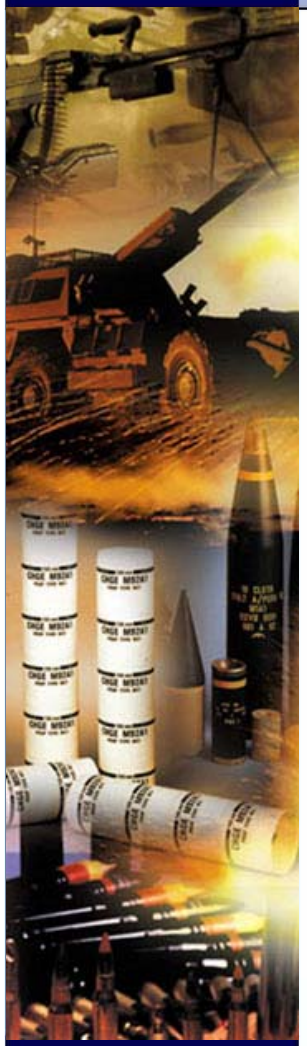

New Indirect Fire Capabilities from Industry Cooperation

2004-06-16

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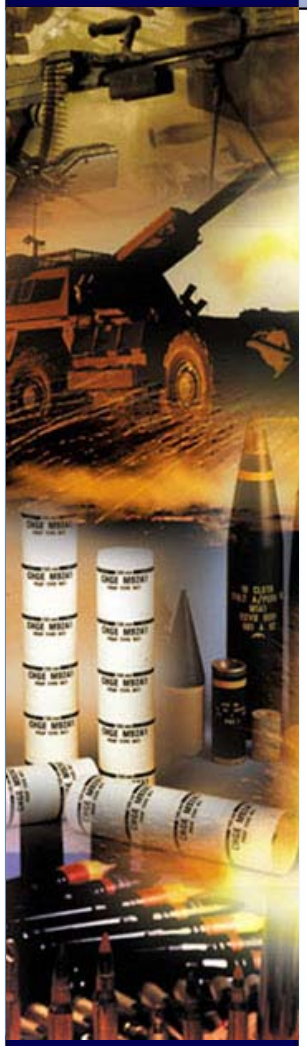
Introduction



- Background
- Constraints/Challenges
- Objectives/Goals
- Required Technologies
- Options
- Results
- Market Conflict
- Greater Partnerships
- Spin-offs
- Looking to the Future
- Realities

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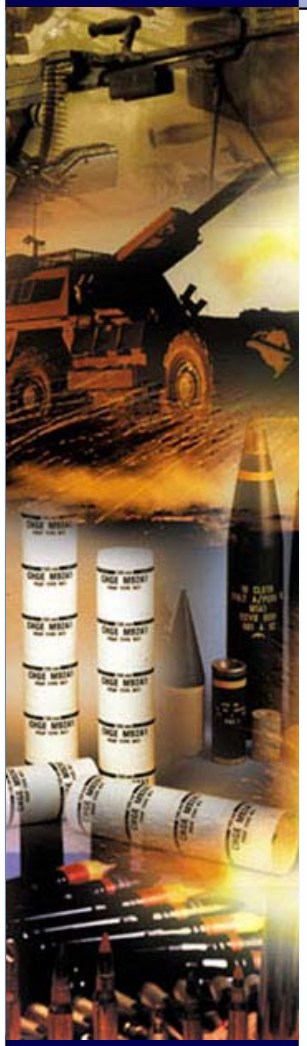
Background



- Technology developments in the 1990's led to:
  - 105mm long range artillery ballistic system
  - 52-cal NATO conformal HE projectiles
  - 120mm Long Range HE mortar System

Constraints / Challenges

- Lack of clearly defined User requirement
- Competitive challenge
- Funding
- IM compliance by DoDs
- Intellectual Property Rights
- Licensing
- NIH
- Market base protection
- Licensing

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Objective / Goals

Meet emerging User Requirements through core competencies

Examples:

