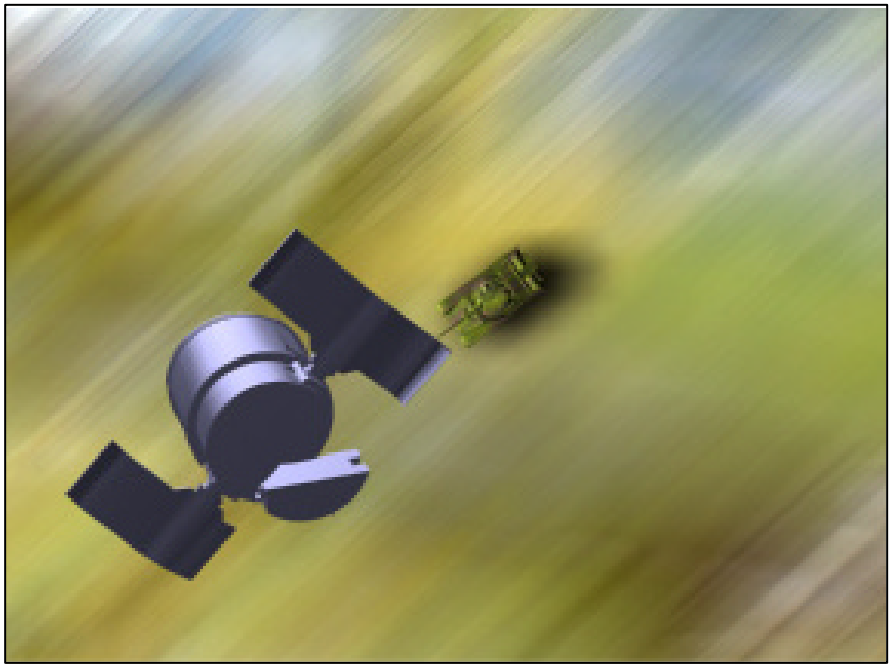
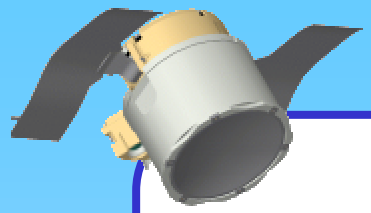
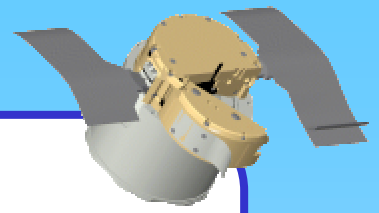
37th Annual Gun & Ammunition Symposium
April 15-18, 2002
Panama City, FL

155 BONUS
SENSOR FUZED MUNITIONS
presented by
Col(R) T Gerhardsson







Agenda

- **BONUS System and Program Overview**
- **BONUS Characteristics**
- **Performance in Desert Conditions**
- **BONSIM validation model**
- **Summary**

System overview

1. Launch phase

- Preparation
- Firing

2. Ballistic phase

- Base bleed

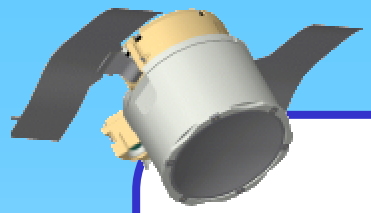
3. Transition phase

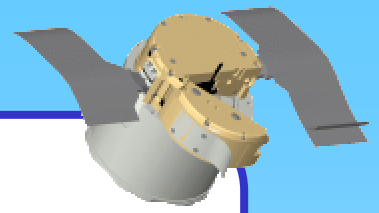
Cylinder expulsion
- Velocity reduction
- Rotation reduction

Submunition expulsion
- Stabilisation

4. Terminal phase

- Altimetering
- Search
- Kill





Program History

- **Swedish concept/feasibility studies 82-86**
- **Product Definition Phase 86-89**
- **Ph I Full Scale Development (Sweden) 90-93**
- **Studies in France (ACED Program) -92**
- **Joint Development (Sweden/France) 93-99**
- **Serial Production Decision/Contract -00**
- **Initial Deliveries Sweden/France) -02**
- **First Unit Equipped -03**

