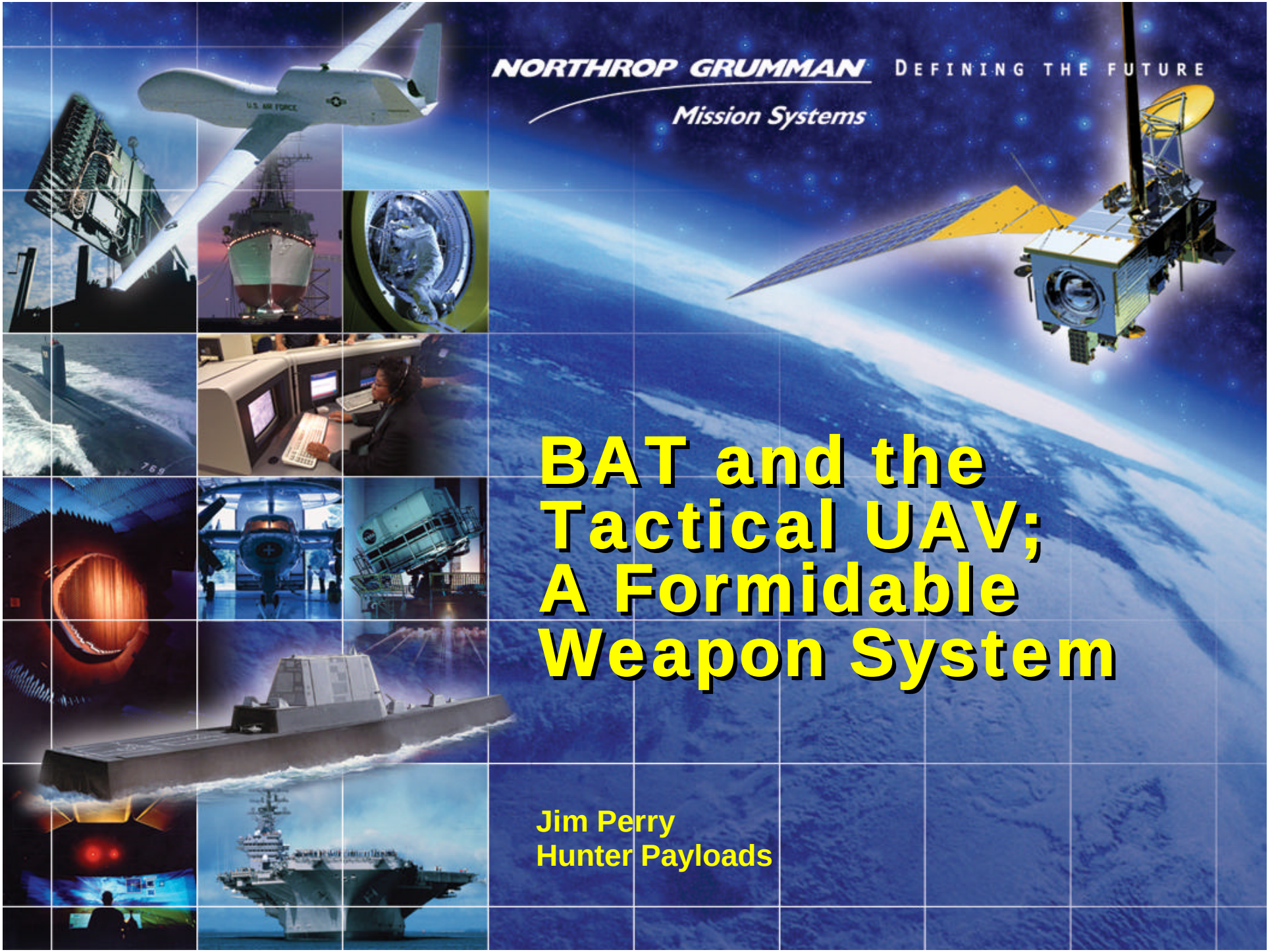
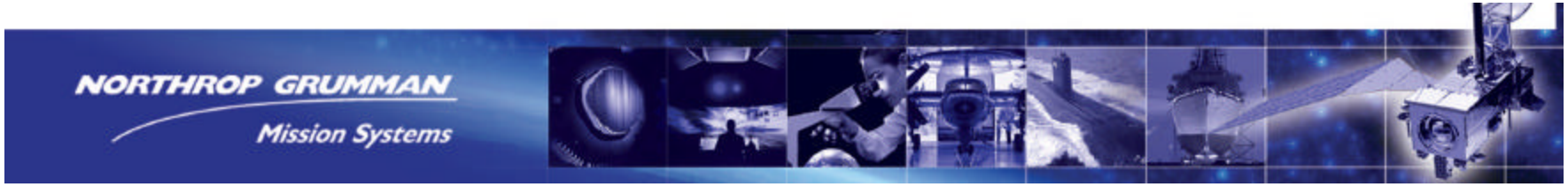

NORTHROP GRUMMAN
DEFINING THE FUTURE
Mission Systems
BAT and the Tactical UAV; A Formidable Weapon System
Jim Perry
Hunter Payloads



Agenda

- **Why put Munitions on a TUAV?**
- **Record of Success**
- **System Development**
  - **Munitions**
  - **Delivery System**
- **Demonstrations**
- **Future**
- **Summary**

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Mission Systems

Why a Weaponized TUAV?

- DOD Support Unprecedented
- Dull, Dirty, Dangerous Mission
- No SAR Missions for Down Pilots
- Self Contained Capability
  - ISR/Target/Attack/BDA
  - Precludes Targets Escaping While Awaiting Shooter
    - Shortens the Sensor to Shooter Chain
    - Experiences in Kosovo

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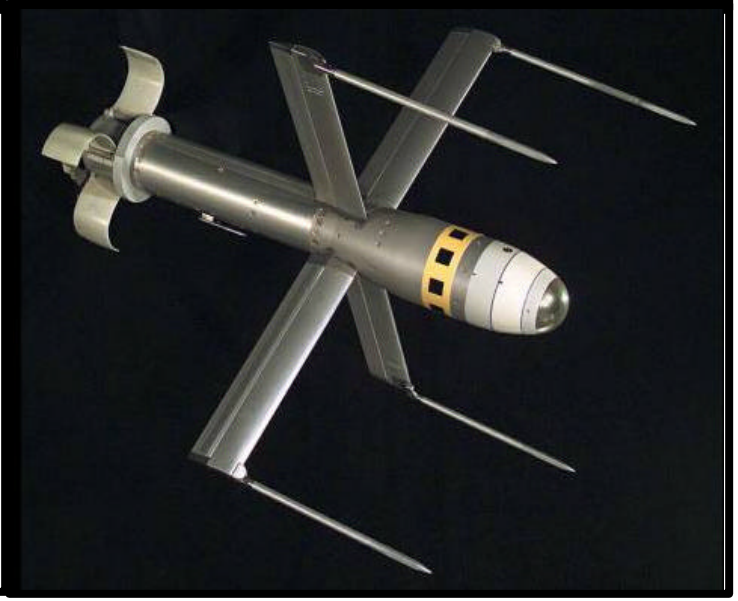
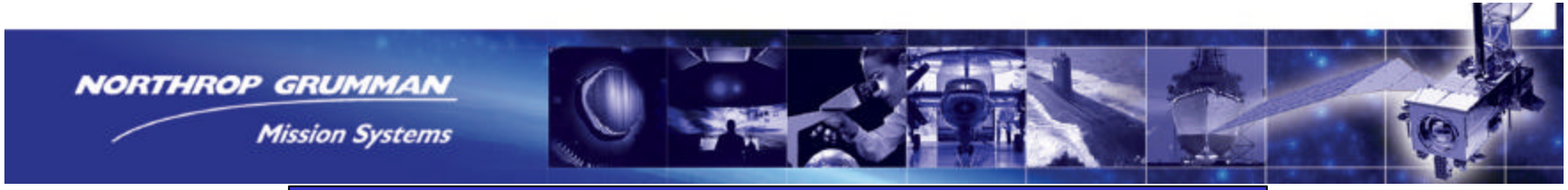
Mission Systems

