

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

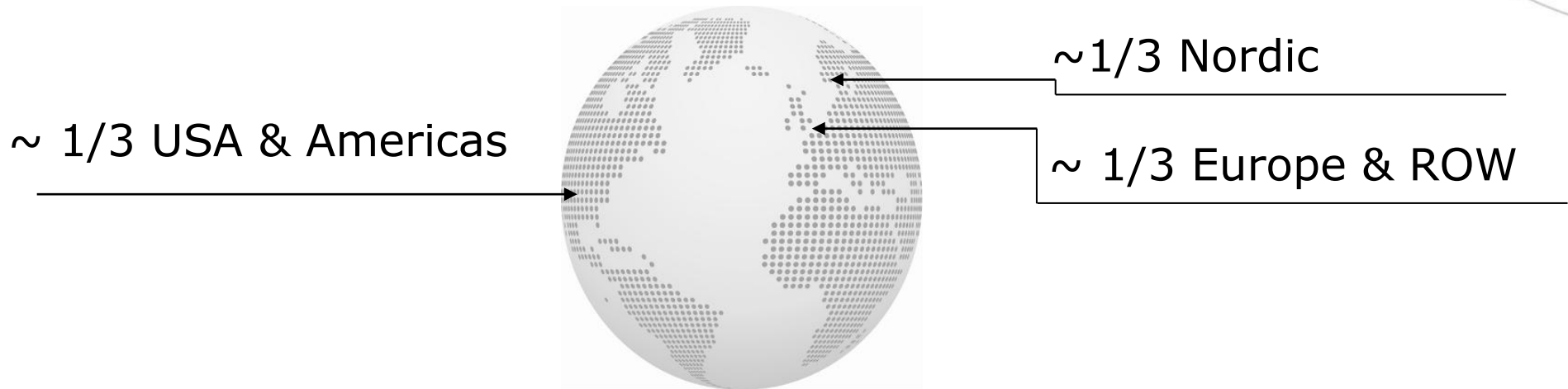
Eva Friis
Vegard Sande



NAMMO Overview

- A Technology Driven Aerospace & Defense Group

- Corporate HQ in Norway
 - Presence in 9 countries
 - 2200 employees
 - Approximately \$620 million revenue (2013)
 - 85% defense / 15% civil
- Nammo Inc HQ in Virginia
 - Nammo Talley (SSA)
 - Nammo Pocal
 - Nammo Tactical Ammunition
 - Nammo Demilitarization
 - Nammo Composite Solutions



Core Business & Technologies

- **Ammunition**
 - Specialty producer of small, medium and large caliber ammunition
- **Shoulder-Launched Munitions**
 - Advanced multi-purpose SLMs for current and emerging warfighter missions
- **Missile Products**
 - Highly engineered rocket motors, warheads, composite/metallic cases and actuation systems
- **Demilitarization**
 - World leader in safe and environmentally responsible recycling of ammunition and energetic materials



