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Developments in Processing of IM Gun Propellants in the UK

Authors: Anne Marie Wilton,
Remco Broekhuis,
Tom Somerville

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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.

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Presentation Overview

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

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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.

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Facility Overview

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

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Incorporation

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

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Extrusion

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

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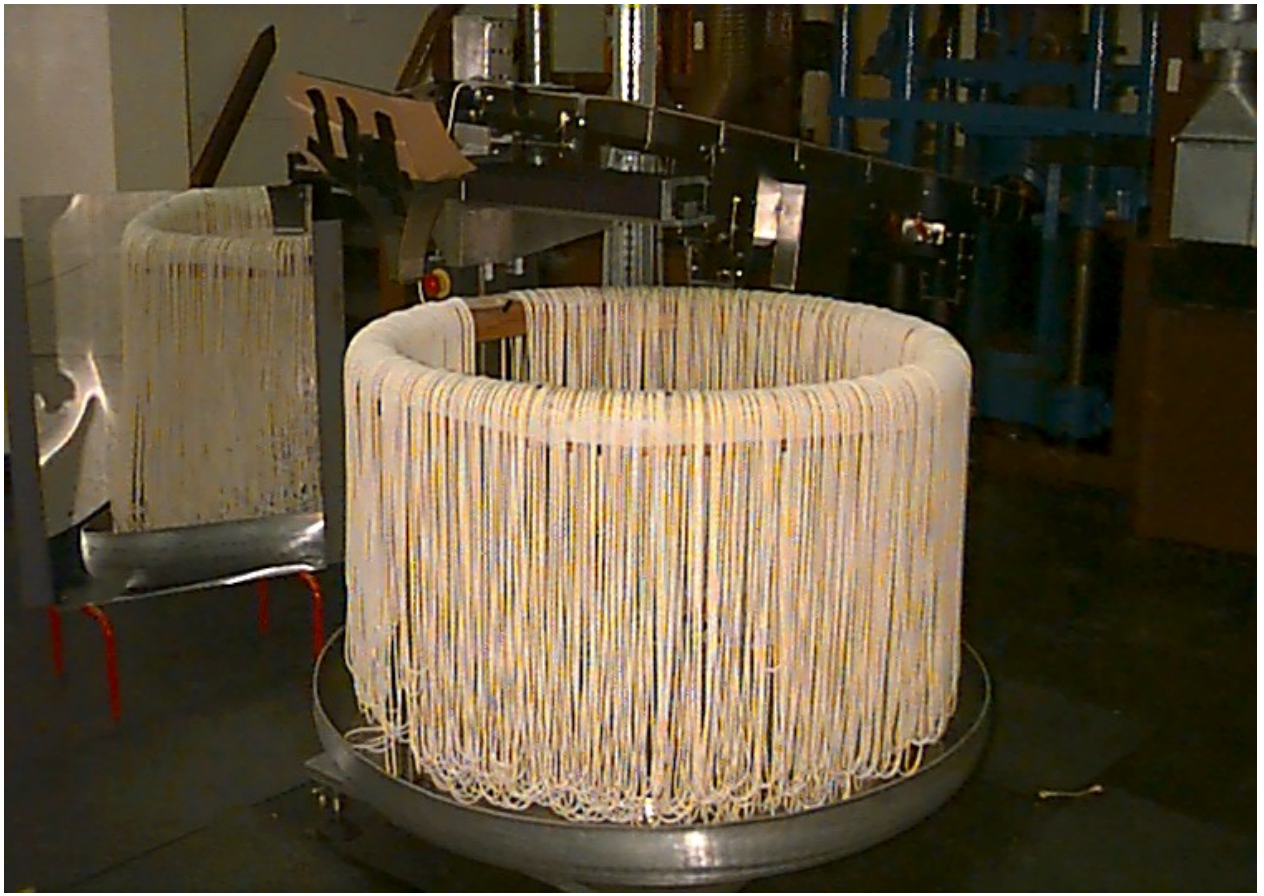
Cord handling & Cutting



