The United States Air Force Summer Faculty Research Program (USAF-SFRP) is a program designed to introduce university, college, and technical institute faculty members to Air Force research. This is accomplished by the faculty members being selected on a nationally advertised competitive basis for a ten-week assignment during the summer intercession to perform research at Air Force Laboratories/centers. Each assignment is in a subject area and at an Air Force facility mutually agreed upon by the faculty member and the Air Force. In addition to compensation and travel expenses, a cost of
20. Cont.

Living allowance is also paid. The USAF-SFRP is sponsored by the Air Force Office of Scientific Research/Air Force Systems Command, United States Air Force, and is conducted by the Southeastern Center for Electrical Engineering Education, Inc.
1981 USAF/SCEEE SUMMER FACULTY
RESEARCH PROGRAM

Conducted by
Southeastern Center for
Electrical Engineering Education

under
USAF Contract Number F49620-79-C-0038

MANAGEMENT REPORT

Submitted to
Air Force Office of Scientific Research
Bolling Air Force Base
Washington D.C.

by
Southeastern Center for
Electrical Engineering Education

October 1981
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UNITED STATES AIR FORCE
SUMMER FACULTY RESEARCH PROGRAM
1981
PROGRAM MANAGEMENT
SOUTHEASTERN CENTER FOR ELECTRICAL ENGINEERING EDUCATION
I. Introduction and History

The United States Air Force Summer Faculty Research Program (USAF-SFRP) Contract was awarded to the Southeastern Center for Electrical Engineering Education on December 7, 1978. The contract is sponsored by the Air Force Office of Scientific Research, Air Force Systems Command, United States Air Force and is conducted by SCEEE.

The program provides opportunities for research in the physical sciences, engineering, life sciences, business, and administrative 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, associate 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.

Follow-on research opportunities have been developed for a large percentage of the participants in the Summer Faculty Research Program in 1979, 1980, and 1981.

II. Recruiting and Selection

The program is conducted on a nationally advertised and competitive selection basis. Advertising for the 1981 program was placed in Science Magazine, The ASEE Journal and News, and the proceedings of the Frontiers in Education Conference. Information on the SFRP was mailed to over 500 department chairman; brochures were made available to all participating USAF Laboratories/Centers; distribution was made through AFROTC units on universities campuses; information was supplied to all who made requests. Overall, over 3000 brochures were distributed throughout the country.
In the 1979 program, 70 faculty members participated. In the 1980 and 1981 programs, 87 faculty members participated each year. There were approximately 4 applicants for each available position in the 1981 program. Applications were due at SCEEE on or before February 1, 1981. The selection panel convened in February and announcements of selection were made before March 1, 1981.

III. The Historically Black College Workshop

SCEEE and AFOSR place special emphasis on the participation of Historically Black Colleges. As a part of the USAF-SPRF, SCEEE conducted an Opportunities in Research Workshop for representatives from 77 Historically Black Colleges. To further emphasize its commitment to Historically Black Colleges, SCEEE negotiated a subcontract with the Atlanta University Center to host the workshop. The purpose of the workshop was to familiarize the attendees with the research and development requirements, facilities, and activities of the Air Force and specifically with opportunities available within the USAF R&D community. There were 127 participants at the workshop.

SCEEE has received substantial encouragement from the Historically Black Colleges since the December 1979 workshop. Twelve Historically Black College faculty members were offered appointments by SCEEE in the 1981 AFOSR Summer Faculty Research Program and 10 participated. The indication is that initiatives such as the Opportunities in Research Workshop will provide a much needed bridge between federal laboratories and the Historically Black Colleges. SCEEE has been encouraged by the Historically Black Colleges to offer a workshop devoted to Opportunities in Research on a bi-annual basis.

IV. 1981 Summer Faculty Research Program Management

After each Research Associate had signed and returned his Appointment Letter to the Southeastern Center, he was directed to contact the designated representative at the laboratory/center of assignment to schedule a pre-summer visit. The purpose of the pre-summer visit was basically threefold:
1) to meet laboratory personnel, especially the Effort Focal Point with whom the Research Associate would be most closely working, and to become personally acquainted with the laboratory facilities; 2) to finalize and formalize objectives for the Research Associate's summer research period and report these to SCEEE; 3) to make arrangements for lodging for the research period. The focus of this visit was on making sufficient preparation so that the summer research effort would be effective. Preceding the summer research period, all Research Associates were provided with detailed written instructions and procedures for obtaining payment for research efforts, travel reimbursement, and lodging cost reimbursement.

Data collected via critique is displayed in this report.
**USAF/SCCEE SUMMER FACULTY RESEARCH PROGRAM**  
**EVALUATION QUESTIONNAIRE**  
*(TO BE COMPLETED BY PARTICIPANT)*

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. (at home)</td>
<td>Home Institution</td>
</tr>
<tr>
<td>Research Colleague(s)</td>
<td></td>
</tr>
<tr>
<td>Laboratory Address of Colleague(s)</td>
<td></td>
</tr>
<tr>
<td>Brief Title of Research Topic</td>
<td></td>
</tr>
</tbody>
</table>

**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. Were your relations with your research colleague(s) satisfactory from a technical point of view?  
   YES  NO  
   If no, why?  

5. Suggestions for improvement of relationship(s).  

6. 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?  

7. Considering the calendar "window" of ten weeks (limited by varying college and university schedules), please comment on the program length. Did you accomplish more than , less than , about what you expected ?

8. Do you think that you will continue this or related research efforts upon returning to your home institution (i.e., application for mini-grant and/or other funding)? YES  NO  
   Give brief explanation of your plans.  

9. Were you asked to present seminars on your work and/or your basic expertise? YES  NO  
   Please list number, dates, approximate attendance, length of seminars, title of presentations (use reverse side if necessary.)  

10. Were you asked to participate in regular meetings in your laboratory? YES  NO  
    If yes, approximately how often?  

11. Did you perform travel on behalf of the laboratory? YES  NO  
    Where to?  
    Purpose?  

---

5
PARTICIPANT QUESTIONNAIRE

Page Two

12. Give a list of any "special" meetings you may have attended or participated in, such as conferences, visiting lectures, etc.

13. Other comments concerning any "extra" activities.

14. On a scale of A to D, how would you rate this program? (A high, D low)
   - Technically challenging
   - Future research opportunity
   - Professional association
   - Enhancement of my academic qualifications
   - Enhancement of my research qualifications
   - Overall value

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 cause you any problems of commitment? YES__ NO__ How could it be improved?

4. After your acceptance, was information (housing, location, directions, etc.) supplied to you prior to the summer period satisfactory? YES__ NO__ How could it be improved?

5. Did you have any difficulty in any domestic aspects (i.e., 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 do you rate the importance of 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 V.O.O.____, apartment____, other____ (specify)____? Name and address of apartment complex and manager's name____

9. Please suggest names (and give source) of organization, mailing lists, or other information you think would be helpful in advertising next year's program.
10. Considering the many-faceted aspects of administration of this program of this magnitude, how do you rate the overall conduct of this program? Poor _ Fair _ Good _ Excellent _ Please add any additional comments._

11. Please comment on what, in your opinion, are:
   a. Strong points of the program _______________________________
   b. Weak points of the program _______________________________

12. Other remarks: _____________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

THANK YOU!
### A. TECHNICAL ASPECTS

1. **Assignment in field of competency and/or interest?**
   
   Yes - 83  No - 0

2. **Reasonable choice of assignment?**
   
   Yes - 78  No - 5

   a. If no, why? A specific task was assigned. I did not get my first choice of assignment.

3. **Work Challenging?**
   
   Yes - 82  No - 1

4. **Relations with colleague satisfactory?**
   
   Yes - 80  No - 3

   a. If no, why? We had widely different backgrounds. I had a change of Research Colleague during the research period.

5. **Suggestions for improvement?**
   
   The Research Colleague should be well prepared; the Research Colleague should have a commitment to the program; regular meetings should be scheduled; I felt isolated from the mainstream of the laboratory effort. There were numerous complimentary remarks about Research Colleagues.

6. **Afforded adequate facilities?**
   
   Yes - 79  No - 4

7. **Accomplishment in ten weeks?**
   
   More than expected - 23, Less than expected - 15, About what expected - 44

8. **Will you continue this or related research efforts?**
   
   Yes - 81  No - 2

9. **Asked to present seminars?**
   
   Yes - 39  No - 44

10. **Asked to participate in meetings?**
    
    Yes - 54  No - 29

11. **Traveled on behalf of laboratory?**
    
    Yes - 24  No - 59

12. **Participated in "Special" meetings?**
    
    36 attended conferences, seminars, or presentations.

13. **Other comments on extra activities?**
    
    There were numerous requests for more interaction with other Research Associates.

14. **Technically challenging?**
    
    A - 54  B - 24  C - 4  D - 1

    **Future research opportunity?**
    
    A - 63  B - 17  C - 1  D - 2

    **Professional association?**
    
    A - 52  B - 25  C - 5  D - 1

    **Enhancement of academic qualifications?**
    
    A - 39  B - 41  C - 3  D - 0

    **Enhancement of research qualifications?**
    
    A - 42  B - 39  C - 2  D - 0

    **Overall value?**
    
    A - 56  B - 27  C - 0  D - 0
Participants Summary
Page Two

B. ADMINISTRATIVE ASPECTS

1. First hear about program? Through brochure - 21, from friend or colleague - 37, through regular publication advertising - 9, through direct mail - 5, through Air Force - 10

2. Decisive aspect of application? Interesting new research area - 11, area of possible future research funding - 31, good research opportunity - 31, opportunity to work in attractive environment - 13, opportunity to work with USAF - 18

3. Commitment to program a problem? Yes - 10 No - 73
   a. If yes, explain? More time for decision is required desirable - 7.

4. Program information satisfactory? Yes -70 No - 13

5. Problems in domestic aspects? Yes - 16 No - 67
   a. If yes, explain? Lodging expense reimbursement too small - 7, difficulty in finding short term housing - 10, transportation was a problem - 2, need social opportunities - 2. There were several comments complimenting Mr. Danishek at WPAFB

6. Stipend Level? Meager - 26, Adequate - 56, Generous - 1


8. Housing information? VOQ - 29, Apartment - 31, other - 23

9. Mailing list suggestions? Mailing list suggestions have been tabulated for future use.

10. Program administration overall rating? Poor - 1, Fair - 6, Good - 31, Excellent - 44
    a. Comments? Problem of security clearance; invoices were processed rapidly and other aspects run efficiently; was a rewarding 10-week period; program managed in a professional and competent manner; instructions were very clear; invoices were processed promptly and checks always arrived within 7-10 days of mailing invoice to SCEE; would like to see newsletters telling what other fellows are doing at their labs; Professor Peele was accessible and very helpful—Dan Danishek at WPAFB same; very professional from beginning to end; Professor Peele and his people do a superb job; it was first rate; should have special passes for fellows to get on base - too much time spent getting passes daily; very rewarding and worthwhile experience; very well administered by SCEE - fairly well by research site; paper work excessive; stipend is low; living and travel not clearly described in information brochure; staff at SCEE always helpful.

11. A. Strong points of the program? Air Force personnel helpful - 8, opportunity to make contact with government engineers - 5 change of routine - 2, full time work on research project - 3, future research opportunities - 7, entire program good - 4, pleasant working conditions - 4, can research something of your own interest - 3
11. B. Weak points of the program? Too much emphasis on clerical requirements - , lack of funds - , ten week period too short - , lack of information on other AF activities - , Laboratory Representative not within reach, more information on mini-grants, low visibility, unnecessary to have colleague sign invoices, can only be accepted once for the program.
USAF/SCEEE SUMMER FACULTY RESEARCH 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:

6. Did work performed by the Associate contribute to the overall mission/program of your laboratory? YES NO If yes, how?

7. Were your relations with the Associate satisfactory from a technical point of view? YES NO Suggestions as to how they might be improved:

8. 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:

9. Do you feel that the 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?

10. 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? (A high)

A B C D

11
Also, please evaluate:

<table>
<thead>
<tr>
<th>Opportunity to stimulate group activity</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional association</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>Program administration</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

B. ADMINISTRATIVE ASPECTS

1. When did you first hear of this program?

2. Were you involved in the screening and prioritizing of the faculty persons' applications 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, less than, or 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?

Other remarks:

THANK YOU
QUESTIONNAIRE EVALUATION SUMMARY
(66 Research Colleagues Reported)

1. Did you have personal knowledge of Associate's capabilities? Yes - 39
   No - 27

2. Was associate prepared? Yes - 63 No - 3

3. Comments on preparedness, etc., in subject area? Well prepared; excellent
   background; most impressed; new area and took him time to get up speed;
   very good; considerable knowledge of subject area; helpful background;
   scope and depth of knowledge excellent; extremely competent; contributed
   immediately; very well prepared; extensive experience; authority in his
   field; prior work valuable; a thorough job of preparation; exceptionally
   talented researcher; exceptional in every sense; did not have a sufficient
   background to function independently; a rare blend of theoretical
   knowledge and understanding of applications; a very broad technical
   background in the area; well prepared and well organized.

4. Comments on cooperativeness? All comments were complimentary in varying
   degrees.

5. Increase in Associate's research potential? Yes - 61 No - 5

6. Did work performed contribute to overall laboratory mission? Yes - 65 No - 1

7. Were technical relations with Associate satisfactory? Yes - 66 No - 0

8. Did Associate stimulate others? Yes - 63 No - 3

9. Will summer experience and performance form basis for continuation
   effort by Associate? Yes - 63 No - 3

10. Effectiveness in respect to capabilities and availability to USAF?
    A - 50 B - 16 C - 5 D - 0
    Opportunity to stimulate group activity?
    A - 41 B - 23 C - 2 D - 0
    Professional association?
    A - 51 B - 14 C - 1 D - 0
    Program administration?
    A - 38 B - 23 C - 3 D - 2

8. Administrative Aspects

1. When did you first hear of program? Most answered they knew about program
   for several years. The answers ranged from 1965 - 1981.

2. Involved in screening and prioritizing? Yes - 39 No - 25

3. Expense paid pre-program visit? Not worth expense - 3, Convenient - 19,
   Essential - 43

4. Please comment on program length? How much accomplished? More than - 9,
   less than - 12, what expected - 45

5. Want another participant? Yes - 66 No - 0
6. Other Comments? Well pleased with technical accomplishment; was a useful program to us; very successful program; would like to see similar program but for one year appointments; I regard this program as extremely useful and look forward to next year's candidate; like to see wider dissemination of information on the program; allow time at end for writing, typing, and review of paper; valuable program of mutual benefit to the Air Force and Faculty Research Participant; it is an investment in the future and a critically needed stimulus for our own staff; desire another faculty member; excellent opportunity for AF to get an update on a technical area; the program is very worthwhile; the involvement of graduate and undergraduate students in addition to desiring another faculty associate; this is our 6th year - we find it more valuable each year; program is a good deal! We got good work done at very little cost to us; ten week period is too restrictive; participant brought expertise and left us stimulated and refreshed; rewarding experience to all involved; program is a must at whatever cost.
**USAF/SCEEE SUMMER FACULTY RESEARCH PROGRAM**
**EVALUATION QUESTIONNAIRE**
*(TO BE COMPLETED BY LABORATORY REPRESENTATIVE)*

<table>
<thead>
<tr>
<th>Laboratory/Center</th>
<th>Name</th>
</tr>
</thead>
</table>

1. How do you rate the correspondence, verbal and telephone communications, and other aspects concerning program administration? Poor_ Average_ Good_ Excellent_

   How could it be improved?