Ballistics

Similar to M864, NATO standard

Base Bleed in trajectory

- **35 km** range with a 52 calibre gun
- **27 km** range with a 39 calibre gun

BASE BLEED PROVIDES GREATER AREA COVERAGE

<u>without Base-Bleed</u>

. Range: 27 km

. Coverage: 2,290 km²

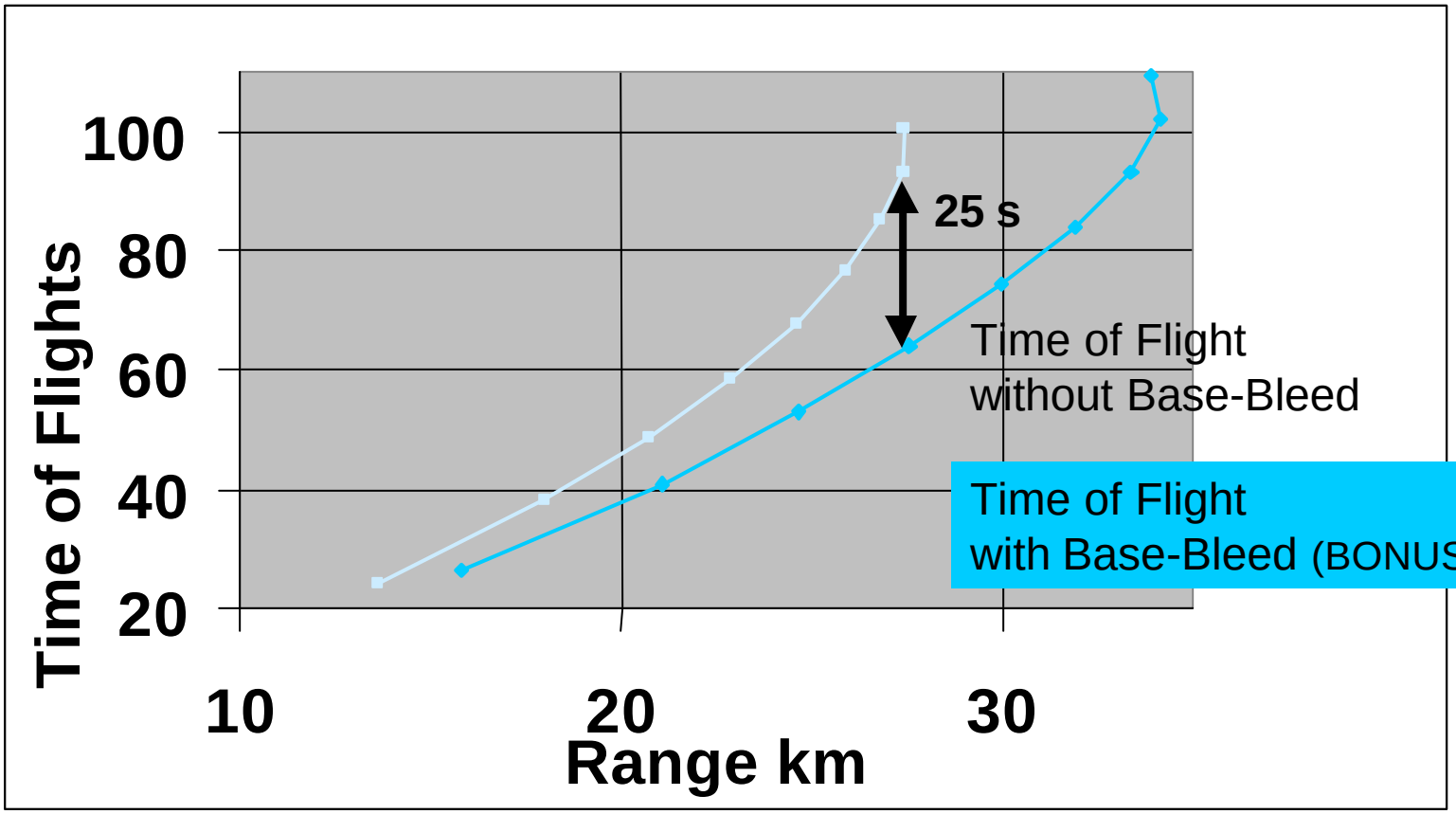
+ 70 %

<u>with Base-Bleed (BONUS)</u>

. Range: 35 km

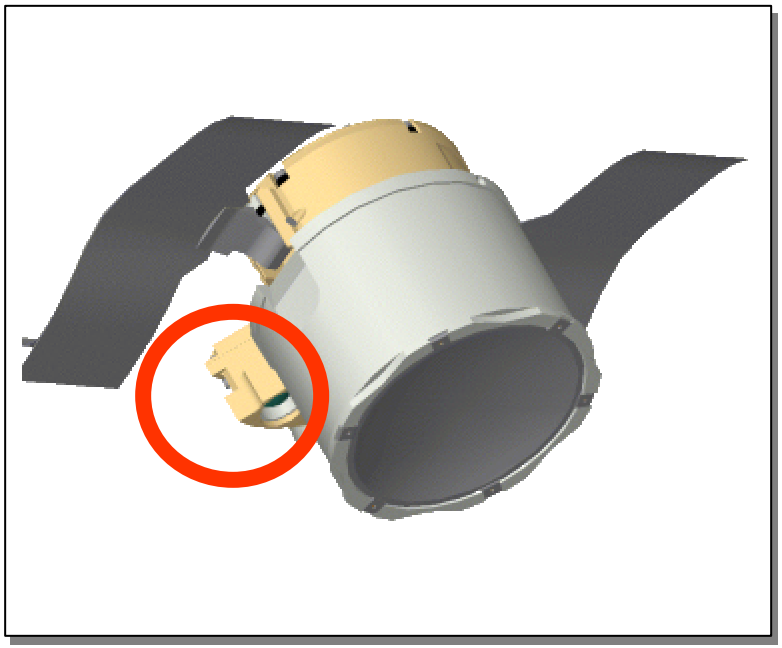
. Coverage: 3,850 km²

Reduced Time of Flight through Base Bleed (52 Caliber)



