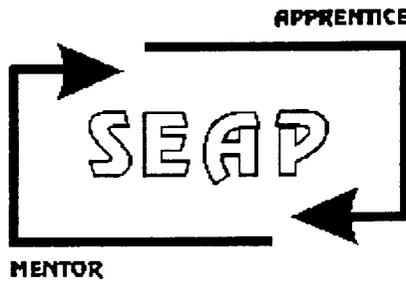


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203113



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Science and Engineering Apprentice Program



1997 Report

For Work Conducted  
Under Grant #NGT2-52223  
From NASA

By  
The George Washington University  
School of Engineering and Applied Science

NGT-2-52223  
TO

C.A.S.I.  
APR 27 1998



SCHOOL OF ENGINEERING AND APPLIED SCIENCE  
SCIENCE AND ENGINEERING APPRENTICE PROGRAMS  
(202) 994-2234 • Fax (202) 994-2459 • seap@gwis2.circ.gwu.edu

### FINAL EVENTS -- NASA

#### Tuesday, August 12

- 7 pm Navy Memorial Concert -- 8th & Pennsylvania Ave, NW  
Transportation on your own

#### Wednesday, August 13

- 12 noon National Air & Space Museum -- 4th & Independence Ave, SW  
"The Enterprise Aircraft Carrier Model"  
Tim Wooldridge discusses the Enterprise Aircraft Carrier Model.
- 4pm Navy Memorial IMAX Film -- 8th & Pennsylvania Ave, NW
- 7pm US Naval Observatory Tour -- 34th & Massachusetts Ave, NW  
Meet in Front of Mitchell Hall (514 19th Street) for Group Departure  
**STUDENTS ONLY**

#### Thursday, August 14

- 9:45am White House Tour -- **LIMITED TO 30 PEOPLE**  
Transportation on your own
- 11 am Double Decker Bus Tour of DC, Capitol Hill Visits  
Meet at corner of 22nd and H Streets. See attached Capitol Hill  
Agenda for rest of afternoon.
- 3:30 pm Air & Space Museum IMAX Film
- 5 pm Air & Space Museum -- Planetarium Show

#### Friday, August 15

- 10 am SEAP Closing Ceremonies -- GWU Lisner Auditorium
- 1:15 pm Tour of Printing and Engraving -- Meet in Tompkins 201  
**STUDENTS ONLY**
- 7:00 pm Marine Corps Tattoo Ceremony -- Marine Barracks, 8th & I St, SW  
Transportation on your own

#### Saturday, August 16

- 10:15 am Tour of Holocaust Museum -- Meet in front of SEAP Office (707 22nd  
Street, NW)

THE WHITE HOUSE  
WASHINGTON

July 18, 1997

The Honorable Robert C. Byrd  
United States Senate  
SH-311  
Washington, DC 20510-4801

Dear Senator Byrd:

Group Tour Confirmation:           **NASA**  
  
Date Scheduled:                   **Thursday, August 14, 1997**  
  
Number in Group:               **30**                   Group ID#: **97-70838**

This group, along with others, will be placed at the head of the public line for the self-guided walkthrough tour.

**To receive brochures and to enhance the tour, the group should first stop at the White House Visitor Center at 15th Street, near E Street. Look for the American flags and the blue awnings. Allow between 20 minutes and 1 1/2 hours to see the videos, exhibits, and sales area. The Visitor Center is open from 7:30 a.m. until 4 p.m., seven days a week.**

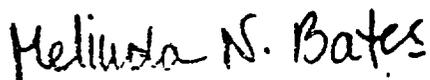
The members of the group should then walk to the Visitor Entrance, on East Executive Avenue between the White House and the Treasury Building, at **09:45a.m.** It is not necessary to arrive earlier. The person in charge of the group *should show this letter* to the officer on duty.

The number of people in the group may **not** be increased. If there is a reduction in the number scheduled, or if for some reason the tour is cancelled, please notify the Group Tour department as soon as possible at 202-456-2202. Our TDD (telephone device for the deaf) is 202-456-2121.

• Tour hours are occasionally affected at the last minute by unforeseen events. Please call the Visitors Office **24-hour info line recording at 202-456-7041** to confirm that tours will be conducted.

On behalf of The President and Mrs. Clinton, we hope that members of this group enjoy their visit to the White House.

Sincerely,



Melinda N. Bates  
Special Assistant to the President and  
Director, Visitors Office

# METRO DIRECTIONS

General information about the METRO system:

The METRO stop that the George Washington University is located at is FOGGY BOTTOM / GWU and is on the **BLUE** and **ORANGE** lines. The base fare for the METRO is \$1.10 and for most trips with in DC the fare is also \$1.10. For other destinations, there are fares listed at the station. You must buy a farecard and use it for both entering and exiting the METRO system.

Air and Space Museum

The National Air and Space Museum is located nearest to L'Enfant Plaza, which can be reached by the **BLUE**, **ORANGE**, **YELLOW**, or **GREEN** line trains. You can get to the Air & Space Museum, located at 7th Street and Independence Avenue by proceeding on 6th street to Independence Avenue (about 2 blocks).