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

3. Was the number of faculty associates assigned to your organization satisfactory? YES_ NO_ If not, how many would be desired?

   How did you determine this number?

4. Please rate the expense-paid pre-program visit: Not worth expense___ Convenient___ Essential___

5. In your opinion is the ten-week time period an optimum length of time to obtain the objective of providing the introduction to each other (associates and laboratory/center personnel and programs)? YES_ NO_ If no, what length would be?

   Other comments:

6. Did your laboratory/center establish a seminar program (or other means) to "tap" the faculty associates' 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(s) assigned to your organization? YES_ NO_ 

8. Did you have a formal exit exercise for each associate (such as doing his final technical briefing to the organization management, or in 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 and production, and meaningful research accomplishment? (Note: These answers will be held confidential.) QUESTION CONTINUED ON NEXT PAGE.

List Name(s) | Poor | Average | Excellent | Superior
|-------------|-------|---------|-----------|---------|

15
<table>
<thead>
<tr>
<th>List Name(s)</th>
<th>Poor</th>
<th>Average</th>
<th>Excellent</th>
<th>Superior</th>
</tr>
</thead>
</table>

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

THANK YOU
QUESTIONNAIRE EVALUATION SUMMARY  
(20 of 24 Laboratory Representatives Reported)

1. **Rate correspondence?**  Poor - 0, Average - 2, Good - 8, Excellent - 10

2. **Sufficient time for selection?**  Yes - 20  No - 0

3. **Number of Associates satisfactory?**  Yes - 14  No - 6

4. **Rate pre-program visit?**  Not worth expense - 0, Convenient - 3, Essential - 17

5. **Ten week period an optimum amount of time?**  Yes - 18  No - 2

6. **Established seminar program?**  Yes - 9  No - 11

7. **Conduct briefing?**  Yes - 17  No - 3

8. **Exit exercise?**  Yes - 15  No - 3

9. **Quality of participants?**  Poor - 0, Average - 7, Excellent - 44, Superior - 35

10. **Comments?**  Faculty members need more information on expenses; we have been very pleased with enthusiastic manner in which the faculty associates have attacked the assigned research problems; ten weeks is a very short time; this was the best group of SFRP participants we have ever had; highly beneficial to AEDC; we value this program; SCEEE was very helpful in assuring smooth operation; good program; SCEEE does an outstanding job in running this program; SCEEE is the most supportive contractor I have ever dealt with; laboratory personnel were extremely pleased with associates assigned.
APPENDIX I

1. Program Statistics
2. List of 1981 Participants
3. Participant Laboratory Assignments
1981 USAF/SCCEE SUMMER FACULTY RESEARCH PROGRAM

Conducted by
SOUTHEASTERN CENTER FOR ELECTRICAL ENGINEERING EDUCATION, INC.

PROGRAM STATISTICS

1. Number of Air Force Installations (Laboratories/Centers) - 25

2. Applications Received (First Choice as Follows) - 273

<table>
<thead>
<tr>
<th>Installation</th>
<th>First Choice</th>
<th>Second Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>APL</td>
<td>10 (W-PAFB)</td>
<td>HRL/PTD (Williams)</td>
</tr>
<tr>
<td>AMRL</td>
<td>15 (W-PAFB)</td>
<td>HRL/PMD (Brooks)</td>
</tr>
<tr>
<td>AD</td>
<td>12 (Eglin)</td>
<td>HRL/TDD (Lowry)</td>
</tr>
<tr>
<td>AEDC</td>
<td>1 (Arnold)</td>
<td>LMDC (Maxwell)</td>
</tr>
<tr>
<td>AL</td>
<td>9 (W-PAFB)</td>
<td>LC (W-PAFB)</td>
</tr>
<tr>
<td>BMRC</td>
<td>9 (W-PAFB)</td>
<td>LMC (Gunter)</td>
</tr>
<tr>
<td>ESMC</td>
<td>11 (Patrick)</td>
<td>ML (W-PAFB)</td>
</tr>
<tr>
<td>ESD</td>
<td>10 (Hanscom)</td>
<td>RPL (Edwards)</td>
</tr>
<tr>
<td>ESC</td>
<td>21 (Tyndall)</td>
<td>RADC (Griffiss)</td>
</tr>
<tr>
<td>FDL</td>
<td>10 (W-PAFB)</td>
<td>RADC/ET (Hanscom)</td>
</tr>
<tr>
<td>FJSSL</td>
<td>18 (USAFA)</td>
<td>SAM (Brooks)</td>
</tr>
<tr>
<td>GL</td>
<td>11 (Hanscom)</td>
<td>WL (Kirtland)</td>
</tr>
<tr>
<td>HRL/ASD</td>
<td>7 (W-PAFB)</td>
<td>(W-PAFB)</td>
</tr>
</tbody>
</table>

3. Number of Participants - 87

- Number holding Doctorate Degree - 83
- Number holding Masters Degree - 4
- Number holding Professor Rank - 18
- Number holding Associate Professor Rank - 27
- Number holding Assistant Professor Rank - 41
- Number holding Instructor Rank - 0
- Number holding Chairman Rank - 1

4. Average Age of Participants - 41.6 years

5. Distribution of Participants Location

<table>
<thead>
<tr>
<th>Installation</th>
<th>First Choice</th>
<th>Second Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>APL</td>
<td>6 (W-PAFB)</td>
<td>HRL/PTD (Williams)</td>
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<td>AMRL</td>
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6. Disciplines Represented - 24

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<td>Industrial &amp; Systems Engineering</td>
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<td>Political Science</td>
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<tr>
<td>Psychology</td>
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7. Number of Colleges/Universities Represented - 69

- Alabama A & M
- Alabama/Huntsville, University of Alabama
- Alaska, University of
- Arizona, University of
- Auburn University
- Ball State University
- Bowling Green State University
- California/Northridge, State University
- Cedarville College
- Central Community State College
- Central State University
- Cincinnati, University of
- Citadel, the
- Clarkson College
- Clemson University
- College of the Holy Cross
- Colorado, University of
- Coppin State College
- Dayton, University of (2)
- Drexel University
- Duke University
- Eastern Washington University
- Fayetteville State University
- Florida Institute of Technology
- Florida, University of (2)
- Gannon University
- Georgia Institute of Technology
- Grambling State University
- Indiana State University
- Iowa State University
- Kansas State University
- Kansas, University of
- Kent State University (1)
- Kentucky, University of (1)
- Lowell, University of (2)
- Massachusetts/Amherst, University of
- Michigan Technological University
- Mississippi State University (5)
- Nebraska/Lincoln, University of
- New Jersey Institute of Technology
- New Mexico State University
- New York/Albany, State University
- New York/Buffalo, State University
- New York/Stone Brook, State University
- North Texas State University
- Notre Dame, University of
- Ohio State University
- Pacific University
- Pennsylvania State University
- Princeton University
- Purdue University
- Rice University (2)
- Rider College
- Rochester Institute of Technology
- South Dakota, University of
- Southern University/Baton Rouge
- Southern Louisiana University (2)
- Stevens Institute of Technology
- Syracuse University
- Tennessee State University (2)
- Texas A & M University (2)
- Toledo, University of (2)
- Trinity University
- Tuskegee Institute
- Utah State University
- Virginia Military Institute (2)
- Virginia Polytechnic Institute & State University (2)
- Washington State University
- Wright State University (4)
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<td>Michigan</td>
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1981 USAF/SCHEE SUMMER FACULTY RESEARCH PROGRAM