Sensors

- Laser altimeter
- Multiband passive
- IR detectors

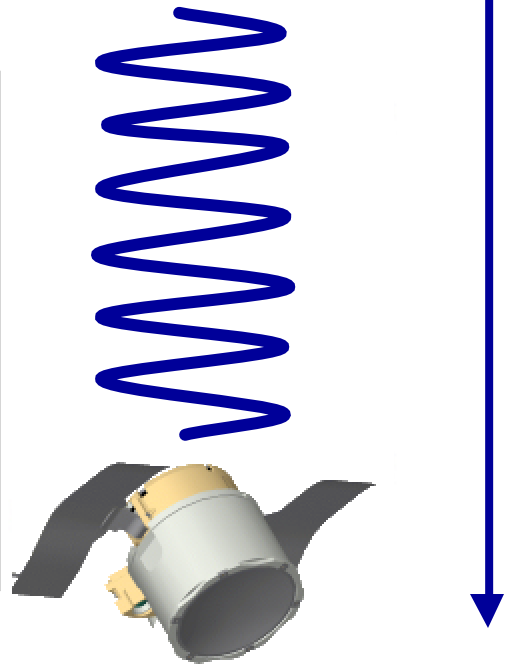


Submunition

- Asymmetrically fixed wings
- Rapid descent
- High spin rate

45 m/sec

15 rev/sec



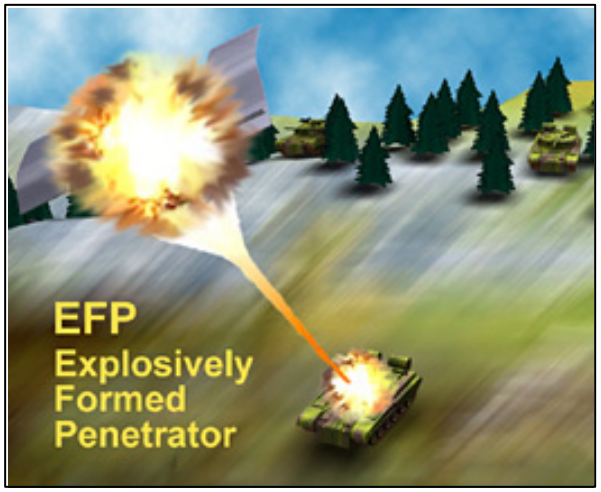
results in

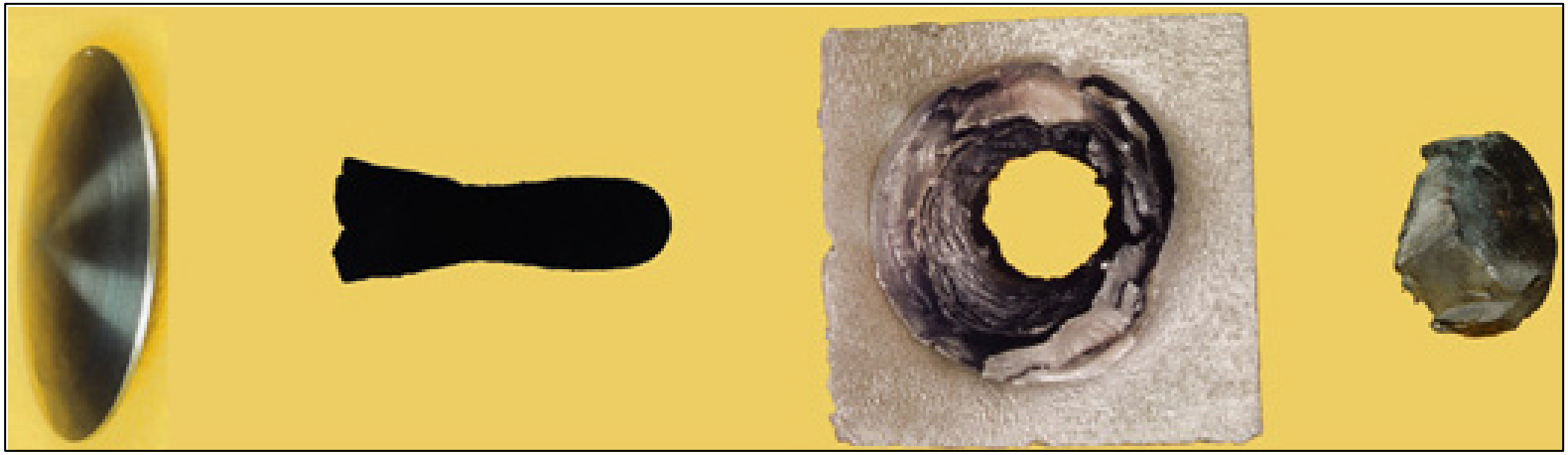
- Very stable flight
- Low sensitivity to wind and wind gusts
- Low detectability

Penetrator

Explosively Formed Penetrator

- Stand-off: 0 - 200 m
- Penetrator velocity: >2 km/s
- Tantalum liner
- Perforation capability: >100 mm