Navy Memorial

From The George Washington University, take either a **BLUE** line train in the direction of **ADDISON ROAD** or an **ORANGE** line train in the direction of **NEW CARROLLTON** to L'Enfant Plaza (6 stations). There transfer to a **YELLOW** line train to Mt. Vernon Square. Ride one stop to the Navy Memorial/Archives station. From the exit of the METRO station, you will see the Navy Memorial (located at 9th and Pennsylvania Ave).

# CAPITOL HILL AGENDA

## NASA - West Virginia

● SENATE VISIT ●	
○ 1:00 pm	Senator Robert Byrd - Hart 311. Suzanne Bailey, a Legislative Assistant will meet with you and answer any questions that you have as well as relate your comments about your summer experience to Senator Byrd.
○ 1:30 pm	Senator Jay Rockefeller - Hart 531 Chris Frost, a Legislative Assistant will meet with you and answer any questions that you have. He will also relate your comments about your summer experience to Senator Rockefeller.
● CONGRESSIONAL VISIT ●	
○ 2:30 pm	Congressman Alan Mollohan - Rayburn 2346. (3rd Floor) Leslie Robertson, a legislative assistant will meet with you and answer any questions that you have as well as relate your comments about your summer experience to Congressman Mollohan.

### **Thursday, August 14**

**9:45 am -- White House Tour. LIMITED TO 30 PEOPLE. See Attached Letter. Transportation is on your own.**



The National Aeronautics and Space Administration's Science and Engineering Apprentice Program for high school students is one of NASA's many efforts toward a goal of scientific literacy. It embraces science, mathematics, and technology as keys to purposeful and sustained progress and security for our nation and its people. It serves as a model for helping reform education by striving to address mechanisms to influence the knowledge, skills, and attitudes of our students. **It focuses on what to do today to meet the challenges of tomorrow.**

## OVERVIEW

The Science and Engineering Apprentice Program for high school students places academically talented students with an interest in science, engineering, and mathematics in NASA laboratories for eight weeks in summer for hands-on experience under the mentorship of laboratory scientists and engineers.

## SUMMER 1997

The program undertaken by the NASA Independent Verification & Validation Facility in Fairmont, West Virginia, to introduce academically talented high school students to the world of technology and NASA activity that has proven so successful during the past two summers, was continued. Once again, the facility felt that the optimum number of meaningful placements was ten students. Two students were retained for a second summer, while eight others were recruited from a slightly wider geographical area. The procedure included the following steps.

1. Brochure and application forms were created by the University.
2. The general philosophy and operating procedures of the existing program had proved satisfactory and they were maintained with minor modification.
3. Applications were distributed to the local schools early in 1997 and a deadline date set for receipt of completed applications at the George Washington University.
4. Project descriptions were submitted to the University by prospective mentors which included prerequisite student academic accomplishments. Program staff matched three or four appropriate applications with each mentor request and forwarded the packets along with all

other possible applications. All of the students were called in to tour the site and meet prospective mentors. After extensive interviews, eight new students and two who had been apprentices the previous summer were chosen. The actual final selections were made by participating mentors.

5. The students spent eight hours a day, five days a week between June and August at the facility. Each produced a technical paper, which was reviewed by his mentor and then presented orally before NASA personnel, school personnel, parents and friends.
6. Students received an academic award of \$1400 for their efforts.
7. At the close of the program, students, mentors, and in most cases, parents joined the large group of SEAP apprentices in DC for closing events. These included a closing ceremony in GWU's Lisner auditorium and concurrent seminar sessions at which each student presented an oral summary of his/her summer project.
8. Apprentices and their guests at no charge to them enjoyed social events, such as special speakers and presentations at the Air and Space Museum, Congressional visits, and an I-MAX film.
9. Both students and mentors were asked to submit evaluation forms, which rated their summer experience, and to offer suggestions for continued improvement and augmentation of the program.

## STUDENT INFORMATION

All ten students participating in the SEAP program at NASA's IV&V facility in Fairmont, WV successfully completed their assigned projects. Two of the ten students returned to the lab for a second year. They, and family representatives, traveled to Washington, DC for the program's scheduled final events. These activities included a tour of the White House, a visit to Capitol Hill, where they met with a representative from Senators Byrd and Rockefeller office, and a representative from Congressman Mollohan. The visit culminated in the presentation of their research findings at the Lisner Auditorium of George Washington University. Each student presented his/her research results in subject specific seminars after a culminating program featuring Rear Admiral Paul G. Gaffney, II, Chief of Naval Research.

As a result of their exemplary presentation and outstanding research activity this summer, two of the students received AFCEA awards from the Armed Forces Communication and Electronics Association for their research in specific areas of Communications and Electronics. Below is an Abstract of one of the papers presented.

