

Ladar Technology Development at AFRL/MN



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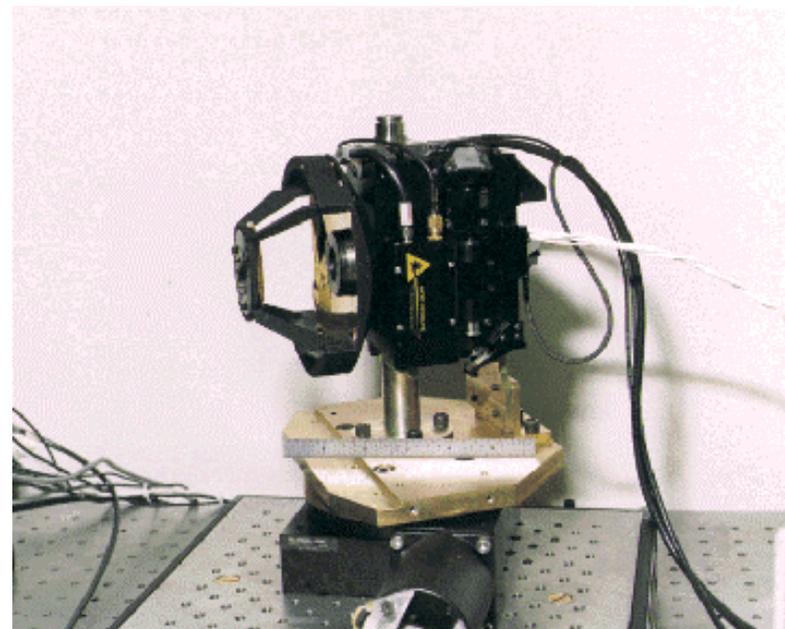
Ladar Development Motivation



- Ladar seekers produce high resolution, 3-D imagery
 - Enables robust, computer based, real-time autonomous target acquisition
 - Enables autonomous munition search and precision track guidance, including aim point selection

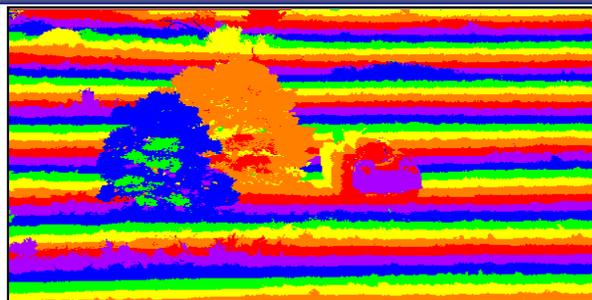


12/10/2003





Ladar Seeker Operation



Ladar Seeker



RANGE IMAGE
(round trip time)

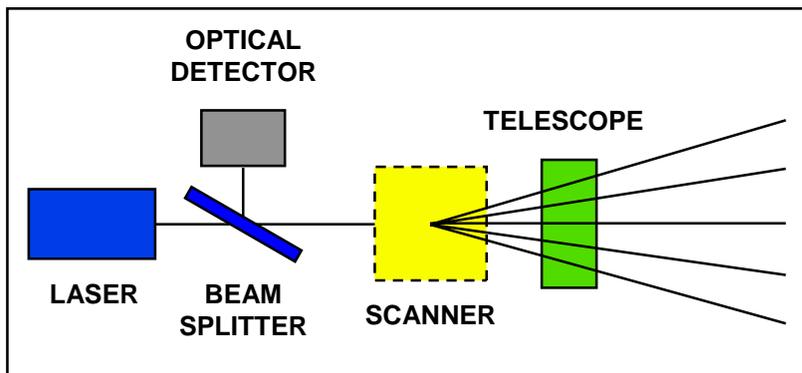
INTENSITY IMAGE
(return pulse amplitude)

Light scattered from fog, smoke, or dust

= False returns
(filter with range gate)

