B. Ames Research Center (ARC)

ARC operates or oversees the operation of a variety of UAS for Earth science missions, flight controls research, and technology demonstration. Range Safety played a role in these missions.

1. Bat-4 UAS mission to Sugarloaf Shores, FL (May 13-24, 2012)

The Bat-4 is a 100-pound class UAS with a 13-foot wingspan (Figure 13). During the mission to Sugarloaf Shores, Bat-4 carried an imaging system over sea grass and coral to evaluate the effects of climate change on near shore environments. Ames provided the Designated Range Safety Officers (DRSOs) to ensure deconfliction of the UAS and manned aircraft traffic. The DRSOs were prepositioned and daisy-chained so that a pair of eyes was on the UAS at all times during its transit from Sugarloaf Shores airport to the data collection area and back.

FIGURE 13: BAT-4 UAS

The Bat-4 carried an altitude encoding transponder with a unique squawk code assigned by Key West Approach. Approach was very helpful in providing advisories to manned aircraft traffic and warning our range safety personnel when an uncooperative (non-communicating) aircraft was in the area.

Due to frequent skydiving activity out of Sugarloaf Shores airport, close coordination and communication with the skydiving operator was required during launch and recovery of the Bat-4. Sometimes a very small window of just a few minutes was available to get the Bat-4 clear of the drop zone or back on the ground. For this mission, a total of six imaging flights were conducted.

2. Sensor Integrated Environmental Remote Research Aircraft (SIERRA) UAS mission to Surprise Valley, CA (31 Aug – 7 Sep, 2012)

SIERRA is a 400-pound class UAS with a wingspan of 20 feet (Figure 14). It can carry up to 100-pound payloads with a range of 550 nautical miles (nm) at a 55-knot cruise speed. The payload on the mission shown in Figure 14 consisted of two magnetometers used to map the magnetic field in a seismically active valley near the Oregon border.

FIGURE 14: SIERRA ON THE AMES RESEARCH CENTER RAMP

The 50 nm length of the valley made the use of ground-based observers

impractical, so a Cessna 172SP chase aircraft with a pilot and dedicated observer was used to satisfy the see-and-avoid requirement. The chase aircraft was stationed at a different airport (Alturas), where aviation fuel was available. The flight operation was coordinated so the chase aircraft would arrive overhead as the SIERRA was flying the local pattern at Cedarville Airport in Surprise Valley (Figure 15). The ground control station and chase crews made periodic radio calls on the airport Unicom frequency to advise any manned aircraft of the UAS operation.

FIGURE 15: SIERRA ON THE RAMP AT CEDARVILLE AIRPORT IN SURPRISE VALLEY, CA

The faster flight speed of the Cessna created some challenges for the chase pilot. It was necessary to fly a zigzag course to avoid overtaking the slower SIERRA. The SIERRA flights lasted up to four hours, which also taxed the endurance of the chase crew. A total of five flights were conducted.

3. SIERRA UAS mission to Key West, FL (Oct 11-23, 2012)

For the mission to Key West, FL (Figure 16), a hyperspectral imager was installed in the SIERRA nose section, and data was collected over the same sea grass and coral areas that Bat-4 had flown over earlier in the year. The SIERRA was hangared at Key West Naval Air Station (KWNAS), and the deployment benefitted from the excellent infrastructure and support of the Navy.

FIGURE 16: SIERRA ON THE KEY WEST NAVAL AIR STATION RAMP

Per FAA requirements, concurrent flights of manned and unmanned aircraft were not allowed in the KWNAS Class D airspace, so close coordination was needed to get SIERRA in and out of the airport traffic area. Due to the very high level of fighter activity in the airspace of KWNAS, the SIERRA would hold outside of the airport airspace to await a window of opportunity to return and land.

Daisy-chained ground observers were used during the transit to and from the data collection area over the ocean where a boat-based observer was stationed. All observers utilized the trunking radios provided by KWNAS, resulting in excellent voice communications. Key West Approach provided a great service deconflicting the general aviation traffic passing through the area and significantly improved the safety of the operation. A total of six flights were conducted, and the SIERRA will return to KWNAS in May 2013 for additional imaging flights.