## SAMPLE ABSTRACT OF STUDENT PAPER

Student: Nicholas Ryan Butcher  
Fairmont High School  
Marion County

Mentor: Joseph V. Gardner, Ph.D.  
MEASURING LEARNING IN CYBERSPACE  
Testing the Effectiveness of the Internet as an  
Educational Tool

A World Wide Web exhibit was developed on tsunamis and then documented on the Internet to test how much knowledge the common Internet user retains from exploring a Web exhibit on something with which they are not familiar. Pre-and post tests were given at the exhibit, asking the same five questions to see just how much information the user retained from the exhibit could be measured. Student's t-test was used to determine that the difference between the mean scores on the two tests was significant and it was concluded that the common Internet user could learn facts about scientific phenomena from exploring a Web exhibit.

Statistics and summary details are given in the following Appendix Section.

## SCHOOL DEMOGRAPHICS

Forty-nine applications were received from twelve schools in West Virginia representing four counties. The alphabetical names of the schools are listed with their respective county as follows:

### SCHOOLS BY COUNTY

<b>SCHOOLS</b>	<b>COUNTIES</b>	<b>STUDENTS APPLIED</b>	<b>STUDENTS SELECTED</b>
BridgePort High School	Harrison	1	0
Clay-Battele Middle/Senior	Monongalia	1	0
East Fairmont High	Marion	5	2
Fairmont High	Marion	7	3
Fast Fairmont	Marion	1	1
Grafton High	Taylor	4	0
Liberty High	Harrison	3	0
Lincoln High	Harrison	5	0
Morgantown High	Monongalia	5	0
North Marion High	Marion	5	1
Robert C. Byrd High	Harrison	6	0
South Harrison High	Harrison	3	1
University High	Monongalia	3	2
<b>OVERALL TOTAL</b>		<b>49</b>	<b>10</b>

## GENDER DEMOGRAPHICS

Of the 49 applications, ten students were selected to participate in the NASA program.

### GENDER BY NUMBER OF STUDENTS

<b>GENDER</b>	<b>STUDENTS APPLIED</b>	<b>STUDENTS SELECTED</b>
Male	33	8
Female	16	2
<b>OVERALL TOTAL</b>	<b>49</b>	<b>10</b>

## RACE DEMOGRAPHICS

Although only one Black American and one Asian-Pacific American applied to this program, three Hispanic American applied and one was chosen. Statewide, the State of West Virginia has a total minority population of 3 percent. Therefore, the Hispanic student actually represents 10 percent of the total population.

### RACE BY GENDER

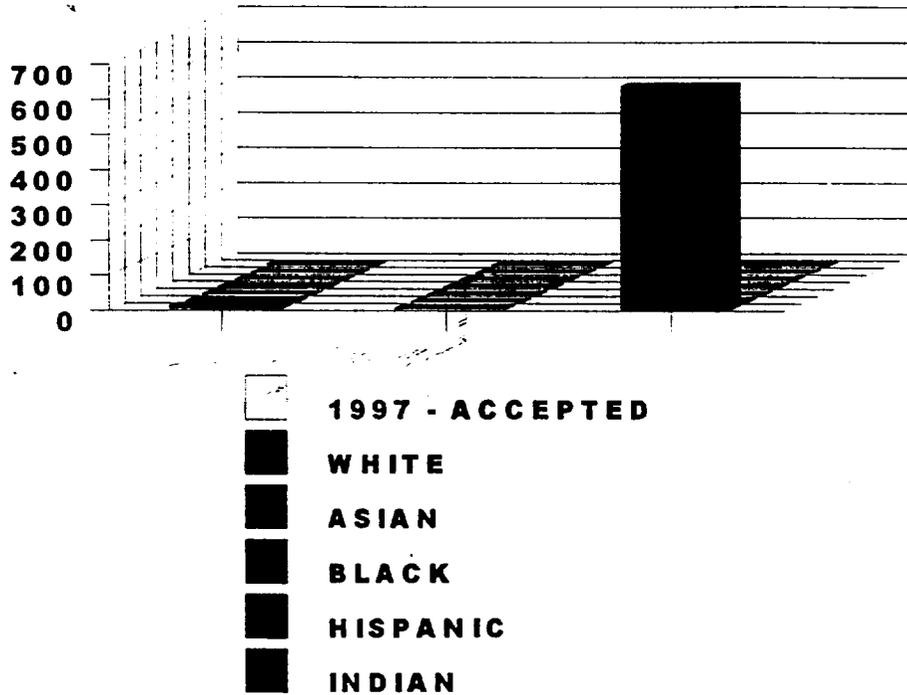
<b>RACE</b>	<b>Male</b>	<b>Female</b>
White	24	13
Asian	1	0
Black	1	0
Hispanic	2	1
Indian	0	0
Other	6	1
<b>OVERALL TOTAL</b>	<b>34</b>	<b>16</b>



# 1997 NASA ACCEPTED STUDENTS DEMOGRAPHICS

1997 - ACCEPTED	MALE	FEMALE	TOTAL
WHITE	5	2	7
ASIAN	0	0	0
BLACK	0	0	0
HISPANIC	1	0	1
INDIAN	0	0	0
OTHER	2	0	2
OVERALL TOTAL	8	2	10