SLANT RANGE ~ ROUND TRIP TIME
INTENSITY ~ RETURN PULSE AMPLITUDE

LADAR DIAGRAM



In-coming light pulse

Reflected light pulse



Direct Detect LADAR

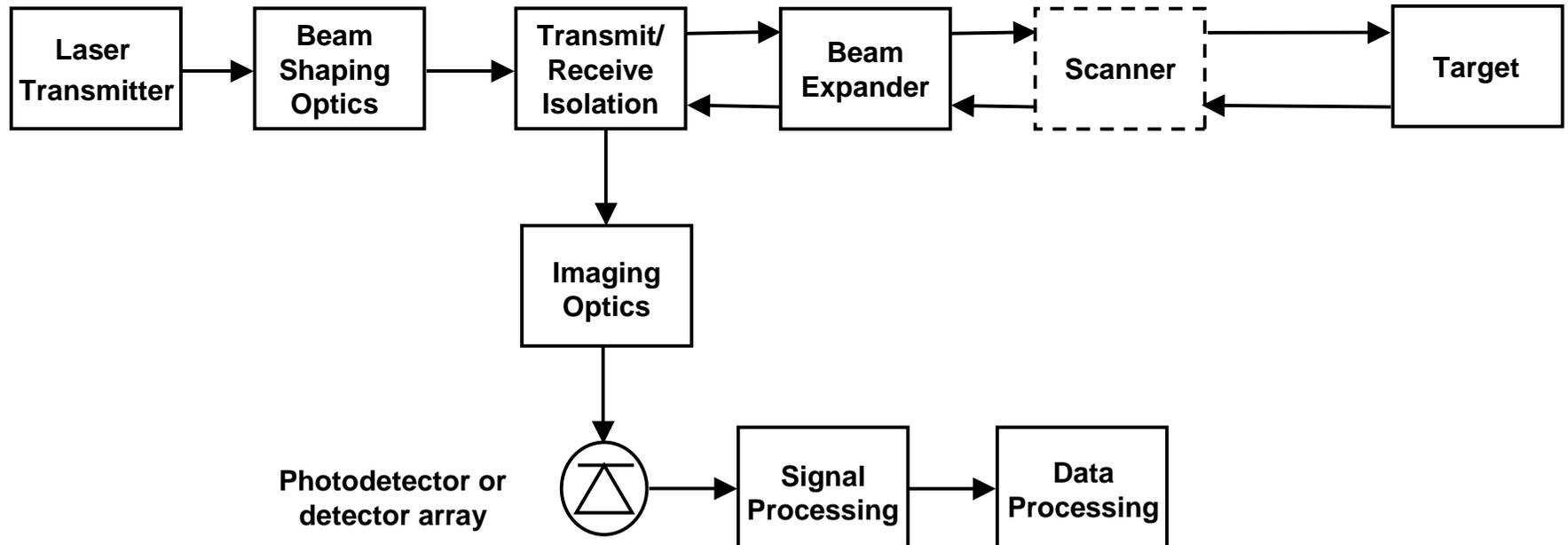


-ADVANTAGES

- High resolution 3D data.
- Simplified architecture
- Multi-discriminants (such as multiple wavelength) are possible with parallel channels.