- 120mm IHE SPH Mortar Program (Wiesel)
- Light weight SPH indirect fire capability (BCT)
- 155mm Insensitive HE projectile (AFASS)
- 105mm Improved HE projectile (LIMAWS)

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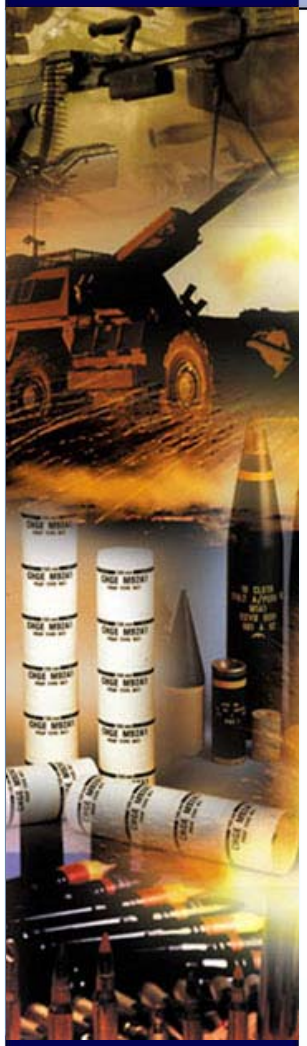
Required Technologies



PROJECTILES

- Warhead design for high-end ballistic environments
- Setback and spin Insensitive High Explosive for mortar and artillery projectiles
- Filling process
- Enhanced terminal effect
- Insensitive munition characteristics

Howitzer

- Lightweight SP Platform and Turret Design

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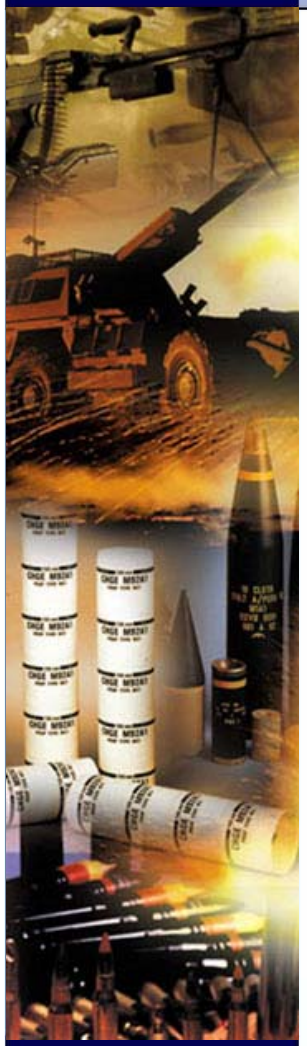
Options



- Internally funded development
- Co-funded collaborative development
- Government sponsored development

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Objectives

- Share technologies for mutual benefit
- Provide User with new and enhanced capabilities
- Reduce NDA lead-time
- Share cost burden
- Maintain revenue potential
- Protect key core competence IP

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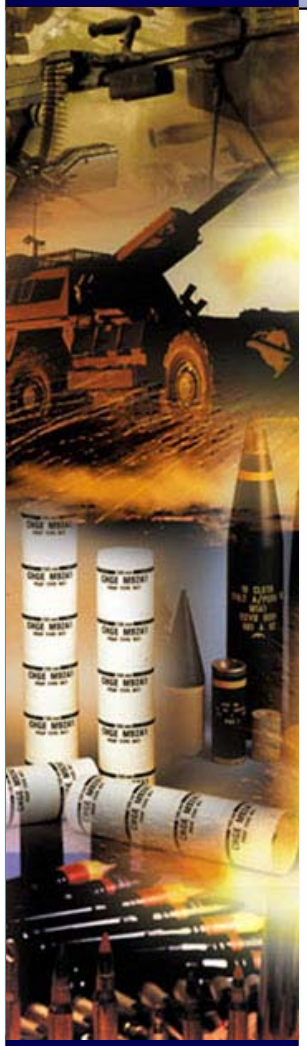
Technology Partnerships: Examples



- 105mm SPH Howitzer - GDLS/Denel
- 155mm Insensitive HE Projectile - Denel/DMS/Dyno
- 120mm IHE Mortar - DenelDMS/NC/Dyno/

