



2001 Continuous Mixer and
Extruder User's Group
Picatinny Arsenal



***2.75" MK 90 Propellant Grain
Advanced Processing Demonstration
Equipment and Facility Upgrades***

Wayne Thomas
Indian Head Division, NSWC
Indian Head, Maryland
thomasgw@ih.navy.mil

2 May 2001





Project Overview

Equipment Upgrades

- As the result of a hazard analysis for the extrusion of AA-2 propellant there were several equipment deficiencies noted. The following systems were implemented to solve the problems.
 - ➔ The die restraint system was inadequate in two areas.
 - The system would not hold at extrusion pressures above 2,500 psi.
 - Pressure release system.
 - ➔ The screws should be able to be removed from the extruder remotely.
 - ➔ There should be some way to stop the propagation of a fire from the extruder to the feeder.
 - ➔ Englehardt feeder instead of K-Tron S-200. The Englehardt is a vibratory tray feeder versus the K-Tron which is a screw feeder.





Equipment Upgrade Process Improvements

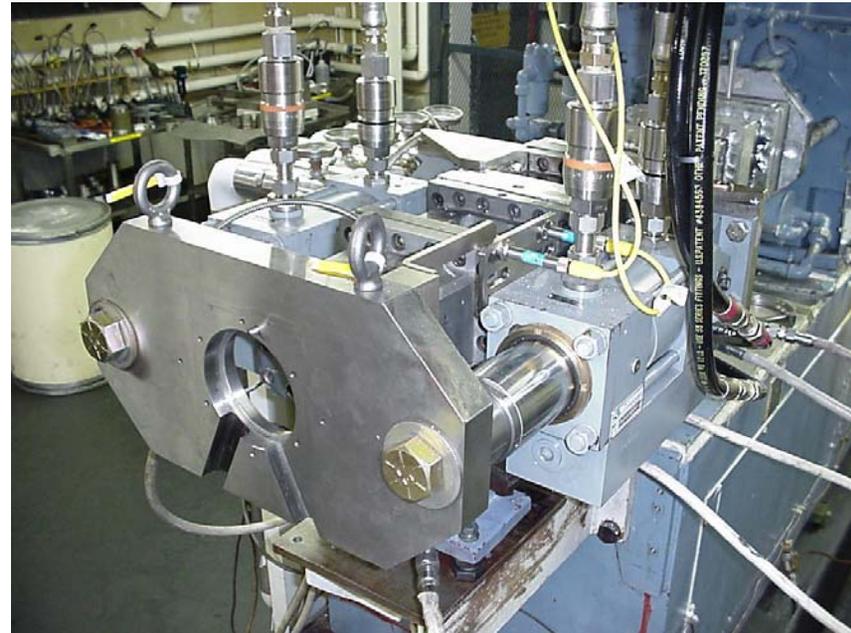
- Equipment was added to improve the process and minimize waste.
 - Laser micrometer
 - On-line dimensional analysis
 - Water jet cutter
 - Part of the extrude-to-size effort





Die Restraint System

- The die restraint system will be able to operate at an extrusion pressure of 3,000 psi.
- There are three pressure release mechanisms
 - ➔ A shear ring
 - ➔ Pressure relief valves
 - ➔ electromechanical
- Built under the patent from ICT
 - ➔ Dr. Mueller under contract





Screw removal system

- The screw removal system is designed to remove the screws remotely.
 - The concern over slow cook off problems with double base lead to the implementation of this equipment.
 - Uses the same hydraulic power source as the die restraint system.





Feed Funnel

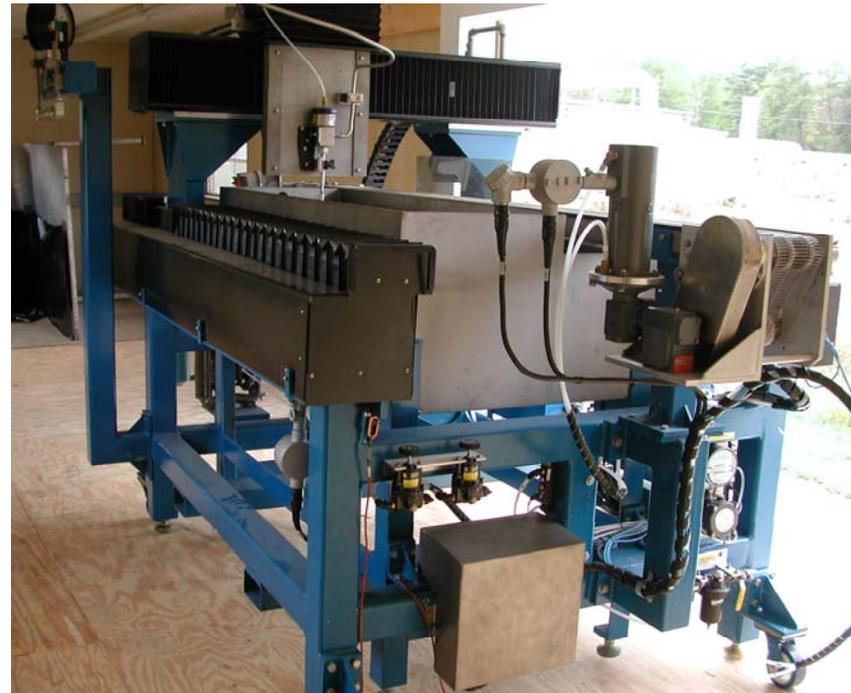
- Thiokol designed
- Designed to stop the propagation of fire from extruder to feeder.
- The plan at Indian Head is to use this style of funnel for all dry ingredient feeding.





Water Jet Cutter

- The water jet cutter was implemented to assist with the extrude to size effort.
 - ➔ This work is limited due to a funding reduction.
- Capabilities include strand and pattern cuts.





Laser Micrometer

- Gives real time strand dimensions.
 - ➔ We would see the impact of process changes on strand dimensions.
 - ➔ Part of the extrude to size effort for the 2.75 inch grain.
 - ➔ Possibility of feedback loop for extruder control.





Englehardt Feeder

- Vibratory tray feeder.
- No pinch points.
- Will be used to feed double base pellets.