-DISADVANTAGES

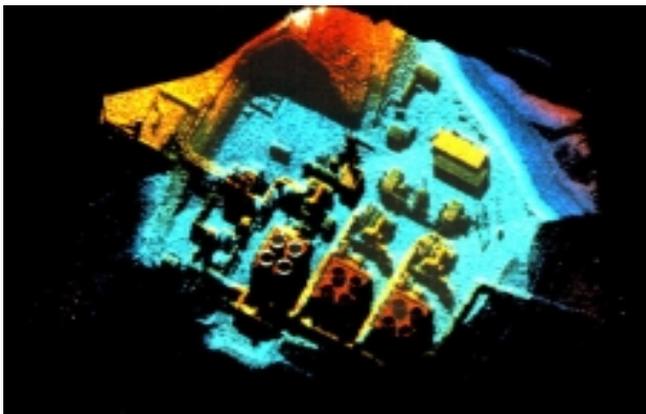
-No frequency/phase information





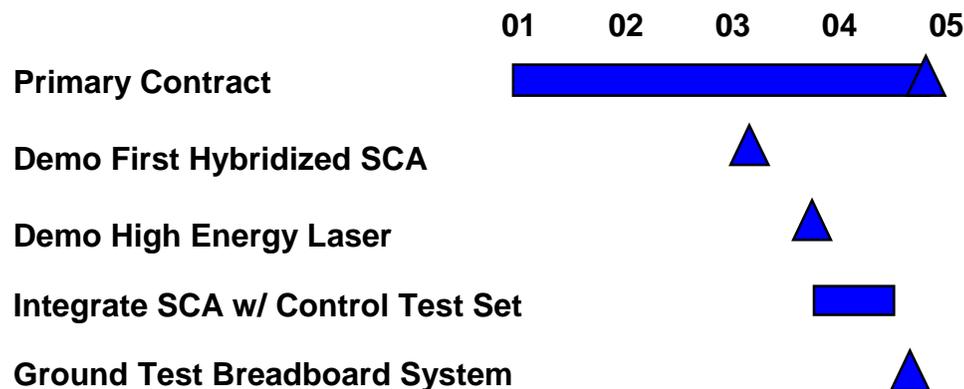
Flash LADAR Seeker Technology

AFRL/MN



LADAR Image
Height Above Ground

Technology Schedule (FY) As of 20 Aug 02



Description	Benefits to the War Fighter
<ul style="list-style-type: none"> • Focal Plane Array Laser Radar Seeker for Autonomous Precision Guided Munitions 	<ul style="list-style-type: none"> • Staring architecture will reduce seeker costs while improving seeker performance over current raster scanning systems • Cost and weight reduction realized through elimination/simplification of scan mechanism • Increased system robustness both electrically and mechanically • Increased frame rates to Warfighter through single pulse 3D range imaging
<p style="text-align: center;">Technology</p> <ul style="list-style-type: none"> • Large, solid state, focal plane array of eye-safe optical detectors • High energy, eye-safe laser transmitter • Integrated high performance pulse processing circuitry at the pixel level • Advanced ATA algorithms for parallel architectures 	



Focal Plane Sensor Chip Assembly



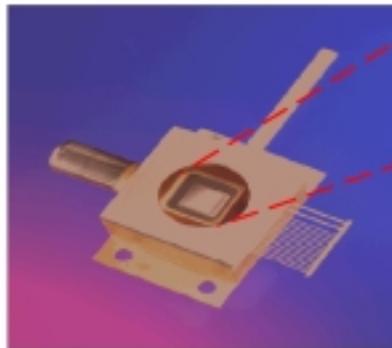
- **Sensor Chip Assembly composed of detector array and ROIC**

256x256 HgCdTe APD Array

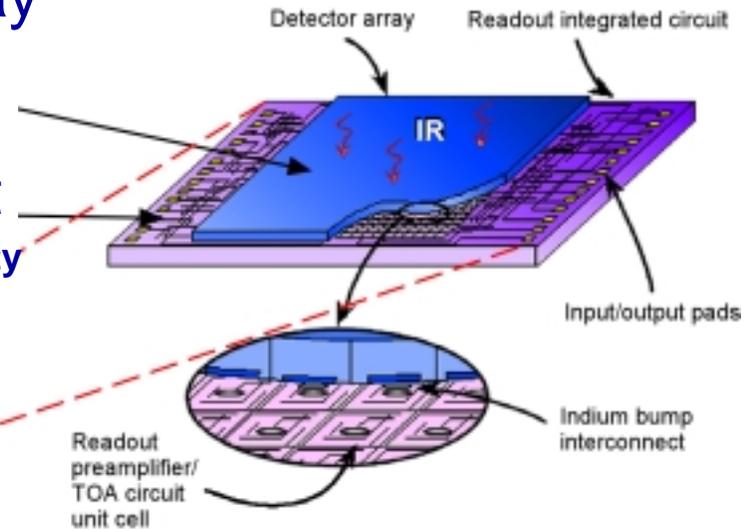
-Detectors have gain of 5-10

Readout Integrated Circuit

- Provides 2 range reports and first intensity

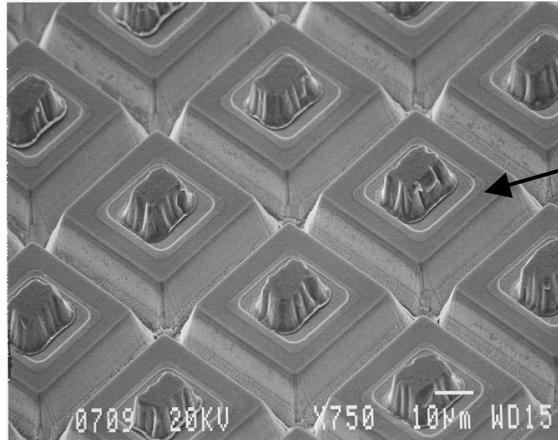


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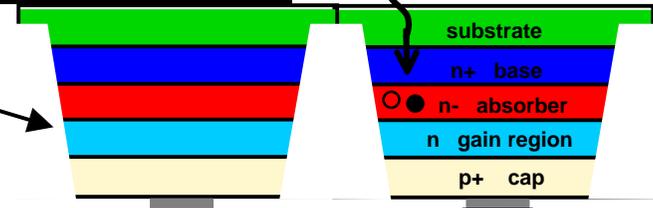