BASE BAT





Phase One

- Army Awarded QRC 90 day demonstration program
  - Awarded in July ’02
  - Develop Hunter Extended Center Wing (ECW)
    - With hard points, pylons, bomb racks, cables
  - Develop Hunter Data Link Interface Module
  - Design, manufacture, and integrate
    - Munition Interface Unit (MIU)
    - Dispenser Tube
  - Develop Software
  - ECW test flown at Ft Huachuca 9/02
  - BAT simulants launched from Hunter at Ft Huachuca 9/02
  - Two instrumented BATs hit moving tgts at WSMR 10/02
  - Two live warheads hit moving tgts at WSMR 10/02
    - Metal on Metal Success!

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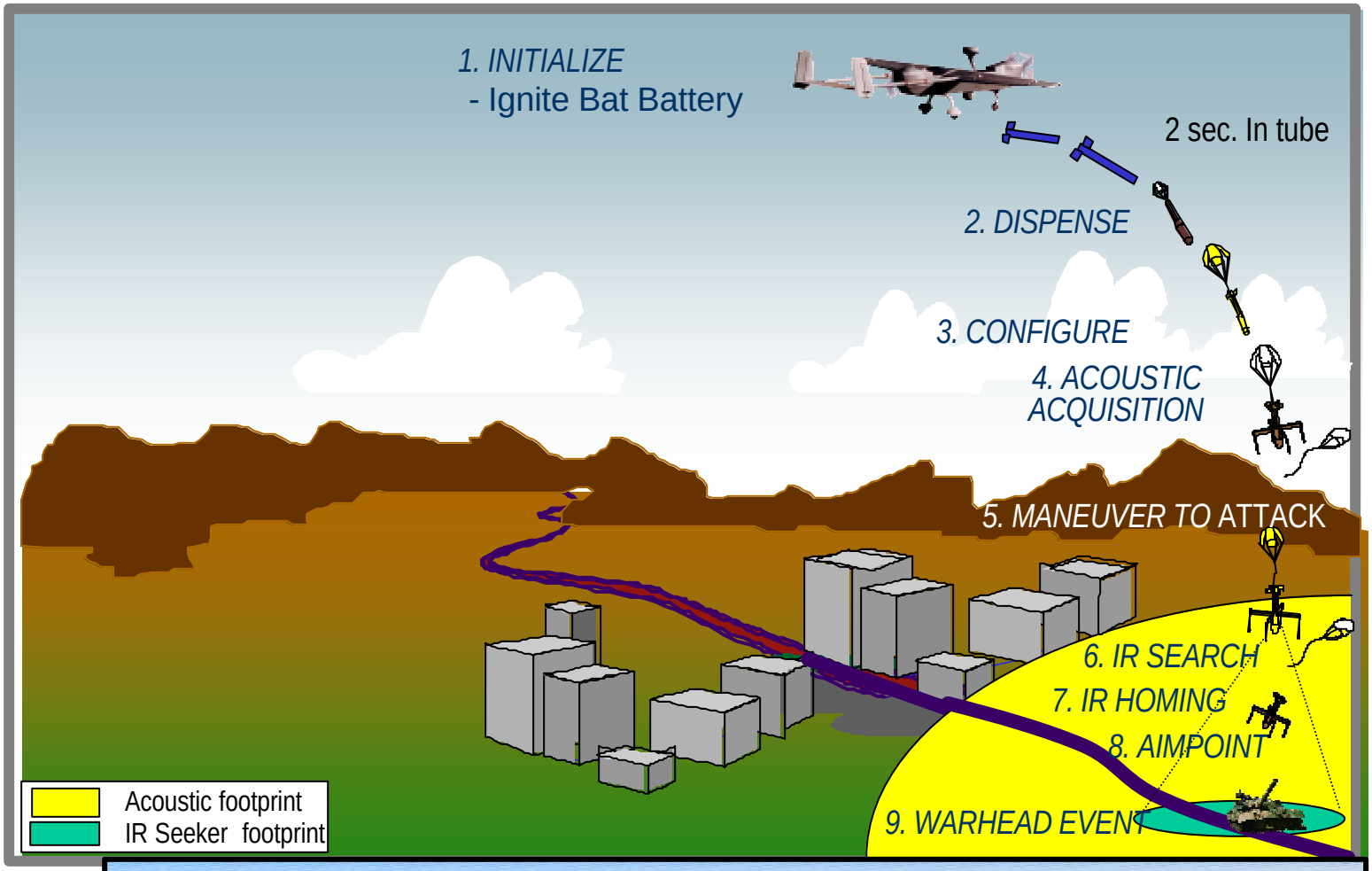
BASE BAT Launch from Hunter



Attack Warm Moving Target (IR Target)

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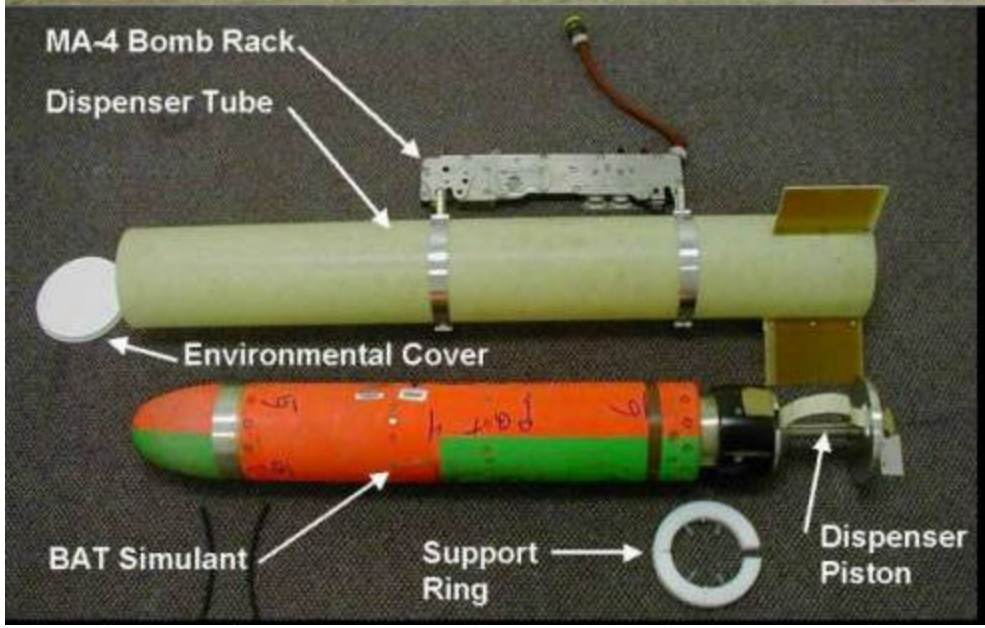

