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Dinitramides – applications and availability

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$$M^{+}[N(NO_2)_2]^{-}$$

- ADN burns better than AP
- ADN is free from chlorine
- More moles of gas is formed

Patented by SRI

R_3C-[N(NO2)2] = dinitramines

Used in USSR

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Stable dinitramides

$$M^{+}[N(NO_2)_2]^{-}$$

- M=H (Dinitraminic acid)
- Stable salts has so far been found:
- M is a metal cation
  - Li, Na and K
- M is a strong Nitrogen base
  - M=NH_4 (ADN)
  - M=$(NH_2)_2CNHC(O)NH_2$ (GUDN, FOX-12)

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High Energy Minimum Signature Propellants

- Invisibility
- Higher speed or range than when using AP
- Other candidates for HEMSP
  - HNF (sensitive)
  - CI-20 (high cost)

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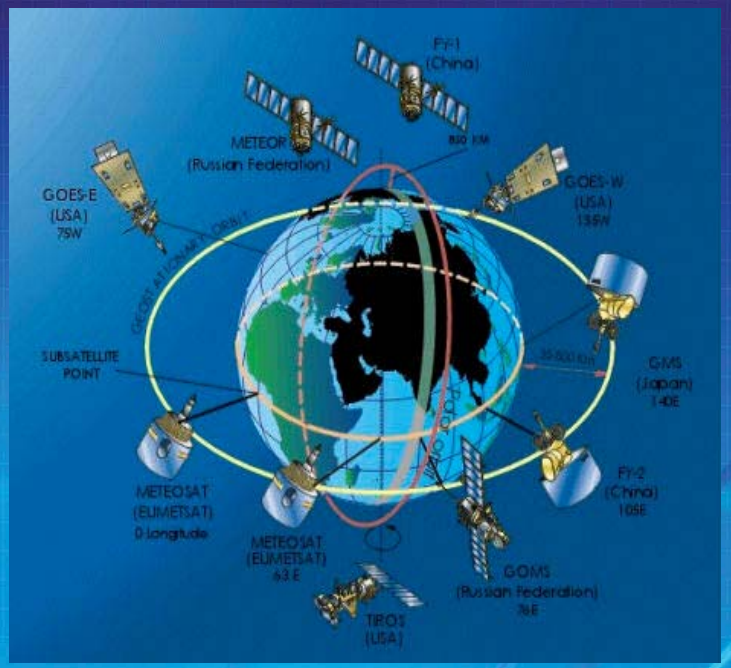
ADN replaces Hydrazine in space



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Improving ADN

- **Thermal stabilization**
  - Hexamethylene tetramine (2-4 times @ 80^{0}C)
  - Acardite II (2-4 times @ 80^{0}C)
  - Hexamine
  - MgO (from 3 to 24 h @ 98^{0}C)
- **Spherical shape (at least compact)**
  - Prilling needs scale up work
- **Particle size distribution**
  - 20 – 300 microns (EB)
- **Hydrophobic coatings**

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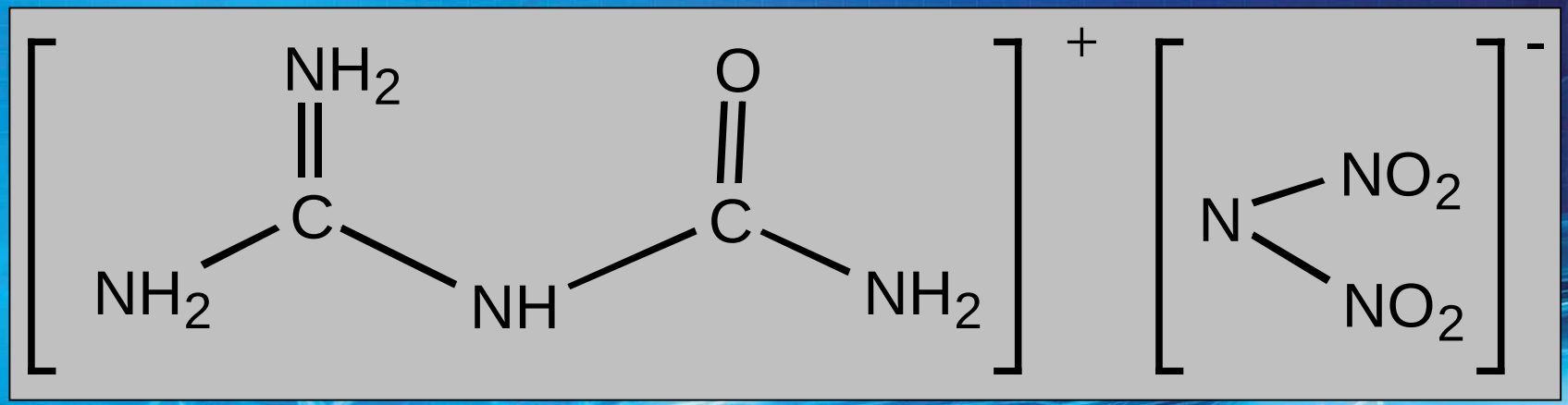
FOX 12 (GUDN) – the most useful

- Water solubility (20°C) 5 g/liter
- Hygroscopicity (20°C, 25-75 %RH) 0.020 %,
- Ignition temp 200 °C
- M.P. Decomp.
- Thermal stability 110°C/400 h
- Sensitivity
  - Impact (BAM) > 49 J
  - Friction (BAM) > 353 N
  - ESD (Bofors) > 3125 mJ