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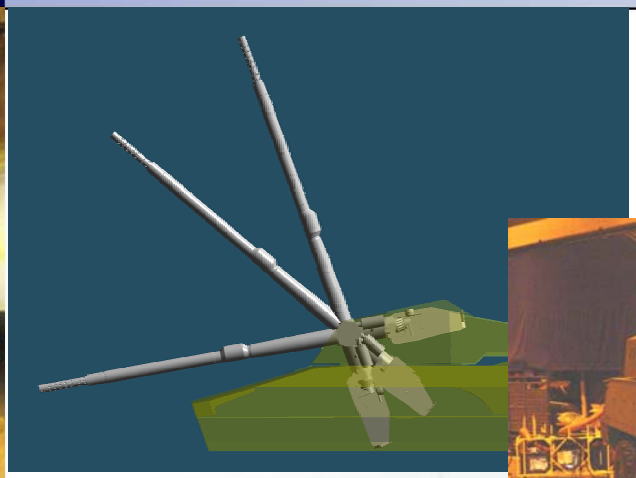
Results(2): 105mm LAVIII SPH Demonstrator



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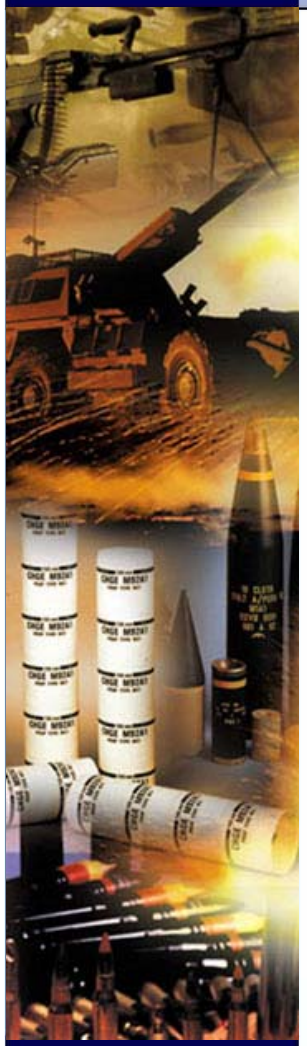
Results(2): 105mm LAVIII SPH Demonstrator



- Meets the weight threshold for C130 transportability
- Can fly 1.000 mile tactical mission
- Meets aircrew egress requirement
- Reaches 30km range (40km with V-LAP)
- Modular charge system 105mm miniMACS
- Auto-loading (user choice)
- 39-cal 155mm lethality (JMEMS T#1 to #5)
- Insensitive IHE munitions

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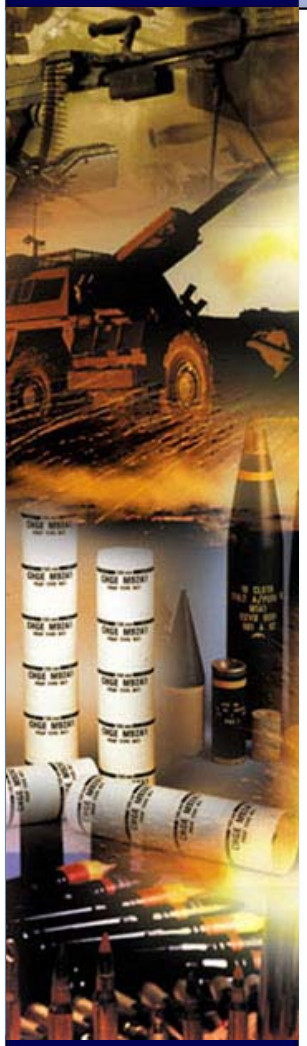
Results(3): 105mm LAVIII SPH Demonstrator



Convergence of technologies:

- LAVIII platform (GDLS)
- Ballistic system (Denel)
- Turret (Denel/GDLS)
- IHE ammunition (Denel/DMS/GD-OTS)

