NRL's FINDER UAV: A Counterproliferation Asset

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Introduction: NRL's significant technological advances and breakthroughs made in the areas of low Reynolds number (LRN) aerodynamics, in-flight deployability, advanced composite structures, and microdigital electronics applied to unmanned air vehicles (UAVs) has enabled rapid prototyping and testing of unique autonomous vehicles. The Flight Inserted Detector Expendable for Reconnaissance (FINDER) UAV is an example of the integration of these capabilities in action. The vehicle potentially adds a highly capable, small, affordably expendable asset to the military or homeland defense inventory. This article highlights it's capabilities, development timeline, and overall significance.

During the FINDER effort, the goal was to produce a warfighting component within the Chemical Combat Assessment System (CCAS) segment of an Advanced Concept Technology Demonstration (ACTD). A number of field tests (most notably at: Edwards Air Force Base, Indian Springs Air Force Base, and the Nevada Test Site) were used to prove the system's potential value as a reconnaissance tool. FINDER was developed as a multi-use low-cost UAV. The vehicle can readily be modified to accept a number of different payloads. These can range from real-time Battle Damage Assessment (BDA) via optical imaging and acoustic sensing, to active determination of the presence of hazardous chemical/biological agents. In this case, FINDER was integrated with a U.S. Army-developed payload to determine the presence and concentrations of chemical agents within a Weapons of Mass Destruction (WMD) facility. Figure 1 illustrates the CCAS system architecture.

Program Overview: The FINDER mini-UAVs are carried into the target area attached to the wing hard points on a Predator UAV. Each FINDER contains point chemical sensors and an integrated sample collector. The mini-UAVs are dispensed from the Predator and descend to intercept and interrogate a suspect post-strike plume. This allows the Predator to stay at higher altitudes, enhancing its survivability and its ability to avoid contamination. NRL tailoring of a microprocessor-based autonomous navigation and flight control system, long-range communications, a propulsion system, and a unique deployment methodology were critical in allowing FINDER and its payload to achieve numerous successes within the CCAS development.

Figure 2 shows FINDER's integration on the Predator and a deployment. Key CCAS sensor information is collected onboard the Predator and distributed to the warfighter in near-real-time, using existing Predator and theater communications infrastructure.

The FINDER project was initiated in June 1999. Full development of the vehicle structure and fabrication of prototype units was completed at NRL. Advanced autopilot development, communications, and autonomous flight testing of the prototypes began in August 2000. The full CCAS system was targeted for a military utility demonstration as a participant in the Counterproliferation 2 ACTD in May 2003.

FINDER has participated in multiple field exercises over an 18-month period. The system was tested and evaluated in six highly visible field exercises during fiscal year 2003. These exercises were designed to prove the feasibility of the FINDER concept of operations. Reports by the Air Force's Technical Assessment Team (AFOTECH) have documented the successes of those exercises. AFOTECH has acknowledged the CCAS system and FINDER's potential operational capability. Its positive reports have provided the impetus for the Defense Threat Reduction Agency (DTRA) to purchase residual units in 2004 for warfighter use. DTRA and the Office of the Secretary of Defense (OSD) have hailed the development and testing of the Chemical Combat Assessment (CCAS) system and the FINDER component as a major accomplishment toward providing a capability to detect and track chemical agents in real time.

During the development period, more than 20 units were manufactured, integrated, and tested by NRL. Under Predator GCS control, the FINDER has completed 18 nominal deployments from the Predator pylon at altitudes up to 20,000 ft. Additionally, the FINDER's capability to be controlled by line-of-site (LOS) and via satellite communications (SATCOM) has been demonstrated in flight testing. FINDER has validated an endurance capability of 7 hours and has demonstrated the potential to fill an operational capability gap. Accordingly, NRL has been tasked to deliver and support a number of units to DTRA on behalf of the U.S. Air Force for the immediate future.

Significance: FINDER supports European Command requirements for a chemical BDA tool. The FINDER air vehicle and payload provides real-time local area meteorological data, Predator stand-off BDA capability, critical sample collection, return of sample to a safe area, and extended range operations.