LIST OF PARTICIPANTS

NAME/ADDRESS | DEGREE, SPECIALTY, LABORATORY | ASSIGNED
--- | --- | ---
Dr. Milton J. Alexander  
Professor  
Auburn University  
Management Department  
Auburn University, AL 36849  
(205) 826-4730
Specialty: Management Information Systems  
Assigned: LMC
---
Dr. David W. Allender  
Associate Professor  
Kent State University  
Dept. of Physics  
Kent, OH 44242  
(216) 672-2816
| Degree: PhD, Physics, 1975  
Specialty: Condensed Matter Theory  
Assigned: AL
---
Dr. Martin D. Altschuler  
Associate Professor  
SUNY/Buffalo  
Dept. of Computer Science  
4226 Ridge Lea Campus  
Amherst, NY 14226  
(716) 831-3065
| Degree: PhD, Physics and Astronomy, 1964  
Specialty: Robot Vision, Surface Mapping, Internal Mapping  
Assigned: SAM
---
Dr. Aloysius A. Beex  
Assistant Professor  
VPI & SU  
Dept. of Electrical Engineering  
Blacksburg, VA 24061  
(703) 961-6307
| Degree: PhD, 1979  
Specialty: Surface Science and Catalysis  
Assigned: RPL
---
Dr. Albert W. Biggs  
Professor  
University of Kansas  
Dept. of Electrical Engineering  
2026 Learned Hall  
Lawrence, KS 66045  
(913) 864-4615
| Degree: PhD, Electrical Engineering, 1965  
Specialty: Electromagnetics, Radar, Microwaves, Antennas  
Assigned: WL
---
Dr. William G. Bradley  
Assistant Professor  
University of AL/Huntsville  
Electrical Engineering Dept.  
Huntsville, AL 35899  
(205) 895-6139
| Degree: PhD, Electrical Engineering, 1973  
Specialty: Communication and Radar Systems and Digital Design  
Assigned: RADC (Huntsville)
<table>
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<tr>
<th>NAME/ADDRESS</th>
<th>DEGREE, SPECIALTY, LABORATORY</th>
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<tbody>
<tr>
<td>Dr. Jerome D. Braverman</td>
<td>Degree: PhD, Statistics, 1966</td>
<td>Assigned: RADC (Griffiss)</td>
</tr>
<tr>
<td>Professor &amp; Chairman</td>
<td>Specialty: Statistical Inference, Statistical Decision Theory, Quality Control &amp; Reliability</td>
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<tr>
<td>Rider College</td>
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<tr>
<td>Dept. of Decision Science &amp; Computers</td>
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<td>Lawrenceville, NJ 08648</td>
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<td>(609) 896-5124</td>
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<tr>
<td>Dr. Louis W. Buckalew</td>
<td>Degree: MS, General Experimental Psychology, 1969</td>
<td>Assigned: AMRL</td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>Specialty: Physiological Psychology</td>
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<tr>
<td>Alabama A &amp; M University</td>
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<tr>
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<tr>
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<tr>
<td>Dr. Gale H. Buzzard</td>
<td>Degree: PhD, Mechanical Engineering, 1966</td>
<td>Assigned: RPL</td>
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<tr>
<td>Assistant Professor</td>
<td>Specialty: Fluid Mechanics, Heat Transfer, System Dynamics</td>
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<td>Duke University</td>
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<td>Dept. of Mechanical Engineering and Material Science</td>
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<td>Durham, NC 27706</td>
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<td>(919) 684-2832</td>
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<td>Dr. David A. Carlson</td>
<td>Degree: PhD, Computer Science, 1980</td>
<td>Assigned: HRL (Lowry)</td>
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<tr>
<td>Assistant Professor</td>
<td>Specialty: Computer Science, Design &amp; Analysis of Algorithms</td>
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<tr>
<td>Dr. Robert E. Carlson</td>
<td>Degree: PhD, Ecology &amp; Limnology, 1975</td>
<td>Assigned: ESC</td>
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<tr>
<td>Assistant Professor</td>
<td>Specialty: Ecology, Aquatic Biology</td>
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<tr>
<td>Kent State University</td>
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<td>Kent, OH 44242</td>
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<td>(216) 672-2266</td>
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<tr>
<td>Dr. Junho Choi</td>
<td>Degree: PhD, Control Systems &amp; Signal Processing, 1978</td>
<td>Assigned: ESMC</td>
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<tr>
<td>Assistant Professor</td>
<td>Specialty: Modern &amp; Conventional Control Systems</td>
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<td>Florida Institute of Technology</td>
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</table>
| Dr. Hugh W. Coleman  
Associate Professor  
Mississippi State University  
Dept. of Mechanical Engineering  
P.O. Drawer ME  
Mississippi State, MS 39762  
(601) 325-3260 | Degree: PhD, Mechanical Engineering, 1976  
Specialty: Turbulent boundary layers - Fluid Mechanics & Heat Transfer  
Assigned: AD |
| Dr. David L. Cozart  
Associate Professor  
The Citadel  
Dept. of Mathematics  
Charleston, SC 29409  
(803) 792-7896 | Degree: PhD, Mathematics, 1973  
Specialty: Programming languages, Statistics  
Assigned: AL |
| Dr. Robert W. Cunningham  
Associate Professor  
Kent State University  
Dept. of Physics  
University Drive, NE  
New Philadelphia, OH 44663  
(216) 339-3391 | Degree: PhD, Physics, 1969  
Specialty: Solid State Physics  
Assigned: ML |
| Dr. Larry R. Dalton  
Associate Professor  
SUNY/ Stony Brook  
Dept. of Chemistry  
Long Island, NY 11794  
(516) 246-8601/5068 | Degree: PhD, Chemistry, 1972  
Specialty: Physical Chemistry, Electronics & Instrumentation Microwaves  
Assigned: FISRL |
| Dr. Charles B. Davis  
Assistant Professor  
University of Toledo  
Dept. of Mathematics  
Toledo, OH 43606  
(419) 537-2297/2568 | Degree: PhD, Statistics, 1976  
Specialty: Mathematical & Applied Statistics  
Assigned: SAM |
| Dr. Carol A. Deakyne  
Assistant Professor  
College of the Holy Cross  
Chemistry Dept.  
Worcester, MA 01610  
(617) 793-3367 | Degree: PhD, Theoretical Chemistry, 1976  
Specialty: Applications of Molecular Orbital Theory  
Assigned: GL |
| Dr. Donald W. Emerich  
Professor  
Mississippi State University  
Chemistry Dept.  
P.O. Box CH  
Mississippi State, MS 39762  
(601) 325-3584 | Degree: PhD, Chemistry, 1951  
Specialty: Analytical Chemistry, Classical  
Electroanalytical Chemistry  
Assigned: RPI |
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| Dr. Chris W. Eskridge | Degree: PhD, Public Administration, 1978  
Specialty: Public Administration, Policy Organization & Management | Assigned: LMDC |
| Dr. Glenn E. Fanslow | Degree: PhD, Electrical Engineering, 1962  
Specialty: Applications of Microwave Power | Assigned: APL |
| Dr. William A. Feld | Degree: PhD, Chemistry, 1971  
Specialty: Synthetic Organic & Polymer Chemistry | Assigned: NL |
| Dr. John A. Fleming | Degree: PhD, Electrical Engineering, 1977  
Specialty: Electrical Systems | Assigned: AL |
| Dr. Dennis R. Flentge | Degree: PhD, Physical Chemistry, 1974  
Specialty: Physical Chemistry, Catalysis, IR & EPR Spectroscopy | Assigned: APL |
| Dr. Harold W. Fox | Degree: PhD, Economics, 1967  
Specialty: Business Administration | Assigned: BMRC |
| Dr. Peter Freymuth | Degree: PhD, Aerospace Engineering, 1985  
Specialty: Turbulence, Thermal Anemometry, Stability | Assigned: FASIL |
<table>
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<tr>
<th>Name/Address</th>
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| Dr. Joel R. Sried Assistant Professor  
University of Cincinnati Chemistry Engineering Dept.  
Mail Location #171  
Cincinnati, OH 45221  
(513) 475-3500 | Degree: PhD, Polymer Science & Engineering, 1976  
Specialty: Mechanical Properties, Calorimetry & Rheology of Polymer Blends  
Assigned: ML |
| Dr. David E. Greene Assistant Professor  
Texas A & M University  
Industrial Engineering Dept.  
College Station, TX 77840  
(713) 845-5531 | Degree: PhD, Applied Mathematics, 1973  
Specialty: Control Theory, Man Machine Systems, Biological Regulation, PDE, DE  
Assigned: SAM |
| Dr. Gurmohan S. Grewal Professor  
Southern University/Baton Rouge  
Dept. of Electrical Engineering  
P.O. Box 11060  
Baton Rouge, LA 70813  
(504) 771-2317 | Degree: PhD, Electrical Engineering, 1969  
Specialty: Control Systems, Simulation, State Estimation  
Assigned: AL |
| Dr. Paul B. Griesaker Associate Professor  
Gannon University  
Dept. of Physics  
Erie, PA 16508  
(814) 871-7338 | Degree: PhD, Physics, 1963  
Specialty: Physical Optics, Coherent Radiation  
Assigned: RADC (Griffiss) |
| Dr. Vijay L. Gupta Assistant Professor  
Central State University  
Dept. of Chemistry  
Wilberforce, OH 45384  
(513) 376-6423 | Degree: PhD, Chemistry, 1968  
Specialty: Physical Chemistry, Physical Organic Laboratory, Physical Science, General Chemistry  
Assigned: APL |
| Dr. Kenneth R. Hall Associate Professor  
Mississippi State University Aerospace Engineering Dept.  
P.O. Drawer A  
Mississippi State, MS 39762  
(601) 329-3623 | Degree: PhD, Aerospace Engineering, 1973  
Specialty: Simulation, Flight Dynamics, Control, Optimization  
Assigned: AD |
| Dr. Robert M. Harnett Associate Professor & Director  
Clemson University  
System Engineering Dept.  
Clemson, SC 29631  
(803) 556-3375 | Degree: PhD, Industrial & Systems Engineering, 1974  
Specialty: Operations Research, Optimization  
Assigned: AD |
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<tr>
<td>Dr. Ronney D. Harris&lt;br&gt;Professor&lt;br&gt;Utah State University&lt;br&gt;Dept. of Electrical Engineering&lt;br&gt;UMC 41&lt;br&gt;Logan, UT 84321&lt;br&gt;(401) 750-2973</td>
<td>Degree: PhD, Electrical Engineering, 1964&lt;br&gt;Specialty: Aeronomy - Atmospheric Radiation Transfer</td>
<td>Assigned: GL</td>
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<tr>
<td>Dr. Franklin D. Hill&lt;br&gt;Professor&lt;br&gt;Grambling State University&lt;br&gt;Chemistry Dept.&lt;br&gt;Grambling, LA 71245&lt;br&gt;(318) 247-8397</td>
<td>Degree: PhD, Biochemistry, 1960&lt;br&gt;Specialty: Lipid Metabolism</td>
<td>Assigned: AMRL</td>
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<td>Dr. Francis J. Jankowski&lt;br&gt;Professor&lt;br&gt;Wright State University&lt;br&gt;Dept. of Engineering&lt;br&gt;Dayton, OH 45436&lt;br&gt;(513) 871-2709/2503</td>
<td>Degree: ScD, Physics, 1949&lt;br&gt;Specialty: Systems Engineering, Nuclear Engineering, Mechanical Engineering, Human Factors Engineering</td>
<td>Assigned: WI</td>
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<tr>
<td>Dr. Stanley E. Jones&lt;br&gt;Associate Professor&lt;br&gt;University of Kentucky&lt;br&gt;Engineering Mechanics&lt;br&gt;Lexington, KY 40506&lt;br&gt;(606) 258-2719</td>
<td>Degree: PhD&lt;br&gt;Specialty: Applied Mathematics, Nonlinear Mechanics</td>
<td>Assigned: AD</td>
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<tr>
<td>Dr. Paul R. Kalata&lt;br&gt;Assistant Professor&lt;br&gt;Drexel University&lt;br&gt;Dept. of Electrical &amp; Computer Engineering&lt;br&gt;32nd &amp; Chestnut Street&lt;br&gt;Philadelphia, PA 19104&lt;br&gt;(215) 895-2251</td>
<td>Degree: PhD, Electrical Engineering, 1976&lt;br&gt;Specialty: Control Theory, Estimation Theory</td>
<td>Assigned: WL</td>
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<td>Dr. Richard Y.C. Kwor&lt;br&gt;Assistant Professor&lt;br&gt;University of Notre Dame&lt;br&gt;Dept. of Electrical Engineering&lt;br&gt;Notre Dame, IN 46556&lt;br&gt;(219) 281-6269</td>
<td>Degree: PhD, Electrical Engineering&lt;br&gt;Specialty: Electrical Engineering</td>
<td>Assigned: AL</td>
</tr>
<tr>
<td>Dr. Richard C. Liu&lt;br&gt;Associate Professor&lt;br&gt;Purdue University&lt;br&gt;Dept. of Industrial Engineering&lt;br&gt;Griswold Hall&lt;br&gt;W. Lafayette, IN 47907&lt;br&gt;(317) 749-2948</td>
<td>Degree: PhD, IE (Manufacturing), 1973&lt;br&gt;Specialty: Manufacturing Engineering</td>
<td>Assigned: WI</td>
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<td>Dr. William S. McCain</td>
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<tr>
<td>Mechanical Engineering</td>
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<tr>
<td>3500 Centennial Blvd.</td>
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<tr>
<td>Nashville, TN 37203</td>
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<td>(615) 320-3555</td>
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<tr>
<td>Degree: PhD, Metallurgical Engineering, 1973</td>
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<td>Specialty: Aluminum alloys, fabrication &amp; heat treatments of aerospace alloys, rolling, forging, extrusion x-ray diffraction</td>
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<td>Dr. William S. McCormick</td>
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<td>Associate Professor</td>
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<td>University of Kentucky</td>
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<td>Dept. of Psychology</td>
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<td>Lexington, KY 40506</td>
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<tr>
<td>(606) 258-5959/5601</td>
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<tr>
<td>Degree: PhD, Experimental Psychology, 1966</td>
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<td>Specialty: Learning, Operant Conditioning, Animal Performance</td>
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<tr>
<td>Dr. Henry A. McGee, Jr.</td>
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<tr>
<td>Professor &amp; Dept. Head</td>
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<td>Specialty: Cryogenics, Molecular Phenomena &amp; Processes</td>
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<td>Dr. Patrick J. McKenna</td>
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Degree: PhD, Political Science, 1961
Specialty: US Foreign Policy; American National Security Policy
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Dr. C. Frederic Reynolds
Degree: PhD, Chemistry, 1939
Specialty: Physical Chemistry (Spectroscopy)
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Assigned: FJSRL
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<tr>
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1981 USAF/SCREE SUMMER FACULTY RESEARCH PROGRAM

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<td>Degree: PhD, Geophysics, 1980</td>
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<td>Specialty: Seismology</td>
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Pacific University  
Dept. of Optometry  
Forest Grove, OR 97116  
(503) 357-0151 X 272 | Degree: PhD, Psychology, 1975  
Specialty: Visual System Function & Analysis  
Assigned: SAM |
| Dr. Poh Shien Young  
Associate Professor  
Mississippi State University  
Physics Dept.  
Mississippi State, MS 39762  
(601) 325-2806 | Degree: PhD, Physics, 1966  
Specialty: Sparse Physics, Cosmic Rays,  
Mathematical Physics, Orbital Determination, Optimal Control  
Assigned: AD |
PARTICIPANT LABORATORY ASSIGNMENT

1981 USAF/SCEE SUMMER FACULTY RESEARCH PROGRAM

APL
AERO PROPULSION LABORATORY
(Wright-Patterson Air Force Base)
1. Dr. Glenn Fanslow - Iowa State University
2. Dr. Dennis Fentge - Cedarville College
3. Dr. Vijay Gupta - Central State University
4. Dr. Samuel Noodleman - University of Arizona
5. Dr. John Roberts - Rice University
6. Dr. Sarwan Sandhu - University of Dayton

AMRL
AEROSPACE MEDICAL RESEARCH LABORATORY
(Wright-Patterson Air Force Base)
1. Dr. Louis Buckalew - Alabama A & M University
2. Dr. Franklin Hill - Grambling State University
3. Dr. Donald McCoy - University of Kentucky
4. Dr. William Norton - Southern Louisiana University
5. Dr. Thomas Nygren - Ohio State University
6. Dr. John Riggs - Tuskegee Institute

AD
ARMAMENT DIVISION
(Eglin Air Force Base)
1. Dr. Hugh Coleman - Mississippi State University
2. Dr. Kenneth Hall - Mississippi State University
3. Dr. Robert Harnett - Clemson University
4. Dr. Stanley Jones - University of Kentucky
5. Dr. Alan Stiffler - Mississippi State University
6. Dr. Poh Shien Young - Mississippi State University

AEDC
ARNOLD ENGINEERING DEVELOPMENT CENTER
(Arnold Air Force Station)
1. Dr. Eugene Niemi - University of Lowell
2. Dr. Venugopal Veeramany - Tennessee State University

AL
AVIONICS LABORATORY
(Wright-Patterson Air Force Base)
1. Dr. David Allender - Kent State University
2. Dr. David Cozart - The Citadel
3. Dr. John Fleming - Texas A & M University
4. Dr. Gurmoohan Grewal - Southern University/Baton Rouge
5. Dr. Richard Kwor - University of Notre Dame
6. Dr. William McCormick - Wright State University
7. Dr. Robert Puckett - Indiana State University
8. Dr. Arthur Thorbjornsen - University of Toledo

BRMC
BUSINESS RESEARCH MANAGEMENT CENTER
(Wright-Patterson Air Force Base)
1. Dr. Harold Fox - Ball State University
2. Dr. Patrick Sweeney - University of Dayton

ESMC
EASTERN SPACE & MISSILE CENTER
(Patrick Air Force Base)
1. Dr. Junho Choi - Florida Institute of Technology
PARTICIPANT LABORATORY ASSIGNMENT (Continued)

ESD
ELECTRONIC SYSTEMS DIVISION
(Hanscom Air Force Base)
1. Dr. Richard Van Slyke - Stevens Institute of Technology

ESC
ENGINEERING & SERVICES CENTER
(Tyndall Air Force Base)
1. Dr. Robert Carlson - Kent State University
2. Dr. William Payne - Virginia Military Institute
3. Dr. Richard Richter - Washington State University
4. Dr. M. C. Wang - Pennsylvania State University

FDL
FLIGHT DYNAMICS LABORATORY
(Wright-Patterson Air Force Base)
1. Dr. Patrick McKenna - University of Florida
2. Dr. David Miller - Wright State University
3. Dr. Levon Minnetyan - Clarkson College
4. Dr. Hsi-Han Yeh - University of Kentucky

FJSRL
FRANK J. SEILER RESEARCH LABORATORY
(USAF Academy)
1. Dr. Larry Dalton - SUNY/Stony Brook
2. Dr. Peter Freymuth - University of Colorado
3. Dr. Frederic Reynolds - Michigan Technological University

GL
GEOPHYSICS LABORATORY
(Hanscom Air Force Base)
1. Dr. Carol Deakyne - College of the Holy Cross
2. Dr. Ronney Harris - Utah State University
3. Dr. Steven Newman - Central Community State College
4. Dr. Alan Nye - Rochester Institute of Technology
5. Dr. Stanley Spiegel - University of Lowell
6. Dr. Brenton Watkins - University of Alaska

HRL/ASD
HUMAN RESOURCES LABORATORY/ADVANCED SYSTEMS DIVISION
(Wright-Patterson Air Force Base)
1. Dr. Charles Teplitz - SUNY/Albany

HRL/PTD
HUMAN RESOURCES LABORATORY/FLYING TRAINING DIVISION
(Williams Air Force Base)
1. Dr. Edward Rinalducci - Georgia Institute of Technology
2. Dr. Charles Sanders - Coppin State College
3. Dr. Vina Sloan - Eastern Washington University

HRL/PRD
HUMAN RESOURCES LABORATORY/PERSONAL RESEARCH DIVISION
(Brooks Air Force Base)

HRL/TTD
HUMAN RESOURCES LABORATORY/TECHNICAL TRAINING DIVISION
(Lowry Air Force Base)
1. Dr. David Carlson - University of Massachusetts/Amherst

LMDC
LEADERSHIP & MANAGEMENT DEVELOPMENT CENTER
(Maxwell Air Force Base)
1. Dr. Chris Eskridge - University of Nebraska/Lincoln
PARTICIPANT LABORATORY ASSIGNMENT (Continued)

LC
LOGISTICS COMMAND
(Wright-Patterson Air Force Base)
1. Dr. John Powell - University of South Dakota

LMC
LOGISTICS MANAGEMENT CENTER
(Gunter Air Force Base)
1. Dr. Milton Alexander - Auburn University
2. Dr. Louis Martin-Vega - University of Florida

ML
MATERIALS LABORATORY
(Wright-Patterson Air Force Base)
1. Dr. Robert Cunningham - Kent State University
2. Dr. William Feld - Wright State University
3. Dr. Joel Fried - University of Cincinnati
4. Dr. Richard Liu - Purdue University
5. Dr. William McCain - Tennessee State University
6. Dr. Thomas Roth - Kansas State University

RPL
ROCKET PROPULSION LABORATORY
(Edwards Air Force Base)
1. Dr. Jay Benziger - Princeton University
2. Dr. Gale Buzzard - Duke University
3. Dr. Donald Emerich - Mississippi State University
4. Dr. Russell Smith - North Texas State University

