USING SUMMER INTERNSHIPS TO ENHANCE SENIOR DESIGN PROJECTS FOR UNDERGRADUATE ENGINEERING STUDENTS

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A summer internship program supported by NASA was designed to give some undergraduate Engineering and Engineering Technology majors very unique professional experiences by matching them with mentors in the NASA Wallops Facilities. Six undergraduate students worked on several projects during a 10-week summer internship program at the Wallops Facilities. Five of the students are electrical engineering majors and one a major in Aviation Sciences. This paper is on the work done by the electrical engineering students. The students participated in several activities, held bi-weekly meetings to report on their activities, wrote a final report and made a final presentation to NASA staff. There was an exit meeting to access and reflect on the program. One important thing that emerged was the possibility of students, individually and in groups working on senior design projects on on-going projects at the Facility with the help of NASA mentors. Having identified the mentors and the projects during their summer internship, the students are expected to work on senior design projects based on the on-going projects at NASA Wallops. This approach will make the students' senior design projects and experiences more industry oriented and practical. Through series of reports and presentations, they also worked on their communication skills and record keeping. The students worked on practical projects that helped them better understand some of the materials that they learnt in the class room. This paper discusses issues on relevance of internship projects toward senior design for undergraduate engineering students and the impact they have on the undergraduate students' overall industrial experiences.

I. INTRODUCTION

Summer internships for students in general have focused on providing students with a meaningful experience that will motivate and refine the students' study habits when they return to their home campuses for continuation of their studies These experiences in most cases, however, never translate to senior design projects sometimes due to the distances between the internship host site and the university and in other instances as a result of the nature of activities the students' were engaged in. With the proximity of NASA Wallops to the University of Maryland Eastern Shore (UMES) and the need for engineers by NASA, a unique opportunity exists to create an outreach program that will foster student development in areas critical to NASA's missions and to become a resource pool for prospective engineers and scientists to NASA Wallops facility. The chosen mechanism was to establish a focused internship program with NASA Wallops that required matching students with specific NASA organizations such that by the end of the summer internship period, a project for senior design project can be identified and initiated as a continuation of the summer experience. While students may work individually with their assigned groups, the senior design projects group students together to achieve the goals and objectives of a particular project where only one or two of the group members participated on the original summer experience.

II. THE INTERNSHIP PROCESS

The internship process started with the screening of the initial applications to establish eligibility and the invitation of the eligible candidates for interview conducted on the UMES campus by a panel of five NASA employees and two UMES employees. At the end of this process, students were selected and were then assigned to specific NASA Wallops organizations by matching their perceived talents to mentors at NASA Wallops who in turn supervised the students during their internship period at NASA Wallops. Following the completion of this phase of the process, students were notified of their assignments as well as expectations during the ten week period. The orientation process described the mission of NASA as well as expectations as summarized in the Table 1 below.

Table 1 NASA-UMES Student Internship Program (NUSIP) Schedule

DATE/TIME	ACTIVITY	PURPOSE
Friday, June 14, 2002	Wallops Tour with SEICA Interns from Greenbelt	Orientation to facilities; interact with other interns
Wednesday, July 10, 2002 Depart Wallops @ 7 a.m. Return to Wallops @ 6 p.m.	Trip to Goddard-Greenbelt	Orientation to Center
Tuesday, July 23 Depart Wallops @ 7 a.m. Return to Wallops @ 6 p.m.	Trip to Virginia Air and Space Museum, Hampton, VA	Tour NASA LaRC museum
Thursday, August 1	Wallops Student Program Presentations (PowerPoint)	Present to Wallops Senior Staff on Project(s)
Friday, August 2	Technical Reports Due (disc and logbook provided)	Reporting Requirement
Monday, August 12	Closing Program at UMES	Close out

The Biweekly Meeting Progress Report Format included, Problem Definition and Scope, Literature Review Conducted if Any, Problems Encountered, Possible Solutions, Project Status, Percent Completion, and Project Progress Chart as shown below.