## 1997 NASA ACCEPTED



September 15, 1997

**APPENDIX A**  
**STUDENT RECRUITMENT INFORMATION**

Application Deadline  
March 31, 1997

NATIONAL AERONAUTICS & SPACE ADMINISTRATION  
SCIENCE AND ENGINEERING APPRENTICE PROGRAM  
JUNE 9 – AUGUST 1, 1997 & AUGUST 13 - 15

TEACHERS OF SCIENCE AND MATHEMATICS  
GUIDANCE DEPARTMENT ADVISORS  
Area High Schools

The National Aeronautics and Space Administration is again implementing the program in which meaningful summer research experience will be offered to selected high school students. We are looking for students who have the potential to pursue successful careers in science, engineering and mathematical fields. Selection will be made according to the following criteria:

1. strong interest in science, engineering, mathematics and computer applications;
2. science and mathematics courses taken and grades attained;
3. scores on national standardized tests;
4. teacher recommendations;
5. extracurricular interests and activities;
6. personal statement of goals and career interests.

As you can see, teacher recommendations will play an important role. You, as the science/math teacher or advisor, can spot the student whose grades may not be the highest because he or she is not challenged. If you feel a student has potential, we will try to give that student the opportunity.

The students you nominate should be given both the brochure and the applications, and advised that the form must be carefully printed so that it is legible. Students are responsible for transportation to and from the NASA site and **MUST** show proof of U.S. citizenship, (i.e. social security card).

Please note that the students selected will receive an academic award as well as invaluable experience and exposure to the world of scientific research.

We would appreciate having **TWO COPIES OF** applications, student essay, letter(s) of recommendation, and transcripts sent out as quickly as possible, but postmarked no later than the deadline, 31 March 1997.

Sincerely yours,

Marilyn Krupsaw, Program Director  
Science and Engineering  
Apprentice Programs

School of Engineering  
& Applied Science

Summer 1997

National Aeronautics &  
Space Administration

SCIENCE AND ENGINEERING APPRENTICE PROGRAM

APPLICATION DEADLINE:  
Postmarked by 31 March 1997

June 9 - August 1, 1997 & August 13 - 15

STUDENT APPLICATION FORM

Month/Day/Year

Last Name (please type or print) First MI Male Female Date of Birth Age US Citizen  Yes  No

Home Address Street City State Zip Code

Home Phone with Area Code Social Security Number<sup>1</sup> Weight lbs ft in Height Hair Color Eye Color

(Optional)

How would you describe yourself? Black American American Indian or Alaskan Native  
Asian-Pacific American Hispanic American White, Non-Hispanic Other \_\_\_\_\_

Parent or Guardian Name ( ) Daytime Phone Number (in case of emergency)

Present grade in school 10 11 12 Name of High School Name of Principal

Address of School Street City State Zip Code County

Major academic and career interests \_\_\_\_\_

Science activities in which you participated (in and outside of school), hobbies & special interests \_\_\_\_\_

Do you have computer programming experience? \_\_\_\_\_ Yes No

Which computer languages? Basic Pascal Fortran C Other Explain \_\_\_\_\_

<sup>1</sup>Applicants must have a social security number before June 1997.

FOR MENTORS ONLY

Mentor \_\_\_\_\_ Alternate Mentor \_\_\_\_\_

Phone \_\_\_\_\_ E-Mail # \_\_\_\_\_ Phone \_\_\_\_\_ E-Mail # \_\_\_\_\_

Date Interviewed \_\_\_\_\_ Date Notified of Acceptance \_\_\_\_\_

FOR OFFICE USE ONLY

Date Entered Computer \_\_\_\_\_ Date Letter Sent \_\_\_\_\_ Date Received \_\_\_\_\_

List the science, mathematics, and related computer courses you have taken or are presently taking. Show the grade you received in each course (A, B, etc.). You may attach an additional sheet if needed.

MATH    PHYSICS    BIOLOGY    COMPUTER    CHEMISTRY    OTHER

If you are now in high school, what career/careers do you THINK you might want to pursue?

---

---

What college/colleges would you like to attend?

---

**NOTE: *Applications will not be processed until complete with all questions answered.***

A complete application consists of two copies of each of the following:

1. This Student Application Form - Complete both front and back
2. Personal Statement - A one page essay on your personal goals and why you want to participate in this program. Please include enough information in your personal statement to indicate career interests and goals.
3. Teacher/Advisor Recommendations (One or two maximum, from Science and Mathematics teachers).
4. Transcript (including standardized test scores, wherever possible).

Send to:

M. Krupsaw, Director  
Science & Engineering  
Apprentice Programs  
707 22nd Street, NW  
Staughton Hall 104  
Washington, DC 20052  
Phone: 202-994-2234

The students selected will be given the opportunity to participate in research and gain experience with computer software and hardware at the NASA IV&V Facility in Fairmont, WV.