RADC
ROME AIR DEVELOPMENT CENTER
(Griffiss Air Force Base)
1. Dr. Aloysius Beex - Virginia Polytechnic Institute & State University
2. Dr. Jerome Braverman - Rider College
3. Dr. Paul Griesacker - Gannon University

RADC/ET
ROME AIR DEVELOPMENT CENTER/ELECTRONICS TECHNOLOGY
(Hanscom Air Force Base)
1. Dr. William Bradley - University of Alabama/Huntsville
2. Dr. Lawrence Suchow - New Jersey Institute of Technology

SAM
SCHOOL OF AEROSPACE MEDICINE
(Brooks Air Force Base)
1. Dr. Martin Altschuler - SUNY/Buffalo
2. Dr. Charles Davis - University of Toledo
3. Dr. David Greene - Texas A & M University
4. Dr. Kishan Mehrotra - Syracuse University
5. Dr. Rex Moyer - Trinity University
6. Dr. Albert Thompson - Fayetteville State University
7. Dr. Alice Ward - Southern University/Baton Rouge
8. Dr. Robert Yolton - Pacific University

WL
WEAPONS LABORATORY
(Kirtland Air Force Base)
1. Dr. Albert Biggs - University of Kansas
2. Dr. Francis Jankowski - Wright State University
3. Dr. Paul Kalata - Drexel University
4. Dr. Henry McGee - Virginia Polytechnic Institute & State University
WEAPONS LABORATORY (Continued)
(Kirtland Air Force Base)
5. Dr. John McNeil - New Mexico State University
6. Dr. Gerald Simila - California State University/Northridge
APPENDIX II

1. Listing of Research Reports Submitted in the 1981 Summer Faculty Research Program

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#### 1981 USAF-SCEEE SUMMER FACULTY RESEARCH PROGRAM

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THE DETERMINATION OF INPUT DATA ACCURACY
IN THE MAINTENANCE DATA COLLECTION SYSTEM

by

Milton J. Alexander

ABSTRACT

The question of input data accuracy in the maintenance data collection system is investigated. It is shown that the level of input data accuracy is subject to two different types of errors - data which should have been entered into the MDCS (Type I errors) and erroneous data which was entered into the MDCS (Type II errors). Techniques were developed to measure both types of errors and field tested on a TAC unit. The two error types may be combined as a joint probability to provide a measure of input data accuracy. When field test data was substituted in the mathematical formulation, the computed input data accuracy level was about one percent, i.e., only about one maintenance action in 100 was being correctly reported into MDCS. Suggestions for improving input data accuracy as well as further research in this area are offered.
SUPERCONDUCTING PAIR BINDING ENERGY

IN DEGENERATE FERMI SYSTEMS

by

David W. Allender

ABSTRACT

The binding energy of Cooper pairs in degenerate Fermi systems in one
and three dimensions is examined as a function of the carrier density, the
cut-off energy of the attractive interaction, and the momentum of the pair.
It is found that when the cut-off energy is sufficiently small compared to
the effective BCS interaction parameter, the binding energy as a function of
momentum, q, has two relative maxima: one at q = 0 and one at q greater
than twice the Fermi momentum in a one dimensional system. Thus a metastable
state is predicted. Large momentum pairing in three dimensions is also
examined. Results are related to experimental observations and recommenda-
tions are made for further research.
SOFTWARE FOR RAPID REMOTE 3-D MAPPING OF AN
ARBITRARILY-COMPLEX OBJECT

by

Martin D. Altschuler

ABSTRACT

The development of interactive software for dependable remote nondestructive 3-D surface mapping of an arbitrarily-complex object in real time is well under way. Hardware/software techniques and trade-offs have been investigated for the rapid (in parallel) laser illumination, imaging, and triangulation of 16,000 points of an unknown surface. To produce an operational device for real-time anthropometric measurement (for example, to measure real-time changes in human-body anatomy and work motions in a zero-gravity space environment) requires developing, implementing, testing, and packaging optimal algorithms for (1) multi-directional laser-array illumination, (2) multi-directional imaging, and (3) rapid dependable calibration of cameras and laser arrays. Needed resources are an interactive raster graphics facility and a compatible host computer. If funding is available, an operational real-time surface mapping system can be produced within two years.
ENHANCED SCENE RESOLUTION: 2-D SPECTRAL ESTIMATOR APPROACHES
by
A.A. (Louis) Beex

ABSTRACT

In this report, an initial performance evaluation is presented for two modern spectrum estimators, used in the context of resolution enhancement in scenes with limited support. This is to identify the potential these methods may have in a practical environment.

The availability of limited sets of observations has spurred procedures for extending data beyond the observation limits, in order to defeat the classical Rayleigh resolution. The one-step extrapolator /2/ is one such approach, that is extended and implemented in the 2-D setting. The potential of this one-step extrapolator is demonstrated, but also the enormous sensitivity to any type of noise, which renders this particular extrapolation algorithm of low practical value.

A different approach is to assume a parametric model for the stochastic process that underlies the data. The 2-D autoregressive moving average (ARMA) model is rather general, and leaves one with a difficult parameter estimation problem. The difficulty of implementation pays off in a high resolution property for certain classes of signals, and a relative robustness in the presence of noise.
DECOMPOSITION OF NITROMETHANE
OVER METAL OXIDE CATALYSTS
by
Jay B. Benziger

ABSTRACT
In the course of this work, the reaction of nitromethane over NiO/alumina and Cr₂O₃/alumina catalysts was examined to determine the feasibility of developing a nitromethane based monopropellant system. The kinetics of nitromethane decomposition over those two catalysts were found to be adequately represented by Langmuir–Hinshelwood expressions
\[
\frac{K_P}{s^s + K_P} r = -k_{e} C_e
\]
under conditions T = 100 - 300°C, P = 1 - 100 torr. The kinetic parameters \( k_{e} \) and \( K_P \) were measured and used to fit the data over the entire temperature range. It was found that nitromethane decomposition caused catalyst deactivation due to carbon deposition, which was due to the fuel rich nature of the nitromethane. The rate of deactivation was found to increase with decreasing temperature. Lastly, a reactor model was presented to display the qualitative features of operation of a monopropellant system. Catalyst bed length and preheat temperature and feed temperature were identified as the important parameters in determining system response time.
INTERACTION BETWEEN AN ELECTROMAGNETIC PULSE AND A
METAL CYLINDER CONNECTED TO A PARALLEL PLATE GUIDE BY A WIRE

by

Albert W. Biggs

ABSTRACT

The interaction between an electromagnetic pulse (EMP) and a metallic cylinder, connected to one side of a parallel plate guide by a wire, is analyzed. The axes of the cylinder are collinear and perpendicular to the walls of the guide. The EMP is a transverse electromagnetic (TEM) wave with the electric field intensities of the frequency components being perpendicular to the guide walls. The surface currents and charges induced on the cylinder and wire surfaces are dependent upon the geometry or spatial dimensions of the structure normalized with respect to the width of the guide.
ELECTROMAGNETIC SCATTERING FROM
DIELECTRIC AND COMPOSITE BODIES
by
Dr. William G. Bradley

ABSTRACT

The methods of computing scattered fields from dielectric bodies are reviewed. The procedure that is required to extend some of these methods to include the computation of bistatic cross sections is considered. A literature search showed that little work has been done on scattering from composite bodies. Carbon composites are of particular interest, and experimental and analytic work is proposed. The possibility of controlling the scattering cross sections by the design of special composite materials is considered. Specifically, it may be possible to construct a composite with $\mu_r = \varepsilon_r$. This is relevant to the theory of absorbers in scattering where additional work is proposed.
AN INVESTIGATION OF NONPARAMETRIC MAINTAINABILITY AND
RELIABILITY TEST PROCEDURES

by
Jerome D. Braverman

ABSTRACT

A wide body of nonparametric statistical tests was investigated to
determine which, if any, are applicable, either as described or with modif-
ications, to the maintainability/reliability demonstration problem. The
nonparametric tests having the greatest potential for this application
belong to the category of one-sample tests of location. Of these, the sign
test and the Wilcoxon signed rank test appear to be directly applicable to
the maintainability demonstration problem as alternatives to the currently
used parametric tests, particularly when sample sizes are small and/or
parametric assumptions cannot be validated.

A group of tests called "normal scores tests" also appear to be
applicable to the maintainability demonstration problem while the "expon-
ential scores test" may be applicable to the reliability demonstration
problem. These tests should be the subject of future research effort. It
is also recommended that further research into the general area of order
statistics, a class to which the previous tests belong, be continued.
ENVIRONMENTAL EFFECTS ON AFFECT AND PSYCHOMOTOR PERFORMANCE

by

L. W. Buckalew

ABSTRACT

Scientific and public information sources have suggested or alluded to beneficial effects to humans of exposure to negative air ions. Claims include improved performance, reduced anxiety and depression, increased attention level, and enhanced physiological condition. While some evidence does support some of these claims, the clarity, validity, and reliability of findings are clouded by methodological problems of control and a lack of standardization in treatment and equipment, with particular problems in too narrow a spectrum of response considerations. This study investigated the effects of negative air ions, as produced by commercially available air purification/negative ion generation instrumentation, on a wide range of affective, cognitive, psychomotor, and physiological measures. Dependent variables included anxiety, grip magnitude, digit symbol coding, motor dexterity, reaction time, tracking, pulse, blood pressure, and temperature. Two groups of 12 subjects, similar in age, sex, education, and physical condition, were subjected to either 6 continuous hours of negative ion exposure or 'normal' ion exposure. Repeated measures (0, 3, 6 hours) on each of 10 variables were obtained for each subject. MANOVA comparisons of each group's change scores (0 vs 3, 0 vs 6, 3 vs 6 hour) revealed no significant differences between groups, and consideration of group differences on individual variables for both 0 vs 3 hour and 0 vs 6 hour change reflected no significance for any variable. It was concluded that the air ion condition resulting from treatment with air purifiers/negative ion generators did not produce any generalized effect or alteration of specific affective, performance, or physiological measures.
THERMAL ANALYSIS
OF A
ROCKET ENGINE ALTITUDE TEST FACILITY DIFFUSER

by

Gale H. Buzzard

ABSTRACT

Simulated altitude testing of a rocket engine places a severe thermal load upon whatever device is used to contain the rocket engine exhaust plume and maintain the simulating low pressure. Analysis of the problem is considerably complicated for the complex two phase exhaust flow resulting from the combustion of high energy, metallized solid propellants. Such a propellant exhausts large quantities of very energetic solid particles. The thermal load imposed as these particles impinge upon the containment of the exhaust plume is capable of exceeding that of the convective load from the plume. One means of containing the exhaust plume under these conditions is a water cooled diffuser. Models for the heat loads on such a diffuser are discussed and recommendations are made for implementing a computational capable of predicting the maximum wall and coolant temperatures under test conditions.
REHOSTING THE ADVANCED INSTRUCTIONAL SYSTEM

by

David A. Carlson

ABSTRACT

This report investigates a number of issues involving the rehosting of a computer-based instructional system from its present hardware configuration to a more affordable one. Specifically, four alternative approaches to the rehosting effort are analyzed in terms of their cost-effectiveness, and the problems that will occur in the transformation of the system's database are discussed. The report offers a set of general guidelines to be followed during the rehosting effort along with suggestions of areas where further study is required.
THE BIOLOGICAL DEGRADATION OF SPILLED JET FUELS:
A LITERATURE REVIEW

by

Robert E. Carlson

ABSTRACT

Biodegradation of many of the components of Air Force fuels does occur, although most studies have been done under laboratory conditions, and the extrapolation of the findings to natural rates of biodegradation is premature. Many factors affect biodegradation rates, including the nature and concentration of the specific hydrocarbon compound, the species of bacteria present and their quantity, and environmental factors such as nutrient availability, temperature, and oxygen concentrations. Initial concerns should be first, the determination of the importance of biodegradation relative to other loss factors such as volatilization and sediment sorption, and second, the determination of the ultimate fate of recalcitrant compounds and their metabolites.
ON-AXIS KALMAN TRACKING FILTER FOR H.S. VANDENBERG ARIS SYSTEMS

by

Junho Choi

ABSTRACT

The Metric Accuracy Improvement Program (MAIP) has been rigorously studied during the last couple of decades at the Eastern Test Range, Patrick Air Force Base in Florida for the Advanced Range Instrumentation Ships (ARIS). To improve the accuracy, several approaches have been launched on a modernization program aimed at upgrading various systems such as computer hardware, calibration, timing systems, etc. In this work on-axis tracking algorithm was proposed through several possible extended Kalman filter along with the brief review of the present tracking technique and coordinate algorithm.

Simulation was conducted on two-states Kalman filter and six-states Kalman filter to observe the feasibility of on-axis tracking purpose. Results indicate that the initializations are very important on the basis of the need for updating the measurement statistics of the maneuvering target which can effectively correct the differences between the measurement and filtering estimates.