The A/C Ammunition Background



Nammo ammunition used
on these aircraft

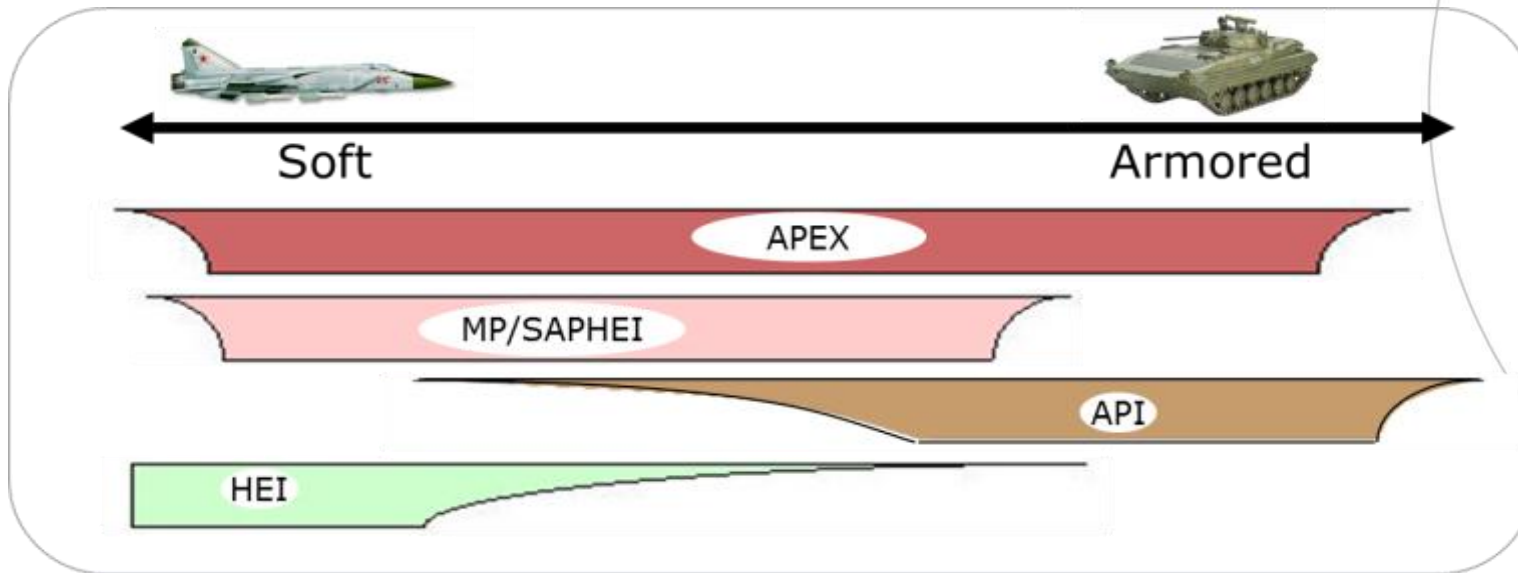


- An MP license and data package was acquired by the US DoD in 1981
- Technology activity with USN on A/C ammunition during the last 20 years
- Nammo has a strategic alliance agreement with GD-OTS within the Medium Caliber Ammunition (MCA) segment

25 mm APEX Program Background

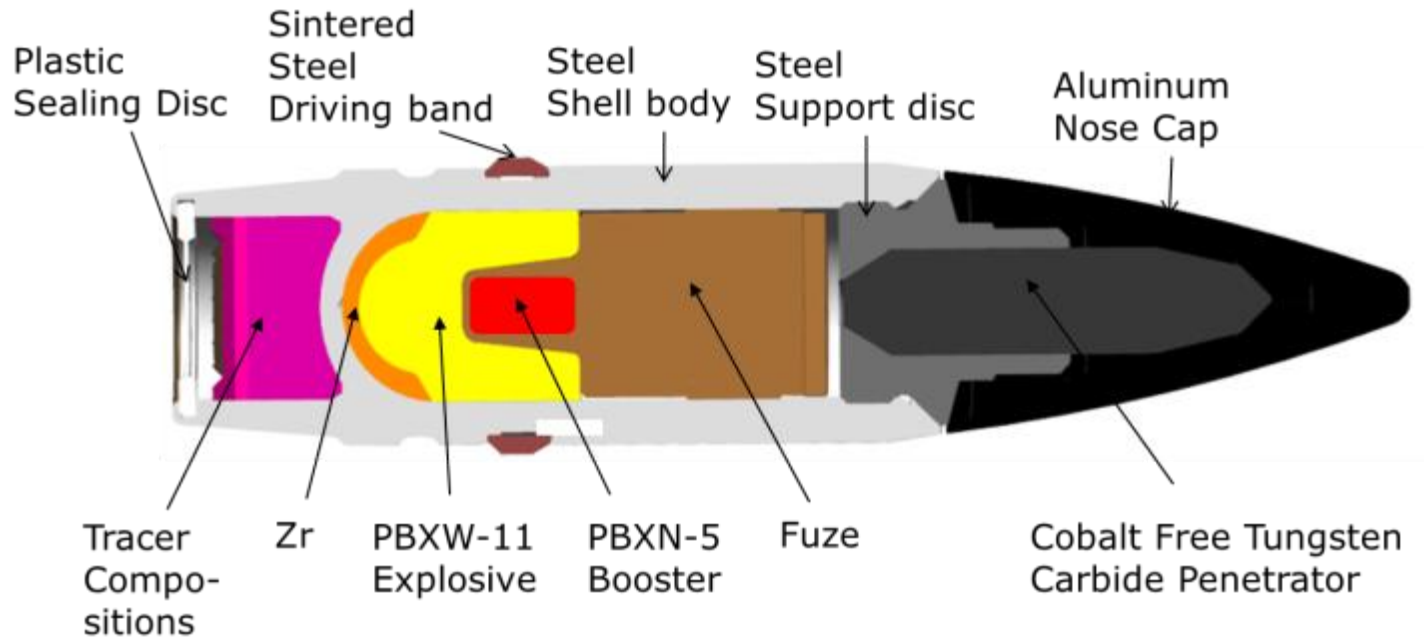
- Development and ground qualification funded by NDLO
- The 25 mm APEX is developed to meet RCAF performance requirements and the GD-OTS CIDS
- F-35A SDD (Block III) integration funded 50/50 by the Australian and Norwegian MoD
 - Officially approved by F-35 Lightning II JPO PEO 31 July 2013
- USN NAVAIR FCT contract awarded in 2013
- US designation of the 25 mm APEX is PGU-47/U

