UNITED STATES AIR FORCE

SUMMER FACULTY RESEARCH PROGRAM

1988

PROGRAM MANAGEMENT REPORT

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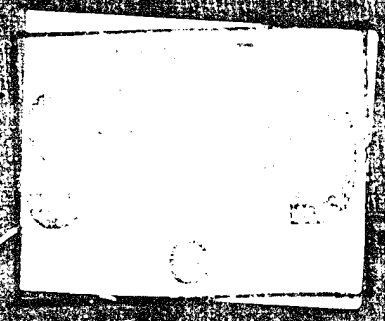

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The purpose of this program is to develop the basis for cintinuing research of interest to the Air Force at the institution of the faculty member; to stiumlate c continuing relations among faculty members and professional peers in the Air Force to enhance the research interests and capabilities of scientific and engineering educators; and to provide follow-on funding for research of particular promise tha was started at an Air Force laboratory under the Summer Faculty Research Program.

During the summer of 1992 185 university faculty conducted research at Air Force laboratories for a period of 10 weeks. Each participant provided a report of thei research, and these reports are consolidated into this annual report.

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UNIVERSAL ENERGY SYSTEMS, INC.

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Program Administrator, UES
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Submitted to

Air Force Office of Scientific Research

Bolling Air Force Base

Washington, DC

December 1988

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I. INTRODUCTION

Universal Energy Systems, Inc. (UES) was awarded the United States Air Force Summer Faculty Research Program on August 15, 1984. The contract is funded under the Air Force Systems Command by the Air Force Office of Scientific Research.

The program has been in existence since 1978 and has been conducted by several different contractors. The success of the program is evident from its history of expansion since 1978.

The Summer Faculty Research Program (SFRP) provides opportunities for research in the physical sciences, engineering, and life sciences. The program has been effective in providing basic research opportunities to the faculty of universities, colleges, and technical institutions throughout the United States.

The program is available to faculty members in all academic grades: instructor, assistant professor, professor, department chairman, and research facility directors. It has proven especially beneficial to young faculty members who are starting their academic research programs and to senior faculty members who have spent time in university administration and are desirous of returning to scholarly research programs.

Beginning with the 1982 program, research opportunities were provided for graduate students. The 1982 pilot student program was highly successful and has expanded from its initial involvement with 17 graduate students to its current level of 107 graduate students in the 1988 program. Initially the graduate students were selected along with their professors to participate in the program. Starting with the 1985 program, the graduate students were selected on their own merits. The students were assigned to be supervised by either a professor on the SFRP or an engineer/scientist at the participating Air Force Laboratory. The following table shows the growth of this program.

Year	Number of graduate students
1982	17
1983	53
1984	84
1985	92
1986	100
1987	101
1988	107

Table 1 Growth of GSRP

The 1988 GSRP report is published as four separate documents under the 1988 Summer Faculty Research Program and are entitled, Graduate Student Summer Support Program Management Report and Technical Reports, Volume I, II and III, October 1988.

Follow-on research opportunities have been developed for a large percentage of the participants in the SFRP. In 1979-1983 period this was accomplished through an AFOSR Minigrant Program.

On 1 September 1983, AFOSR replaced the Minigrant Program with a new Research Initiation Program (RIP). The RIP provides follow-on research awards to home institutions of SFRP participants. Awards were made to approximately 50 researchers in 1983. The awards were for a maximum of $12,000 and a duration of one year or less. Substantial cost sharing by the schools contributes significantly to the value of the RIP.

For the 1985 program, the amount of the RIP was increased to a maximum of $20,000. The growth of the RIP is shown in Table 2.

YEAR	Number of SFRP Fellows	Number of RIP Applicants	Number of RIP Awards
1983	101	No Data	50
1984	152	No Data	80
1985	154	120	82
1986	158	141	97
1987	159	124	83
1988	153	N/A	(Approx. 75)

Table 2 Growth of the RIP

Funding and cost sharing for the RIP is shown in Table 3.

YEAR	Number of RIP's	AFOSR Funding	Cost Sharing
1985	82	$1,551,091.00	$782,812.00
1986	97	$1,932,164.00	$754,857.00
1987	83	$1,646,379.00	$721,398.00

Table 3 RIP Funding and Cost Sharing

Under the SFRP a College Science and Engineering Program and a High School Apprenticeship Program were conducted. These two programs are described in Sections VI and VII of this report.

II. RECRUITING AND SELECTION

The program is conducted on a nationally advertised and competitive selection basis. Advertising for the 1988 program was conducted via direct mail to all accredited schools. The mailing was sent to the department chairman at the schools. The departments included biology, genetics, ecology, entomology, chemistry, computer science, graphics, mathematics, physics, aeronautical engineering, ceramic engineering, chemical engineering, materials science, mechanical engineering, electrical engineering, metallurgy, nuclear science, and psychology. The brochures were also mailed to all of the participants in the 1985 and 1986, and 1987 programs. Brochures were mailed to the Presidents of Historically Black Colleges. The brochures were sent to all participating USAF laboratories/centers; distribution was made through AFROTC units on university campuses; information was supplied to all who

made requests. Overall, more than 17,000 brochures were distributed throughout the country.

Application deadline was February 1, 1988. There were over four (4) applications received for each position available on the 1988 Summer Faculty Research Program. The selection panels met in February. The announcements of selections were mailed on March 1, 1988. In total 182 offers of position were made for the Summer Faculty Research Program, with 153 professors accepting appointments. Table 4 shows the growth in the number of faculty and graduate students participating in the program.

YEAR	Number of SFRP Participants	Number of GSRP Participants
1979	70	0
1980	87	0
1981	87	0
1982	91	17
1983	101	53
1984	152	84
1985	154	92
1986	158	100
1987	159	101
1988	153	107

Table 4 SFRP and GSRP Participation

III. PRE-SUMMER VISIT (Optional)

Each Summer Fellow was directed to contact the designated representative at the laboratory/center of assignment to discuss a pre-summer visit. The purpose of the pre-summer visit is basically threefold: 1) to meet with laboratory personnel, especially the Effort Focal Point with whom the Summer Fellow would be working most closely, and to become personally acquainted with the laboratory facilities; 2) to finalize and formalize objectives for the Summer Fellow's summer research period and report these to UES; 3) to make arrangements for lodging for the research period. The focus of this visit was on making sufficient preparations so that the ten week summer research effort would be effective.

IV. SITE VISITS

Visits listed below include those by UES and AFOSR personnel. The faculty, USAF research colleagues, and student participants are generally satisfied with the program. Criticisms were: a) too much paper work to administer program, b) housing difficult to find, c) delays experienced in receiving payment d) 10 weeks too short for research period.

June 20, 1988 School of Aerospace Medicine
HRL: Training Systems Division
HRL: Manpower and Personnel Division
Occupational and Environment Health Laboratory
Brooks Air Force Base, Texas

June 21, 1988	Armament Laboratory Eglin Air Force Base, Florida
June 22, 1988	Engineering and Services Center Tyndall Air Force Base, Florida
June 23, 1988	Eastern Space and Missile Center Patrick Air Force Base, Florida
June 28, 1988	Arnold Engineering Development Center Arnold Air Force Base, Tennessee
June 29-30, 1988	Wright-Patterson Air Force Base Dayton, Ohio
July 7, 1988	Rome Air Development Center Griffiss Air Force Base, New York
July 8, 1988	Electronics Systems Division Geophysics Laboratory Hanscom Air Force Base, Massachusetts
July 19, 1988	Astronautics Laboratory Edwards Air Force Base, California
July 20, 1988	HRL: Operations Training Division Williams Air Force Base, Arizona
July 21, 1988	Weapons Laboratory Kirtland Air Force Base, New Mexico
July 22, 1988	Frank J. Seiler Research Laboratory United States Air Force Academy, Colorado

Because of the proximity of UES to Wright-Patterson Air Force Base, several site visits were made to the following laboratories:

Aerospace Medical Research Laboratory
Aero Propulsion Laboratory
Avionics Laboratory
Flight Dynamics Laboratory
Human Resources Laboratory
Materials Laboratory
Wright-Patterson Air Force Base, Ohio

We find that the objectives of the SFRP are being well served. SFRP Research Fellows indicate that they are performing independent research, and are not being used as "summer help". There are some misconceptions by research colleagues and summer fellows concerning the purpose of the program; one misconception is that the program is suitable for repeated research efforts by an individual. However, in this program we have found no abuse of the non-personal services requirements. As expected, enthusiasm is high for the possibilities of follow-on funding by

AFOSR at the home university. Research fellows often conduct lectures and seminars at the Air Force locations.

As a record of the documentation supplied to the appointees, the UES Information and Appointment Packets are provided in Appendix I of this report.

V. HISTORICALLY BLACK COLLEGES/UNIVERSITIES (HBCU's) WORKSHOP

In support of the Summer Faculty Research Program, and as part of the UES EEO/Affirmative Action Program, UES sponsored an information booth at the NAFEO (National Association for Equal Opportunity in Higher Education) Conference. The conference was held on March 23 through March 27, 1988. UES provided information on the UES-AFOSR summer programs at this conference.

UES visited various Historical Black Colleges and Universities throughout the country. During these visits faculty and administrators were briefed on the benefits and research opportunities of the SFRP. The targeted groups within the University community were faculty of the Engineering, Physics, Mathematics, Life Sciences, Physical Sciences, and Computer Sciences Departments.

The objectives of the visits are to encourage administration support and faculty participation. The program's reception at each institution was very good.

Because of the contract starting date and the Program Office desires in scheduling, the 1987-88 visitation schedule was decreased by 18% from 1986 schedule. Below is a summary of universities that were visited and the date:

NOVEMBER 1987

Wilberforce University, Wilberforce, OH	November 16
Central State University, Wilberforce, OH	November 17
Philander Smith College, Little Rock, AR	November 18
Arkansas Baptist College, Little Rock, AR	November 18
University of Arkansas, Pine Bluff, AR	November 19
Alabama A&M University, Huntsville, AL	November 23
Talladega College, Talladega, AL	November 23
Tuskegee University, Tuskegee, AL	November 24
Alabama State University, Montgomery, AL	November 25

DECEMBER 1987

Bowie State College, Bowie, MD	December 1
College of the Virgin Islands, VI	December 3, 4, 5
North Carolina Central, Durham, NC	December 8
Fayetteville State Univ., Fayetteville, NC	December 9
North Carolina A&T University, Greensboro, NC	December 10, 11

JANUARY 1988

LeMoyne Owen College, Memphis, TN	January 12
Jackson State University, Jackson, MS	January 13
Tougaloo College, Tougaloo, MS	January 13
Southern University, Baton Rouge, LA	January 14
Dillard University, New Orleans, LA	January 15
Xavier University, New Orleans, LA	January 15
Texas Southern University, Houston, TX	January 19
Prairie View University, Prairie View, TX	January 19
University of Puerto Rico, Mayaguez, PR	January 21
University of Puerto Rico, San Juan, PR	January 22

The success of the HBCU Workshops is demonstrated in the HBCU participation in the SFRP, GSRP, and RIP. Data prior to 1985 is not available for this report. Table 5 lists the participation of the HBCU's in these programs.

YEAR	Number of HBCU SFRP Applicants	Number of HBCU GSRP Applicants	Number of HBCU RIP Applicants
1985	76	15	10
1986	70	20	16
1987	82	32	23
1988	53	23	N/A

YEAR	Number of HBCU on SFRP	Number of HBCU on GSRP	Number of HBCU on RIP
1985	23	11	7
1986	18	10	10
1987	18	10	7
1988	18	14	N/A

Table 5 HBCU Participation

VI. COLLEGE SCIENCE AND ENGINEERING PROGRAM

As part of the Special Studies section of the Summer Faculty Research Program, UES initiated a College Science and Engineering Program for the Astronautics Laboratory in 1988.

The CSEP was sponsored by the Air Force Astronautics Laboratory through the Air Force Office of Scientific Research (AFOSR) and conducted by Universal Energy Systems, Inc. (UES). It provides research opportunities for qualified college students from U.S. universities or technical institutions. These opportunities consist of an eleven week research appointment with the Astronautics Laboratory, located at Edwards Air Force Base, California.

The students were selected from such fields as Analytical Chemistry, Chemical Physics, Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Aeronautical Engineering, Electrical Engineering, Mechanical Engineering, Nuclear Engineering, Material Science and Physics.

The students in this program have the following specific obligations:

1) To participate in research under the direction of a laboratory scientist or engineer at the Astronautics Laboratory.

2) To prepare a report at the end of the summer period describing the summer research accomplishments.

3) To complete an evaluation questionnaire on the program.

The program objectives on the College Science and Engineering Program are as follows:

1) To stimulate among college students broader interest in careers in science and engineering specialties of interest to the Air Force.

2) To establish individual working relationships between students and active researchers.

3) To strengthen the nations efforts to recruit and sustain careers in science and engineering.

The research period of these appointments were for eleven continuous weeks, a maximum of 55 working days. The research was done at the Astronautics Laboratory between 1 June and 30 September.

The stipends for the student researchers in this program depended on the student's degree status:

Freshman	$220.00 per week
Sophomore	$232.00 per week
Junior	$260.00 per week
Senior	$290.00 per week

Travel expenses were reimbursed to the student for one round trip between the student's permanent residence and the Astronautics Laboratory in accordance with the UES travel policy.

The Final Report on this effort was delivered to AFOSR. The CSEP Final Report presents the management information as well as the technical reports for the program.

VII. HIGH SCHOOL APPRENTICESHIP PROGRAM (HSAP)

As part of the Special Studies section of the Summer Faculty Research Program, UES initiated an Air Force High School Apprenticeship Program in 1986. The purpose of the program was to place highly qualified and highly motivated high school students in the Air Force Laboratories for orientation and training in science and engineering. UES provided the recruiting, selection, and management to start up the Air Force HSAP. Much of the program development was based on the successful Army High School Program and material prepared under the contract to the Department of the Army by the National Institute for Work and Learning. To accomplish this effort, UES followed the schedule presented in Table 1. There were 42 High School students participating in the 1986 program and 73 High School students participating in the 1987 program, and 101 students in the 1988 program.

TABLE 1
AIR FORCE HIGH SCHOOL
APPRENTICESHIP PROGRAM

Calendar of Activities

December	o Identify schools and laboratories for participation o Prepare informational material for schools and installations application forms for students and mentors, and covering letters. o Disseminate information o Recruit apprentices, mentors
January	o Send student applications to teachers
February	o Applications with teacher recommendations o Receive mentors' project descriptions and student requirements o Make preliminary selection of students for referral to mentor
March	o Make preliminary matching of students with mentors; send letters with several student applications to each mentor o Mentors interview students, inform UES of choice
April	o Send letters of placement to students, with acceptance forms to be signed by them and parents and returned to UES o Place 2nd year apprentices o Make final matches o See that security clearances are started, where applicable o (Mentors provide background reference material to chosen apprentices) o Encourage enrichment activities: arrange for films, speakers, tours, etc.
May	o Send letters to students and mentors re-opening session o Send students Apprentice Handbook
June	o Arrange general orientation for students and mentors
July, August	o Administer and monitor apprenticeships o Check on enrichment activities o Distribute evaluation forms to students and mentors
September	o Analyze evaluations o Prepare final report to Air Force

In the near future the United States may face shortages of scientists and engineers in such fields as physics, electronic engineering, computer science, and aeronautical engineering. High school students are currently not selecting to prepare for careers in these areas in numbers large enough to match the projected need in the United States.

The Air Force faces "a formidable challenge - the acquisition and retention of the technological competence needed to ensure a strong national security, both in-house and in the industrial and academic base which supports defense preparedness." The Director of the Office and Science of Technology Policy in the Executive Office of the President in 1979 responded to this need by requesting the federal agencies to incorporate in their contract research programs the mechanisms to stimulate career interests in science and technology in high school students showing promise in these areas. The Air Force High School Apprenticeship Program is an example of the response to this.

Under this program, UES placed the selected high school students in a wide variety of scientific and engineering fields at the participating Air Force Laboratories/centers. The students worked for an eight-week period during their summer vacations. UES provided all the support and administration to advertise the program, coordinate applications with the Air Force Laboratory mentors, made final selection of student-mentor matches for the summer, made payment to the students during their working period, and collected and coordinated the final reports from the students.

The Laboratories participating in the program, along with the number of high school students assigned to the laboratory is listed below.

Laboratory	Students
Aero Propulsion Laboratory Dayton, Ohio	4
Armament Laboratory Fort Walton Beach, Florida	16
Astronautics Laboratory Lancaster, California	14
Avionics Laboratory Dayton, Ohio	9
Engineering and Services Center Panama City, Florida	11
Flight Dynamics Laboratory Dayton, Ohio	12
Geophysics Laboratory Boston, Massachusetts	9

Harry G. Armstrong Aerospace Medical Research Laboratory Dayton, Ohio	9
Occupational and Environment Health Laboratory San Antonio, Texas	1
Rome Air Development Center Rome, New York	11
School of Aerospace Medicine San Antonio, Texas	5

There were a total of 101 participants in the program selected from 270 High School student applicants. The final report on the High School Apprenticeship Program is published under a separate report entitled United States Air Force High School Apprenticeship Program 1988 Program Management Report.

APPENDIX I

This appendix presents the following documents which were distributed to appointees and other program participants.

A. Information Brochure for Summer Fellows.

B. Questionnaire for participants and a summary of their replies.

C. Questionnaire for Air Force laboratory representative and a summary of their responses.

D. Questionnaire for participants research colleagues and a summary of their replies.

APPENDIX 1.A

INFORMATION BROCHURE

for

SUMMER FELLOWS

on the

1988 USAF-UES SUMMER FACULTY RESEARCH PROGRAM

March 1988

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I. SUMMER FELLOW OBLIGATIONS

Universal Energy Systems, Inc. (UES) is required by contract to impose certain obligations on you in your status as a Summer Fellow. This section outlines those obligations, and you should read them thoroughly. Your are required to sign and return the statement of understanding before the final processing of your appointment can be completed. The following is a list.

1. Pre-Summer Visit: A pre-summer visit to your research location is optional but has been of great value to previous participants in planning the summer research effort. Approval for such a trip may be granted upon written request to UES along with the concurrence of the Laboratory/Center representative. The purpose of this visit is to enable you to make your final plans for the summer research period if needed. Reimbursement is paid for allowable travel expenses incurred on a pre-summer trip as indicated in the Allowable Travel Expenses section (page 3) of this brochure. To be reimbursed, you must invoice for it as described in the Instructions for Invoicing for Compensation and Reimbursement section (page 5) of this brochure.

2. Research Goals and Objectives: A statement of research objectives must be provided to UES PRIOR TO the start of the summer research period. It should outline your goals and the approach you intend to follow in researching these goals. Neither travel expenses nor expense allowances will be reimbursed until after receipt of your statement of research objectives. The report should also clearly indicate the date of your first working day of the summer research period. In many cases, these will be finalized during the pre-summer visit.

3. Final Report: At the end of your summer research effort, you are required to submit to UES a completed, typewritten scientific report stating the objectives of the research effort, the approach taken, results, and recommendations. Information on the required report format will be sent to you with a "FINAL REPORT INFORMATION BULLETIN" and sample report illustrating a suggested format. The final report must first be approved by your Effort Focal Point and then transmitted so as to reach UES by Friday, September 30, 1988. Payment of "Compensation" for the final two weeks of your ten-week research period cannot be made until UES has received and approved this report in the required format.

4. Program Evaluation Questionnaire: This critique form should be completed and returned to UES, along with your final report, by Friday, September 30, 1988. The return of this form is a program requirement; it also must be received by UES before the final compensation payment can be made.

5. U.S. Air Force - Summer Fellow Relationship: The U.S. Air Force and UES understand and agree that the services to be delivered by Summer Fellows under this contract will be non-personal services and the parties recognize and agree that no employer-employee or master-servant relationships will exist between the U.S. Air Force and the Summer Fellows. Non-personal services are defined as work performed by an individual who is responsible for an end item, such as a report, free of supervision of the U.S. Air Force and free of an employer-employee relationship.

   As a Summer Fellow, you will not:

   (a) Be placed in a position where you are appointed or employed by a Federal Officer or are under the supervision, direction, or evaluation of a Federal Officer, military or civilian.

   (b) Be placed in a staff or policy-making position.

   (c) Be placed in a position of command, supervision, administration, or control over Air Force military or civilian personnel or personnel of other contractors or become a part of the U.S. Air Force organization.

   The services to be performed under the SFRP do not require UES or the Summer Fellow to exercise personal judgement and discretion on behalf of the U.S. Air Force; rather, the Summer Fellows will act and exercise personal judgement and discretion on their research programs on the SFRP conducted by UES.

The Air Force will have unrestricted use of and access to all data developed during the period of this appointment.

II. ALLOWABLE TRAVEL EXPENSES

If you live outside of the area (50 miles) where you will be assigned for the summer program, the SFRP provides potential funding for two trips between your home and your assigned research location. As soon as you have signed and returned your appointment letter along with the budget sheet, you will be authorized to receive reimbursement for travel expenses as described below.

As outlined in the Summer Fellow Obligations section in this brochure, you may make a pre-summer visit in addition to the trip to and from your assigned research location for your summer effort. You are expected to make your own arrangements for these trips, and after the trips you may invoice UES for reimbursement of allowable expenses in the format described in the Instructions for Invoicing for Compensation and Reimbursement section of this brochure. Closely coordinate your travel plans with your FOCAL POINT.

All travel reimbursements under Summer Fellow appointments are made according to current UES policy, and deviations from the approved budget are not authorized and will not be reimbursed. In light of these restrictions, you may choose either to travel by common carrier at coach rates or less, by driving your private auto, or by a combination of both. (Please note that funding for rental cars requires ADVANCED WRITTEN approval by UES and UES will not reimburse this expense unless the prior written approval is obtained.) With any of these choices you may claim reimbursement up to the amount for the most direct routing, taking into the account the desirability of routing on interstate highways if you drive your private auto.

Reimbursement for direct route travel by common carrier will be paid on your submission of an invoice to UES following the invoicing instructions referenced above. In the view of the convenience of having a car at the research location, UES strongly recommends that a private auto be used for travel when practical. Reimbursement when you drive your private auto is at the rate of 20¢ per mile within the above routing restrictions and will be paid on submission of a suitably prepared invoice. These reimbursements cannot be extended to cover travel by your family if they accompany you on either of these authorized trips.

During the pre-summer visit, you will be authorized to claim a per diem reimbursement at the rate of $50.00 per day for a maximum of three days spent at your assigned research location outside of your area of residence. Instructions for claiming this per diem are also described in the Instructions for Invoicing for Compensation and Reimbursement section of this brochure.

During the ten week summer research period, you will be authorized to receive an expense allowance in lieu of a per diem payment at a rate of $42 per day for a maximum of 70 days. To receive this allowance, you must invoice for it and be living (50 miles) outside your area of residence.

These items above are the only reimbursable travel allowances authorized under the SFRP appointment. Any additional travel expenses incurred during the appointment period will be your personal responsibility.

UES has arranged with a travel office in Dayton, Ohio, to have the Air Fare costs of your travel on the SFRP charged directly to UES. For you to take advantage of this you must call this travel service. The number in Dayton, Ohio, is (513) 293-7444 or 1-800-628-6668. You must give the code SLI3 to have the tickets charged to UES. Please reference project 210 when ordering tickets.

III. INSTRUCTIONS FOR INVOICING FOR COMPENSATION AND REIMBURSEMENT

Attached is a copy of the Invoice Format that you are required to use to obtain compensation or reimbursement from UES. Note that all disbursements by UES for compensation, travel, and/or other expenses are subject to audit approval, so you must submit receipts substantiating charges invoiced.

In addition, you must prepare, sign, date and attach to each completed invoice a Brief Report of Effort

A. PREPARATION OF BRIEF REPORT OF EFFORT

Whenever you submit an Invoice for reimbursement to UES you must also include a brief report describing your activities for the invoice period. To meet this obligation, you must prepare, date, sign, and attach to your completed invoice a Brief Report of Effort describing the research accomplished on the appointment and explain any travel during the invoice period.

This report should describe innovative techniques and designs or discoveries which may be disclosed as patents. Rights to any inventions or discoveries shall reside with UES unless determined otherwise by the contracting agency.

The Brief report should never exceed one typewritten page and most often should be considerably shorter than one page.

B. PREPARATION OF INVOICE FORMAT

The financial items required on the Invoice Format are for COMPENSATION, TRAVEL, EXPENSE ALLOWANCE, AND PER DIEM.

Item (1) SOCIAL SECURITY/MAILING ADDRESS

Fill in your name, social security number, and address to which you wish to have your check mailed.

Item (2) COMPENSATION

(a) Indicate the dates for which you are claiming compensation, and indicate the number of days you are claiming for compensation, this may include holidays, such as July 4.

(b) Multiply this number by $124.00 and enter the total dollar amount in the blank total charges for service. The accumulated total number of days you claim on this appointment may not exceed the number authorized in your appointment letter.

Item (3) TRAVEL

(a) Under the heading Date indicate the date you departed on your trip and the date you arrived at your destination. If you are invoicing for a round trip, also list the date you departed on your trip and the date you arrived home.

(b) Under the heading Dept/Arrival Time list the departure and arrival times for the corresponding days you listed under Date.

(c) List your destination under the heading Destination.

(d) Under the heading Mode, indicate your principal means of conveyance; i.e., commercial air, private auto, etc

(e) Under the heading Amount, itemized these expenditures for travel reimbursement. Continue them on a separate sheet if necessary.

(f) Total these travel items and enter the dollar amount for travel in this invoice on the line to the right of Total Travel Expense.

Item (4) EXPENSE ALLOWANCE

This item on the invoice will be used to claim the $42 per day for reimbursement of per diem.

(a) In the first blank to the right of EXPENSE ALLOWANCE enter the number of days for which you are claiming the expense allowance at your assigned research location.

(b) Multiply this number by the daily allowance rate of $42.00 and enter this total dollar amount in the blank at the far right.

(c) Itemize the days for which you are claiming the Expense allowance reimbursement. It can include weekend days and holidays as well as regular work days. It does not apply to the pre-summer visit.

Item (5) PER DIEM

This item will be used to claim reimbursement only for Per diem charges on the optional pre-summer visit. This cannot exceed three days; only days spent at the actual research site are allowed.

(a) In the first blank to the right of PER DIEM enter the number of days reimbursement being requested. This entry must correlate with an accompanying lodging receipt.

(b) Multiply this number by the $50.00 daily Per diem rate and enter the total dollar amount in the blank at the far right.

Item (6) INSTRUCTIONS

You may combine reimbursement requests for compensation, travel, and Per diem or expense allowance in the same invoice. The total for all items invoiced should be indicated on the blank labeled "Total Amount of Bill" in the lower right hand side of line 6.

Item (7) If you have arranged your travel through the UES travel office as described on page 4, please indicate the cost of the tickets on this line.

IMPORTANT: Indicate in the space provide on each invoice the address to which you want the check mailed.

You must sign and date your invoice in the space provided as "Summer Fellow" before it is submitted; you MUST also have your Focal Point countersign the invoice before it is mailed to UES. Your Focal Point is an Air Force individual at your research location who will be identified prior to your effort start date.

Invoices should be mailed to:

Universal Energy Systems, Inc.
SFRP Office
4401 Dayton-Xenia Road
Dayton, Ohio 45432

IV

BILL FOR SERVICE

1. _____ _____
Name (First, Initial, Last) Social Security #

_____
Address (Street, City, Zip)

SERVICE: SFRP Summer Fellow

SERVICE AUTHORIZED BY: Rodney C. Darrah RATE AUTHORIZED: $124.00/day

This service is for:

Government Contract: Project # 210
Government Contract No. F49620-87-R-0004

2. DATES OF SERVICE: _____ TOTAL DAYS OF SERVICE _____

TOTAL CHARGES FOR SERVICE: _____

ADDITIONAL ITEMIZED REIMBURSABLE EXPENSES:
(receipts required for expenditures over $25.00)

3. TRAVEL: DATE _____ DEPT/ARRIVAL TIME _____

DESTINATION MODE _____ AMOUNT _____

4. EXPENSE ALLOWANCE: (_____ days at $42.00/day) $_____

5. PER DIEM: (_____ days at $50.00/day) (Pre Summer Visit) $_____

6. TOTAL AMOUNT OF BILL: _____

7. AIR FARE TICKETS CHARGED DIRECTLY TO UES AMOUNT $_____

_____ _____
Summer Fellow Signature - Date Telephone

Invoice Approval: _____
Effort Focal Point Signature

X_____ Brief Report of Effort Attached _____
Type or Print Name

Location: _____

Telephone: _____

Date: _____

Send bill to:
UNIVERSAL ENERGY SYSTEMS, INC.
ATTN: SFRP Office
4401 Dayton-Xenia Road
Dayton, Ohio 45432

In order for UES to provide quick turn around of your bills for service, we request your assistance in complying with the following schedule. The dates indicated are the dates your bills MUST be at UES. Please allow adequate mailing time for UES to receive your bills by the dates indicated for 1988

DATES BILLS MUST BE AT UES	DATES CHECKS WILL BE MAILED
April 7, 21	April 15, May 2
May 6, 23	May 16, 31
June 8, 23	June 15, 30
July 7, 21	July 15, Aug. 1
August 8, 23	August 15, 30
September 8, 22	September 15, 30
October 6, 21	October 17, 31
	November 15, 30

For bills received on or before these dates, UES will be able to process checks to you in the mail by the 15th and 30th. For bills received after these dates, the checks may not be processed until the next pay period, causing a two week delay in your receiving your check.

Your bill may be for any period of time. It does not have to start on a Monday or end on a Friday. Your bill may be for any period convenient for you to meet our billing dates listed above. Please note these are the dates the bill must be at UES. For example, a bill received on or before April 7 will be mailed out to you on April 15. A bill received on April 8 will not be mailed until the April 25 bills are processed on May 2.

1673s

1988-89 RESEARCH INITIATION PROGRAM

As a participant in the 1988 Summer Faculty Research Program (SFRP) you are eligible to submit a proposal for the AFOSR RIP, as discussed in the 1988 SFRP Brochure.

To compete for a RIP award SFRP participants must submit a complete proposal and proposed budget either during or promptly after their SFRP appointment period. Each proposal will be evaluated for technical excellence, with a special emphasis on relevance to continuation of the SFRP effort, as determined by the Air Force Laboratory/Center. The most effective proposals are those closely coordinated with the SFRP Effort Focal Point and which follow the SFRP effort with proposed research having strong prospects for later sustained funding by the Air Force Laboratory/Center.

The maximum award under the RIP is $20,000 plus cost-sharing by your University/College.

The total funds available from AFOSR will limit the number of awards to approximately 75, or one-half of the 1988 SFRP participants. The final decision on funding a proposal is the responsibility of AFOSR.

The mechanics of applying for a RIP award are as follows:

(1) Program proposals for $20,000 plus cost-sharing must be submitted no later than November 1, 1988. Budgets must include, where applicable, Principal Investigator time, graduate assistant and support effort, equipment and expendable supplies, travel and per diem costs, conference fees, indirect costs, and computer charges. No special format is required, however cost sharing must be indicated on the budget if applicable.

(2) Proposals are evaluated and a final award decision is recommended by AFOSR after consultation with the Laboratory/Center.

(3) Subcontract awards will be negotiated with the employing institution, designating the individual as Principal Investigator, with the award period having a start date no earlier than October 1, 1988 and a completion date no later than December 31, 1989. The performance period of the research may not exceed one year. Employing institutions are encouraged to cost-share since this program is designed specifically as a research initiation procedure.

In summary, a RIP proposal must be:

Technically excellent;
A continuation of SFRP work:
Received no later than November 1, 1988
Budgeted not to exceed $20,000 plus cost-sharing
Less than one year duration.

Proposals for the RIP should be transmitted to UES as soon as possible. Some awards may be made prior to the submission deadline. The first RIP awards are planned to be in effect during the month of December 1988. All awards are expected to be in effect shortly after the final submission deadline of November 1, 1988, with final negotiation with your University completed by January 1, 1989.

Send completed proposals to:

RESEARCH INITIATION PROGRAM
Universal Energy Systems, Inc.
4401 Dayton-Xenia Road
Dayton, Ohio 45432

APPENDIX 1.B

PARTICIPANT'S QUESTIONNAIRE & REPLY SUMMARY

1988 USAF/UES SUMMER FACULTY RESEARCH PROGRAM
EVALUATION QUESTIONNAIRE

(TO BE COMPLETED BY PARTICIPANT)

Name_____Title_____

Dept. (at Home)_____Home Institution_____

Research Colleague_____

Laboratory Address of Colleague_____

Brief Title of Research Topic_____
_____

A. TECHNICAL ASPECTS

1. Was the offer of research assignment within your field of competency and/or interest? YES_____NO_____

2. Did you have a reasonable choice of research assignment? YES____ NO_____
If no, why?_____

3. Was the work challenging? YES_____NO_____. If no, what would have made it so?_____

4. Would you classify your summer effort as research? YES_____NO_____
Comment:_____

5. Were your relations with your research colleague satisfactory from a technical point of view? YES_____NO_____ if no, why?_____
_____
_____

6. Suggestions for improvement of relationship._____
_____
_____

7. Considering the circumstances of a summer program, were you afforded adequate facilities and support? YES_____NO_____ If no, what did you need and why was it not provided?_____
_____

8. Considering the calendar "window" of ten weeks, limited by various college and university schedules, please comment on the program length. Did you accomplish: more than_____;
less than_____;
about what you expected_____?