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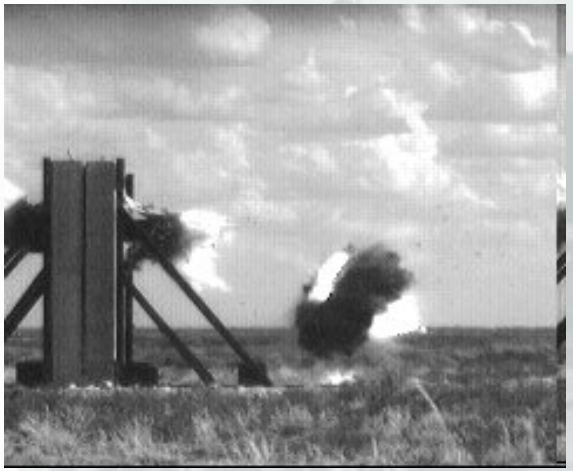
Results(1): 155mm IHE Projectile (ACA²P)

M0121 Insensitive High Explosive



2 x 38 cm (double reinforced), > 6525Psi 90° NATO

3 x 23 cm (each double reinforced), > 6525Psi, 90° NATO

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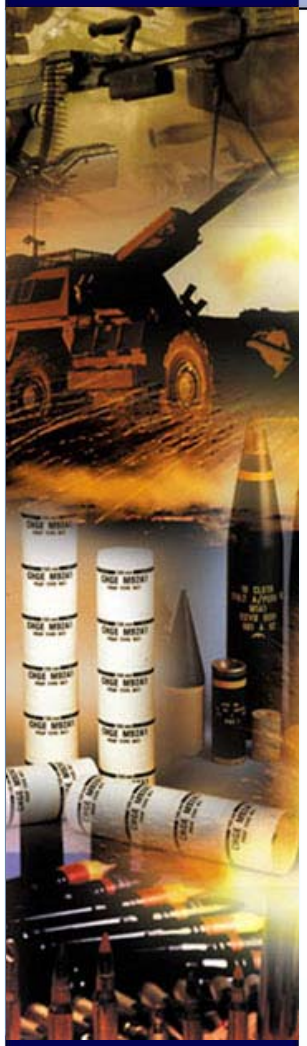
Results(2): 155mm IHE Projectile



- JMBoU conformal architecture
- Range
  - 39-cal >24km BT and >30km BB
  - 52-cal >30km BT and >40km BB
- Insensitive Munition Performance (Mil Std 2105B or STANAG 4439)
  - Fast Cook-off Type V reaction
  - Shaped Charge Jet Type V reaction
  - Bullet Impact Type V reaction
  - Sympathetic Detonation Type III reaction
  - Fragment Impact Type V
- Structure Perforation Exceeds BWB requirements
- Fragmentation Exceeds BWB requirements (>L15)
- Accuracy Exceed L15 PE_R and PE_D

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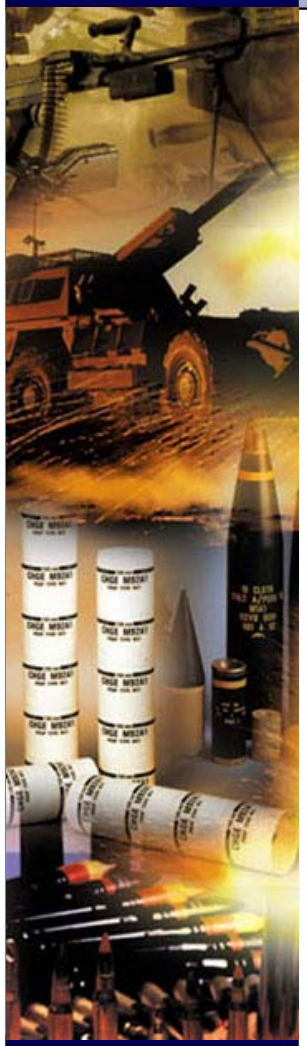
Results(3): 155mm IHE Projectile



Convergence of technologies:

- Projectile design (Denel)
- Fragmenting body optimization (Denel)
- Insensitive explosive (Dyno)
- Filling technology (DMS)
- IHE optimization (Denel/DMS)