25 mm APEX: Multi Role Dual Purpose Round



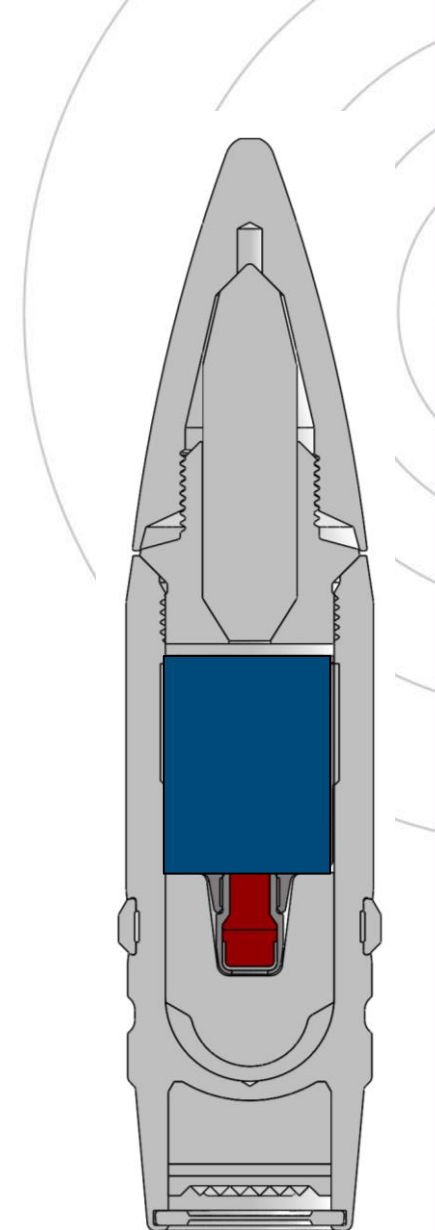
- APEX capabilities:
 - Safe arming distance and safe separation distance
 - Detonation inside target: blast, fragmentation, incendiary effects
 - Penetration capability
 - Graze impact function (82.5° NATO in sand)
 - Suppressive effects
 - Low drag

25 mm PGU-47/U APEX Projectile Design



25 mm PGU-47/U APEX Basic Data

- Muzzle velocity at +21°C: 970 m/s (3182 ft/s)
- Projectile mass: 223 g
- Cartridge mass: 535 g
- Tracer burn time: 3 s
- Ammunition dispersion: < 0.5 mills (single barrel)
- Fuze (FMU-171/U) function:
 - Dual safety
 - Min. arming distance: 10 m