9. Do you think that you will continue this or related research efforts upon returning to your home institution by applying for a Mini Grant or other funding? YES_____NO_____ Give a brief explanation of your plans._____
_____

10. Were you asked to present seminars on your basic expertise of work? YES_____NO_____ Please list number, dates, approximate attendance, length of seminars, title of presentations.

11. Were you asked to participate in regular meetings in your laboratory? YES_____NO_____ If yes, approximately how often? _____
_____

12. Did you perform travel on behalf of the laboratory? YES_____NO_____
Where to?_____
Purpose?_____

13. List any "special" meetings you may have attended or participated in, such as conferences, visiting lectures, etc._____
_____
_____
_____

14. Other comments concerning any "extra" activities._____
_____
_____

15. On a scale of A to D, how would you rate this program?

	A (High) . . . . D (Low)			
Technically challenging	A	B	C	D
Future research opportunity	A	B	C	D
Professional association	A	B	C	D
Enhancement of my academic qualifications	A	B	C	D
Enhancement of my research qualifications	A	B	C	D
Overall value	A	B	C	D

B. ADMINISTRATIVE ASPECTS

1. How did you first hear of this program?_____
_____

2. What aspect of the program was the most decisive in causing you to apply?_____
_____

3. Considering the time of year that you were required to accept or reject the offer, did this timetable cause you any problems of commitment? YES_____NO_____

4. After your acceptance, was the information on housing, location, directions, etc. supplied to you prior to the summer period satisfactory? YES_____NO_____

5. Did you have any difficulty in any domestic aspects such as, locating suitable housing, acceptance in community, social life, any other "off-duty" aspects? YES_____NO_____ If yes, please explain._____
_____
_____

6. How do you rate the stipend level? Meager_____Adequate____ Generous_____.

7. How important is the expense-paid pre-program visit to the work site? Not worth expense_____Convenient_____Essential_____. Please add any other comments you may have._____

_____

_____

8. Please give information on housing: Did you reside in apartment_____, VOQ_____, other (specify)_____? Name and address of apartment complex and manager's name._____

_____

9. Please suggest names and give sources, of organizations, mailing lists or other information you think would be helpful in advertising next year's program._____

_____

10. Do you believe the Graduate Student Program increased the effectiveness of this program? YES_____NO_____.

11. Did a student work with you? YES_____NO_____ If so, please comment on the Graduate Student Support influence on your summer research._____

_____

12. Considering the many-faceted aspects of administration of a program of this magnitude, how do you rate the overall conduct of this program? Poor_____Fair_____Good_____Excellent_____. Please add any additional comments._____

_____

_____

13. Please comment on what, in your opinion, are:

a. Strong points of the program:_____

_____

_____

_____

b. Weak points of the program:_____

_____

_____

_____

PARTICIPANT QUESTIONNAIRE
(Page 5 of 5)

14. On balance, do you feel this has been a fruitful, worthwhile, constructive experience? YES_____NO_____

15. Other remarks:_____

_____

_____

_____

_____

_____

_____

THANK YOU

1980s

UES 1988 EVALUATION RESPONSE
QUESTIONNAIRE EVALUATION SUMMARY
(Participant)

1. Assignment in field of competency and/or interest? Yes - 152
No - 0

2. Reasonable choice of assignment? Yes - 149
No - 3

If no, why?

One said other offers were made, and another said preference was to work on an existing research project. (One response was not clear to the evaluator).

3. Work challenging? Yes - 146
No - 5

If no, why?

One response did not answer directly, but rater indicated what specific task would have made it challenging. Two others said to have been able to work on some samples or do laboratory/experimental work. Still another suggested complete implementation of the experiment but noted that was beyond the lab's control. The other comment was interaction with people the report was to serve.

4. Would you classify your summer effort as research? Yes - 145
No - 7

Comments:

Yes

Some specified the nature of the project. One said it was a well-defined problem; another clarified it as "applied" rather than "pure" research; and still another noted that research led to submittal of a paper for journal publication.

No

One called it "library work". Another defined it as perfecting of a technique.

5. Were your relations with colleagues satisfactory? Yes - 146
No - 5

If no, why?

6. Suggestions for improvement of relationships.

Scheduling regular seminars and holding more social gatherings and informal events were suggested as ways of improving relations. Other suggestions were more applicable to program administration and included the following: provide more information about the program, announce awards earlier, allow more time prior to the start of the actual work period for meeting with colleague to clarify project, require the colleague be in residence and/or more available for discussion and technical support. One comment asked that more attention be given to matching interests of research colleague with those of participant.

7. Were you afforded adequate facilities?

Yes	139
No	12

If no, why?

8. Accomplishment in ten weeks?

More than expected	28
Less than expected	26
About what expected	98

9. Will you continue this or related research efforts?

Yes	139
No	13

10. Were you asked to present seminars?

Yes	78
No	74

11. Were you asked to participate in meetings?

Yes	84
No	68

12. Did you travel on behalf of the laboratory?

Yes	15
No	136

13. Did you participate in "special" meetings?

Yes	65
No	82

14. Please give other comments on extra activities.

15.

	A (High) . . . D (Low)			
Technically challenging?	A- 109	B- 38	C- 5	D- 0
Future research opportunity?	A- 115	B- 31	C- 1	D- 3
Professional association?	A- 105	B- 36	C- 10	D- 0
Enhancement of my academic qualifications?	A- 69	B- 63	C- 15	D- 5
Enhancement of my research qualifications?	A- 98	B- 41	C- 12	D- 1
Overall value?	A- 116	B- 34	C- 2	D- 0

B. ADMINISTRATIVE ASPECTS

1. How did you first hear about this program?

Colleagues	- 48
Advertisement	- 26
Air Force	- 16
Direct Mail	- 61

2. Decisive aspect of application?

NOTE ON THIS QUESTION, APPLICANTS HAD MORE THAN ONE ANSWER

Area of possible future research funding	- 33
Good research opportunity	- 111
Opportunity to work with USAF	- 37
Location	- 11
Financial support	- 10
Chance of publishable result	- 1
Flexible research schedule	- 2

3. Did the program timetable cause you any problems? Yes - 25
No - 125

4. Program information satisfactory? Yes - 133
No - 12

5. Did you have problems in domestic aspects? Yes - 23
No - 122

If yes, explain:

6. Stipend level?

Generous	- 7
Adequate	- 99
Meager	- 45

7. Travel reimbursement?

Adequate	- 116
Inadequate	- 20
N/A	- 1

NOTE, THAT NOT EVERYONE WENT ON A PRE-PROGRAM VISIT

8. Pre-program visit?

Essential	- 102
Convenient	- 35
Not worth expense	- 5
N/A	- 7

9. Housing information:

VOQ	- 12
Apartment	- 87
Other	- 52

10. Mailing list suggestions?

11. Addition of Graduate Student Program increased effectiveness of program?
NOTE NOT EVERY FACULTY MEMBER HAD A GRADUATE STUDENT WORK WITH THEM, THEREFORE THEY DID NOT ANSWER THIS QUESTION.

Yes - 92
No - 13

12. Did a student work with you?

Yes - 47
No - 102

Comments:

13. Program administration overall rating?

Excellent	- 93
Good	- 50
Fair	- 8
Poor	- 0

14a. Comments on the strong points of the program:

These summarized categories reflect a subjective analysis of comments. Care was taken to be as accurate as possible in interpreting the comments and identifying the breakdown. Most comments included more than one area. There were 95 references to the research opportunity provided, some specifying the aspect of research in government areas and the chance for exchange between academia and the Air Force. A few also noted positive elements related to research outside of academic environments citing the chance to focus completely on the research problem with no distractions.

28 referred to the mini-grant option or possible future funding. 25 mentioned the contacts and the value of continuing work relationships or future work opportunities that result from this. While 28 cited the facilities and resources. 40 included the interaction with colleagues or professional association as important. Some specifically mentioned the hospitality, support, and positive work relationships.

20 complimented the program on the administration aspect, pointing out the lack of excessive paperwork and general ease of operative as strong points for them. Nine liked the independence and flexibility such as latitude in choosing research topics. Two appreciated the student-faculty relationship and the career opportunities for students while one included the stipend as a strong points of the program.

14b. Comments on the weak points of the program:

These summarized categories reflect a subjective analysis of comments. Care was taken to be as accurate as possible in interpreting the comments and identifying the breakdown. Most comments included more than one area. 22 gave funding as a concern, including inadequate coverage for travel and/or moving. (Some specified the stipend was too low for senior faculty).

Almost as often cited was the duration of the program. It was too short or in general restrictive. One suggested way to help this was to spend more time preparing prior to actual start-up when faculty arrive for the program. There were about 20 comments that fell into the area of restrictions and requirements such as daily attendance, the 8 to 5 schedule, reports, paperwork, security clearance, format for reports, etc. A few said that the required schedule didn't allow time to get home during the program.

Approximately 20 listed housing and/or the payroll system (e.g. cash out-of-town checks) as weak points. Included in this number were those who specified relocations as a problem. Nine mentioned the procurement system accounted for delays and made it hard to accomplish goals in the sort period allotted. Fewer than 10 included a need for greater clarification in various aspects of the program such as procedures with the lab, restrictions on choice of project topics, regulations for using the library, etc. Seven mentioned too little interaction with other participants in the program. About five noted limited facilities ore resources, including computer power, library, clerical support and a couple cited limited chances for reappointment or no provision for developing an on-going research relationship.

15. Has this been a fruitful, worthwhile, constructive experience?

Yes - 150
No - 1

16. Other Remarks.

Most comments praised the program in general terms. Some singled out UES for the professional way the program was handled. A few other areas are noted below:

Positive work relationships; congenial staff to work with. One appreciated having graduate students.

Follow-on research is required. (Ten weeks is too short). Would appreciate getting RIP grant.

Request more information be provided on how to obtain funding for future work, housing, maps of the area, a list of other participants (for contact during the project). Also suggested graduate students have a pre-program visit.

Raise RIP ceiling to 35K.

Expand the program to industries.

Move up deadline to November and make decisions by January.

Provide some expense monies.

Issue temporary ID cards to make it possible to enjoy more employee benefits.

Set up a special order department and a supply budget to accommodate special purchases quickly. Procurement procedures caused project delays for some people.

A couple of problem areas cited were banking services (cashing out-of-town checks, etc.), housing arrangements, and lack of services such as access to computers, secretarial support, etc. No suggested solutions were offered.

1980s

APPENDIX 1.C

LABORATORY REPRESENTATIVE'S QUESTIONNAIRE & REPLY SUMMARY

1988 USAF/UES SUMMER FACULTY RESEARCH PROGRAM

EVALUATION QUESTIONNAIRE

(TO BE COMPLETED BY LABORATORY REPRESENTATIVE)

Laboratory/Center _____

Name _____

1. How do you rate the correspondence, verbal and telephone communication, and other aspects concerning program administration?

Excellent____ Good____ Average____ Poor____ How could it be improved?

_____

_____

2. The participant selection process is two-fold: academic and technical. Did you have sufficient time to conduct an evaluation of applications?

YES____ NO____

Comments:_____

_____

_____

3. Was the number of faculty researchers assigned to your organization satisfactory?

YES____NO____. If not, how many would be desired?_____ How do you determine this number?

_____

_____

4. Please rate the expense-paid pre-program visit:

Essential____ Convenient____ Not worth the expense____

5. In your opinion is the ten-week time period an optimum length of time to develop a viable working relationship among the faculty researchers, students, laboratory/center personnel and programs? YES____ NO____. If no, what length would it be.

_____

_____

Other comments:

_____

_____

_____

_____

6. Did your laboratory/center establish a seminar program, or other means, to "tap" the faculty associate's academic knowledge other than his research assignment? YES____NO____.

If yes, give description and evaluation.

_____

_____

_____

7. Did the laboratory/center conduct a general briefing, tour, and/or other formal means of welcome and introduction for the associate assigned to your organization?

YES____ NO____.

8. Did you have a formal exit exercise for each associate such as a final technical briefing presented to the organization management, a private interview, or other?

YES____ NO____.

9. In your opinion, what was the overall quality of this year's participants as measured by attitude, technical competence, work habits, production and meaningful research accomplishment?

(Note: These answers will be held confidential.)

List Names	Superior	Excellent	Average	Poor

10. Do you believe the Graduate Student Program enhances the Summer Research Program?

YES____ NO____

LABORATORY REPRESENTATIVE QUESTIONNAIRE (Page 4 of 5)

11. Was a student assigned under the Graduate Student Summer Support Program to your laboratory this summer? YES____ NO____. If so, was their participation productive? YES____ NO____.

12. Please furnish any recommendations you may have on improving the Graduate Student segment of the program.

_____

_____

_____

_____

_____

13. Site visits were made by Program Director and/or Administrator and the AFOSR representative. Do you feel these visits are beneficial to the program participants and Laboratory in understanding the management of the program? YES____ NO____. Do you feel these visits should be done again next year. YES____ NO____.

14. UES has a coordinator assigned at your base to assist the Summer Faculty participants in the administration of the program. Did you find this beneficial to the program. YES____ NO____. Are there any problem areas coordinators should administrator in future years?

_____

_____

_____

LABORATORY REPRESENTATIVE QUESTIONNAIRE (Page 5 of 5)

15. Please furnish any other comments or suggestion to improve the program in future years.

_____

_____

_____

_____

THANK YOU

1981s

1988 USAF/UES SUMMER FACULTY RESEARCH PROGRAM
EVALUATION QUESTIONNAIRE
LABORATORY REPRESENTATIVE

1. How do you rate the correspondence, verbal and telephone communication, and other aspects concerning program administration?

Excellent	10
Good	6
Average	2
Poor	
No Response	

How could it be improved?

Two comments were given: one requesting copies of the correspondence sent to SFRP participants; the other suggesting replacing a meeting with phone contact.

2. Did you have sufficient time to conduct an evaluation of applications?

Yes	15
No	1

Comments:

The comments indicated there was time pressure, but recognized that the system precluded providing more time. One said administrative changes on the evaluator's part needed to be effected.

3. Was the number of faculty researchers assigned to your organization satisfactory?

Yes	13
No	5

If no, how many would be desired?

The numbers ranged from 9 to 16 as indicated below, with comments included.

9. Consistent with the number requested by my researchers and the Math Lab I support.

15. Interest in this program in our technical divisions is quite high. A larger number of participants would allow us also to expand HBC participation in the SFRP.

14-16. Two professors per RADC directorate.

12. The growth of in-house research conducted within the Lab is such that an additional four faculty members could be well utilized.

10, by the number requested by research colleagues.

4. Please rate the expense-paid pre-program visit:

Essential	- 12
Convenient	- 5
Not worth the expense	-

5. In your opinion is the ten week time period an optimum length of time to develop a viable working relationship among the faculty researchers, students, laboratory/center personnel and programs?

Yes	- 12
No	- 5
N/A	- 1

Other comments:

Five of the ten comments specified 12 weeks as desirable. Another suggested flexible periods of 10-13 weeks. Consistent with this were two comments saying it depended on whether previous work relationship had been established as to what the orientation or supervision would be a higher requirement. One recognized the constraints of the schedule as a reasonable trade-off to ensure more participants as a 12 week program would negatively affect potential number of participants because of university schedules.

6. Did your laboratory/center establish a seminar program, or other means, to "tap" the faculty associate's academic knowledge other than his research assignment?

Yes	- 10
No	- 8

If yes, give description and evaluation.

There seemed to be a variety of approaches to this, with only a few indicating regularly scheduled seminars, such as weekly meetings or seminars. Others had informal seminars and out-briefs. Some briefed in their area of expertise. One person said it was not as formal as he would have liked and was writing a plan to improve this (the report was to be sent to UES.)

7. Did the laboratory/center conduct a general briefing, tour, and/or other formal means of welcome and introduction for the associate assigned to your organization?

Yes	- 13
No	- 5

8. Did you have a formal exit exercise for each associate such as a final technical briefing presented to the organization management, a private interview, or other?

Yes - 12
No - 6

9. In your opinion, what was the overall quality of this year's participants as measured by attitude, technical competence, work habits, production and meaningful research accomplishment?

List Names	Superior	Excellent	Average	Poor
	64	42	8	2

10. Do you believe the Graduate Student Program enhances the Summer Research Program?

Yes - 15
No - 1
N/A - 2

11. Was a student assigned under the Graduate Student Summer Support Program to your laboratory this summer?

Yes - 16
No - 2
N/A -

If so, was their participation productive?

Yes - 14
No -

12. Please furnish any recommendations you may have on improving the Graduate Student segment of the program.

Three saw no problems and praised the program. A couple wanted to increase the number of positions. It was also suggested by two that students only be assigned with faculty members (and one specified that the professors bring their own graduate students and another said the student should have prior experience in working with a faculty summer participant.) A final comment was to have start dates for graduate students coincide with those of the professors with whom they will work.

13. Site visits were made by Program Director and/or Administrator and the AFOSR representative. Do you feel these visits are beneficial to the program participants and Laboratory in understanding the management of the program?

Yes - 15
No - 2
N/A - 1

Do you feel these visits should be done again next year?

Yes - 14
No - 2

14. UES has a coordinator assigned at your base to assist the Summer Faculty participants in the administration of the program. Did you find this beneficial to the program?

Yes - 15
No - 1
N/A - 2

Are there any problem areas coordinators should administrator in future years?

Housing is a problem, as indicated by 4 of the 5 comments. Getting in touch early with both student and faculty could be a way of providing assistance in such areas. The other comment specifically praised the UES Coordinator for the outstanding job she has done.

15. Please furnish any other comments or suggestion to improve the program in future years.

Five expressed satisfaction with the program. One requested more mini-grants; another felt additional publicizing of the program would help. The combination of a summer faculty and graduate student was indicated by one to be more productive than either one working alone.

APPENDIX 1.D

PARTICIPANTS RESEARCH COLLEAGUES QUESTIONNAIRE & REPLY SUMMARY

1988 USAF/UES SUMMER FACULTY PROGRAM
EVALUATION QUESTIONNAIRE
(TO BE COMPLETED BY PARTICIPANT'S RESEARCH COLLEAGUE)

Name_____ Title _____

Division/Group _____ Laboratory _____

Name of
Participant _____

A. TECHNICAL ASPECTS

1. Did you have personal knowledge of the Associate's capabilities prior to arrival at work site? YES___ NO____. If yes, where/how/what?

_____

_____

2. Was the Faculty Associate prepared for his project? YES____ NO___.

3. Please comment on his preparedness, competency, scope, depth of knowledge of subject area: _____

_____

_____

4. Please comment on the Associate's cooperativeness, diligence, interest,
etc._____

_____

_____

5. In your opinion, has his participation in this summer program contributed to an increase in the Associate's potential to perform research? YES____ NO___. Comments:_____

_____

_____

COLLEAGUE QUESTIONNAIRE (Page 2 of 4)

6. Did work performed by the Associate contribute to the overall mission/program of your laboratory? YES____NO___ .
   If yes, how?_____

_____

7. Would you classify the summer effort under the SFRP as research?
   YES___ NO____.

   Comment:_____

8. Was a Graduate Student assigned to your group this summer?
   YES____ NO____. If so, did this enhance the research productivity?
   YES___NO____. Was it an administrative burden? YES___ NO____.

9. Were your relations with the Associate satisfactory from a technical point of view? YES___ NO____. Suggestions as to how they might be improved:_____

_____

_____

10. Do you think that by having a Faculty Associate assigned to your group, others in the group benefited and/or were stimulated by his presence? YES___ NO____. Comments:_____

_____

11. Do you feel that introduction to each other, together with the summer work experience and performance could form a sound basis for continuation of effort by Associate at his home institute?
    YES___ NO____. If yes, how?_____

_____

    If no, why not?_____

_____

12. One of the objectives of this program is to identify sources of basic research capability and availability to the USAF. On a scale of A to D, how effective do you think this program will be in that respect? (high) A B C D (low)

13. Also, please evaluate:

	A (high.....D (low)			
Opportunity to stimulate group activity	A	B	C	D
Professional association	A	B	C	D
Program administration	A	B	C	D

B. ADMINISTRATIVE ASPECTS

1. When did you first hear of this program?

2. Were you involved in the screening and prioritizing of the faculty applicants for your lab? YES___ NO ___. If yes, do you have any suggestions for improvement of the procedures used?_____

_____

3. How do you rate the importance of the expense-paid pre-program visit to the work site? Not worth expense___ Convenient___ Essential___. Please add any comments:_____

_____

4. Considering the calendar "window" of ten weeks (limited by varying college and university schedules), please comment on the program length. Were you as a team able to accomplish more than___, less than___, about what you expected___ Comments:_____

_____

5. Would you desire another Faculty Associate to be assigned to you and/or your group/division? YES___ NO___. If no, why not?_____

_____

6. Would you desire additional Graduate Students in this program? YES___ NO____.

COLLEAGUE QUESTIONNAIRE (Page 4 of 4)

7. Should the Graduate Students only be assigned to research <u>with</u> the Summer Research Faculty Member? YES___ NO____.

8. Should Graduate Students continue to be assigned <u>without</u> Summer Research Faculty supervision? YES___ NO____.

9. Other remarks:_____

_____

_____

1981s

1988 USAF/UES SUMMER FACULTY PROGRAM
EVALUATION QUESTIONNAIRE
(TO BE COMPLETED BY PARTICIPANT'S RESEARCH COLLEAGUE)

A. TECHNICAL ASPECTS

1. Did you have personal knowledge of the Associate's capabilities prior to arrival at work site?

70 YES
54 NO

If yes, where/how/what?

21 a. Previous SFRP or other relationship on related program.

18 b. Publications, symposia, workshops, lectures, professional meetings.

14 c. Application form, resume, pre-program visit, phone.

12 d. Colleague or instructor; recommended by colleague.

2. Was the Faculty Associate prepared for his project?

112 YES
12 NO

3. Please comment on his preparedness, competency, scope, depth of knowledge of subject area:

These categories reflect a subjective analysis of comments. Care was taken to be as accurate as possible in interpreting comments. Comments that included superlatives such as "extremely" or "very" competent, etc., were rated as high or excellent. Unqualified positive statements were in general rated "good."

82 a. Excellent or High

36 b. Good

6 c. Low

Two comments that explained the low ratings were that the Associate's field was not directly related, and that although the Associate's background was appropriate, experience was lacking.

4. Please comment on the Associate's cooperativeness, diligence, interest, etc.

These categories reflect a subjective analysis of comments. Care was taken to be as accurate as possible in interpreting comments. Comments that included superlatives such as "extremely" or "very" competent, etc., were rated as high or excellent. Unqualified positive statements were in general rated "good."

101 a. Excellent

18 b. Good

1 c. Low

5. In your opinion, has his participation in this summer program contributed to an increase in the Associate's potential to perform research?

114 YES
8 NO

Comments:

Responses were categorized for ease of summarization and ranged from:

29 a. Exposure to new areas or increased experience with somewhat unfamiliar areas.

24 b. Exposure to Air Force or government problems and research.

15 c. Demonstrated problem solving or advanced research that can be built on.

10 d. Access to better research facilities, more research scientists, professional opportunities that contributed to development of Associate's potential.

9 e. Practical application of knowledge.

8 f. Material for publication or specific plan for continued joint research.

7 g. Contributed to professional growth including such areas as team work and professional networking.

One response state that the Associate was already at his or her potential; another noted that the associate's background was not suited to the project.

6. Did work performed by the Associate contribute to the overall mission/program of your laboratory?

129 YES
4 NO

If yes, how?

Responses ranged from more general areas, such as saving time, to specific or more quantifiable contributions, such as discoveries. Some of these are grouped below. Again, categories were developed to aid in summarizing comments and are necessarily less complete than actual responses.

52 a. Contributed new methods, techniques, viewpoints, and skills; and enhanced technical understanding.

18 b. Contributed in such areas as increasing databases, requirement gathering, statistical support, data analysis, literature search, etc.

11 c. Identified or solved problems that will save time, improve accuracy, etc.

11 d. Made discoveries or developed technology to include: onion transporting membrane, lower acid-base buffer, NTO decomposition kinetics and activation energy, coupling concept, bone removal, electromagnetic topology theory, measurement improvement, testing.

5 e. Trained others.

7. Would you classify the summer effort under the SFRP as research?

116 YES
7 NO

Comment:

Comments indicated that the time period is too short.

8. Was a Graduate Student assigned to your group this summer?

59 YES
64 NO

If so, did this enhance the research productivity?

41 YES
9 NO

Was it an administrative burden?

0 YES
51 NO

9. Were your relations with the Associate satisfactory from a technical point of view?

121 YES
3 NO

Suggestions as to how they might be improved:

Suggestions for improvement centered on being allocated more time to spend with the Associate.

10. Do you think that by having a Faculty Associate assigned to your group, others in the group benefited and/or were stimulated by his presence?

108 YES
15 NO
1 N/A

Comments:

Comments that supported affirmative responses treated some aspects of cross fertilization of information and exchange of ideas.

Those comments that related to a negative response, of which there were few, indicated such things as:

- Little interfacing with others, or little opportunity for sharing. (To qualify their answers, some specifically indicated that the nature of the project did not require or allow group interaction or exchange of ideas.)
- The associate brought no RIP with him.
- Research topic is too specialized, or the problem is unique.

11. Do you feel that introduction to each other, together with the summer work experience and performance could form a sound basis for continuation of effort by Associate at his home institute?

110 YES
14 NO

If yes, how?

Responses fell into the following areas:

- 32 mentioned that a mini-grant or other proposal is projected or funding of some kind is required. Fifty specified technical or research areas and/or indicated plans to continue that line of research. Only three pointed out a need to either make occasional visits to WPAFB for use of facilities, or purchase equipment in order to continue their research at the home institute.

If no, why not?

There were very few comments, as noted here:

- Project is limited to this site; lack of costly instrumentation or equipment; and area of research is either not compatible with the Associate's primary focus, or not supported by the home institution. (In one case, the comment noted there was communication difficulty.)

12. One of the objectives of this program is to identify sources of basic research capability and availability to the USAF. On a scale of A to D, how effective do you think this program will be in that respect? (high) A B C D (low)

The breakdown of the responses was:
A-68, B-40, C-4, and D-nine.

13. Also, please evaluate:

Evaluation of the following three areas ranged from high (A) to low (D) with the following breakdown:

	A	B	C	D
Opportunity to stimulate group activity	76	35	11	2
Professional association	81	27	3	1
Program administration	63	46	11	4

B. ADMINISTRATIVE ASPECTS

1. When did you first hear of this program?

22 a. Recently, up to one year ago, or 1987.

36 b. Two to four years ago, or 1983, 1984, 1985, 1986.

38 c. Several (five or more) years ago, including statements such as "when the program began."

2. Were you involved in the screening and prioritizing of the faculty applicants for your lab?

79 YES
44 NO

If yes, do you have any suggestions for improvement of the procedures used?

There were very few comments, but the suggestions for improvement included:

- More material, such as research papers, to evaluate area of research compatibility.
- Government researchers should screen applicants.
- Eliminate meeting of UES and lab representatives.
- Assign only the number of associates requested.
- Standardize procedures, establish criteria.
- Send all applications to the lab at the same time.
- Increase the selection basis.
- Make final decisions earlier (move the deadline ahead one month).

3. How do you rate the importance of the expense-paid pre-program visit to the work site?

2	Not worth expense
30	Convenient
85	Essential

Please add any comments:

Comments focusing on the value of the visits fell into two major areas with the first category often delineated into one of two subcategories.

16 1. Facilitating quicker start-up of the research effort.

In addition to the general comment, some elaborated on how this aided in start-up.

30 a. By clarifying goals and direction in advance, and getting necessary supplies or other resources in time.

9 b. By familiarizing Associate with research, personnel, and resources in advance.

7 2. Aiding the Associate in obtaining living accommodations, or in handling administrative activities.

Two responses which did not fall into these categories were:

- Associate lived in the area; depends on the candidate - valuable, but not essential.

4. Considering the calendar "window" of ten weeks (limited by varying college and university schedules), please comment on the program length. Were you as a team able to accomplish

26 more than
20 less than
77 about what you expected

Comments:

16 a. Ten weeks is too short to accomplish a great deal. Extend it to 12 weeks. A variation on this was offered by two other commentors who suggested to make it flexible - 8 to 12 weeks or even as long as 14 weeks. This would attract more applicants.

9 b. Prior planning and preparation are essential. Without the pre-program visit for planning, or voluntary overtime, the time would have been too short.

3 c. Technical or equipment problems hampered work.

5. Would you desire another Faculty Associate to be assigned to you and/or your group/division?

119 YES
3 NO

If no, why not?

The three comments indicated the following requests for consideration: One wanted to keep the same person because of unique work experience and knowledge; another requested "better screening"; and the other asked that more support for the program be offered by the Branch and Division.

6. Would you desire additional Graduate Students in this program?

87 YES
26 NO
9 N/A

7. Should the Graduate Students only be assigned to research with the Summer Research Faculty Member?

55 YES
54 NO
16 N/A

8. Should Graduate Students continue to be assigned without Summer Research Faculty supervision?

65 YES
38 NO
21 N/A

9. Other remarks:

Most of the remarks were general statements reinforcing the value of the program to both researchers and host laboratories, and praising UES and the program.

Some additional information included the following:

- Greatest benefit is seen with follow-on research proposals and activities, since one summer is not long enough. Suggested two-year awards be considered.
- More students should be on site.
- UES should encourage the development of a good task plan, for summer faculty down to summer high school students, that wouldprovide guidance to prospective mentors.
- If the graduate student did not come with an advisor, it might put too much demand on colleague's time to supervise.
- Problems in obtaining housing. Arrangements might be made by UES and some rental complexes to facilitate this process.
- Increase the mini-grant to $35K.

1981s

APPENDIX II

A. Program Statistics

B. List of 1988 Participants

C. Participant Laboratory Assignments

APPENDIX II A

Summer Faculty Research Program

Sponsored by
Air Force Office of Scientific Research

Conducted by
Universal Energy Systems, Inc.