GUDN

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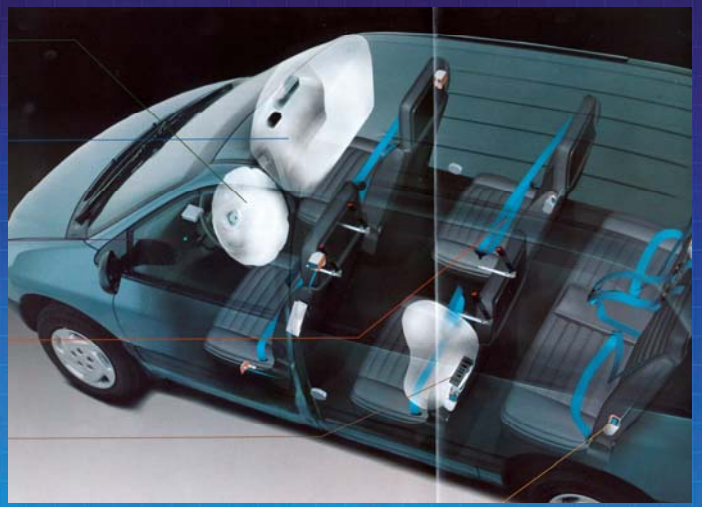
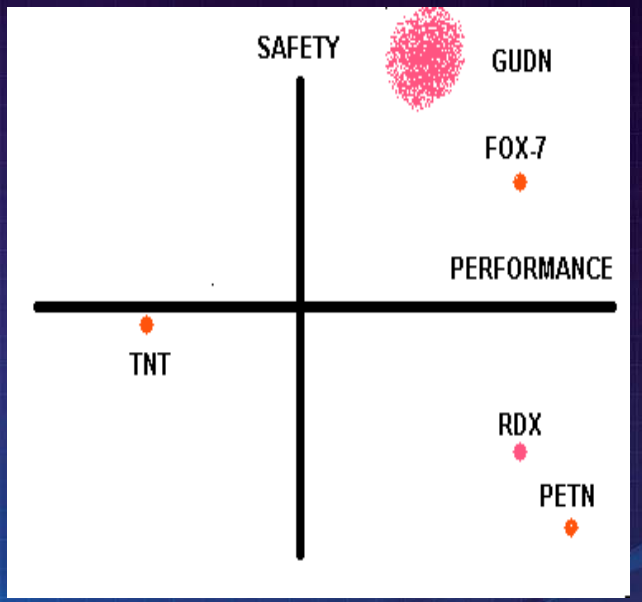
FOX-12- the already used dinitramide





- High gas yield
- Burns with low temperature coefficient
- Thermal stability

UN – class 1.3 C

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Propellants containing FOX-12

19-perf, slotted, rosette

155 mm FH 77B05 L52

- **FOX 12 is a low sensitive explosive**
- **No sustained detonation**
- **Performance as single-base propellant**

An application for Bofors

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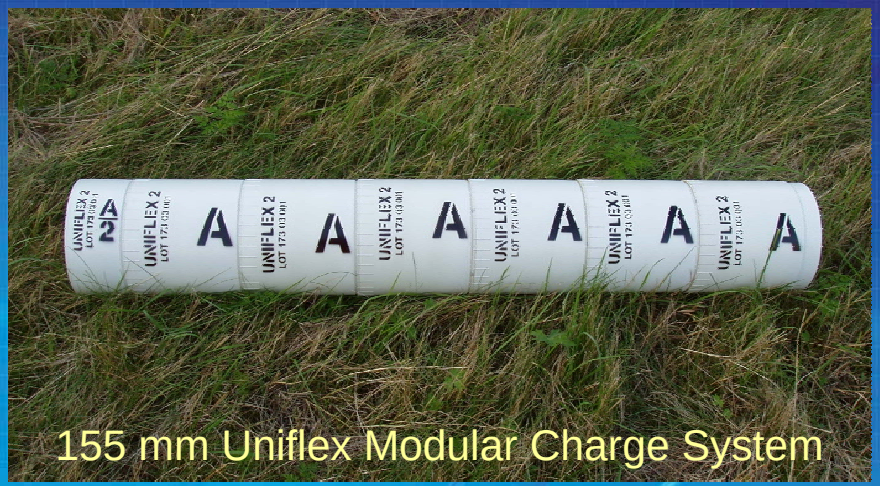
FOX-12 for Uniflex IM (Modular Charge)



155 mm Uniflex Modular Charge System

Advantages:

Propellant contains FOX-12

- Low sensitive propellant
- Low barrel wear (2200K)
- Production scale manufacturing capability

Flexibility:

- Uniflex IM can be fired with only one module in the chamber. This allows for a true unimodular charge system.

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Jet Impact Test – Single Base Modular charge

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Jet Impact Test – FOX-12 Modular Charge

Availability

$[NH_3]$ —(HNO3, H2SO4, -30 ^{0}C)→ $HN(NO_2)_2$ —(NH_3, water)→ NH4N(NO2)2 (aq)

Recovering from water → $NH_4N(NO_2)_2$ (crystalline powder)

Sample from first batch 1996

In 2004 we will produce 10 tons
In 2005 we plan for 25 tons

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Next Dinitramide Conference in Karlskoga April 12-13, 2005