Several areas for additional and continuing work are suggested to achieve the goals.
ROUGH SURFACE EFFECTS ON
TURBULENT BOUNDARY LAYERS

by

Hugh W. Coleman

ABSTRACT

The prediction of the fluid dynamic and thermal behavior of a turbulent boundary layer on a surface of arbitrary roughness is considered. The equivalent sand-grain roughness concept is examined in some detail, and it is concluded that (1) assumptions inherent in the concept are not supported by recent data, (2) there is currently no acceptable method for determining the equivalent sand-grain roughness for a general rough surface on which no skin friction data are available, and (3) experimental data and physical arguments indicate that heat transfer probably does not scale with equivalent sand-grain roughness. Brief comments on a discrete element approach to the problem are presented, and suggestions for further research are made.
INTERPOLATION AND APPROXIMATION TECHNIQUES
FOR GRIDDED TERRAIN DATA

By

David L. Cozart

ABSTRACT

Various interpolation and approximation techniques which are applicable to terrain data defined on a square grid are described. Most of these techniques have the potential for data compaction, i.e., effectively representing the given data using less computer memory than required by the raw data. The amount of compaction obtained depends upon 1) the technique used, 2) the allowable error in representing the data, 3) the grid spacing, and 4) the raw data values. Some of the methods are two stage processes involving both approximation and interpolation. For each technique, the advantages and disadvantages of the method are discussed. One two stage technique is proposed for further research. A method of comparing the different techniques is also described.
EPITAXIAL LAYER EVALUATION OF III-V SEMICONDUCTOR MATERIALS

by

Robert W. Cunningham

ABSTRACT

Problems associated with the electronic evaluation of epitaxial layers on substrates have been studied. Two models for the measurable resistivity voltage of van der Pauw type specimens have been investigated to determine the importance of both the epi layer and substrate. A simple circuit model indicates the epi layer resistivity may be determined with negligible error under conditions that may be obtained in the laboratory. When the model is applied to the Hall effect an identical result is obtained. A more sophisticated model for the resistivity voltage is suggested but detailed solution has not been completed. Electrical measurements on several specimens are reported and the data is in reasonable agreement with other specimens. Suggestions for continued work are offered.
(A) SPECTROSCOPIC ANALYSIS AND OPTIMIZATION OF THE OXYGEN/IODINE CHEMICAL LASER AND (B) ALUMINUM-27 NMR OF DIALKYLIMIDAZOLIUM CHLOROALUMINATE MOLTEN SALTS

by

Larry R. Dalton

ABSTRACT

The development of a computer correlated electron paramagnetic resonance/optical emission spectrometric/mass spectrometric (EPR/OES/MS) facility was undertaken for the analysis of the gas-phase chemical reactions in the oxygen/iodine chemical laser. The objective was EPR detection of the \( \text{O}_2(3\Sigma), \text{O}_2(1\Delta), \text{I}(2P_{3/2}), \text{I}(2P_{1/2}) \) and \( \text{I}_2(3\Sigma) \) species with simultaneous EPR/OES monitoring of the \( \text{O}_2(\Delta) \) and \( \text{I}(2P_{1/2}) \) species. Failure by Varian Associates to complete upgrading of the EPR facility prevented realization of the original objectives although the feasibility of OES detection within a microwave cavity was demonstrated. Aluminum-27 NMR spin-spin and spin-lattice relaxation measurements were carried out on dialkylimidazolium chloroaluminate molten salts. NMR linewidths measured at ambient temperatures employing a FT-150 spectrometer varied from 60 Hz to 11 Hz in going from \( \text{AlCl}_3 \) concentrations of 0.3 to 0.5N and from 11 Hz to greater than 2000 Hz in going from 0.5N to 0.7N. In the former region linewidths were observed to exhibit a minimum with temperature while in the latter region linewidths were observed to monotonically decrease with increasing temperature. These measurements may permit a fast, non-invasive characterization of molten salt solutions.
SOME ASPECTS OF CARDIAC RISK EVALUATION
AT THE USAF SCHOOL OF AEROSPACE MEDICINE

by

Charles B. Davis

ABSTRACT

Various statistical and biometrical aspects of coronary artery disease screening at the USAF are investigated, including the following: the selection of an appropriate data base from which to estimate risk functions; the missing data inherent in any such data base assembled over years, and procedures for using incomplete records in estimation; a multivariate binary/normal distribution suited for those missing data procedures; and the construction of statistical models incorporating measures of disease severity, including two-stage (latent and acute) models of the disease process. The data base constructed as suggested is described, and specific guidance for fitting the proposed models is offered.
A MOLECULAR ORBITAL STUDY OF NO$_3^-$ · H$_2$O, OH$^-$ · HNO$_3$, AND H$^+$·(H$_2$O)·(CH$_3$CN)$_k$ CLUSTER IONS

by
Carol A. Deakyne

ABSTRACT

The structure and energetics of NO$_3^-$ · H$_2$O, OH$^-$ · HNO$_3$, H$^+$·(CH$_3$CN), H$^+$·(H$_2$O)·(CH$_3$CN), and H$^+$·(CH$_3$CN)$_2$ have been investigated ab initio at the STO-3G and 4-31G basis set levels. Fully optimized geometries have been obtained for the cations and for several conformations of OH$^-$ · HNO$_3$. Partial geometry optimization is shown to be sufficient for H$^+$·(H$_2$O)·(CH$_3$CN). The hydrogen bond in H$^+$·(H$_2$O)·(CH$_3$CN) is asymmetric and much of the positive charge is localized on the proton; the hydrogen bond in H$^+$·(CH$_3$CN)$_2$ is symmetric and the positive charge is more delocalized. The data on H$^+$·(H$_2$O)·(CH$_3$CN)$_2$ are consistent with a hydrogen bond which is stabilized primarily by an electrostatic interaction. The results for H$^+$·(CH$_3$CN)$_2$ are evidence for predominantly covalent binding in the H-bond in that ion. Calculated proton affinities and bond dissociation energies are in reasonable agreement with experiment, particularly when they are calculated via isodesmic reactions. Suggestions are made for follow-on research in these areas.
ANALYSIS OF SEVERAL SOLID PROPELLANT STABILIZERS
BY DC POLAROGRAPHIC TECHNIQUES
by
Donald W. Emerich

ABSTRACT

The polarographic reduction of N-Methyl-p-nitroaniline, 2-Nitrodiphenylamine (2-NDPA), and 4-Nitrodiphenylamine (4-NDPA), resp., was demonstrated using a Princeton Applied Research (PAR) Model 174A Polarographic Analyzer with Drop Timer. The polarographic cell consisted of the PAR two-piece cell body, dropping mercury electrode, platinum counter electrode, and silver-silver chloride in 0.1 formal sodium chloride in methanol as reference electrode. Solutions of the stabilizers were prepared in methanol containing 0.3 formal lithium perchlorate as supporting electrolyte.

Each compound exhibited a single reduction wave (Sampled DC or Pulse modes) or single peak (Differential Pulse mode). Efficient oxygen removal from the solutions is required to secure satisfactory polarograms. Half-wave potentials observed using the Sampled DC mode (versus the above-mentioned reference electrode) were: -0.97 v. for the N-Methyl-p-nitroaniline, -0.80 v. for the s-Nitrodiphenylamine, and -0.86 v. for the 4-Nitrodiphenylamine. The limiting current (Pulse mode) and the peak current (Differential Pulse mode) is directly proportional to concentration, within the limits of precision obtained, for each of the stabilizer solutions, respectively.

An attempt to quantitate the concentration of 4-NDPA in the methanol extract of a solid propellant sample by DC polarography using the Pulse mode and the Differential Pulse mode was not successful due, presumably, to interference by other compounds extracted with the stabilizer that also are reduced at the dropping mercury electrode and at potentials that overlap the wave of the stabilizer. The necessity for separation of the methanol extracted compounds prior to the polarographic quantitation of the stabilizer is evident.
THE IMPACT OF BACKGROUND CHARACTERISTICS
ON OAP TEST SCORES:
DEVELOPING BASELINE INFORMATION
by
Chris W. Eskridge, Ph.D.

ABSTRACT
In an attempt to enhance the validity of the Organizational Assessment Package (OAP) as an organizational assessment instrument, this project sought to determine the nature and extent of the variance in OAP scores that could be explained due to the impact of background characteristic variables, and to develop standardized background test score coefficients to control for the impact of such variables. To achieve this end, the data were subjected to a zero order correlation analysis, an $\eta^2$ analysis, a breakdown analysis of variance, and a multiple classification analysis.

It was found that background characteristic variables accounted for a significant amount of variance in OAP scores. When controlling for the impact of background characteristics, OAP scores tended to decrease slightly in size. It was additionally found that background information variables accounted for a relatively large portion of the variance in period of time change scores. When controlling for such background factors, most OAP scores still increased over time, but at a reduced rate. These findings emphasize the need and usefulness of the standardized background test score coefficients for both consulting and evaluation purposes.
RADIATION SIGNATURES FROM A SPACE POWER SYSTEM

by

GLENN E. FANSLOW

ABSTRACT

Magnetic fields produced by the switching currents in the power conditioning circuitry of a space power system are investigated. A theoretical worst-case condition determines the field produced if all of the power available is used to drive a loop antenna. Experimental measurements show that the actual fields radiated from a power system will be much lower than the worst-case condition. It is concluded that the radiation signatures from a space power system would not be easily detectable on the earth.
ACETYLENE TERMINATED SYSTEMS:
QUINOXALINES AND ISOMERIC SULFONES

by
William A. Feld

ABSTRACT

The use of a 95% m-dibromobenzene: 5% p-dibromobenzene mixture in place of pure m-dibromobenzene in a series of cuprous oxide catalyzed coupling reactions was shown not to affect product distributions. It was also determined that cupric oxide gives identical product distributions to those obtained from cuprous oxide. A new symmetrically substituted quinoxaline, 2,3-bis(4-bromophenoxophenyl)-quinoxaline was synthesized and fully characterized. A one-pot acetylenic coupling reaction involving iodoaromatics and phenyl-acetylene was developed. Recommendations for using the results of these projects are offered.
A SIMULATION FRAMEWORK FOR THE EVALUATION OF TERRAIN FOLLOWING AND
TERRAIN AVOIDANCE TECHNIQUES
by
John A. Fleming

ABSTRACT

The structure of a simulation for the evaluation of automatic terrain following/terrain avoidance/obstacle avoidance flight is specified. Models for the components of a TF/TA/OA system are proposed. A generator for realistic synthetic terrain is developed and a model for the Digital Land Mass Simulation (DLMS) data base is given and implemented. Finally, a description of the path generation problem is given and research remaining to be done in this area is outlined.
VOLTAMMETRIC STUDIES OF THE LITHIUM/VANADIUM OXIDE ELECTROCHEMICAL CELL
by
Dennis R. Flentge

ABSTRACT

The cell composed of a lithium metal anode and a vanadium oxide, V$_{6}O_{13}$, cathode has been examined using cyclic voltammetry. The cell was found to discharge in several distinct steps and showed reasonable rechargeability. The cell capacity was found to be 80 Ah/kg V$_{6}O_{13}$. 
by:
Dr. Harold Fox

Abstract

"Project IMP: Institutionalization Methods and Policies at the Business Research Management Center" discusses opportunities for translating future research results into action. This report lays out options only. It does not offer recommendations. The principal findings from interviews and secondary sources are:

1. A focus on institutionalization would alter drastically BRMC's methods and procedures. An illustrative set of new procedures appears in the report.

2. Two major premises of such new management methods are: (a) Institutionalization becomes an integral part of every phase of a project, and (b) User involvement in all phases is imperative.

3. BRMC is at a crossroads, and a new articulation of its mission may be in order. Viewed broadly, the articulation includes a decision on the levels of organizational and financial support. The report discusses many possibilities and their ramifications with respect to BRMC's mission, management process, and organization and staffing.

4. Decision makers can select a combination of policies and methods that melds into a cohesive strategy for institutionalization. In the words of two experts on this subject, referenced in the report, "It would be reckless to suggest that there exists a technique or research style which could force or guarantee implementation success."
SOME PROBLEMS OF LASER VELOCIMETRY AND UNSTEADY AERODYNAMICS OF CURRENT INTEREST TO THE F.J. SEILER RESEARCH LABORATORY

by

Peter Freymuth

ABSTRACT

The following problems of current interest have been addressed:

a. The velocity range of the dual beam TSI anemometer has been considered.

b. The error in velocity measurement due to noise has been considered for the dual beam TSI anemometer as well as for its proposed three-velocity five beam system.

c. The possible retrieval of a Doppler burst from noise by means of a digital frequency analyzer has been considered.

d. The use of plexiglass for optical windows of the laser beam system has been explored for practical purposes.

e. Toward an investigation of the vortical development for a uniformly accelerated airfoil.
EFFECTS OF CLOTH SUBSTRATE AND FINISH ON THE NITROGEN CURE OF ACETYLENE TERMINATED SULFONE (ATS) BY TORSION IMPREGNATED CLOTH ANALYSIS (TICA)

by

Joel R. Fried

ABSTRACT

Temperature scans (0-350°C) of acetylene terminated sulfone (ATS) in nitrogen were obtained by torsion impregnated cloth analysis (TICA) using a variety of standard finished and unfinished cloths including quartz, glass, and graphite fabrics. Comparison of results with those obtained by ATS/unfinished glass TICA indicate that the appearance of the highest temperature peak in the loss curve of the unfinished glass sample is not a result of an anomalous curing process but arises from degradation of a cloth impurity, probably an organic binder used in the weaving process. The degradation products are believed to act as a temporary plasticizer for the curing resin. Thermogravimetric analysis and cloth heat treatment experiments support this conclusion. Unfinished quartz has been found to be a superior substrate for TICA applications both for ATS cure studies and as a TICA matrix to study the sub-$T_g$ and $T_{lg}$ transitions of four high temperature engineering thermoplastics.
APPLICATION OF CONJOINT MEASUREMENT THEORY

TO THE QUANTIFICATION OF SUBJECTIVE RATINGS

by

David E. Greene

ABSTRACT

Conjoint measurement theory, as applied to the quantification of subjective ratings, is introduced and evaluated through a prototype example in which measures of aircraft quality are used to compare a new fighter aircraft with other classes of fighter aircraft. An ordinal scale of aircraft quality is determined through pilot rank orderings of cells in a two factor rating matrix. Conjoint measurement theory is used to convert this ordinal scale to one with interval properties. The relationship of additive conjoint measurement with the analysis of variance is noted. Two conjoint measurement methods are considered: monotone analysis of variance MONANOVA and delta-scaling. Additive conjoint measurement in this application has two primary problems. First, unless there are many levels in each factor, slight changes in the rank orderings produce major changes in the measurement scale. Second, it is difficult to determine whether the measurement scale is a true improvement over the ordinal scale. Conjoint measurement theory appears to be especially useful in scaling the factors and in modeling the factor relationships.
SENSOR NOISE AND KALMAN FILTER FOR AIDED INERTIAL NAVIGATION SYSTEM

by

Gurmohan S. Grewal

ABSTRACT

Inertial Navigation System, barometric altimeter, TACAN, and ILS are used to achieve a synergistic combination of the outputs of individual subsystems. Kalman filter is used to provide an ideal method for data processing in this multisensor navigation system. The filter design begins with the development of mathematical and statistical error models to describe the truth system. The truth model is simplified and reduced, in steps, to lower the computation burden on the on-board computer. The covariance analysis and the Monte Carlo method of testing the performance of the Kalman filters based on reduced and simplified system models are discussed. Suggestions for further research in the area of fault detection and isolation are offered.
CALIBRATION OF WIDEBAND OPTICAL SIGNAL PROCESSOR (WOSP)

by

Paul B. Griesacker

ABSTRACT

The physical principles of the operation of an electro-optical signal processor using the Coherent Light Valve to modulate the optical wave and a high resolution vidicon TV camera as the output transducer are discussed. System characteristics are presented. System start up and shut down procedures are suggested and system diagnostics are explained. The results of initial calibration and resolution measurements are presented and an exhaustive list of recommendations relative to future development of the WOSP system are listed.