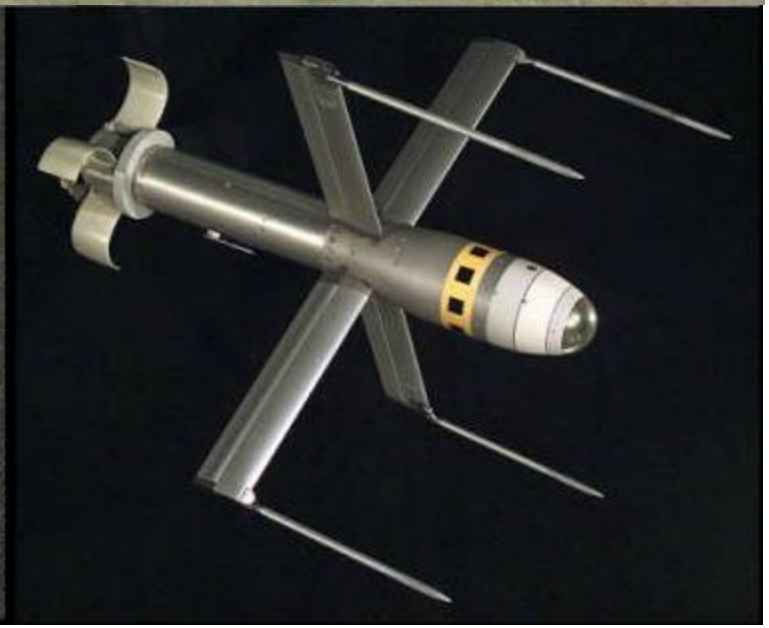

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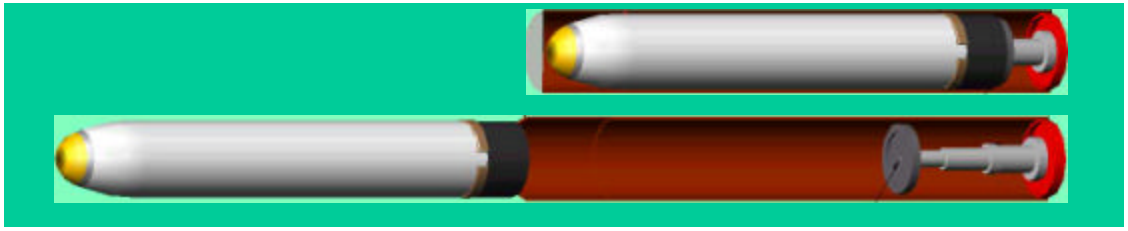
Hunter / BAT - Concept

- **Utilize Hunter wing mounted pylons attached at external hard points**
- **Utilize BATs in jettisonable, composite containers (tubes)**
  - **BAT canister delivery system developed by Systima Technologies**
  - **1 BAT per canister**
  - **Hunter currently carries 2 tubes; 1 on each side**
- **Man-in-the-Loop target detection using EO/IR sensor, decision to engage**
- **Maneuver Hunter to engagement point**
- **Initiate BAT power-up with Ready command to MIU from GCS**
- **Initiate BAT/canister drop with Launch command to MIU from GCS**
- **Dispense BAT from canister 2 seconds after separation**



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Dispenser System Demonstration

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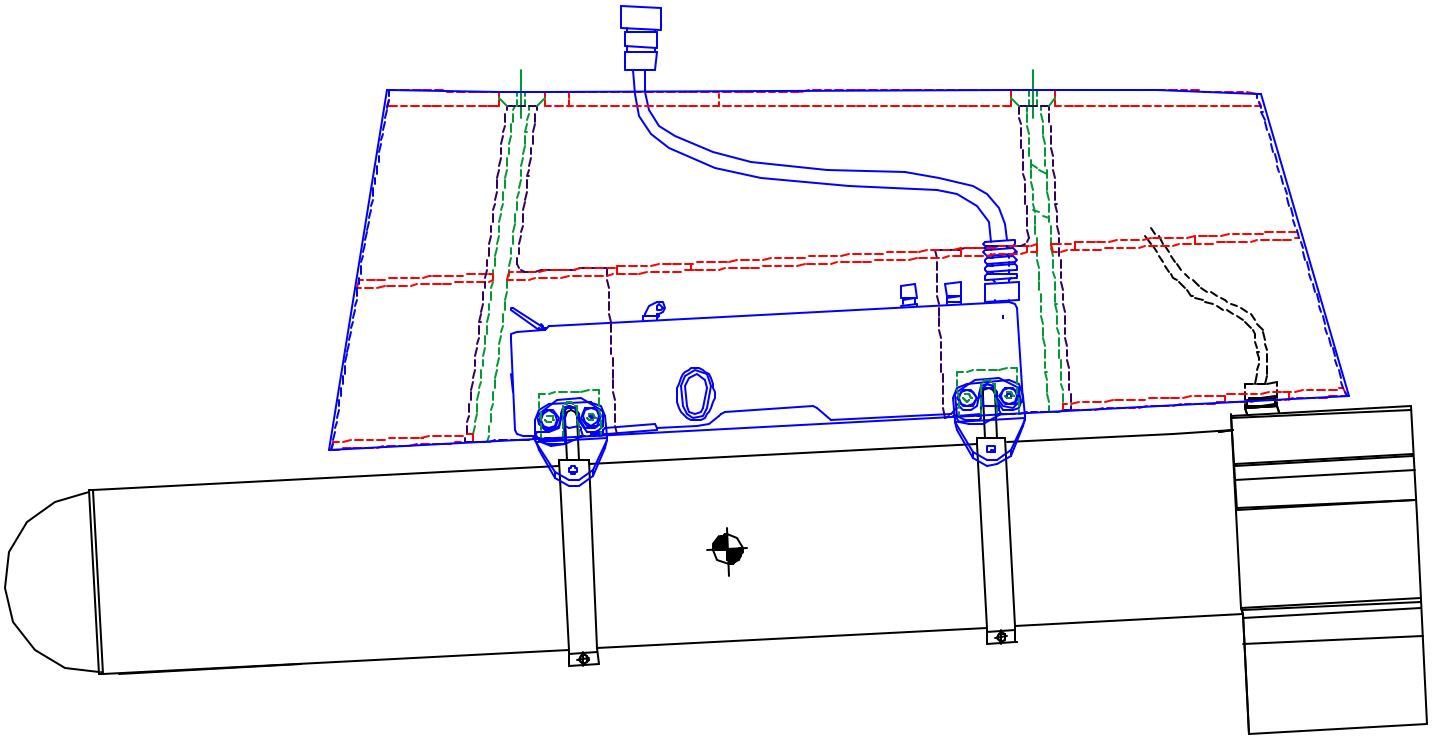
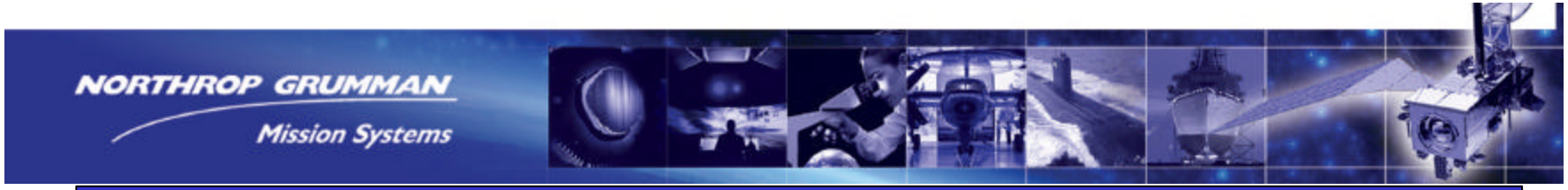
BAT Attached to MA-4 Rack on Pylon





