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Bring IM propellants within REACH

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Authors

Anne Marie Wilton
Mark Penny
Tom Somerville

Abstract No. 13803

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Outline

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Introduction

BAESYSTEMS Global Combat systems re-established a gun propellant R + D facility at their munitions site in South Wales, UK.

This enabled development of the next generation propellant formulations.

Manufactured TPE propellants since 2006.

Support of the future Insensitive Munitions (IM) charge systems

IM propellant group has the ability to adapt to changes in suppliers and regulations. One such issue being REACH…..

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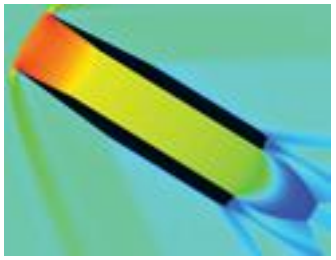
The REACH Issue to be addressed

The European Union regulation, REACH (Registration, Evaluation, Authorisation and restriction of Chemical Hazards) is constantly checking and updating its list of hazardous chemicals.

One such substance, Di Butyl Phthalate (DBP) is already classified as a Substance of Very High Concern and now has a sunset date in January 2015. Thus, DBP will no longer be considered for new propellant formulations.



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Technical approach for DBP issue

- DBP not to be considered for new formulations (it is toxic to reproduction (R61 & R62))
- Maybe an issue with all Phthalate based materials
- Investigate alternatives to phthalates
- Alternatives need to be cheap & readily available

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Technical approach continued..

- A number of plasticisers were looked at
- Down selection to two most viable
- Initial small scale development of new formulations
- Small scale production
- To lead into full scale production

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REACH Propellant Options

Propellants for comparison		
LOVA Baseline	Option 1	Option 2
F300/424	F300/463	F300/469
DBP	Plasticiser 1	Plasticiser 2

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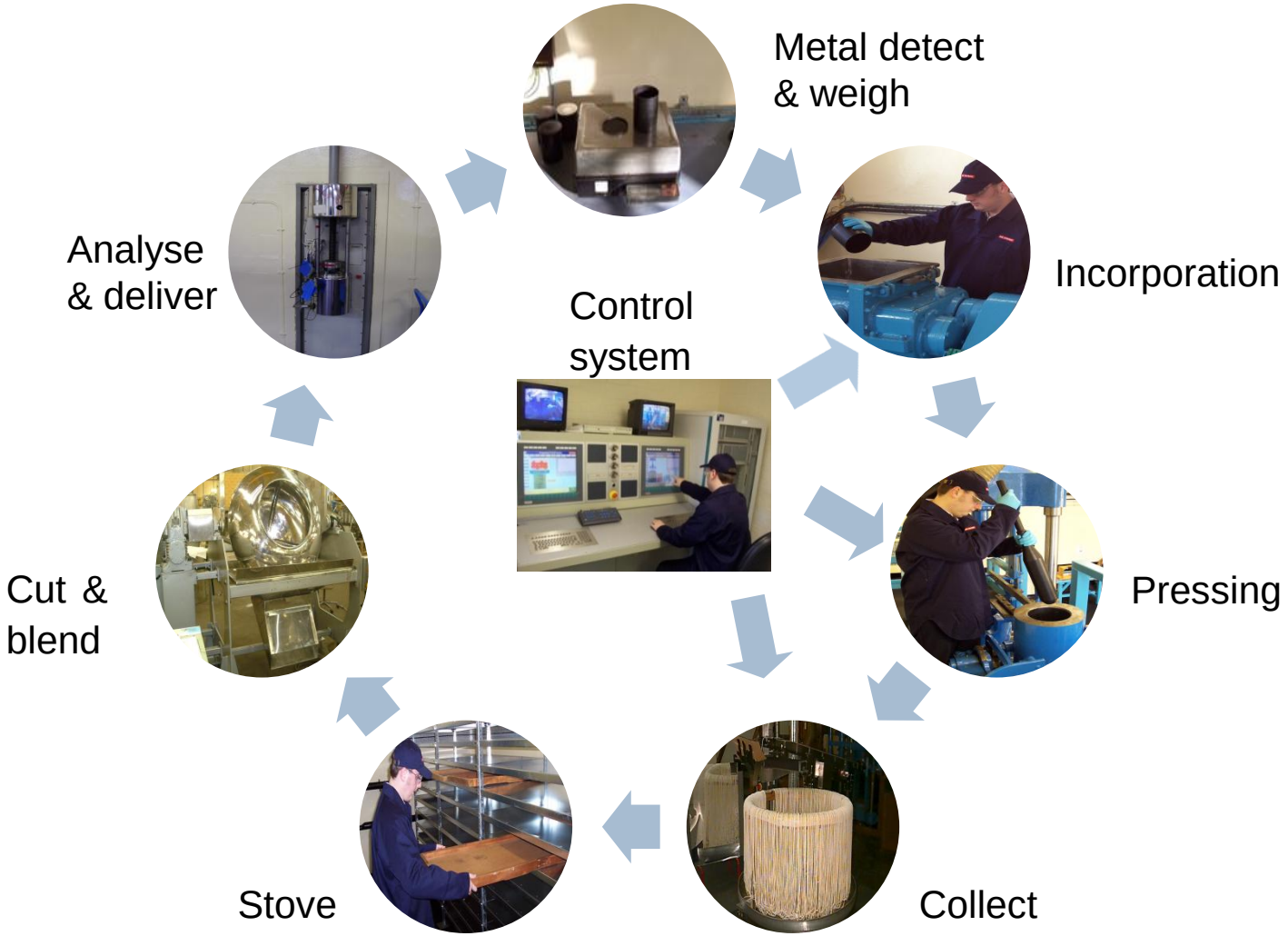
Process Flow



