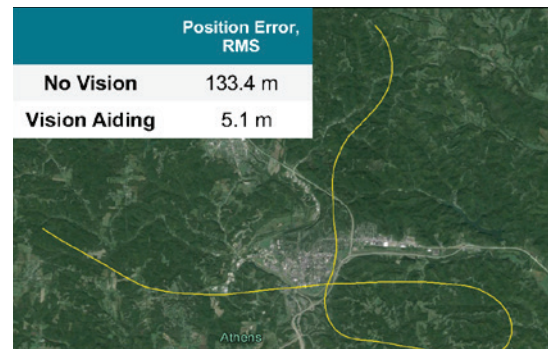# ASSURED DATA ENGINE FOR POSITIONING AND TIMING (ADEPT)
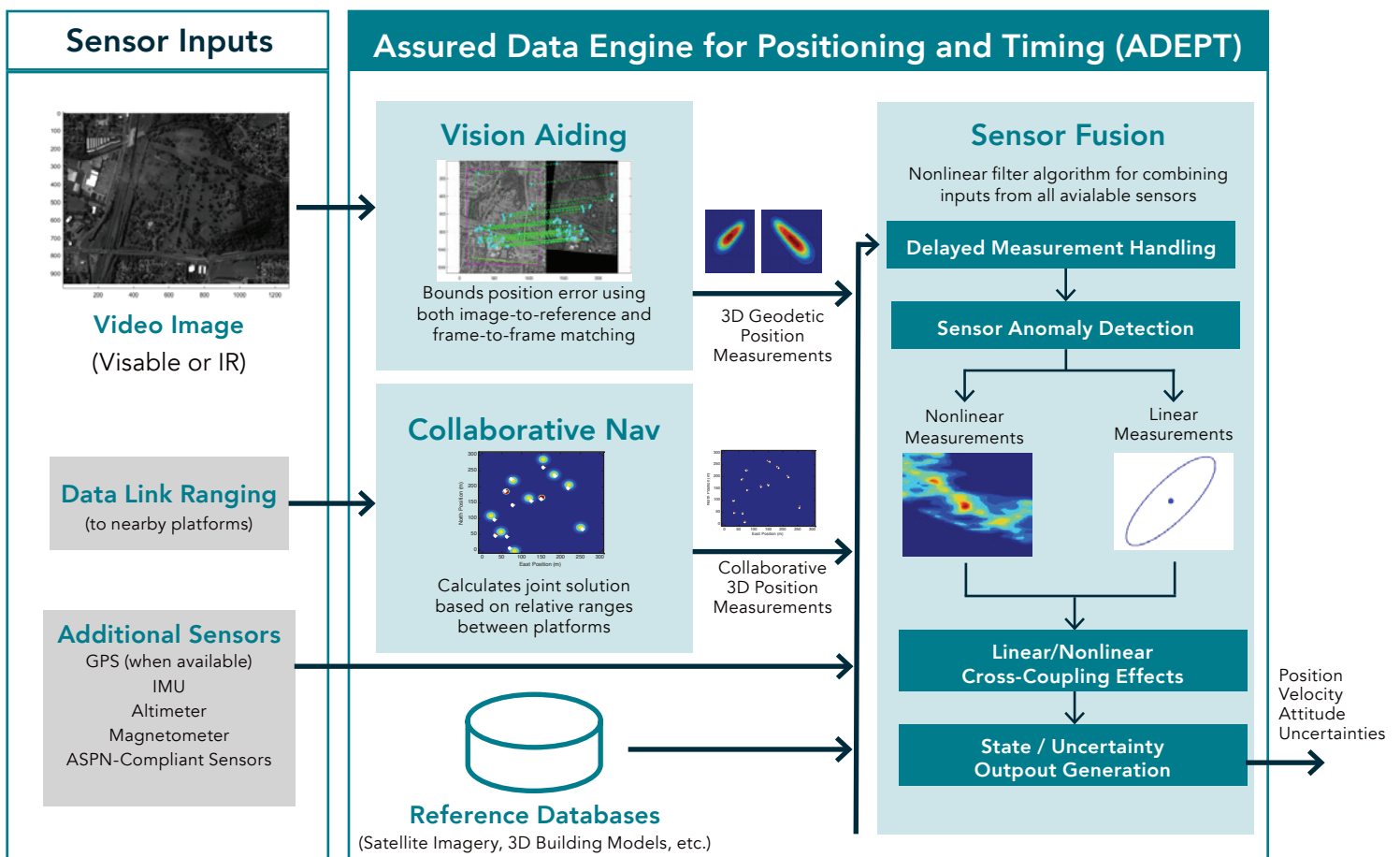
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MULTI-PLATFORM ASSURED NAVIGATION FOR ALL ENVIRONMENTS