Command and Control

- Control/Status
  - New Weapons Panel developed for the Hunter Ground Control Station (GCS).
  - Uplink via C Band Data Link.
  - Commands to Data Link Interface Module.
    - Developed by Northrop Grumman, Mission Systems & Neptune Sciences Corp
    - Formats commands and sends to MIU via RS-422 interface
  - MIU Controls BAT
    - Developed by BAT Manufacturer; Northrop Grumman, Electronics Systems.
  - MIU sends BAT Status to GCS via C Band downlink.
    - Status returned to Air Vehicle Operator (AVO) via Weapons Panel.

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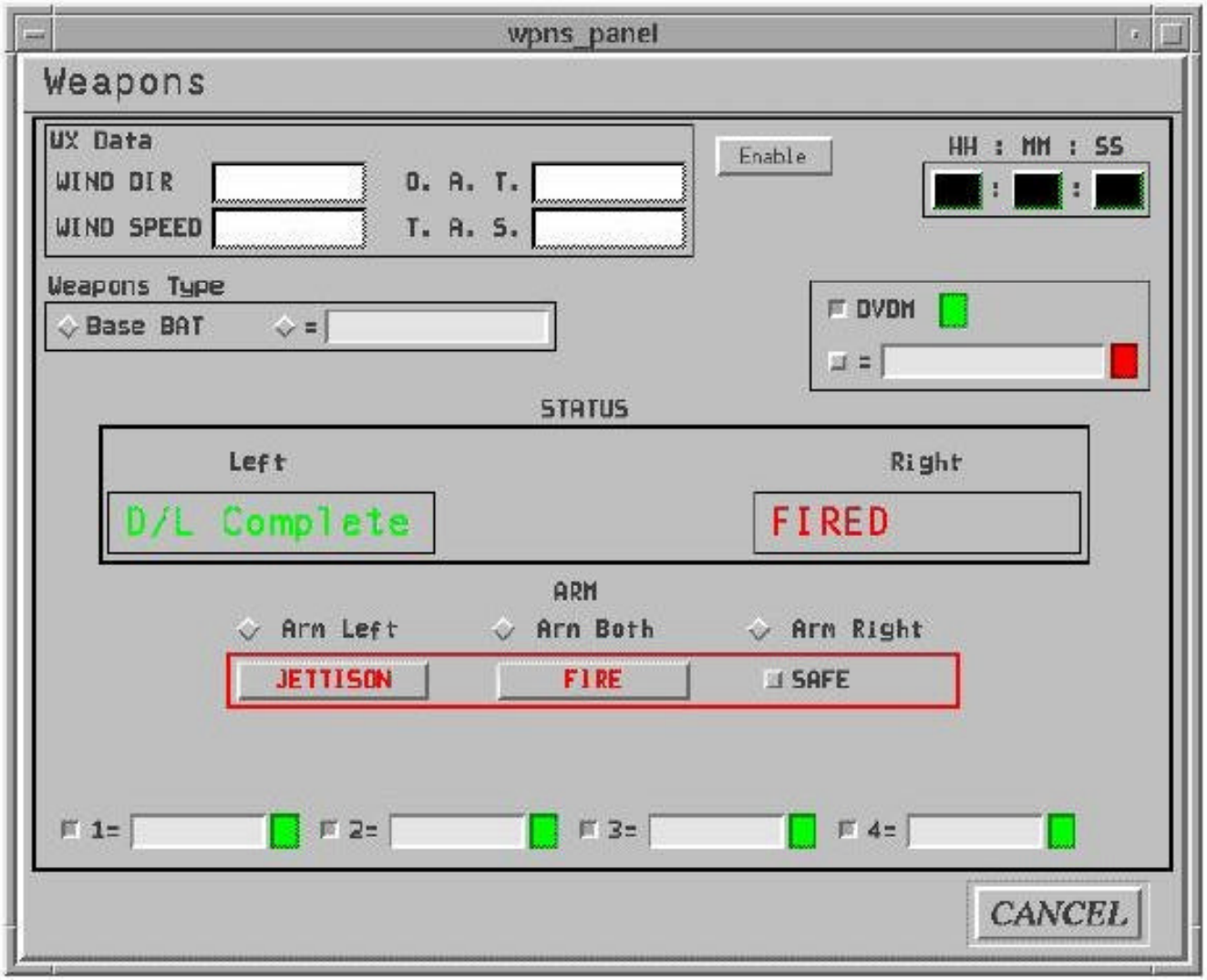
Weapons Panel