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CORROSION STUDIES OF CALCIUM-THIONYL CHLORIDE ELECTROLYTE SYSTEMS

by

Vijay K. Gupta

ABSTRACT

The Calcium-thionyl chloride battery system is very attractive from the point of view of combining high energy density with a high degree of system safety. The most pressing problem in this system is the high self discharge rate of Calcium (corrosion). In order to understand the problem of calcium corrosion, the corrosion studies of calcium in thionyl chloride and different electrolytes have been carried out as function of time and temperature. The present study has indicated that calcium metal surface can be effectively cleaned and polished and the metal is highly sensitive to air and moisture. High purity of solvent and electrolytes and the moisture content of chemicals are very significant as far as the corrosion of calcium metal is concerned. Pure thionyl chloride causes less corrosion as compared to lithium or calcium electrolytes. The amount of corrosion increases with the passage of time and the rate of corrosion is significantly affected by the increase in temperature. Further studies incorporating different additives to the electrolyte have been suggested for further work. The use of calcium alloys rather than pure calcium has also been suggested as a possible direction of further research to achieve high energy density and safe battery systems.
AN INVESTIGATION INTO STATE ESTIMATION FOR AIR-TO-AIR MISSILES

by

Kenneth R. Hall

ABSTRACT

The use of modern control theory in the development of the guidance algorithms for homing missiles requires full knowledge of the state vector for producing the optimal control law. In the majority of situations encountered, this state information is not available directly from the measurements but must be deduced from the actual measurements. The process of obtaining the desired state information from the measurements is known as state estimation and is the subject of this study. The estimation procedure requires that a model of the state vector propagation be created, and the output of the model is used to construct estimates of the measurements. As the measurements are made, the discrepancy between the actual measurements and the estimated measurements is used to adjust the state estimates of the model. This study will address the creation of an estimation algorithm (the extended Kalman filter), the application of the theory to the missile control problem, and then discuss the use of the available information in allowing the filter algorithm to adapt to the noise characteristics of the problem. Numerical results are obtained and compared to information from other sources. Suggestions for further research are offered.
OPTIMAL RECOVERY FROM CRATERING ATTACKS
ON AIRBASE PREPARED SURFACES

by
R. Michael Harnett

ABSTRACT

The problem of locating minimum-repair areas on airbase prepared surfaces which meet operational requirements is addressed. Both runways and taxiways are considered. An algorithm is described which achieves exact optimal solutions for the runway problem recognizing variation in crater repair difficulty. The algorithm is shown through computational experiments to feature increased computational efficiency compared to existing solution methods. An algorithm is described which achieves exact optimal solutions for the taxiway problem recognizing variation in crater repair difficulty. Computer codes for the algorithms are provided. Suggestions for further research in this area are offered.
INFRARED CLUTTER: EFFECTS OF AIR MOTION PRODUCED BY AURORAL ZONE JOULE HEATING

by

Ronney D. Harris

ABSTRACT

Irregularities, or clutter, in the earth's infrared profile may cause problems in Air Force infrared surveillance systems. One such irregularity may be produced by particle precipitation and Joule heating in the auroral zone. Vertical air motion induced by this heating can carry infrared active molecules above the dissociation level resulting in patches of enhanced infrared radiation scattering. A two-dimensional self-consistent model of the neutral gas motion has been developed. The problems associated with a general numerical solution of the Navier-Stokes equations for compressible gases have been discussed, and a specific scheme to solve these equations for our model are outlined.
CATABOLISM OF TOLUENE IN THE BLUEGILL SUNFISH

by

Franklin D. Hill

ABSTRACT

The catabolism of toluene by bluegill sunfish exposed to a high, non-lethal, aqueous concentration of the non-labelled hydrocarbon is investigated. No catabolic product of toluene could be identified in fish bile following hydrocarbon exposure. The inability to identify certain expected catabolic products is discussed. Suggestions for further research in this area are offered.
STUDIES OF THE ENGINEERING DESIGN PROCESS:

DESIGN OF EXPLOSIVELY DRIVEN GENERATORS: HUMAN FACTORS IN HAZARDOUS ACTIVITIES

by

Francis J. Jankowski

ABSTRACT

This study looks at two design problem areas for insights into developing better engineering design methods. An examination of current practice in explosively driven magnetic compression generators shows a need for emphasizing the systems approach, with attention to efficiency, safety factors and constraints, and evaluating alternative approaches. Conservative and "forgiving" design approaches are proposed for initial engineering designs.

The application of human factors to improving safety in hazardous activities is examined. A study of accident statistics suggests that other countries, particularly Japan, may have a better safety record than the U.S.A. Japanese business and management practices are reviewed; these may have application to safety. Several stress and stress-related factors are examined. Reducing high stress will improve safety. A systems approach to the application of human factors to the improvement of safety appears essential.

Suggestions for the execution of engineering design and for further research are offered.
IMPACT OF CYLINDRICAL RODS ON RIGID BOUNDARIES

by

Stanley E. Jones

ABSTRACT

A new formulation of the normal rod impact problem is given. The rod is divided into two regions: that which is undergoing plastic deformation and that which is not. The material formulation in the plastic zone is discussed in detail, along with an application to the rigid/perfectly plastic rod. Conclusions and recommendations are given in the last section of the report.
An Information-Theoretic Approach To Target Estimation of a Conical Scan Controlled Laser Radar Tracking System

by:

Dr. Paul Kalata

ABSTRACT

High energy laser systems with highly accurate measurements as target tracking sensors use a conical scan process to obtain a target capture and tracking within the narrow beamwidth. This searching process and the target tracking algorithm are major factors in the performance of the laser radar/target tracking system. The summer research results presented in this paper use information-theoretic concepts in establishing laser radar/target tracking performance bound independent of the filtering algorithm. A computer program was developed to calculate the lower bound of the estimation error variation due to a dithered signal, non-linear guassian glint measurement process.
ELECTRICAL CHARACTERIZATION
OF ION IMPLANTATION IN GaAs

by

Richard Kwor

ABSTRACT

Two separate projects are reported. The first is the study of the effect of two-stage annealing of sulfur-implanted GaAs. Electrical activations for samples annealed at 900 °C for 15 min. are compared with samples annealed at 700 °C for 15 min. and then 900 °C for 15 min. The results show a slight improvement of mobility and activation for two-stage annealed samples. Further research in this area is suggested. The second part is the fabrication and testing of Se-ion implanted MESFETs made from GaAs substrates obtained from various suppliers. The FET performances are used in a study of the correlation between device characteristics and substrate properties.
A REVIEW OF CURRENT DATA BASE SYSTEMS FOR FLEXIBLE MANUFACTURING

by

Dr. Richard Liu

ABSTRACT

Three different data base models; namely, hierarchical, relational and network, are reviewed. Related data base schema designs are discussed.
HOMOGENEOUS COMPRESSION OF RAPIDLY SOLIDIFIED ALUMINUM POWDER ALLOY BILLETS

by

William S. McCain

ABSTRACT

A program to collect data required for developing constitutive equations for compressible solids was initiated. Billets of partially dense, rapidly solidified aluminum alloy CT-91(x7091) were warm and hot compressed under homogeneous strain conditions to develop flow curves and strain rate sensitivity data. These data are to form the basis for further work in materials behavior modeling, process modeling and process model validation.
IMAGING RADAR AUTOFOCUS UPDATE OF AN INERTIAL NAVIGATION SYSTEM BY MEANS OF A KALMAN FILTER

by

William S. McCormick

ABSTRACT

The value of an Autofocus update of an INS is investigated. Three cases are considered: (1) centripedal acceleration only; (2) centripedal and line-of-sight acceleration; and (3) centripedal and line-of-sight acceleration as well as attitude error effects. The extended Kalman filter configuration was employed using the versatile SOFE Monte Carlo simulation program. Measurement matrices were defined for each of the three cases. Simulation results indicated an observability problem for Case (1). Suggestion for further work was included.
THE UTILITY OF THE ANIMAL MODEL CONCEPT

BY

DONALD F. MCCOY

ABSTRACT

The evaluation of aircrew performance can be accomplished in two separate but related ways. First, one can explore and describe the performance capabilities of the human operator under various simulated environments. Second, a researcher can use the behavior of an animal (preferably a primate) as a performance model for that of the human operator. Perhaps this simpler approach will lead to the discovery of fundamental behavioral mechanisms which support aircrew performance. Additionally, the animal preparation enables the use of various invasive procedures through which physiological substrates of performance can be elucidated. The viability of the animal model concept was delineated in two general ways during the reporting period. First, the utility of the animal preparation was described in a series of weekly seminars dealing with the logic, methods and application of animal learning concepts. Second, two animal behavior studies were initiated during the 10 week report period. These studies are currently in progress. It is believed that the results of these studies will demonstrate the viability of the animal model concept. Suggestions for future research along these lines are offered.
ABSTRACT

VIBRATION-ROTATION RELAXATION IN THE HF LASER

by

Dr. Henry McGee

The literature on rotational and vibration relaxation in HF has been reviewed. The rates of these processes are critical to the design of large devices such as ALPHA, and yet our understanding is meager. The areas of minimum understanding are identified and the recommendations are made for further work.
APPROPRIATE FAR-FIELD BOUNDARY CONDITIONS FOR THE NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS

by

Patrick J. McKenna

ABSTRACT

The problem of prescribing fictitious far-field boundary conditions at an artificial boundary is discussed. Several boundary conditions which have been used in the literature are compared with two newly proposed sets. The proposed boundary conditions are shown to be non-reflecting and superior in both accuracy and time to convergence. Graphs showing the numerical results for the different types of boundary conditions are displayed and the wave motion is demonstrated. In particular, reflecting boundary conditions are shown give rise to fictitious variations of a periodic wavelike nature.
CONSTITUENT MONITORING OF EVAPORATION SOURCE PLUMES

by

Dr. J. R. McNeil

ABSTRACT

Thin film physical characteristics depend to a great extent upon the techniques used for deposition. In particular, films of ThF₄ have been deposited from different sources (boats, e-beam, etc.) and have displayed different absorption characteristics. A system of monitoring plume constituents has been implemented that employs mass spectroscopy. Drawbacks to this approach include low sensitivity for detecting plume constituents. Plans have been made to modify the deposition system in order to improve the sensitivity. Optical absorption and emission spectroscopy have been evaluated, but these techniques also appear to have low sensitivity to species in the plume, particularly molecular and impurity constituents.
DEVELOPMENT OF A COMPUTER ASSISTED
AIRCRAFT LOAD PLANNING MODEL

by

Louis A. Martin-Vega

ABSTRACT

The main objective of this applied research effort was to assist the Logistics Planning Office at Gunter AFS in their attempts to describe, model and develop computer assisted approaches to the aircraft load planning problem. Part of the research effort involved visits to locations where actual deployments were carried as well as meetings with experienced load planners throughout the course of the study. Information gathered from these visits and meetings was analyzed and documentation concerning the way the aircraft loading problem is approached by load planners was developed. A test data base was also developed and used to compare loading plans generated by manual load planners with existing computer assisted approaches. These comparisons resulted in a consensus that existing computer assisted approaches are still of limited practical value. Based on the insight obtained from the analysis, documentation and testing, a general methodology was developed which could serve as a foundation for the future development of computer assisted approaches. The feasibility of using microcomputer technology to assist in aircraft load planning was also explored yielding what appears to be a very promising area for future applied research in this area. Suggestions for basic research into the mathematical structure of the aircraft loading problem are also included.
A MODEL FOR CATH DATA AND SOME RESULTS ON THE
ARBITRARY RIGHT CENSORED DATA

by

Kishan G. Mehrotra

ABSTRACT

Two problems of interest in bio-statistics are considered
in this paper. In the first part we discuss a model which can
be used to predict the amount of blockage in arteries, given
some important factors such as age, cholesterol and blood
pressure. How well this model explains the data, collected at
the School of Aerospace Medicine, Brooks AFB, Texas, is currently
under investigation.

The problem of comparing two populations when the data is
collected with arbitrary right censoring is also investigated.
In past ten years several tests have been proposed to compare
two populations under arbitrary right censoring schemes. First
we prove that several, seemingly different, two sample tests are
the same. Next, we perform a small sample study to compare the
power and asymptotic level of significance of these tests.
A DIRECT STATE SPACE APPROACH TO

THE CONTROL OF SAMPLED-DATA SYSTEMS

by

David F. Miller

ABSTRACT

Simple and direct algorithms for the control of multivariable sampled-data systems are presented. Both the digital redesign and the direct digital design problems are considered. A "period optimal" digital control problem is formulated, and a general solution methodology is discussed. Emphasis is placed upon developing adaptive control design methods which are uncomplicated, responsive, and which avoid the computational complexities of many conventional state space techniques. Complete algorithmic solutions of the output matching and signal tracking problems for linear systems are given. In both cases, the solutions reduce to solving systems of linear equations. A unique feature of this work is the effective incorporation of conventional data holds into the digital controller for the purposes of smoothing and predicting sampled signals. A simple numerical example illustrates the effectiveness of the output matching algorithm.
TRANSIENT ANALYSIS OF STRUCTURES
WITH DISTINCT NONLINEARITIES

By
Levon Minnetyan

ABSTRACT

A new hybrid method is formulated for the transient response analysis of certain structural systems with isolated nonlinear components. The method is aimed to achieve an optimal solution path that will reliably predict the dynamic response of all structural components. Options on substructuring and requirements for orthogonality of rigid body and flexible modes are stated. The solution procedure incorporates a time-history analysis of the nonlinear response with a frequency domain analysis of the linear modes. The linear modes that affect the response of nonlinear structural components are also included in the time-history analysis. The resulting nonlinear response time-histories are used as external inputs for the analyses of linear substructures. The response of linear structural components is determined through the frequency domain. The frequency domain analysis uses a larger number of modal coordinates to realistically simulate the details of substructural response. The application of the method to the modeling of taxiing aircraft is studied.
PLASMID FINGERPRINTS OF STAPHYLOCOCCUS AUREUS STRAINS
ISOLATED FROM A TOXIC SHOCK SYNDROME FEMALE PATIENT

by
Rex C. Moyer

ABSTRACT

The objective was to use plasmid fingerprinting as a means of identifying various strains of a bacterial pathogen isolated during disease outbreaks among Air Force personnel and to determine if it would help track nosocomial infections.

Four isolates of Staphylococcus aureus from the urine, cervix, and throat from a female patient with toxic shock syndrome which could not be differentiated by conventional techniques were used as models. Escherichia coli V517 and other strains with plasmids of known molecular weight were used as reference DNA. Plasmid DNAs were purified by several techniques (and modifications thereof). DNAs were electrophoresed on 0.8% agarose vertical slab gels. The electropherograms were stained with ethidium bromide and photographed with long wave UV light. Molecular weights of plasmid DNAs were estimated by comparison of their migration with plasmids of known molecular weight. The plasmid fingerprints of S. aureus isolates from the 3 different body sites were all unique but plasmid fingerprints from the two isolates from urine were identical. Different
DNA isolation techniques yielded different plasmid fingerprints, therefore, precise numbers of plasmids and their molecular weights were not obtained.

I conclude that plasmid fingerprinting can differentiate various *S. aureus* strains and probably will be useful for tracking nosocomial infections.
AN INVESTIGATION INTO THE NATURE OF THE MELTING LAYER
IN STRATIFORM CLOUDS

by
Dr. Steven B. Newman

ABSTRACT

Research into the nature of the melting layer in mixed stratiform clouds has been conducted in the Cloud Physics Branch of the Air Force Geophysics Lab (AFGL). An extensive reference list has been compiled, covering some 35 years of published work concerning the melting layer and the radar bright band.