Sensor Chip Assembly



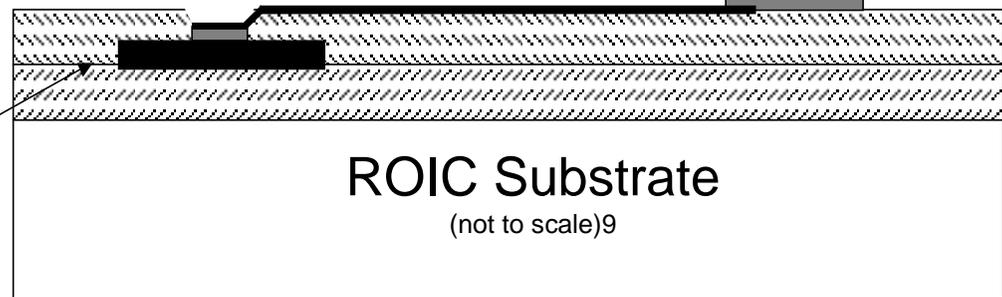
4 or 5-Layer Engineered Thin Base SAM APD

Detector



Indium Bump

ROIC Input Pad





Targeted Munition Concepts

Small Direct Attack

- Fixed high value targets
- Future moving target capability



Wide Area Search and Attack

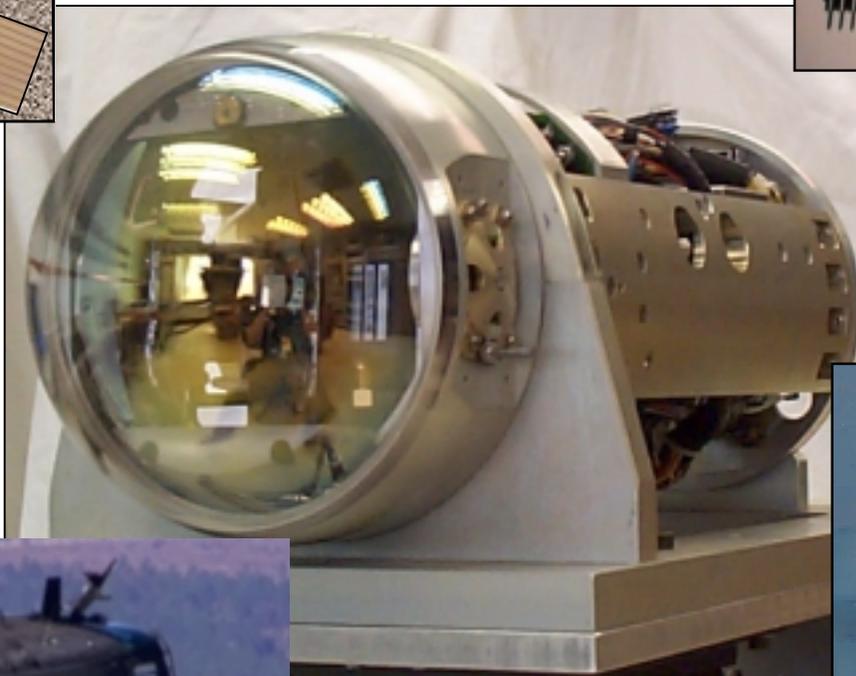
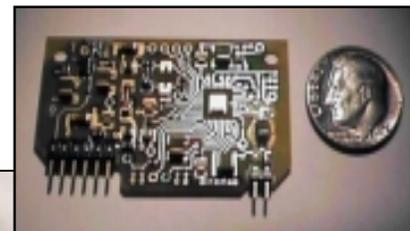
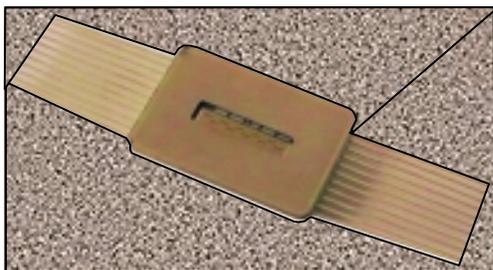
- Loitering munition
- Critical mobile targets





Approved for Public Release

Demonstration of Advanced Solid State LADAR (DASSL)





Demonstration of Advanced Solid State LADAR (DASSL)



- **Navy exploring putting LADAR on cruise missile**
- **Part of joint Air Force and Navy Next Generation LADAR (NGL) 1996 MOA**
- **DASSL technology will give cruise missile in-flight retargeting capability by adding high resolution search, acquisition, and track modes**
- **DASSL developed as joint, four-phased, advanced development and demonstration (6.3A) program**
- **AF DASSL seeker currently on loan in support of Netfires program**