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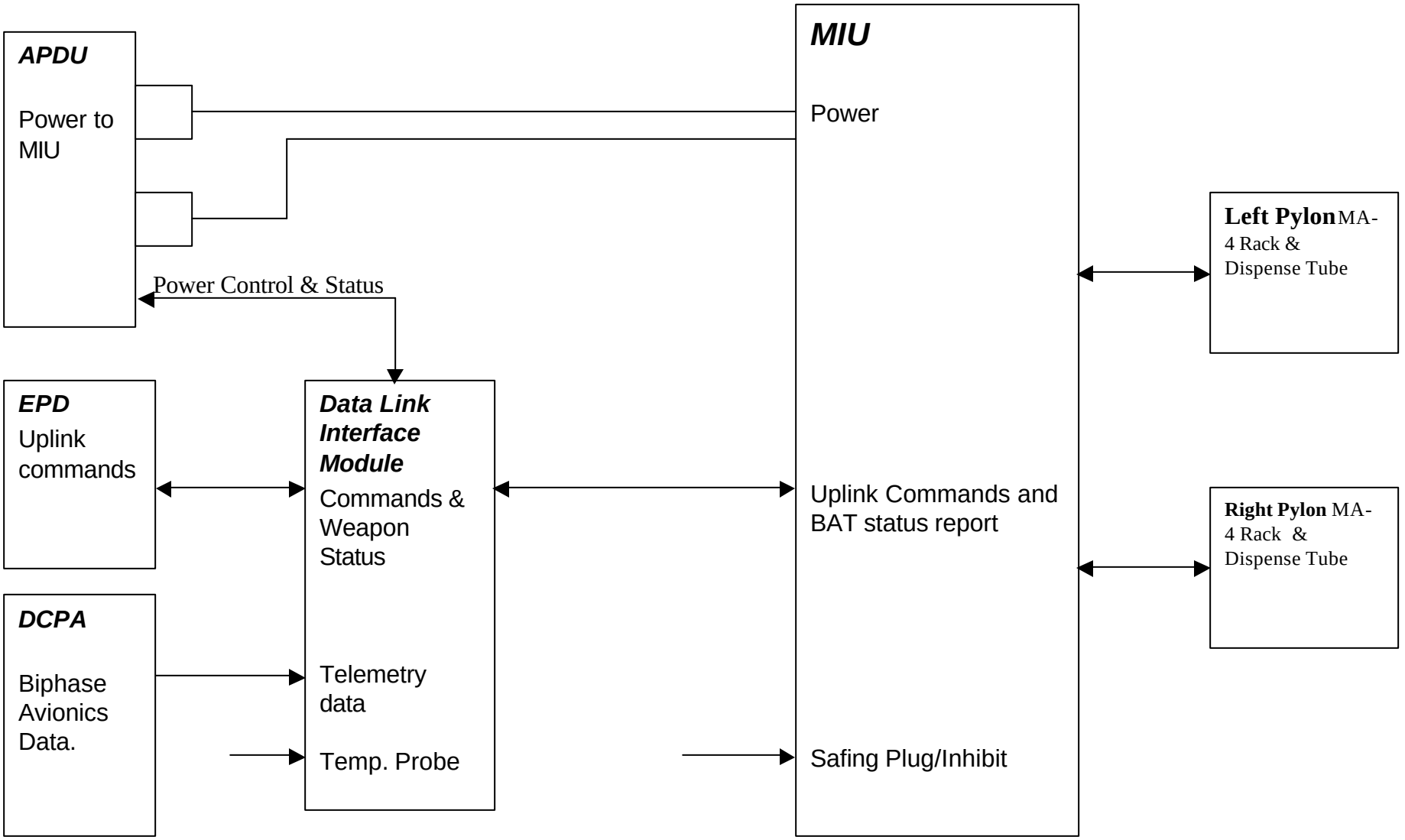
Hunter/BAT Control



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Center Wing Before/After

- Adds approximately 2.6 feet to each side
- Adds 110 liters additional fuel capacity in wet version
  - Demonstrated 15.7 flight hours with MOSP & clean wing
- Adds hard points on each side
  - Capable of carrying up to 135 Pounds each

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View from Hunter On-Board FLIR

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Phase 1 Instrumented Bats on Hunter Results

Dispense from Hunter

Bat Impact
T 72

Bat Impact
BMP

2 Instrumented Bats Against Small Array of Moving Armored Targets
2 Out of 2 Hits!

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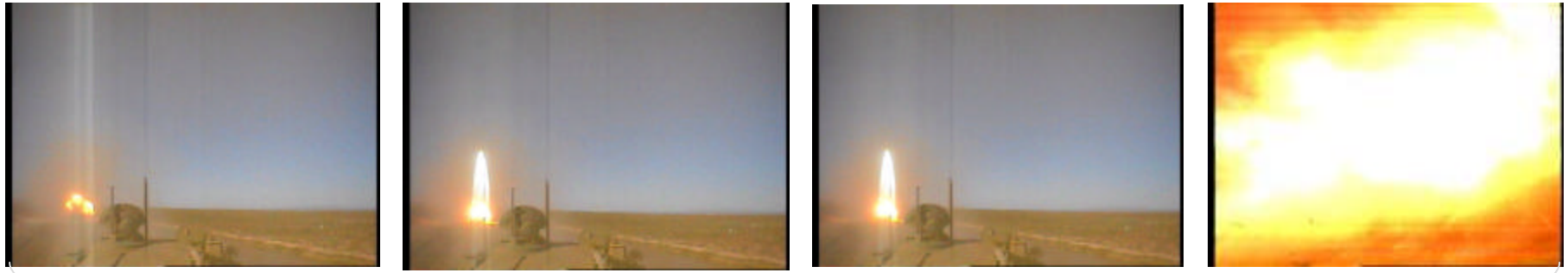
Mission Systems

Phase 1 Warhead Bats on Hunter Results

Bat Impact
T 72



Bat Impact
BMP

2 Warhead Bats Against Small Array of Moving Armored Targets
2 Out of 2 Hits!

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View of Near Simultaneous Hits from Hunter Camera

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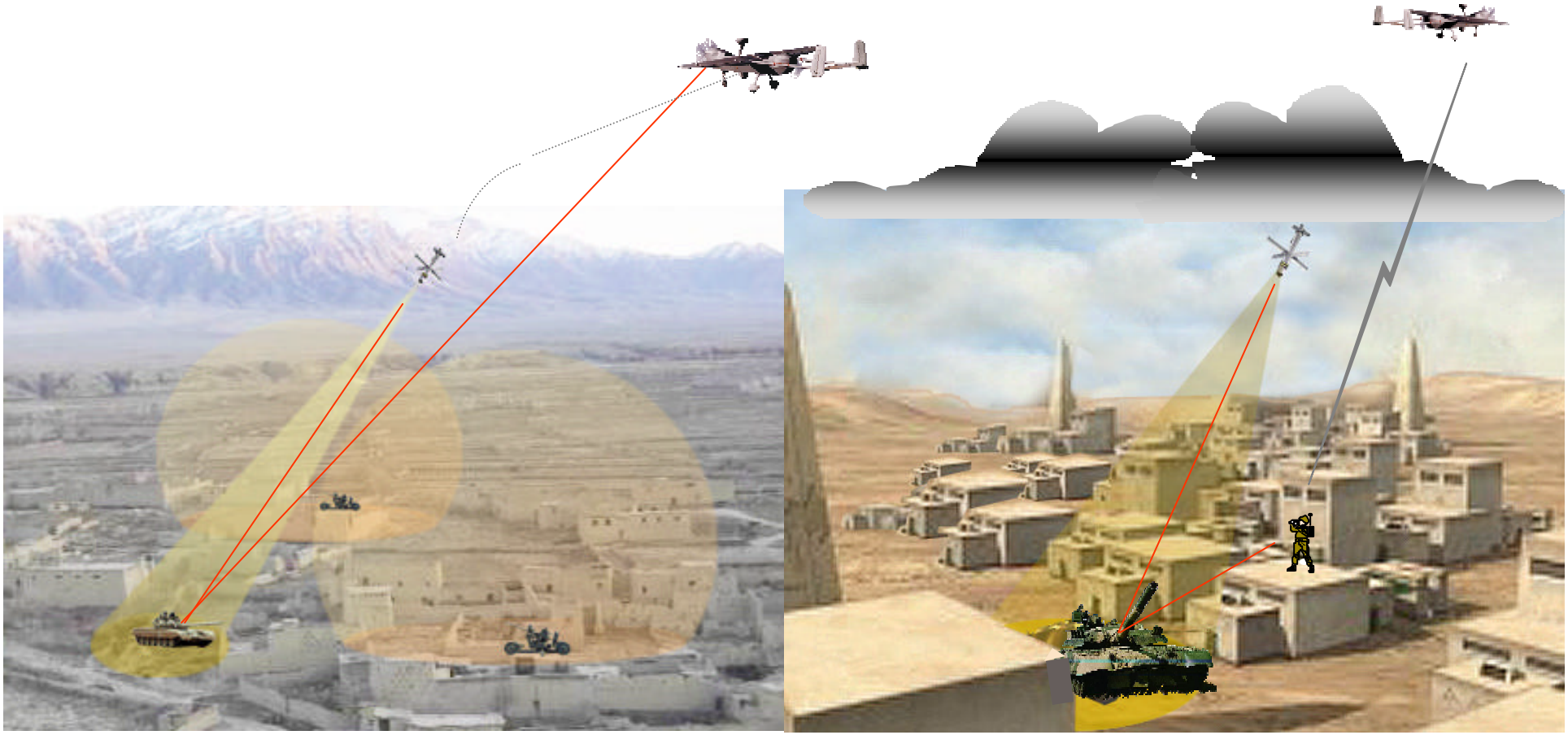
Viper Strike – SAL Option