In addition, the problem of defining the boundaries of the melting layer have been examined. It is postulated that the 0°C dry bulb isotherm may not always be the best threshold level for the top of the melting layer. Instead, the 0°C wet bulb level is examined, and a relationship between airmass stability and the height difference between these two levels is developed. The lower boundary of the melting layer remains undefined, primarily due to lack of a concrete definition of the "end" of melting.

A simple model of snowflake aggregation and breakup has been developed. It is shown that at reasonable cloud ice contents, the aggregation and breakup of snowflakes just above the melting layer results in considerable ice multiplication, as well as growth. The increase in both size and number concentration of snowflakes entering the melting layer may play a considerable role in enhancing the radar echo intensity in the melting layer resulting in the radar bright band.
JET SIMULATION PARAMETERS FOR WIND TUNNEL MODEL

THRUST REVERSER TESTING

by

Eugene E. Niemi, Jr.

ABSTRACT

An investigation is made of the simulation requirements necessary for wind tunnel tests of aircraft models using thrust reversers. Dimensional analyses are reviewed to determine the kinds of parameters that theoretically must be scaled to accurately represent a thrust reverser test. Previous test results are examined as a guide in deciding which of these parameters are most important in simulation.

It is found that the following parameters should be simulated to get reliable wind tunnel test data from thrust reversers: ratio of jet exit static pressure to free stream static pressure, $p_e/p_\infty$; jet exit Mach number, $M_e$; jet exit specific heat ratio, $\gamma_e$; and product of gas constant and temperature of exiting jet, $(RT)_e$. Various gases are suggested for use in wind tunnel tests, based on these results.

The hysteresis effect in thrust reverser flow attachment to an aircraft fuselage is examined. Suggestions for future research in this area are made.

Recommendations for future wind tunnel tests to study thrust reverser behavior are made. Several types of tests are recommended.
ANALYSIS OF THE 60 KVA PERMANENT MAGNET
ALTERNATOR AND A NEW ROTOR CONCEPT
FOR THESE TYPE MACHINES

by

Samuel Noodleman

ABSTRACT

The design of the 60 KVA alternator as used in the VSCF Power Generating System was reviewed and calculations made of the flux distribution in the machine.

The study concentrated on the permanent magnet rotor design. An analysis of the flux produced by the magnets in the rotor with the present tangential configuration shows that much of the flux is lost in leakage. Only about 50 percent of the magnetic field as generated in the permanent magnets reaches the stator windings and generates useful electrical energy.

A rotor design using the permanent magnets in a radial orientation is proposed. This concept requires less permanent magnet material and will provide more electrical output for the same size and weight. Because the fields generated by the currents in the stator windings do not link as much iron in the proposed rotor, the stator winding inductances are reduced and the inherent voltage regulation of the alternator is improved.

An analysis is also made of the new rotor concept with higher energy rare earth-cobalt magnet materials and some of the design changes required to better utilize this type permanent magnet material.
THE EFFECTS OF JP-4 AVIATION FUEL ON SPECIFIC INTERNAL ORGANS

OF THE FAT-HEAD MINNOW, PIMEPHALE PROMELUS

by

William N. Norton

ABSTRACT

Water-soluble fractions of petroleum-derived JP-4 fuel induce ultrastructural alterations of the kidney, gill, pseudo-branch and nasal epithelium of the fat-head minnow, Pimephale promelus. There appears to be no common ultrastructural effect among the organs studied in regard to the degradation of a specific cellular organelle. The sole tissue which exhibits extensive cellular degradation is the nasal epithelium. The lesions are manifested in the form of myeloid bodies and electron-dense figures. A proliferation of vacuoles and a disruption of mitochondria-tubule complexes is evident in the pseudo-branch of experimental fish. Cellular membranes associated with the surface of gill filaments and secondary lamellae maintain their integrity throughout the investigation, however, focal sites of pillar cell degradation are evident. Within the kidney endothelial cells associated with convoluted tubules undergo degradation as characterized by the fragmentation of plasma membranes.

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OBSERVATIONS OF SUNSPOT DYNAMICS AND
THEORETICAL EFFECTS OF INHOMOGENEITIES
IN THE SOLAR CONVECTION ZONE

By

Alan H. Nye

ABSTRACT

Observations giving high resolution in wavelength, time, and horizontal space were taken of sunspots to determine the characteristics of oscillations at different heights. There was a high correlation between velocity and magnetic field fluctuations in the umbral photosphere. These oscillations excite waves which move the penumbra vertically in phase. There was no correlation between velocities observed at chromospheric and photospheric levels. This implies that wave mode eigenfunctions are sharply peaked in height, which imposes useful constraints on any theoretical sunspot model.

Observations of the surface of the solar convection zone show the presence of trapped nonradial acoustic waves whose frequencies shift with time. A theoretical analysis of a simple model shows that inhomogeneities in the sound speed will lead to shifts in the eigenfrequencies of the trapped modes. An arbitrary two dimensional perturbation on a uniform sound speed is decomposed into its Fourier components, each of which causes a shift of a single eigenfrequency. The eigenfunctions are all perturbed which leads to a spreading of the ridges in the \((A, \phi)\) plane similar to those observed.
DEVELOPMENT OF A MANUAL OF USE FOR
CONJOINT SCALING TECHNIQUES

by

Thomas E. Nygren

ABSTRACT

Conjoint measurement methodology offers a new and potentially useful approach for obtaining psychological scale values for components of multidimensional attributes. An investigation of this methodology and its mathematical foundations was conducted. Six computer based algorithms that can be used to perform specific kinds of conjoint analyses were generalized and documented for wider application as subjective assessment techniques. Following a discussion of the mathematical foundations, the six programs (CONJOINT, PCJM2, NONMETRIG, MONANOVA, DISTRIB, and DUALDIST) are each summarized with respect to their function as conjoint analysis techniques. Shortcomings of the current state of lack of systematic research efforts dealing with methodological and statistical issues in conjoint analysis are discussed. Suggestions for further research are then presented.
EVALUATION OF NASTRAN TO PREDICT THE DYNAMIC RESPONSE OF REINFORCED CONCRETE

By

William W. Payne, Jr.

ABSTRACT

This report evaluates the ability of the finite element program NASTRAN to analyze reinforced concrete structures under dynamic loads. Experimental data from a quarter scale model test of an underground shelter was used to validate the computer projections.

NASTRAN is a general purpose structural analysis program containing several types of finite elements and several displacement analysis approaches. For this study five different computer models of reinforced concrete were used. The models were composed of the following elements:

1. Plate membrane elements.
2. Plate membrane and rod elements.
3. Plate bending elements.
4. Plate bending-membrane elements.
5. Plate bending-membrane and beam elements.

Static Analysis and Transient Analysis Approaches were used to evaluate the computer model.

Favorable results were obtained for the plate membrane and rod element model using the Transient Analysis Approach. Strain in the reinforcing rods, time to maximum strain, and time to return to zero strain were used to compare the experimental data to the computer predictions.
AN ANALYSIS OF THE AVAILABILITY, ACCESSIBILITY
AND TIMELINESS OF COST DATA ASSOCIATED WITH
THE AFLC AIRCRAFT MODIFICATION SYSTEM WITH
EMPHASIS ON CLASS IV MODIFICATIONS

by

John E. Powell

ABSTRACT

Modification of existing Air Force systems is receiving increased emphasis when faced with escalating costs of labor and materials associated with obtaining replacement systems. Approximately ninety percent of all modifications are designated Class IV and are concerned with safety of flight, mission essential and logistics as contrasted with Class V modifications which are designed to provide a new or improved capability. Approximately 80% of the Class IV modifications are IV-B, mission essential. It is not possible to budget all Class IV modifications required to maintain and update USAF aircraft. This research project looks at currently used allocation methods and observes several possible shortcomings. Suggestions are made for further research associated with the costing and prioritizing algorithms.
THE AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
RESEARCH AND DEVELOPMENT PLANNING PROCESS
by
Robert H. Puckett

ABSTRACT

The AFWAL research and development planning process is investigated from the viewpoint of political science. Suggestions are offered concerning how AFWAL could interface more effectively with the external environment. The results of interviews with Air Force and Department of Defense officials in Washington, D.C., are presented. The contention is made that Air Force research and development planning must be integrated with (a) international political forecasts and (b) international context analysis. Suggestions for further research in this area are offered.
COUPLING REACTIONS AND REARRANGEMENTS OF 1,3,5-TRIAZINES

by

G. Fredric Reynolds

ABSTRACT

Some unique chemistry of 5-triazines is described involving the coupling of organic substrates containing acidic protons to the halogen sites on the triazine ring. In this manner, chains and rings of 5-triazines can be formed. Rearrangements of oxygen-substituted 5-triazine esters to nitrogen-substituted 5-triazine esters are described, and a mechanism for the catalyzed rearrangement is proposed that is consistent with the kinetic data obtained.
The adsorption of trichloroethylene (TCE) onto inorganic soil fractions was studied to determine whether these materials might be significant sinks for chlorinated hydrocarbons. Results indicate that inorganic soils adsorbed TCE in the following order of capacity: goethite, kaolinite, amorphous manganese oxyhydroxide, montmorillonite. Organic peat and a soil from a TCE-contaminated aquifer were also used as adsorbents. As expected due to its organic carbon concentration, the peat had a greater capacity to remove TCE from solution. The aquifer soil had a capacity between that of kaolinite and manganese oxide. Freundlich adsorption isotherms were developed for the soils and K and 1/n values were determined.

Calculations using the isotherm equations for the inorganic soils and the octanol/water partitioning adsorption equation of Karickhoff indicate that when the amount of organic carbon in a composite soil is small compared to the clay content (less than 1 to 5), it is possible for the inorganic fraction to control the adsorption of TCE.

Further adsorption studies, both batch and column should be conducted to learn the behavior of halogenated hydrocarbons, such as TCE, in groundwater aquifers. The role of the inorganic soil fraction in the adsorption process should not be underestimated.
THE EFFECTS OF 2,3,7,8- TETRACHLORODIBENZO-p-DIOXIN (TCDD) ON TRIIODOTHYRONINE (T₃) BINDING TO RAT ISOLATED HEPATIC NUCLEI

by

JOHN J. RIGGS

ABSTRACT

The toxic effects caused by 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) are remarkably similar to those caused by certain long-chain perfluorinated fatty acids. The Air Force is interested in these chemicals because TCDD was a contaminant of herbicide formulations used in Vietnam and derivatives of the perfluorinated fatty acids are used today as surfactants in fire fighting foams. Their mechanisms of toxicity, in particular TCDD, remain unknown. Because of the structural similarity between TCDD and triiodothyronine (T₃), it was of interest to determine if TCDD antagonized the binding of T₃ to its nuclear receptor sites. Animals were treated with a single dose of TCDD (50 µg/kg IP) and sacrificed 7, 9, 14, and 21 days after treatment. The livers were removed, nuclei were isolated, incubated with 0.5 pM of radioactive T₃ solution alone or with increasing amounts of non-radioactive T₃ (1.0 to 1000 pM). In the control animal (acetone/corn oil) 6% of incubated T₃ was specifically bound to the Triton X-100 washed nuclei. Treated animals sacrificed at 7, 9, 14, and 21 days showed a decrease in specific T₃ binding of 65%, 80%, 98% and 98%, respectively. The data clearly showed a decrease in T₃ binding capacity in TCDD treated animals. A Scatchard plot showed a single class of T₃ binding sites, with an apparent association constant of 7.8 x 10⁸ M⁻¹, and a binding capacity of 1.36 picomoles T₃ for nuclei obtained from 0.25 g of liver.
Visual cues used by pilots to maintain altitude in low level flight simulation were examined. In particular, terrain texture in the form of black vs. white topped inverted cones, the presence or absence of vertical development, and the effects of rate of motion on terrain features were investigated using pilots who varied in flying experience. Less experienced pilots demonstrated increases in their mean altitude and RMS deviation with an increase in airspeed or with an increase in airspeed combined with a lack of vertical development in terrain features. Experienced pilots on the other hand, only showed increases in mean altitude and RMS deviation with an increase in airspeed. No differences were found between all black and white topped cones. Suggestions are made for application of research findings to CIG development and pilot training.
A METALLURGICAL INVESTIGATION OF THE INTERNAL BRONZE MANUFACTURING PROCESS OF Nb₃Sn SUPERCONDUCTING WIRE

by

DR. JOHN MELVILLE ROBERTS

ABSTRACT

An introductory basic type of metallurgical investigation has been carried out on nominally 13 wt.% Sn bronze rods and Nb/bronze multifilamentary composite wires. These studies have included optical metallographic, scanning electron microscopy and x-ray microprobe techniques. Preliminary ageing studies of the quenched in metastable α phase in 13 wt.% Sn bronze have been made up to 220°C. This program of study was carried-out in an attempt to learn more about unwanted and often premature failures occurring in these Nb/bronze multifilamentary wires during manufacture. Defects such as voids, chemical inhomogeneities, tin rich phases and abnormally large and possibly discontinuous Nb filaments in these wires have been observed. The consequences of these defects upon the success of manufacturing high quality Nb₃Sn superconducting wire are briefly discussed. The concept of the "limiting bronze grain size" and possibly the "limiting sub-grain structure size" imposed upon the bronze matrix by the Nb filaments has been discussed and preliminary observations of these effects are presented. Numerous suggestions for further research in this area are offered. The concept of a new matrix alloy for the internal bronze process is suggested and it is pointed out higher temperature superconductors, i.e. better than Nb₃Sn, should be investigated.
INVESTIGATION OF THE MECHANICAL PROPERTIES
OF LESS THAN 100% DENSE TITANIUM POWDER
METALLURGY COMPACTS

by

Thomas A. Roth

ABSTRACT

A possible method to improve the mechanical properties of porous powder compacts by altering the surface condition of the compacts through the use of shot-peening to reduce surface porosity is used to study the tensile properties of elemental blend Ti-6Al-4V. The effects of a stress-relief treatment of the shot-peened material are considered. Tensile test data, along with studies of the porosity and microstructure, suggest improvement is to be found in the fatigue behavior of the material rather than in the tensile properties. Suggestions for further research examining the effect of shot-peening on the fatigue behavior of the less than 100% dense material are offered.
Application of Task Analytic Techniques to the Design of A Flight Simulator Instructor/Operator Console

by

Charles D. Sanders

ABSTRACT

Instructional Systems Development (ISD) has contributed to the efficiency and low cost of air flight training through the medium of the simulator. Task analysis is a component of ISD, and its application to the improvement of devices such as simulator instructor/operator consoles will continue to enhance the quality of flight training. Task analytic techniques are inextricably interwoven into the design of an instructor/operator console. The application involves the process, persons, and a machine within the context of a flight simulator. The tasks of the instructor and student are primary in the design process. The efficiency and economy of the task analytic process has implications for its use in the future developments of automated flight training.
STUDY OF DYNAMIC BEHAVIOR OF A BLUFF-BODY DIFFUSION FLAME IN THE APL COMBUSTION TUNNEL FACILITY

by

Sarwan S. Sandhu

ABSTRACT

An experimental study to gain insight into the dynamic behavior of the combustion process in the APL combustion tunnel facility has been initiated with the intent of utilization of information attained from such a study to develop a mathematical model for the prediction of combustion process in a combustor of the APL combustor type. From the preliminary data acquired dependence of fireball frequency and velocity on air/fuel flow rates, effect of axial location on the frequency, and, fireball and nonemitting region number distribution versus time length are presented. A qualitative global mechanism for relative increase or decrease in fireball frequency is proposed.
SHEAR-WAVE VELOCITY STRUCTURE DETERMINED
FROM ANALYSIS RAYLEIGH-WAVE GROUP-VELOCITY DISPERSION
by
Gerald W. Simila