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Results(1): 120mm IHE Mortar

HE (IHE)
M0310

PRAC
M118

SMK-RP
M115

ILLM-VIS
M116

ILLM-IR
M126

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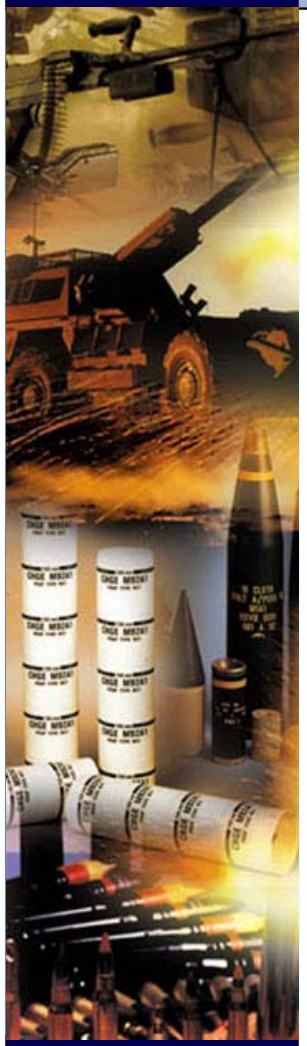
GD-OTS

DIEHL
Munitionssysteme

GDLS

Results(2): 120mm IHE Mortar



- Meets range requirements of €-User
- Meets IM requirements of STANAG 4439
- Has equal increment charge system
- Excellent PE_{Range}
- Good low temperature propellant
- Capable of >10km from SANDF M12 mortar

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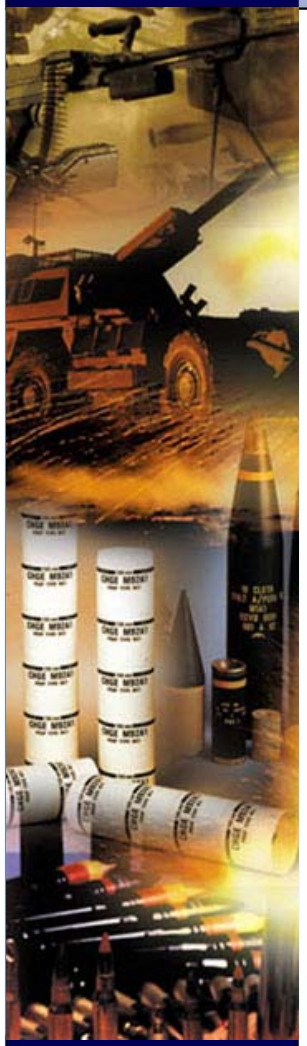
Results(3): 120mm IHE Mortar



Convergence of technologies:

- Mortar design (Denel)
- Insensitive explosive (Dyno)
- Filling technology (DMS)
- Propulsion system (Denel/NC)

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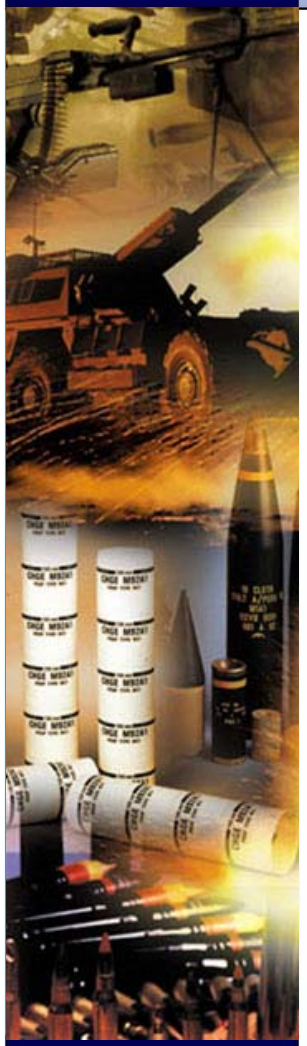
Resolving the Market conflict



- Contractually agreed market share (domain)
- Mutual support
- One team approach
- Lead/support understanding
- Government acceptance
- Competition rules
- Indigenization (USA and Europe)

