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13. SUPPLEMENTARY NOTES

14. ABSTRACT
Lockheed Martin AeroParts, Inc. (LMAPI), Johnstown, PA, produces gun turret components for military helicopters, including the Sikorsky CH-53. Machining the 12" x 18" x 4" diamond-shaped aluminum gun mount adapter is challenging because of the intricate ISO grid pattern designed to reduce weight and provide strength. Machining the ISO grid requires the use of high speed machining techniques. Lockheed Martin has implemented the use of z-axis milling techniques for roughing the component, but sought the help of the National Center for Defense Manufacturing and Machining (NCDMM) to reduce machining time and optimize the finish milling operations, which includes an M60 x 1.5mm 4"-deep threaded hole in the component currently taking 1.5 hours to complete using a single point-threading tool.

15. SUBJECT TERMS
National Center for Defense Manufacturing and Machining; NCDMM; Lockheed Martin AeroParts, Inc.; Sikorsky CH-53; military helicopters

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CH-53 Gun Mount Adapter

NCDMM Project No. 04-0045-06

Technical Report

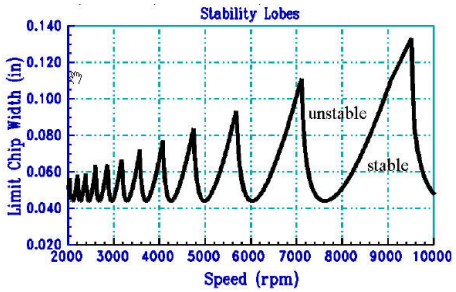
PROBLEM / OBJECTIVE

Lockheed Martin AeroParts, Inc. (LMAPI), Johnstown, PA, produces gun turret components for military helicopters, including the Sikorsky CH-53. Machining the 12" x 18" x 4" diamond-shaped aluminum gun mount adapter is challenging because of the intricate ISO grid pattern designed to reduce weight and provide strength. Machining the ISO grid requires the use of high speed machining techniques. Lockheed Martin has implemented the use of z-axis milling techniques for roughing the component, but sought the help of the National Center for Defense Manufacturing and Machining (NCDMM) to reduce machining time and optimize the finish milling operations, which includes an M60 x 1.5mm 4"-deep threaded hole in the component currently taking 1.5 hours to complete using a single point-threading tool.

ACCOMPLISHMENTS / PAYOFF

Process Improvement

NCDMM visited LMAPI and performed Modal Analysis on their Mazak vertical machining center being used for this operation. Modal analysis identified the optimum speeds and depths of cut that would maximize the machine's capabilities.



Stability Lobe Diagram

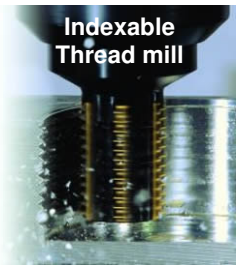
NCDMM recommended the application of the Advent indexable insert thread mill featuring insert coatings designed especially for milling of aluminum.

The thread mill includes through tool coolant capability, multiple inserts and longer insert engagement. This allowed the threads to be completed in one pass around the circumference of the threaded hole that has a depth of 4" with .75" of thread length at the top and bottom. The threads at the top and bottom must be timed with each other to accept a bushing to the full 4" depth.

Implementation and Technology Transfer

The modal analysis indicated that the one speed at which LMAPI was operating was within about 200 RPM of the recommended preferred speed. LMAPI spent countless hours using the trial and error method to find the optimized operating speeds. Using modal analysis, we were able to identify the preferred speed in approximately 15 minutes.

The implementation of the Advent thread milling tool reduced finishing time of the threads from 1.5 hours to approximately 15 minutes. This new tooling allows much higher speeds and feed rates.



Expected Benefits

In summary, implementation produced:

- The use of the multiple inserted thread milling tool produced a time savings of 75 minutes for each component
- Introduced LMAPI to modal analysis techniques that will provide additional savings on future projects when applying high speed machining techniques.
- Resulted in improved thread quality

An estimated savings of $35,000 on the initial order was realized based on an average hourly shop rate of $70 for this area with additional savings expected following full implementation of NCDMM recommendations.

TIME LINE / MILESTONE

Start Date.....June 04
End Date.....September 04

PROJECT FUNDING

NCDMM funding $10K

PARTICIPANTS

Lockheed Martin AeroParts, Inc., Johnstown, PA.
Design & Manufacturing Solutions, Inc. (DMS)
Kennametal Inc.
Manufacturing Laboratories, Inc. (MLI)

For additional information concerning this project, contact the NCDMM at www.ncdmm.org