Program Statistics

Program Statistics

1. Applications Received (by Laboratory)

Organization		Choice 1st	2nd	3rd	Total
Aerospace Medical Research Laboratory	(WPAFB)	43	35	10	88
Aero Propulsion Lab.	(WPAFB)	30	24	12	66
Armament Laboratory	(Eglin)	21	27	12	60
Arnold Engineering Development Center	(Arnold)	6	10	7	23
Astronautics Laboratory	(Edwards)	25	18	25	68
Avionics Laboratory	(WPAFB)	30	15	11	56
Engineering and Services Center	(Tyndall)	37	26	13	76
Electronic Systems Div.	(Hanscom)	9	12	5	26
Eastern Missile and Space Center	(Patrick)	8	3	3	14
Flight Dynamics Lab.	(WPAFB)	40	27	7	74
Frank J. Seiler Research Laboratory	(USAFA)	14	15	9	38
Geophysics Laboratory	(Hanscom)	36	6	7	49
Human Resources Lab.	(Williams, Brooks and WPAFB)	54	26	26	106
Materials Laboratory	(WPAFB)	46	25	15	86
Occupational and Environment Health Lab.	(Brooks)	19	22	3	44
Rome Air Development Ctr.	(Griffiss)	62	41	20	123
School of Aerospace Med.	(Brooks)	44	22	13	79
Wilford Hall Medical Ctr.	(Lackland)	12	8	5	25
Weapons Laboratory	(Kirtland)	32	32	19	83
Late Applications		42			
	Totals	610	394	222	

2. Number of Participants - 153

Number with Bachelors Degree	- 2
Number with Masters Degree	- 10
Number with Doctorate Degree	- 141

3. Academic Ranking

Assistant Professor	- 64
Associate Professor	- 39
Department Chairman	- 4
Instructor	- 4
Professor	- 40
Researcher	- 2

4. Number of Participants at Each Laboratory

Organization		
Aerospace Medical Research Laboratory	(WPAFB)	10
Aero Propulsion Laboratory	(WPAFB)	8
Armament Laboratory	(Eglin)	8
Arnold Engineering Development Ctr.	(Arnold)	5
Astronautics Laboratory	(Edwards)	8
Avionics Laboratory	(WPAFB)	8
Eastern Space & Missile Center	(Patrick)	1
Electronic Systems Division	(Hanscom)	2
Engineering and Services Center	(Tyndall)	8
Flight Dynamics Laboratory	(WPAFB)	10
Frank J. Seiler Research Laboratory	(USAFA)	7
Geophysics Laboratory	(Hanscom)	12
Human Resources Laboratories	(Brooks)	14
Materials Laboratory	(WPAFB)	12
Occupational & Environment Health Lab.	(Brooks)	4
Rome Air Development Center	(Griffiss)	12
School of Aerospace Medicine	(Brooks)	16
Weapons Laboratory	(Kirtland)	6
Wilford Hall Medical Center	(Lackland)	2
	Totals	153

5. Discipline Represented -

Aerospace Engineering	- 2	Exercise Physiology	- 2
Analytical Chemistry	- 1	Genetics	- 1
Applied Mathematics	- 4	Industrial Engineering	- 2
Atmospheric Science	- 2	Inorganic Chemistry	- 3
Biochemistry	- 2	Language	- 1
Biology	- 4	Material Science	- 3
Biomedical Engineering	- 1	Mathematics	- 8
Chemical Engineering	- 6	Mechanical Engineering	- 20
Chemistry	- 13	Molecular Biology	- 2
Civil Engineering	- 3	Organic Chemistry	- 3
Cognitive Psychology	- 2	Philosophy	- 3
Computer Science	- 4	Physical Chemistry	- 5
Dentistry	- 1	Physics	- 17
Electrical Engineering	- 12	Physiology	- 2
Engineering	- 12	Psychology	- 7
Entomology	- 1	Statistics	- 4

6. Colleges and Universities Represented - Total 118

Akron, University of	- 1	Maine, University of	- 1
Alabama, University of	- 1	Meharry Medical College	- 1
Albany College	- 1	Miami University	- 1
Arizona State University	- 1	Miami, University of	- 1
Arizona, University of	- 1	Michigan State University	- 1
Arkansas State University	- 1	Michigan Tech. University	- 1
Arkansas, University of	- 2	Michigan, University of	- 2
Auburn University	- 1	Minnesota, University of	- 1
Austin Peay State University	- 1	Missouri Western State Coll.	- 1
Ball State University	- 1	Missouri, University of	- 2
Boston College	- 1	Montana, University of	- 1
California State University	- 2	Montclair State College	- 1
California, University of	- 1	Morehouse College	- 1
Calvin College	- 1	Muhlenberg College	- 1
Carnegie Mellon University	- 1	Murray State University	- 1
Central State University	- 3	Nebraska, University of	- 1
Central Wesleyan College	- 1	New Hampshire, Univ. of	- 3
Cincinnati, University of	- 3	New Mexico, University of	- 1
Clarkson University	- 2	New York State University	- 2
Clemson University	- 1	New York, City College of	- 1
Colorado State University	- 2	North Carolina State Univ.	- 1
Columbia Basin College	- 1	North Carolina, Univ. of	- 2
Dayton, University of	- 5	Northern Illinois Univ.	- 1
Delta State University	- 1	Ohio State University	- 2
East Texas State University	- 1	Oklahoma State University	- 1
Eastern New Mexico Univ.	- 1	Oral Roberts University	- 1
Fairleigh Dickinson Univ.	- 1	Oregon Inst. of Technology	- 2
Fayetteville State Univ.	- 1	Oregon State University	- 1
Florida Inst. of Technology	- 1	Pennsylvania State Univ.	- 1
Florida, University of	- 1	Polytechnic University	- 1
Francis Marion University	- 1	Prairie View A&M Univ.	- 2
George Mason University	- 1	Presbyterian College	- 1
Georgia Inst. of Technology	- 2	Purdue University	- 1
Georgia, University of	- 1	Redlands, University of	- 1
Gonzaga University	- 1	Rennsselaer Polytechnic Inst	- 1
Hampton University	- 1	Rice University	- 1
Illinois Inst. of Technology	- 1	Rochester Inst. of Tech.	- 1
Indiana University	- 1	Rose-Hulman Inst. of Tech.	- 1
Iowa State University	- 1	Saint Paul's College	- 1
Jackson State University	- 3	San Francisco State Univ.	- 1
Jacksonville State Univ.	- 1	Santa Clara University	- 1
Jarvis Christian College	- 1	Southeast Oklahoma State U.	- 1
Kentucky, University of	- 1	Southern Mississippi, Univ.	- 1
LaVerne, University of	- 1	Southern University	- 2
Louisiana State University	- 2	Southwest Missouri State U.	- 1
Louisiana Tech. University	- 1	St. Norbert College	- 1
Lowell, University of	- 2	Staten Island, College of	- 1

Continued

Program Statistics
Continued

6. Colleges and Universities Represented (Continued)

Syracuse University	- 1	Warren Wilson College	- 1
Taylor University	- 1	Wayne State University	- 1
Tennessee Space Inst., Univ.	- 1	Wesleyan College	- 1
Tennessee Tech. University	- 2	West Florida, University of	- 1
Tennessee, University of	- 1	West Texas State Univ.	- 1
Texas A&I University	- 1	West Virginia Tech.	- 1
Texas Lutheran College	- 1	Western Illinois University	- 1
Texas, University of	- 4	Western Michigan University	- 1
Towson State University	- 1	Widener University	- 1
Trinity University	- 1	Wilberforce University	- 1
Tuskegee University	- 1	Wisconsin-Madison, Univ. of	- 1
Virginia Polytechnic Inst.	- 1	Wright State University	- 5
		Total	153

Program Statistics
Continued

7. States Represented - Total 38

Alabama	- 4
Arizona	- 2
Arkansas	- 3
California	- 7
Colorado	- 2
Delaware	- 1
Florida	- 3
Georgia	- 4
Illinois	- 4
Indiana	- 4
Iowa	- 1
Kentucky	- 2
Louisiana	- 5
Maine	- 1
Maryland	- 1
Massachusetts	- 2
Michigan	- 8
Minnesota	- 1
Mississippi	- 5
Missouri	- 4
Montana	- 1
Nebraska	- 1
New Hampshire	- 4
New Jersey	- 3
New Mexico	- 2
New York	- 10
North Carolina	- 6
Ohio	- 21
Oklahoma	- 3
Oregon	- 3
Pennsylvania	- 4
South Carolina	- 4
Tennessee	- 6
Texas	- 13
Virginia	- 3
Washington	- 2
West Virginia	- 1
Wisconsin	- 2

8. Age of Participants -

Average - 44

APPENDIX II B

LIST OF PARTICIPANTS

LIST OF 1988 PARTICIPANTS

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Ibrahim A. Ahmad Professor and Director Division of Statistics Dept. of Math Sciences Northern Illinois University DeKalb, IL 60115 (815) 753-6739	Degree: Ph.D., Statistics, 1975 Specialty: Statistics and Operations Research Assigned: Armament Laboratory
Dr. Robert J. Arenz Professor Dept. of Mechanical Engineering Gonzaga University Spokane, WA 99258 (509) 328-4220	Degree: Ph.D., Aeronautical Eng., 1964 Specialty: Solid Mech. Assigned: Materials Laboratory
Dr. Lucia M. Babcock Assistant Professor Dept. of Chemistry Louisiana State University Choppin Hall Baton Rouge, LA 70803 (504) 388-3239	Degree: Ph.D., Chemistry, 1978 Specialty: Gas Phase Ion-Molecule Chem. Assigned: Air Force Geophysics Lab.
Dr. Praphulla K. Bajpai Professor Dept. of Biology University of Dayton 300 College Park Dayton, OH 45469 (513) 229-3029	Degree: Ph.D., Animal Physiology, 1965 Specialty: Physiology and Biomaterials Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. Stephen D. Baker Professor Dept. of Physics Rice University Houston, TX 77251-1892 (713) 527-8101	Degree: Ph.D., Physics, 1963 Specialty: Nuclear Physics Assigned: Air Force Geophysics Lab.
Dr. Pradip M. Bakshi Research Professor Dept. of Physics Boston College Chestnut Hill, MA 02167 (617) 552-3585	Degree: Ph.D., Theoretical Physics, 1962 Specialty: Quantum Theory Assigned: Air Force Geophysics Lab.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Shankar S. Bale Professor Dept. of Science and Math Saint Paul's University Lawrenceville, VA 23868 (804) 848-3111	Degree: Ph.D., Genetics, 1971 Specialty: Toxicology-Cytogenetics Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Mr. Beryl L. Barber Assistant Professor Dept. of Electronics Eng. Oregon Institute of Technology 3201 Campus Drive Klamath Falls, OR 97601-8801 (503) 882-6890	Degree: MSEE, Electrical Eng., 1961 Specialty: RF/Microwave Components Assigned: Rome Air Development Center
Dr. Bryan R. Becker Assistant Professor Dept. of Aerospace Engineering University of Missouri 600 West Mechanic Independence, MO 64050-1799 (816) 276-1279	Degree: Ph.D., Eng. Science, 1979 Specialty: Computational Fluid Dynamics Assigned: Aero Propulsion Laboratory
Dr. Reuben Benumof Professor Dept. of Applied Sciences College of Staten Island 130 Stuyvesant Pl. Staten Island, NY 10301 (718) 390-7973	Degree: Ph.D., Physics, 1945 Specialty: Semiconductor Physics Assigned: Air Force Geophysics Lab.
Mr. George N. Bratton Associate Professor Dept. of Math and Comp. Science Austin State Peay State Univ. P O Box 8343 Clarksville, TN 37044 (615) 648-7834	Degree: Ed.D., Mathematics Ed., 1977 Specialty: Statistics Assigned: Electronics Systems Division
Dr. Dan R. Bruss Assistant Professor Dept. of Physical Sciences Albany College of Pharmacy 106 New Scotland Avenue Albany, NY 12208 (518) 445-7225	Degree: Ph.D., Chemistry, 1985 Specialty: Physical Organic Chemistry Assigned: Frank J. Seiler Research Lab.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Ronald Bulbulian Associate Professor Dept. of Health, Physical Education and Recreation University of Kentucky Seaton 100 Lexington, KY 40506 (606) 257-7904	Degree: Ph.D., Physiology, 1980 Specialty: Exercise Physiology Assigned: School of Aerospace Medicine
Dr. Charles M. Bump Assistant Professor Dept. of Chemistry Hampton University P O Box 6483 Hampton, VA 23668 (804) 727-5330	Degree: Ph.D. Organic Chemistry, 1979 Specialty: Organic Synthesis Assigned: Frank J. Seiler Research Lab.
Dr. John A. Burke, Jr. Professor Dept. of Chemistry Trinity University 715 Stadium Drive San Antonio, TX 78284 (512) 736-7316	Degree: Ph.D., Chemistry, 1963 Specialty: Inorganic Compounds Assigned: School of Aerospace Medicine
Mr. Mike Burlakoff Assistant Professor Dept. of Computer Science Southwest Missouri State Univ. 901 S. National Springfield, MO 65804 (417) 836-5930	Degree: MS., Math, Computer Sci., 1965 Specialty: Computer Science Assigned: Avionics Laboratory
Dr. Larry W. Byrd Assistant Professor Dept. of Mechanical Engineering Arkansas State University P O Box 1080 State University, AR 72467-1080 (501) 972-3421	Degree: Ph.D., Mechanical Eng., 1984 Specialty: Mechanical Engineering Assigned: Flight Dynamics Laboratory
Dr. Clarence Calder Associate Professor Dept. of Mechanical Engineering Oregon State University Corvallis, OR 97331 (503) 754-2427	Degree: Ph.D., Mechanical Eng., 1969 Specialty: Stress Wave Propagation Assigned: Astronautics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Richard T. Carlin Assistant Professor Dept. of Chemistry Polytechnic University 333 Jay St. Brooklyn, NY 11201 (718) 260-3339	Degree: Ph.D., Chemistry, 1983 Specialty: Inorganic Chemistry Assigned: Frank J. Seiler Research Lab.
Dr. Gene O. Carlisle Professor Dept. of Chemistry and Physics West Texas State University Canyon, TX 79016 (806) 656-2282	Degree: Ph.D., Inorganic Chem., 1969 Specialty: Coordination Chemistry Assigned: Materials Laboratory
Dr. Patricia Carlson Professor Dept. of Humanities Rose-Hulman Institute of Tech. 5500 Wabash Terre Haute, IN 47803 (812) 877-1511	Degree: Ph.D., Language & Lit., 1973 Specialty: Document Design Assigned: Human Resources Laboratory: Logistics & Human Factors Div.
Dr. David R. Cecil Professor Dept. of Mathematics Texas A&I University Campus Box 172 Kingsville, TX 78363 (512) 592-1839	Degree: Ph.D., Mathematics, 1962 Specialty: Algebra (Finite Fields) Assigned: Wilford Hall Medical Center
Dr. Wayne A. Charlie Associate Professor Dept. of Civil Engineering Colorado State University Fort Collins, CO 80523 (303) 491-8584	Degree: Ph.D., Civil Engineering, 1975 Specialty: Geotechnical Engineering Assigned: Engineering & Services Center
Dr. Steven C. Chiesa Assistant Professor Dept. of Civil Engineering Santa Clara University Santa Clara, CA 95053 (408) 554-4697	Degree: Ph.D., Civil Eng., 1982 Specialty: Biological Waste Treatment Assigned: Occupational and Environment Health Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Karen C. Chou Associate Professor Dept. of Civil Engineering Syracuse University Syracuse, NY 13244-1190 (315) 423-3314	Degree: Ph.D., Structural Eng., 1983 Specialty: Structural Engineering Assigned: Flight Dynamics Laboratory
Dr. Phillip A. Christiansen Associate Professor Dept. of Chemistry Clarkson University Potsdam, NY 13676 (315) 268-4099	Degree: Ph.D., Physical Chem., 1978 Specialty: Physical Chemistry Assigned: Astronautics Laboratory
Dr. Keith A. Christianson Assistant Professor Dept. of Electrical Engineering University of Maine Orono, ME 04469 (207) 581-2244	Degree: Ph.D., Materials Science and Engineering, 1985 Specialty: Electronic Materials Assigned: Rome Air Development Center
Dr. Mingking K. Chyu Assistant Professor Dept. of Mechanical Eng. Carnegie Mellon University Pittsburgh, PA 15213 (412) 268-3658	Degree: Ph.D., Heat Transfer, 1986 Specialty: Heat Transfer Assigned: Aero Propulsion Laboratory
Dr. Jerry D. Clark Assistant Professor Dept. of Physics Wright State University 248 Fawcett Hall Dayton, OH 45435 (513) 426-3917	Degree: Ph.D., Physics, 1982 Specialty: Atomic Physics Assigned: Aero Propulsion Laboratory
Dr. Lane Clark Assistant Professor Dept. of Mathematics University of New Mexico Albuquerque, NM 87106 (505) 277-2104	Degree: Ph.D., Mathematics, 1980 Specialty: Graph Theory Assigned: Weapons Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Donald F. Collins Faculty in Physics Dept. of Physics Warren Wilson College Swannanoa, NC 28778 (704) 298-3325	Degree: Ph.D., Physics, 1970 Specialty: Optics, Image Processing Assigned: Air Force Geophysics Lab.
Dr. Susan T. Collins Assistant Professor Dept. of Chemistry California State University 18111 Nordhoff Street Northridge, CA 91330 (818) 885-3367	Degree: Ph.D., Physical Chem., 1981 Specialty: Matrix Isolation Spectroscopy Assigned: Astronautics Laboratory
Dr. Charles D. Covington Assistant Professor Dept. of Electrical Engineering University of Arkansas Bell Engineering Center 3217 Fayetteville, AR 72701 (501) 575-6583	Degree: Ph.D., Electrical Eng., 1984 Specialty: Digital Signal Processing Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. Parvis Dadras Professor Dept. of Mech. Systems Eng. Wright State University Dayton, OH 45435 (513) 873-2944	Degree: Ph.D., Mechanical Eng., 1972 Specialty: Mechanics of Materials Assigned: Materials Laboratory
Dr. John F. Dalphin Professor Dept. of Computer Science Towson State University Baltimore, MD 21204 (301) 321-3701	Degree: Ph.D., Mathematics, 1973 Specialty: Computer Science Assigned: Electronics Systems Division
Mr. Darin S. DeForest Research Associate Dept. of Computer Science Arizona State University Tempe, AZ 85287 (602) 965-3664	Degree: B.Sc., Computer Science, 1984 Specialty: Programming Language Design Assigned: Rome Air Development Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. David H. DeHeer Associate Professor Dept. of Biology Calvin College 3201 Burton Street, S.E. Grand Rapids, MI 49506 (616) 957-6083	Degree: Ph.D., Molecular Biology, 1972 Specialty: Molecular Biology Assigned: Engineering & Services Center
Dr. Eustace L. Dereniak Associate Professor Dept. of Optical Science University of Arizona 528 N. Martin Tucson, AZ 85719 (602) 621-1019	Degree: Ph.D., Optics, 1976 Specialty: Infrared Physics Assigned: Arnold Engineering Development Center
Prof. Paul T. Dingman Assistant Professor Dept. of Electronics Eng. Tech. Oregon Institute of Technology 3201 Campus Drive Klamath Falls, OR 97601-8801 (503) 882-6890	Degree: MSEE., Electrical Eng., 1974 Specialty: Digital, Microprocessors Assigned: Rome Air Development Center
Dr. David A. Dolson Assistant Professor Dept. of Chemistry Murray State University Murray, KY 42071 (502) 762-4490	Degree: Ph.D., Physical Chem., 1981 Specialty: Laser Spectroscopy Assigned: Weapons Laboratory
Dr. Hugh K. Donaghy Assistant Professor Dept. of Computer Science Rochester Inst. of Technology 1 Lomb-Memorial Drive Rochester, NY 14623 (716) 475-2994	Degree: Ph.D., Philosophy, 1972 Specialty: Natural Language Processing Assigned: Rome Air Development Center
Dr. Stephen J. Dow Assistant Professor Dept. of Math and Statistics Univ. of Alabama in Huntsville Huntsville, AL 35899 (205) 895-6252	Degree: Ph.D., Mathematics, 1982 Specialty: Discrete Mathematics Assigned: Armament Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Derek Dunn-Rankin Assistant Professor Dept. of Mechanical Engineering University of California 616 Engineering Irvine, CA 92717 (714) 854-0460	Degree: Ph.D., Mechanical Eng., 1985 Specialty: Laser Diagnostics (combustion) Assigned: Aero Propulsion Laboratory
Dr. Deanna S. Durnford Assistant Professor Dept. of Agric. & Chem. Eng. Colorado State University Ft. Collins, CO 80523 (303) 491-5252	Degree: Ph.D., Civil Eng., 1982 Specialty: Groundwater Assigned: Engineering & Services Center
Dr. Suren N. Dwivedi Associate Professor Dept. of Mechanical Eng. University of North Carolina Charlotte, NC 28223 (704) 547-2303	Degree: Ph.D., Engineering, 1976 Specialty: Material Processing Assigned: Materials Laboratory
Dr. Wayne A. Eckerle Associate Professor Dept. of Mech. & Ind. Eng. Clarkson University Potsdam, NY 13676 (315) 268-2203	Degree: Ph.D., Fluid Mech., 1985 Specialty: Experimental Fluid Mechanics Assigned: Aero Propulsion Laboratory
Dr. J. Kevin Ford Assistant Professor Dept. of Psychology Michigan State University East Lansing, MI 48824 (517) 353-5006	Degree: Ph.D., Philosophy, 1983 Specialty: Industrial/Organ. Psychology Assigned: Human Resources Laboratory: Training Systems
Prof. Michael E. Frantz Assistant Professor Dept. of Math and Physics University of LaVerne 1950 Third Street LaVerne, CA 91750 (714) 593-3511	Degree: M.S., Mathematics, 1978 Specialty: Partial Differential Equations Assigned: Air Force Geophysics Lab.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Barry K. Fussell Assistant Professor Dept. of Mechanical Engineering University of New Hampshire Kingsbury Hall Durham, NH 03824 (603) 862-1352	Degree: Ph.D., Mechanical Eng., 1987 Specialty: Systems Modeling & Controls Assigned: Materials Laboratory
Dr. Hugh. P. Garraway, III Associate Professor Dept. of Computer Science Univ. of Southern Mississippi Box 5106 Hattiesburg, MS 39406 (601) 266-4949	Degree: Ph.D., Instruc. Tech., 1980 Specialty: Computer Based Learning Assigned: Human Resources Laboratory: Training Systems
Dr. Christopher P. Godfrey Assistant Professor Dept. of Computer Science Missouri Western State College 4525 Downs Drive St. Joseph, MO 64507 (816) 271-4372	Degree: Ph.D., Physics, 1982 Specialty: High Energy Astrophysics Assigned: Air Force Geophysics Lab.
Dr. Barry P. Goettl Assistant Professor Dept. of Psychology Clemson University 108 Brackett Hall Clemson, SC 29634-1511 (803) 656-2831	Degree: Ph.D., Psychology, 1987 Specialty: Engineering Psychology Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. Gerald W. Grams Professor School of Geophysical Sciences Georgia Tech. Atlanta, GA 30332 (404) 894-3628	Degree: Ph.D., Meteorology, 1966 Specialty: Atmospheric Physics Assigned: Avionics Laboratory
Dr. Edward K. Greenwald Assistant Professor Engineering Professional Dev. Univ. of Wisconsin-Madison 432 N. Lake Street Madison, WI 53706 (608) 262-0573	Degree: Ph.D., Physics, 1967 Specialty: Electrical Engineering Assigned: Engineering & Services Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Prof. William M. Grissom Assistant Professor Dept. of Physics Morehouse College 830 Westview Dr., S.W. Atlanta, GA 30314 (404) 681-2800	Degree: M.S.E., Mechanical Eng., 1978 Specialty: Combustion Diagnostics Assigned: Arnold Engineering Development Center
Dr. David A. Grossie Assistant Professor Dept. of Chemistry Wright State University Dayton, OH 45435 (513) 873-2210	Degree: Ph.D., Chemistry, 1982 Specialty: X-ray Crystallography Assigned: Materials Laboratory
Dr. Vijay K. Gupta Professor Dept. of Chemistry Central State University Wilberforce, OH 45384 (513) 376-6423	Degree: Ph.D., Chemistry, 1969 Specialty: Physical Chemistry Assigned: Materials Laboratory
Dr. Awatef Hamed Dept. of Aerospace Eng. University of Cincinnati Mail Location 70 Cincinnati, OH 45221 (513) 475-5630	Degree: Ph.D., Engineering, 1972 Specialty: Engineering Assigned: Flight Dynamics Laboratory
Dr. Albert A. Heaney Professor Dept. of Electrical Eng. California State University Shaw & Cedar Avenues Fresno, CA 93740-0094 (209) 294-4823	Degree: Ph.D., Electrical Eng., 1972 Specialty: Computer Engineering Assigned: Eastern Space Missile Center
Dr. David Hemmendinger Assistant Professor Dept. of Compt. Sci. & Eng. Wright State University Research Bldg. 317 Research Blvd. Kettering, OH 45420 (513) 259-1345	Degree: Ph.D., Philosophy, 1973 Specialty: Logic Programming Assigned: Avionics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Bennye S. Henderson Associate Professor Dept. of Biology Jackson State University 1325 Lynch Street Jackson, MS 39217 (601) 968-2586	Degree: Ph.D., Physiology, 1979 Specialty: Physiology Assigned: School of Aerospace Medicine
Dr. Darrell E.P. Hoy Assistant Professor Dept. of Mechanical Eng. Tennessee Technological Univ. Box 5014 Cookeville, TN 38505 (615) 372-3732	Degree: M.S.E., Mechanical Eng., 1985 Specialty: Ballistic Impact Shocks Assigned: Arnold Engineering Development Center
Dr. Manuel A. Huerta Professor Dept. of Physics University of Miami P O Box 248046 Coral Gables, FL 33124 (305) 284-2323	Degree: Ph.D., Physics, 1970 Specialty: Plasma Physics Assigned: Armament Laboratory
Dr. Randolph B. Huff Professor Dept. of Chemistry Presbyterian College Clinton, SC 29325 (803) 833-2820	Degree: Ph.D., Inorganic Chem., 1969 Specialty: Physical-Inorganic Chemistry Assigned: Occupational and Environment Health Laboratory
Dr. Neil J. Hutzler Associate Professor Dept. of Civil Engineering Michigan Tech. University Houghton, MI 49931 (906) 487-2194	Degree: Ph.D., Environmental Eng., 1978 Specialty: Environmental Engineering Assigned: Engineering & Services Center
Dr. Douglas E. Jackson Professor Dept. of Math Sciences Eastern New Mexico University Portales, NM 88130 (505) 562-2367	Degree: Ph.D., Mathematics, 1969 Specialty: Math/Statistical Information Assigned: Human Resources Laboratory: Manpower & Personnel Division

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Oleg G. Jakubowicz Assistant Professor Dept. of Elect. & Compt. Eng. State University of New York 238 Bell Hall Buffalo, NY 14260 (716) 636-2406	Degree: Ph.D., Physics, 1984 Specialty: Neural Nets Assigned: Rome Air Development Center
Dr. Manjit S. Jawa Professor Dept. of Mathematics Fayetteville State University Fayetteville, NC 28301 (919) 486-1675	Degree: Ph.D., Applied Math., 1967 Specialty: Applied Mathematics Assigned: Arnold Engineering Development Center
Dr. David W. Jensen Assistant Professor Dept. of Aerospace Eng. Pennsylvania State University 233N Hammond Bldg. University Park, PA 16802 (814) 863-1077	Degree: Ph.D., Structures Tech., 1986 Specialty: Advanced Composite Materials Assigned: Astronautics Laboratory
Dr. Eric R. Johnson Associate Professor Dept. of Chemistry Ball State University Muncie, IN 47306 (317) 285-8078	Degree: Ph.D., Biochemistry, 1974 Specialty: Protein Biochemistry Assigned: School of Aerospace Medicine
Dr. William M. Jordan Assistant Professor Dept. of Mech. & Indus. Eng. Lousiana Tech. University P O Box 10348 Ruston, LA 71272 (318) 257-4304	Degree: Ph.D., Intersiciplinary Eng., 1985 Specialty: Composite Materials Assigned: Weapons Laboratory
Dr. Mohammad A. Karim Assistant Professor Dept. of Electrical Eng. University of Dayton KL-241D Dayton, OH 45469 (513) 229-3611	Degree: Ph.D., Electrical Eng., 1982 Specialty: Electro-Optics Assigned: Avionics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Arkady Kheyfets Assistant Professor Dept. of Mathematics North Carolina State Univ. Box 8205 Raleigh, NC 27695-8205 (919) 737-3265	Degree: Ph.D., Physics, 1986 Specialty: Mathematical Physics Assigned: Weapons Laboratory
Prof. Daisy W. Kimble Assistant Professor Dept. of Chemistry Southern University P O Box 11487 Baton Rouge, LA 70813 (504) 771-3734	Degree: M.S., Analytical Chem., 1986 Specialty: Analytical Chemistry Assigned: School of Aerospace Medicine
Dr. Yulian B. Kin Associate Professor Dept. of Engineering Purdue University Calumet Potter Building Hammond, IN 46323 (219) 989-2684	Degree: Ph.D., Fatigue Stress Analysis 1971 Specialty: Stress Analysis Assigned: Flight Dynamics Laboratory
Dr. Samuel P. Kozaitis Assistant Professor Dept. of Electrical Eng. Florida Institute of Tech. Melbourne, FL 32901-6988 (305) 768-8000	Degree: Ph.D., Electrical Eng, 1986 Specialty: Optics, Computer Architecture Assigned: Rome Air Development Center
Dr. Janet U. Kozyra Assistant Research Scientist University of Michigan Space Physics Research Lab. 2455 Hayward Ann Arbor, MI 48109-2143 (313) 747-3550	Degree: Ph.D., Atmospheric Sci., 1986 Specialty: Space Physics Assigned: Air Force Geophysics Lab.
Dr. Charles E. Lance Assistant Professor Dept. of Psychology University of Georgia Athens, GA 30602 (404) 542-3053	Degree: Ph.D., Psychology, 1985 Specialty: Industrial/Organizational Psy. Assigned: Human Resources Laboratory: Manpower & Personnel Division

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Thomas L. Landers Assistant Professor Dept. of Industrial Engineering University of Arkansas 4176 Bell Engineering Ctr. Fayetteville, AR 72703 (501) 575-6042	Degree: Ph.D., Industrial Eng., 1985 Specialty: Reliability & Maintainability Assigned: Human Resources Laboratory: Logistics & Human Factors Div.
Prof. Anastas Lazaridis Assistant Professor Dept. of Mechanical Eng. Widener University Chester, PA 19013 (215) 499-4487	Degree: Sc.D., Thermal Fluids, 1969 Specialty: Ablation, Solar Energy Assigned: Armament Laboratory
Dr. L. James Lee Associate Professor Dept. of Chemical Eng. The Ohio State University 140 W. 19th Avenue Columbus, OH 43210 (614) 292-2408	Degree: Ph.D., Chemical Eng., 1979 Specialty: Polymer & Composite Processing Assigned: Materials Laboratory
Dr. Robert Y. Li Assistant Professor Dept. of Electrical Eng. University of Nebraska Lincoln, NE 68588 (402) 472-5892	Degree: Ph.D., Electrical Eng., 1981 Specialty: Image Processing Assigned: Avionics Laboratory
Dr. Irving Lipschitz Associate Professor Dept. of Chemistry University of Lowell 1 University Lane Lowell, MA 01854 (617) 452-5000	Degree: Ph.D., Physical Chem., 1965 Specialty: Vibrational Spectroscopy Assigned: Air Force Geophysics Lab.
Dr. Harold G. Longbotham Visiting Assistant Professor Dept. of Electrical Eng. Univ. of Texas - San Antonio San Antonio, TX 78285 (512) 691-5518	Degree: Ph.D., Electrical Eng., 1985 Specialty: Nonlinear Digital Filtering Assigned: School of Aerospace Medicine

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. David A. Ludwig Assistant Professor Dept. of Mathematics Univ. of North Carolina at Greensboro Greensboro, NC 27412 (919) 334-5836	Degree: Ph.D., Biostatistics, 1982 Specialty: Biostatistics, Exp. Design Assigned: School of Aerospace Medicine
Dr. Douglas A. Mandra Associate Professor Dept. of Psychology Francis Marion College P O Box 7500 Florence, SC 29501 (803) 661-1378	Degree: Ph.D., Psychology, 1974 Specialty: Experimental Psychology Assigned: Human Resources Laboratory: Operations Training Division
Dr. Robert E. Masingale, Sr. Professor Dept. of Chemistry Jarvis Christian College Hawkins, TX 75765 (214) 769-2174	Degree: Ph.D., Organic Chemistry, 1968 Specialty: Organic & Analytical Chemistry Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. John P. McHugh Assistant Professor Dept. of Mechanical Eng. University of New Hampshire 133 Kingsbury Durham, NH 03824 (603) 862-1899	Degree: Ph.D., Applied Mechanics, 1986 Specialty: Fluid Mechanics Assigned: Air Force Geophysics Lab.
Dr. Michael L. McKee Associate Professor Dept. of Chemistry Auburn University Auburn, AL 36849-5312 (205) 826-4043	Degree: Ph.D., Chemical Physics, 1977 Specialty: Molecular Orbital Theory Assigned: Frank J. Seiler Research Lab.
Dr. Thomas T. Meek Associate Professor Dept. of Materials Sci. & Eng. University of Tennessee 434 Dougherty Engineering Bldg. Knoxville, TN 37966-2200 (615) 970-0940	Degree: Ph.D., Ceramic Eng., 1977 Specialty: Ceramic Processing Assigned: Materials Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Tammy J. Melton Assistant Professor Dept. of Chemistry St. Norbert College DePere, WI 54115 (414) 337-3206	Degree: Ph.D., Inorganic Chem., 1986 Specialty: Inorganic Synthesis Assigned: Frank J. Seiler Research Lab.
Dr. Carolyn W. Meyers Assistant Professor Dept. of Mechanical Eng. Georgia Inst. of Technology School of Mechanical Eng. Atlanta, GA 30332 (404) 894-3264	Degree: Ph.D., Physical Metallurgy, 1984 Specialty: Microstructure Assigned: Engineering & Services Center
Dr. David W. Mikolaitis Assistant Professor Dept. of Engineering Sciences University of Florida 231 Aero Gainesville, FL 32611 (904) 392-0961	Degree: Ph.D., Theoretical & Applied Mechanics, 1981 Specialty: Applied Math Assigned: Armament Laboratory
Dr. Kwang S. Min Professor Dept. of Physics East Texas State University Commerce, TX 75428 (214) 885-5483	Degree: Ph.D., Physics, 1962 Specialty: Signal Processing Assigned: Armament Laboratory
Dr. Joseph J. Molitoris Professor Dept. of Physics Muhlenberg College Allentown, PA 18104 (215) 821-3413	Degree: Ph.D., Physics, 1985 Specialty: Nuclear Physics Assigned: Armament Laboratory
Mr. Augustus Morris Instructor Dept. of Manufacturing Eng. Central State University Wilberforce, OH 45384 (513) 376-6435	Degree: B.S., Biomedical Eng., 1981 Specialty: Biomedical Engineering Assigned: Flight Dynamics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. William P. Mounfield Assistant Professor Dept. of Mechanical Eng. Louisiana State University R2513-A CEBA Bldg. Baton Rouge, LA 70803-6413 (504) 388-6488	Degree: Ph.D., Mechanical Eng., 1985 Specialty: Automatic Controls Assigned: Engineering & Services Center
Dr. Nanda L. Mukherjee Associate Professor Dept. of Chemical Eng. Tuskegee University Tuskegee, AL 36088 (205) 727-8050	Degree: Ph.D., Chemical Eng., 1967 Specialty: Kinetics Assigned: Flight Dynamics Laboratory
Dr. Richard S. Myers Professor Dept. of Physical Sciences Delta State University P O Box 3255 Cleveland, OH 38733 (601) 846-4482	Degree: Ph.D., Physical Chem., 1968 Specialty: Experimental Physical Chem. Assigned: Engineering & Services Center
Dr. Himanshoo V. Navangul Professor Dept. of Chemistry and Physical Science North Carolina Wesleyan College Wesleyan Station Rocky Mount, NC 27804 (919) 977-7171	Degree: Ph.D., Physical Chem., 1967 Specialty: Molecular Spectroscopy Assigned: Air Force Geophysics Lab.
Dr. Mark A. Norris Assistant Professor Dept. of Mechanics Virginia Polytechnic Inst. and State University 227 Norris Hall Blacksburg, VA 24061 (703) 961-4576	Degree: Ph.D., Eng. Mechanics, 1986 Specialty: Structural Dynamics & Controls Assigned: Astronautics Laboratory
Dr. Mufit H. Ozden Associate Professor Dept. of Systems Analysis Miami University 2303 Kreger Hall Oxford, OH 45056 (513) 529-5937	Degree: Ph.D. Eng. Systems, 1975 Specialty: Operations Research Assigned: Human Resources Laboratory: Logistics & Human Factors Div.