**A complete application consists of: TWO COPIES of each of the following:**

1. Student Application Form - Complete both front and back
2. Personal Statement - A one page essay on your personal goals and why you want to participate in this program
3. Teacher/Advisor Recommendations (one or two maximum)
4. Transcript (including standardized test scores, wherever possible)

Local Contact:

Mr. John Griggs  
NASA, I V & V Facility  
Office of Safety and Mission Assurance  
Code QV  
Fairmont, WV 26554

Phone: 304-367-8204

# **NASA**

## **National Aeronautics & Space Administration Science and Engineering Apprentice Program**

**For High School Students**

**June 9 - August 1, 1997**

**The George Washington University  
School of Engineering and Applied Science**

## **Are You Interested in Science & Math?**

The Science and Engineering Apprentice Program is a National Aeronautics and Space Administration summer program for high school students designed to provide valuable experience and exposure to the world of scientific research. The students will pursue scientific experiences with a scientist or engineer who serves as mentor to the apprentice for eight continuous weeks, June 9 through August 1, 1997 at the NASA Independent Verification & Validation Facility in Fairmont, West Virginia. The program includes a sponsored trip to Washington, DC between August 13 and 15. This schedule permits student participation in extra-school activity with only three days missed for the trip to Washington.

### **Applications:**

See your science/math teacher or guidance counselor for an application form. Send two copies of each - the application form, your transcript, teacher recommendations, and a page about yourself and your interests and accomplishments in science to:

M. Krupsaw, Director  
Science & Engineering Apprentice Programs

GWU / SEAS

Staughton Hall 104

Washington, DC 20052

Telephone: 202-994-2234

FAX: 202-994-2459

E-mail: [seap@gwis2.circ.gwu.edu](mailto:seap@gwis2.circ.gwu.edu)

**Applications will not be processed until complete.**

**All applicants must be U.S. citizens and have a social security number before June and be committed to the stay in Washington between August 13th and 15th.**

### **APPLICATION DEADLINE**

**Postmarked by March 31, 1997**

Each application will be matched with a project description submitted by a scientist at the facility. The scientist will interview candidates and make a final selection. All students selected for the 1997 summer program will be notified by May 15, 1997. If you have not heard by this date, it was not possible to arrange a placement for you this year.

### **Selection:**

Students are selected on the basis of grades, science and mathematics courses taken, areas of interest, scores on national standardized tests and teacher recommendations.

Academic Awards of \$1400 will be provided for the eight continuous weeks. Each student is responsible for transportation to and from the facility in Fairmont. Support will be made for the Washington trip.

**APPENDIX B**  
**MENTOR INFORMATION**

SCIENCE AND ENGINEERING APPRENTICE PROGRAM  
for High School Students

MENTOR SEAP REQUEST FORM

*\*Please Print legibly\**

Agency \_\_\_\_\_ Agency Address \_\_\_\_\_

Laboratory Coordinator \_\_\_\_\_ Phone \_\_\_\_\_ Coordinator E-Mail \_\_\_\_\_ Fax Number \_\_\_\_\_

Laboratory Coordinator's Location \_\_\_\_\_ (Code, Room, Building, Site ) \_\_\_\_\_

Requesting Mentor \_\_\_\_\_ Phone \_\_\_\_\_ Requesting Mentor E-Mail \_\_\_\_\_ Fax Number \_\_\_\_\_

Requesting Mentor's Location \_\_\_\_\_ (Code, Room, Building, Site ) \_\_\_\_\_

Alternate Mentor \_\_\_\_\_ Phone \_\_\_\_\_ E-Mail \_\_\_\_\_ Alternate Mentor's Location \_\_\_\_\_ (Code, Room, Building, Site)  
Designated Person Responsible if Mentor is Unavailable

Previous SEAP or CQL Name Request \_\_\_\_\_  
Name \_\_\_\_\_ School \_\_\_\_\_

Project Title \_\_\_\_\_

Project Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Desired Background, Interests, Qualifications of Applicant \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Mentor Signature \_\_\_\_\_ Date \_\_\_\_\_ Supervisory Approval Signature \_\_\_\_\_ Date \_\_\_\_\_

Program Dates: June 8, 1998 - July 31, 1998.

These Dates are fixed; any alterations must be cleared through the George Washington University SEAP Office.

**PLEASE SEND THIS FORM TO YOUR LABORATORY SEAP COORDINATOR.**

For Official Use Only: Date Received: \_\_\_/\_\_\_/\_\_\_ Date Sent Applicant(s): \_\_\_/\_\_\_/\_\_\_

# Request for EOSDIS IV&V

## Project Overview/Probable Work Assignment

The Earth Observing System (EOS) is a part of the NASA Mission to Planet Earth initiative. Data gathered by the Earth Observing System Data and Information System (EOSDIS) will be studied by scientists to gain a greater understanding of how the Earth works as a system. For additional information about EOS, see the NASA EOS homepage located at "<http://eosps0.gsfc.nasa.gov/>".