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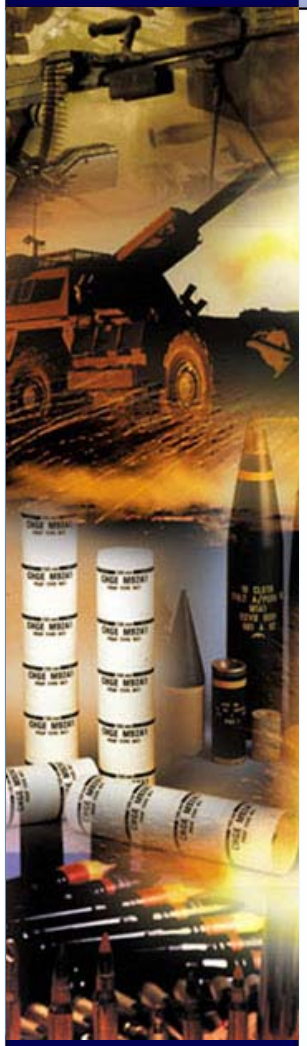
Greater Partnership



- Nobody has all the technology
- Industry too has valuable technologies
- Shared development cost-load more affordable
- Stable User vision/requirements
- User community committed engagement vital to affordable developments
- DoDs too can be a partners

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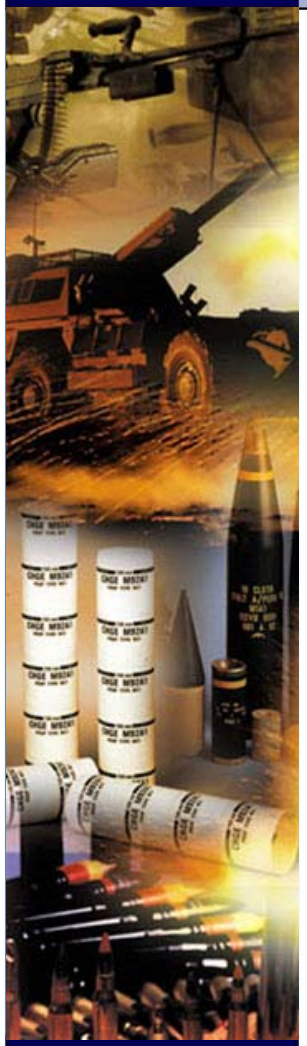
Spin-offs



Application of technologies to other associated munition types:

- 60/81mm IHE long-range mortar
- 76/62mm naval ammunition
- 155mm naval ammunition
- 5” naval ammunition

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Looking to the Future

- Greater precision
- Greater range
- Lighter platform recoil absorbing masses
- Greater lethality
- Improved safety
- Improved reliability
- Improved safety
- Lowered cost
- Demilitarization

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Realities

- DoDs will have to allow technologies to be shared
- Fewer competitors
- Fewer choices
- Earlier fielding dates
- Enhanced war-fighter capabilities

