MSIAC
Supporting Munitions Safety

Munitions Safety Information Analysis Center












Reduced Vulnerability Gun Propellants

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AIM OF THE PRESENTATION

Overview of gun propellant that are available

or will be in the immediate future

BACKGROUND

NIMIC IM Design Technology Workshop

US Joint Services IM Technology Panel

Limited amount of IM data for LOVA propellants

Lack of high performance-low vulnerability propellants

Large Calibre Gun Propellants: TOP PRIORITY for the development of IM technology

MSIAC Project

IN A NUTSHELL

Medium (20 mm +) and large caliber propellant

Available in the immediate future

Based on

- Survey carried out with propellant manufacturers
- Literature

Details in a MSIAC report

"Status of Available Reduced Vulnerability Gun Propellant "

IN A NUTSHELL

Data requested from manufacturers

- IM test results
- Ballistic performance
- Cost/production capability
- Manufacturing process
- Formulation chemistry and sensitivity

FORMULATION SELECTION

Potential to be in the field within 10 years

Ballistic performance demonstrated in intended application

Existing production scale manufacturing facilities

IM properties demonstrated

Significant IM tests carried in intended application

TRENDS

- Improving conventional formulations
  - By using less sensitive ingredients
    - Environmentally friendly ingredients
    - Processing techniques reducing the environmental burden

TRENDS

- Improving the nitramine based XM39 formulation
  - Improved RDX particle size distribution
  - Energetic plasticizer
  - Process friendly binder
    - Processing techniques reducing the environmental burden

MODIFIED CONVENTIONAL

- Artillery Charges (155 mm Modular Charges)
  - Eurenco
    - HUX designed by Eurenco France in the late 90's
    - NL-100 to be introduced in service in 2009
  - NitroChemie
    - R 5730 in service with few countries such as Ge, UK, US

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR
Eurenco Bofors	NL-100	155 mm Charges	V	V	IV	NR	IV	V
Eurenco France	HUX	155 mm Charges	IV	V	IV	IV		III
NitroChemie	R5730	155 mm Charges		V			IV	NR

MODIFIED CONVENTIONAL

- Fixed ammunition
  - NitroChemie
    - SCDB in service in few 105 mm and 120 mm tank rounds
    - EI Family (SBST, EI, EI+, EI ++, ECL)
      - In service with 20 mm to 35 mm rounds in Ge, Fi, No, Sw, US
    - ECL
      - In qualification with 30 mm rounds in GE
      - Feasibility study with 30 mm and 120 mm mortar rounds in US

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR
Eurenco Bofors	NL-2XX	40-120 mmTk							
IMI	CLP-26	105 mm Tk		III/IV		V	III/IV	
NitroChemie	SCDB	105-120 mm Tk			IV		V	
NitroChemie	SBST	20-35 mm			III/IV		V	
NitroChemie	EI++	20-35 mm			V		V	
NitroChemie	ECL	20-76 mm, Mortar				NR	IV/V	

MODIFIED CONVENTIONAL

- Fixed ammunition
  - Eurenco
    - NL2XX for 40 mm, 57 mm and 105 mm tank rounds, still in development.
  - IMI
    - CPL Family
      - In qualification in 105 mm and 120 mm tank KE rounds

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR
Eurenco Bofors	NL-2XX	40 - 120 mm Tk						
IMI	CLP-26	105 mm Tk		III/IV		V	III/IV	
NitroChemie	SCDB	105-120 mm Tk			IV		V	
NitroChemie	SBST	20 - 35 mm			III/IV		V	
NitroChemie	EI++	20 - 35 mm			V		V	
NItroChemie	ECL	20 - 76 mm, Mortar				NR	IV/V	

MODIFIED CONVENTIONAL

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR

- Propelling Charges

Eurenco Bofors	NL-100	155 mm Charges	V	V	IV	NR	IV	V
Eurenco France	HUX	155 mm Charges	IV	V	IV	IV		III
NitroChemie	R5730	155 mm Charges		V			IV	NR

- Fixed Ammunition

Eurenco Bofors	NL-2XX	40 -120 mm Tk						
IMI	CLP-26	105 mm Tk		III/IV		V	III/IV	
NitroChemie	SCDB	105-120 mm Tk			IV		V	
NitroChemie	SBST	20 - 35 mm			III/IV		V	
NitroChemie	EI++	20 - 35 mm			V		V	
NItroChemie	ECL	20 - 76 mm, Mortar				NR	IV/V	