The EOSDIS Independent Verification and Validation (IV&V) contract is a means to insure the integrity of what is being developed for NASA. Individuals here in Fairmont, WV and in Greenbelt, MD are performing common IV&V activities (e.g. Requirements Analysis, Design Analysis, Interface Analysis, etc.) to monitor development activities to insure that what is built meets NASA and scientist expectations as best as possible. The primary objective for development oversight is to identify problem areas and recommend corrective action for items that impede development, jeopardize intended functionality, and impact system safety and reliability.

One of the tasks being performed here in WV is a support task for ongoing IV&V activities. One activity associated with the local support task involves the development of tools that automate IV&V practices, enhance the quality of what is produced, and increase productivity. In performing this task, various software engineering concepts and disciplines are followed. The EOSDIS IV&V CIAP will be involved in one or more of the software engineering development aspects (design, implementation, test, etc.). Through assigns tasks and mentoring provided by tool development staff, the CIAP will obtain a high level understanding of the software engineering life-cycle and associated development milestones, methods, and processes.

### **SEAP Task Description**

The Intern will be assigned to the NASA Systems Software independent Assessment task with focusing on a project tool to assess the software criticality functions for potential IV&V activity. The potential intern will search for appropriate tool and make recommendation of a given tool with actual inputs and outputs. The intern will also help to assess additional existing tools for use in software IV&V (e.g., McCabe Tool) and transfer the tools under assessment task for future use. The intern may also help in preparation of assessment report and organizing some of the previous documentation. The intern will work with the NASA staff and IV&V contractor to obtain necessary information regarding above functions.

The intern skills include: good organization, excellent communication, research capability, excellent computer tools operation and software background.

The intern will learn about software assessment and IV&V tasks and how to use a tool to define the critical software domains with further IV&V activity for a given NASA Enterprise project.

Siamak Yassini

Return-Path: steve@atlantis.ivv.nasa.gov  
Date: Tue, 28 Jan 1997 16:46:17 -0500  
From: steve@atlantis.ivv.nasa.gov (Steve Easterbrook)  
To: J.Griggs@ivv.nasa.gov  
Subject: SEAP proposal  
X-Sun-Charset: US-ASCII

John,

I just realised I never sent you my proposal for a SEAP project. I've attached a draft description. Please let me have any comments.

Steve

-----

### Reaching Agreement when Evaluating Risk

(A SEAP project for summer 1997)

Risk management is crucial to the success of any large engineering project. Engineering decisions nearly always involve some assessment of risk, as they involve making trade-offs amongst different options. For example, imagine a problem is found in the current design for a spacecraft computer system, such that it might fail and damage the spacecraft under certain conditions. An assessment is needed of how likely those conditions are to occur, and this likelihood must be compared with the extra cost to correct the design. Risk management is the process of identifying potential future problems and ensuring that contingency plans are made in case the problems do occur.

One important feature in risk management is that it involves a subjective judgement of the importance of each risk. Evaluations are made of how likely each risk is to occur, and if it does occur, what the cost will be (i.e. how much damage will it do). Different people will make these assessments differently. It is therefore important to take many different people's viewpoints into account when assessing risk, because one person might ignore or forget factors that another person will spot. Unfortunately, it can sometimes be hard to get the different people to reach an agreement, especially when the people involved have a large stake in the success of the project. For example, one engineer might argue that a design flaw is a major risk involving potential loss of the spacecraft, and is therefore worth spending millions of dollars to correct. Another engineer might argue that the risk is valid, but is so unlikely to occur that it is not worth spending the money to fix it. It is not possible to make a decision without exploring these competing arguments in more detail. Note that there is no objective truth here: it is not the case that one engineer is right and the other is wrong; rather that they have different ways of looking at the problem, both of which might be equally valid.

This aim of this project is to evaluate and compare a number of

different software tools that may help a project manager to evaluate the competing arguments. These tools have generally been developed for exploring the rationale for a decision, or to support a negotiation process. In many cases these applications are currently research prototypes. Two possible outputs from the project are (1) to recommend an approach and/or tool to use to help assess risks on NASA projects, and (2) to suggest improvements to the existing tools that would make them better suited to risk assessment.

To perform the evaluation, we will adopt a case study using an important risk from a current NASA project (probably the space station), where there was disagreement over the importance of the risk.

Details about the risk will be collected from the documentation, and from interviews with the engineers working on the project. We will then

explore how good the different software tools are at handling the data,

and how much help they are in comparing the different arguments.

Results from the tools will be discussed with the engineers and managers working on the NASA project, to evaluate what benefits each tool brings, and whether it helps in the risk management process.

A suitable candidate for this project will have an interest in issues to do with safety and risk, and in the human aspects of the uses of advanced technology. An interest in social psychology and organisational behavior would also be useful, as the software tools we will be evaluating draw on theories from these fields.

The Remote Sensing Public Access Center (RSPAC) is seeking an intern to be a member of our Web site development team during the 1997 Science and Engineering Apprentice Program (SEAP).