The Final Report Format included, Title, Author's Data, Abstract, Introduction, Methodology (Subsections if required), Analysis (Include Figures and Tables where necessary along with subtitles), Conclusion, Further Work Required, Acknowledgements, and References

III. EXPECTATIONS FOR SENIOR DESIGN PROJECTS

The student participants, the sections in which they worked during the project, and their supervisors are listed below

1. Robert Fries, *Observational Science Branch*, code 972, Supervisor: Mr. John Moisan.
2. Freshteh Agdam, *Guidance, Navigation, and Control Systems Engineering Branch*, code 571, Supervisor: Mr. Joel Simpson
3. Matthew Watson, *Electrical Systems Branch*, code 565, Supervisor: Mr. Drew Green
4. Tunde Alade, *Microwave Systems Branch*, Supervisor: Mr. Dan Mullinex
5. Nnenna Ofurum, *Mechanical Systems Center*, Carrier Systems Branch, Supervisor Mr. Prasad Hanagud.

The summaries of the work performed by the students are listed below.

1. UNMANNED AERIAL VEHICLES (UAVS) ***(Guidance, Navigation, and Control Engineering Branch)*** by Freshteh Agdam, Senior, Electrical Engineering.

Unmanned Aerial Vehicles (UAVs) have been around since the dawn of aviation. Much work has been done in recent years to abstract computational models of human control strategy (HCS) that are capable of accurately emulating dynamic human control behaviors. Land-based autonomous vehicles, both in simulation and on real roads, have made successful use of this modeling formalism. The first guided (UAV) was a flying bomb, the Sperry Aerial Torpedo, which was part of an experimental program for the U.S. Navy during World War I. During World War II, Germany launched thousands of V-1 "buzz Bombs" at England. Since that time, the primary use of UAVs has been to serve as aerial targets or drones to be shot down by military pilots and anti-aircraft gunners during training missions and as reconnaissance planes used in Iraq and Kosovo. The UAV flights have helped avoid casualties among pilots. UAVs also fill an important and growing role in the civilian aviation industry. There are many jobs, which are dangerous, monotonous, or very expensive if they are performed by manned aircraft. It has been estimated that over the past five years, on average, eight deaths have occurred annually in the geophysical survey industry, where pilots fly their instrumented aircraft over long routes, close to the ground, and over severe terrain or doing research on active volcanoes, etc. Regardless of the mission, precise guidance is essential for a UAV; therefore, the flight computer performs a major role as a brain to the aircraft and in the success of a UAV. Electrical engineers in Guidance, Navigation, and Control Division of NASA Wallops have begun to develop a flight computer that acts as a brain to the UAV.

2. **INTERCOM COMMUNICATION SYSTEM (ICS)** ***(Mechanical Systems Center, Carrier Systems Branch)*** by Nnenna Ofurum, Senior, Electrical Engineering Technology.

ICS (intercom communication system) is an electronic device used in an aircraft by pilots, copilots, mission managers, crewmembers and passengers to communicate within and near the aircraft. My project this summer was to research a replacement for an existing ICS with an advanced digital and wireless feature for the NASA Wallops P-3 Orion Aircraft. The P-3 is a four-engine turboprop, which supports the NASA LAASP (Low Altitude Airborne Science Program). It is one 3 aircraft owned by NASA Wallops Flight Facility. The P-3 was used in the Soil Moisture Experiment (SMEX '02) in Iowa in June of 2002. The Aircraft Office I work in provides services such as maintenance, configuration control, airborne science and mission support for assigned aircraft. It develops and implements rules and procedures to ensure the safety of aircraft operation. Other services provided includes, aircraft scheduling services, launch range requirements and budgetary management. The primary reason for the replacement of the existing ICS system is that the company that manufactured the current ICS is out of business and its parts are costly and difficult to find. Another reason is that since it's not wireless, its longs cord can be a safety hazard. The new ICS system will be more user friendly, cost efficient and safer than the current one.

3. **ENVIRONMENTAL TESTING OF RF COMPONENTS** *(Microwave System Branch)* by Tunde Alade, Senior, Electrical Engineering.