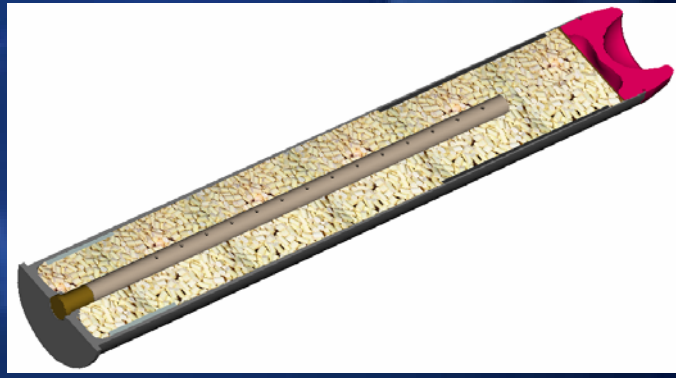
MODIFIED CONVENTIONAL

- In service
  - HUX (155 mm French Army Top Modular)
  - R5730 (155 mm DM72)
  - SCDB (105 mm & 120 mm tank KE rounds)
  - EI Family (20 mm - 35 mm)
- In qualification
  - NL-100 (155 mm Uniflex 2 IM)
  - CPL Family (105 mm & 120 mm tank KE rounds)
- In development
  - NL-2XX (20 mm – 76 mm & mortar)
  - ECL (30 mm & 120 mm mortar)

NITRAMINE BASED

- Eurenco
  - NL-0XX
- GD-OTS Canada (Valleyfield)
  - XM39 (Modified)
- NSWC Indian Head
  - M43
  - EX-99
    - Process licensed from Eurenco Bofors

NITRAMINE BASED



- Naval Propelling Charges
  - With **energetic plasticizer** (EX99)
    - To be introduce in service by
      - US Navy as the 5 inch gun Extended Range Guided Munition propelling charge

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR

DSTO/ADI	XM39/P	5 inch 54 Cal	V	NR	II/III	NR		
US Navy	EX-99	5 inch 62 Cal	III	II/IV	III	III		

NITRAMINE BASED

Fixed Ammunition

- With **inert plasticizer** (NL-0XX, XM39)
  - NL-0xx
    - In service with the 40 & 57 mm gun in Se (Eurenco)
    - In certification for the US Coast Guard
  - XM39 Extensively tested by
    - GD-OTS Canada in a HE 105 mm tank cartridge
    - US Army in a HEAT 105 mm tank cartridge (M456)

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR
Eurenco Bofors	NL-0XX	40 & 57 mm							
GDOTS Canada	XM39	105 mm Tk HE		IV		V		III
US Army	M43	105 mm Tk KE							

NITRAMINE BASED

Fixed Ammunition

- With **energetic plasticizer** (M43 very similar to EX-99)
  - In service with the US M900 APFSDS-T 105 mm tank

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR
Eurenco Bofors	NL-0XX	40 & 57 mm							
GDOTS Canada	XM39	105 mm Tk HE		IV		V		III
US Army	M43	105 mm Tk KE						

NITRAMINES BASED

BARE TESTS	SCO	FCO	FI	BI	SCJ	SR

- Propelling Charges

DSTO/ADI	XM39/P	5 inch / 54 Cal	V	NR	II/III	NR		
US Navy	EX-99	5 inch / 62 Cal	III	II/IV	III	III		

- Fixed Ammunition

Eurenco Bofors	NL-0XX	40 & 57 mm						
GDOTS Canada	XM39	105 mm Tk HE		IV		V		III
US Army	M43	105 mm Tk KE						

NITRAMINE BASED

- In service
  - NL-0XX (40 mm & 57 mm)
  - M43 (105 mm Tank KE with restrictions)
- To be introduced in service soon
  - NL-0XX (57 mm)
  - EX-99 (5 inch propelling charges)

SUMMARY

- Two trends
  - Modifying Conventional Formulations
  - Improving Nitramine Based Formulations
- Numerous formulations available
- All formulations rely on de-confiment to pass thermal tests.
- Some propellants meet most of the STANAG 4439 requirements.
  - IM is a system requirement

SUMMARY

- European leading producers and advanced developers
  - Eurenco
  - Nitrochemie
- Other sources
  - IMI
  - GD-OTS Canada Valleyfield
  - NSWC Indian Head
- Details in MSIAC 'Governments Only' report

  "Status of Available Reduced Vulnerability Gun Propellant "