 - Detonation delay: 0.4 ms (at 2 mm DurAl plate)
 - Sensitivity: 2 mm DurAl plate in 45° NATO @ 2750 m (9000 ft) from A/C with 283 m/s (550 KTS) aircraft speed



Nammo

APEX: Multi Role Dual Purpose Round



2 mm DURAL
Target plate
0° NATO



20 mm Armour Steel
Target plate
45° NATO



50 mm Armour Steel
Target plate
0° NATO

0,08 in, 2 mm Al Multi-Array Target Plate @ 0 deg. NATO

Photron

7500 fps

Center

Date : 2011/3/31

FASTCAM SA5 mode...

1/71000 sec

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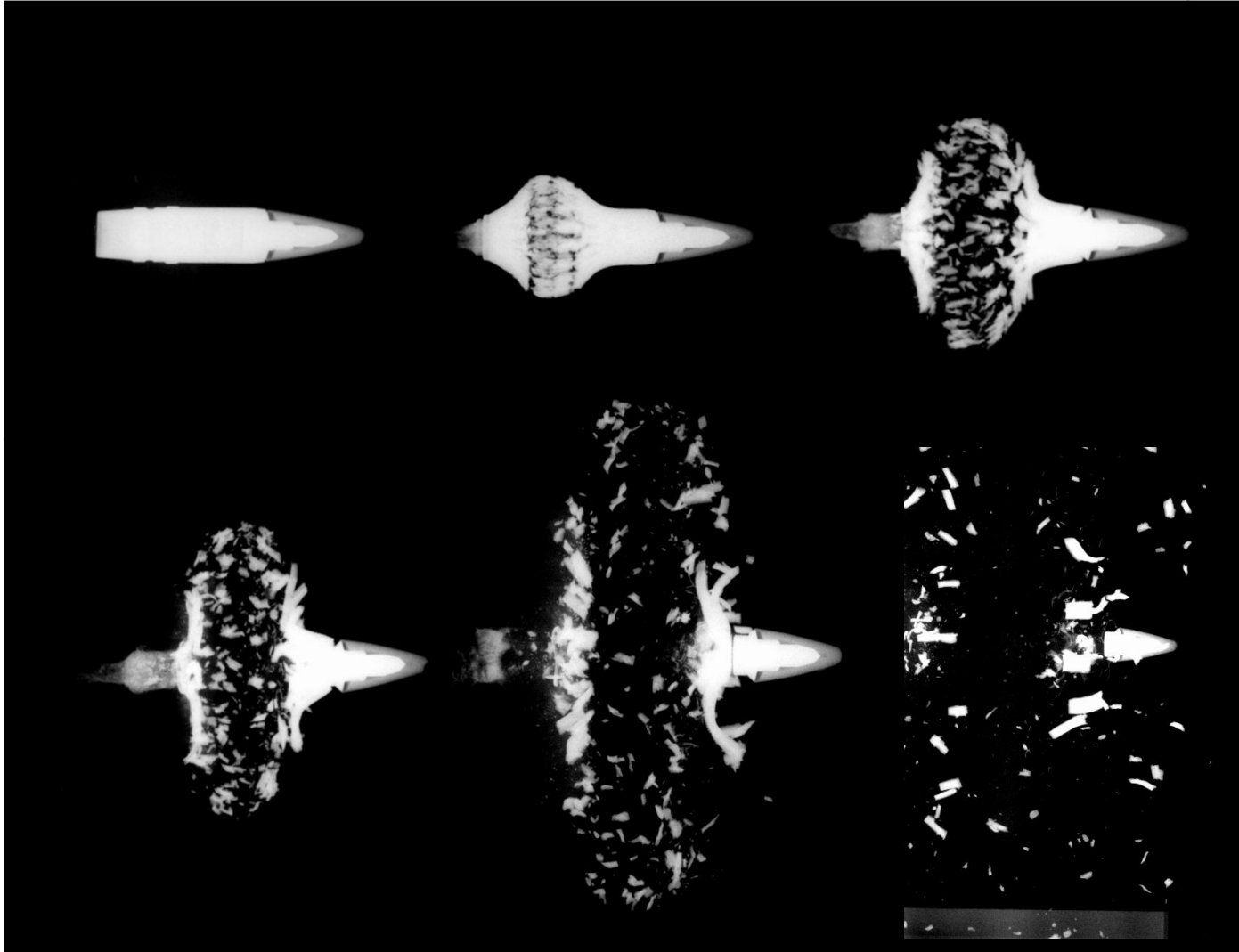
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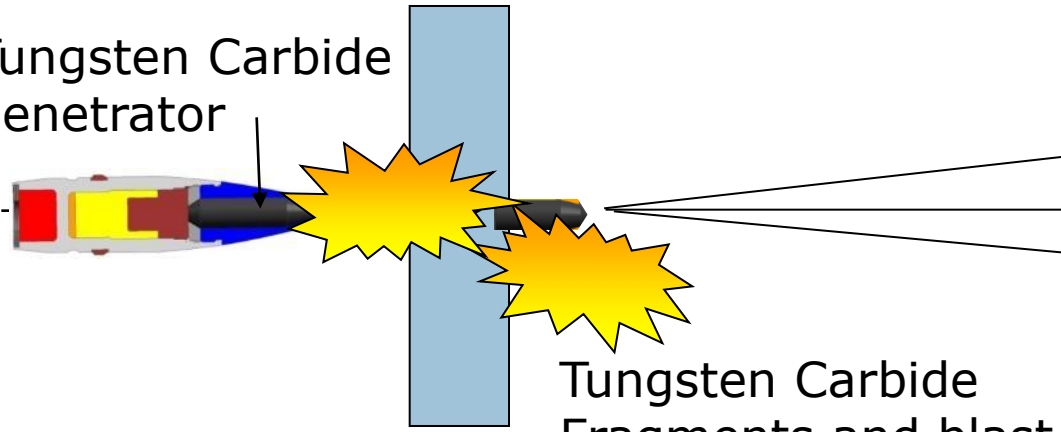


