Deployable Unmanned Systems for Targeting, Exploitation, and Reconnaissance (DUSTER)

D.C. Linne von Berg, J.G. Howard, M.R. Kruer, and J.N. Lee
Optical Sciences Division

Introduction: The Deployable Unmanned Systems For Targeting, Exploitation, and Reconnaissance (DUSTER) program is developing and demonstrating networked ground and airborne command, control, exploitation, and dissemination systems for use with simultaneous, multiple, dissimilar, tactical unmanned aerial vehicles (UAVs). The initial four key goals of this program include (1) demonstration of simultaneous multiple dissimilar UAV screening and control from ground and airborne control and display stations (CADS); (2) development of modular reusable digital avionics and payloads for small tactical UAV systems; (3) demonstration of joint manned/unmanned control station operation; and (4) demonstration of real-time netcentric dissemination and relay of intelligence, surveillance, reconnaissance, and targeting (ISRT) information. The purpose of this effort is to develop and demonstrate technologies that will enhance the military's ability to deploy, control, exploit, fuse, and disseminate sensor data from various manned and unmanned systems directly to the forward-deployed forces that need the real-time ISRT information.

The "Mother-ship" Concept: The goal of the initial phase of the DUSTER program is to demonstrate the "mother-ship" concept of using a single CADS system for the control, exploitation, and dissemination of information from both onboard manned sensors and multiple remote UAVs simultaneously. The sensor systems incorporated into the control and display stations include visible and midwave infrared (EO/MWIR) panchromatic sensors and visible through short wave infrared (VNIR-SWIR) hyperspectral (HSI) sensors of various types (including step-stare, push-broom, whisk-broom, and video). The data received by CADS from the onboard or extended airborne UAVs can be relayed directly to the ground, disseminated to an airborne relay aircraft, or exploited onboard the mother-ship platform to provide real-time tracking and targeting of hard-to-find and mobile targets. Demonstrated exploitation capabilities include real-time screening, construction of a geo-referenced mosaic image, change detection, stereo imaging, moving target tracking, and networked dissemination to distributed exploitation nodes (man-pack, ground vehicle, and command centers). Use of the mother-ship control station concept allows for more rapid exploitation and greater dissemination range from individual UAVs to a given ground station or command center than was previously achievable. Additional relay capabilities, such as sending data via satellite communication are also included. As Fig. 7 shows the simultaneous control of multiple onboard and UAV-based sensor from the common control station allows controllers and imagery exploiters to retask, exploit, and disseminate data and intelligence information from each sensor in real time while remaining at a safe stand-off distance.

Initial System Implementation and Real-time Flight Demonstrations: The DUSTER program is leveraging and improving existing Navy UAVs, sensors, avionics, and data-link technologies and is developing a single CADS system that can be hosted on airborne, shipboard, and mobile ground platforms for use with both manned and unmanned sensor systems. Existing ground-launched tactical UAVs (e.g., Dragon Eye/ATR, Finder, TERN, etc.) are used and the UAV-provided intelligence, surveillance, reconnaissance, and targeting information is exploited and disseminated from the CADS systems over various integrated communication links. The initial configuration of the DUSTER system was demonstrated during simultaneous, multiple UAV flights at Aberdeen Proving Ground (Maryland) in June 2004 (using Finder and ATR UAVs) and August 2004 (using TERN and ATR UAVs). A final Phase I demonstration was performed in September 2004 in Montana. For this demonstration, the Montana National Guard deployed military targets and the ATR and TERN UAV systems transmitted persistent surveillance imagery in real time to the NRL-developed Chevrolet Suburban-based and man-pack CADS units (Fig. 8). The exploited data were subsequently transmitted over wireless networks and satellite communication channels to networked, distributed ground stations and command centers. Figure 9 shows the video imagery window, real-time video imagery mosaicing, and situational awareness screen provided by CADS. These screens indicate the instantaneous field of view of the sensors, the total imagery history of the flights, and the actual location of the UAVs in flight overlaid on DoD imagery and mapping databases.

Summary and Acknowledgments: The initial flight demonstrations of the DUSTER program have

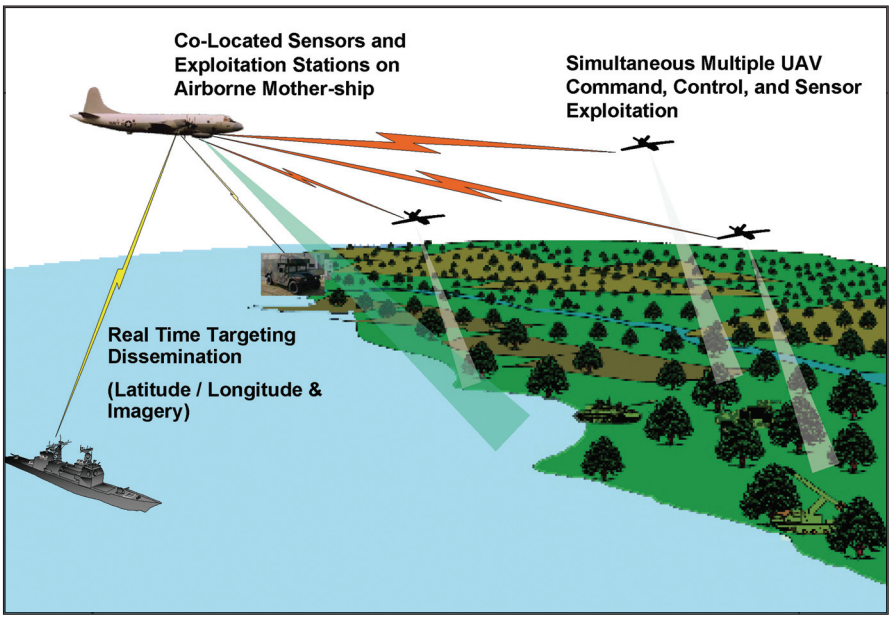

FIGURE 7
Mother-ship concept: simultaneous control of multiple onboard and UAV-based sensors from the common control station.

