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RETURN OF THE FLYING ROBOTS:

STUDENT-BUILT AUTONOMOUS AERIAL MACHINES

FLY & NAVIGATE WITHOUT A HUMAN OPERATOR

Robotic blimps, helicopters, a "flying gyroscope" and two "tailsitters" are among the unique air vehicles expected to participate in the second annual Aerial Robotics Competition held June 19 on the campus of the Georgia Institute of Technology in Atlanta.

Built by teams of students from 11 different colleges, the autonomous flying machines will attempt a task that has never been done before: to find and retrieve metal disks from a bin and fly them across a barrier to another bin -- all without human direction or intervention.

"Once the vehicle is started, each robot must travel

Team members from the University of Texas at Arlington ready their "tailsitter" during the first Aerial Robotics Competition held July 29 at the Georgia Institute of Technology. (Color/B&W Avail)

on its own, using its machine vision to perceive the environment and its own intelligence to find a disk, acquire it, and navigate across the barrier to drop it," explained Rob Michelson, vice-president of the Association for Unmanned Vehicle Systems (AUVS), the event's sponsor. "It's a real technical challenge."

Teams from California Institute of Technology, Ecole Polytechnique Federale de Lausanne (Switzerland), the Georgia Institute of Technology, Mississippi State University, the U.S. Naval Academy, Purdue University, San Diego State University, the Southern College of Technology, the University of Dayton, the University of Southern California and the University of Texas at

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Arlington are expected to compete.

Many of the college teams have support from industrial and government organizations such as the Lockheed Aeronautical Systems Company and the U.S. Army Aerostructures Directorate. A prize of $10,000 will be awarded to the team judged the winner.

The task sounds relatively simple, but to accomplish it, the aerial robots will have to sense their environment, locate the disks, navigate to a drop-off bin, avoid obstacles, and stay within the boundaries of the designated arena area -- all while maintaining stable flight. The vehicles will use a variety of sensing mechanisms and computer intelligence.

Five teams entered the first Aerial Robotics Competition held in July 1991 in a Georgia Tech volleyball court. None of the machines completed the task, though one autonomously found the bin containing the disks, but crashed as it descended to acquire one.

Because of the technical difficulty of the task, Michelson expects that many of this year's group of machines may also fail -- though he hopes at least one will be able to fly off with a disk.

The 1992 event will take place in one end of Georgia Tech's Bobby Dodd Stadium. This year, the rules allow larger aerial vehicles to enter, as long as they fit within a 10-foot cube.

"As a result, we should expect to see some new lighter-than-air entries such as blimps," explained Michelson, who is a senior research engineer with the Georgia Tech Research Institute (GTRI). At least two blimps are expected to participate, along with several helicopters, two "tailsitter" craft and a ducted-fan vehicle its builders call a "flying gyroscope."

The vehicles will be allowed six minutes to move as many disks as possible from one bin to the other, and each craft will be allowed three attempts. A three-foot barrier across the middle of the field will test the machines' ability to avoid obstacles.

A detailed scoring system will award points based on the size, weight and speed of each craft -- in addition to what part of the task it is able to accomplish.

Three of the 11 teams participated in the 1991 event, and Michelson believes the lessons they learned may give them an edge over competitors.

"The main thing that the teams learned was that when you do a real engineering project, you must integrate all of your systems together," he

said. "People always seem to put that off to the end, thinking that since their systems work individually, they will also work correctly together. That's not so."

The teams also learned that the simpler solutions often work better than complex ones, and that many problems can arise between the drawing board and the competition field, Michelson added. The AUVS hopes these lessons will help students be better engineers -- and equip them with skills that will advance knowledge about autonomous aerial vehicles.

"The higher the level of complexity, the more there is to go wrong," he noted. "You can do almost anything on paper, but when you are constrained by what parts are available and how much money you have, you quickly learn the virtue of simplicity."

The work is also interdisciplinary, requiring skills in mechanical, aerospace, electrical and materials engineering, along with computer science and software development.

"This competition forces interaction between specialties in many disciplines, requiring each to understand how his contributions strengthen the whole, and how important trade-offs and compromise can be," Michelson added. "The Aerial Robotics Competition involves significant engineering challenges identical to those students will encounter after graduation. Some of the teams have been working for over a year to build their entries."

Interest in the competition appears to be much stronger this year, with several universities fielding more than one team -- and some teams bringing more than one flying machine. Michelson attributes that to publicity over last year's event, and the competitive nature of college engineering students.

Autonomous aerial vehicles would be useful for both the military and commercial sectors. Military agencies already use remotely-piloted vehicles to fly behind enemy lines to obtain information about positions and activities without jeopardizing humans.

Commercial uses could include "dull, dirty or dangerous" jobs such as pipeline inspections or timber monitoring. Autonomous vehicles would have the intelligence to respond to changing conditions and still complete the assigned mission.

NOTE: Please call for videotape, slides or photos of the 1991 event, or for information about attending the June 19 contest.