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14. ABSTRACT Raytheon Missile Systems (Raytheon) of Tucson, AZ, manufacturer of the Excalibur and Extended Range Guided Munitions (ERGM) have consistently received critical components containing Class III, buttress threads out-of-tolerance from their suppliers. These out-of-tolerance conditions have caused failures of the components at the buttress thread joints. The Rockwell hardness of the 4340 steel (Rc53) being used for the components is a major contributor to the out-of-tolerance condition. The National Center for manufacturing & Machining (NCDMM) was requested to evaluate and optimize the machining of these Class III buttress threads to eliminate the failures. After reviewing the supplied material and current processes, the NCDMM developed a plan to optimize cutting of both the internal and external threads using advanced technologies and methodologies.					
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Improved Buttress Thread Machining for the Excalibur and Extended Range Guided Munitions

NCDMM Project No. 05-0077-10

PROBLEM / OBJECTIVE

Raytheon Missile Systems (Raytheon) of Tucson, AZ, manufacturer of the Excalibur and Extended Range Guided Munitions (ERGM) have consistently received critical components containing Class III, 7°/45° buttress threads out-of-tolerance from their suppliers. These out-of-tolerance conditions have caused failures of the components at the buttress thread joints. The Rockwell hardness of the 4340 steel (Rc53) being used for the components is a major contributor to the out-of-tolerance condition.

The National Center for Manufacturing & Machining (NCDMM) was requested to evaluate and optimize the machining of these Class III buttress threads to eliminate the failures. After reviewing the supplied material and current processes, the NCDMM developed a plan to optimize cutting of both the internal and external threads using advanced technologies and methodologies. After completing numerous detailed designs of experiments (DOE), the NCDMM was successful in consistently machining the internal and external buttress threads in the 4340 material. These new machining parameters ensure threads meet the required tolerances specified in ANSI B1.9 - 1992.



Internal Threads



External Threads

ACCOMPLISHMENTS / PAYOFF

Process Improvement

By combining advanced PVD TiAlN (Titanium Aluminum Nitrate) threading inserts with the optimum machining parameters, the NCDMM was successful in establishing a robust process improvement to machine the buttress threads for the Excalibur and ERGM.

Implementation and Technology Transfer

By utilizing these advanced technologies and methodologies developed and implemented by the

NCDMM engineers, successful machining of the Class III buttress threads has been accomplished and actual cutting time to machine the buttress threads was reduced significantly. Transitioning this technology will prove instrumental in the success of future Excalibur and ERGM products.



Excalibur



ERGM

Expected Benefits

By providing their suppliers the recommended machining parameters and tooling recommendations developed by the NCDMM, Raytheon can be assured the components having the buttress threads will meet the requirements set forth in ANSI Standard B1.9-1992. These benefits include:

- Precise, Class III, 7°/45° buttress threads (in tolerance)
- Significant time savings of ten (10) minutes per thread
- Extended tool life

Total savings over the life of the program is estimated at nearly \$2M.

TIME LINE / MILESTONE

Start Date.....September 05
End Date April 06

PROJECT FUNDING

NCDMM Funding.....\$67K

PARTICIPANTS

CNC Software, Inc./MasterCam
Fryer Machine Systems Inc.
HAAS Automation, Inc.
Kennametal Inc.

For additional information concerning this project,
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