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Prof. Martin A. Patt Associate Professor Dept. of Electrical Eng. University of Lowell 1 University Ave. Lowell, MA 01854 (617) 452-5000	Degree: M.S., Electrical Eng., 1964 Specialty: Computer Applications Assigned: Air Force Geophysics Lab.
Dr. David G. Payne Assistant Professor Dept. of Psychology SUNY Binghamton Binghamton, NY 13901 (607) 777-4610	Degree: Ph.D., Cognitive Psy., 1984 Specialty: Human Memory Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. William Z. Plachy Professor Dept. of Chemistry & Biochem. San Francisco State University San Francisco, CA 94132 (415) 338-1436	Degree: Ph.D., Physical Chem., 1967 Specialty: Physical Chemistry Assigned: School of Aerospace Medicine
Dr. Patricia L. Plummer Professor Dept. of Physics & Chemistry Columbia Univ. of Missouri Columbia, NC 65211 (314) 882-3053	Degree: Ph.D., Chemical Physics, 1964 Specialty: Quantum Chemistry Assigned: Frank J. Seiler Research Lab.
Dr. Leonard E. Porter Professor Dept. of Physics & Astronomy University of Montana Missoula, MT 59812 (406) 243-6223	Degree: Ph.D., Nuclear Physics, 1965 Specialty: Nuclear Physics Assigned: Weapons Laboratory
Dr. Ramalingam Radhakrishnan Assistant Professor Dept. of Civil Engineering Prairie View A&M University Prairie View, TX 77084 (409) 857-2418	Degree: Ph.D, Structure Eng., 1974 Specialty: Structures Assigned: Engineering & Services Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Periasamy K. Rajan Professor Dept. of Electrical Eng. Tennessee Tech. University Box 5004 Cookeville, TN 38505 (615) 372-3308	Degree: Ph.D., Electrical Eng., 1975 Specialty: Digital Signal Processing Assigned: Avionics Laboratory
Dr. Panapakkam A. Ramamoorthy Associate Professor Dept. of Elect. & Computer Eng. University of Cincinnati M.L. #30 Cincinnati, OH 45220 (513) 475-4247	Degree: Ph.D., Digital Signal Processing, 1977 Specialty: Optical Memory Assigned: Avionics Laboratory
Dr. Dharam S. Rana Associate Professor Dept. of Management & Marketing Jackson State University 1400 J.R. Lynch Jackson, MS 39217 (601) 968-2534	Degree: Ph.D., Statistics, 1976 Specialty: Quantitative Techniques Assigned: Human Resources Laboratory: Manpower & Personnel Division
Dr. Sunita S. Rana Instructor Dept. of Computer Science Jackson State University 1400 Lynch Street Jackson, MS 39217 (601) 968-2105	Degree: Ph.D., Biology, 1969 Specialty: Computer Science Assigned: Human Resources Laboratory: Training Systems
Dr. Hal C. Reed Associate Professor Dept. of Biology Oral Roberts University 7777 S. Lewis Tulsa, OK 74171 (918) 495-6945	Degree: Ph.D., Entomology, 1982 Specialty: Insect Behavior Assigned: School of Aerospace Medicine
Dr. Michael D. Rice Associate Professor Dept. of Computer Science George Mason University 4400 University Dr. Fairfax, VA 22030 (703) 323-3884	Degree: Ph.D., Mathematics, 1973 Specialty: Computer Science/Math Assigned: Weapons Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Mateen M. Rizki Assistant Professor Dept. of Computer Science Wright State University 410 Fawcett Hall Dayton, OH 45435 (513) 873-2394	Degree: Ph.D., Computer Science, 1985 Specialty: Modeling and Simulation Assigned: Avionics Laboratory
Dr. Thomas R. Rogge Professor Dept. of Eng. Science & Math Iowa State University 3015 Black Eng. Ames, IA 50010 (515) 294-2956	Degree: Ph.D., Applied Math, 1964 Specialty: Finite Element Analysis Assigned: School of Aerospace Medicine
Dr. Joe M. Ross Assistant Professor Dept. of Chemistry Central State University Wilberforce, OH 45384 (513) 376-6214	Degree: Ph.D., Molecular Bio., 1977 Specialty: Biochemistry of Macromolecules Assigned: School of Aerospace Medicine
Dr. Joseph E. Saliba Assistant Professor Dept. of Civil & Engr. Mechanics University of Dayton 300 College Park Dayton, OH 45469 (513) 229-3847	Degree: Ph.D., Solid Mechanics, 1983 Specialty: Engineering Mechanics Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. Dhiraj K. Sardar Assistant Professor Dept. of Physics University of Texas Div. of Earth & Physical Sci. San Antonio, TX 78285-0663 (512) 691-5462	Degree: Ph.D., Physics, 1980 Specialty: Materials Science & Lasers Assigned: School of Aerospace Medicine

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Prof. Sonia H. Sawtelle Teaching Associate Dept. of Education Univ. of Texas - San Antonio San Antonio, TX 78285 (512) 691-4412	Degree: MS., Exercise Physiology, 1975 Specialty: Exercise Physiology Assigned: School of Aerospace Medicine
Dr. Paul O. Scheie Professor Dept. of Physics Texas Lutheran College 1000 West Court Seguin, TX 78155 (512) 379-4161	Degree: Ph.D., Biophysics, 1965 Specialty: Electrophysiology Assigned: School of Aerospace Medicine
Dr. James L. Schmutz Professor Dept. of Chemistry Central Wesleyan College 1 Wesleyan Drive Central, SC 29630 (803) 639-2453	Degree: Ph.D., Chemistry, 1976 Specialty: Inorganic Polymers Assigned: Frank J. Seiler Research Lab.
Dr. Jodye I. Selco Assistant Professor Dept. of Chemistry University of Redlands P O Box 3080 Redlands, CA 92373-0999 (714) 793-2121	Degree: Ph.D., Chemical Physics, 1983 Specialty: Spectroscopy, Kinetics Assigned: Astronautics Laboratory
Dr. Shawky E. Shamma Professor Dept. of Math/Statistics University of West Florida Pensacola, FL 32514 (904) 474-2281	Degree: Ph.D., Applied Math, 1969 Specialty: Applied Mathematics Assigned: Armament Laboratory
Dr. Rameshwar P. Sharma Associate Professor Dept. of Mechanical Engineering Western Michigan University 2065 Kohrman Hall Kalamazoo, MI 49008 (616) 383-1408	Degree: Ph.D., Mechanical Eng., 1978 Specialty: Fluid Mechanics Assigned: Astronautics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Larry R. Sherman Professor Dept. of Chemistry University of Akron Akron, OH 44325-0001 (216) 375-7333	Degree: Ph.D., Analytical Chem., 1969 Specialty: Organotin Chemistry Assigned: Occupational and Environment Health Laboratory
Dr. James A. Sherwood Assistant Professor Dept. of Mechanical Eng. University of New Hampshire Kingsbury Hall Durham, NH 03824 (603) 862-2624	Degree: Ph.D., Aerospace Eng., 1987 Specialty: Solid Mechanics Assigned: Flight Dynamics Laboratory
Dr. Sanford S. Singer Professor Dept. of Chemistry University of Dayton 300 College Park Dayton, OH 45469 (513) 229-2833	Degree: Ph.D., Biological Chem., 1967 Specialty: Enzymology Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. Trilochan Singh Professor Dept. of Mechanical Eng. Wayne State University Detroit, MI 48202 (313) 577-3845	Degree: Ph.D., Mechanical Eng., 1970 Specialty: Chemical Combustion Assigned: Astronautics Laboratory
Dr. Jorge L. Sintes Chairman Dept. of Preventive Dentistry and Community Health Meharry Medical College 1005 D.B. Todd Blvd. Nashville, TN 37208 (615) 327-6185	Degree: Ph.D., Nutrition, 1978 Specialty: Dentistry Assigned: Wilford Hall Medical Center
Dr. Kenneth M. Sobel Associate Professor Dept. of Electrical Engineering The City College of New York 138th St. & Convent Ave. New York, NY 10031 (212) 690-4241	Degree: Ph.D., Electrical Eng., 1980 Specialty: Eigenstructure Assigned: Flight Dynamics Laboratory

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Jonathan M. Spector Assistant Professor CSIS Jacksonville State University Pelham Road Jacksonville, AL 36265 (205) 231-5718	Degree: Ph.D., Philosophy, 1978 Specialty: Logic Assigned: Human Resources Laboratory: Training Systems Division
Dr. Gary R. Stevens Assistant Professor Dept. of Statistics Oklahoma State University 301 MS Stillwater, OK 74078 (405) 624-5684	Degree: Ph.D., Statistics, 1986 Specialty: Stochastic Processes Assigned: Occupational and Environment Health Laboratory
Dr. Patrick J. Sweeney Asst. Dean of Engineering University of Dayton 300 College Park, KL201 Dayton, OH 45469 (513) 229-2736	Degree: Ph.D., Mechanical Eng., 1977 Specialty: Computer Modeling Assigned: Flight Dynamics Laboratory
Dr. Michael Sydor Professor Dept. of Physics University of Minnesota Duluth, MN 55812 (218) 726-7205	Degree: Ph.D., Physics, 1965 Specialty: Optics, Material Science Assigned: Materials Laboratory
Dr. Douglas G. Talley Assistant Professor Dept. of Mechanical Eng. University of Michigan 313 Automotive Lab Ann Arbor, MI 48109-2121 (313) 936-0429	Degree: Ph.D., Mechanical Eng., 1978 Specialty: Combustion Assigned: Aero Propulsion Laboratory
Dr. David J. Townsend Associate Professor Dept. of Psychology Montclair State College Upper Montclair, NJ 07042 (201) 893-7222	Degree: Ph.D., Cognitive Psy., 1982 Specialty: Cognitive Science Assigned: Rome Air Development Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Donald R. Ucci Associate Professor Dept. of Elect. & Computer Eng. Illinois Inst. of Technology 3300 S. Federal Chicago, IL 60616 (312) 567-3405	Degree: Ph.D., Electrical Eng., 1986 Specialty: Adaptive Arrays Assigned: Rome Air Development Center
Dr. Ahmad D. Vakili Associate Professor Dept. of AE/ME Univ. of Tennessee Space Inst. Tullahoma, TN 37388 (615) 455-0631	Degree: Ph.D., Aerospace Eng., 1978 Specialty: Unsteady Flows Assigned: Arnold Engineering Development Center
Dr. Richard S. Valpey Assistant Professor Dept. of Chemistry Wilberforce University Wilberforce, OH 45384 (513) 376-2911	Degree: Ph.D., Organic Chemistry, 1983 Specialty: Organic Synthesis Assigned: Materials Laboratory
Dr. Peter J. Walsh Professor Dept. of Physics Fairleigh Dickinson University Teaneck, NJ 07666 (201) 692-2493	Degree: Ph.D., Physics, 1960 Specialty: Superconductivity Assigned: Rome Air Development Center
Dr. Kenneth L. Walter Associate Professor Dept. of Chemical Engineering Prairie View A&M University Prairie View, TX 77446 (409) 857-2827	Degree: Ph.D., Chemical Eng., 1972 Specialty: Chemical Engineering Process Assigned: Rome Air Development Center
Dr. Gwo-Ching Wang Associate Professor Dept. of Physics Rensselaer Polytechnic Inst. Troy, NY 12180-3590 (518) 276-8387	Degree: Ph.D., Materials Science, 1978 Specialty: Surface Sciences Assigned: Rome Air Development Center

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Dr. Andrew P. Whipple Associate Professor Dept. of Biology Taylor University Upland, IN 46989 (317) 998-5333	Degree: Ph.D., Biology, 1979 Specialty: Cell Biology Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Prof. Sharon T. Williams Instructor Dept. of Chemistry Southern University Baton Rouge, LA 70813-2074 (504) 771-3990	Degree: M.S., Biochemistry, 1981 Specialty: General Chemistry Assigned: School of Aerospace Medicine
Dr. Lawrence A. Witt Assistant Professor Dept. of Psychology Western Illinois University Macomb, IL 61455 (309) 298-1593	Degree: Ph.D., Psychology, 1985 Specialty: Industrial/Organ. Psychology Assigned: Human Resources Laboratory: Operations Training Division
Dr. Frank A. Witzmann Assistant Professor Dept. of Biology IUPUI - Columbus 4601 Central Avenue Columbus, IN 47203 (812) 372-8266	Degree: Ph.D., Biology, 1981 Specialty: Protein Analysis Assigned: Harry G. Armstrong Aerospace Medical Research Laboratory
Dr. William E. Wolfe Associate Professor Dept. of Civil Engineering Ohio State University 2070 Neil Avenue Columbus, OH 43210 (614) 292-0790	Degree: Ph.D., Engineering, 1979 Specialty: Geotechnical Engineering Assigned: Flight Dynamics Laboratory
Dr. John R. Wright Professor Dept. of Chem., Physical Sci. Southeast Oklahoma State Univ. Box 4181, Station A, SEOSU Durant, OK 74701 (405) 924-0121	Degree: Ph.D., Chemistry, 1971 Specialty: Biochemistry Assigned: School of Aerospace Medicine

NAME/ADDRESS	DEGREE, SPECIALTY, LABORATORY ASSIGNED
Prof. Wafa E. Yazigi Instructor Dept. of Mathematics Columbia Basin College 2600 N. 20th Pasco, WA 99301 (509) 547-0511	Degree: M.S., Aeronautical Eng., 1986 Specialty: Solid Mechanics Assigned: Armament Laboratory
Dr. Lawrence F. Young Associate Professor Dept. of QA/IS, CBA University of Cincinnati ML 30 Cincinnati, OH 45220 (513) 475-7169	Degree: D.Sc., Industrial Eng., 1978 Specialty: Industrial Engineering Assigned: Human Resources Laboratory: Logistics & Human Factors Div.
Dr. Robert K. Young Professor Dept. of Psychology University of Texas Mezes 330, Psychology Dept. Austin, TX 78713 (512) 471-9228	Degree: Ph.D., Exp. Psychology, 1954 Specialty: Experimental Psychology Assigned: Human Resources Laboratory: Manpower & Personnel Division
Dr. Juin S. Yu Professor Dept. of Mechanical Eng. West Virginia Tech. Montgomery, WV 25136 (304) 442-3248	Degree: Ph.D., Mechanical Eng., 1964 Specialty: Thermofluid Transport Assigned: Aero Propulsion Laboratory

APPENDIX II C

PARTICIPANT LABORATORY ASSIGNMENT

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 1)

1988 USAF/UES SUMMER FACULTY RESEARCH PROGRAM

AERO PROPULSION LABORATORY (AFWAL/APL)
(Wright-Patterson Air Force Base)

1. Bryan Becker
2. Mingking Chyu
3. Jerry Clark
4. Derek Dunn-Rankin
5. Wayne Eckerle
6. David Mikolaitis
7. Douglas Talley
8. Juin Yu

ARMAMENT LABORATORY (AD)
(Eglin Air Force Base)

1. Ibrahim Ahmad
2. Stephen Dow
3. Manuel Huerta
4. Anastas Lazaridis
5. Kwang Min
6. Joseph Molitoris
7. Shawky Shamma
8. Wafa Yazigi

HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY (AAMRL)
(Wright-Patterson AFB)

1. Praphulla Bajpai
2. Shankar Bale
3. Charles Covington
4. Barry Goettl
5. Robert Masingale
6. David Payne
7. Joseph Saliba
8. Sanford Singer
9. Andrew Whipple
10. Frank Witzmann

ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC)
(Arnold Air Force Base)

1. Eustace Dereniak
2. William Grissom
3. Darrell Hoy
4. Manjit Jawa
5. Ahmad Vakili

ASTRONAUTICS LABORATORY (AL)
Edwards Air Force Base)

1. Clarence Calder
2. Phillip Christiansen
3. Susan Collins
4. David Jensen
5. Mark Norris
6. Jodye Selco
7. Rameshwar Sharma
8. Trilochan Singh

AVIONICS LABORATORY (AFWAL/AL)
(Wright-Patterson Air Force Base)

1. Mike Burlakoff
2. Gerald Grams
3. David Hemmendinger
4. Mohammad Karim
5. Robert Li
6. Periasamy Rajan
7. Panapakkam Ramamoorthy
8. Mateen Rizki

EASTERN SPACE AND MISSILE CENTER (ESMC)
(Patrick Air Force Base)

1. Albert Heaney

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 2)

ELECTRONIC SYSTEMS DIVISION (ESD)
(Hanscom Air Force Base)

1. George Bratton
2. John Dalphin

ENGINEERING AND SERVICES CENTER (ESC)
(Tyndall Air Force Base)

1. Wayne Charlie
2. David DeHeer
3. Deanna Durnford
4. Edward Greenwald
5. Neil Hutzler
6. William Mounfield
7. Richard Myers
8. Ramalingam Radhakrishnan

FLIGHT DYNAMICS LABORATORY (FDL)
(Wright-Patterson Air Force Base)

1. Larry Byrd
2. Karen Chou
3. Awatef Hamed
4. Yulian Kin
5. Augustus Morris
6. Nanda Mukherjee
7. James Sherwood
8. Kenneth Sobel
9. Patrick Sweeney
10. William Wolfe

FRANK J. SEILER RESEARCH LABORATORY (FJSRL)
(USAF Academy)

1. Dan Bruss
2. Charles Bump
3. Richard Carlin
4. Michael McKee
5. Tammy Melton
6. Patricia Plummer
7. James Schmutz

GEOPHYSICS LABORATORY (AFGL)
(Hanscom Air Force Base)

1. Lucia Babcock
2. Stephen Baker
3. Pradip Bakshi
4. Reuben Benumof
5. Donald Collins
6. Michael Frantz
7. Christopher Godfrey
8. Janet Kozyra
9. Irving Lipschitz
10. John McHugh
11. Himanshoo Navangul
12. Martin Patt

HUMAN RESOURCES LABORATORY (HRL)
(Brooks, Williams, and Wright-Patterson Air Force Bases)

1. Patricia Carlson
2. Kevin Ford
3. Hugh Garraway
4. Douglas Jackson
5. Charles Lance
6. Thomas Landers
7. Douglas Mandra
8. Mufit Ozden
9. Dharam Rana
10. Sunita Rana
11. Jonathan Spector
12. Lawrence Witt
13. Lawrence Young
14. Robert Young

C. PARTICIPANT LABORATORY ASSIGNMENT (Page 3)

MATERIALS LABORATORY (ML)
(Wright-Patterson Air Force Base)

1. Robert Arenz
2. Gene Carlisle
3. Parvis Dadras
4. Suren Dwivedi
5. Barry Fussell
6. David Grossie
7. Vijay Gupta
8. L. James Lee
9. Thomas Meek
10. Carolyn Meyers
11. Michael Sydor
12. Richard Valpey

OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY (OEHL)
(Brooks Air Force Base)

1. Steven Chiesa
2. Randolph Huff
3. Larry Sherman
4. Gary Stevens

ROME AIR DEVELOPMENT CENTER (RADC)
(Griffiss Air Force Base)

1. Beryl Barber
2. Keith Christianson
3. Darin DeForest
4. Paul Dingman
5. Hugh Donaghy
6. Oleg Jakubowicz
7. Samuel Kozaitis
8. David Townsend
9. Donald Ucci
10. Peter Walsh
11. Kenneth Walter
12. Gwo-Ching Wang

SCHOOL OF AEROSPACE MEDICINE (SAM)
(Brooks Air Force Base)

1. Ronald Bulbulian
2. John Burke
3. Bennye Henderson
4. Eric Johnson
5. Daisy Kimble
6. Harold Longbotham
7. David Ludwig
8. William Plachy
9. Hal Reed
10. Thomas Rogge
11. Joe Ross
12. Dhiraj Sardar
13. Sonia Sawtelle
14. Paul Scheie
15. Sharon Williams
16. John Wright

WEAPONS LABORATORY (WL)
(Kirtland Air Force Base)

1. Lane Clark
2. David Dolson
3. William Jordan
4. Arkady Kheyfets
5. Leonard Porter
6. Michael Rice

WILFORD HALL MEDICAL CENTER (WHMC)
(Lackland Air Force Base)

1. David Cecil
2. Jorge Sintes

APPENDIX III

A. Listing of Research Reports Submitted in the 1988 Summer Faculty Research Program

B. Abstracts of the 1988 Summer Fellow's Research Reports

RESEARCH REPORTS

APPENDIX III A

RESEARCH REPORTS

1988 SUMMER FACULTY RESEARCH PROGRAM

Technical Report Number	Title	Professor
Volume I		
Armament Laboratory		
1	Measuring Systems Effectiveness and Systems Availability of Hardened Targets Subject to a Variety of Weapons	Dr. Ibrahim Ahmad
2	Model Drawing Algorithms for a Matching Problem	Dr. Stephen Dow
3	Two Dimensional Simulation of Railgun Plasma Armatures	Dr. Manuel Huerta
4	Modeling Reactive Fragments	Dr. Anastas Lazaridis
5	Target-Aerosol Discrimination Techniques for Active Optical Proximity Sensors	Dr. Kwang Min
6	The Dynamics of Projectile Impact	Dr. Joseph Molitoris
7	ARIMA Modeling of Residuals in AD/KR TDOP Models	Dr. Shawky Shamma
8	Stress Analysis for a Fin Stabilized Projectile	Dr. Wafa Yazigi
Arnold Engineering Development Center		
9	Infrared Charge Transfer Device Characterization	Dr. Eustace Dereniak
10	Liquid Film Cooling In Rocket Engines	Dr. William Grissom
11	Diffuser Failure Investigation/Non-Interference Stress Measurement System Algorithms Study	Dr. Darrell Hoy
12	Solid Rocket Motor Plume Analysis Through Emission Computerized Tomography	Dr. Manjit Jawa
13	Skin Friction Measurement Using Surface Mounted Hot Films	Dr. Ahmad Vakili

Astronautics Laboratory		
14	Study of Embedded Sensors in Graphite-Epoxy Composites	Dr. Clarence Calder
15	Core Polarization in Lithium and Aluminum	Dr. Phillip Christiansen
16	The Photochemistry of μ3-(η-Diethylacetylene)-Decacarbonyltriosmium in Solid Argon	Dr. Susan Collins
17	Composite-Embedded Fiber-Optic Strain Sensors	Dr. David Jensen
18	Observer Design for the AFAL Grid Structure Using Low-frequency Accelerometer Data	Dr. Mark Norris
19	Photochemistry of Azulene Solutions and a Novel Photochemical Nitration Process	Dr. Jodye Selco
20	Injection System and Spray Characteristics	Dr. Rameshwar Sharma
21	Chemical Kinetic Mechanisms for $CH_4/NO_2/O_2$ Flames	Dr. Trilochan Singh
Eastern Space and Missile Center		
22	Generic Requirements for a CAE/CAD/CAM System	Dr. Albert Heaney
Electronics Systems Division		
23	Alaskan HF Test Data Analysis	Dr. George Bratton
24	Stage 1 Analysis of Alaskan High Frequency Radio Network	Dr. John Dalphin
Engineering and Services Center		
25	High Intensity Stress Wave Propagation in Partially Saturated Sand	Dr. Wayne Charlie
26	Individualization of Human Tissue by the Serologic Identification of Erythrocyte Antigens	Dr. David DeHeer
27	Estimation of Jet Fuel Contamination in Soils	Dr. Deanna Durnford
28	Cogeneration Assessment on Military Bases	Dr. Edward Greenwald

44	Digital Photometric Calibration of and Analysis with Video Imagers in the Ultraviolet	Dr. Donald Collins
45	A Model for Intensified Frontogenesis Over a Modified Mountain Ridge	Dr. Michael Frantz
46	Gamma and X Radiation from Solar Flares	Dr. Christopher Godfrey
47	Theoretical and Observational Studies of Geomagnetic Storm-Related Ion and Electron Heating in the Subauroral Region	Dr. Janet Kozyra
48	Update of the Hitran Database	Dr. Irving Lipschitz
49	Spectral Domain Decomposition	Dr. John McHugh
50	On the Possible Inclusion of "Heavy" Molecules in the HITRAN Database	Dr. Himanshoo Navangul
51	Software Tools for Processing Large Lidar Data Streams	Dr. Martin Patt

Rome Air Development Center

52	Noise Calculations in a RADAR Receiver	Dr. Beryl Barber
53	Stability of Au/W/GaAs and Au/Pt/Ti/GaAs Schottky Barrier Height: A Preliminary Study	Dr. Keith Christianson
54	Parallel Runtime System For Lucid	Dr. Darin DeForest
55	Pre-Sort Processor Phase Distortion Evaluation	Dr. Paul Dingman
56	A PROLOG Natural Language Front End to an ERIC Object Oriented Database	Dr. Hugh Donaghy
57	No Report Submitted at this Time	Dr. Oleg Jakubowicz
58	Design of an Optical Correlator Testbed and Optical Co-Processor	Dr. Samuel Kozaitis
59	Characteristics of Dialog in a Noisy Channel for Performing a Time-Oriented Task	Dr. David Townsend
60	The Effects of Nonlinearities of High Speed Analog-to-Digital Converters on Digital Beamforming Arrays	Dr. Donald Ucci

61	Studies in Microwave Superconductors	Dr. Peter Walsh
62	Chemical Vapor Deposition of Titanium Compounds with an Atomic Layer Epitaxy System	Dr. Kenneth Walter
63	Surface Effects on the High Temperature Superconducting YBaCuO Thin Films grown by RF Sputtering	Dr. Gwo-Ching Wang

Weapons Laboratory

64	Realization of Sublayer Relative Shielding Order in Electromagnetic Topology	Dr. Lane Clark
65	Diode Laser Probe of Vibrational Energy Transfer Kinetics in Sulfur Monoxide	Dr. David Dolson
66	Evaluating How Laser Irradiation Damages Loaded Composite Materials	Dr. William Jordan
67	Relativistic Effects in GPS Time Transfer	Dr. Arkady Kheyfets
68	Stopping Power and Penetration Physics	Dr. Leonard Porter
69	Performance Models for Parallel Algorithms	Dr. Michael Rice

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Aero Propulsion Laboratory

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71	Use of Laser Light Visualization Techniques on Studies of Film Cooling Flow And Flow Over Cavities	Dr. Mingking Chyu
72	Experimental Study of Electronic Excitation of Xenon by Electon Impact	Dr. Jerry Clark
73	Cars Thermometry in Droplet-Laden Flows	Dr. Derek Dunn-Rankin

74	Measurement of the Velocity Field and Heat Transfer Coefficients Associated with a Rectangular Wall Jet	Dr. Wayne Eckerle
75	Lifted Jet Diffusion Flames	Dr. David Mikolaitis
76	Interpretation of a Lifted Turbulent Diffusion Flame as a Problem in Stratified Combustion	Dr. Douglas Talley
77	Diffusion and Convection in the Condenser of a Gas-Loaded Heat Pipe	Dr. Juin Yu

Avionics Laboratory

78	Ada Compiler Evaluation Capability	Dr. Mike Burlakoff
79	A Study of Sky Backgrounds and Sub-Visual Cirrus at the Megalidar Site and a Proposed Turbulence Monitoring Facility for Wright-Patterson AFB	Dr. Gerald Grams
80	Formal Verification of VHDL Specifications	Dr. David Hemmendinger
81	Low Voltage Broadband Beam Steering Devices Using Liquid Crystals	Dr. Mohammad Karim
82	Model-based Target Recognition Using Laser Radar Imagery	Dr. Robert Li
83	Signal Processing for ESM Receivers	Dr. Periasamy Rajan
84	Neural Networks and their Applications in Digital Receiver Design	Dr. Panapakkam Ramamoorthy
85	Applications of Evolutionary Learning Strategies to Pattern Recognition Tasks	Dr. Mateen Rizki

Flight Dynamics Laboratory

86	Heat Flux Prediction for Nucleate Boiling in Liquid Metal Heat Pipes	Dr. Larry Byrd
87	Reliability Study of Nonlinear Structural Response under Reversible Cyclic Loading Processes	Dr. Karen Chou
88	Survey and Assessment of Validation Data Base for Shockwave Boundary Layer Interaction in Supersonic Inlets	Dr. Awatef Hamed

89	Failures of F-16 Transparencies Analysis and Failure Prevention Recommendations	Dr. Yulian Kin
90	Visual Capabilities on a Robot Aided Aircraft Refueler Prototype	Mr. Augustus Morris
91	Reaction Kinetic of Halon 1301 Suppression of Fire Explosion in an Aircraft Fuel Tank	Dr. Nanda Mukherjee
92	Development of an Aircraft Tire-Wheel Interface Model for Flange/Beadseat Contact Loads	Dr. James Sherwood
93	Robust Eigenstructure Assignment for Flight Control Design	Dr. Kenneth Sobel
94	A Computer Model for Air-to-Air Combat (Force on Force) Assessment	Dr. Patrick Sweeney
95	Damage in Graphite/Epoxy Plates Subjected to Low Velocity Impact	Dr. William Wolfe
Materials Laboratory		
96	Analysis Methods for Nonlinear Mechanical Behavior of Glassy Polymers	Dr. Robert Arenz
97	Laser Hardened Materials Via Magnetically Aligned Polypeptide-Phthalocyanines	Dr. Gene Carlisle
98	Joining of Carbon-Carbon Composite Materials	Dr. Parviz Dadras
99	Rapid Simulation for Experimental Validation of H Section Forging Using Finisher Punch	Dr. Suren Dwivedi
100	QPA Control of the End Milling Process	Dr. Barry Fussell
101	Single-Crystal Diffraction Analysis of Compounds with Potential Nonlinear Optical Properties	Dr. David Grossie
102	Effect of Various Metals on the Thermal Degradation of a Chlorotrifluorethylene Based Fluid	Dr. Vijay Gupta

103	Characterization of Heat Transfer and Reaction in the Autoclave Curing of Graphite/Epoxy Composites by Scaling Analysis	Dr. L. James Lee
104	A Study of the Melting of the Plagioclase Feldspars in a Microwave Field	Dr. Thomas Meek
105	Reaction Zone Characeristics of Titanium Aluminide Composites	Dr. Carolyn Meyers
106	Photoreflectance Measurements of Unintentional Impurities in Undoped Galium Arsinide	Dr. Michael Sydor
107	The Synthesis of 2-Formyl Pyridoimidazoles	Dr. Richard Valpey

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Harry G. Armstrong Aerospace Medical Research Laboratory

108	Ceramic Composites for Studying Bone Ingrowth and Remodeling	Dr. Praphulla Bajpai
109	In Vitro Cytotoxic Effects of Perfluorodecanoic Acid on Human Peripheral Blood Lymphocytes	Dr. Shankar Bale
110	Auditory Modeling	Dr. Charles Covington
111	Cognitive Demands of Tracking Strategies as Assessed by the Optimum-Maximum Procedure	Dr. Barry Goettl
112	Evaluation of an Extraction Procedure for the Analysis of Serum Steroids	Dr. Robert Masingale
113	Performance in a Visual Monitoring Task with Serial and Simultaneous Display Formats	Dr. David Payne
114	A Nonlinear Lumped Parameter Model for the Seated Humans	Dr. Joseph Saliba
115	In Vitro Modeling of Perfluoro-N-Decanoate Effects on Enzymes of Fatty Acid Metabolism	Dr. Sanford Singer
116	Perfluorodecanoic Acid Efflux from Cultured Primary Rat Hepatocytes	Dr. Andrew Whipple

117	Determination of Perfluoro-N-Decanoic Acid Toxicity in Vitro and in Vivo Via Two-Dimensional Polyacrylamide Gel Electrophoresis	Dr. Frank Witzmann
Human Resources Laboratory		
118	Hypertext and Intelligent Interfaces for Text Retrieval	Dr. Patricia Carlson
119	Linking Training Evaluation to Training Needs Assessment: Development of a Conceptual Model	Dr. J. Kevin Ford
120	A Concept for an Intelligent Tool to Facilitate the Development of Qualitative Process Models in Novice Programmers	Dr. Hugh Garraway
121	A Tool for Studying the Effect of Range Restriction on Correlation Coefficient Estimation	Dr. Douglas Jackson
122	Evaluation of a Methodology for Estimating Cross-AFS Transferability of Skills	Dr. Charles Lance
123	An Expert System Approach for Reliability Data Analysis	Dr. Thomas Landers
124	No Report Submitted at this Time	Dr. Douglas Mandra
125	Graphical Programming of Simulation Models in an Object-Oriented Environment	Dr. Mufit Ozden
126	A Study of Interaction Between Job Properties and Personal Characteristics in the New PACE System	Dr. Dharam Rana
127	An Intelligent Tutor for the IBM System/360 Assembly Language: BIGBLUE	Dr. Sunita Rana
128	Preliminary Design Considerations for an Advanced Instructional Design Advisor	Dr. Jonathan Spector
129	Effectiveness of Contract Monitors In An Air Force Human Resources Laboratory: Prediction and Measurement	Dr. Lawrence Witt

130	Computer Support of Creativity in Unified Life Cycle Engineering	Dr. Lawrence Young
131	The Relationship Between Inspection Time and Intelligence	Dr. Robert Young
Occupational and Environmental Health Laboratory		
132	Solvent Extraction of Boron From Wastewater	Dr. Steven Chiesa
133	Extention of the Detection Limits of Arsenic and Selenium in Solid Samples by ICP/AES Utilizing Preconcentration Techniques	Dr. Randolph Huff
134	Determination of Asbestos Fibers in Environmental Samples Using Scanning Electron Microscopy and Energy Dispersive X-ray Analyses (SEM-EDXA)	Dr. Larry Sherman
135	Analysis of Contaminated Ground Water Using Kriging Methods	Dr. Gary Stevens
School of Aerospace Medicine		
136	Blood Flow Distribution In The Non-Working Forearm During Exercise	Dr. Ronald Bulbulian
137	Photophysics and Photochemistry of Transition Metal Complexes of 8-Quinolinamine Schiff Bases	Dr. John Burke
138	Immunocytochemical Localization of Vasoactive Intestinal Peptide, Neuropeptide Y and Arginine Vasopressin within the Supra-chiasmatic Nuclei of the Rat	Dr. Bennye Henderson
139	Development of Improved Assays for Cholesterol and Major Lipoprotein Fractions	Dr. Eric Johnson
140	Plasma Catecholamine Assays by High Performance Liquid Chromatography	Dr. Daisy Kimble
141	Application of Nonlinear Filters to VEP Data	Dr. Harold Longbotham
142	Extensions of Several Difference Score Approaches for the Analysis of Time Ordered Repeated Measures	Dr. David Ludwig

143	Spin Label Studies of Oxygen in Biological Systems	Dr. William Plachy
144	The Stinging Wasps (Hymenopter: Vespidae) of South Texas	Dr. Hal Reed
145	Modeling of Blood Flow in the Systemic Human Arterial Tree	Dr. Thomas Rogge
146	The Separation of HDL2 and HDL3 Using the Technique of Ultra-centrifugation	Dr. Joe Ross
147	An Experimental Design to Demonstrate the Dispersion Effects of Salt Water on OPTICAL PULSES	Dr. Dhiraj Sardar
148	Literature Search on Nutrition and the Relation to Tactical Air Command Pilots, G-Tolerance and Energy Output	Dr. Sonia Sawtelle
149	A Small Inert-Gas Generator	Dr. Paul Scheie
150	High Performance Liquid Chromatography (HPLC) Determination of High Energy Phosphate Pool	Dr. Sharon Williams
151	Chemiluminescent Probes Based on Luminol and Luminol Derivatives	Dr. John Wright

Wilford Hall Medical Center

152	PC - Mainframe Interface for Data Entry	Dr. David Cecil
153	Oral Health	Dr. Jorge Sintes

1982s

APPENDIX III B

ABSTRACTS

ABSTRACTS
ARMAMENT LABORATORY

Measuring Systems' Effectiveness and Systems' Availability of Hardened Targets Subject to a Variety of Weapons

By
Ibrahim A. Ahmad

ABSTRACT

This report is a trial to conceptualize two aspects of systems effectiveness and systems availability when these systems are embodied in hardened targets that are subject to a variety of weapons. The emphasis is on statistical analysis of the developed concepts and particularly as on estimation of systems availability and systems effectiveness under a variety of different data schemes.

