



High Explosives (HE) Machining System

Montana State University (MSU) has leveraged a collaboration between MSU and the Technical Applications office in the Associate Laboratory Directorate (ALD) for Weapons Engineering Production (ALDWP-TAO) at Los Alamos National Laboratory (LANL). The LANL ALD for Weapons Engineering (ALDW) has partnered with MSU to develop a small footprint machining system to provide gas gun samples for HE characterization efforts within ALDW group M-8. The goal of this effort is to modify a Pocket NC 5 axis CNC system to develop an appropriate enclosure system, along with equipment modifications, for machining HE materials within LANL facilities. Successful completion of this effort also includes modeling, programing, demonstration with surrogate material, and validation to specifications.

Figure 1 highlights several of the modifications required to successfully satisfy the stringent requirements for machining HE materials unavailable on a commercially purchased Pocket NC. The addition of the aluminum enclosure system enables the application of coolant on the workpiece, which is not available commercially. The addition of coolant within the operation also required waterproofing the motors, and protective coverings were also added to the ways to ensure HE is not trapped within bearing surfaces (Figure 2). The enclosure also implements a safety interlock that stops the machine when opening during operation.

The most significant modification to the commercial system was replacement of the spindle and collet system to accommodate the lower rpm required for the machining of HE materials. A new spindle motor supplier was identified and implemented within the hardware/software interface; however, specially designed interfaces were needed to implement tool holding with the new motor.



Figure 1. The expanded enclosure system developed to incorporate systems requirements.



Figure 2. Adding protective coatings to help ensire HE is not trapped within bearing surfaces.

The completed system was delivered to LANL by MSU staff members and demonstrated on surrogate materials for LANL management and staff.

Both MSU students and staff contributed to this project. Continuing efforts on this platform are implementing a measurement system that will provide tool forces during the cutting procedure. That information can then be utilized to look at the forces applied to the HE during the cutting operations. The initial LANL ALDWP-TAO/MSU collaboration has been funded by the National Nuclear Security Administration's NA-191 with additional programmatic funding in support of the HE specific efforts.

This work was conducted in collaboration with ALDW group M-8, and group leader Tyler Brown.

ALDWP Management Lead: Dr. Robert Putnam, Program Director 505-665-8494 • rputnam@lanl.gov *M-8 contact:* Tyler Brown, GL 505-664-0972 • tylerb@lanl.gov MSU contact: Dr. David Miller, Professor 406-994-6285 • davidmiller@montana.edu

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