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Propellant data & testing

For each propellant:

- Physical analysis
  - Viscosity, density, size, shape etc…
- Chemical analysis
- Hazard testing
  - EMTAP
- Closed Vessel Testing
- IM Testing – Shaped Charge Jet

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Propellant performance - Processing

- Processing with plasticiser 1 and 2 showed no significant difference compared with DBP baseline material
  - Incorporated within the process parameters of the existing baseline
  - Pressed to give similar extrudate
  - Viscosity of the alternative plasticisers propellant was slightly higher than the DBP propellant
  - Web size of all the propellants were not affected by changing the plasticiser
  - Density values showed no significant variation with different plasticisers

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Propellant performance - Sensitiveness results when compared to the baseline

Sensitiveness results			
Propellant	**F300/424**	**F300/463**	**F300/469**
F of I	73	Similar	Similar
Mallet friction	0% for all surfaces	Similar	Similar
F of F	>6	Similar	Similar
Electric Spark	No ignitions at 4.5J	Exact same response	Exact same response
Temp of Ignition	251ºC	Very Slightly lower	Very Slightly lower
Ease of ignition	Fails to ignite	Exact same response	Exact same response
Train test	Ignites and supports a train steadily throughout	Exact same response	Exact same response

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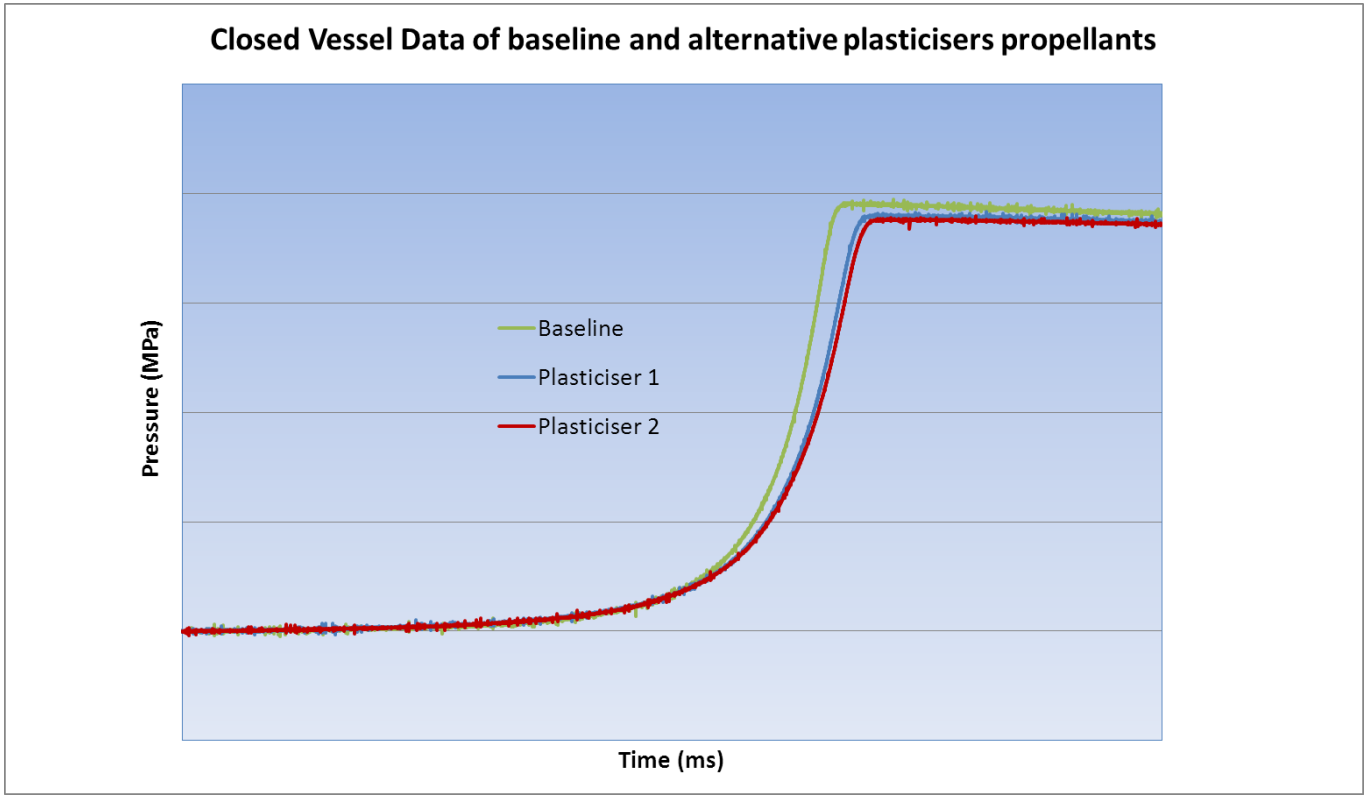
Propellant performance - Closed Vessel

- No difference observed between the new plasticisers
- Similar performance for DBP and the new plasticisers



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Propellant performance - IM Results