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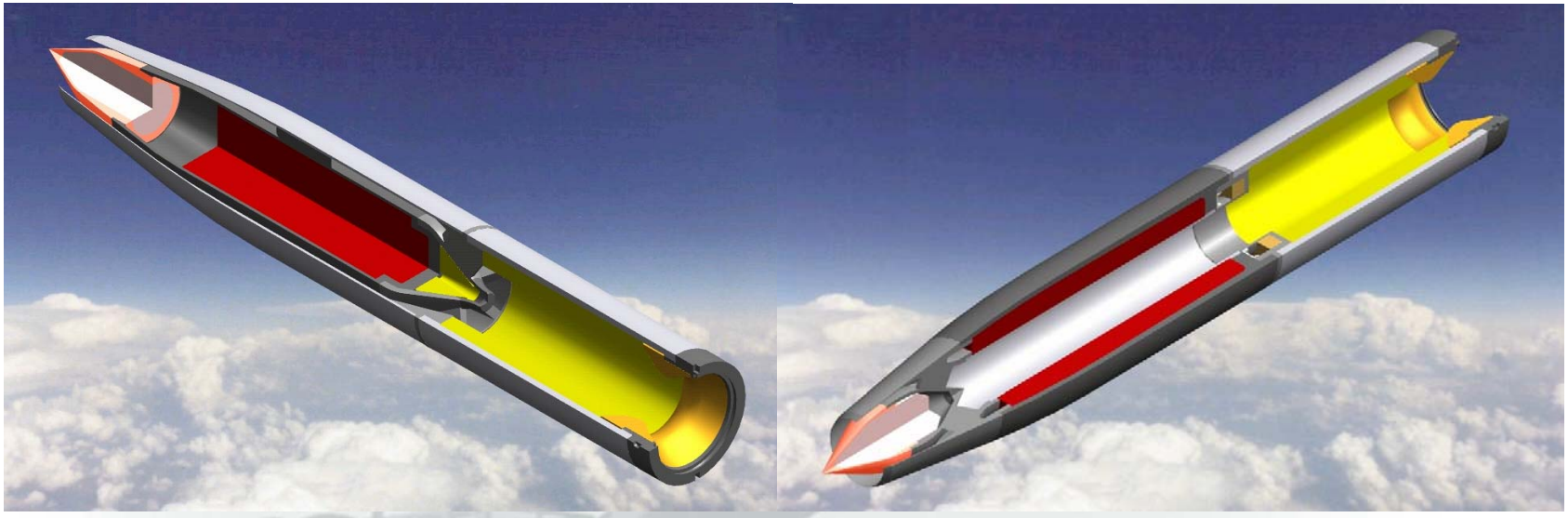
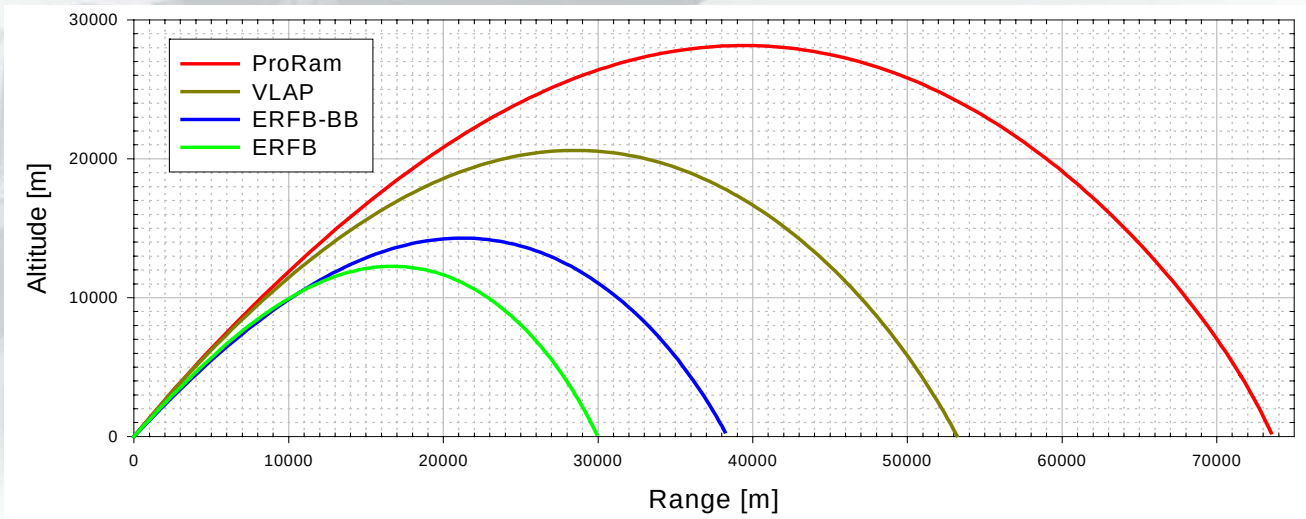
An Example: 155mm Ram-Jet HE Projectile





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Co-operation Opportunities

- Co-funding of program
- Warhead Initiation (annular fuzes)
- Mid-course Range Correction Fuze technology
- Telemetry Capability

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