# APEX – Armor Piercing with Explosive
# The Dual Purpose Round for the F-35

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Nammo

# Nammo Aircraft Ammunition Heritage

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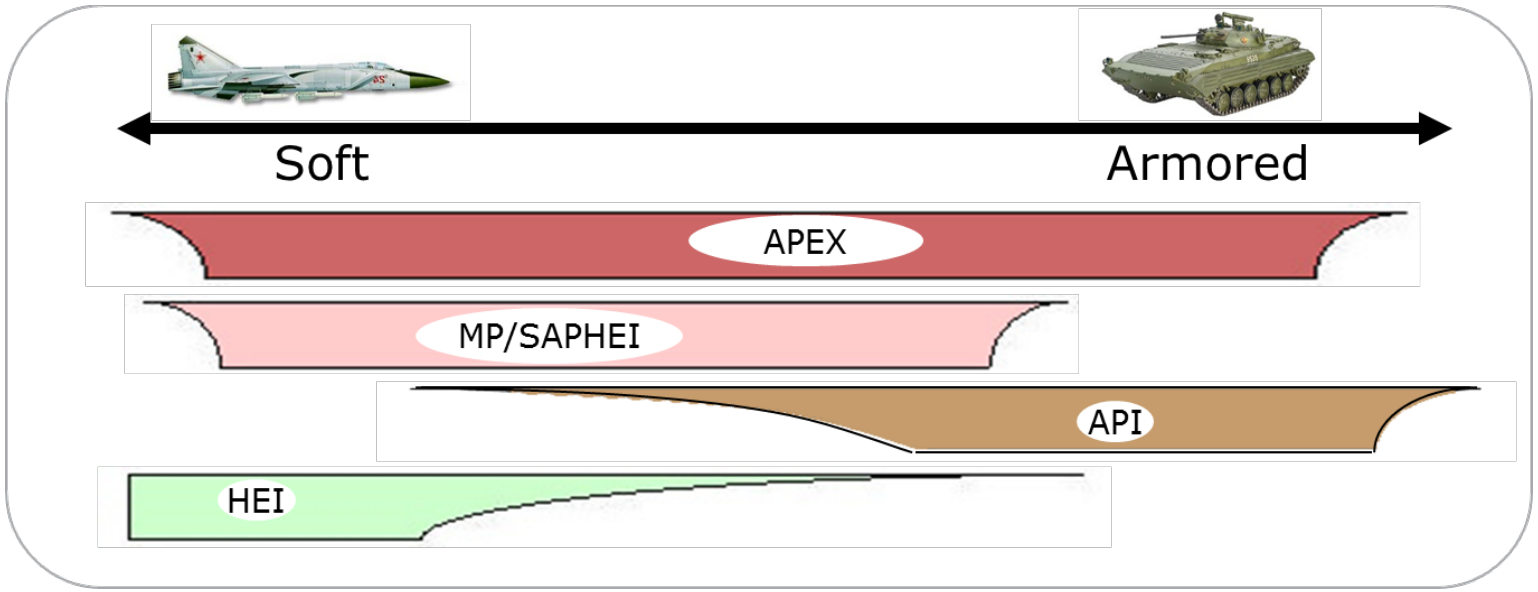
# Operational Requirements

- Effective against all target categories
  - Supports swing role, one ammunition for all missions
- Adequate effect in air-, sea- and land targets
  - Penetration, fragmentation and incendiary effects
  - Suppressive effects
- Meets required employment range
  - High-angle, long range



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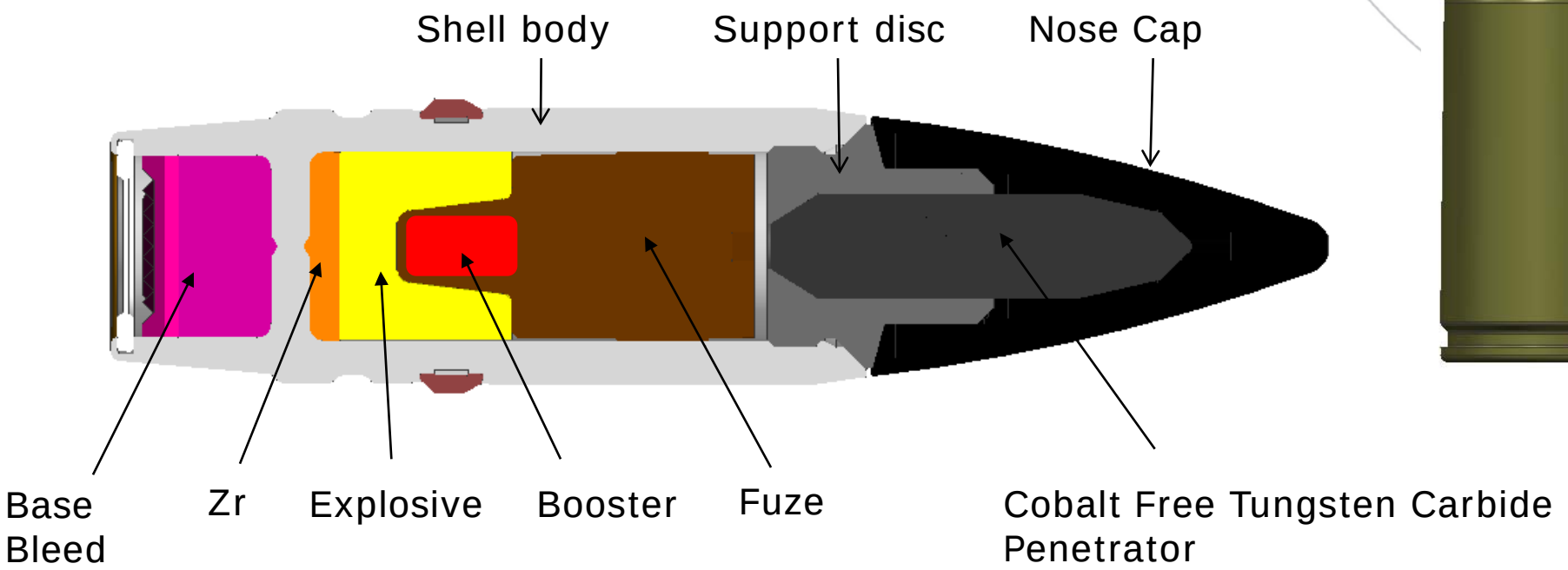
# The APEX Concept