Propellant is draped and cut

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Stoving & Blending

- Stoving
  - Propellant is dried on trays in a controlled room
  - Max temp is 45ºC

- Blending
  - Stick propellant is manually blended
  - Granules are blended or coated in a drum blender

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Remote control process

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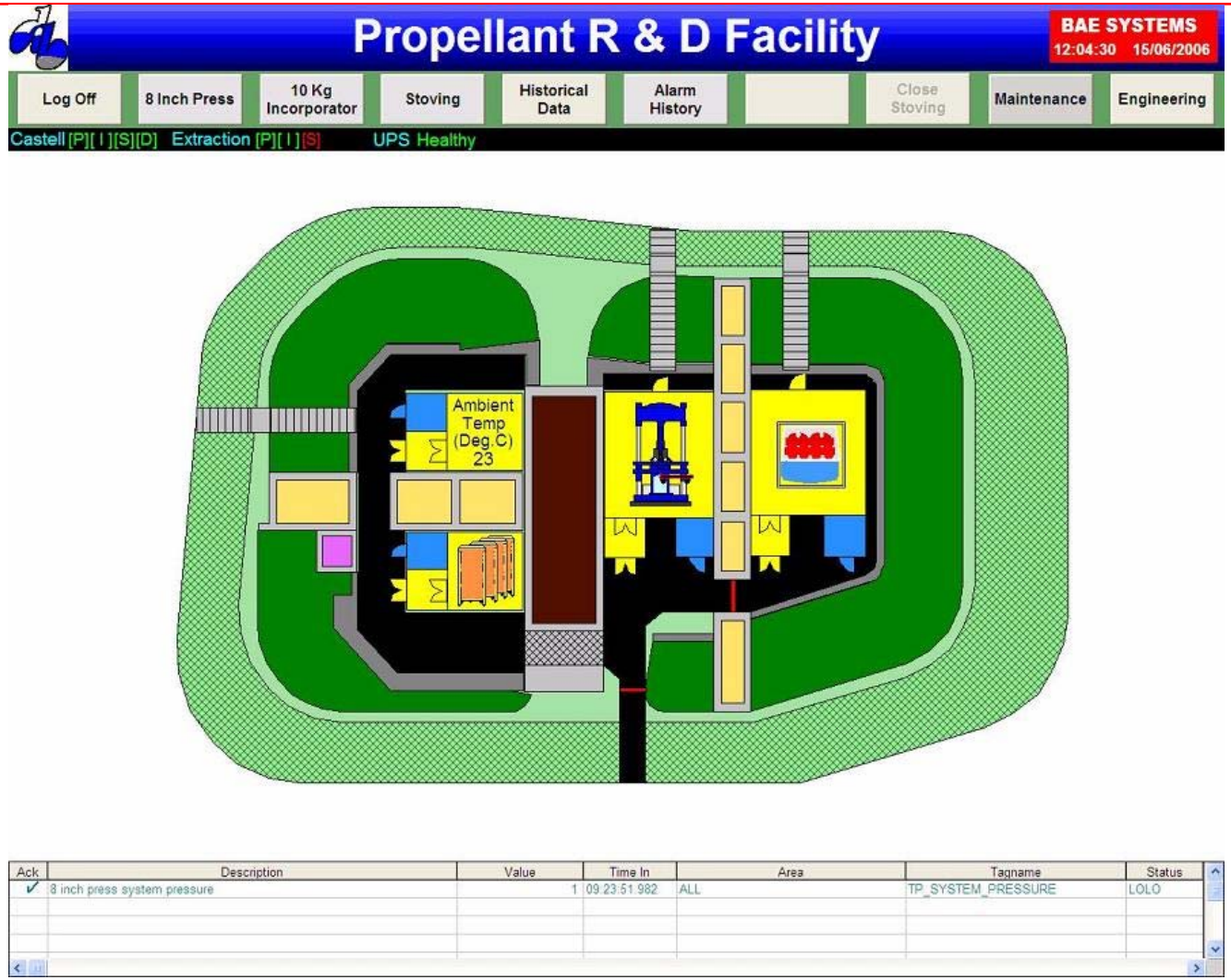
Control system – Initial access screen