Several computer programs are currently in use that attempt to evaluate systems effectiveness but suffer from some limitations in the scope of systems that they apply to. Also, they are simple simulations and may require very complex procedures.

This report is in two parts dealing with the effectiveness and availability of systems respectively. The intention is to lay the foundation for a coherent theory of systems effectiveness and availability that is applicable to hardened target and to bring its statistical inference to reality.

Model Drawing Algorithms for a Matching Problem

by

Dr. Stephen J. Dow

ABSTRACT

A matching problem for obtaining motion parameters requires rapid generation of a 2D graphics image of a 3D model undergoing a 6 degree of freedom motion and perspective projection. The nontrivial part of the 3D model is a solid of revolution modeled as a series of truncated cones on a common axis, from which a sihouette must be extracted. Methods using a boundary tracking algorithm or morphological operators to extract the silhouette from a binary digital line drawn images are described. Then an algebraic approach is presented using homogeneous coordinates to reduce the motion and perspective projection to an invertible projective transformation followed by a simple orthographic projection. This made it possible to derive equations of the boundary curves forming the silhouette.

Two Dimensional Simulation of Railgun Plasma Armatures

by

Manuel A. Huerta

ABSTRACT

We report on our development of a two dimensional MHD code to simulate the internal dynamics of a railgun plasma armature. We use the equations of resistive MHD, with Ohmic heating, and radiation heat transport. We use an explicit Flux Corrected Transport code to advance all quantities in time. Preliminary runs show the growth and shedding of plasma structures in response to a small perturbation upon an initial equilibrium. We completed a run of an isothermal plasma armature that reached the end of a 1 m barrel. We have done many debugging runs of a full radiation heat transport model. At this point we are completing the revised code for this model. We expect to run it in a Cray-2 in the near future.

MODELING REACTIVE FRAGMENT WARHEADS

by

Anastas Lazaridis

ABSTRACT

The interaction of a reactive fragment with its target is a complicated process in which several physical phenomena occur simultaneously. In general, impact and penetration through the skin of the target are associated with shock waves that produce spall and vaporific effects. The latter result from chemical reactions and secondary combustion in and around an expanding turbulent jet. The effectiveness of the reactive fragment is commensurate with the target materials it encounters, the geometry after impact, particle size, velocity, and temperature of spall, environmental pressure and temperature, dispersion and mixing characteristics of the reactants, and reaction kinetics. For modeling purposes, all targets are grouped in two classes. The first consists of several layers of solid materials, such as plates of metals or organic composites, while the second is a fluid confined behind one or two layers of solid materials.

This work presents an evaluation of the literature obtained from a computer search and in-house sources, identifies gaps in the available information, defines areas of further research, and makes recommendations for future experimental and theoretical work.

Target-Aerosol Discrimination Techniques for Active Optical Proximity Sensors

by

Kwang S. Min

ABSTRACT

Development of all-weather Active Optical Proximity Sensors have been of vital interests to USAF for the applications in armament systems. False signals caused by cloud, fog, and snow interfere with proper response of the sensors, and efforts to discriminate the target signals from those of aerosol have been in progress for nearly two decades [1-18].

Upon examination of recent efforts by the Air Force [5-10] and by the Army [11-15], developments of three new methods for the aerosol discrimination were initiated. They utilize signal processing techniques to separate the Ladar returns. Their preliminary simulation results are encouraging. In the process, a new aerosol model has been introduced.

Some considerations for the realistic system implementation of these methods are given, and possible uses of parallel computing archtecture, optical signal processing, and ASIC technology are discussed. Prospective utilizations of signal processing on artificial neural nets and Kalman or adaptive filtering are also included.

The Dynamics of Projectile Impact

by

Joseph J. Molitoris

ABSTRACT

The physics of impact and penetration is relevant to both the development of armor and armor penetrators. This dynamic process was studied through the use and development of one-dimensional physics models and a two-dimensional hydrodynamic code. The appropriateness of the physics assumptions in these models was verified by comparison with both final state and time resolved data.

ARIMA MODELING OF RESIDUALS IN AD/KR TDOP MODELS

by

Shawky E. Shamma and Anne L. Siegman

ABSTRACT

The measurement residuals generated by AD/KR Test Data Optimal Processor (TDOP) for extracting optimal vehicle trajectory depend on the error model used in the software for the measurement processing. These residuals are found often to be correlated, not white noise as assumed by TDOP. A set of software and algorithms for time series analysis which makes use of ARIMA (autoregressive integrated moving average) has been used to analyze some of the measurement residuals obtained from TDOP output and obtain the ARIMA model coefficients that fit the measurement residuals and that can be used in turn to correct the raw measurements for a rerun of TDOP software or in a "renovation" processing of TDOP.

The advantage of this approach is that one can achieve an improved accuracy in applying TDOP in tracking, weapon scoring, and system accuracy evaluations.

STRESS ANALYSIS FOR A FIN STABILIZED PROJECTILE

Wafa Yazigi

ABSTRACT

A stress analysis was done on a projectile where the stresses at the critical sections in the structure were evaluated and compared to the maximum allowable stresses that the structure can withhold before any deformation occurs. As a result structural failure criteria were established which in turn would be a basis for the design of the projectile. Similar analysis was also done for the sabot.

ABSTRACTS
ARNOLD ENGINEERING AND DEVELOPMENT CENTER

ABSTRACT

Infrared Charge Transfer Device Characterization

by

Eustace L. Dereniak

This report summarizes the test methodology necessary to characterize an advanced infrared focal plane array. These arrays were characterized in a low background flux in order to measure their read noise, noise equivalent input (NEI), responsivity, dynamic range, and spatial crosstalk. The focal planes had arsenic-doped silicon detectors in a hybrid-charge transfer readout and were cryogenically cooled by liquid helium.

LIQUID FILM COOLING IN ROCKET ENGINES

by
William M. Grissom

ABSTRACT

A simple analysis based upon proven heat transfer correlations can be used to accurately calculate the liquid evaporation rate and vapor mixing in liquid film-cooled rocket engine combustion chambers. The vapor transpired from the liquid film greatly decreases the normal convective heat transfer rate so that radiation becomes significant. The radiative heat flux is absorbed at the walls and transmitted to the liquid film by boiling heat transfer. Under certain conditions the radiative heat flux can cause burnout of the liquid film. If too high of a coolant flow rate is used, large waves form on the liquid film and droplets are mechanically sheared off of the liquid film without evaporation, making ineffective use of the liquid for cooling. The gaseous mixing of the vapor downstream of the liquid film can be analyzed by using existing integral correlations in a differential form to account for free-stream acceleration in the throat. The analysis provides excellent correlation of the existing experimental data and fair comparison in an absolute sense.

DIFFUSER FAILURE INVESTIGATION/

NONINTERFERENCE STRESS MEASUREMENT SYSTEM ALGORITHMS STUDY

by

Darrell E.P. Hoy

ABSTRACT

Investigation of repeated cracking occurring in turbine engine diffusers was undertaken. Past histories of diffusers used in jet engine test cells at AEDC were examined and evaluated. The most likely critical load parameters in the cracking process were found to be: geometric stress concentration effects, residual stress effects, acoustic loads, and vibrational response. An investigative plan was formulated to quantify these parameters and to generate an improved diffuser model.

Investigation of the algorithms used in the Noninterference Stress Measurement System for determining turbine-blade vibratory deflections and stresses was also made. Examination of the techniques used for measurement of integral-order vibrations (4 sensor technique and SDOF technique) led to the proposal of a "combined" technique for measuring integral-order resonant vibrations. Advantages of the combined technique include multiple determination of resonant amplitudes and frequencies using only off-resonance measurements, elimination of the need to establish "DC trends" in the data. The deflection-to-stress conversion procedures were also evaluated and found to be appropriate. A summary of the requirements for interfacing with the finite element model was written.

SOLID ROCKET MOTOR PLUME ANALYSIS THROUGH EMISSION COMPUTERIZED TOMOGRAPHY

By

Manjit S. Jawa

ABSTRACT

ABEL Inversion Techniques are used to reconstruct the axial symmetric distribution of light emitting gases and particles in the plumes of solid rocket motors. The analysis of the plumes with asymmetrical distribution of the gases and particles is more complex. Emission computerized tomography will be further studied and researched to determine its effectiveness in reconstructing asymmetrical distributions.

SKIN FRICTION MEASUREMENT USING SURFACE MOUNTED HOT FILMS

by

A. D. Vakili

Abstract

Skin friction measurements using surface mounted hot film probes have been successfully made by many authors. In order to apply this measurement technique to high enthalpy high Mach number facilities, a probe capable of withstanding such test environments has been developed at AEDC by Mr. W. Strike and Mr. Joe Donaldson for prediction of skin friction forces on models in flow regimes noted. Measurement results, however, indicated significant levels of scatter among the data obtained as well as a lack of self-similar calibration behavior.

As a result of this summer's program, these discrepancies have been mainly explained and recommendations made to modify the probe and remedy the problem.

ABSTRACTS
ASTRONAUTICS LABORATORY

Study of Embedded Sensors in Graphite-Epoxy Composites

by

Clarence A. Calder

and

Gregory J. Price

ABSTRACT

The winding or layup fabrication process for composites lends itself to the development of "smart" structures which could sense load, vibration, or material degradation conditions using embedded sensors. Such embedded sensors would provide continuous information on the static and dynamic strain or displacement state of the structure (health monitoring) while being protected from the environment and severe surface conditions through the embedment.

In this study various strain and stress sensors were embedded in graphite-epoxy composite specimens to evaluate their potential for application in real structures. Conventional strain gages, strain wire, piezoelectric crystals, and the graphite tow itself were considered. Other possibilities such as various optical and acoustic techniques were beyond the scope of the project. The sensors were embedded in twelve-laminate panels which were cut into specimens suitable for cantilever loading and vibration tests.

While some difficulties were encountered with the delicate leads shorting out or breaking during the fabrication process, the strain gage, strain wire, and piezoelectric crystal all showed promise for use in "smart" structure applications. The graphite tow application presented several difficulties and was judged to require longer term development.

CORE POLARIZATION IN LITHIUM AND ALUMINUM

by

Phillip A. Christiansen

ABSTRACT

Core-valence correlation potentials were computed for Li and Al using two and ten-electron core wavefunctions respectively. The potentials included dipole, quadrapole and higher order corrections within the constraints of the respective (s p d) and (s p d f) basis sets. With core polarization included, relativistic quantum Monte Carlo simulations were used to compute the first three Al ionization potentials which were found to be within 0.03 eV of experimental values. Modifications to include core polarization corrections in the MESA electronic structure codes used at AFAL were begun.

THE PHOTOCHEMISTRY OF μ_3-(η-DIETHYLACETYLENE)-DECACARBONYLTRIOSMIUM IN SOLID ARGON

by

Susan Collins and Will Moran

ABSTRACT

The photochemistry of μ_3-(η-diethylacetylene)-decacarbonyl-triosmium (compound I) was studied by FTIR at 10K in argon matrices. Upon irradiation at 470 nm, compound I readily converted to a nonacarbonyl intermediate (compound II), accompanied by the elimination of carbon monoxide. The isomer of compound II, (compound III), is obtained at higher temperatures (>300 K) (1). This isomer is obtained when the methylene-hydrogen migrates along the molecule to form an Os-H-Os hydride bond. Compound III was not produced upon warming to 50 K. However, a 10 K matrix of this was prepared from a stable, room temperature sample. Compound III was found to form a new photoproduct (compound IV) at 10 K which has a spectrum similar to compound I. The photochromic properties and IR spectra of compounds I, II, and III are discussed. A structure for compound IV is postulated.

Composite-Embedded Fiber-Optic Strain Sensors

by
David W. Jensen, Ph.D.
and
Michael J. Koharchik

ABSTRACT

An experimental investigation was conducted on advanced composite structures with embedded fiber-optic strain sensors for smart structures applications. The fabrication procedure for embedding the sensors into advanced composite components was refined and the effects of the fiber optic inclusion on the tensile properties of composite laminates were examined. Difficulties encountered during fabrication involved maintaining the integrity and alignment of the optical fibers and protecting them during the filament winding and curing processes. Several 1.5 inch diameter composite tubes with embedded fiber-optic sensors were successfully fabricated. Preliminary results obtained from three independent optical systems, including an RF interferometer (NASA Langley Research Center), a Mach-Zehnder interferometer (Penn State University), and an optical time-domain reflectometer (G2 Corporation) indicate that further research is warranted, particularly in the area of interferometry. Additionally, two flat graphite/epoxy plates were filament wound and cut into one-inch wide specimens. Ten of these 22 specimens contained three embedded optical fibers each. Tensile tests conducted on these specimens indicated no discernible degradation in stiffness due to the embedded fiber-optic sensors.

Observer Design for the AFAL Grid Structure Using Low-frequency Accelerometer Data

by

Mark A. Norris

ABSTRACT

Analytical and experimental results demonstrate the low-frequency response of accelerometers in a 1-G environment. It is concluded that for low-frequency response measurements, the dynamic effect of gravity on the accelerometer response cannot be ignored. The effect is demonstrated experimentally for pendulum motion and elastic vibration of the AFAL two-dimensional Grid structure. The results of analysis and experiment show that accelerometer nodal locations exist and predominantly occur in the lower modes of vibration. Furthermore, an observer is designed to account for the accelerometer nodal locations and the dynamic effect of gravity on the accelerometer measurements.

PHOTOCHEMISTRY OF AZULENE SOLUTIONS AND A NOVEL PHOTOCHEMICAL NITRATION PROCESS

by

Jodye I. Selco

ABSTRACT

The solution phase photochemistry of azulene in various solvents was investigated using a variety of light sources. For the case of low power light sources, this process involves two photons of different colors and proceeds through one of the triplet states of azulene. It does not appear to be the triplet state itself that is involved in the photochemical process since they are not long lived enough to explain the secondary photon absorption. It is probably an optical isomer formed from the accessed triplet state that is involved in the chemical reaction following absorption of the secondary photon. The photochemical products formed include various products resulting from the reaction of azulene with a solvent molecule.

A novel photochemical nitration process has been investigated. This reaction involves the photodissociation of nitromethane and the subsequent attack on the solute molecule by the NO_2 radical formed during the photodissociation process. The solute used in this study was cyclohexane. Both nitrocyclohexane and dinitrocyclohexane were formed as a result of this novel photochemical process.

INJECTION SYSTEM AND SPRAY CHARACTERISTICS

BY

RAMESHWAR P. SHARMA

ABSTRACT

The atomization process in combustion applications has hundreds of publications and various theories related to liquid atomization as it applies to liquid rocket engines. A detailed literature search was conducted on atomization, spray characteristics, discharge coefficients, and various measurement techniques (for droplet velocity and size measurement). The published data are mostly empirical and only qualitatively understood with very little utility. The area of injector hydraulics is not very well understood. Very little or almost no data on atomization and mixing at high pressures are available with any reliability. This injector system and spray characteristics test project will help in establishing quantitative injector design criteria which will show the impact of injector design changes on C* performance, delta pressures, and thrust chamber compatability. This will also establish the cavitation limits and separation criteria. Most of the measurement techniques and test fixture design issues have been resolved. Many issues can only be resolved during the test setup calibration. Development of a mathematical model of this injector cold flow test setup is recommended from a future research and development point of view (for injector design, combustion, stability phenomenon and system performance) for rocket engines.

Chemical Kinetic Mechanisms for $CH_4/NO_2/O_2$ Flames

by

Trilochan Singh

ABSTRACT

The composition (37 species) profiles for a one-dimensional pre-mixed flame having $CH_4/NO_2/O_2$ ratio of .24/.56/.20 have been calculated. A chemical kinetic mechanism consisting of 160 reactions has been used for modelling the chemistry. The computed results and the experimental data of Branch et al. (4) show similar trends. The quantitative difference between the calculated composition profiles and the experimental composition profiles for CH_4, NO_2, NO, O_2, CO and CO_2 vary by a factor of 1.2 to 1.8. The computer program works over a wide range of initial reactant composition. The reasons for the differences between the computed profiles and the experimental profiles are attributed to the uncertainties in the flow rate, chemical kinetic mechanism and the rate data for various chemical reactions.

ABSTRACTS
EASTERN SPACE AND MISSLE CENTER

Generic Requirements for a CAE/CAD/CAM System

Albert A. Heaney

ABSTRACT

It is well recognized that the use of computer aided engineering, computer aided design/drafting, and computer aided manufacturing (CAE/CAD/CAM) equipment will have a significant impact on the design/manufacturing productivity of a facility particularly in the "high tech" area. For a facility that is convinced of this fact and prepared to make an investment into the purchase of such equipment, the questions that first arises is the quantity and kind of equipment to purchase. In particular, what hardware platforms, what software products, what support equipment, and what network configuration is needed? This study was aimed at developing a data base that would provide the basis for answering these questions relative to the specific CAE/CAD/CAM needs at ESMC. The study dealt with a methodology for identifying the needs of diverse groups that make up the engineering/drafting/analysis/maintenance operations at ESMC. The result of the study makes specific recommendations relative to each group that is to become part of the "network" even though some of the groups have some experience with CAD/CAM and others have no experience at all.

ABSTRACTS
ELECTRONIC SYSTEMS DIVISION

ALASKAN HF DATA ANALYSIS

by

George N. Bratton

ABSTRACT

The performance of networked high frequency communication in a disturbed environment is being tested in an attempt to document the superiority of networking as opposed to point to point HF communication. Although implementation problems have dramatically delayed the collection and analysis of sufficient data on which to base valid inference, the types of data that will be available have been recognized. A software system for providing initial (Stage 1) analysis has been developed, tested, and documented for use by Air Force personnel. Review of pre-implementation simulations indicates there may be potential problems with the particular networking protocols and field comparisons of networking protocols has been recommended.

STAGE 1 ANALYSIS OF ALASKAN HIGH FREQUENCY RADIO NETWORK

by

John F. Dalphin

ABSTRACT

Voice and data communications in the military currently rely primarily on microwave, satellite relay and other high technology mechanisms. These media, however, are the very ones most sensitive to EMF and other enemy intervention.

In considering other aternatives for maintaining communications in a hostile (nuclear) environment, the Air Force is testing the use of a high frequency radio network. This testing is taking place in Alaska where the aurora borealis produces deionization effects similar to those anticipated in a nuclear environment.

In the experiment high frequency radios located at Air Force sites function in a store-and-forward network structure. Each radio is controlled by a Zenith 150 computer which queues messages, selects transmission targets based on message traffic and dynamic link quality analysis (frequency selection), and maintains a history of its operation. Fixed length digital messages are transmitted and relayed; routing information, delay times and character error counts are captured in the data.

Statistical analysis of reduced data is performed and a graphical representation of the results is produced for briefing purposes.

ABSTRACTS
ENGINEERING AND SERVICES CENTER

High Intensity Stress Wave Propagation in Partially Saturated Sand

by

Wayne A. Charlie, Ph.D., P.E.
and
Steven J. Pierce

Abstract

We conducted high amplitude, Split Hopkinson Pressure Bar (SHPB) laboratory tests on specimens of 20-30 Ottawa and Eglin sands to evaluate the influence of saturation and capillary pressure on compressional wave velocity, stress transmission and damping. All specimens were compacted to a constant dry density and then subjected to a constant input stress. For specimens compacted at various water contents, both the wave speed and the transmitted stress ratio were found to increase as the saturation was increased from zero to approximately 30 percent and then decreased with increasing saturation. For specimens compacted dry, saturated and then desaturated utilizing the pressure-plate method, both the wave speed and the transmitted stress ratio were found to decrease with increasing saturation. Analysis of the experimental results indicates that these trends may be explained by the effect that capillary pressure has on the compaction effort required to compact the sands to a given dry density.

INDIVIDUALIZATION OF HUMAN TISSUE BY THE SEROLOGIC IDENTIFICATION OF ERYTHROCYTE ANTIGENS

by

David H. DeHeer, Ph.D.

ABSTRACT

Air Force investigators frequently are required to identify and individualize multiple tissue fragments recovered after aircraft mishaps. Serologic techniques offer the greatest possibility for individualization because they detect genetically determined antigens present in tissue. To permit the analysis of tissue, extracts of human red blood cells and skeletal muscle were prepared in 5% ammonium hydroxide and clarified by centrifugation. The erythrocyte antigens in the extracts were identified in a sensitive hemagglutination-inhibition assay performed in 96-well microtiter plates. Both direct and indirect assays were developed using commercially available antisera. A detailed procedure manual was written and investigation specialists were trained in the application and use of the serologic techniques.

ESTIMATION OF JET FUEL CONTAMINATION IN SOILS

by

Deanna S. Durnford

ABSTRACT

A petroleum product used for jet fuel called JP4 has been found in well bores penetrating unconfined aquifers underlying several air force bases. Because of the widespread use of JP4 and its potential for contamination of the vadose zone, an accurate method for predicting the total quantity and distribution of this fuel in the subsurface is essential.

A methodology that can be used to estimate the quantity of JP4 in soil from well bore data was developed and illustrated during this project. The basic data required was determined and laboratory column studies were used to illustrate the procedure.

COGENERATION ASSESSMENT ON MILITARY BASES

by

DR. E. K. GREENWALD, P.E.

ABSTRACT

The primary research consisted of developing a methodology for determining the technical and economic feasibility of establishing a cogeneration plant on a military base. The methods of analysis developed are preliminary in nature, designed to screen among the several cogeneration technologies available and to develop parameters so that an appropriate and promising technology can be recognized and identified for additional engineering study. If the situation looks promising, a final engineering analysis and design should be conducted by consulting engineers experienced in cogeneration technology.

There is a trend in government towards the privatization of services where applicable. Therefore, the methodology was developed under the assumption that the cogeneration project would be owned and operated by a private third-party. The pros and cons of this issue were developed as an secondary assignment.

SOIL VAPOR EXTRACTION OF VOLATILE ORGANIC CHEMICALS

by

Dr. Neil J. Hutzler and
David B. McKenzie

ABSTRACT

Laboratory experiments were conducted to measure the rate of removal of volatile organic chemicals from unsaturated porous materials by vapor extraction. Columns were packed with uniform sand and a fired, porous clay and contaminated with water containing trichloroethylene, toluene, or 1,1,1-trichloroethane. Organic-free air was drawn through the column into a gas chromatograph, which was programmed for automatic sampling.

All volatile organic chemicals were effectively removed from the column by vapor extraction. TCE and toluene exhibited similar behavior because their volatility is approximately the same. 1,1,1-TCA, which has a higher air/water partitioning coefficient, was removed at a faster rate. Toluene and TCA were more slowly removed from the porous clay because of the time required for diffusion out of the particles.

The rates of vapor extraction as determined by experiments were compared to predictions made by a mathematical model of the soil column system. While the model could predict the early removal rates of the volatile compounds quite well, it did not simulate the tailing of the compounds seen in the experiments.

A PRELIMINARY INVESTIGATION OF NEURAL NETWORKS FOR THE AIR FORCE ENGINEERING AND SERVICES CENTER

by

W. Pratt Mounfield, Jr. Ph.D.

ABSTRACT

Adaptive Neural Systems were searched in the recent literature for algorithms to solve optimization problems that may be encountered under the Rapid Runway Repair Directive. In particular, the solutions to the Traveling Salesman Problems were sought, because of the similarity to TSP and the Minimum Operating Strip Problem. The TSP problem was simulated under a continuous systems simulation program (ACSL) for ten cities using the Hopfield and Tank solution model. The TSP is an example to a N-P complete problem and a good local minimum was found based upon random initial conditions. Areas of further research were discussed, including the application of simulated annealing and Genetic Algorithms to the TSP problem.

Rapid Measurements of Adsorption and Desorption of Volatile Organic Compounds

by

Richard S. Myers

ABSTRACT

A technique for the measurement of concentration changes due to the rapid adsorption of volatile organic compounds was used to determine the speed with which these compounds are sorbed on soil and aquifer materials. The technique works well for adsorbing materials with a reasonably high organic carbon content. Results indicate a rapid initial adsorption followed by a slower approach to equilibrium. Most of the adsorption occurred within ten minutes. Desorption, however, proceeded at a much slower rate.

PREFABRICATED HYPAR STRUCTURAL SYSTEM
COST COMPARISON WITH BOX AND ARCH STRUCTURES

by

Ramalingam Radhakrishnan

ABSTRACT

The USAF is interested in the evaluation and selection of an economical shelter system that can protect equipment and personnel from conventional weapons. Details of the three types of protective structures are given. The Hypar protective structure system uses prefabricated hyperbolic paraboloid shells which could be erected in a short notice at preferred locations on a foundation slab. An equivalent rectangular box and arch (barrel vault) are conventional type structures which require cast-in-place construction. Design of structural elements, structural details, construction time, unit price of materials and labor for the three structures are presented. Cost comparison of Hypar, Box, and Arch structures and recommendations for selection are provided.

ABSTRACTS
FRANK J. SEILER RESEARCH LABORATORY

THERMAL DECOMPOSITION KINETIC STUDIES OF NTO BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

by

Dan R. Bruss

Abstract

Thermal decomposition of 3-nitro-1,2,4-triazol-5-one (NTO) was monitored over a temperature interval of 508-518 K. Rate constants were obtained for the temperatures investigated by measuring unreacted NTO as a function of time as determined by high performance liquid chromatography. The decomposition patterns are indicative of an autocatalytic mechanism. The temperature dependence of the rate constants found in the interval exhibited Arrhenius behavior, yielding an activation energy of 75.5 kCal $\pm$ 9.3 kCal. Mass spectral analysis of head space gas samples taken during decomposition demonstrate carbon dioxide as a decomposition product. Preliminary UV and IR analyses of NTO suggest a shift from the more stable keto form to the enol near a pH of 7.

Preparation and Properties of Nitronium Tetrachloroaluminate

by

Charles M. Bump

ABSTRACT

Liquid nitryl chloride (NO_2Cl) at -80° reacts with solid aluminum chloride to produce a yellow solid. The UV-visible spectrum of this adduct is identical to that of commercial nitronium tetrafluoroborate in dry acetonitrile. Aluminum-27 magnetic resonance spectroscopy showed the presence of tetrachloroaluminate ion. The compound is tentatively labeled nitronium tetrachloroaluminate, although there is an alternate structure possible for this adduct. The adduct does not nitrate benzene or toluene in good yield using the acidic or neutral chloroaluminate melts.

Homogeneous Ziegler-Natta Catalysis in Lewis Acid Molten Salts

by

Richard T. Carlin

Abstract

Dissolution of the Cp_2TiCl_2 catalyst and its $AlCl_{3-x}R_x$ cocatalyst in the ambient-temperature molten salt $AlCl_3$:MEIC (MEIC = 1-ethyl-3-methylimidazolium chloride) produces an active homogeneous Ziegler-Natta catalyst system. The Ti catalyst is active in acidic melts, $AlCl_3$:MEIC molar ratios > 1, but not in basic melts, $AlCl_3$:MEIC molar ratios < 1. Cp_2ZrCl_2 and Cp_2HfCl_2 with $AlCl_{3-x}R_x$ cocatalysts are not catalytically active in acidic melts. The lack of activity of Zr and Hf complexes is attributed to their inherently stronger M-ligand bonding which precludes ethylene coordination .

NMR studies of the Cp_2TiCl_2 complex in acidic melts indicate formation of a strong 1:1 complex with $AlCl_3$ while Zr and Hf form much weaker 1:1 complexes. The weaker $AlCl_3$ complexation by Zr and Hf is indicative of stronger M-Cl bonding in Zr and Hf versus Ti.

The study clearly demonstrates the usefullness of ambient-temperature molten salts as solvents to generate catalytically active transition metal complexes.

A MCSCF STUDY OF THE REARRANGEMENT OF NITROMETHANE TO METHYL NITRITE

Michael L. McKee, Ph. D.

ABSTRACT

Ab initio calculations, which use the 6-31G* basis set and a multiconfigurational (MC) wavefunction, have been carried out for the unimolecular rearrangement of nitromethane to methyl nitrite. Geometry optimization of nitromethane and methyl nitrite have been carried out with a two configuration wavefunction while the unimolecular transition state was refined with a 20-configuration wavefunction which was determined by using all configurations generated by excitation from the two highest occupied orbitals into the two lowest empty orbitals (4 electron in 4 orbitals). The transition state indicates a weak interaction between a methyl radical and nitro radical. In the transition state the breaking CN bond and the forming CO bond are 3.617 and 3.700Å, respectively and there is a significant difference predicted in the NO bond lengths in the transition state (1.371/1.155Å). At the highest level of calculation (Multireference CI) the unimolecular barrier is predicted to be 57.1 kcal/mol which is 7.7 kcal/mol above the sum of CH_3 and NO_2 radical energies.