The purpose of RSPAC is to support and stimulate broad public use, via the Internet, of remote sensing and other databases maintained by NASA and other agencies. Our goal is to help Internet users learn about NASA and related Internet resources. Toward this end, RSPAC develops and operates a world-class Web site, NASA's Observatory (<http://observe.ivv.nasa.gov>). This site closely parallels the NASA Enterprise areas of Aeronautics, Space Science, Earth Science, and Spaceflight. We also have an entire top-level section devoted to education resources, earth and space imagery, and games.

We believe that clear explanations, especially to the public, of physical and natural science concepts and applications, go hand-in-hand with the practice of these sciences. We also believe that, in the future, this nation will need to have excellent scientist-writers who can translate science and technology into clear, precise, and interesting language.

The successful applicant will have a deep interest in the Observatory/NASA Enterprise areas listed above, basic understandings of the principles, concepts, and applications of these areas, and a desire to communicate these through clear, imaginative writing. The successful applicant will be able to use the Internet and local library resources to conduct research into topics that will become feature articles on the Observatory.

The intern will function as a full member of a content development team, not as an observer. A team consists of a professional scientist, who will be the intern's mentor, a professional graphics artist, and a professional systems administrator and programmer. Since several projects are in-process concurrently, the intern will be a member of several teams at once, working with different individual writers, graphics artists, and computer specialists. Specific topics for Observatory articles may be assigned from existing schedules; we welcome topic proposals by our intern.

Web experience, especially navigation and using search engines is desirable. Other relevant experience including HTML, Java, Perl, etc., while very useful, is not required. Although a strong background in earth and/or space sciences is desirable, a successful applicant may be aiming at a career in journalism or a related writing field. Therefore, our search is not limited to the sciences.

RSPAC invites those who are interested in applying for this challenging position to examine in detail the Observatory at the URL listed above. Come learn with us!

## **SORT's Science Engineering Apprentice Program (SEAP) Intern**

NASA, as with other Government Agencies has been practicing acquisition policies that are mostly sequential in nature. There are significant lags between the time requirements are conceptualized and the time when solutions are designed and eventually implemented. It may take years to field a system from the time requirements are identified. During this time computer processing technologies may have gone through one or more generations of advancement. Additionally, the mission requirements may have changed. By building systems that are based on industry best practices and adaptable, NASA can take advantage of emerging technologies and be capable of evolving with changing mission requirements. Innovative approaches to information systems acquisition may assist in this process. A close look at systems built by NASA shows that they are usually a variation of recurring themes, such as wind-tunnel systems, mission-operation systems, launch support systems, etc. These recurring commonalities can be exploited to create *product-lines*<sup>1</sup> or families of systems.

The Software Optimization and Reuse Technology (SORT) Program has been tasked to identify *product-lines* along with dependencies between NASA centers in supporting the development of product-lines. To complete this task the following products will be produced:

1. *product-lines* issues (technical, management, and acquisition/budget) that need to be resolved to support product-line initiatives at NASA centers.
2. The identification and documentation of possible NASA programs and organizations that may be "ripe" for insertion of *product-line* approach.

SORT's Science Engineering Apprentice Program intern will be tasked to do a requirements analysis (to build, buy, or borrow ) on a tool to track the *product-lines* issues and potential *product-lines* identified by the program. One of the goals of SORT is to have this information available via the World Wide Web (www), so some web interface development will be required.

In any event the intern will assist SORT in development and the capturing of collected data for input into this tracking tool.

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<sup>1</sup> **What is a Product Line:** A product line is a collection of software products that address a common set of system requirements and are organized around a specific business activity

**SEAP task for summer '97:**

The student will develop and verify an environmental plant math model that will be later integrated into the IV&V testbed. The top-level requirement of the model will be to maintain the positions of the GPS satellites. The student will learn basics in the GPS navigation system, orbital mechanics, and software development using MatrixX. The student will formulate the requirements, perform the software design and development, and verify the resulting software module. The student will also prepare the associated documentation such that this module complies with the standards for reuse software.

The following task is recommended for the Science and Engineering Apprentice Program (SEAP) student:

**Develop enhancements to the IV&V Requirements Matrix reporting capabilities.**

Specifically, this includes development of a web based browser of Requirements Matrix contents. This would help to eliminate the management and distribution of this very large product via paper. This would also greatly enhance usability of this product by providing an on-line browsing capability. Additional enhancements could include an input capability by IV&V analysts to specify when IV&V analyses have been completed. However, this would only be done if the above capabilities were delivered. Because we have built numerous similar applications, there is little risk involved. The SEAP student would learn basic software engineering skills. The SEAP student would develop a set of requirements, architectural design, and user's guide.

Richard T Kouzes, 04:38 PM 3/18/97 , No Subject

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Return-Path: rkouzes@wvnm.wvnet.edu  
Date: Tue, 18 Mar 1997 16:38:57 -0500  
To: john.griggs@ivv.nasa.gov  
From: Richard T Kouzes <rkouzes@wvnm.wvnet.edu>

>X-Sender: dleder@wvnm.wvnet.edu  
>To: Richard Kouzes <rkouzes@wvnm.wvnet.edu>  
>From: David Lederman <dleder@wvu.edu>  
>Subject:

>Mime-Version: 1.0  
>Date: Tue, 18 Mar 1997 11:24:50 -0500

>  
>Interest in magnetic thin films has in recent years has been spurred on by  
>technological applications resulting from this research. In particular,  
>research into giant magnetoresistance has resulted in new magnetic  
>detectors that will soon be used in common magnetic devices such as  
>computer disk drives.