▶ Leverages software developed under multiple DARPA projects

▶ Functions with or without access to GPS

▶ Uses onboard or low SWAP-C sensors and processors

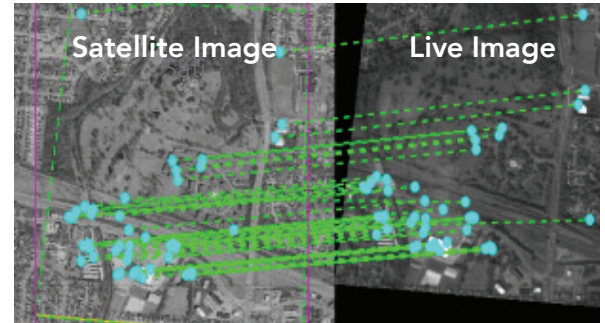▶ Leverages latest reference databases including 3-D terrain and build models

	Position Error, RMS
No Vision	133.4 m
Vision Aiding	5.1 m

Imaging sensor on DC3:
Long-Wave IR camera (320 x 420 with 24° FOV)

Sensor Inputs

Video Image
(Visable or IR)

Data Link Ranging
(to nearby platforms)

Additional Sensors
GPS (when available)
IMU
Altimeter
Magnetometer
ASPN-Compliant Sensors

Reference Databases
(Satellite Imagery, 3D Building Models, etc.)

Assured Data Engine for Positioning and Timing (ADEPT)

Vision Aiding

Bounds position error using both image-to-reference and frame-to-frame matching

3D Geodetic Position Measurements

Collaborative Nav

Calculates joint solution based on relative ranges between platforms

Collaborative 3D Position Measurements

Sensor Fusion

Nonlinear filter algorithm for combining inputs from all avialable sensors

Delayed Measurement Handling

Sensor Anomaly Detection

Nonlinear Measurements

Linear Measurements

Linear/Nonlinear Cross-Coupling Effects

State / Uncertainty Outpout Generation

Position
Velocity
Attitude
Uncertainties

ADEPT AIRBORNE NAVIGATION

▶ Vision-Based Navigation (VBN) demonstrated navigation errors < 10 m (1-σ) for multiple long duration flights without GPS

- › IR Sensor Inputs → Full Day / Night Capability
- › Wide Area Search → Water Overflight Recovery
- › NVIDIA Tegra Execution → Low SWAP Processing

▶ Currently being integrated into Army Gray Eagle and Shadow UAVs

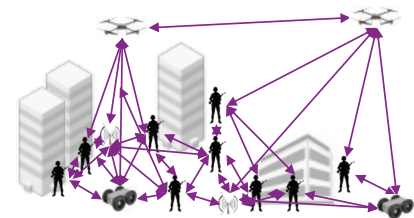Precision Aerial Feature Matching

ADEPT MOUNTED NAVIGATION

▶ Demonstrated <10 m (1-σ) for multiple drive tests at Aberdeen Proving Grounds

- › Visual Aiding
    - › Visual Odometry → bounds inertial drift
    - › Loop Closure → detects revisited locations
- › Collaborative Navigation
    - › Ranging radios → enables joint filter solution
- › Sensor Fusion
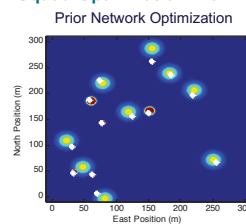   - › ASPN filter → blends all available sensors

Navigation Error (1-σ) = 7.29 meters
0.02 % of Distance Traveled
Distance Traveled = 63.65 kilometers

ADEPT DISMOUNTED NAVIGATION

▶ Demonstrated <10 m GPS-denied navigation for team of dismounted soldiers

- › Augmented by squad UAV and UGV
- › Ranging radios from mesh network
- › Real-time nonlinear joint solution optimization

▶ Rigorously Tested in the Field

- › ≥1,500 km of dismount data collected to date

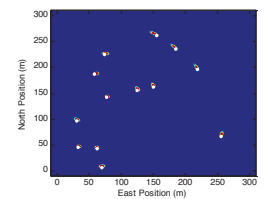## FOR MORE INFORMATION

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Squad Optimization with Ranges
Prior Network Optimization

Post Network Optimization

Max Error: 25 m
Mean Error: 9.5 m

Max Error: 5.4 m
Mean Error: 3.0 m

White dots indicate true position.

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COMMERCIAL PRICING CATALOG FOR NAVIGATION SOFTWARE PRODUCTS

ADEPT Vision Based Navigation (VBN) Interface Software for Airborne Platforms (P/N VBNI01)*

Quantity	Discount	Price
1-74	-	Call for pricing
75-199	Call for pricing	Call for pricing
200+	Call for pricing	Call for pricing

*Each license includes a tailored version of the ADEPT/VBN software engine (P/N VBNA01), plus an installation and operations manual (P/N VBND01).

ADEPT Interface Software for Ground Vehicles

License Prices: Coming soon.

ADEPT Interface Software for Dismounts

License Prices: Coming soon.

Terms and Conditions		
License Term	Term of License Validity	Perpetual
Annual Maintenance Agreement	Per-license subscription for software updates, modifications, and technical support.	Not currently available
Technical Support	Additional tecnical support, software customization, feature addition, software modifications and updgrades.	Available via seperate T&M contract. Contact for details.

FOR MORE INFORMATION

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