Flash X-ray Pictures of the Fragmentation

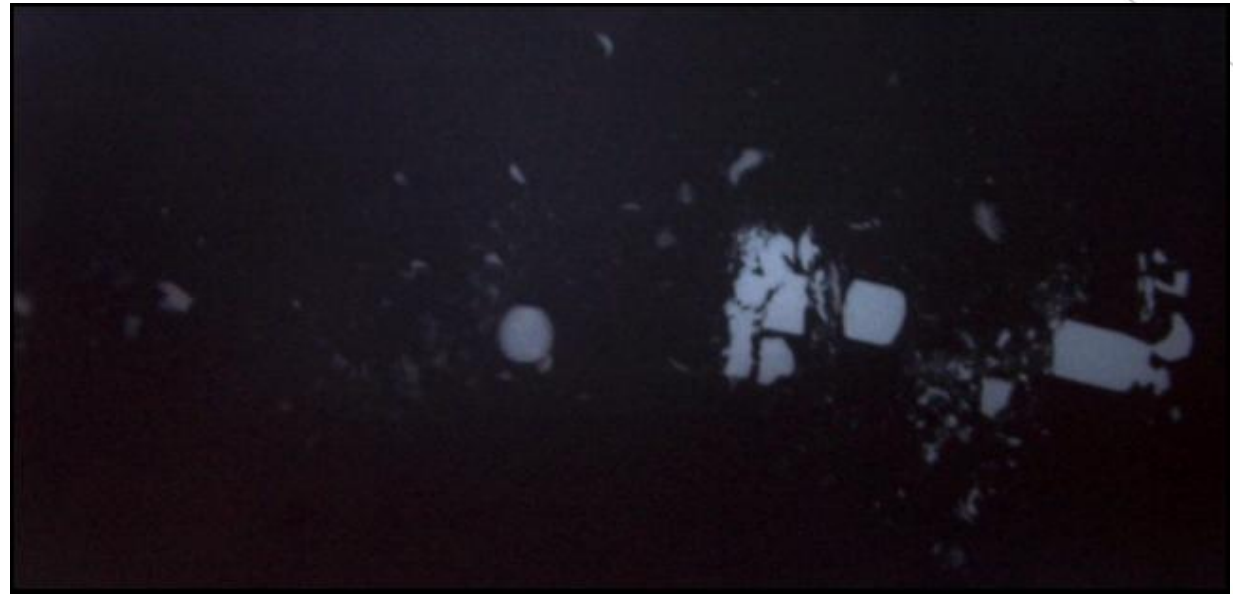
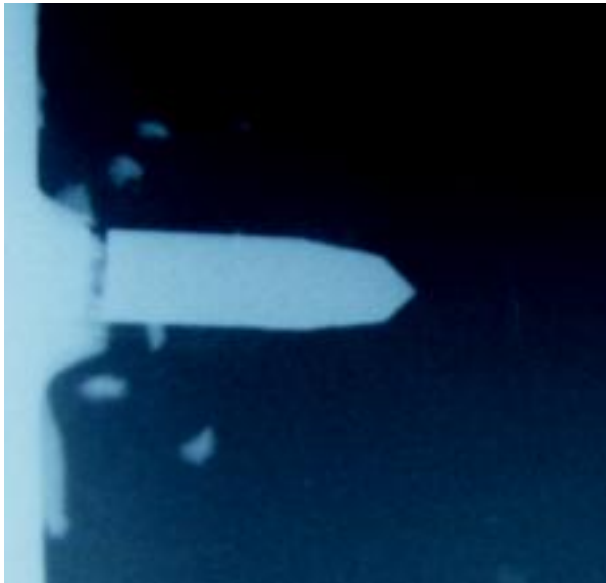
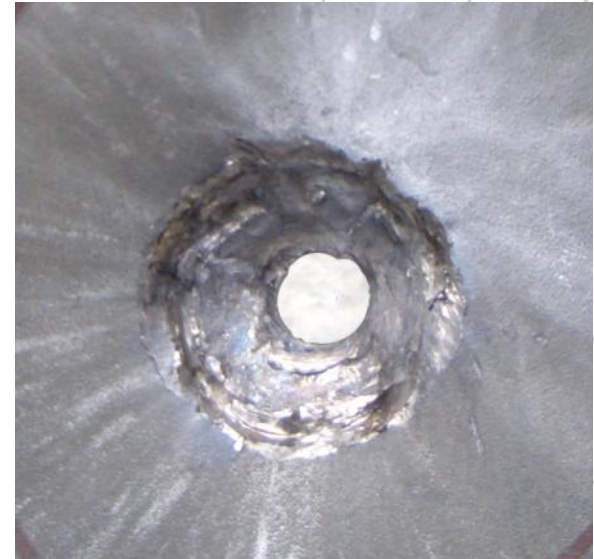