THE EFFECTS OF SODIUM CHLORIDE ON ROOM TEMPERATURE MOLTEN SALTS

by

Tammy J. Melton

ABSTRACT

The effects of adding sodium chloride to room temperature molten salts containing 1-methyl-3-ethylimidazolium chloride and aluminum chloride have been examined. Sodium chloride will dissolve in basic or neutral melts, but only in very small quantities. Sodium chloride will dissolve in larger quantitites in acidic melts. The limit of the solubility has been determined to be that quantity which will result in a neutral melt, that is, where mole fraction aluminum chloride is reduced to 0.5. Cyclic voltammetry indicates a neutral melt by showing no aluminum reduction (indicative of an acidic melt) and no chloride oxidation (indicative of a basic melt) except at extremely low concentrations. A sodium electrode was constructed which exhibited a rest potential of -2.05 V and maximum current at -0.85 V.

AB INITIO AND CHEMICAL DYNAMICS STUDY OF ENERGETIC MATERIALS

by

Patricia L. Moore Plummer

ABSTRACT

Theoretical modeling of energetic materials was undertaken using the methods of ab initio quantum mechanics and molecular or chemical dynamics. This study continued the ab initio calculations of 1-nitro-propene reactions already underway at Seiler Laboratory. Both extended basis set calculations and post Hartree-Fock calculations were carried for NO_2 , HONO, OH, C_3H_5, 1-nitro-propene, 1-nitroso-propene,and related compounds. Of principal interest were reactions which involved the migration of a hydrogen from the CH_3 group to the NO_2group. Reaction energies were determined for the various levels of theory, in part to determine what level of calculations are needed for predicting experimental results.

In addition to the ab initio calculations, chemical dynamics codes were installed. Calculations were carried out on ethylene, both to test the code and to gain information on the importance of the double bond on energy transfer processes within a molecule. Preliminary work on the development of a force field for nitro-ethylene and 1-nitro-propene was initiated.

SEPARATORS FOR MOLTEN SALT BATTERIES

by

James L. Schmutz

ABSTRACT

Various polymeric films were made, and along with some commercially supplied membranes, were tested as possible separators for batteries with the room temperature molten salt electrolyte system: 1-methyl-3-ethylimidazolium chloride/aluminum chloride (the melt). The polymers tested were poly(1,1-dimethyl-3,5-dimethylenepiperidinium chloride) (PDDPCl); undoped and $ZnCl_2$ doped polyethylene oxide (PEO); polyphosphazenes with mixed fluorinated alkoxy side groups (FPN, supplied as Eypel-F gum by Ethyl Corp.) and polyphosphazenes with primarily trifluoroethoxy side groups (TFE). Chloride selective membranes supplied by Toyo Soda Co (Tosoh USA, Inc.) were also tested. Only the polyphosphazenes are suggested for further study.

ABSTRACTS
GEOPHYSICS LABORATORY

RADIATIVE ASSOCIATION IN ION-MOLECULE REACTIONS: REACTIONS OF SOME CARBON CATIONS

by

Lucia M. Babcock

ABSTRACT

For some time now we have been interested in ion-molecule association reactions, particularly in the existence of a radiative stabilization channel. In previous studies, we identified the addition of halide ions to boron trihalides as a group of ion-molecule association reactions which undergo radiative as well as collisional stabilization. These systems are, to our knowledge, the first such studies reported. Association reactions of positive ions, especially those of carbon cations, are also of great interest. Since radiative stabilization has been observed in the boron halide/negative ion reactions, and since carbon cations are isoelectronic with neutral boron species, these are excellent candidates for radiative stabilization. In our work at AFGL this summer, we have looked at the reactions of CH_3^+, CD_3^+, CF_3^+, and CCl_3^+ with both SO_2 and NO as a function of temperature (over the range 210K to 470K) and pressure (over the range 0.3 to 1.0 Torr). While the CCl_3^+ ion does not react at all with either neutral, SO_2 adds to the other three carbon cations and radiative stabilization may be involved. Only charge transfer reactions are observed for NO with CH_3^+, CD_3^+, and CF_3^+.

Finally, ion velocities were measured as a function of pressure, temperature, and helium flow. While there is a monotonic dependence upon helium flow, velocities appear to be independent of pressure and only slightly dependent upon temperature.

Dr. Stephen Baker

UPWARD CONTINUATION OF GRAVITY DATA WITH ERROR ESTIMATES

ABSTRACT

An experiment performed in the past year by AFGL personnel appears to show a deviation from the Newtonian inverse square law. In this experiment, gravity measurements on the earth's surface are continued upward and are compared with gravity measurements on a TV tower. The upward continuation is not a simple exercise and has been done in several different and independent ways. It is proposed here to undertake still another approach to the upward continuation to provide a check of the earlier continuation calculations, to provide a test for the presence of discrepant data, and to obtain independent error estimates in the predicted gravity on the tower.

Impulse Approximation Formalism for Atom Molecule Collisions

by

Pradip M. Bakshi

ABSTRACT

The Impulse Approximation Formalism has been developed beyond the Peaking Approximation to tackle the low projectile velocity, high internal molecular energy collisions. A new representation is given for the T-matrix for the hard core potential. This Momentum Transfer Representation converges rapidly and is found to be separable for the prior and the post forms. Explicit expressions are obtained for the differential and total cross sections in terms of vector coupling coefficients. Various theoretical extensions and experimental applications are discussed.

Total Dose Effect on Soft Error Rate for Dynamic MOS Memory Cells

by

Reuben Benumof

Abstract

A simple model for the soft error rate for dynamic MOS random access memories due to normal galactic radiation was devised and then used to calculate the rate of decrease of the SEU rate with total radiation dose. The computation shows that the decrease in the soft error rate is of the order of one per cent per day if the shielding is 0.5 g/cm^2 and the spacecraft is in a geosynchronous orbit. The decrease is considerably less in a polar orbiting device.

DIGITAL PHOTOMETRIC CALIBRATION OF AND ANALYSIS WITH VIDEO IMAGERS IN THE ULTRAVIOLET

by

Donald F. Collins

ABSTRACT

Algorithms and computer programs were developed for the following tasks: a) analyze close-up images of plumes from rocket engine test firings to determine the plume axis and the plume profile near the edge of the nozzle; b) to calibrate imaging photometers with point-like images; c) to measure the total signal in faint star images with poor signal/noise. The focal length of a supplementary telescope lens was determined which would enhance the images of a large format telescope with respect to field of view and speed. Tutorial instruction was given to AFGL personnel on the use of commercial software packages (ASYST and MATLAB) which the author has used extensively in his analysis.

A MODEL FOR INTENSIFIED FRONTOGENESIS OVER A MODIFIED MOUNTAIN RIDGE

by

Michael E. Frantz

ABSTRACT

A thorough review of meteorology fundamentals was conducted, followed by an analysis of current models in use for representation of frontogenesis. The intensification of frontal strength due to a particular type of mountain/plateau combination profile such as found at the eastern edge of the Rockies is considered, via the development of a model using the geostrophic momentum equations. The atmosphere is assumed to be a stratified, adiabatic, rotating fluid with the Boussinesq and hydrostatic approximations made. Scaling arguments justify use of the geostrophic momentum approximation, and diagnostic and prognostic equations for both the geostrophic and ageostrophic velocity fields are derived. Boundary conditions are established for the numerical solution of these equations. Numerical simulations are proposed for the cases of front only, mountain only, and front and mountain combined.

Gamma and X Radiation from Solar Flares

by

Christopher Godfrey

ABSTRACT

Solar flares are known to produce a variety of types of electromagnetic and charged particle radiation including radio, microwave, visible, x-ray, and gamma ray radiation, and energetic protons. The sites in the solar atmosphere where the x-rays and gamma rays are produced varies in a number of solar flare models. In this study the onset time of the E > 300 KeV x-ray emission was compared with the time of onset of 4-7 MeV gamma ray excess. The results indicate that the > 300 KeV x-rays and 4-7 MeV gamma rays are produced simultaneously in some flares, but that the onsets are separated by as much as 30 seconds or more in others.

This implies that either the x-rays and gamma rays are not generally produced by the same energetic particles, or they are not produced at the same site, or both. In many gamma ray flares, the particles which generate the x and gamma rays cannot be accelerated by a single shock wave moving continuously upward through the solar atmosphere.

Theoretical and Observational Studies of Geomagnetic Storm-Related Ion and Electron Heating in the Subauroral Region

by

Janet U. Kozyra

ABSTRACT

Recent theoretical work indicates that energetic oxygen ions (1 - 200 kev), a component of the earth's ring current, and suprathermal oxygen ions (< 1kev), that accumulate in the outer plasmasphere during geomagnetic activity, may be responsible for elevated electron and ion temperatures, respectively, associated with the subauroral region as a result of Coulomb interactions with the thermal plasma. Stable auroral red arcs are a visible consequence of elevated subauroral electron temperatures. SAR arc observations extend over several solar cycles and contain information on seasonal, solar cycle and magnetic activity variations in the subauroral electron temperature peak and its energy source. Such variations in SAR arc intensity and occurrence frequency may be due to differences in the high altitude heat source or to seasonal and solar cycle changes in the atmosphere and ionosphere . Past studies of SAR arcs have not addressed the question of their solar cycle or seasonal variability and detailed modelling has been done only for solar maximum observations. The ETS/GTMS campaign, which was carried out during the 19-24 September 1984 magnetic storm, however, has now provided a complete set of data detailing atmospheric and ionospheric conditions during the same time period that three solar minimum SAR arcs were observed by the MASP chain of photometers. A parametric study was carried out, using a truncated version of an ionosphere model described in Young et al (1980) and typical ionospheric and neutral atmospheric density profiles for each season and for various stages in the solar cycle given by the IRI and MSIS-86 models, respectively. Electron temperature profiles and resulting 6300Å emission intensity were obtained for different seasonal and solar cycle conditions holding upper boundary heat flux constant. The solar minimum SAR arc observations during the 19-24 September 1984 storm will be interpreted in light of the results of the parametric study and compared to models and observations of solar maximum SAR arcs which have appeared in the literature as work on this topic progresses. This study will provide an insight into causes of solar cycle variations in the intensity of SAR arcs and associated elevated electron temperatures. In addition to this work, a statistical study of the relationship between suprathermal oxygen ions, measured by the DMSP satellite and elevated ion temperatures, observed by the RIMS instrument on DE-1 was initiated. A number of individual storms will be examined in detail using the combined DMSP and DE-1 data sets.

UPDATE OF THE HITRAN DATABASE

by

Irving Lipschitz

ABSTRACT

Six gases were evaluated for the HITRAN database. Two, hydrogen sulfide (H_2S) and formic acid (HCOOH), were not included in previous editions of the database. For H_2S, the ν_1, ν_2, $2\nu_2$ and ν_3 bands, detailed line position, transition intensities, lower state energies, pressure broadening, molecule and isotope indices and upper and lower state vibration and rotation quantum numbers were reported. For formic acid, only lower state energies and line measurements for the ν_6 band were cited. Four gases, methyl chloride, hydrogen peroxide, hydrogen cyanide and formaldehyde are already on the database. We wanted to replace the estimated values used for certain parameters with the latest experimental data. Except for hydrogen peroxide, however, there was precious little suitable information to add to or update the previous values of the database. For these four molecules, the database appears to be correct.

Spectral Domain Decomposition

by

John P. McHugh

ABSTRACT

Spectral Domain decomposition was investigated for application to partial differential. A method of elimination is proposed which allows decomposition to any number of sub-domains without any special requirements on the interfacial conditions. This method allows solution on a parallel processor, where each processor operates on one domain, separate from the others. The method is applied to the one-dimensional heat equation using the Chebychev collation discretization. Accuracy of the method is discussed briefly.

On The Possible Inclusion Of " Heavy " Molecules In The HITRAN Database

by

Himanshoo V. Navangul, PhD

ABSTRACT

Since the early 60's work has been done at the Hanscom AFB on the compilation of various spectroscopic parameters of molecules present in the Earth's atmosphere.

Earlier, the emphasis was placed on simple molecules with relatively high atmospheric concentration. These were generally of small size such as water, carbon dioxide, ozone, methane and so on, and were also highly infrared active. Now efforts are being made to add more data on some of these molecules as well as on others that are relatively large in size and have small atmospheric concentration. These include: Ethane, Ethene(Ethylene), Ethyne(Acetylene), Propane, and others.

A thorough literature search had to be carried out to locate information relevant to the spectroscopic parameters of these molecules and then a critical examination was conducted to see which of the molecular data could be included in the future versions of the HITRAN.

Software Tools For Processing Large LIDAR Data Streams

by

Martin A. Patt

ABSTRACT

A careful study was performed to ascertain what kind of software tools would aid in the development of new LIDAR data analysis programs. A "toolbox" of software utilities was developed and documented.

ABSTRACTS
ROME AIR DEVELOPMENT CENTER

Noise Calculations in a RADAR Receiver

by

Beryl L. Barber

and

Daryl W. Sprehn

ABSTRACT

The availability of low noise receiver preamps has created the need for a new look at the effective noise of radar receivers. The high cost of low noise amplifiers may not be justified without first considering the effects of other system noise sources more carefully.

The theory and approach for looking at the transmitter and antenna effects on receiver noise are presented. The overall effects of temperature, loss, and VSWR are considered.

STABILITY OF Au/W/GaAs AND Au/Pt/Ti/GaAs SCHOTTKY BARRIER HEIGHT: A PRELIMINARY STUDY

by

Keith A. Christianson

ABSTRACT

The stability of the barrier height of Au/W/GaAs and Au/Pt/Ti/GaAs Schottky barriers under long term biasing conditions has been examined. Both types were found to exhibit decreases in barrier height under long term reverse bias conditions, with the changes seen for the Au/W/GaAs diodes (≈30-50 meV) much greater than those for the Au/Pt/Ti/GaAs diodes (≈5 meV). The changes in barrier height were seen to have a characteristic logarithmic dependence on time. Recovery of the barrier height was seen to occur over a period of days in a zero bias condition, or in an accelerated manner under forward biasing for both sets of samples. A preliminary Auger study has correlated the presence of oxide at the interface with the barrier height shift observed, and this oxide is presumably involved in the formation/destruction of deep traps/interface states which are responsible for the change in barrier height.

Parallel Runtime System For Lucid

by

Darin DeForest

ABSTRACT

As parallel computers are becoming more commercially available, programmers are being forced in reorganizing their programming skills as well as developing new strategies to utilize the parallel properties. Unfortunately different parallel computer systems are not identical thus each computer system requires the use of a slightly different strategy. These subtle differences preclude porting a program from one computer system to another, an unacceptable condition since the lifetime of computer systems is approximately 5-10 years while the lifetime of software is 15-20 years. In this paper we outline a portable, parallel runtime system for a high level programming language Lucid. A Lucid program is devoid of instructions specifying sequencing, concurrency, and communication. The runtime system is designed to be generic as possible through the use of abstraction. The instantiation of the runtime system to a specific parallel architecture is done only once when the runtime system is installed by the system administrator. The runtime system manipulates the execution of code blocks which resemble light-weight tasks, independent threads of control sharing a common memory space. The code blocks were generated before execution by a Lucid compiler which have of used specific architectural properties during the generation of code blocks. The exact execution of a code block depends not only on the dynamic execution of the Lucid program, but also uses the load information from each processor.

Pre-sort Processor Phase Distortion Evaluation

by

Paul T. Dingman

ABSTRACT

The Pre-Sort Processor demonstrates signal excision in the frequency plane by means of an optical technique. The process interfaces with analog systems using a Bragg Cell transmitter and a photo cell receiver. A spatially disbursed frequency band is broken into two hundred sub bands that are individually removable by bragg cell difractors. The theory behind the Pre-Sort Processor did not indicate that phase shift would be frequency dependent or increase around the edges of an excised notch.

This researcher has observed that excision does not introduce either of these types of phase distortion. However, during the process of examining the phase shift introduced by optical excision, the researcher became convinced that acousto-optic devices may introduce phase perturbations that could destroy the information content needed for many applications.

A PROLOG Natural Language Front End to

an ERIC Object Oriented Data Base

by

H. Kevin Donaghy

ABSTRACT

CHARISMA, a natural language front end to a PROLOG relational data base, was modified to serve as a front end to an ERIC object oriented database. CHARISMA was translated from Quintus to Symbolics PROLOG. CHARISMA was then altered so that its outputs were logical forms corresponding to natural language query types. Since Symbolics PROLOG supports calls to LISP, and since ERIC code can be embedded in LISP functions, it was then possible to extend CHARISMA so that it directly queried the ERIC data base.

No Abstract Submitted At This Time

Dr. Oleg Jakubowicz

DESIGN OF AN OPTICAL CORRELATOR TESTBED AND OPTICAL CO-PROCESSOR

by

Samuel P. Kozaitis

ABSTRACT

An analysis and evaluation of devices and techniques for analog optical pattern recognition is presented. A software package for producing a variety of filters, and a liquid crystal television operating as a spatial light modulator are analyzed. A highly flexible correlator testbed for the testing and evaluation of a variety of devices is given. The testbed consists of three parts. The first is an input system which is capable of enhancing an input image to the correlator. The next part is a computer-driven portion which is capable of producing a variety of filters. The third section is used for the evaluation of detectors.

A digital optical co-processor is designed based on an optical programmable logic array. the system performs edge detection on an image by storing reference patterns of an algorithm of interest.

CHARACTERISTICS OF DIALOG IN A NOISY CHANNEL FOR PERFORMING A TIME-ORIENTED TASK

by

David J. Townsend

ABSTRACT

This paper is a preliminary report of on-going research on the system that controls the presentation of primary and secondary information in human dialog. In this research we examine dialog between people who are using recording equipment for transcribing speech signals. Experienced transcribers spoke commands for operating the recording equipment, which a second subject heard and executed. By varying the level of noise in the channel of communication from the transcriber to the second subject, we observe how humans modify messages depending on how likely misperceptions are. By varying the time constraints for transcription, we observe the properties of speech when dialog participants are under pressure to communicate quickly. The results will be used to develop a system of speech synthesis that varies the timing and form of utterances depending on the costs, risks, and payoffs of communication.

Dr. Donald Ucci &
Mr. Robert Petroit

ABSTRACT

The Effects of Nonlinearities of High Speed Analog-to-Digital Converters on Digital Beamforming Arrays

Investigation of degradations to digital beamforming arrays caused by nonlinear characteristics of Analog-to-Digital Converters (ADCs) was performed. The study revealed that degradation to the array beam pattern is minimal when only the desired signal is present. However, severe pattern distortion occurred when the signalling environment contained both desired signal and jammer.

These results strongly suggest further investigation into the degradations caused by several jammers and means to counter their effects. Several approaches are proposed to perform these tasks.

STUDIES IN MICROWAVE SUPERCONDUCTORS

P. J. Walsh

SUMMARY

This report covers work which was carried out at Hanscomb Air Force Base, EEAC/Antennas and Components Section during the summer of 1988 as a Air Force Summer Research Fellow. There are two self-contained sections. The first section reviews the theory and experimental studies of the microwave surface impedance of the new classes of high temperature superconductors while the second section† presents a theoretical review of microwave surface impedance applicable both to superconductors and metals. A paper has beeen prepared with John Derov and other scientists at HAFB for submission to Applied Physics Letters.

† not included. Full version at HAFB

Chemical Vapor Deposition of Titanium Compounds with an Atomic Layer Epitaxy System

by

Kenneth L. Walter

ABSTRACT

Equipment was designed, constructed and partially assembled for the purpose of depositing thin films of compounds containing titanium (primarily titanium nitride and titanium boride) on various substrates.

One technique to be used is atomic layer epitaxy (ALE), wherein single monolayers of atoms are deposited one at a time by chemical vapor deposition. This technique has recently been reported in the literature as applied to gallium arsenide, but has not yet been reported for titanium compounds. If successful, this work could produce precisely controlled films with electronic, mechanical and corrosion applications. This work is currently being continued by researchers at Hanscom AFB, Massachusetts.

Surface Effects on the High Temperature Superconducting YBaCuO Thin Films grown by RF Sputtering

by

Gwo–Ching Wang

ABSTRACT

The surface morphology and near surface chemical composition of high temperature superconducting YBaCuO thin films grown on $SrTiO_3(001)$ substrates by RF sputtering technique are studied by Scanning Electron Microscopy (SEM), Scanning Tunneling Microscopy (STM) and the depth profile of Auger Electron Spectroscopy (AES). A new surface effect on superconducting was found that is the chemical compositions at and near the surface of thin films are different from the bulk composition determined by Energy Dispersive X–Ray Analysis (EDX). At about 500Å deep into the film the Auger peak to peak heights of elements in YBaCuO gradually approach the peak to peak heights obtained from the elements at the surface of a fractured bulk material. This off–stoichiometry transition layer near the surface implies that there is a minimum thickness of thin film, i.e., about twice of 500Å, that will exhibit superconductivity. It also decreases the critical temperature and broadens the superconducting transition width of YBaCuO thin films and this effect is very drastic on films that have submicron size grains.

ABSTRACTS
WEAPONS LABORATORY

Realization of Sublayer Relative Shielding Order in Electromagnetic Topology

by

Lane H. Clark

Abstract

A fundamental problem in qualitative electromagnetic topology is the construction of the interaction sequence diagram given a preassigned shielding between all pairs of primary sublayers. Idealizing this into one of relative shielding order makes this problem amenable to graph theoretic treatment. A constructive characterization of the relative shielding order matrix for primary sublayers of an electromagnetic topology defined to the level of layers and sublayers is given. In addition, all possible sublayer topologies with relative shielding order at most 5 are explicitly given.

Diode Laser Probe of Vibrational Energy Transfer Kinetics in Sulfur Monoxide

by

David A. Dolson

ABSTRACT

A new experimental apparatus has been assembled for the purpose of measuring the rates of collisional energy loss from low vibrational levels of sulfur monoxide (SO). The design calls for excimer laser photolysis of sulfur dioxide at 193 nm to prepare the SO radicals. High resolution diode laser absorption spectrometry will be used to obtain time-dependent concentrations of SO in specific energy levels. Preliminary results have suggested directions for improving the signal levels and reducing electrical interference.

EVALUATING HOW LASER IRRADIATION DAMAGES LOADED COMPOSITE MATERIALS

by

William M. Jordan

ABSTRACT

This study was an analysis of how laser irradiation damages composite materials. Particular attention was placed on how lasers damage pressurized cylinders made from composite materials.

Three different models of laser damage of composite materials were examined. They were a viscoelastic model, a model developed by Southwest Research Institute, and Lockheed's 'Hybrid Model'. Each model's assumptions, advantages and limitations were analyzed. The viscoelastic model is not useful at the present time due to inadequate data and analysis. The Southwest Research Institute Model will predict when local failure occurs, while the 'Hybrid Model' is more useful in predicting when global failure will occur.

These last two models are too empirical at the present time and additional analysis and testing is required to determine more precisely under which conditions they will or will not work. Recommendations were made concerning changes on the next set of pressurized cylinder tests so that more useful data for these models could be obtained. Recommendations were made concerning additional mechanical tests whose results could help to examine the predictive capability of the models.

RELATIVISTIC EFFECTS IN GPS TIME TRANSFER

by

Arkady Kheyfets

ABSTRACT

Precise global clock synchronization is an integral part of the Global Positioning System (GPS) operations. The GPS satellites clocks are moving with respect to the clocks of the surface stations observers at speeds sufficient to necessitate careful consideration of special relativistic effects on synchronization of the clocks. At the same time, the GPS satellites orbits radii are large enough to cause the difference between gravitational potentials at the satellites clocks and at the surface stations clocks sufficient to produce effect on the clocks synchronization of the same order of magnitude as the special relativistic effects. A consistent treatment of both effects can be done only in general relativity.

We have performed general relativistic analysis of the GPS time transfer effects using both traditional mathematical techniques and newly developed in general relativity technique of the null strut calculus. The obtained expressions for the effects, as we have shown, admit unambiguous physical interpretation of each term, which clarifies the physical origin of effects. The null–strut calculus technique illuminates the 4–geometry of the procedure. The null–strut calculus looks very promising as future common language in formulation of such kind of problems and developing a satellite–based Spacetime Common Grid (SCG).

Stopping Power and Penetration Physics

by

Leonard E. Porter

ABSTRACT

The stopping power of matter for charged subatomic projectiles, a complex topic even for the specialist, often appears ominously complicated and perplexing for the uninitiated. The subject is of crucial importance in both target discrimination and target destruction aspects of particle beam physics. In the spirit of clarification basic stopping power theory and measurement were reviewed for all classes of projectile traversing elemental targets over the entire accessible interval of projectile energies. Extension of theory for composite target application was discussed in some detail. The concept of range was introduced, and methods of calculation and measurement were explained. Finally, various extant tabulations of range and stopping power were described, compared, and appraised.

Performance Models for Parallel Algorithms

by

Michael D. Rice

ABSTRACT

New definitions of speedup and efficiency are used as the foundation for several models describing the performance of parallel algorithms. The new parameters introduced in these definitions provide improved interpretations of the "serial" and "parallel" fractions frequently used in the parallel computing literature. Moreover, they take into account the effects of problem size and number of processors and allow the formulation and proof of a number of basic laws in the models. These models provide the first sound basis for future theoretical and empirical studies of parallel algorithms. In particular, it is anticipated that the models will provide the foundation for understanding statistical aspects of parallel algorithms which will allow predictions of performance.

ABSTRACTS
AERO PROPULSION LABORATORY

COMPUTATION OF THE FLOW FIELD AND HEAT TRANSFER IN A RECTANGULAR PASSAGE WITH A TURBULATOR

by

Bryan R. Becker, Ph.D., P.E.

ABSTRACT

A detailed numerical study of the aerothermal mechanics within a short straight section of a turbine blade internal cooling passage with a single turbulator is described. The two dimensional, transient, Reynolds averaged Navier Stokes, continuity and energy equations are iterated to a steady state solution using the MacCormack explicit predictor-corrector algorithm. Turbulence closure is achieved through the use of the Baldwin-Lomax algebraic two layer eddy viscosity model.

Axial distributions of local skin friction coefficient, local Stanton number and local Nusselt number are given. Profiles of velocity and temperature are presented as well as contours of streamfunction and temperature which display complex details of the flow structure. It was found that the widely used Reynolds Analogy greatly underpredicts the heat transfer rate as given by a direct calculation using Fourier's law. Finally, the numerical results are found to compare favorably to the experimental results published by Han et al (1986).

USE OF LASER SHEET LIGHT VISUALIZATION TECHNIQUE ON STUDIES OF FILM COOLING FLOW AND FLOW OVER CAVITIES

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ABSTRACT

Flow visualization studies on characteristics of film cooling flow and cavity flow are performed using the technique of laser sheet light illumination with $TiCl_4$ seedings. Primary efforts focus on the detailed structures of film cooling injection and cavity induced free shear layer. The high Reynolds number flow existing in the present film cooling system produces distinctly different coherent structures compared to the low Reynolds number cases reported earlier by Rivir et al. This is, in part, caused by the lift-off effects which induce the injection structures leaning more to those of a free shear layer than to a wall layer. For the cavity flow, development of the separated shear layer is largely determined by the value of the cavity aspect ratio, W/H. The shear layer reattaches on the cavity floor when $W/H \geq 8$. For cavities with $W/H < 8$, current observation clearly shows that part of the shear layer diverts back inside the cavity. Nevertheless, the proportion of this diversion diminishes as the value of W/H decreases. The present flow characteristics support the results of local mass transfer data obtained in a separate study.

Experimental Study of Electonic Excitation of Xenon by Electon Impact

by

Jerry Clark

ABSTRACT

Preliminary 5d optical excitation functions of atomic xenon have been measured from the onset to 100 eV. Particular interest has centered on the technique of fourier transform spectroscopy for the determination of these cross sections. Cross sections of the 5d[3/2] level for the lines at 2.026 microns and 1.73 microns were measured to be $1.89 \cdot 10^{-17} cm^2$ and $7.17 \cdot 10^{-18}$ cm^2 respectively at 50 eV electron energy. Interesting structure has been observed in the excitation function the 2.026 micron line below 10 eV and between 10 and 50 eV. Acquisition of spectra for the determination of optical cross sections is discussed.

CARS THERMOMETRY IN DROPLET-LADEN FLOWS

by

Derek Dunn-Rankin

ABSTRACT

The ultimate objective of this research is to measure simultaneously, and non-intrusively, all of the parameters important in gas turbine combustion. These parameters include droplet size, droplet velocity, gas velocity, gas temperature, and major gas phase species concentration. In support of this ultimate objective, the present research examines the potential for coherent anti-Stokes Raman scattering (CARS) to provide reliable temperature measurements in the presence of liquid droplets. The droplets cause a dielectric breakdown by focussing the CARS laser beams. This breakdown produces a plasma that can disrupt or obscure the CARS signal. Specifically, we examine the influence of laser induced breakdown on the CARS signal, and we determine the importance of droplet position relative to the sample volume, and the importance of droplet concentration, on the reliablity of CARS temperature measurements in droplet-laden flows. In addition, we propose a reliable data reduction procedure to minimize the disruptive influence of laser induced breakdown on CARS temperatures.

Measurement of the Velocity Field and Heat Transfer Coefficients Associated with a Rectangular Wall Jet

by

Wayne A. Eckerle

ABSTRACT

The effect of high free-stream turbulence on heat transfer was experimentally investigated. High turbulence and large length scales simulating gas turbine engine conditions were produced with a wall jet. A 7cm x 48cm rectangular nozzle created the jet. The rectangular geometry reduced the edge effects observed in previous tests with a circular wall jet. All three components of mean and fluctuating velocities were acquired with a three-component Laser Doppler Velocimeter(LDV). Profiles were acquired at the jet centerline at eight streamwise locations. Supply conditions were contolled to provide a maximum velocity in the profiles of 37 m/s. Free-stream turbulence varied from 10% to 20% at these locations. Heat transfer coefficients on the flat wall were acquired at six locations for free-stream velocities ranging from 56 m/s to 10 m/s. Because of the extensive effort required to set up the LDV system and a malfunction of the laser during the program, reduction and correlation of these data is in progress. Some preliminary analysis is presented in this report. A complete summary of the results will be presented at the American Physical Society's Fluid Dynamics Meeting, November 20-22, 1988.

Lifted Jet Diffusion Flames

by

David W. Mikolaitis

ABSTRACT

The larger problem of flame extinction due to strong turbulence intensity has been investigated through the study of the lifted turbulent diffusion flame. Existing extinction criteria were evaluated and the need for a better extinction criterion was identified. A new extinction criterion based on laminar flame theory has been developed and implementation into a numerical fluid dynamics code (GENMIX) has been started. Specific problems in laminar flame theory have been identified whose solution will result in an extinction theory without adjustable constants. Further work is needed to validate the theory.

Interpretation of a Lifted Turbulent Diffusion Flame as a Problem in Stratified Combustion

by

Douglas G. Talley

ABSTRACT

The lifted turbulent diffusion flame has been examined theoretically. Interpretation as a stratified flame partially reconciles conflicting ideas about how the flame becomes stabilized in space by recognizing that the fundamental stability mechanism probably changes as the flame evolves from the just-lifted to the near-blowout condition. Although fundamental understanding of the stratified combustion processes in currently very limited, a model has been proposed for parabolic flows which incorporates the best existing knowledge about stratified combustion and about turbulent combustion. It allows simultaneous calculation of the lifted flame height and the hot and cold flows which should be valuable for engineering purposes.

DIFFUSION AND CONVECTION IN THE CONDENSER OF A GAS-LOADED HEAT PIPE

by

Juin S. Yu

ABSTRACT

This work presents a systematic and self-consistent analysis on the basis of two-dimensional diffusive convection between the vapor and the noncondensable gas for the determination of the rate of heat transport in a gas-loaded heat pipe of circular cross-section. The analysis makes use of the physical conditions that the condenser end plate is insulated and that saturated equilibrium states of the heat transfer fluid exist at the liquid-vapor interface. As a simplification presently used to account for axial heat conduction, the pipe wall is assumed to exist at the local liquid-vapor interface temperature, and the wick structure, the liquid gap (if exists) and the pipe wall are lumped together as a homogeneous region having an effective thermal conductivity. The condenser section of the pipe is allowed to lose heat by either convection or radiation or both. It is shown that the one-dimensional analysis of Edwards and Marcus[1] and the two-dimensional equations of Peterson and Tien[2] represent the lowest levels of approximation of the present formulation.

ABSTRACTS
AVIONICS LABORATORY

Ada Compiler Evaluation Capability

by

Mike Burlakoff

ABSTRACT

The initial phase of the Ada Compiler Evaluation Capability (ACEC) test suite and support software is presently being delivered to the Air Force by the Boeing Company ACEC contractor. The system has undergone formal contractor testing with additional Air Force evaluation and testing. The Air Force determined that it would be desirable to provide additional Independent Validation and Verification (IV&V) of this initial delivery. The primary purpose is to verify test results and to determine whether any usability improvements in the products could be made.

Following are the major areas which were investigated: Execution of the test suite and analysis of the results, verification of procedures for use of the test suite, review of statistical support software and review of the major documentation for users of the system.

A Study of Sky Backgrounds and Sub-Visual Cirrus at the MEGALIDAR Site and a Proposed Turbulence Monitoring Facility for Wright-Patterson AFB

by

Gerald W. Grams

ABSTRACT

This project involved the supervision of two Ph. D. graduate students from the School of Geophysical Sciences at Georgia Tech. Both students carried out independent research efforts.