- Multi-Purpose: Air-to-Air AND Air-to-Ground
- Heavy Armor Piercing Tungsten Carbide Penetrator
- Dual-Safe mechanical fuze (meets MIL-STD-1316)
- Insensitive (IM) High Explosive & (IM) Incendiary
- Low-Drag with base bleed



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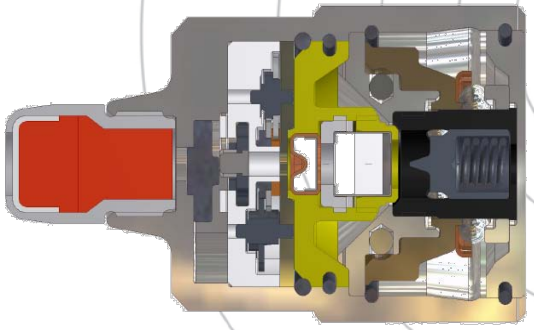
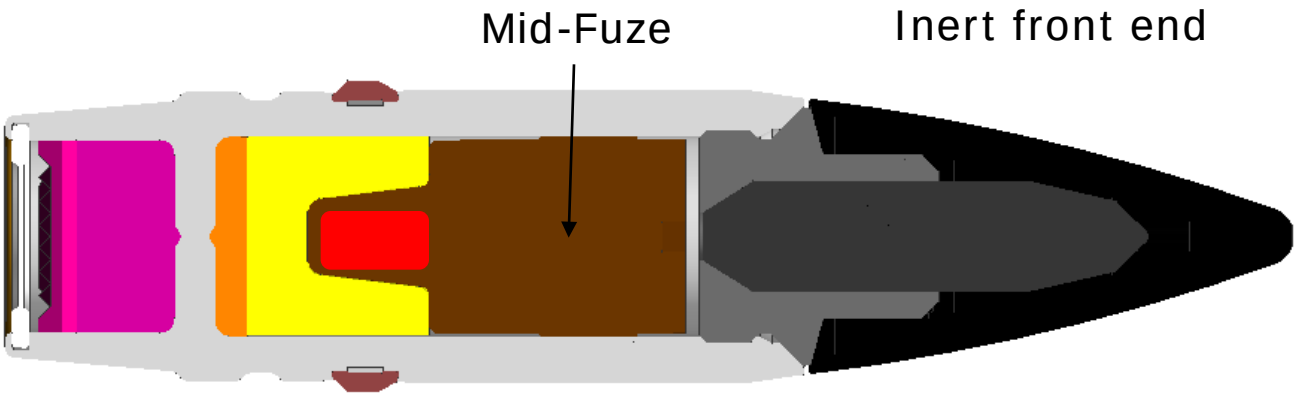
# The APEX Concept - Fuze

- Dual Safety (set-back and spin)
- Safe arming distance
- Point detonating with threshold
- Delays explosive initiation until after penetration
- Meets USG Requirements:
  - MIL-STD-810,
  - MIL-STD 1316 and
  - MIL-STD 2105





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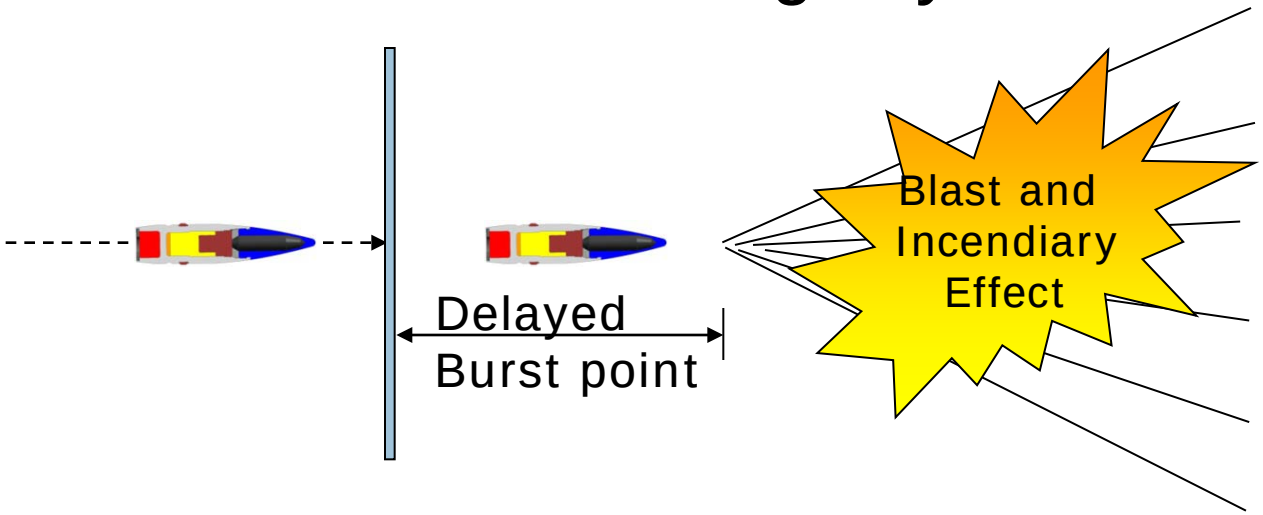
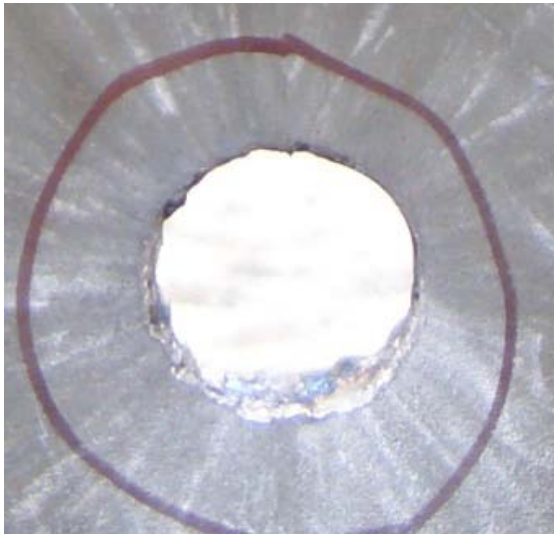
# Soft Skinned to Lightly Armored Targets