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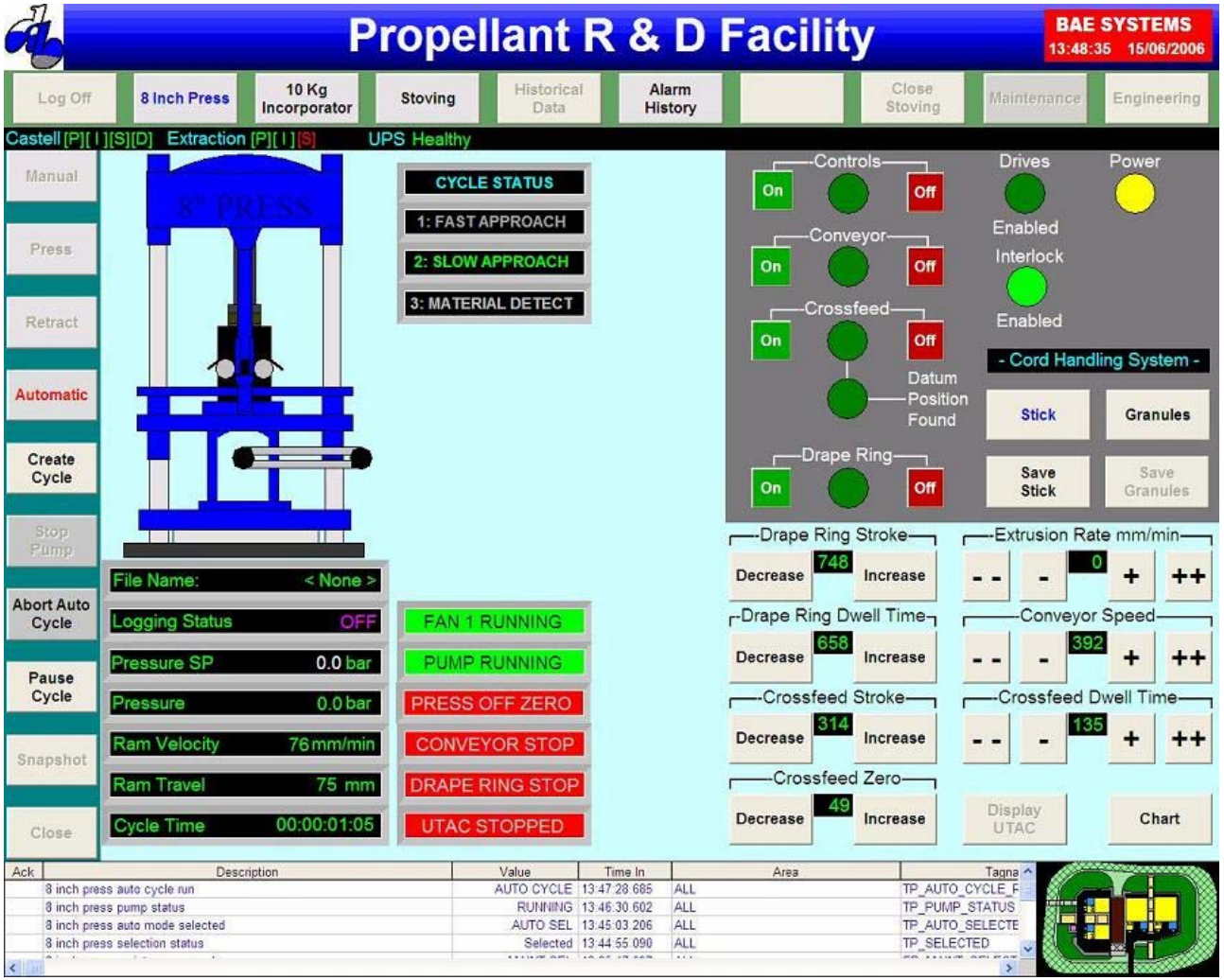
Control system – 8” press and Cord handling



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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

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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

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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

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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

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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