Armored Targets

Tungsten Carbide penetrator



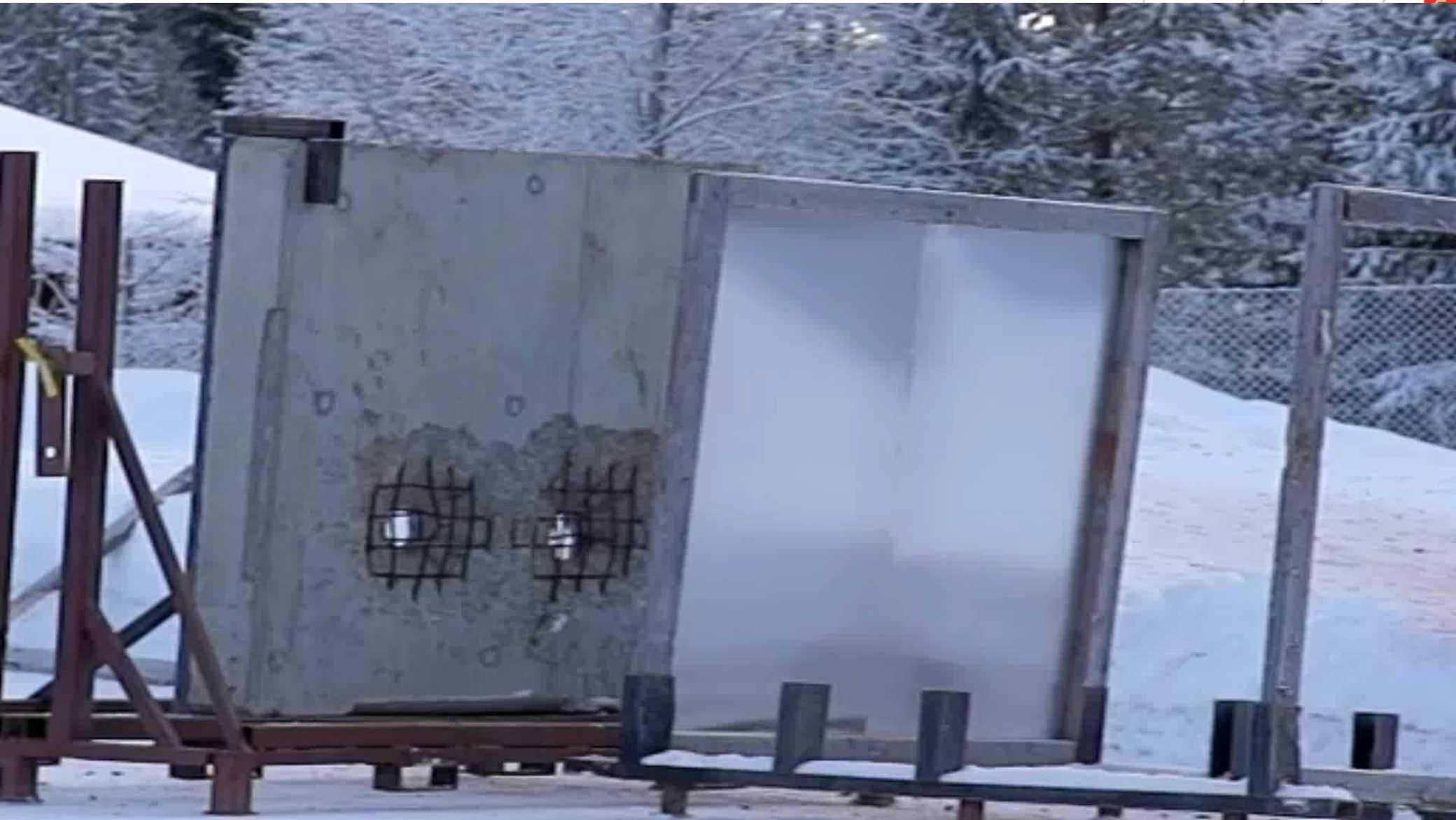
Tungsten Carbide
Fragments and blast



0,8in, 20mm RHA Target Plate @ 45 deg. NATO



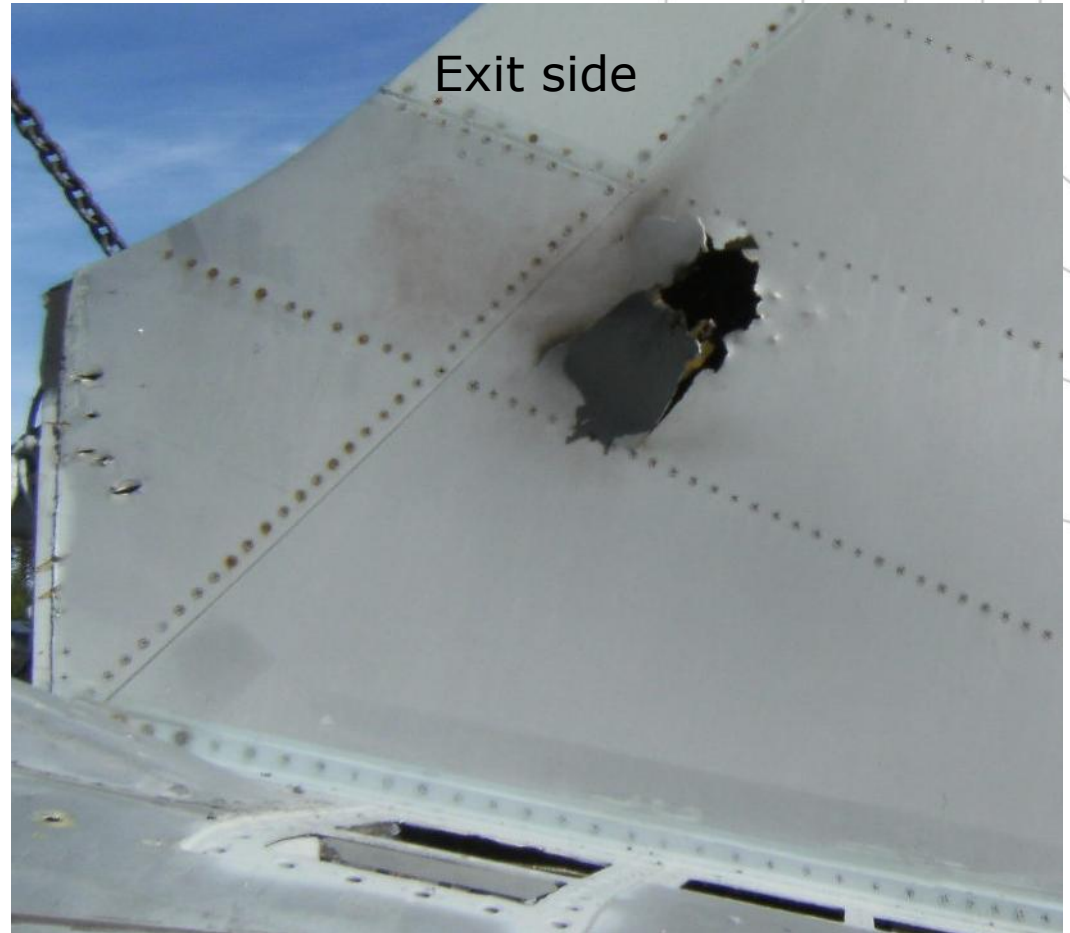
20 cm, 8 in Double Reinforced Concrete Target



