ARIES: One Solution in Rapid Response

by George Gorman and Terry Busch

On November 17, 2004, EarthData led a team that successfully demonstrated the preprototype of its new airborne rapid imaging for emergency response (ARIES) mapping system. Held at Picatinny Arsenal, New Jersey, the demonstration proved that ARIES could collect color digital imagery, lidar terrain profiles, and thermal data; download the data from the aircraft to a transportable ground processing center using a direct wireless downlink; process the data into usable map products within three hours of receiving the data; and disseminate the data through a wireless internet connection to users in the field. The demonstration is a major step forward in getting high quality geospatial products into the hands of responders and emergency response coordinators when they need it most, during crises.

ARIES Components

At Picatinny, team members EarthData, Raytheon-Solipsys, and Trex Enterprises simulated a full-scale mission to confirm the capabilities of ARIES's five components:

1. The **airborne component**, which includes the aircraft, sensors, onboard data recorders, positional data equipment, and gimbaled downlink antenna system, successfully collected data over the entire arsenal. (approximately 15 square miles). ARIES was able to collect the digital imagery, lidar, and thermal data simultaneously in a little under one hour, from the target altitude of 6,500 feet .

2. The **datalink component** consists of an ultra-high-speed millimeter-wavelength wireless air-to-ground communications link between the aircraft and ARIES's ground component, plus a tracking capability that maintains the integrity of the air-to-ground link for the required downlink periods. Immediately after Picatinny data acquisition, the datalink component automatically located the orbiting aircraft and established a 1.2 gigabit-per-second link to transfer more than 5 gigabytes of collected imagery directly into the ground station's central storage system.

3. The **ground component**, a transportable data-production and communications center, is designed in an all-terrain configuration that is self-contained with power and environmental control, large-screen displays, multiple data sources for situational awareness, and mission planning capabilities to support ARIES. The ground component houses the state-of-the-art production unit used to process a variety of remotely-sensed data quickly and efficiently using commercial off-the-shelf (COTS) hardware and software.

4. Data production occurs in the **storage and exploitation component**, which consists of rack-mounted workstations with the capability to process uncorrected imagery rapidly and efficiently into precise and accurate products accessible to a response community with unknown geospatial capabilities. A system of redundant hardware and off-the-shelf software technology ensures ARIES's ability to integrate effectively with existing geospatial technologies. During the demonstration, this facility processed the lidar data within 1.5 hours, generating a 2.5 meter digital elevation model that was used to produce an orthorectified mosaic with a 50-centimeter ground sampling distance within an additional 45 minutes. Concurrently, the thermal data was processed to overlay the lidar data and digital imagery. Within the demonstration's goal of 3 hours, products were ready for wireless dissemination to personnel in the field.

5. The **dissemination component** provides two-way, real-time wireless communications capabilities, placing geospatial products into the hands of responders and providing interoperability with federal gateways such as the Geospatial One-Stop and federal, regional and state systems. This component enables responders to work from comprehensive field collected data, response information, and situational awareness data integrated with imagery. The ARIES demonstration at Picatinny proved this capability as data was disseminated by internet, wireless broadcast, and both hardcopy and softcopy maps as soon as it rolled out of production.

Initial ARIES development and the demonstration at Picatinny were funded by a grant from the U.S. Department of Homeland Security Office for Domestic Preparedness as the first of four planned phases in a development and implementation program. As funding becomes available, phases 2 through 4 will develop a full system prototype, field ARIES systems to permanent sites nationwide, and implement procedures to ensure readiness for national emergencies well into the future.

The ARIES Solution

ARIES was born out of the ashes of the September 11 World Trade Center disaster, where EarthData collected, processed, and produced digital orthophotography matched with lidar and thermal data to provide vital geospatial products to rescue and recovery workers within 10 hours of data collection. Yet workers needed information faster than even leading-edge technology provided; firefighters resorted to using whiteboards to map real-time conditions in the rubble. The need for a system, like ARIES, designed to speed deployment and data collection, production, and dissemination and to support real-time communications was blatant. Responders risk their lives to help others; now, ARIES promises to help reduce their risk and speed their response.

Learn more about the ARIES system and its impact on emergency response operations in the April 2005 issue of *PE&RS*.

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