>  
>In terms of Space research, there is continuing interest in cryogenic  
>pressure and flow detectors. This is because many of the space experiments  
>are performed at liquid helium temperatures (4 K) or lower. In addition,  
>because many of these experiments are performed in confined geometries,  
>there is a need for small detectors, perhaps only a few millimeters in  
>diameter.

>  
>The main problem that I am attempting to solve is to grow thin films which  
>have the required pressure sensitivity and reproducibility required by  
>NASA. Magnetic thin film technology, specifically the inverse  
>magnetostrictive effect, can be used to fabricate pressure detectors for  
>cryogenic space applications. The normal magnetostrictive effect consists  
>of changes in the size of a magnetic material when it is magnetized. The  
>inverse magnetostrictive effect, also known as the Villari effect, consists  
>of changes in the magnetization of a magnetic material when it is strained.  
> These sensors will be small, and together with state of the art  
>magnctometry, will be sensitive to small changes in pressure. Another  
>application is in the use as accelerometers, again at cryogenic  
>temperatures. Small cryogenic accelerometers are important in liquid  
>helium experiments because they allow experimenters to correct their data  
>in accelerated environments.

>  
>  
>  
>David Lederman  
>West Virginia University  
>Physics Department  
>Morgantown, WV 26506-6315

>  
>Tel: (304) 293-3422 Ext. 1494  
>Fax: (304) 293-5732  
>E-mail: dleder@wvnm.wvnet.edu  
><http://wvnm.wvnet.edu/~dleder/leder.html>

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Richard T. Kouzes, Dir. of Program Development, Science and Engineering  
West Virginia University rkouzes@wvu.edu Professor of Physics  
886 Chestnut Ridge Rd, Morgantown, WV 26506-6216  
Tel: (304)293-8281 Home: (304)296-1165 Fax: (304)293-7498  
URL: <http://www.wvu.edu/~research/people/kouzes.html>

**Richard T Kouzes, 05:00 PM 3/18/97 , Magnetic Project**

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Return-Path: rkouzes@wvnm.wvnet.edu  
Date: Tue, 18 Mar 1997 17:00:08 -0500  
To: john.griggs@ivv.nasa.gov  
From: Richard T Kouzes <rkouzes@wvnm.wvnet.edu>  
Subject: Magnetic Project

>Date: Tue, 18 Mar 1997 15:31:55 +0100  
>From: "Boyd F. Edwards" <bedwards@wvu.edu>  
>Subject: Magnetic Project  
>To: "Kouzes, Richard" <rkouzes@wvu.edu>  
>Reply-to: bedwards@wvu.edu  
>Organization: Department of Physics, West Virginia University  
>MIME-version: 1.0

>  
>Dear Dick:

>  
>Here's a topic for the NASA student:

>  
>Control of Air Bubbles in Liquids Using Strong Magnetic Fields

>  
>Magnetic fields exert small forces on liquids such as water. To  
>demonstrate this effect, the student will construct a demonstration  
>experiment involving a small closed vial of liquid with an air bubble  
>inside, and will show that the position of this air bubble can be  
>controlled by the magnetic field of a small rare-earth permanent magnet.  
>Experiments will be performed on both diamagnetic liquids such as pure  
>water, which are repelled by magnetic fields, and on paramagnetic  
>liquids such as manganese chloride solutions, which are attracted. The  
>student will predict and verify the results of the experiments using the  
>Bernoulli equation generalized to include magnetic fields. The  
>easily-portable experiments will be included in the talk given by the  
>student at the end of his/her project.

>  
>Magnetic forces on fluids become especially important in space, where  
>the effect of gravity is small. An ongoing NASA-sponsored research  
>project at WVU involves the detailed study of the effect of magnetic  
>fields on fluids. The proposed project above will form a part of this  
>ongoing study, and the demonstration experiment built as part of this  
>project will be useful for presentations at conferences by WVU  
>researchers.

>  
>This project was conceived by Dr. Jie Huang, a research assistant  
>professor at WVU and a collaborator on the NASA project.

>  
>Please let me know if this is acceptable.

>  
>-Boyd

>  
> Boyd F. Edwards                    "May there always be starlight on the path."  
> PO BOX 6315                         - Robert Burnham, Jr.  
> Department of Physics  
> West Virginia University  
> Morgantown, WV 26506-6315  
>  
> telf: 304 293-3422 ext. 1433  
> fax: 304 293-5732  
> email: bedwards@wvu.edu  
> url: <http://www.as.wvu.edu/phys/index2.html>

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APPENDIX C  
FINAL EVENT INFORMATION