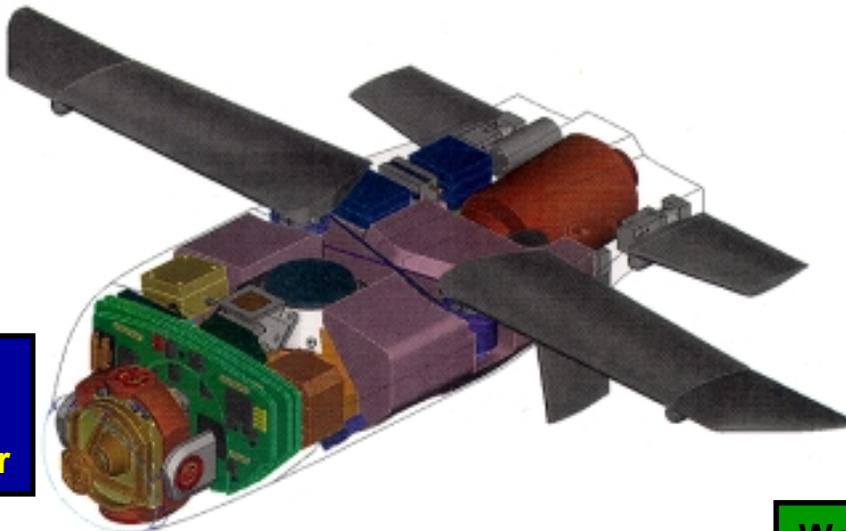
PLOCAAS Description

Suite of Technologies



Solid State LADAR Seeker

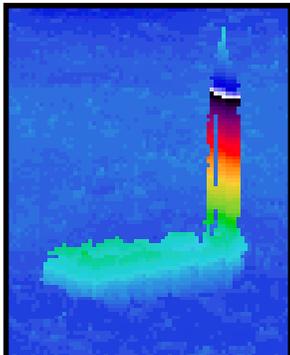
- Large Field of Regard
- 4th Generation LADAR Seeker



