum and program of instruction are validated, the instructors will no longer train students to use manual machines, and the MWMSS will replace manual machines in the field.

Allied trades specialists will receive training that is equivalent to current industry standards and have the opportunity to earn additional industry-recognized metalworking certifications relating to CNC. Fielding the MWMSS and training Soldiers on CNC will enhance the ability for the Ordnance Corps to help the Army win on the battlefield.

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