Senior Capstone Design Class-Academic Year 02-03

Project 1: Several students approached Professor Vano during the summer of 2002 and asked that the SAE Aero Design East competition be one of their project options for the coming academic year. In this competition, students are required to design a heavy-lift radio controlled (RC) airplane with three primary design criteria: 1) the wingspan shall be no more than six feet, 2) the airplane will use an OS 60 engine, and 3) the payload will be non-structural and contained in a 200 cubic inch volume bounded on all sides with a rectangular surface. The fly-off was scheduled for May 24, 2003 at the Air Force Museum in Dayton, Ohio. This project seemed to fit the criteria for Design Class projects so it became the first project option on the list.

Project 2: December 17, 2003 will celebrate the 100th anniversary of the Wright Brothers first powered flight. During these first one-hundred years, humans have progressed from a marginally controlled flight of a few hundred feet to transglobal airlines, hypersonic flight, footsteps on the moon, and robotic explorations to most of our solar system planets and their moons; two spacecraft are on their way into inter-stellar space. We thought it would be fun to have a project to celebrate this anniversary so our second design project for the class was to design and construct a near-scale RC model of the Wright brothers Flyer with the following features: it will be electric powered, have a wingspan of no more than 10 feet, be easily transported and assembled, and have a flight control system with which a relatively inexperienced RC pilot can safely control the airplane.

Project 3: The Experimental Aircraft Association (EAA) is famous for its AirVenture Oshkosh air show, fly-in and aircraft exhibition where hundreds of thousands of aviation enthusiasts gather each summer. Amateur Built airplane kits are a popular part of the exhibition and have become a means by which thousands of people can afford to build/own/operate a small aircraft of their own creation. The third project option for the design class was to prepare the design of Amateur Built aircraft in one of the following categories: Personal Transportation Vehicle, Four-Place Cruiser, Racer or Aerobatic Airplane.

Project 4: Recent years have shown increased international interest in human exploration of space. The Chinese have announced plans to go to the moon. The early 1990s interest in Mars is recurring. NASA has funded the Nuclear Systems Initiative ($1 billion for 2 years) to develop/demonstrate nuclear power generation and propulsion — a necessary infrastructure for human missions. The spacecraft design option for the academic year was the conceptual design of a Solar System Cruiser: a vehicle to provide for extensive human exploration of the planets and their moons.

The Solar System Cruiser will be an international effort and will utilize technology and infrastructure expected to be available by approximately 2025.

The Design Class was formatted in the same way it has been presented for the past several years: complete a Conceptual Design Review (CDR) during Fall Semester and build/test models during Spring Semester.

The class had 57 students. Prior experience has shown that teams with approximately 12 students each works best in the design class environment.

The students selected their projects and were assigned to five teams for the above four projects, with the SAE Aero Design East competition having two independent teams.

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Two field trips were available to interested students this year: Cirrus Design in Duluth and Whirpaine in South St. Paul. Both facility tours were excellent and showed the students some of the complex interactions involved between engineering, manufacturing and quality control in producing airplanes and aircraft floats. Special presenters were brought into the classroom to give the students a better real-world perspective and highlight the importance of professional ethics. Terry Johnson from NemaStar spoke about project management and ISO 9000. James Chiles, author of "Inviting Disaster: Lessons from the Edge of Technology", spoke to the class about some of the man-machine disasters detailed in his book.

Steve Cook, a former AEM student and Design Class Teaching Assistant, and now Deputy Director for Advanced Space Transportation Systems at NASA Marshall Space Flight Center came to the class during Fall Semester to talk to the students (especially the Spacecraft Solar System Cruiser Design Team) about future NASA programs. The Spacecraft team also viewed the IMAX movie "Space station" to give them a sense of the challenges of living in space for long periods of time. This inspired part of the team to do a special study on Crew Resources Management (CRM) during Spring Semester. Dick Jesse, the CRM instructor at Northwest Airlines NATCO facility talked to the class and worked with the students on this project.

The Amateur Built team selected to design an unlimited Reno racer airplane. Solid Works was used as the common CAD program to help the students physically integrate their designs. It was a very busy model building year with several wind tunnel models and four RC airplanes. Dave Hultman, Aero Shop manager, helped the students with their more complex CNC machining problems.

The AEM department's purchase of a Rapid Prototyping machine this academic year provided the students with a state-of-the-art facility to build many of the more complex parts of their wind tunnel and RC models. Greg Nelson, AEM Department Lab Coordinator, also brought his RC modeling experience on-line to help the students build professional class models.

The highlight of the year for the SAE Aero East heavy-lift competition teams was the trip to Dayton May 1-4. Professor Vano, Greg Nelson and Teaching Assistant Chris Regan took 18 students in two university vans to the three day event.

The competition was very fast-paced with lots of flying on one of the old (closed) Wright-Patterson AFB runways. Two social events also highlighted the competition: pizza at the Wright Brothers Bicycle Shop and a formal dinner amongst the airplanes at the Air Force Museum. This was the first time the design class entered a fly-off competition. Although we did not place, the experience was a very real motivator to our students and something they would like to see as part of the class every year.

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