Function:

- High velocity fragments from shell body and penetrator
- Blast
- Incendiary effect

Full body penetration



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# 0.08 in DURAL Multi-Array Target Plate @ 0 deg. NATO

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# 0,08 in DURAL, 0º NATO, 1000 m/s, witness plate array

## Detonation delay: 40 cm

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# APEX High Explosive and Incendiary

- Explosive:
  - Blast Effects
  - Accelerates Fragments
  - Exterior flash reports “hit” on target
- HE/Zirconium (Zr):
  - Ignites fuel
  - Burns hydraulics, electrical and fabric

*20 mm Armour, 45º NATO*

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# 0.8 in RHA Target Plate @ 45 deg. NATO

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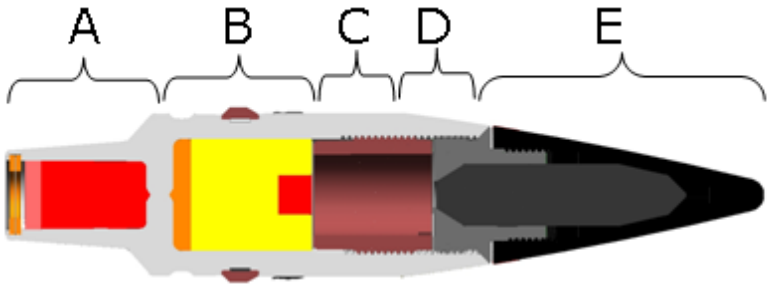
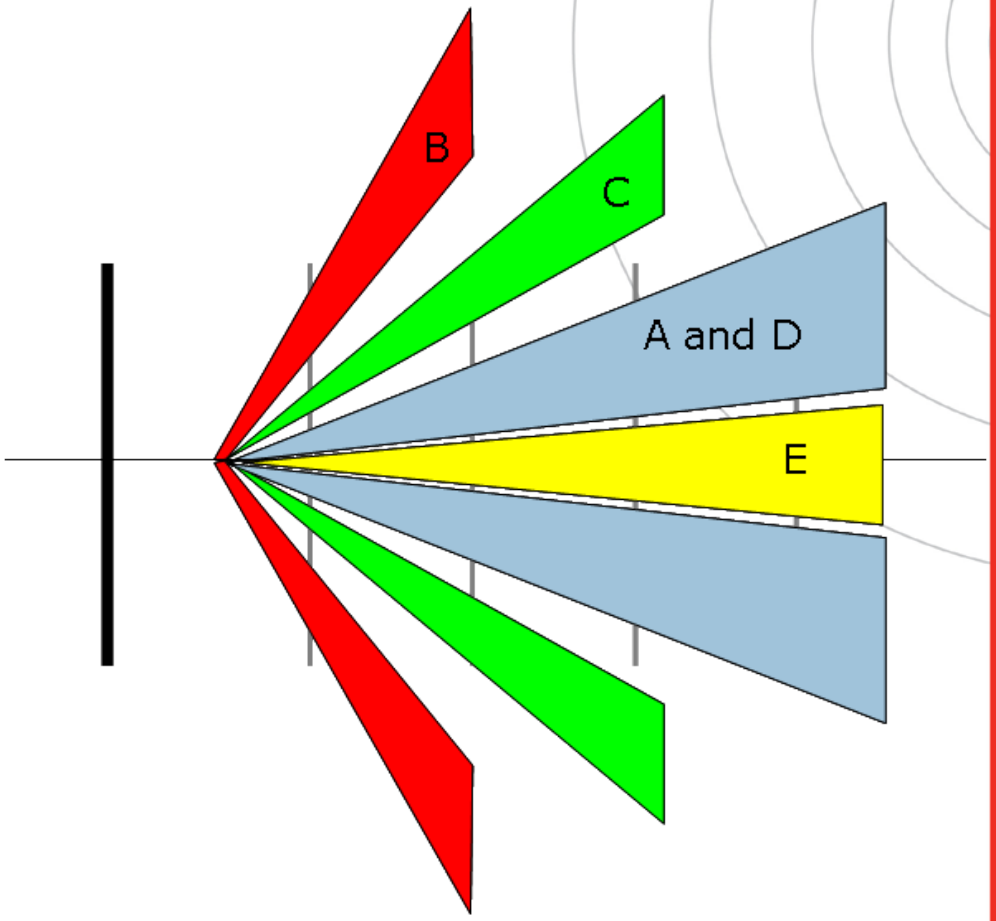
# Fragment Dispersion