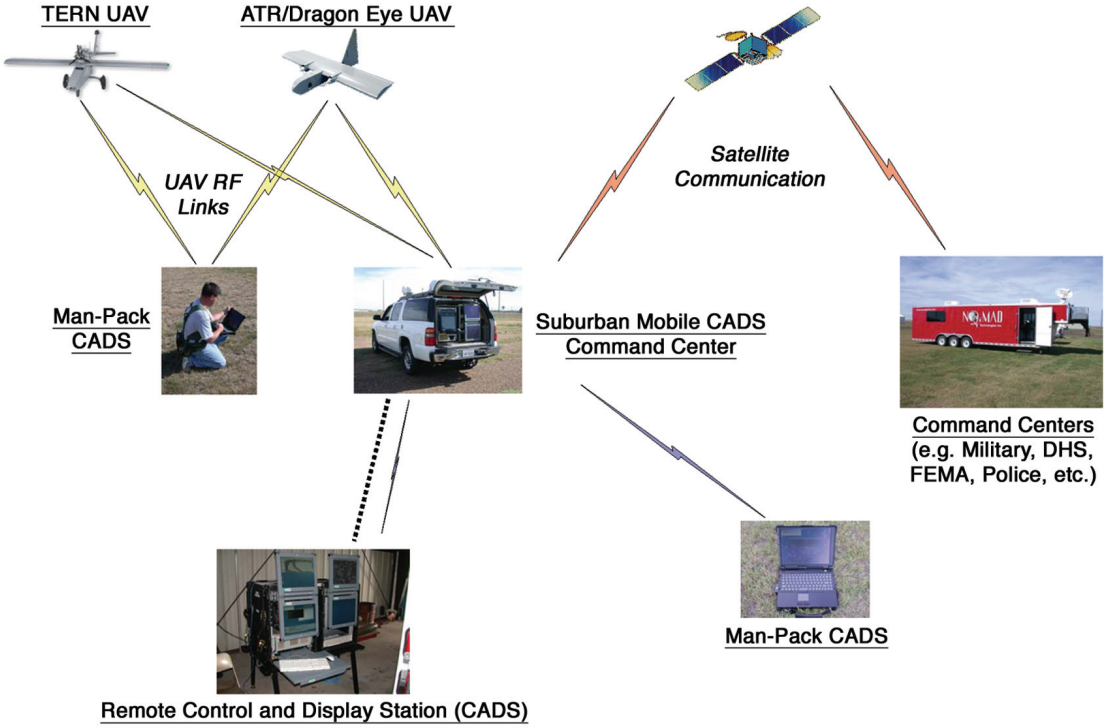

FIGURE 8
DUSTER September 2004 Montana flight demonstration.

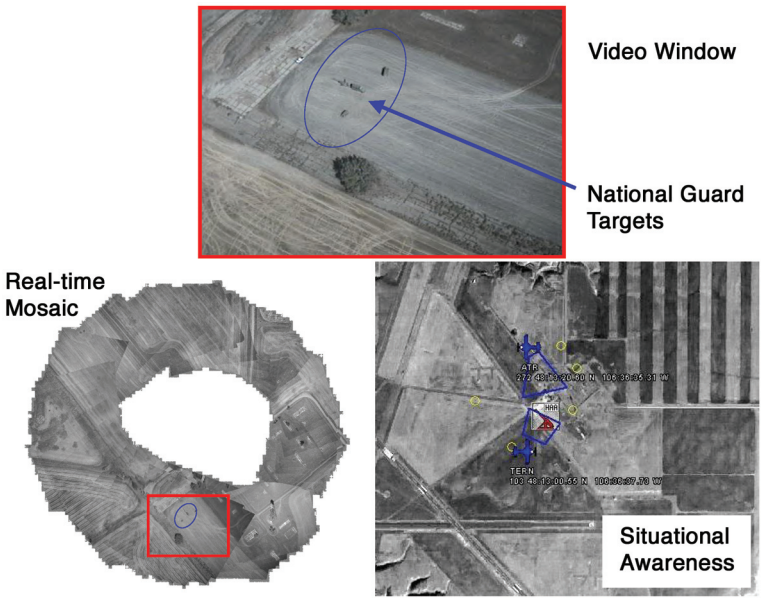

FIGURE 9
CADS video, mosaicing, and situational awareness screens.

shown great promise for the mother-ship concept of controlling, exploiting, and disseminating simultaneous, multiple, dissimilar UAVs and ISRT information from a common control and display station. Significant support for the DUSTER system development and demonstrations was provided by NRL Codes 5700 (Finder, TERN UAVs), 6100 (Dragon Eye/ATR UAV), 8100 (Suburban System Integration), and the Space Dynamics Laboratory (CADS upgrades). Future DUSTER program plans include development of airborne-launched UAVs coupled with an integrated CADS system on the NRL P-3 and potentially other aircraft.

[Sponsored by ONR]