Eric Schmidt performed a series of experiments designed to characterize sky background conditions at the MEGALIDAR site at WPAFB. He also observed subvisual cirrus clouds and smoke layers from forest fires in Yellowstone Park using a portable LIDAR system, ground-based photometers and video imaging devices. These observations are supplemented with meteorological records and satellite images.

Randal Mandock completed a thorough study of the need for characterizing atmospheric turbulence as part of the test and evaluation procedures for new optical sensors. This study resulted in a detailed plan for characterizing atmospheric turbulence at the existing electro-optics sensor test facility operated by AFWAL/AARI.

Formal Verification of VHDL Specifications

by

David Hemmendinger

Abstract

The VHDL (hardware description) language is a powerful tool for the hierarchical specification of computer hardware. Techniques to verify formally that designs meet their specifications would simplify its use by reducing the role of exhaustive simulations. Temporal logic was the first formal verification technique studied in this project, but it subsequently focused on the use of the *assert* statement within VHDL, which permits the designer to state the specification a component is to meet. A major part of the project was devoted to Prolog programs to extract such assertions automatically from low-level VHDL architectures, using the signal attributes provided by VHDL, and to translate these into the form required by a theorem-proving program, LCF. The initial stages of the project indicate that such a theorem-prover has the capacity to verify that a low-level architecture meets a high-level specification stated in VHDL.

LOW VOLTAGE BROADBAND BEAM STEERING DEVICES USING LIQUID CRYSTALS

by

Mohammad A. Karim

ABSTRACT

The broadband characteristics of a number of beam steering systems were investigated. It is desirable for the beam steering device to have a large aperture and, at the same time, a fast time response ($\sim$1 ms) while being controlled with a reasonably small voltage source. The various schemes were examined and judged on the basis of the specifications desirable in the space environment. Two particular concepts were scrutinized to determine if they would be able to deliver a broadband beam steering system. A wollaston prism system in combination with ferro-electric liquid crystal (FLC) layers and an optical phased array system based on nematic liquid cryatal (NLC) layer were analyzed. The FLC-based systems are found to be very fast ($<$ 1 ms) but comparatively bulky and sensitive to transmission losses while the NLC based systems are generally very slow (many milliseconds) but comparatively less sensitive to transmission losses. The current quantitative results along with those expected to be generated through a folow-up mini-grant study would be able to dictate the design characteristics of the most optimum broadband beam steering system.

Prof. Robert Li, and graduate student Yuhong Li

Model-based Target Recognition Using Laser Radar Imagery

Abstract

Autonomous target recognition can be assisted by using CO_2 laser radar data which contains 3-D information of the scene viewed from the sensor. Using efficient image processing algorithms such as the Hough transform, the orientations and dimensions of the target can be calculated. This information then can be used by a model-based recognition system to identify the target. The identification is based on an inference procedure which tests hypotheses using the available evidence from the sensory data.

SIGNAL PROCESSING FOR ESM RECEIVERS

by

Periasamy K. Rajan

ABSTRACT

Receivers for electronic support measures(ESM) have some demanding signal processing requirements. A number of parameters of the received signal has to be determined in real time. In this research a study of the various receivers was carried out. The digital instantaneous frequency measurement (DIFM) receiver was analysed. The sensitivity functions of the calculated frequencies to the errors in the measurement of the correlation lags in DIFM receivers were derived for the two frequency case. Further, a new formulation of the equations that avoid the use of the correlation value at zero lag was developed. Finally, a setup for the acquisition of real data in digital form was tested.

NEURAL NETWORKS AND THEIR APPLICATIONS IN DIGITAL RECEIVER DESIGN

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Abstract

Recently there is tremendous interest in Artificial neural network models for applications such as pattern recognition and function minimization or optimization. These networks are modeled based on our present understanding of the biological nervous systems and seem to achieve good performance via dense interconnection of simple computation elements. In this report, we present a simple review of some neural network architectures, their potentials and problems. It has to emphasized here that in most of the articles that are available in the open literature, neural networks are touted as solution or "cure-all" for all problems, without consideration to the real gains as compared to existing conventional techniques. Therefore, in this report we take a critical and hopefully unbiased look at the neural networks and point out what the real innovations or potentials are and where they are simply used to map known algorithms/techniques into network form (old wine in the new bottle syndrome). More importantly we discuss how neural networks can be applied to digital receiver design and arrive at some innovative approaches to solving that problem.

APPLICATIONS OF EVOLUTIONARY LEARNING STRATEGIES TO PATTERN RECOGNITION TASKS

by

Mateen M. Rizki
Louis A. Tamburino
William VanValkenburgh
Michael Zmuda

ABSTRACT

A software environment was developed to study learning strategies applied to tasks in image processing. This environment facilitates the systematic exploration of evolutionary learning processes and embedded adaptive control mechanisms that modify both feature extraction and image classification tasks. The feature detectors were constructed as Hit or Miss templates based on principles of mathematical morphology. This representation provided a suitable substrate for the gradual changes introduced by evolutionary learning algorithms. The software package was used to conduct experiments on a two-class character recognition problem. These preliminary experiments illustrate the importance of incorporating adaptive learning mechanisms in image processing systems.

ABSTRACTS
FLIGHT DYNAMICS LABORATORY

Heat Flux Prediction for Nucleate Boiling in Liquid Metal Heat Pipes

by

Larry W. Byrd

ABSTRACT

Suggested methods for calculating the boiling limit for heat pipes give heat fluxes lower than those found experimentally. A better understanding of this limit is needed. The vapor pressure curve for sodium was used to check a method presented by Chi [1] for temperature between 500-1300°C. This method used an approximation of the Clausius-Clapeyron equation to calculate the boiling limit. Chi's method gave much larger values for the heat flux for certain wick geometries and operating conditions. Preliminary work on a conceptual model incorporating partial dryout of the wick simultaneously with boiling was also initiated.

Reliability Study of Nonlinear Structural Response under Reversible Cyclic Loading Processes

by

Karen C. Chou

ABSTRACT

Reliability assessment of aircraft components is studied for nonlinear structural response due to stochastic load processes such as thermal and maneuver loads. During the investigation, the material is assumed to have a bilinear load response behavior where the compressive properties are the same as tensile. The load processes may have any form of distributions for load arrivals and magnitudes. A discussion on the reliability analysis procedures are presented in this report.

SURVEY AND ASSESSMENT OF VALIDATION DATA BASE FOR SHOCKWAVE BOUNDARY LAYER INTERACTION IN SUPERSONIC INLETS

by

Awatef Hamed

ABSTRACT

The performance of supersonic inlets is strongly affected by the boundary layer development over its internal surfaces. Boundary layer bleed is used to suppress separation and to provide the desired inlet performance. The gain in pressure recovery and stability is accompanied however with a loss in mass flow and an increase in drag which must be minimized by optimizing the amount of bleed and bleed configuration.

The purpose of this work is to review and assess the data base for shock boundary layer interaction, which is pertinent to the flow prediction in supersonic inlets. The effect of bleed in the interaction zone is especially emphasized.

FAILURES OF F-16 TRANSPARENCIES

ANALYSIS AND FAILURE PREVENTION RECOMMENDATIONS

by

Yulian B. Kin

ABSTRACT

Recently, some F-16 aircraft have experienced damage (cracks and crazes) at the bolt holes of the canopy transparencies. In some units the cracks propagated from the holes to the forward end of the transparency in flight, and this represents a serious problem for the F-16 fleet.

The nature and mechanics of the failures are not fully understood. Therefore, the investigation of the failure mechanics and the recommendations based on that analysis were core endeavors of this research.

Visual Capabilities on a Robot Aided Aircraft Refueler Prototype

by

Augustus Morris, Jr., Ph.D.

ABSTRACT

The Special Projects Group of the Flight Dynamics Laboratory at Wright Patterson Air Force Base is researching robotics as an in-house project. In particular, robotics is being looked at as a means of providing aircraft maintenance during times of chemical warfare. A scaled demonstration system was constructed to maintain a 1/8 scale F-16 aircraft. The present robotic system was capable of pick and place movements under the teach mode. The upgraded version integrates a vision system so that the robot can move to any coordinates within its workspace. The specific task tested was aircraft refueling. Traditional image processing techniques were tried but proved to be too slow for the computer presently used. An ad hoc approach was used to determine the coordinates and orientation of the fuel port so that the robot could successfully locate and insert the fuel nozzle in the refueling port.

ABSTRACT

Reaction Kinetic of Halon 1301 Suppression of

Fire Explosion in an Aircraft Fuel Tank

By

Nanda L. Mukherjee

A mixture of fuel vapor and air containing more than 10 vol % oxygen in the ullage of a fuel tank will ignite at a temperature of 450-500°C due to ballistic impact and cause fire, flame and explosion. The addition of Halon 1301, monobromotrifluromethane, compound enhances the ignition temperature as a result of chemical reaction of bromine radicals with active hydrogen radicals of the fuel, thus decreasing intensity of inflammability. The chain reactions mechanism which explains removal of active fuel hydrogen radicals by bromine radicals of Halon 1301 compound is discussed in the report. Reaction kinetic investigations include: (a) specific rate constant equation and calculation of rate constant and (b) active energy calculation. In addition, recommendations have been made for future test runs in order to obtain more useful data required to design an efficient aircraft fuel tank.

DEVELOPMENT OF AN AIRCRAFT TIRE-WHEEL INTERFACE MODEL FOR FLANGE/BEADSEAT CONTACT LOADS

by

James A. Sherwood

N. Christopher Holmes

ABSTRACT

A research program has been initiated to investigate the force distribution at the interface of an aircraft wheel and tire. An F-16 main wheel was instrumented with strain gages at ten critical structural points. Test data were recorded for bolt torque, inflation pressure, vertical static and dynamic load conditions using both radial and bias-ply tires. A detailed three-dimensional finite-element model of the wheel was generated for evaluation via the ADINA finite-element code using the ADINA-IN preprocessor. An analytical technique of using influence coefficients determined from the finite-element analysis was devised to backcalculate the tire-wheel interface load distribution from the experimental data.

ROBUST EIGENSTRUCTURE ASSIGNMENT FOR FLIGHT CONTROL DESIGN

by

Kenneth M. Sobel

ABSTRACT

A recent sufficient condition for the stability robustness of linear systems with time varying norm bounded state space uncertainty is extended to include the structure of the uncertainty. Our new result requires that the nominal eigenvalues lie to the left of a vertical line in the complex plane which is determined by a norm involving the structure of the uncertainty and the nominal closed loop eigenvector matrix. Therefore, this robustness result is especially well suited to the design of control systems using eigenstructure assignment. When the uncertainty is time invariant, our norm is also an upper bound on the incremental eigenvalue perturbations. We consider the use of Perron weightings to reduce conservatism and the extension of the results to discrete time systems. An aircraft flight control example is presented which indicates that the new stability condition is less conservative than previous results which do not utilize the structure of the uncertainty.

A Computer Model for Air-To-Air Combat (Force on Force) Assessment

by

Patrick J. Sweeney, Ph.D.

Kathy Bennett, Grad Student

ABSTRACT

This IBM-PC compatible computer model can be used to assess the affects of changing weapons, aircraft performance, electronic sensors and countermeasures, situational awareness, tactics, observables, and combat support on the force on force air battle. Both enemy and friendly air forces can engage in both BVR and CIC missions. Sortie regeneration is limited by the air losses and by enemy action taken against fixed installations, which is included in the model. The model requires a hard disc for operation and uses menus to direct the user to battle graphics, forces structuring, calculations, and output to the screen and/or printer.

DAMAGE IN GRAPHITE/EPOXY PLATES SUBJECTED TO LOW VELOCITY IMPACT

by_

William E. Wolfe
Gregory Schoeppner

ABSTRACT

A continuation of the experimental program begun during Summer 1987 was conducted. Instrumented impact tests on laminated graphite/epoxy panels. The velocity of the impactor and the load time history were recorded for each specimen tested. In several tests, strains were measured on the back face during the impact event. The depth of surface indentation and the areal extent of internal damage were measured and correlated with the impact energy. Predicted strains in the outermost ply were compared with experimentally obtained values measured both perpendicular to and in the direction of the outermost fiber. The amount of internal damage and the indententation were found to be dependent upon the energy at impact and to a somewhat lesser degree on the velocity of the impactor. The shape of the damaged area in the specimens tested, was largely dependent upon the thickness of the panel and the location of the supports.

ABSTRACTS
MATERIALS LABORATORY

Analysis Methods for Nonlinear Mechanical Behavior of Glassy Polymers

by

R. J. Arenz

ABSTRACT

As thermoplastic polymers become candidates for use as the matrix material of advanced composite structures, one of the aspects needing study is their nonlinear viscoelastic behavior. Even small strains can produce nonlinear effects that are different from thermosetting plastics. This may affect the analysis of the interaction between the matrix and the reinforcing fibers as well as influence the processing conditions to be used during the manufacturing cycle for the composite material. In this investigation recent theories on the nonlinear mechanical response of glassy polymers are examined qualitatively. Several of the more promising formulations involving the free volume of polymer materials are quantitatively compared and related to experimental data by computer techniques to handle the numerical integration and iterative procedures required in solving the associated sets of coupled nonlinear differential equations. Engineering approaches to treating thermoplastic matrix mechanics are suggested. The analysis indicates that more complete viscoelastic characterization of bulk modulus is needed to facilitate the application of the free volume approach.

LASER HARDENED MATERIALS VIA MAGNETICALLY ALIGNED POLYPEPTIDE-PHTHALOCYANINES

by

Gene O. Carlisle

ABSTRACT

The problem of selecting a new nonlinear optical (NLO) material is reviewed, and the rationale for the selection given. The new material selected is a guest-host type of system in which the biomolecule, poly-γ-benzyl-L-glutamate (PBLG) is the host for a guest phthalocyanine (Pc) molecule. Solubility and spectral measurements were taken on three copper phthalocyanine compounds in order to determine compatible solvent-PBLG-Pc systems. The tetrasodium salt of copper phthalocyanine-3,4',4",4'"-tetrasulfonic acid was determined to be suitable for PBLG in the solvent DMF; however, the combination of PBLG-MgPc-CH_2Cl_2 is recommended as the best system for magnetic alignment. Plans are outlined for the continuation of this research.

Joining of Carbon-Carbon Composites

by

Parviz Dadras

ABSTRACT

Joining of carbon-carbon composites by diffusion welding and diffusion brazing is proposed in this project. The objective is to produce joints that can retain sufficient strength at service temperatures up to 2000°C (3632°F). Joining of carbon-carbon composites to two refractory metals, tungsten, and tantalum, and to a structural alloy Ti-6Al-4V is also suggested for consideration.

Six different interlayers, a commercial brazing alloy Ti-15Cu-15Ni, an experimental alloy Ti-21V-25Cr, and two brazing compounds $MoSi_2$ and SiC have been proposed. These materials have appropriate wetting and flow characteristics for joining graphite. In each case, the process variables (time, temperature, and pressure) will be optimized so that the maximum strength and the highest service temperatures can be obtained.

In this project lap joints and squared-edge butt joints will be investigated. The strength of the joints will be evaluated under in-plane tensile and across-ply shear and tensile modes of loadings at the expected service temperatures. Also, the joints will be examined by light and scanning microscopy.

Rapid Simulation for Experimental Validation of H Section

Forging using Finisher Punch

by

Suren N. Dwivedi

ABSTRACT

Analytical modeling of deformation processes requires material data bases which can adequately describe the dynamic behavior of the material. Dynamic material modeling techniques were applied to determine the constitutive equations. A rigid viscoplastic finite element method based code called ALPID (Analysis of Large Plastic Incremental Deformation) was used to simulate the closed die, flashless, isothermal precision forging of H sections. The H section was simulated to study the metal flow characteristics and the distribution of effective strain, effective strain rate and effective stress were determined. The load requirements were predicted and the behavior of the process was completely analyzed. The H section analytical simulation was experimentally validated.

QPA Control of the End Milling Process

by

Dr. B.K. Fussell

Abstract

Qualitative Process Automation (QPA) control was applied to the end milling machining process to maximize feed rates while avoiding unwanted cutting events such as excessive tool deflection, tooth overload and cutter shank overload. QPA controlled the process actively by achieving desired events and preventing undesired events. QPA is a real-time controller with its control output based on process events and not on temporal relationships as are classical control systems. Various procedures for detecting machining events with sensor data were investigated and used with an existing QPA computer structure to develop a controller for the end milling process. The QPA controller used cutting force, spindle speed and feed rate data to predict and avoid excessive tool and tooth loads and to maintain part tolerance with the highest feed rate. Simulation cutting results, using an experimentally validated end milling model, showed the QPA system to be successful in controlling end milling cuts. Successful simulation runs were demonstrated for step changes in the radial and axial depths of cut on aluminum workpieces.

SINGLE-CRYSTAL DIFFRACTION ANALYSIS OF COMPOUNDS WITH POTENTIAL NONLINEAR OPTICAL PROPERTIES

by

David A. Grossie, Ph.D.

ABSTRACT

Single-crystal x-ray diffraction data was collected on two compounds having potential nonlinear optical (NLO) properties, $C_{13}H_{18}N_2O_2Si$ and $C_{22}H_{17}N_5O_5$. The former compound is a derivative of 2-methyl-4-nitroaniline, a molecule with known NLO properties. It crystallizes in a monoclinic crystal lattice with cell constants of a=20.258(6), b=10.444(4), c=7.129(2) Å, and β=93.05°. The observed space group is $P2_1/c$, a centric space group. The structure was solved and refined, yielding a R-factor of 0.085. $C_{13}H_{18}N_2O_2Si$ is planar with little distortion in the internal bond distances and angles.

$C_{22}H_{17}N_5O_5$ crystallizes in a triclinic crystal lattice having cell constants of a=8.179(4), b=16.915(4), c=8.190(2) Å, α=94.98(2), β=116.54(3), and γ=83.99(3)°. The space group was determined to be $P\bar{1}$. This compound has defied structure solution, in spite of application of the most recent and capable direct methods programs.

Effect of Various Metals on The Thermal Degradation of A Chlorotrifluoroethylene Based Fluid

by

Vijay K. Gupta and Oden L. Warren

ABSTRACT

Thermal stability characteristics of a chlorotrifluorethylene (CTFE) basestock candidate nonflammable hydraulic fluid, MLO 86-7, have been investigated as a function of time and temperature via micro-thermal stability tests in the presence of various metal powders and alloys. It has been found that this fluid is a complex mixture of chlorofluorocarbon compounds. The fluid was found to be thermally stable when stressed for 22 hours at 232°C or below, but when stressed at temperatures above 232°C, degradation was observed, and the extent of degradation increased with increasing stress temperature. The fluid degraded severely when stressed at 302°C for 66 hours. When the fluid was also stressed at 177°C for time periods ranging up to 40 days in the presence of alloys or metal powders, some degradation of the fluid was observed. At 177°C, the presence of Cu in the fluid caused more degradation as compared to other metals and alloys, and the degradation was further accelerated by the presence of water. At 302°C, the elements Cu, Fe, Sn, and Ti seem to have accelerated the degradation of the CTFE fluid whereas elements like Al, Co, Cr, Mn, Ni, W, and Zn do not seem to have any significant impact on the degradation of the CTFE fluid. The increase in acidity of the fluid caused by thermal degradation processes at temperatures much higher than 175°C (anticipated maximum use temperature) in the presence of metals and moisture produces corrosive products.

Characterization of Heat Transfer and Reaction in the Autoclave Curing of Graphite/Epoxy Composites by Scaling Analysis

by

L. James Lee

ABSTRACT

The temperature distribution and the degree of cure of the resin in the autoclave curing of graphite/epoxy composites are governed by heat transfer through bagging materials and laminates, and the exothermic reaction of epoxy resins. Determination of the major heat transfer and reaction characteristics was carried out by a scaling analysis. Heat transfer can be described by a time constant for overall thermal response. Its value can be determined by on-line temperature measurements. Exothermic reaction is best described by a lumped parameter, Damkohler number (Da), which is a function of reaction activation energy (E) and heat of reaction (ΔH). The value and/or the change of Da can be used to establish rules for the control of autoclave heating/cooling in order to prevent any thermal run-away problem. The change of Da at any given spot in the laminate can be estimated by three temperature sensors or two heat flux sensors located near that spot.

A Study of the Melting of the Plagioclase Feldspars in a Microwave Field

by

Thomas T. Meek

ABSTRACT

Thermal processing of dielectric materials using microwave radiation has recently become of interest to the scientific community. Work in this area spans over four decades; however, only recently have results indicated potential economic and technical benefits from this thermal processing technique.

This work investigates melting phenomena which occur in the albite-anorthite system ($NaAlSi_3O_8$ - $CaAl_2Si_2O_8$) when heated using 2.45 GHz electromagnetic radiation. Compositions of 90, 81, and 72 weight percent albite were synthesized from alkoxides. Five or ten gram quantities were heated in alumina crucibles to 1200°C and held for 1, 2, and 4, hours before cooling to 800°C in a nine minute period. Heating was done in a conventional electric furnace and in a 2.45 GHz microwave furnace. Sample microstructure was then determined and compared to see if the 2.45 GHz electromagnetic radiation had any affect on equilibrium phase compositions.

REACTION ZONE CHARACTERISTICS OF TITANIUM ALUMINIDE COMPOSITES

by

CAROLYN W. MEYERS

ABSTRACT

To obtain optimum performance of metal matrix composites, the reinforcing agents are coated prior to consolidation. The purpose of this treatment is to reduce the chemical reactions between the fibers and the matrix. However, during the consolidation of the composite, the coating breaks down forming a reaction layer. The extent of this reaction layer as well as its characteristics significantly influence the mechanical behavior of the composite. In this research, the nature and properties of the reaction layer are studied for two titanium matrix alloys, each reinforced with two types of fibers.

PHOTOREFLECTANCE MEASUREMENTS OF UNINTENTIONAL IMPURITIES IN UNDOPED GALIUM ARSINIDE

Michael Sydor

ABSTRACT

Photoreflectance (PR) is used to measure the unintentional impurity and defect concentrations in undoped epitaxial GaAs.The PR signature above the band gap spreads with defects and shows well defined Franz-Keldysh peaks whose separation provide a good measure of the unintentional impurity concentration as compared with Hall data. The PR signal at and below the band edge has a large excitonic component, and contains surface effects which preclude analysis by the usual three point functional fits for low electric fields.

Bulk semi-insulating materials generally provide a wide, single PR structure whose breadth depends on traps and bound excitons. Analysis of PR shows that a three point functional fit with excitonic function alone provides a reasonable fit to semi-insulating bulk data.

THE SYNTHESIS OF 2-FORMYL PYRIDOIMIDAZOLES

by

Dr. Richard S. Valpey III

ABSTRACT

The synthesis of a new class of monomers for use in developing heterocyclic rigid-rod polymers with nonlinear optical properties has been developed. A model compound, 2-formyl-1-phenyl pyridoimidazole was prepared in three steps starting with 2-chloro-3-nitropyridine. This new methodology was then applied to the synthesis of 2,6-diformyl-1,7-diphenyl pyridobisimidazole.

ABSTRACTS
HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY

CERAMIC COMPOSITES FOR STUDYING BONE INGROWTH AND REMODELING

by

Praphulla K. Bajpai

Abstract

Two different ceramics were used in developing ceramic and organic acid composites for repairing traumatized bone and (eventually) studying bone remodeling. Composites of tricalcium phosphate (TCP) and polyfunctional acids (keto-glutaric acid and malic acid) with and without calcium hydroxide were developed for conducting studies in rats. Among the tricalcium organic acid composites studied, TCP, malic acid, and calcium hydroxide composites had the best setting and hardness properties. These composites also maintained an alkaline pH (ideal for bone growth) in an aqueous environment. Plugs of previously set composites of aluminum calcium phosphorous oxide (ALCAP), malic acid, and calcium hydroxide, as well as powders of composites set immediately before implantation, were used for repairing traumatized left femurs and L-4 vertebrae in 12 rhesus monkeys. Radiographs and scanning electron micrographs of repaired sites showed that the composites implanted in the bone were compatible with the surrounding tissue. Blood chemistry data obtained at the time of physical examination and euthanasia of 4 monkeys implanted for 4 weeks with the composites indicated that the the ALCAP-organic acid composites did not cause any adverse effects in the implanted animals.

Invitro Cytotoxic Effects of Perfluorodecanoic Acid on Human Peripheral Blood Lymphocytes

By

Shankar S. Bale

ABSTRACT

Cytotoxic effects of PFDA on human peripheral blood lymphocytes were studied. Unstimulated cells were exposed to 0, 2, 4, 6, 8, and 16 ug/ml of PFDA for 24 hours and analysed for cytotoxicity. PFDA at 6 ug/ml and below did not cause any significant change in cells compared to controls. Cells stimulated with mitogen were exposed to various concentrations of PFDA. Cells grown in RPMI medium supplemented with fetal bovine serum did not show any toxicity at the levels of PFDA used. However, the cells grown in RPMI medium supplemented with Nutriodoma-HU showed toxicity at all levels of PFDA. Cells were cultured in various media to determine the cell proliferation. RPMI medium supplemented with fetal bovine serum and Hana medium showed higher degree of cell proliferation compared to the cells grown in other media.

Auditory Modeling

by

C. David Covington

and

Michael K. Ellis

ABSTRACT

Several promising auditory models exist as reported in the literature, but they execute in different systems. We have ported two of three chosen auditory models to the Symbolics lisp machine. This affords the advantage of direct comparison of output and permits a more modular approach to the auditory modeling problem. In addition with all models residing in the powerful rapid-prototyping lisp environment, the researcher can then conveniently apply model output to either conventional pattern recognition algorithms or to more recently introduced simulated neural network systems. This report also discusses our efforts to develop a programming environment suitable to implement the more promising neural network approaches as means of modeling postprocessing by the brain on auditory periphery output in the human.

Cognitive Demands of Tracking Strategies as Assessed by the Optimum-Maximum Procedure

by

Barry P. Goettl

ABSTRACT

Twenty subjects performed two compensatory first order tracking tasks concurrently while using either a double impulse strategy or a continuous strategy. The cognitive load of either task was increased by changing the control dynamics to second order. Attention allocation was manipulated using Navon's (1985) optimum-maximum procedure. Results indicated that subjects using the continuous strategy were more adversely effected by increased cognitive demands than subjects using the impulse strategy. This result suggests that the continuous strategy draws more heavily from central processing resources than does the impulse strategy. Also, subjects showed only limited trade-off between the two tasks. This finding has major implications for a multiple resources theory of attention. However, several problems with the optimum-maximum procedure were identified and discussed.

ABSTRACT

Evaluation of an Extraction Procedure

for the Analysis of Serum Steroids

by

Dr. Robert E. Masingale

and

Deborah J. Mitchell

ABSTRACT

Two methods are described for the screening, extraction and confirmation of the free and conjugated steroids in rat serum. It was demonstrated that a liquid-solid extraction technique combined with a three-solvent extraction system allows for more expedient sample preparation of the steroids. These methods were evaluated by screening for the presence of the following from sera: (1) androstenedione, (2) corticosterone, (3) estradiol, and (4) progesterone. Gas chromatographic/mass spectrometric analyses of the derivatized products were performed to evaluate the two procedures.

Performance in a Visual Monitoring Task
with Serial and Simultaneous Display Formats

by

David G. Payne

ABSTRACT

Thirteen adults monitored either four or eight sets of three-digit numbers that appeared on a computer monitor. These stimulus items were labelled with an uppercase letter A - H and each stimulus was paired with a unique response key. The stimulus values were periodically incremented or decremented and the subject's task was to respond whenever a value exceeded a prespecified limit. In the simultaneous condition, all four (or eight) number-letter combinations were presented concurrently in spatially distinct locations. In the serial condition, each item was presented individually in the same central location .8 seconds and was then replaced by the next item in sequence. Results showed that subjects responded more quickly in the serial condition than in the simultaneous condition. Although subjects made more errors in the serial condition, these error rates did not increase across trials, even though the reaction times improved. These results indicate that the rapid serial presentation format has the potential for yielding better performance in visual supervisory monitoring tasks than does the conventional (i.e., spatially distributed) display format.

A NONLINEAR LUMPED PARAMETER MODEL

FOR THE SEATED HUMANS

By

Joseph E. Saliba

ABSTRACT

A brief review of both continuous and lumped-parameter models describing the structural response of the human body due to the acceleration environment associated with seat ejection is first presented. The need for a nonlinear lumped-parameter model to remedy the inadequacy of reproducing laboratory experiments was then examined. Four different tasks were then shown. The first task was to insure that the tests conducted in the laboratory were yielding meaningful output, otherwise the model developed would be meaningless. Then a nonlinear lumped-parameter model that best predicts the behavior of the human subject was developed. The values of the lumped-parameter models were then obtained by using a least-squares fitting technique. This process was performed and validated on one single laboratory test.

Finally, a more realistic and comprehensive validation plan to ensure the effectiveness of this approach in addition to a sensitivity study on the shape, duration and magnitude of the input acceleration was recommended.

IN-VITRO MODELING OF PERFLUORO-N-DECANOATE EFFECTS ON ENZYMES OF FATTY ACID METABOLISM

by

Sanford S. Singer

ABSTRACT

Acyl-SCoA synthetase, acyl-SCoA oxidase & carnitine acetyltransferase were studied in our efforts to model, in vitro, the basis for effects of perfluoro-n-decanoate(PFDA) on fatty acid metabolism. We found that: (1) Acyl-SCoA synthetase used palmitate, oleate, laurate & decanoate as substrates to similar extents. However, it converted PFDA to PFDA-SCoA very slowly. PFDA inhibited acyl-SCoA formation from the fatty acids. The inhibitions appeared to be competitive. Palmitoyl-SCoA formation was inhibited most & decanoyl-SCoA formation was inhibited least. Palmitoyl-SCoA formation was inhibited up to 30% when the [PFDA]/[palmitate] was 4. (2) Acyl-SCoA oxidase, used palmitoyl-SCoA, lauroyl-SCoA & decanoyl-SCoA as substrates. It preferred the smaller acyl-SCoAs. Inhibition of oxidation of the C-10 and C-12 acyl-SCoAS by PFDA was more extensive than that of palmitoyl-SCoA. PFDA inhibition of decanoyl-SCoA & palmitoyl-SCoA oxidation was examined in depth & found to be competitive, with K_Is of 593 ± 150 μM & 76 ± 6.0 μM. (3) Carnitine acetyltransferase used acetyl-SCoA as its best substrate. Butryryl-SCoA, hexanoyl-SCoA, and octanoyl-SCoA were less effective sybstrates than acetyl-SCoA. Transfer of all acyl groups to carnitine was inhibited to a similar extent by PFDA. The K_Is were 111 ± 15 μM & 76.0 ± 28 μM.with the C-2 and C-8 acyl-SCoAs. Inhibition was competitive with acetyl-SCoA & noncompetitive with octanoyl-SCoA. Our examination of the PFDA effects on the enzymes gave useful information that may provide connections between isofunctional enzymes of rat liver and in-vivo effects of PFDA on lipid metabolism in the rat. Study of inhibition by PFDA-SCoA was tabled , as it was unavailable during the SFRP.

Perfluorodecanoic Acid Efflux from Cultured Primary Rat Hepatocytes

by

Andrew P. Whipple

ABSTRACT

The interaction of perfluorodecanoic acid (PFDA) with cultured rat hepatocytes is very dynamic, with both uptake and efflux of PFDA occurring very rapidly. Just as earlier studies demonstrated nearly maximal uptake levels within one hour, and no significant increase in cell-associated PFDA over 24 hours, so is the rate of efflux of PFDA from rat hepatocytes cultured on collagen-coated dishes rapid. Regardless of whether the cells were loaded with ^{14}C-labeled PFDA for 4 hours or 24 hours, when the cultures were switched to media without labeled PFDA a dramatic drop in cell-associated ^{14}C occurred. The loss of this PFDA from the cells was the same regardless of whether or not unlabeled PFDA was present in the medium. About half was lost in the first five minutes and by 40 minutes less than 5% of the ^{14}C-PFDA was still cell-associated. By 4 hours less than 2% reamined and by 24 hours only about 1%, indistinguishable from background levels.

DETERMINATION OF PERFLUORO-N-DECANOIC ACID TOXICITY IN VITRO AND IN VIVO VIA TWO-DIMENSIONAL POLYACRYLAMIDE GEL ELECTROPHORESIS

by

Frank A. Witzmann, Ph.D.