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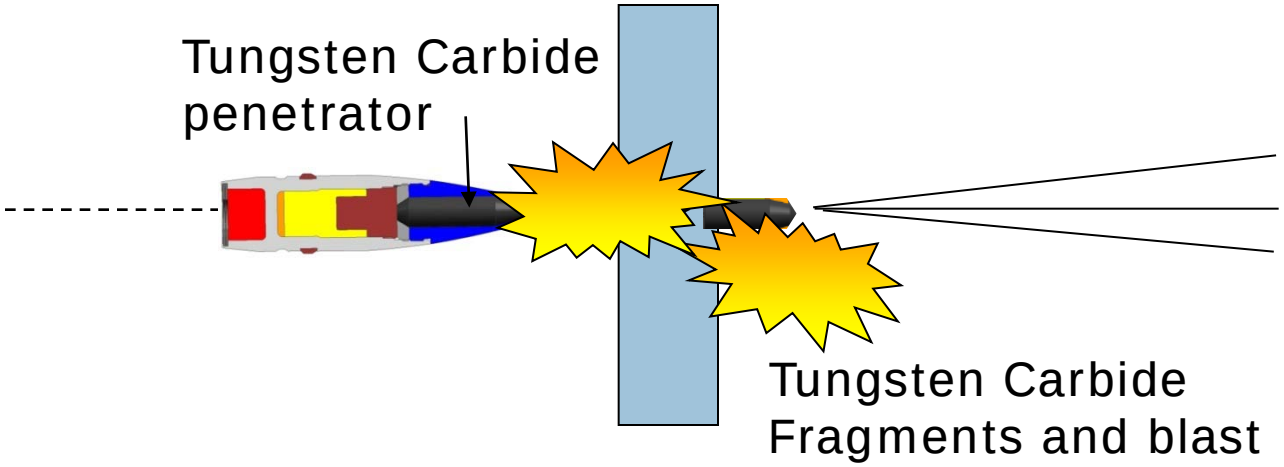
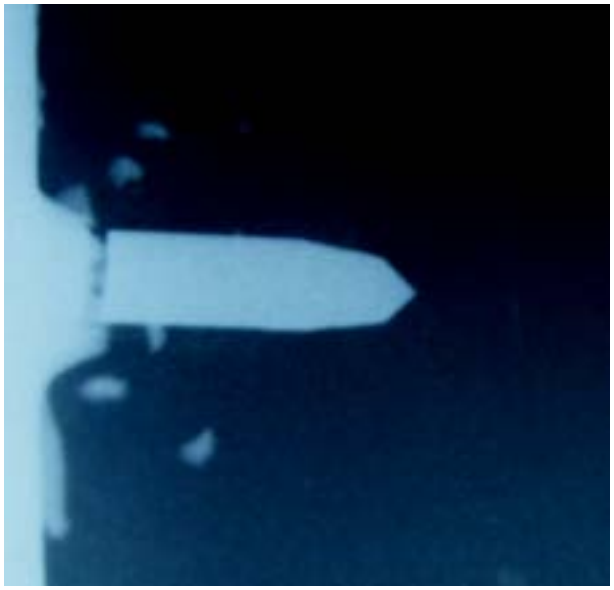
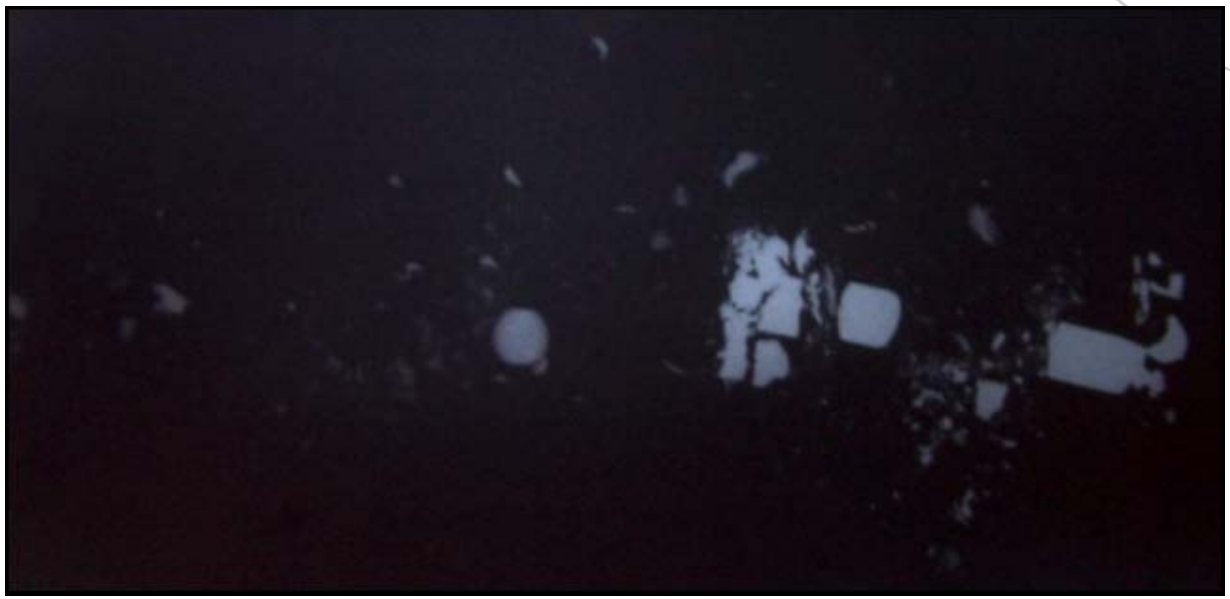
# Armored Targets









