DDF annual report

Title of Investigation:

Airborne Science and Technology Institute (ASTI)

Principal Investigator:

Geoff Bland (Code 614.6)

Other In-house Members of Team:

Ted Miles (Code 569)

Other External Collaborators:

University of Maryland faculty and students, including Dr. Abhijit Nagchaudhuri, Prof. Robert Conry, Mr. Gabriel Ladd, and others

Initiation Year:

FY 2005

Aggregate Amount of Funding Authorized in FY 2004 and Earlier Years:

$0

Funding Authorized for FY 2005:

$15,000

Actual or Expected Expenditure of FY 2005 Funding:

In-house: $15,000

Status of Investigation at End of FY 2005:

To be continued in FY 2006 with an additional $7,500 in DDF funding.

Expected Completion Date:

September 2006

Purpose of Investigation:

The Airborne Science and Technology Institute (ASTI) program is aimed at creating a training curriculum for uninhabited aerial-vehicle (UAV observations of the Earth's surface and

atmosphere. This activity engages University of Maryland Eastern Shore (UMES) students and faculty from several disciplines, including Aviation Science, Agriculture, Engineering, and Technology. The ASTI activities will contribute to the University's agriculture-related research. Imagery obtained using small, inexpensive UAVs will be gathered throughout the growing season to aid in the analysis of crop health and yield distributions. Low-cost imaging UAVs are shown in Figure 1.

Figure 1. Preparation and flight operations with low-cost imaging UAVs

Accomplishments to Date:

Work conducted during FY 2005 created a core capability that encompasses multiple elements. Specific training steps successfully introduced included UAV capability and systems overview, basic ground school, introductory flight training, basic airborne imagery missions, and data analysis systems and techniques. This work validated our approach and set the stage for detailed development. Results include proof-of-concept imagery of the UMES experimental agricultural field as shown in Figure 2.

Figure 2. Proof-of-concept imagery of UMES experimental agricultural field

Planned Future Work:

We intend to introduce additional concepts and procedures during the second year of this experimental program. These new steps include proficiency flight training, advanced airborne imagery missions, and systematic observation of research crops. Atmospheric profiling missions also are planned, using similar platform systems with miniature temperature, humidity, and GPS instrumentation.

Long-term plans include detailed development of curriculum elements, as well as engaging and encouraging other institutions to follow the ASTI/UMES model. A Web-based presence that enables communication and learning is a long-term goal for sustaining this activity. An active partnership with industry is clearly evolving, as interest in ASTI techniques and future graduates is strong.

Key Points Summary:

Innovation: The ASTI program is a pioneering effort expose students to UAV-related research, a rapidly growing area of science and aerospace. Activities specifically are aimed at supporting agricultural research at UMES and providing an excellent training ground for students of many disciplines.

Potential Payoff to GSFC: ASTI has fostered increased collaboration between UMES and NASA. We have initiated plans for extensive research activities, potentially including partners from the U.S. Department of Agriculture and other organizations. This program also will enhance our future workforce by familiarizing students with and training them in the emerging UAV field. While our industry partners are ready to hire graduates who participated in this program, we benefit in the near term with student experiments using UAVs.

Success Criteria: Previous work resulted in image acquisition and analysis of UMES's experimental agricultural fields. Students have become familiar with hardware and procedures suitable for this work. The first year is considered successful. A key objective of our FY 2006 activity will be to enable students to regularly image the agricultural fields at UMES in support of specific research programs. Another objective is to increase the awareness of potential employment in this emerging industry and ultimately to arrange an internship or full-time employment with a UAV-related company.

Risks: There are a number of risks. Low-cost UAV technology is emerging – much of it is derived from the hobby and entertainment sectors. Transition to research use requires solid hardware and systematic techniques, although indications are that our approach is valid. Perhaps the greatest challenge we face is the availability of faculty and students. There is much excitement surrounding this program, but UMES is a small school, with a limited population. We are confident we can maintain a strong core of students and faculty to capitalize on this opportunity, but it is likely that creating a national-level asset will require resources and effort beyond the FY 2006 performance period. Nonetheless, ASTI is clearly paving the way by developing techniques and practices suitable for training future UAV researchers.