Overview - Viper Strike

- Release outside AAA and IR SAM Envelopes
- Semi Active Laser (SAL) Seeker for Restrictive ROE
- Top Attack between Buildings
- Small Warhead ~ 0 CEP for Low Collateral Damage
- Light, Lethal Weapon Allows Many Kills per Sortie
- Carriage/Dispense Tested from Standard Bomb Racks
- SAL Seeker Successfully Integrated & Tested in Mar ‘03

Viper Strike Increases Attack Options



- On Board Designation
  - 2 Hunter Laser Designators available
    - EO/Laser or IR/Laser
    - Tri-Sensor Available soon

Off –board Designation
(low clouds)

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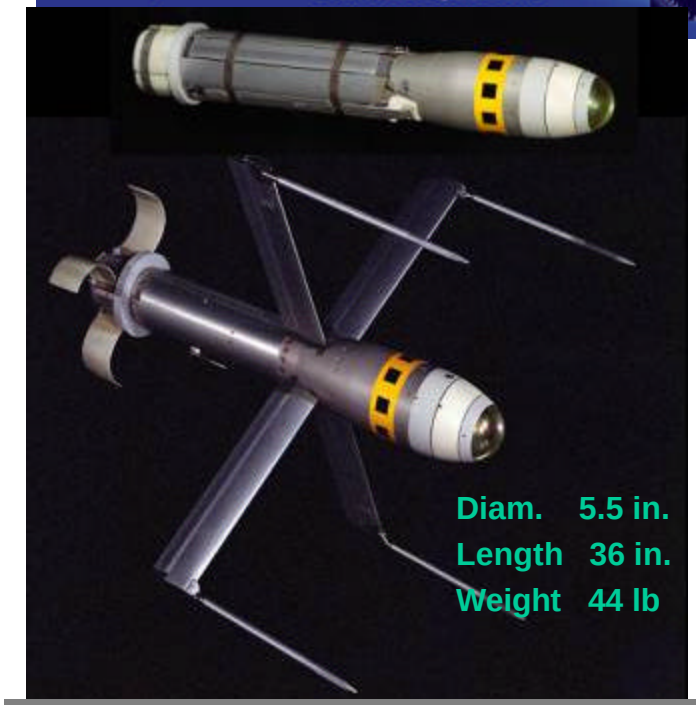
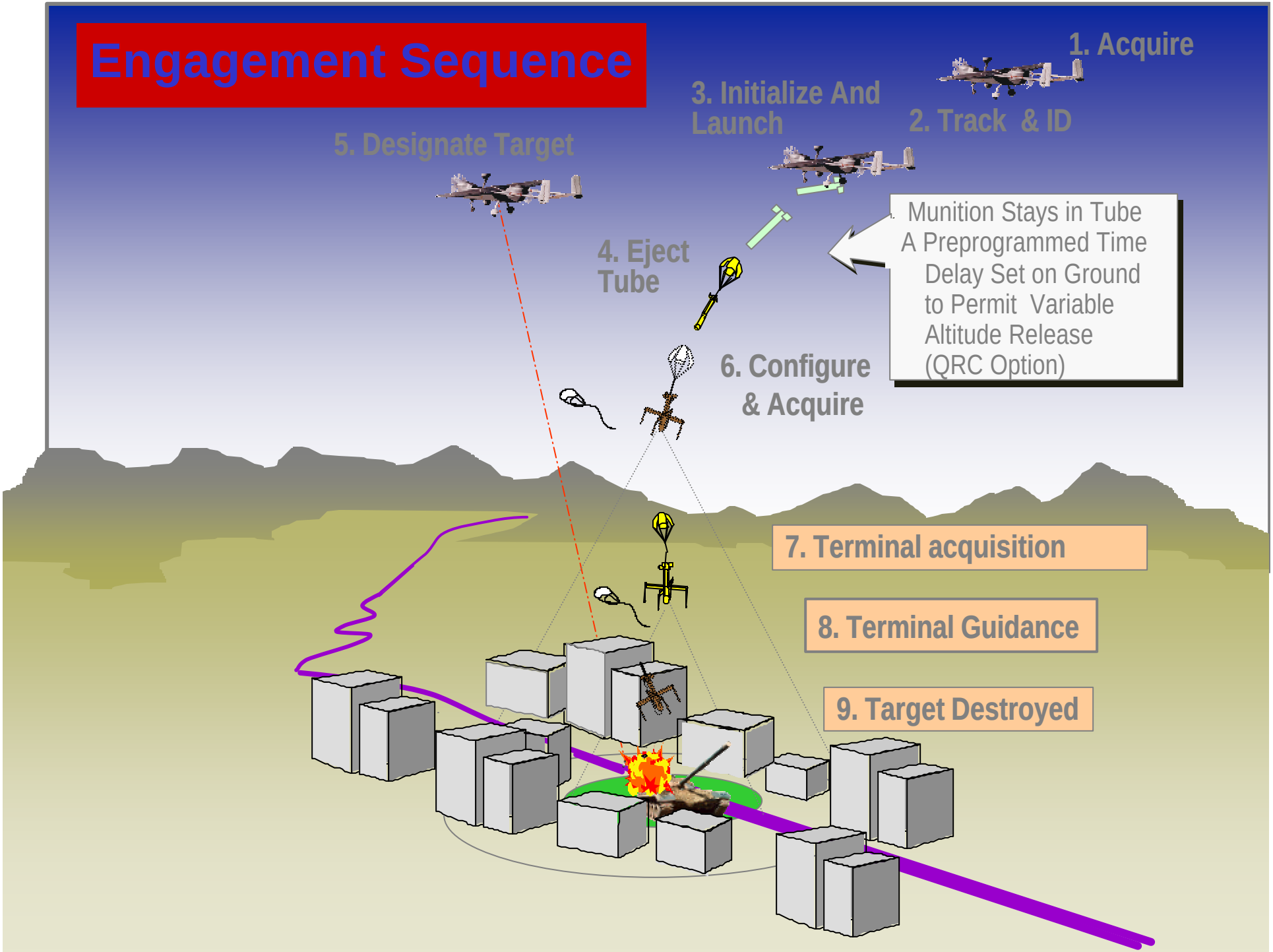
Mission Systems

