

# Report Documentation Page

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### PROBLEM / OBJECTIVE

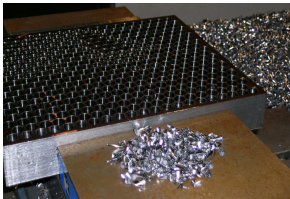
When drilling holes in hard steel plate used in up armor kits for Humvee light trucks, the Anniston Army Depot, Anniston, Ala., requested the assistance of the National Center for Defense Manufacturing (NCDMM) to find ways to speed the operations and also reduce tooling and machining costs.

A Humvee up armor kit consists of flat plates ranging in size from 4' x 6' to 3' x 6". Hole sizes range from 0.3125" to 0.750" diameter, and each diameter requires 4 to 14 holes. Some holes are simple through-holes, while others are tapped with threads for fasteners. After drilling, the plates are formed and shaped for installation.

### ACCOMPLISHMENTS / PAYOFF

#### Process Improvement

Anniston Depot had been using cobalt-high-speed-steel (HSS) drills while performing the drilling on a number of different machine tools. The NCDMM performed drilling tests on material meeting the armor's specifications and determined that the key to improving the operation was the application of high performance solid carbide drills, accompanied by through-spindle coolant to control and clear chips and enhance tool life.



Proof-of-Concept part produced on a HAAS VF-6 milling machine



#### Implementation and Technology Transfer

The Kennametal K7515 and K211-HP solid carbide drills recommended by the NCDMM feature special tip geometries and hard coatings that, in combination with through-coolant, permit the use of more aggressive drilling parameters and also produce increased tool life.

For example, the Depot had been applying a 0.5310"-dia. cobalt-HSS drill at a cutting speed of 28 surface feet per minute (sfm) and a feed rate of 0.004 inches per revolution (ipr). Using the solid carbide drills with through-coolant capability, 400 sfm cutting speed and 0.005 ipr feed were possible.

The new drilling setup increased drill life by forty times. The cobalt-HSS drills could complete 30 holes before wear required them to be changed, while the solid carbide drills produced 1200 holes before wear became significant.

Four of the 0.5310"-dia. holes are required in each armor kit, resulting in drill cost savings per kit of \$3.84 for this diameter alone. Savings ranged from \$0.28 to \$1.54 per hole, and \$1.12 to \$8.26 per kit, with other drill diameters.

Equally important, considering recent pressure to up armor vehicles quickly, was a reduction of 15 minutes in machining time required for each up armor kit, a result of the higher cutting speeds possible with the recommended drilling setup.

Finally, the new tooling increased efficiency, which enabled Anniston Depot to consolidate armor drilling operations on one CNC machine tool, freeing up other machines and boosting overall shop productivity.

#### Expected Benefits

Implementation produced:

- Reduction in drilling costs of \$23.58 per kit or \$51,876 over 2200-kit production run
- Savings of 15 minutes drilling time per kit, or 550 hours over the total production run
- Consolidation of drilling operations on one machine tool

Additional savings can be realized pending implementation of NCDMM recommendations for other aspects of up armor manufacturing, including milling of armor plate.

### TIME LINE / MILESTONE

Start Date..... Oct 04  
End Date ..... Dec 04

### PROJECT FUNDING

NCDMM funding..... \$14 K

### PARTICIPANTS

Anniston Army Depot  
NCDMM  
HAAS  
Kennametal Inc.

*For additional information concerning this project, contact the NCDMM at [www.ncdmm.org](http://www.ncdmm.org)*