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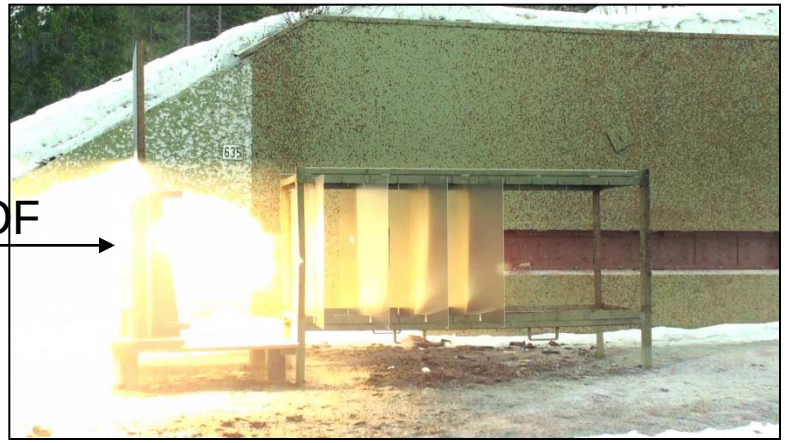
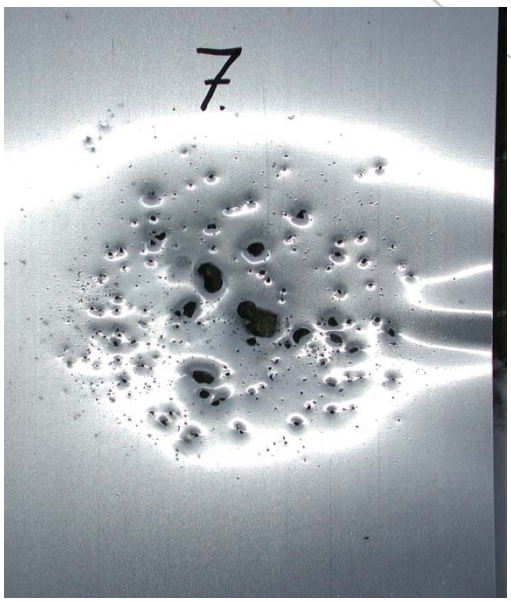
# Penetrator Penetration: Behind Armour Effect




Function:
- Penetration/Fragmentation
~ 20% Blast inside target
- Incendiary effect




*50 mm RHA, 0º NATO*



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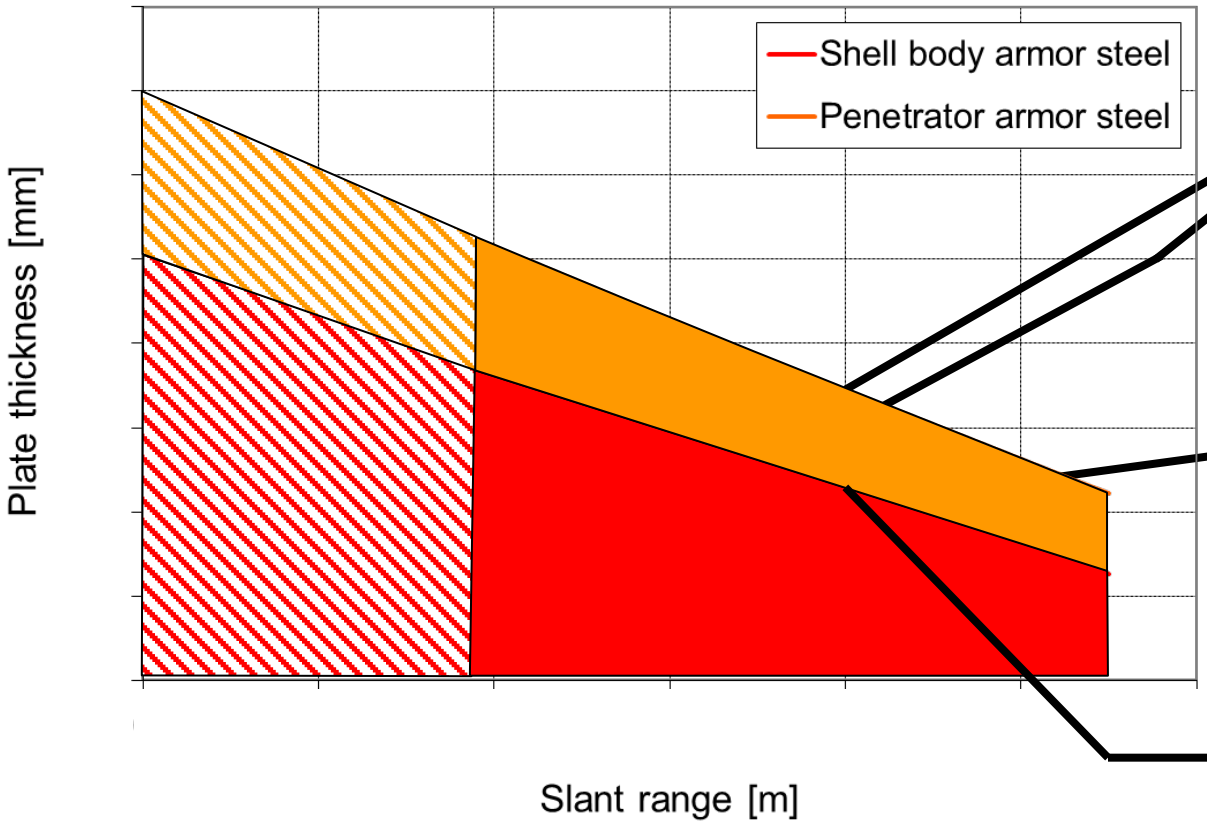
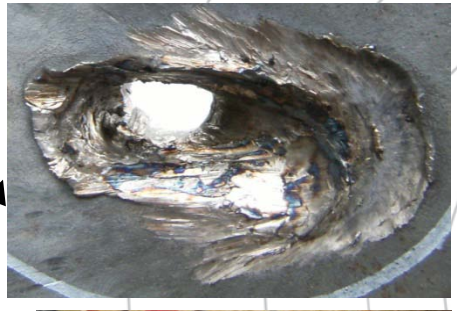
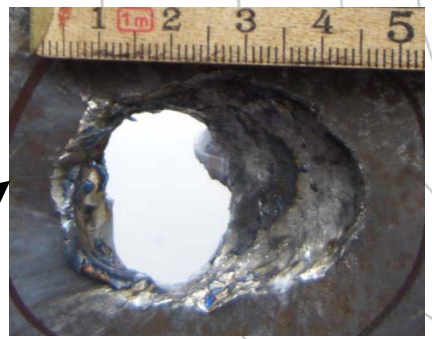
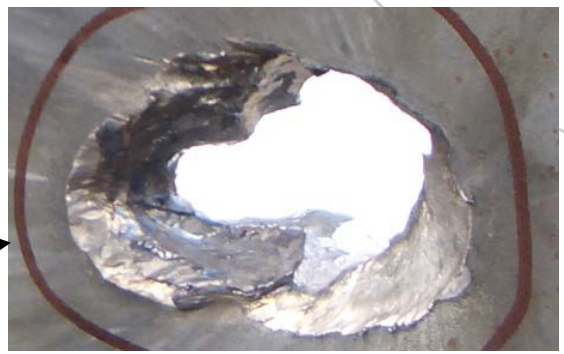
# Sum-Up Penetration in RHA @ 45 degrees