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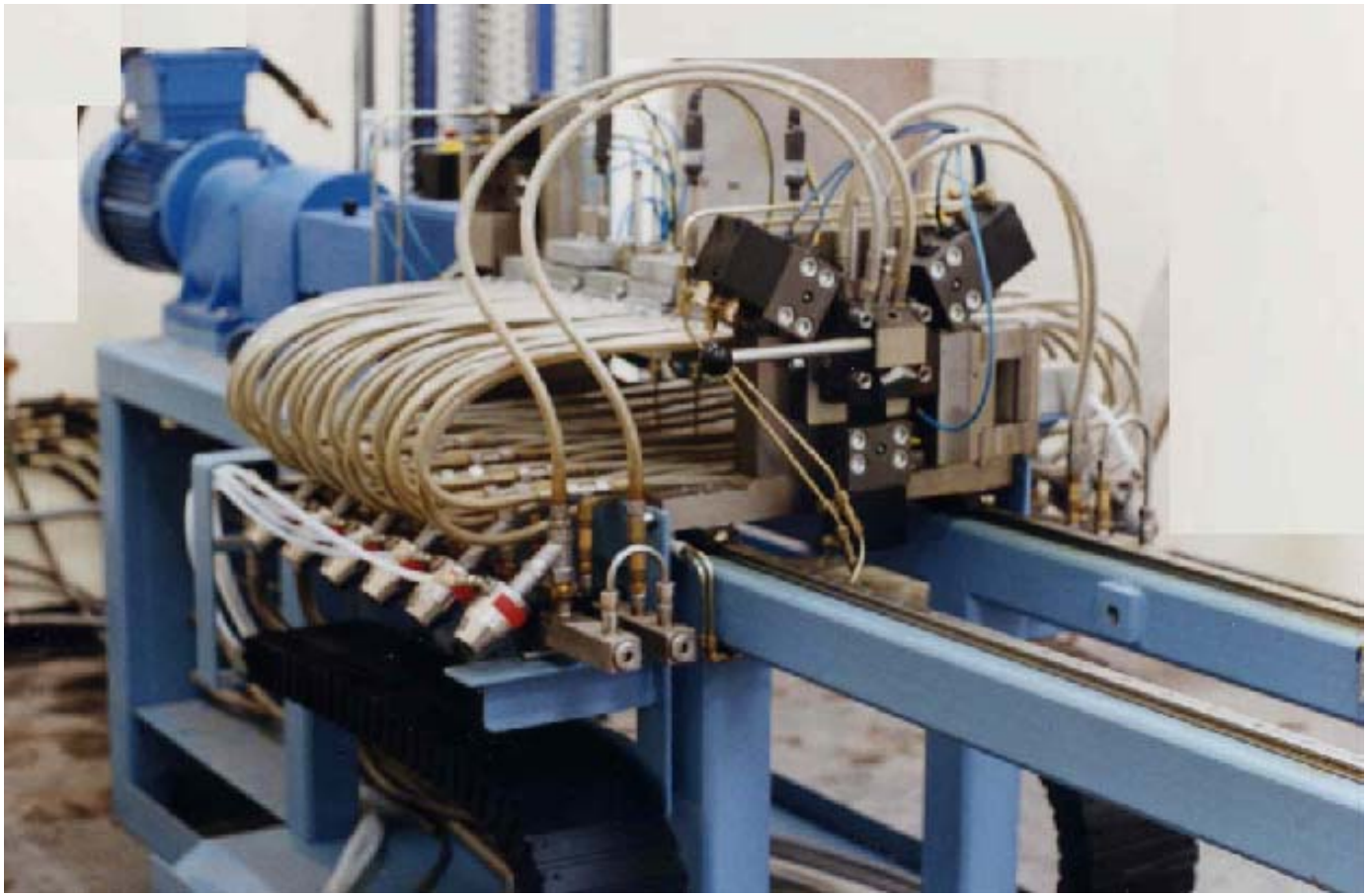
Future technology



30 mm twin screw extruder to be installed in 2008

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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.

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Questions?