ABSTRACT

Preliminary studies were conducted to assess the effect of perfluoro-n-decanoic acid (PFDA) on the two-dimensional protein pattern of cultured human peripheral lymphocytes and their spent media as well as rat liver cell fractions (cytosol, microsomes, and mitochondria) exposed to PFDA in vivo. Previous investigations of PFDA toxicity, which closely resembles that of dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin), have been directed primarily at the liver though numerous other organs are PFDA targets. Among these is the thymus where PFDA-induced atrophy suggests immunodepressant activity. Despite such studies, specific PFDA effects on lymphocytes have not been well characterized. In the present studies, sample proteins from in vitro and in vivo experiments were separated by 2D-PAGE and visualized by polychromatic silver and Coomassie blue staining procedures. In the in vitro studies, various cellular proteins were altered as a result of PFDA exposure such that expression of specific proteins was either enhanced, diminished, or abolished entirely. Proteins of presumable cellular origin appeared in the spent culture medium as a result of PFDA exposure despite little or no in vitro cell lysis. Similarly, proteins from liver cells exposed to PFDA in vivo demonstrated several significant alterations. Foremost among the three fractions studied were protein additions and deletions in the microsomal fraction. While identification of the effected proteins awaits further study, these results lend support to the notion that in vitro toxicity testing methods may serve as viable adjuncts to traditional systems with the inclusion of two-dimensional polyacrylamide gel electrophoresis.

ABSTRACTS
HUMAN RESOURCES LABORATORY

Hypertext and Intelligent Interfaces for Text Retrieval

by

Patricia Ann Carlson

ABSTRACT

The Integrated Maintenance Information System (IMIS) concept is to provide the technician with all logistical, operational, technical, training, and diagnostic information for aircraft repair. Because of the sheer amount of information being integrated, user overload is a significant concern. The traditional solution to this problem of presenting complex information in a timely fashion is to design a consistent display format and to employ standard commands. At a deeper level, however, questions of information integration become issues of information engineering and the nature of knowledge structures. At this level, the definition of user interface takes on a more sophisticated meaning.

The hypertext concept considers a body of knowledge as a database -- potentially a highly organized, compressed structure of richly interconnected "chunks" -- and allows for flexible indexing and retrieval by implementing a "smart" interface (a programmable "idea processing" mechanism). Hypertext, as the backbone for development philosophy, permits advanced design features -- such as enhanced functionality, customized views, and improved knowledge synthesis and representation -- which, in turn, increase the user's ability to interact productively with information.

Any successful electronic publishing system must provide access to text and graphics in a timely and meaningful fashion. This study identifies three categories of retrieval facilities and considers their efficacy when combined with hypertext. Because of its structure and connectivity, a hypergraph (hypertext web) incorporates intelligence, perhaps more than is possible with most current, static database storage representations. The purpose of this study is to suggest retrieval facilities that will squeeze as much functionality out of the hypergraph as possible. The end results of the investigation also include four "toy-world" interfaces built to demonstrate the characteristics of information retrieval using a hypertext database.

Linking Training Evaluation to Training Needs Assessment:

Development of a Conceptual Model

by

J. Kevin Ford, PhD.

ABSTRACT

A critical linkage in training systems is the translation of training evaluation information for reassessing training needs and for making training program changes. This report presents the development of a conceptual framework for examining the job relevancy and efficiency of training and the linkage of this evaluative information to training needs reassessment. How to integrate job performance information into the existing training evaluation system for identifying over- and under-trained tasks is also described. Recommendations for future research to identify the content domain of an Airman Basic in Residence (ABR) Training program and to integrate performance information into the evaluation system is presented.

A CONCEPT FOR AN INTELLIGENT TOOL TO FACILITATE THE DEVELOPMENT OF QUALITATIVE PROCESS MODELS IN NOVICE PROGRAMMERS

by

Hugh P. Garraway

ABSTRACT

This document relates the learning environment for computer programming and the development of students' mental models for programming. Problems with this environment are discussed through a review of previous research and a design is proposed for a software tool, an intelligent debugging assistant incorporating artificial intelligence techniques, to advise and direct novice programmers through strategic debugging paths. This tool will allow a student to confer with an "expert" during the debugging of programs under development. This tool should help students to more quickly develop an accurate qualitative process model for programming and thus resolve a problem area associated with learning to program in the Air Force and academia. The resulting tool could become a component of an Intelligent Tutoring System.

A Tool for Studying the Effect of Range Restriction on Correlation Coefficient Estimation

by

Douglas E. Jackson

ABSTRACT

It frequently happens that one must try to estimate the correlation coefficient between two random variables, X and Y, in some population P using data taken from a population Q, where Q is a proper subset of P. For example X and Y might be performance scores, P the set of individuals trying to gain acceptance into the armed services, and Q the subset of P consisting of those accepted. If X or Y or both are not part of the screening tests used as the basis for selection, then for at least one of these scores we have no data outside Q. We can administer tests to the members of Q and hence obtain data which may be used to estimate ρ_{X^*,Y^*} [X^* and Y^* are X and Y restricted to Q]. Now suppose that X is a criterion variable and we wish to measure the value of Y as a means of selecting individuals who will have high X scores. Obviously we want to know $\rho_{X,Y}$ and not ρ_{X^*,Y^*}. This paper has two purposes. The first is to present the equations involved in such a way that the problem becomes more intuitively understandable. The second is to describe a monte-carlo program written to simulate repeated sampling from Q. This program displays the sampling distribution of the traditional estimator for ρ_{X^*,Y^*} and of a proposed statistic for estimating $\rho_{X,Y}$. This proposed statistic is sometimes called the Pearson correction formula for range restriction. Presently the program assumes that the joint distribution of all variables is multinormal.

Evaluation of a Methodology for Estimating Cross-AFS Transferability of Skills

by

Charles E. Lance

ABSTRACT

A Skills and Knowledge Questionnaire (SKQ) was designed for the collection of experienced airmen's ratings of the job content of 47 selected Air Force Specialties (AFSs) for the purposes of: (a) evaluating the usefulness of an Occupational Measurement Center (OMC) skill/task taxonomy for assessing cross-AFS job content similarity, (b) examining the feasibility of measuring skill requirements using Subject Matter Expert (SME) judgments, and (c) identifying procedures for calculating cross-AFS relative ease-of-movement predictions. "Part-of-Job," "Relative Time Spent," and "Months to Proficiency" ratings on 26 task categories were completed by 675 7-skill level respondents in 47 AFSs. Results indicated that (a) experienced airmen made reliable judgments about the task content of AFSs, (b) SKQ ratings effectively distinguished among AFSs on the basis of task content, and (c) one method for estimating cross-AFS relative ease-of-movement produced predictions which were consistent with AFS differences in Occupational Learning Difficulty and ASVAB aptitude area qualifying scores. Ease-of-movement predictions need to be validated against the actual ease with which airmen are able to attain proficiency in a new AFS.

An Expert System Approach for Reliability Data Analysis

by

Thomas L. Landers, Ph.D., P.E.

ABSTRACT

An expert system approach was investigated for statistical analysis of failure data in a RAMCAD environment. The research emphasized definitions of the concept, functional requirements and knowledge base. The NASA CLIPS expert system shell was selected for prototyping. The project used actual field data, from the F-16 central air data computer and radar power supply, for purposes of testing and demonstration. The expert system approach proved to be feasible for aiding engineers in failure data analysis. A rule-based expert system shell was suitable for prototyping but additional research is needed to determine resource requirements for a full-scale application.

No Abstract Submitted At This Time

Dr. Douglas Mandra

GRAPHICAL PROGRAMMING OF SIMULATION MODELS IN OBJECT-ORIENTED ENVIRONMENT

by

Mufit H. Ozden

ABSTRACT

Graphical programming has been used in conjunction with conventional simulation languages via block diagrams or activity networks. Its beneficial effects on programming and modeling in simulation have been accepted by everyone involved in these languages. However, none of these conventional techniques is truely interactive. Given the level of the current hardware and software technology, it is possible to design a very good graphical programming system which supports an interactive incremental programming style in specifications of simulation models. The benefit of such a visual system would go beyond the modeling phase of a simulation study and it might as well be realized in understanding the behavior of complex problems, in being a communication and training medium for the user and developers, and finally in presenting the simulation results.

In this study, the graphical programming methodology has been investigated from the perspective of object-oriented simulation. The truely interactive and graphical orientation of some of the object-oriented languages (e.g., Smalltalk-80) has opened up new avenues of research in this very important topic. Today, the nature of this type of research will be not whether it can be done but how the known techniques should be combined to yield the highest benefit.

A Study of Interaction Between Job Properties and Personal Characteristics in the New PACE System

by

Dharam S. Rana

ABSTRACT

This study examined the feasibility of studying interaction between job properties and personal characteristics in the new processing and classification of nonprior-service enlistees (PACE) system. A general linear model was developed and successfully applied to assess interaction in a test example. The model was also applied to analyze interaction in the Administrative aptitude area for a particular weekly batch of the Air Force trainees. The results indicated that nearly 33 percent of the variance of the "final payoff" variable was accounted for by the interaction (residual). To investigate underlying distributions of the PACE variables, goodness-of-fit tests were performed. The findings indicated that the PACE variables with the exception of "objective interest" do not follow a normal distribution. Correlations among payoffs of different Air Force Specialties in the Administrative area were also computed for a week group of recruits.

An Intelligent Tutor for the IBM System/360 Assembly Language: BIGBLUE

by

Sunita S. Rana &
Charles Drake

ABSTRACT

The Air Force Human Resources Laboratory (AFHRL) at Brooks Air Force Base in San Antonio, Texas is a major research center for developing Artificial Intelligence (AI) and ways in which to utilize this intelligence for the military. There is a need to supplement or replace a shrinking pool of human Air Force instructors.

Assembly language is taught at the Air Force Technical School and also as a part of the CDC 49152 for Information Systems Programming Specialist in the Air Force. The IBM system 360/370 mainframe is the hardware most commonly found at Air Force installations. During my summer research here, an attempt was made to develop an Intelligent Tutoring System (ITS) for the IBM 360/370 Assembly Language. Thus far, all ITSs in the computer programming area have been attempted for high-level languages (frequently Pascal). It was a challenge to develop one for a low-level language. Low-level languages are machine dependent and more difficult to code, as each instruction directly manipulates hardware of the machine. Assembly language is more a tool to teach computer architecture than programming style. Therefore, an ITS on assembly language requires an explanation in tandem with each instruction of the hardware basis for doing so. This is also a required language for graduate and undergraduate students at Jackson State University. The tutor was named BIGBLUE for IBM's System/360.

PRELIMINARY DESIGN CONSIDERATIONS FOR AN ADVANCED INSTRUCTIONAL DESIGN ADVISOR

by

Jonathan Michael Spector

ABSTRACT

This is a general description of an automated and intelligent tool to assist course authors in instructional design. The problem addressed by this research is the difficulty and expense of designing effective instructional materials given the complexities of advanced hardware and software technologies and the variety of instructional settings. Many automated tools to support the instructional process are being developed. However, no existing systems address the general issue of effective instructional design at the course level. An Advanced Instructional Design Advisor (AIDA) can and should be built to aid the process of course design and development. This tool should be designed within the context of a standard design philosophy for all tools developed to support the instructional process. The tool should incorporate many instructional models and prescriptions for their use at the course or course module level.

EFFECTIVENESS OF CONTRACT MONITORS IN AN AIR FORCE HUMAN RESOURCES LABORATORY: PREDICTION AND MEASUREMENT

by

L. Alan Witt, Ph.D

and

Mark N. Beorkrem

ABSTRACT

Facing decreasing operating budgets, Air Force R&D laboratories must increase the productivity of their human resources in order to maintain expected levels of performance. As a step toward that end, the multivariate study partially described in this report was designed to identify individual and situation-level factors that are related to the effectiveness of contract monitor/researchers at the Operations Training Division of the Human Resources Laboratory at Williams AFB, Arizona. Effectiveness criterion data were collected from managerial ratings, organization archives, and questionnaires administered to the contract monitors/researchers. The cognitive and affective reactions of personnel to their work environment were assessed by interviews and the above-mentioned questionnaire. Results indicated several perceptual/affective and behavioral predictors of effectiveness.

COMPUTER SUPPORT of CREATIVITY in UNIFIED LIFE CYCLE ENGINEERING

by

Lawrence F. Young, D. Sc.

ABSTRACT

The Air Force program called Unified Life Cycle Engineering (ULCE) is concerned with more effectively designing producibility and supportability, as well as performance, cost, and scheduling, into new weapon systems. A main thrust of this program is to identify functions for a Decision Support System (DSS) for ULCE. As one aspect of DSS for ULCE, this project makes an assessment of the opportunity for computer support of creativity in the systems development process. It first examines the systems engineering and design process generically, then the specific nature of the Air Force weapons acquisition process, and thirdly, creativity support functions that might impact the problem requirements definition and systems design phases. Recommendations are made to develop computer support for requirements specification and systems design.

The Relationship between Inspection Time and Intelligence

by

Robert K. Young

ABSTRACT

The relationship between inspection time and intelligence was investigated using a relatively homogeneous population: Air Force recruits. Inspection time is defined as the minimum time necessary to see a difference between two or more items. In the usual task, two lines are presented for an extremely short duration and the task of the subject is to indicate which of the two lines is shorter. Previous research was replicated using a relatively large sample size (N = 113).

Consistent with previously reported studies, a correlation between inspection time and the Cattell Culture Fair Test, the measure of intelligence employed, was found for the entire sample (r = 0.34). Additional analyses indicated that some subjects used an apparent movement strategy. For those subjects no relationship was found between measure of intelligence and inspection time (r = 0.21). But for those subjects who did not use a strategy, a relatively high correlation was found (r = 0.56) between inspection-time performance and our measure of intelligence. However, no mean difference in inspection time was found between the strategy and non-strategy groups. Nor was there any mean difference found between the strategy and non-strategy groups in the measure of intelligence employed.

ABSTRACTS
OCCUPATIONALAL AND ENVIRONMENT HEALTH LABORATORY

Solvent Extraction of Boron from Wastewater

by

Steven C. Chiesa

ABSTRACT

As the demand for irrigation water throughout the western portion of the United States grows, the use of reclaimed wastewater for agricultural use is being contemplated with increasingly greater frequency. The suitability of reclaimed wastewater for irrigation is strongly dependent on the post-treatment concentration of certain effluent constituents. Boron is one of these critical effluent constituents. When present in sufficiently high concentrations, boron is toxic to many forms of plant life, including many agriculturally valuable crops. Boron behaves as a conservative pollutant in conventional secondary wastewater treatment systems with little net removal normally expected or observed. Pretreatment of industrial wastewaters to remove boron may, accordingly, be necessary where locally high effluent boron concentrations limit the beneficial uses of reclaimed wastewaters and/or surface water receiving conventionally treated effluents.

This research project evaluated liquid/liquid extraction as a means of removing boron from industrial wastewaters. An Air Force photography lab wastewater was used as a test case. An aliphatic alcohol, 2-ethylhexanol, was employed in a series of batch experiments as an extractant. A mass distribution coefficient of approximately 0.3 was determined for the wastewater/organic solvent system. The distribution coefficient was independent of pH in the range of 3.4 to 7.4 and was also unaffected by the presence of compounds identifed in the literature as "salting out" agents.

Extention of the Detection Limits of Arsenic and Selenium in Solid Samples by ICP/AES Utilizing Preconcentration Techniques

by

Randolph B. Huff

ABSTRACT

The extention of the detection limit for arsenic by ICP/AES analysis was extended from 0.5 ppm to 0.1 ppm by selecting a different emission line for analysis other than the one normally used for arsenic determination by ICP/AES. The preconcentration of selenium by extraction as the diethyldithiocarbamate, prior to ICP/AES analysis, was proven to be a feasible route for extending the detection limit of selenium by ICP/AES.

Determination of Asbestos Fibers in Environmental Samples Using Scanning Electron Microscopy and Energy Dispersive X-ray Analyses (SEM-EDXA)

by

Larry R. Sherman

ABSTRACT

Large numbers of environmental samples are submitted to the OEHL/SA laboratory for fiber counting. The fibers often need to be identified by a rapid inexpensive method to supply information to the people who make health hazard decisions. SEM-EDXA was selected to provide this information using IUCC, NIOSH and NBS reference materials.

Field samples were mounted on SEM studs, coated with a Au/Pd coating, scanned at 600x and 2000x with an Amray 1820 SEM to determine if the morphology of the fibers warranted analyses. EDXA analysis was performed with a Tracor Northern Series II X-ray analyzer (TN-II). An SQ software package (© Tracor Northern) was used to acquire data and quantitate the X-ray data for Si,Mg,Fe,Ca,Mn and Na using atomic number (Z), absorption (A) and fluorescent (F) corrections. The element mass ratios (Mg/Si, Fe/Si, Ca/Si, Mn/Si and Na/Si) were calculated along with the cation/anion ratios for the fibers. The stoichiometric Si content was normalized to 8 and used as the anion factor. The stoichiometric sum of the other five metals normalization was used as the cation ratio. Element mass ratios and cation/anion ratios along with morphology were

compared with empirical data derived from reference standards to make judgments as to the asbestos type.

In blind tests, the correct assignments were made for more than 95% of the fibers. Computer programs have been prepared for a semi-routine analyses of fibers. A single fiber analysis requires approximately 10 minutes, after mounting the sample in the SEM chamber.

Analysis of Contaminated Ground Water Using Kriging Methods

by

Gary R. Stevens

ABSTRACT

Two plumes of contaminated ground water at Wurtsmith Air Force Base in Michigan are analyzed using Kriging, a stochastic method for interpolation of spatially correlated data. The methodology is extended to create zones of influence for the monitoring wells in the contamination plumes. These zones are then used to help determine a sampling plan for future monitoring of the ground water in these plumes. This new methodology is then verified by the use of cross validation and prediction intervals for five data sets from two plumes at the Air Force Base.

A more standard statistical analysis involving tests of hypotheses is used to establish the frequency of sampling for the wells used in future monitoring of the plumes.

ABSTRACTS
SCHOOL OF AEROSPACE MEDICINE

Blood Flow Distribution In The Non-Working Forearm During Exercise

by

Ronald Bulbulian

ABSTRACT

A non-invasive method for determining forearm blood flow was investigated by combining Laser doppler velocimetry and strain gauge plethysmography. Procedures were developed for deriving absolute muscle blood flow in non-working musculature during leg exercise on a cycle ergometer. Experimental artifact associated with heart rate. exercise (movement) dehydration. and instrumentation calibration were thoroughly investigated and identified. Equipment was designed and manufactured to control motion artifact and non-experimental (error) signals associated with skin (Lazer) and forearm (plethysmography) blood flow. It is determined from the pilot data completed that the procedures and equipment developed is appropriate for quantitative fractionation of forearm blood flow into skin and muscle blood flow in non-working muscle when an accurate assumption or measurement of resting skin blood flow is available.

PHOTOPHYSICS AND PHOTOCHEMISTRY OF TRANSITION METAL COMPLEXES OF 8-QUINOLINAMINE SCHIFF BASES

by

John A. Burke, Jr.

ABSTRACT

Interaction between 633 and 532 nm laser beams has been observed when these beams intersect orthogonally in a solution of a cobalt(II) Schiff base complex derived from 8-quinolinamine and pyridine-2-carboxaldehyde. The effect observed is dependent on the power density of the 532 irradiation and the alignment of the two intersecting beams. The power density dependence follows that observed for standand saturation phenomena and has been fitted to the expression

$$f(P) = \frac{96.6P^2}{100P^2 - 0.097} \qquad (1)$$

where P is the relative power of the 532 laser beam and the function, f(P), is the change in optical density observed when the sample is irradiated. Other complexes have been prepared and investigated for beam interaction effects but none have been observed.

Immunocytochemical Localization of Vasoactive Intestinal Peptide, Neuropeptide Y and Arginine Vasopressin within the Suprachiasmatic Nuclei of the Rat

by

Bennye S. Henderson

ABSTRACT

Neurons that secrete vasoactive intestinal peptide (VIP), neuropeptide Y (NPY) and arginine vasopressin (AVP) were localized within the rat suprachiasmatic nuclei (SCN) using an indirect immunofluorescence technique. VIP-immunoreactive cell bodies were observed only along the ventrolateral border of the nucleus in close association with the optic chiasm. VIP-containing fibers were distributed throughout the nucleus and extended into the surrounding hypothalamus. In contrast, AVP-containing cell bodies were concentrated in the dorsal half of the nucleus. AVP-immunoreactive fibers innervated the dorsal aspect of the SCN and many projections were observed ascending in the direction of the paraventricular nucleus. NPY-positive fibers were concentrated in the ventral half of the SCN. NPY-containing cell bodies were not observed.

ABSTRACT

Development of Improved Assays for Cholesterol and Major Lipoprotein Fractions

by

Eric R. Johnson, Ph.D., and Thomas E. Lane

A sensitive method suitable for the analysis of subnanogram amounts of cholesterol by electron capture gas chromatography has been developed. The method involves extraction of cholesterol and cholesterol esters from saliva or urine followed by hydrolysis and derivatization with 2,3,4,5,6-pentafluorobenzoyl (PFB-) chloride. The yield of the PFB-esters of cholesterol and the internal standard epicoprostanol was in excess of 99%. The method has a lower limit of sensitivity for cholesterol of approximately 500 pg injected, which corresponds to 250 ng per mL of saliva or urine. The coefficient of variation for the extraction and analysis of cholesterol from urine samples was found to be 4.2% (cholesterol concentration 570 ng/mL). This method, which is approximately 1000 times more sensitive than gas chromatographic methods utilizing flame ionization detection, is applicable to the analysis of non-esterified cholesterol and total cholesterol (cholesterol plus cholesterol esters) in saliva and urine.

Development of an improved high performance liquid chromatographic assay for the major lipoprotein fractions in serum was also initiated. A system comprised of three size exclusion columns linked in series was found to give good resolution between low density lipoprotein, high density lipoprotein, and albumin.

PLASMA CATECHOLAMINE ASSAYS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

by

Daisy White Kimble

ABSTRACT

In a study of G-Loss of Consciousness (G-LOC) in pilots, there is a loss of blood flow to the brain. Catecholamines are central nervous system neurotransmitters which may be important in the maintenance of consciousness and in other neurophysiological functions such as heart rate control, etc. Additionally, these amines are released systematically and have direct influence on hemadynamics, heart function and thus G-Tolerance. In order to determine the concentration and physiological effects of catecholamines in blood plasma, an analytical assay was developed for norepinephrine (NE), epinephrine (E) and dopamine (DA). This assay consists of five steps: (1) separation of plasma from whole blood samples, (2) adsorption of the catecholamines from plasma onto alumina, (3) washing the alumina, (4) desorption of catecholamines from the alumina with acid and (5) quantitation by high performance liquid chromatography. The internal standard used was dihydroxybenzylamine (DHBA).

Application of Nonlinear Filters to VEP Data

by

Harold Longbotham, Ph.D.
Jim Roberts, Graduate Student

Abstract

To date, data reduction of steady state VEP data has relied on properties of linear filters. While linear filters are useful in the frequency domain, the technique of noise reduction in analysis of VEP data relies on estimating an unknown constant signal imbedded in an unknown noise. The averager is used currently to estimate this constant signal.

It has been shown that if one assumes the noise is zero mean, white, and considers the nonlinear class of OS (order statistic) filters, the averager is not the optimal filter unless the noise is normally distributed. In this work we demonstrate that for the VEP data considered and the six OS filters used, there is one OS filter that is consistently better than the averager, one that is equivalent, and the averager is better than the other four. This indicates not only that new filtering techniques should be used, but also gives an indication as to the noise distribution.

Extensions of Several Difference Score Approaches for the Analysis of Time Ordered Repeated Measures

by

David A. Ludwig

ABSTRACT

Extensions of several difference score approaches for the analysis of repeated measures experiments involving more than two time periods are presented. They are easily understood and interpreted by research workers while being mathematically equivalent, and in some cases, an improvement over more complex forms of the split-plot analysis of variance and covariance.

Spin Label Studies of Oxygen in Biological Systems

by

William Z. Plachy, Ph.D.

ABSTRACT

Experimental studies were initiated to examine the effect of high oxygen tensions on the membrane of the red blood cell, RBC. Electron Spin Resonance, ESR, spectroscopy was employed using custom designed spin probes. The product of the oxygen concentration in the membrane times the oxygen diffusion rate in the membrane was shown to be significantly less than that same prodect in a simple phospholipid bilayer model membrane. The experimental evidence suggests that high oxygen tensions employed (2.6 atm) do not cause a significant change in the membrane viscosity after 16 hour exposure times. However, evidence was also obtained that suggests that the spin probes themselves may protect the RBC membrane from oxy free radical damage by acting as radical scavengers.

Experiments were designed to test the idea that significant quantities of hyperbaric oxygen could be delivered to the body via a transcutaneous pathway. This pathway would likely require that the natural barrier to transcutaneous oxygen absorption be disrupted temporarily by the use of a permeation enhancer. It is suggested that perfluorinated chemicals may serve as good permeation enhancers for oxygen. The proposed experiments use spin labels in excised porcine skin samples. It is suggested that this transcutaneous mode may prove to be a viable alternative to the conventional mode of delivery of hyperbaric oxygen to some patients.

The stinging wasps (Hymenoptera: Vespidae) of south Texas

by

Hal C. Reed

ABSTRACT

A survey of stinging wasps and their importance to the U. S. Air Force was conducted at Brooks AFB, TX. Collections of individuals and colonies and examinations of regional insect museums revealed the presence of 19 species in south Texas, but only 12 of these occur in the San Antonio area. The most abundant paper wasp in this area is *Polistes exclamans* as 75% of all nests collected or encountered belonged to this species. Three yellowjackets occur in this area and *Vespula squamosa* is the most common of the three species. A revised fact sheet on wasps, a preliminary field key to vespid wasps, and a reference collection was provided the Medical Entomology Section. Examining the pest control records of three local USAF bases reveal that 4% of all animal-related control jobs involved destruction of stinging wasp colonies. Wasp sting allergy among patients at Wilford Hall (Lackland AFB) was the second most important arthropod-induced allergy next to fire ant allergy cases. A preliminary experiment on alarming chemicals in paper wasps demonstrated that methylene chloride extracts of the venom sac elicited defensive behavior.

MODELING OF BLOOD FLOW IN THE SYSTEMIC HUMAN ARTERIAL TREE

by

Thomas R. Rogge

ABSTRACT

The development of a mathematical/computer model of blood flow in the systemic human arterial tree was the project undertaken for the summer. An existing program, based on the finite element method for certain arterial segments, was used as a starting point. The model uses the one-dimensional field equations to simulate pressure and flow waveforms in the arterial segments. The model takes into account taper, nonlinear material behavior, constriction of the arteries (stenosis), and allows a set of different boundary conditions at the proximal and distal ends of the tree. A set of parameters, such as arterial segment geometry and compliances, was compiled and estimates of the resistances and compliance in the distal Windkessel model were obtained. The effect of G-forces was included in the model and simulations comparing a zero G-force to a 1G-force in the arm and leg arteries were made.

THE SEPARATION OF HDL2 AND HDL3 USING THE TECHNIQUE OF ULTRACENTRIFUGATION

by

Joe M. Ross

ABSTRACT

A Beckman TL100 ultracentrifuge fitted with a TL55 swinging bucket rotor was used to:

(1) separate while serum into two fractions - one containing both LDL and HDL and one containing the remaining serum proteins;

(2) separate whole serum into four fractions - one containing only LDL, one containing only HDL2, one containing only HDL3, and one containing the remaining serum proteins.

After centrifugation, fractions were collected using a Beckman fraction recovery system. The purity of each fraction is checked using a Hewlett Packard HP1090 liquid chromatograph.

An Experimental Design To Demonstrate The Dispersion Effects Of Salt Water On Optical Pulses

By

Dhiraj K. Sardar

ABSTRACT

First, the dispersion properties of electromagnetic pulses are elucidated in this report, especially, the spreading of electromagnetic pulses traveling through a dispersive medium is discussed in detail. Second, the qualitative differences between the classic and the modern descriptions of the so-called precursors are illustrated. Finally, described is a detailed experimental design which can be employed to observe the spreading of optical pulses propagating through salt water and thus demonstrate their dispersion effects.

LITERATURE SEARCH ON NUTRITION AND THE RELATION TO TACTICAL AIR COMMAND PILOTS, G-TOLERANCE AND ENERGY OUTPUT

By

Sonia Hart Sawtelle

Studies have shown that irregular and insufficient caloric intake may influence the nutritional state of pilots causing hypoglycemia, reducing G-tolerance and even provoking premature G-induced loss of consciousness. The literature in acceleration physiology has noted that nutrition does play a role in G-tolerance and G-stress.

Extensive library research was done to provide the groundwork for nutrition and the Tactical Air Command pilot; nutrition and G-tolerance; energy output of fighter pilots; special diets for fighter pilots; current dietary recommendations for the Tactical Air command pilot; hypoglycemia and it's relation to G-tolerance; the relation between Tactical Air Command pilots and specific athletic groups of similar energy outputs; and the possibilities of diminishing the fatigue factor of pilots through improved nutrition.

The significance of the literature is discussed and recommendations are suggested for further study.

A Small Inert-gas Generator

by

Paul O. Scheie

ABSTRACT

A small, inert-gas generator (SIGG) was assembled using type 4A molecular sieve subjected to pressure swing adsorption. Properties of cylindrical beds in tubes 1" x 16", 24", and 36" were studied at 20, 30, and 40 psig, with flow rates of 150, 300, 500, and 1000 cc/min, and cycle times of 4, 8, 12, and 16 sec. A variety of purge flows was used. Gas which was up to 99.9% inert was generated, and a mathematical model was formulated to describe the results under conditions of no purge flow. For a given bed size, the constraints for low oxygen content in the product gas included a cycle time of at least 8 sec, a delivered volume less than the void volume of a bed, and a ratio of product flow to inlet pressure of less than 20 cc/min-psig.

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) DETERMINATION OF HIGH ENERGY PHOSPHATE POOL

BY

Sharon T. Williams

ABSTRACT

A High Performance Liquid Chromatography (HPLC) procedure was performed for the analysis of the high energy phosphate nucleotides in platelet rich plasma (PRP) fractions of various subjects. The analytical procedure involved the extraction of platelets from whole blood, centrifugation, aspiration of the supernatant, and a freeze-thaw cycle. Finally, the samples were analyzed for the nucleotides using the HPLC. At present, only one compound was evaluated for use as an internal standard. This compound was 3-(4-hydroxyphenyl) propionic acid. We found that the retention time of this internal standard was too close to one of the nucleotides being analyzed.

The nucleotide composition was determined in the PRP of various subjects. Concentration levels of high energy phosphates in small animals was not determined as originally planned due to lack of equipment (under repair). Therefore plasma was used as a substitute for the biological unknown. We used the Rao et al. [9] HPLC procedure for analyzing the concentration of the adenine nucleotide phosphates from human blood. In the future we hope this HPLC procedure will

provide the specificity and sensitivity needed for the quantitation of these nucleotides and thus brain energy depletion in animal models before and after G induced Loss of Consciousness (G-LOC).

Chemiluminescent Probes Based on Luminol and Luminol Derivatives

by

John R. Wright

ABSTRACT

Luminol reacts with 3-aminotyrosine (3AT) in the presence of nitrite ion to form brown, melanin-like products which have potential value as biological probe substances. The reaction yield is optimal when the 3AT/luminol molar ratio is about 1.6, and zone electrophoresis at pH 6 reveals two products which are unique to this reaction mixture. One product is neutral/insoluble and the other is an anion. Both are chemiluminescent. In related work it was found that colloidal copper(II) hydroxide effects a temperature-sensitive catalysis of the luminol/H_2O_2 chemiluminescent reaction suitable for thermal dosimetry (i.e., for measuring the spatial distribution of RF energy deposition). The empirical equation for luminosity as a function of temperature (^oK) is $I/I_o = e(-19,400/RT)$, where R = 1.987 cal/^oK-mol. An analogous dosimeter based on cobalt(II) produces a bright, transient chemiluminescent reaction when CO_2 is introduced. Also, diazotizing reactions with luminol alone produce a product which chemiluminesces brightly with alkaline peroxide and no activating metal ions.

ABSTRACTS
WILFORD HALL MEDICAL CENTER

PC - MAINFRAME INTERFACE FOR DATA ENTRY

by

David R. Cecil

ABSTRACT

A microcomputer based data entry system was developed to enable researchers to enter their data sets directly to floppy diskettes. Two versions were created, one for hard disk drive PCs and the other for floppy drive only micros. Menus, on-line help, and error recovery were built in as was hard-copy documentation since prior computer knowledge on the part of the end-user researcher was not assumed.

In addition a conversion/interface computer program was designed and implemented for Statistical Consulting to convert the floppy diskette data sets into forms both readable by the statistical package SPSS-X and transmission acceptable to the mainframe VAX computers at WHMC.

ORAL HEALTH

by

Jorge L. Sintes, D.M.D., Ph.D.

ABSTRACT

This project describes the research activities performed by the author during his Summer Faculty Research appointment at Wilford Hall Medical Center, Benjamin Dunn Dental Clinic. Participation in various on-going research projects was part of the experience. These research activities included: a) a review of the literature related to **"Effects of smokeless tobacco and food intake on the oral mucosa of Air Force basic trainees"**, b) participation in **"Resistance form created by 11 pin types in complex amalgam restorations"** and c) participation in **"Finishing techniques for composite resin"**. In addition, the author submitted a protocol entitled **"Effects of biological stressors on salivary cortisol levels and subsequent bioavailability of salivary proteins and calcium"** to the WHMC Institutional Review Committee for approval. Collection of salivary samples from various patients with Graves' disease has been accomplished.