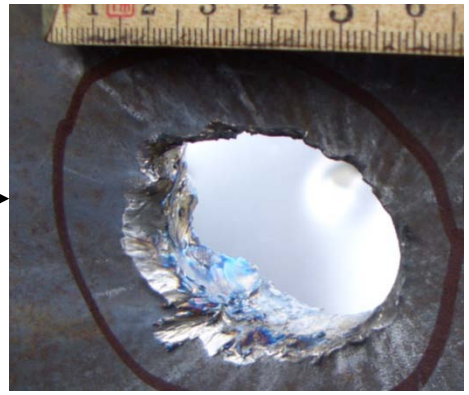
Altitude=6500 ft, Dive angle=-45º, 550 KTS











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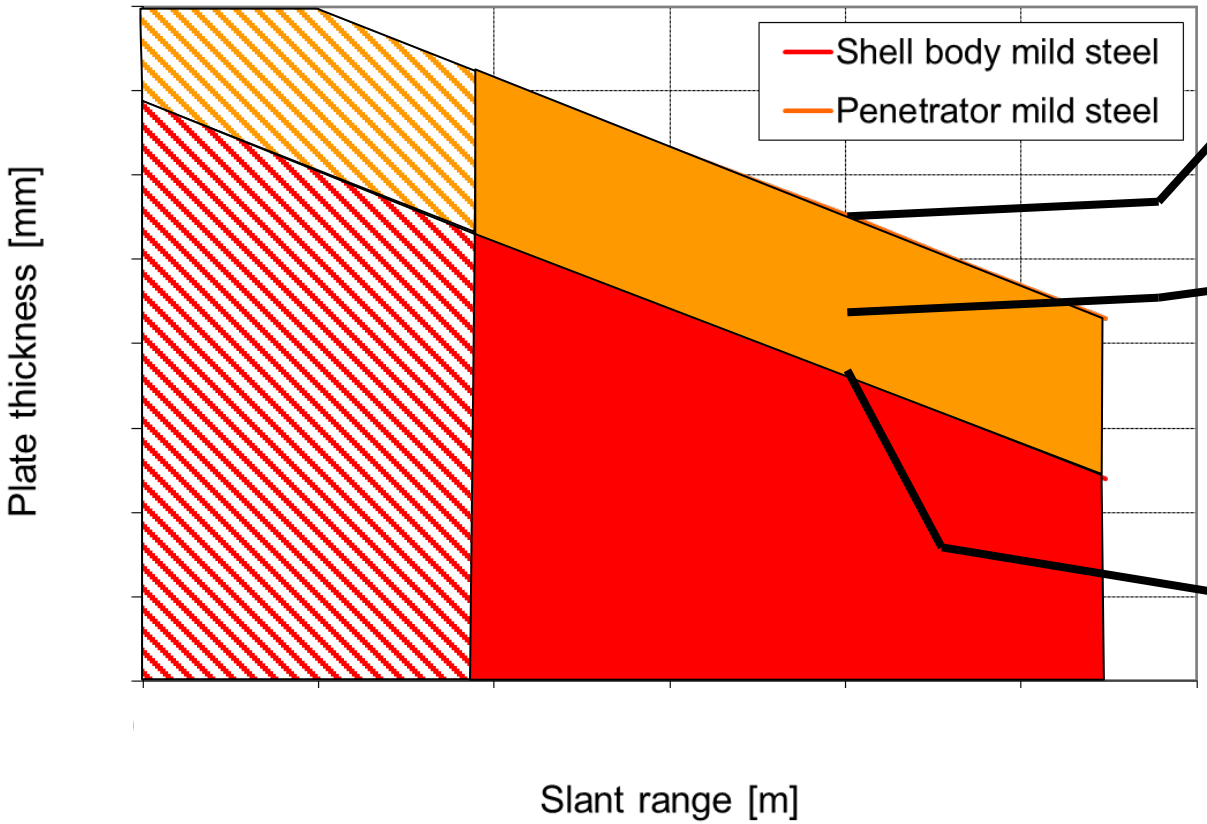
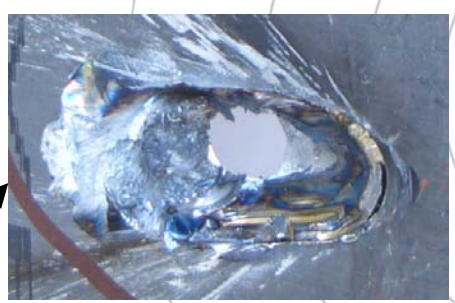
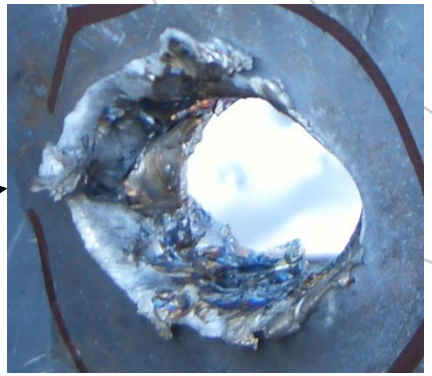
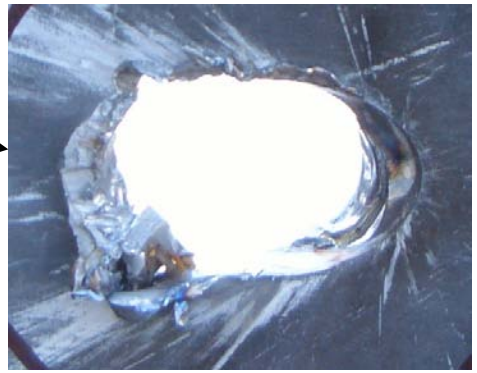
# Sum-Up Penetration in Mild Steel @ 45 degrees