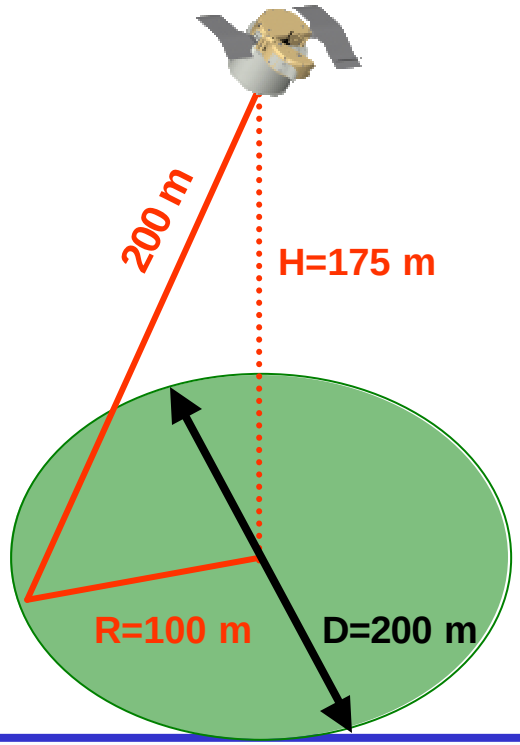




Search area

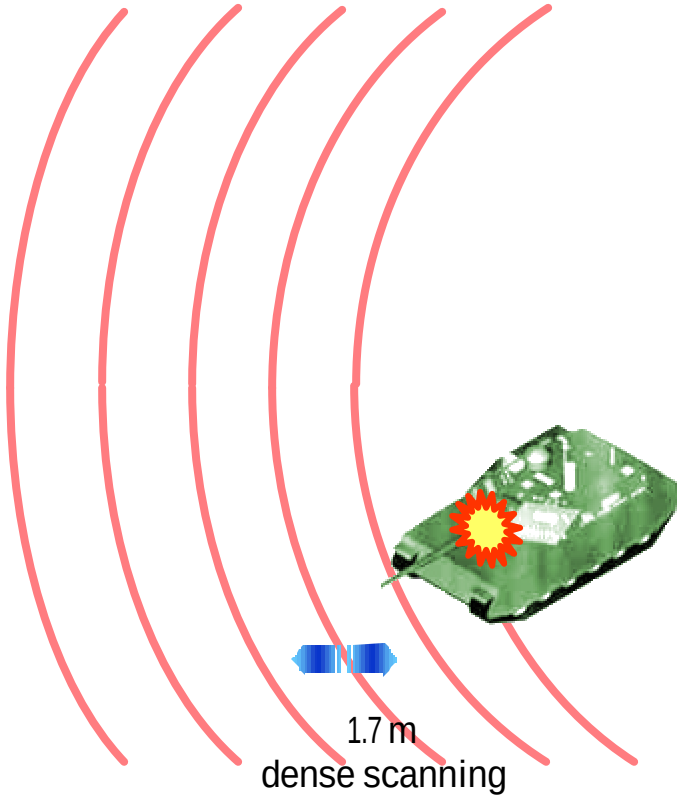
Search area:

32,000 m²/submunition



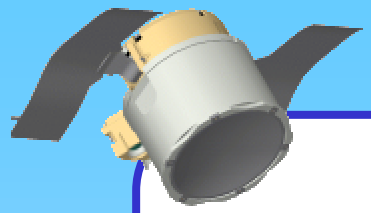
Submunitions

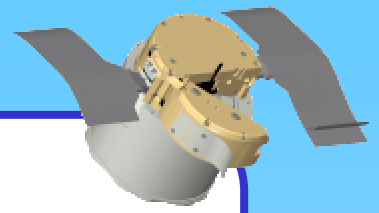
Trigger on Detection



Warhead ignition

- The warhead initiates immediately on target detection
- Self-destruction
  - on impact
  - at time-out





BONUS characteristics

• Range (52 cal)	35 km
• Range (39 cal)	27 km
• Aerodynamics	Fixed wings
• Descent/spin (m/s,rps)	45/15
• Detector	IR(MB)

Desert tests

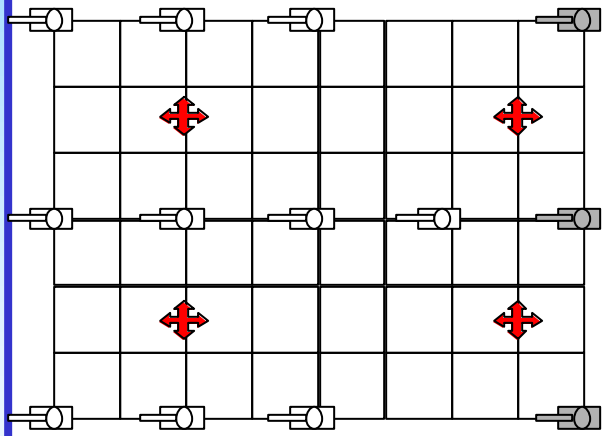
- Sensor tests were carried out in desert conditions in Djibouti during July 2000.
- Five types off terrain were registered by the 155 BONUS sensor.
- All types of terrain were used for simulation of kill probability against three types of targets, this in comparison with performance in European Conditions