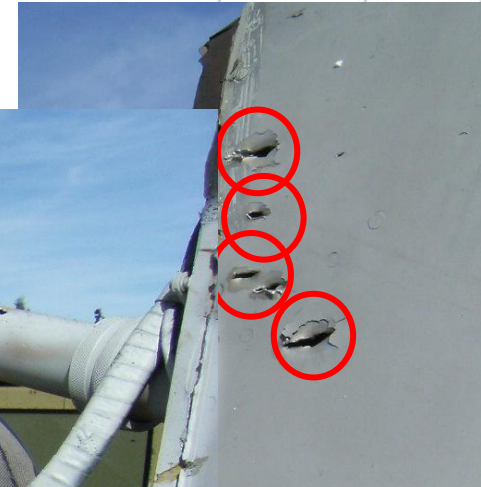
Firing PGU-47/U (APEX) at a F-5 Tail



Firing PGU-47/U (APEX) at a F-5 Tail Pictures

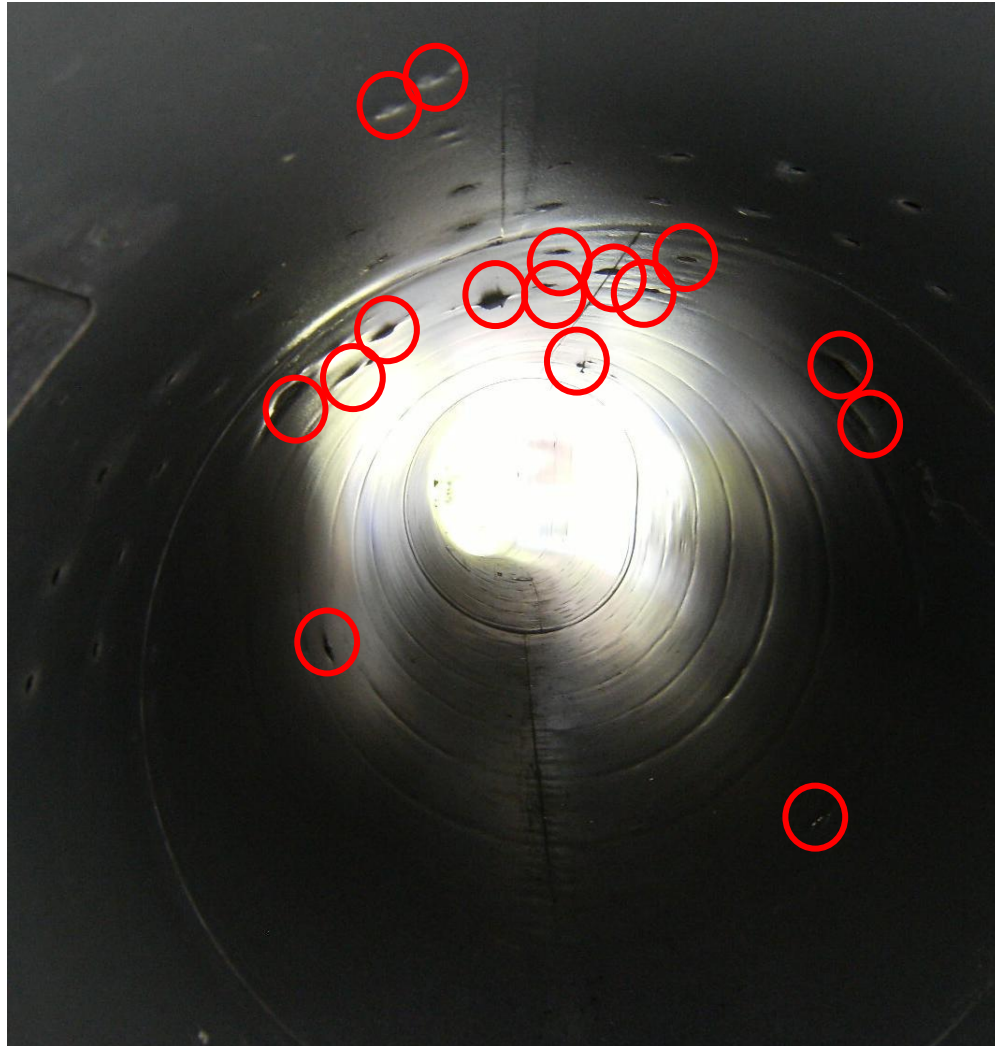


Firing PGU-47/U (APEX) at a F-5 Tail Pictures



Fragments in the aircraft body

Firing PGU-47/U (APEX) at a F-5 Tail - Pictures



Fragments in the left air intake tunnel



Fragments in the wing

Firing PGU-47/U (APEX) at a F-5 Cockpit



Firing PGU-47/U (APEX) at a F-5 Cockpit



Firing PGU-47/U (APEX) at a F-5 Fuel Tank



Grace Impact Angle in Sand: 7.5°

LOF



Status Ground Qualification

- Ongoing ground qualification tests
 - More than 600 rounds fired after environment testing, more than 99,5% function reliability