Altitude=6500 ft, Dive angle=-45º, 550 KTS









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# 20 cm Double Reinforced Concrete Target

Two penetrations from previous tests with 70 mm rocket



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# Rear side of the Double Reinforced Target

Penetrator perforated steel bar at rear side



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# 20 cm Double Reinforced Concrete Target

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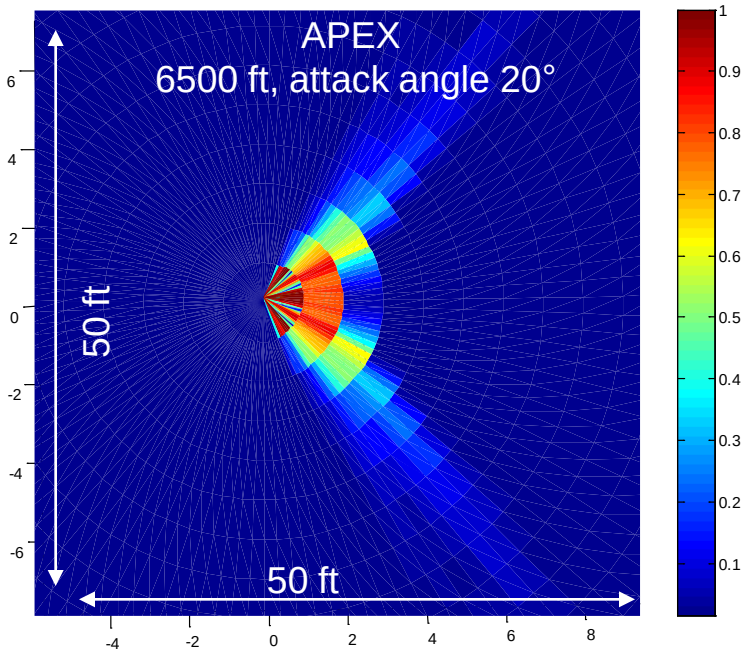
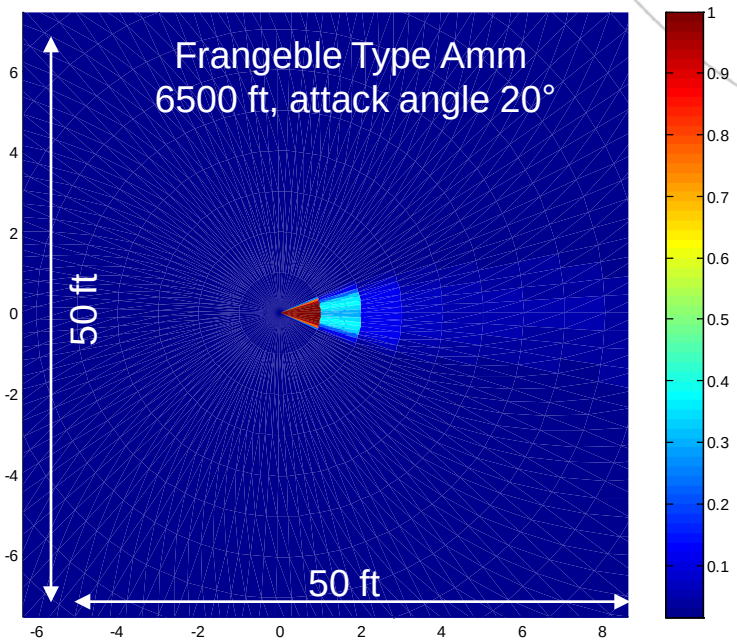
# Effect Against Soft Ground Targets – APEX vs Inert Type Ammunition

- Higher fragment velocity
- Better suppressive effect
- Larger fragment footprint and lethality area for soft targets

Simulations by Norwegian Defense Research Establishment (FFI):