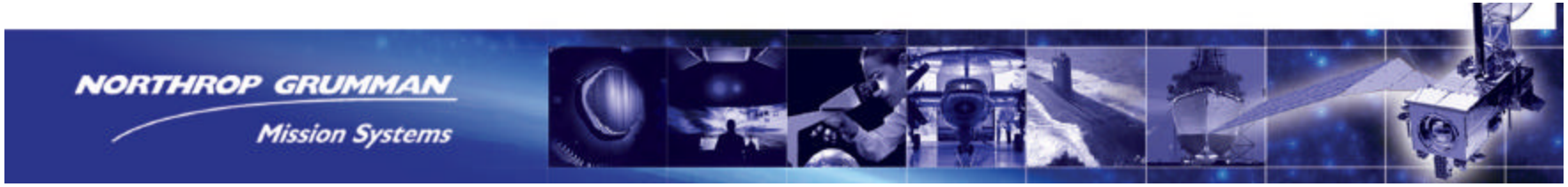


- In Production Airframe
- In Production Semi-Active Laser Seeker
- Successful Demonstration Mar ‘03
- Unlimited Vehicle Target Set
- Effective in low Clouds with Offboard Designator

- High Probability of Kill per round
  - Top Attack
  - Near Zero CEP
  - Small Warhead focused into impact point
- Effective Against Hard and Soft Targets

Ideal Munition for Low Collateral Damage


Engagement Sequence
1. Acquire
2. Track & ID
3. Initialize And Launch
4. Eject Tube
5. Designate Target
6. Configure & Acquire
Munition Stays in Tube A Preprogrammed Time Delay Set on Ground to Permit Variable Altitude Release (QRC Option)
7. Terminal acquisition
8. Terminal Guidance
9. Target Destroyed



Viper Strike Demonstration Phase 2

- Required integration of a Semi-Active Laser (SAL) Seeker onto a Base BAT Airframe
  - Elbit (Strap-down Seeker)
- *Viper Strike* was Demonstrated in Mar ’03
  - Targets designated by on-board Hunter laser
  - Demonstrated capability against “Cold Stationary Targets”
- *Viper Strike* will Demonstrate again in Jul ’03
  - Moving Targets
  - Hunter or Ground Laser Designator (GLD)

Viper Strike provides the Army with a Precision Strike Capability deployable in Urban Environments!

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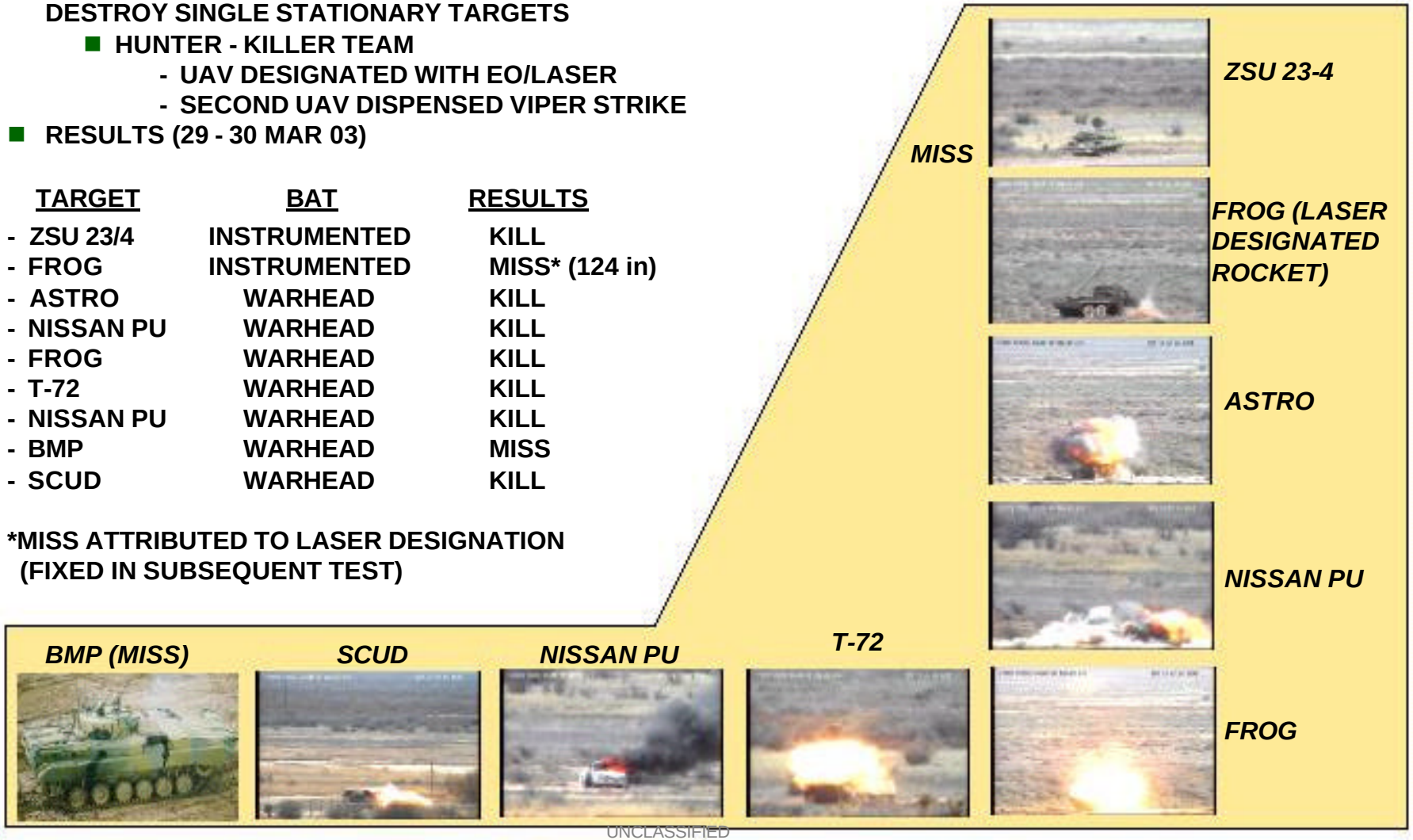
HUNTER-VIPER STRIKE DEMO SUMMARY

- UAV WITH VIPER STRIKE USED TO ENGAGE AND DESTROY SINGLE STATIONARY TARGETS
  - HUNTER - KILLER TEAM
    - UAV DESIGNATED WITH EO/LASER
    - SECOND UAV DISPENSED VIPER STRIKE
- RESULTS (29 - 30 MAR 03)

