Developments in Processing of IM Gun Propellants in the UK

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Due to the increasing requirement to introduce IM propellant formulations into gun propelling charges, in the direct fire and indirect fire systems, BAESYSTEMS has re-established R & D gun propellant processing in the UK at their Land systems Glascoed plant in Wales.
Presentation Overview

- Introduction
- Facility Overview
  - Incorporation
  - Extrusion
  - Cord handling & Cutting
  - Stoving & Blending
  - Control system
  - Testing
- Propellant Processing
- Future technology
- Conclusions
Introduction

- The new propellant processing facility at Glascoed is a remote controlled processing facility. Conventional propellant processing technology equipment has been instrumented and controlled by sophisticated computer technology.
- The facility will be used for all gun propellant Research and Development programmes. Propellant formulations for direct and indirect fire applications will be processed and tested.
Facility Overview

- Incorporation
- Extrusion
- Cord handling & Cutting
- Stoving & Blending
- Control system
  - Interface with interlocks
  - Software restrictions
  - Data collection
- Testing
Incorporation

- Weigh scales & Metal Detector
- Incorporators
  - 3 incorporators available
  - Capacity of 2kg to 20kg batches
- Rheometer
  - Each batch is monitored for viscosity
Extrusion

- 3” Press
  - 1kg capacity
- 8” Press
  - 20kg capacity
- Cord handling system
- Granule Cutter
Cord handling & Cutting

Propellant is draped and cut
Stoving & Blending

• Stoving
  • Propellant is dried on trays in a controlled room
  • Max temp is 45°C

• Blending
  • Stick propellant is manually blended
  • Granules are blended or coated in a drum blender
Remote control process
Control system – Initial access screen
Control system – 8” press and Cord handling
Safety Considerations

• Captive Key system
  • No one allowed in the facility while the press is running
  • No one allowed in the facility before dough-up
• Maximum pressures, torque and temperatures set.
  • First warnings and software regulated actions
• “Emergency stop” buttons throughout the facility and on the panel
Control system - data collection

- Software system monitors the process continuously and data points for all equipment are recorded.

- Incorporator cycles are saved
  - Cycles can be replayed to ensure batch to batch consistency

- Press cycles are recorded

- Processing is monitored by CCTV
Testing

- Rheology
  - Capillary rheometer
  - Viscosity measured for each batch
- Dimensional analysis
- Closed Vessel
  - Recorded for each lot of propellant
- Chemical & physical analysis
  - Density recorded for each batch
- Hazard data
- Ballistic testing
- IM testing
Propellant processing

- Propellant types being processed are multi-based TPE propellants for direct and indirect fire applications including research with novel ingredients.

- Currently supporting MoD project for developing IM propellants.

- Collaborating with production suppliers to develop the scale up process for these propellants.
Future technology

- Continuous extrusion process based on co rotating, fully intermeshing, self wiping, twin screw extruder
- Benefits well known:
  - Safety
    - Remote processing
    - Lower amounts of energetic material being processed
    - Reduction in wastage
    - Highly controlled and instrumented process
  - Quality
    - Aeration decreased
    - Continuous process
  - Performance benefits
    - Enhances propellant physical properties
    - Enhances ballistic properties
    - Highly flexible process
Future technology

30 mm twin screw extruder to be installed in 2008
Conclusions

- BAE Systems Glascoed re-established an R&D capability within the company.
- The new process route is safer and gives an enhanced reliability within the process.
- TPE LOVA propellant has been processed successfully.
- Facility will continue to develop with Twin Screw Extruder programme.
Questions?