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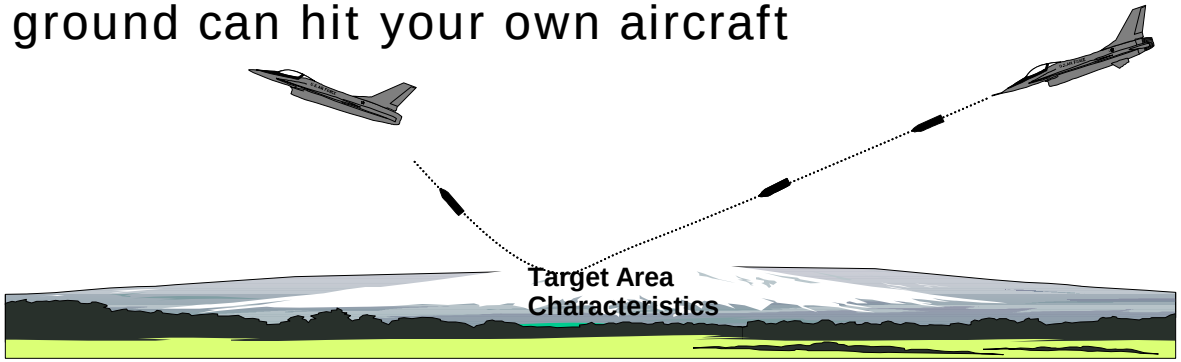
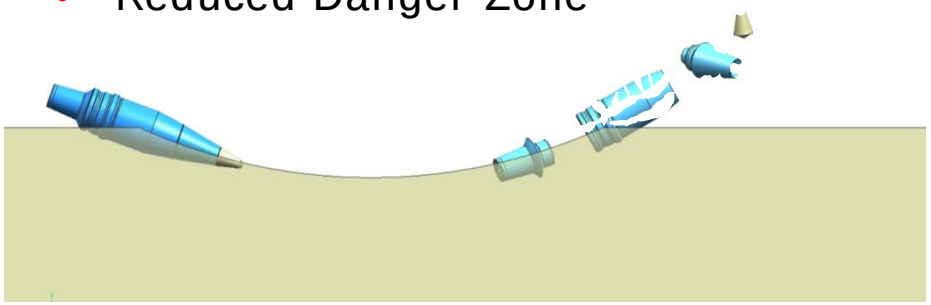
# 25 mm TP-RRR – Cost Effective Training Round

In air-to-ground training there is always a risk that ricochets from ground can hit your own aircraft




TP-RRR:

- Reduced Ricochet Risk
- Reduced Danger Zone



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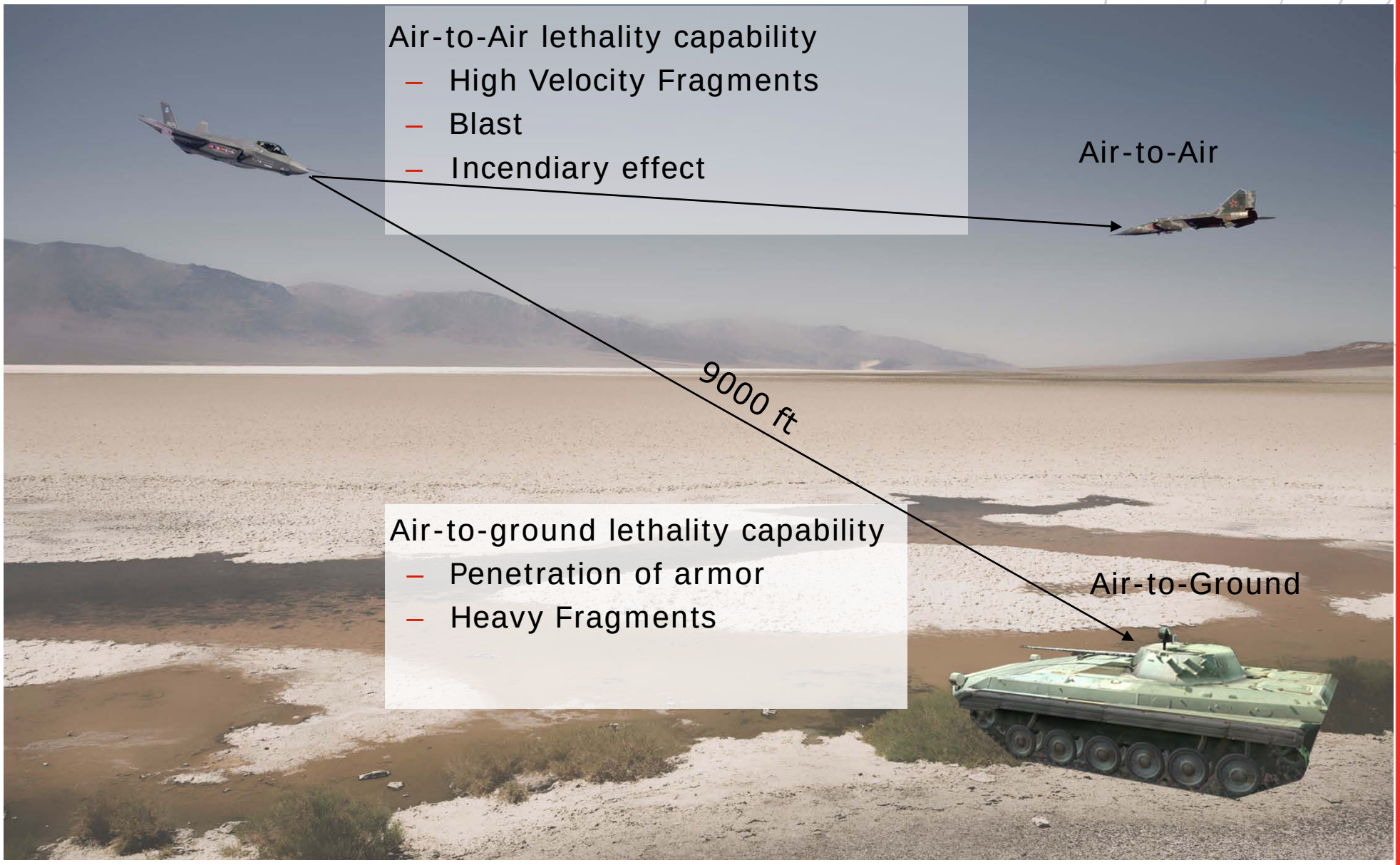
# APEX The Multi Role Multi Purpose Round

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