Miniature Turbojet

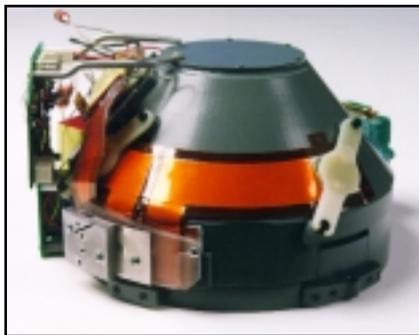
- Standoff Range
- Large Search Area

Weight 85-95 lbs



ATA Algorithms

- Model Matching
- Select Warhead Mode



Multi-mode Warhead

- Optimized Lethality
- Minimize Collateral Damage

INS/GPS

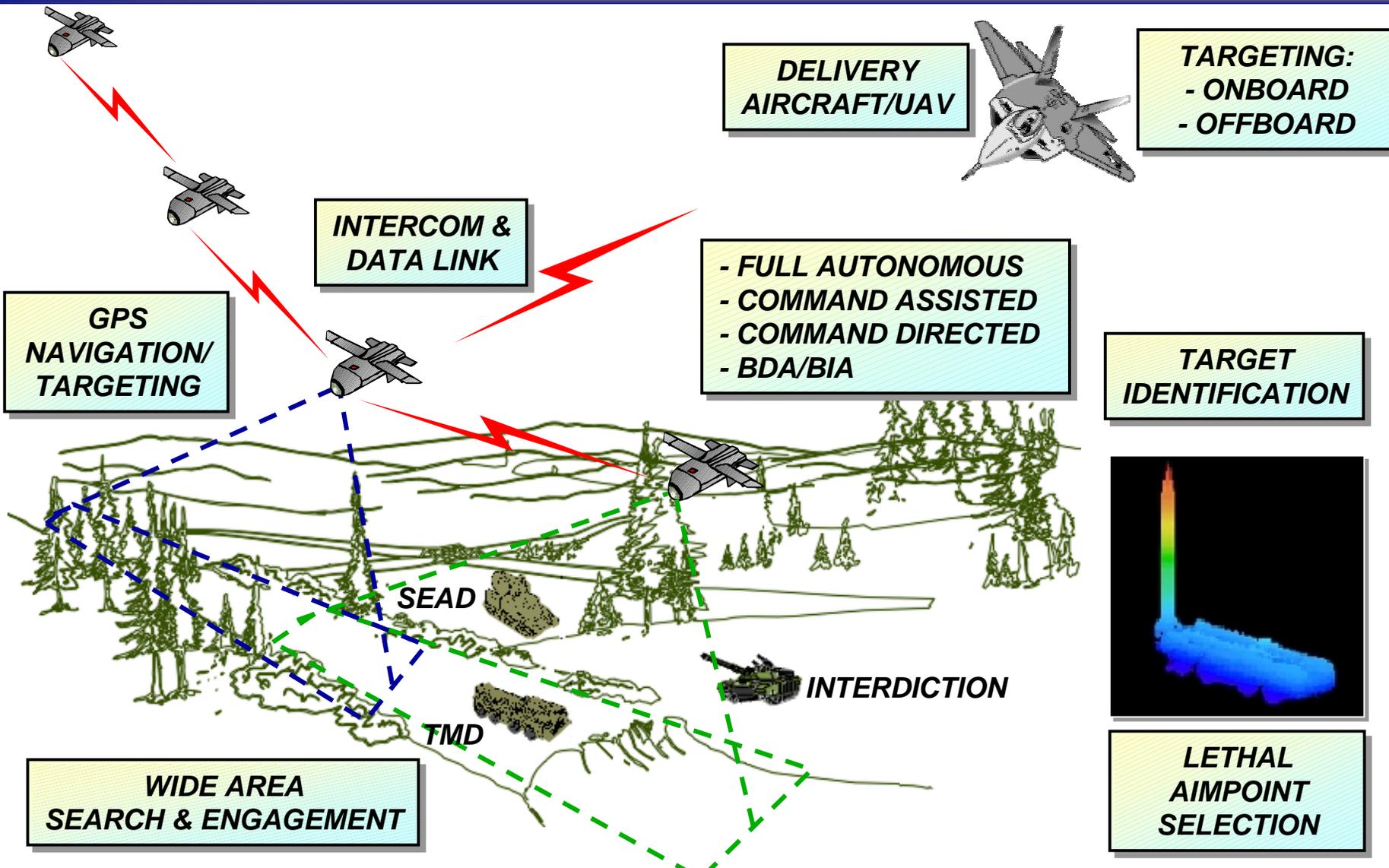
- Midcourse Guidance
- Flexible Search Pattern



Notional CONOPS



With Weapon Intercom & Data Link



**DELIVERY
AIRCRAFT/UAV**

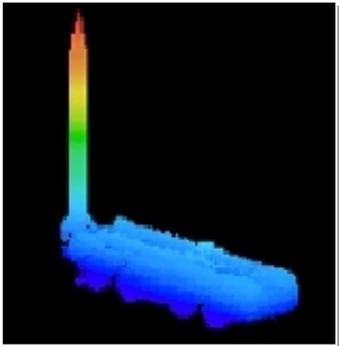
TARGETING:
- ONBOARD
- OFFBOARD

**INTERCOM &
DATA LINK**

- FULL AUTONOMOUS
- COMMAND ASSISTED
- COMMAND DIRECTED
- BDA/BIA

**GPS
NAVIGATION/
TARGETING**

**TARGET
IDENTIFICATION**

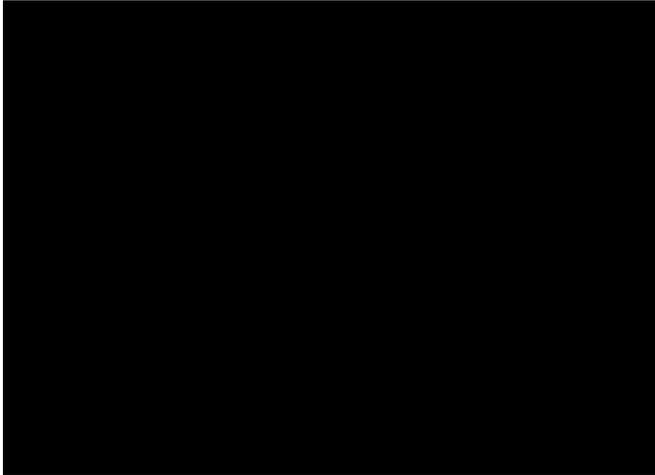


**LETHAL
AIMPOINT
SELECTION**

**WIDE AREA
SEARCH & ENGAGEMENT**



LOCAAS Flight Test



No Picture

LOCAAS_WTV.MPG