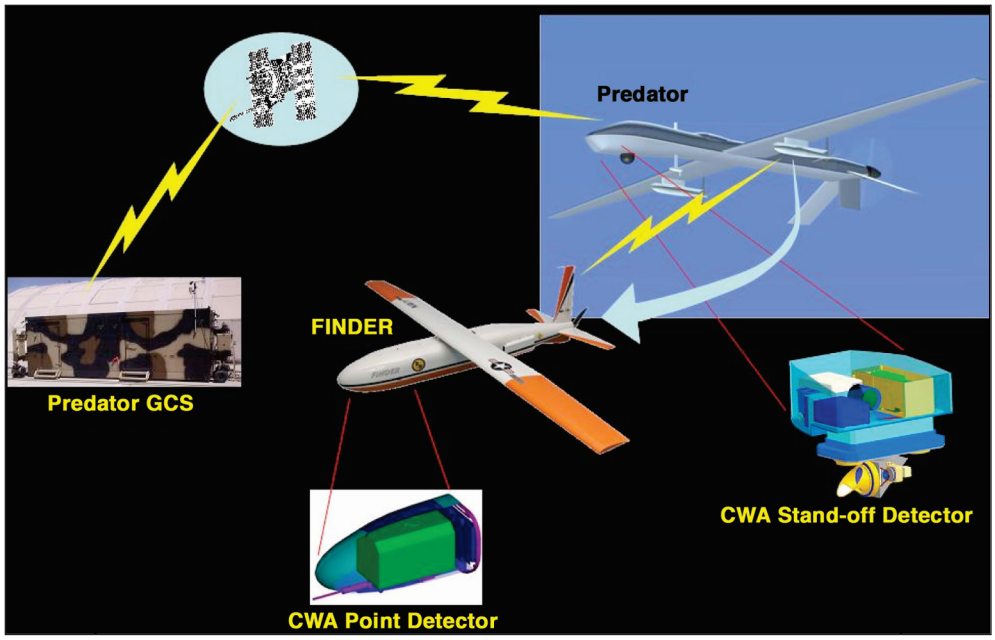

FIGURE 1
Chemical Combat Assessment Systems (CCAS) overview.

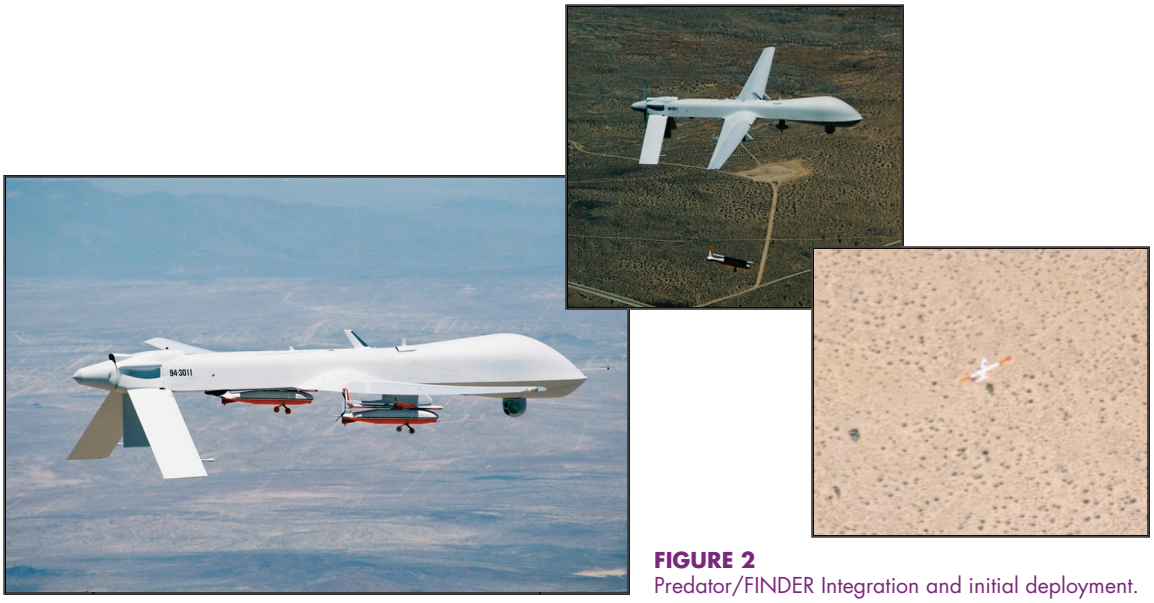

FIGURE 2
Predator/FINDER Integration and initial deployment.

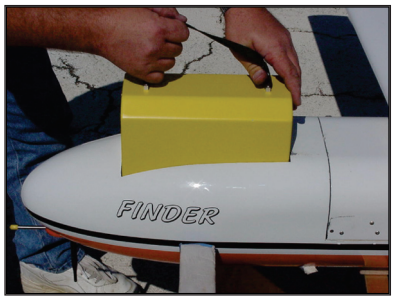

FIGURE 3
FINDER growth options: alternative deployment methods and payload modularity.

As vehicle systems and payload technologies evolve, FINDER possesses the flexibility to accept a wide variety of modular payloads and deployment options. Figure 3 shows a demonstrated deployment alternative that was an outgrowth of the CCAS-specific vehicle development. Future growth capabilities are already being discussed for implementation as follow-on options. They include: close-in targeting support capability, toxic chemical/precursors sensing, biological detection capability, Navy sea-basing options, and radiological hazard sensing.

[Sponsored by OSD and DTRA]