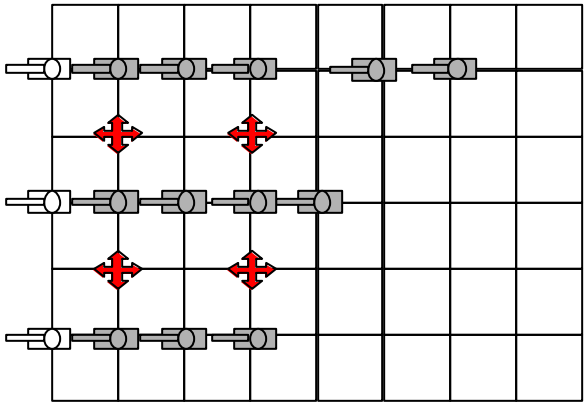
Target descriptions

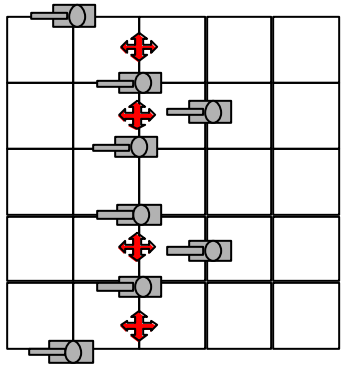
Firing axis - range 15 km

MBT **APC**

Aiming point

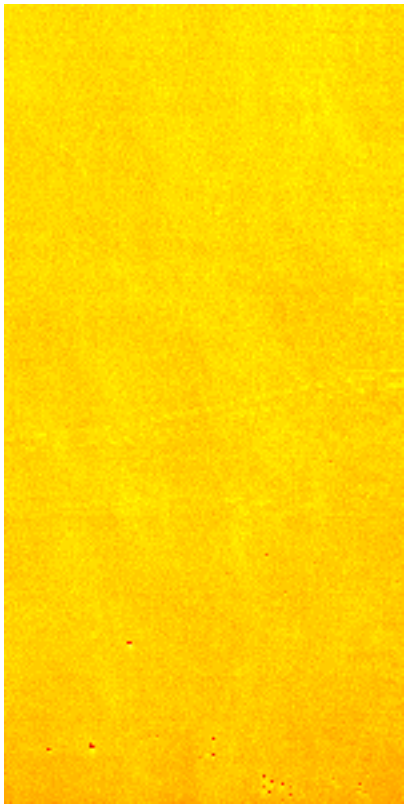






155 BONUS

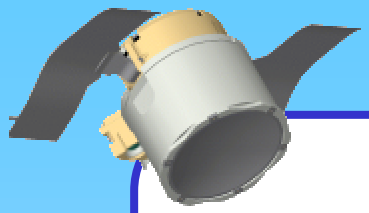
Sand desert



	Morning	Mid-day	F1
MBTS stationary	**6**	**7**	***7***
MBTS moving	**8**	**10**	***9***
MFCO stationary	**7**	**8**	***8***
MFCO moving	**11**	**12**	***12***
Self propelled gun	**6**	**7**	***6***

Number of shells needed to kill 30% of the tgts with 50% probability

155 BONUS



BONUS SIMULATION MODEL

Bonus data:
Flight recorder
Windtunnel
Sensor

Experience, theories

Bonsim validated

Verifies Bonus $\mathbf{P_{kill}}$ performance

Require-ment fulfilled Yes/ No?

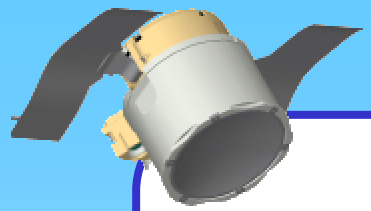
Ballistics
Meteorology
Geodesy
IR background
Target data

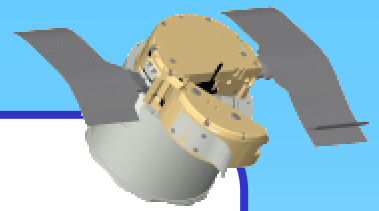
Certified by FMV

Comparison Test Firing and Bonsim

Expected result from simulation with the Bonsim model for **25** submunitions with targets within search area and the same conditions as at the qualification test.

Result	**Expected**	**Firing**
•Target detection	**18**	**19**
•False alarm	**4**	**3**
•Self destruct at ground impact	**3**	**3**
•Hit in the target	**14**	**16**
•Hit per shell(14)	**1.00**	**1.14**





Summary

155 BONUS SFM

- **Is qualified and in production for the Swedish and French Armies**

- **First Series Qualification Test Summer 2002**

- **Has the same performance in desert conditions as in European terrain and climate**

- **System Validated through extensive Modelling and Simulation**