Network Analyzers can be used to measure the transmission and reflection of signals. Environmental chambers can simulate different atmospheric conditions. By combining these two equipments, we can easily test for the durability of microwave equipments under several environmental conditions. The results from these tests can help in diagnosing the possible failure in components before carrying out a mission. Although these components have manufacturers' specification on them, we will find that sometimes we still experience failure in components. The satisfaction of testing one's components personally to guarantee that they are functional under the conditions in which they are required is irreplaceable. The Environmental chamber is one of the many types of equipment that can be used to simulate mission requirements. There are other technologies/equipments such as the vibration table, spin balance, network analyzer, spectrum analyzer and much more. This paper will demonstrate how a network analyzer, vibration table, and environmental chamber can be used to save a mission from possible failures.

4. **OCEAN-ATMOSPHERE SENSOR INTEGRATION SYSTEM (OASIS) DEVELOPMENT** *(Observational Science Branch)* by Robert Fries, Senior, Electrical Engineering.

This report focuses on the continual development of an Ocean-Atmosphere Sensor Integration System (OASIS) to perform dynamic, autonomous, synergistic *in situ* measurements and observations of air and sea processes. OASIS is a low-cost, self-navigable, easily recoverable and reusable ocean sensor platform consisting of unmanned sea surface vehicles (USSVs) interfaced with scientific oceanic and atmospheric instruments. Pre-purchasing of equipment, examination of and comparison to an Autonomous Drifting Ocean Sensor, battery testing, thermal imaging, and motor analysis are various objectives to which OASIS has been and is being subjected.

5. **AUTOMATION AND INSTALLATION** ***(Code Electrical Systems Branch)*** **by** Matthew Watson**,** Senior, Electrical Engineering

The thermal vacuum testing procedure used in building F7 is a slow and arduous process that requires the user to write down numerous numbers after calibrating a series of temperamental pieces of equipment to specific values from hundreds to thousands of times. Updating the procedure using more modern hardware and software is the most logical solution to increase productivity and accuracy of the procedure. Learning how to use the new hardware and software is the major battle because the test procedure from component to component is different and the ability to integrate the systems is crucial. I have learned the hardware and software and feel confident that I could integrate them with most tests involving the thermal vacuum test procedure in building F7. The transmitter site building U 55 has five command destruct transmitting amplifiers, five antennas, and four dummy loads that need to be connected in various ways depending on what mission they are setting up for. In order to do this in an easy and sane way the use of a patch panel network was devised as a solution. On the network each component would be represented by a connected spigot. The two panels that were previously bought for this task have spigots that are routed to each other in a geometric fashion. I was put in charge of the layout of the ports and the installation of the two panels that make up the network and all the tasks involved with the task. Given the available materials I was able to finish approximately 60% of the job.

IV. CONCLUSIONS

As a result of this relationship, the senior students in the electrical engineering program are currently working on a NASA Wallops sponsored senior design project "GSFC UAV Project System Architecture" in which their specific project role is well defined. At the end of this year's experience, we will be evaluating the progress made as well as lessons learned in order to access the effectiveness of this approach. The intended outcome also is the evaluation of these students who for the most part are local to the region and who can easily be assimilated into the NASA culture and working environment given the need for engineers in the eastern shore of Maryland and Virginia.

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Dr. Arumala graduated from the University of Lagos, Nigeria, in 1973 with a Bachelors Degree in Civil Engineering. He has a Masters Degree (1978) and a Doctorate Degree (1982) from Clemson University in Civil Engineering. Dr. Arumala's work experience covers classroom teaching, working in the construction industry, research, administrative duties and professional consultancy for organizations. He has taught several undergraduate courses in soils, surveying, structural analysis and design for several years. He has supervised student research and design projects and has advised students on a continuous basis. He has been actively involved in curriculum development activities. He has worked in the construction industry supervising road and bridge projects and has designed and supervised the construction of several structures. Dr. Arumala has authored a book and has published several refereed articles and has presented scholarly papers at national/international conferences. He is a member of several professional bodies and a PE.