- No significant differences between the different plasticisers in IM Performance
- All formulations performed better than the conventional control
- All IM formulations gave Type 3 / 4 to Shaped Charge jet

Conventional Rd

Plasticiser DBP

Plasticiser 1

Plasticiser 2

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Propellant performance - IM Results

- Witness Plate damage – conventional showed most damage

Conventional Rd

IM Propellant with DBP

IM Propellant with Plasticiser 1

IM Propellant with Plasticiser 2

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Conclusion

- Plasticisers 1 & 2 are good alternatives to DBP
  - No major changes in the process method required
  - Geometry, shape and size of propellants are similar
  - Sensitiveness results are similar
  - CV results show no significant difference in ballistic performance between alternative plasticisers and similar performance as DBP baseline
  - Similar IM performance for all plasticisers

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Future work

- This work shows the versatility of the LOVA facility
  - Addressed the REACH problem swiftly
- In future improved formulations can be manufactured
- These candidates plasticisers are being introduced into conventional propellants
- Work with Propellant production partner to develop these formulations

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Acknowledgements

- Big "Thank you" to those BAESYSTEMS Global Combat Systems Munitions, colleagues without whom this presentation would not have been possible:
  - *Ian Martin, Bishopton*
  - *Martin Johnson, Glascoed*
  - *Chris Carr, Ridsdale*

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Thank you – Any Questions?