ABSTRACT

The moving window technique has been utilized successfully to extract group-velocity dispersion data from high-explosive ground motion records. Fundamental Rayleigh-wave group-velocities (225-264 m/sec) have been determined for period range 50-164 msec. The Haskell method has been used to model the dispersion data. The resulting shear-wave velocity distribution for the McCormick Ranch test site is $V_s = 244-400$ m/sec for depth range 0 - 22 m. In addition, possible body wave dispersion has been observed. Suggestions for further research in this area are presented.
OPERATING VARIOUS SUBSYSTEMS OF THE TOTAL SIMULATION SYSTEMS FOR FLIGHT TRAINING

by

Dr. Vina Sloan

ABSTRACT

In order for these results to be valid, it is necessary for the configuration and performance of the subsystems involved be known and to remain constant during the research project so that measured performance variation can be correctly attributed to subjects performance variations. In addition, that configuration control should be maintained over the entire system so that intelligent decisions can be made regarding the allocation of resources and establishment of priorities for the development of the system. This refers and is directed toward establishing these configuration control policies.
ENHANCING CAREER DEVELOPMENT AT THE AIR FORCE ROCKET
PROPULSION LABORATORY

by
Russ Smith

ABSTRACT

The importance of an effective career development program for an R & D organization, especially for a major Air Force laboratory is investigated. There was widespread interest in an enhanced program at the Rocket Propulsion Laboratory. An exhaustive analysis of top management's concerns, capabilities and constraints of the military and civilian personnel systems, supervisors' and managers' criteria for selection, promotion and transfer, and employees' expectations of a career development program was conducted. This research led to the generation of twenty-five recommendations. Suggestions for further research in this area are offered.
DEVELOPMENT OF A COMPUTER ALGORITHM FOR THE AUTOMATIC DETERMINATION OF SPACE VEHICLE POTENTIAL UTILIZING ELECTROSTATIC ANALYZER MEASUREMENTS.

by

Stanley L. Spiegel

ABSTRACT

A real time technique for determining space vehicle potential using electrostatic analyzer (ESA) positive ion count data has been developed. The method involves examining the count ratios in adjacent ESA energy channels and searching for a precipitous increase in this ratio with increasing energy, or alternatively for a statistically significant increase in the plasma distribution function, derivable from the ion counts. The satisfaction of either condition indicates charging to the level of the higher ESA channel. Tests of the algorithm, using data from the P78-2 satellite have shown excellent agreement with independent estimates of vehicle potential. Hence the algorithm appears suitable to be employed with an ESA of appropriate design for the purpose of automatically activating discharge mechanisms should vehicle potential exceed some critical value.
PLASTIC ROTATING BAND LOADS AND SLIDING RESISTANCE FORCES

by

A. Kent Stiffler

ABSTRACT

A theory is presented for the determination of the projectile resistance forces in interior ballistics. Emphasis is placed on the engraving process for plastic rotating bands. It is proposed that the normal contact stress is constant during engraving and is given by the material flow pressure. Normal loads and friction forces are dependent on the growth of the contact area. The theory is in agreement with experimental data.

The contact stress following the engraving process can be changed by several dynamic sources: (1) projectile spin; (2) projectile compression from acceleration; (3) gas pressure on the barrel wall; (4) rotating band wear. These sources are examined to establish post-engraving contact stresses.

Suggestions for further research on high velocity friction coefficients are offered.
ABSTRACT

Literature studies have been made on (1) compositions with the nickel arsenide structure, (2) growth of large, untwinned crystals of cadmium telluride, and (3) preparation of mercury cadmium telluride thin films. Area 1 will be the basis for an Air Force minigrant proposal for follow-on research. Laboratory research recommendations are also made in areas 2 and 3. A fourth area of endeavor has led to a new explanation of the effectiveness of adding impurities as a means of growing dislocation-free indium phosphide crystals from the melt. A paper on this topic will be submitted for publication, and a recommendation for use of the explanation in designing laboratory experiments is given.
A SYSTEM DYNAMICS MODEL
OF THE ACQUISITION PROCESS

by

Patrick J. Sweeney

ABSTRACT

Numerous instances have been reported concerning cost overruns, delivery delays, and substandard performance characteristics of acquisitions in government and industry. The dynamic models in this report assess portions of the acquisition process as dynamic feedback systems. The report includes sub-models of the Technology, Weapon System, Financial, Resources, Production and Operations Sectors. Additional work will include the Need, Political, Allied, and Enemy Sectors. Continuations of the effort will include bringing the ten sub-models together into one major model. The model should then be tested and validated. The final result will be an all inclusive dynamic computer simulation model of the functioning acquisition system in the Department of Defense. This model can then be used as a policy evaluation mechanism.
ANALYSIS OF MAINTENANCE DECISIONS AT LOWER
ECHELON LEVELS INVOLVING JET AIRCRAFT ENGINES

by

Charles J. Teplitz

ABSTRACT

The existence of diagnostic errors in the decision processes of jet aircraft engine maintenance is investigated. The sources of such errors and their remedies have often gone undiscovered. The effort discussed in this paper was designed (1) to provide a conceptual framework for the analysis of decisions in the maintenance process on jet aircraft, (2) to illustrate the interactions between various factors affecting maintenance decisions, and (3) to identify some major sources of diagnostic errors. Using a simulation model of the maintenance process, insight was gained into the causes and effects of diagnostic errors on jet aircraft maintenance. Suggestions for further research in this area are offered.
A Study of the Interaction of Hydrazine Methylhydrazine and Unsym-dimethylhydrazine with Porphyrins, Metalloporphyrins, and some Metal Coordination Compounds

by

Albert N. Thompson

Abstract

Hydrazine, Methylhydrazine and Unsym-dimethylhydrazine have been shown to react favorably with some porphyrins, metalloporphyrins and first transition series metal coordination compounds. The reaction of the hydrazines with certain porphyrins suggests an initial acid-base reaction followed by an oxidation reduction process. An oxidation reduction reaction is also observed for the reaction of the hydrazines with the metalloporphyrins and the transition metal compounds. The metals in both the metalloporphyrins and the metal compounds are reduced by the hydrazines to lower oxidation states.

Suggestions for follow up research in the area of hydrazine chemistry are given.
GaAs MESFET MODELING

by

Arthur R. Thorbjornsen

ABSTRACT

A mathematical model of a GaAs MESFET has been incorporated into a standard integrated circuit analysis program (SPICE2G). Because of their proprietary nature, it is difficult to obtain a copy of a circuit analysis program that contains a built-in MESFET model. This report contains detailed information on how holders of the SPICE2G program may modify their program to include a GaAs MESFET model. The model is valid for nonlinear DC analysis, linear AC small signal analysis, and nonlinear transient analysis. The results of several example circuit simulations are given. Some directions for future research are also given.
COVERING PROBLEMS IN

C³I SYSTEMS

by

Richard Van Slyke

ABSTRACT

A common problem in the study, design, and deployment of Command, Control, Communications, and Intelligence (C³I) systems is minimizing the cost of satisfying various kinds of coverage requirements. Two examples are repeater coverage for terminals in tactical radio networks and radar surveillance. Mathematical techniques for finding optimal coverings have been well studied by the Operations Research community. Unfortunately, previously developed techniques ignore requirements of particular concern to the Air Force. Most important of these is the need for redundant coverage to provide reliability and to reduce vulnerability to attack. Also of concern is the need for algorithms that have guaranteed computation time requirements for use in real time applications. New algorithms for finding coverings satisfying these requirements are described. The results of extensive testing are reported. An experimental computer implementation is described. Finally, these techniques are applied to radio repeater location in tactical communication networks in Western Germany.
EFFECTS OF ACOUSTIC DISTURBANCES ON THE
BOUNDARY-LAYER TRANSITION IN AEDC WIND TUNNELS

by
Dr Venugopal Veerasamy

ABSTRACT

Boundary-layer transition prediction techniques are reviewed. Experimental results show that free-stream disturbances (acoustic sound, turbulence, and temperature fluctuation, etc.) contribute to the early transition process. At subsonic speeds the dominant disturbances are turbulence and/or acoustic vibrations. At transonic speeds the acoustic noise generated by the test section porous or slotted walls is predominant. At supersonic - hypersonic Mach numbers, the radiated noise from the turbulent boundary layer on the tunnel walls is the dominant source of disturbance. A mathematical model is proposed to predict the early transition due to acoustic interaction. Further theoretical and experimental programs are suggested.
AN EVALUATION OF AIR FORCE PAVEMENT NON-DESTRUCTIVE TESTING METHOD

by

M.C. Wang

ABSTRACT

The strengths and weaknesses of the current Air Force non-destructive pavement testing (NDPT) method have been reviewed, and its effectiveness for routine applications has been evaluated.

The NDPT method is composed of two main components -- the data collection equipment and the PREDICT computer code. The data collection equipment contains an impulse loader with the necessary instrumentation and a desk-top computer for preliminary data analysis and evaluation. The entire equipment is housed in a van which is air transportable and therefore satisfies the Air Force's need of rapid worldwide deployment. The PREDICT is a finite element program which is capable of performing nonlinear analysis for both rigid and flexible pavements.

It is concluded that the current NDPT method is an effective tool for evaluating a pavement's structural capacity in terms of fatigue life. However, further improvement is needed. Recommendations for the improvement are offered.
THE EFFECT OF ONE HUNDRED PERCENT OXYGEN AT ONE ATA AND INCREASED PRESSURE ON THE METABOLISM OF AN ORGANOPHOSPHATE (PARATHION) IN THE RAT

by

Alice Ward

ABSTRACT

In vivo studies have been carried out to determine the effect of 100% oxygen at ambient and increased pressure on the metabolism of the organophosphorous insecticide, parathion. Groups of rats administered a single intraperitoneal dose of the agent (4.5 mg/kg) were either treated immediately or after a period of ten minutes with 100% oxygen at 1 ATA or 2.4 ATA. Results indicate that oxygen at 1 ATA and 2.4 ATA does not prevent the formation of paraoxon, the toxic metabolite of parathion. Also oxygen at these pressures does not appear to influence the degradation of paraoxon. It appears that 100% oxygen at 2.4 ATA may enhance the conversion of parathion to paraoxon.
MEASUREMENTS OF TURBULENCE IN THE TROPOSPHERE AND LOWER STRATOSPHERE USING THE MILLSTONE HILL 440 MHZ RADAR

by

Brenton J. Watkins

ABSTRACT

A program of experiments has been conducted to make intercomparisons of the refractivity turbulence structure constant \( C_n^2 \) in the upper troposphere and lower stratosphere. The Millstone Hill 440 MHz turbulence scatter radar was operated simultaneously with a number of Air Force Geophysics Lab balloon experiments. [The balloon data yield temperature fluctuation profiles that may be converted to \( C_n^2 \) profiles]. On one night a stellar scintillometer was also operated for data comparison purposes. The data indicated large (factor of 100) variations of \( C_n^2 \) with time and height. The decrease of \( C_n^2 \) with altitude (\(-1.4\text{db/km}\)) is generally similar to that reported by other workers, however on two days the slope was considerably less. The absolute magnitude of \( C_n^2 \) from these radar data was greater (factor of 10) than found at other radar sites. However the \( C_n^2 \) data gathered in 1968 at the Millstone Hill site show similar magnitudes to those reported here.
OPTIMAL DESIGN OF DIGITAL FLIGHT CONTROL
SYSTEMS FOLLOWING AN ANALOG MODEL

by
Hsi-Han Yeh

ABSTRACT

The problem of designing a digital controller to replace an analog controller in a flight control system is studied. The objective of the research is to develop a method for synthesizing the z-transfer function of the digital controller which operates at a given sampling rate and preserves the characteristics of the original continuous system as much as possible.

The mathematical tool used in this research is an extended maximum principle of the Pontryagin type, which enables one to synthesize the output signal of a zero-order hold following the digital controller. A performance index of integral squared difference between the continuous state trajectory of the digital control system and that of the continuous model is selected as a means to preserve the performance characteristics. The rationale in the choice of this performance index is that the state trajectories of a continuous control system and a digital control system can be compared over the entire time axis, whereas the comparison between their frequency responses becomes meaningless as the signal frequency approaches the folding frequency.

The z-transfer function of the digital controller is obtained in terms of the parameters of the continuous model. Recommendations for further research in this area are made.
AMPLITUDE VARIABILITY OF THE STEADY STATE

VISUAL EVOKED RESPONSE

by

Robert L. Yolton

Abstract

The amplitude of the human visual evoked response (VER) has been found to be a somewhat unreliable indicator of vision and/or perception. In this study, the reliability of the steady state VER was determined for nine normal subjects using fast Fourier transform analysis procedures with 1.0 Hz and 0.25 Hz frequency bin resolutions. No correlations were found between changes in VER amplitudes and subjects' reports of shifts in attention, accommodation, fixation, or perceived organization of the stimulus.

Analysis, using analog filtering and Fourier techniques, demonstrated that there was no significant and sustained amplitude modulation of the VER by any frequency (including alpha) and that frequency drift of the VER did not contribute significantly to its amplitude variability.

A modeling approach to variability, using mixed sine waves to simulate different signal/noise ratios, established that a significant portion of the VER variability can be accounted for by noise which occurs at the same frequency as the VER and which is not ensemble averaged out of the VER data during initial processing. An empirically determined reliability versus signal/noise ratio curve is presented which shows the minimum variability which can be expected for any given signal/noise ratio.
NEW TESTS OF THEORIES
ON
SHAPED CHARGE
by
Poh Shien Young
ABSTRACT

Two theories on the penetration of the lined shaped charge in targets have been reviewed and compared with the recent experimental data. Under this investigation is the relationship between the penetration depth and time. The discrepancies between the theoretical and experimental values exist. Explanations and suggestions for further research in this field are offered.