25mm PGU-47/U APEX A/C Integration

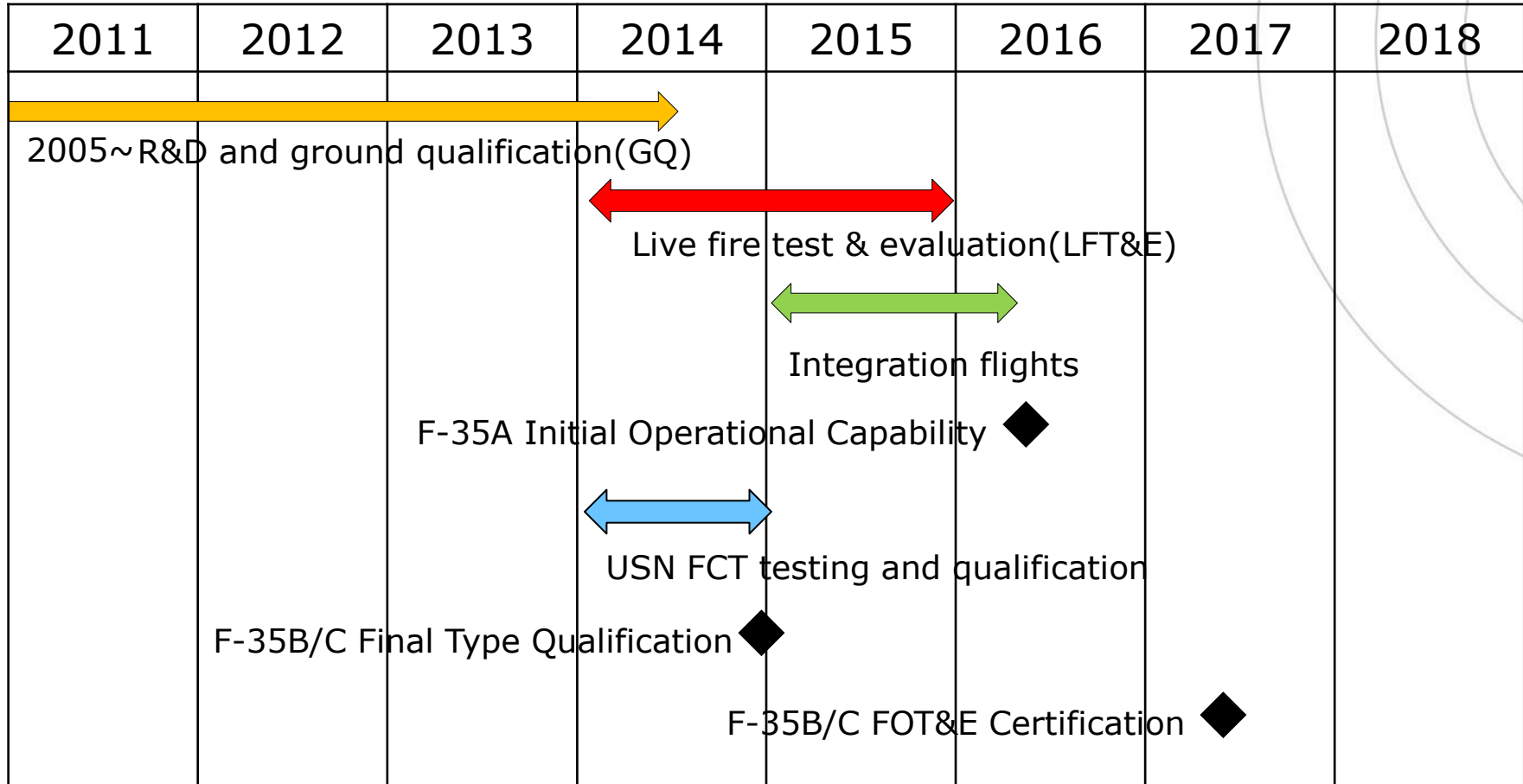
F-35A:

- JPO management, 50/50 funded by Australia and Norway
- The USAF at Eglin AFB will facilitate APEX A/C Integration
 - NNMSB Safety review -> Certification for UASF Aircraft (F-35 A) and pilots
 - LFT&E program
 - Integration flights 2015 – 2016 timeframe

F-35B/C:

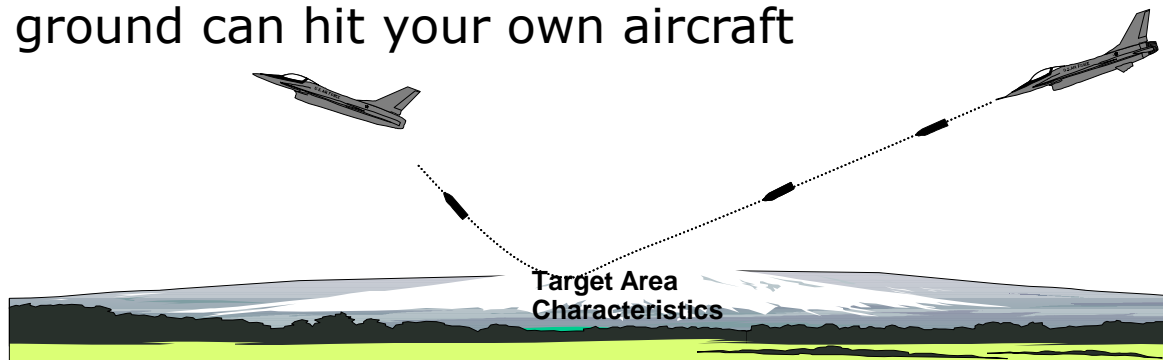
- USN (FCT) will perform delta qualification of the APEX
 - Supporting FISTRP and WSESRB Safety Board reviews
 - Final type qualification end 2014
 - F-35B/C FoT&E -> Certification 2017
- APEX is the only war shot planned certified for all three F-35 versions

25mm APEX Schedule



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



The Dual Purpose Round for the F-35