TARGET	BAT	RESULTS
- ZSU 23/4	INSTRUMENTED	KILL
- FROG	INSTRUMENTED	MISS* (124 in)
- ASTRO	WARHEAD	KILL
- NISSAN PU	WARHEAD	KILL
- FROG	WARHEAD	KILL
- T-72	WARHEAD	KILL
- NISSAN PU	WARHEAD	KILL
- BMP	WARHEAD	MISS
- SCUD	WARHEAD	KILL

*MISS ATTRIBUTED TO LASER DESIGNATION
(FIXED IN SUBSEQUENT TEST)



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Target: Astro; Viper Strike Demo 29 March 03

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Target: FROG Surrogate, Viper Strike Demo 29-30 Mar 03

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Target: FROG Surrogate Viper Strike Demo 30 March 2003

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Target: Pickup Truck with Machine Gun, Viper Strike Demo 30 March 2003

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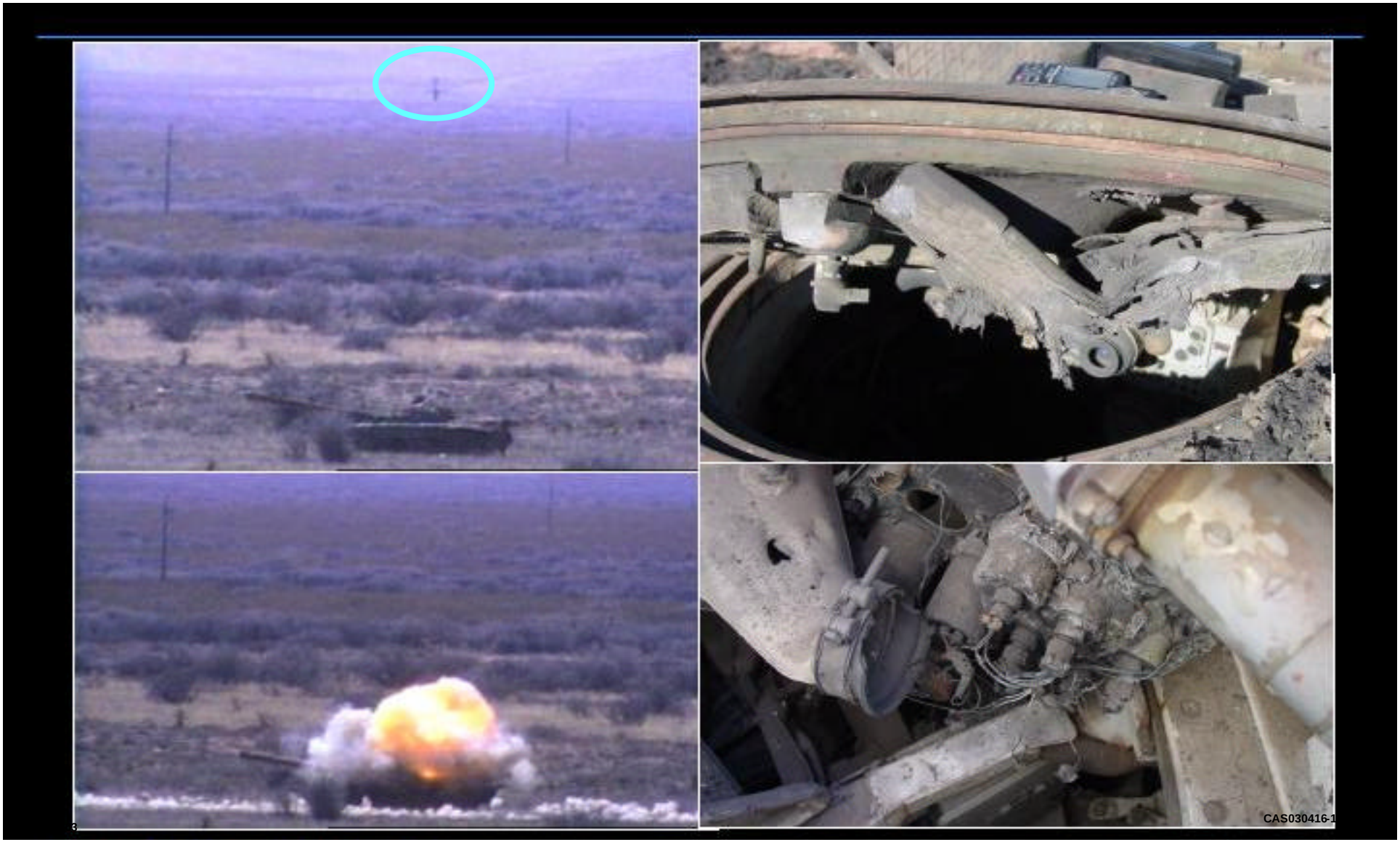
Target: T-72, Viper Strike Demo 30 March 2003



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Target: Scud Surrogate, Viper Strike Demo 30 March 03

Engagement Sequence
–GPS/Transfer Align*

1. Acquire

2. Track & ID

3. Initialize Viper Strike
- Target Position
- Release Conditions

4. Release

5. Eject Tube

6. Configure

7. Fly to Target Area
- 0-15km
- 200kts (6:1 Glide Ratio)

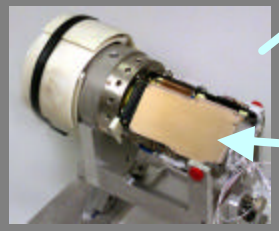
8. Terminal Search

9. Terminal Guidance

10. Target Destroyed

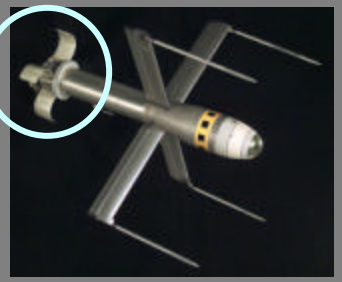
*Future Option

Rear Housing

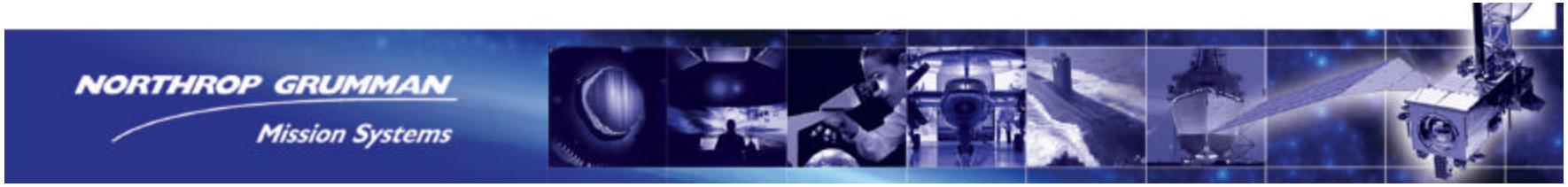


Rear Housing w/GPS

Allows Location of Target to Be Attacked to be Downloaded



SAASM GPS
- L3 Comm



Summary

- BASE BAT on a TUAV is formidable
- Viper Strike on a TUAV is silent, swift, and lethal
- Future Variants using GPS to fly to target coordinates before acquiring and attacking will be silent, swift, and lethal from a greater range.