

LEVEL II

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P.S. 1979 USAF

SUMMER FACULTY RESEARCH PROGRAM

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Administrative Report

Conducted by:
**SOUTHEASTERN CENTER FOR
ELECTRICAL ENGINEERING EDUCATION**
7300 LAKE ELLENOR DRIVE
ORLANDO, FLORIDA
DECEMBER, 1979

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evaluations of the program are reported. The Administrative Report also includes abstracts of the final technical reports.

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1979 USAF/SCEEE SUMMER FACULTY
RESEARCH PROGRAM

Conducted by

The Southeastern Center

for

Electrical Engineering Education

under

USAF Contract Number F49620-79-C-0038

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by

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Richard N. Miller, SFRP Director
Southeastern Center for
Electrical Engineering Education

September 1979

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**UNITED STATES AIR FORCE
SUMMER FACULTY RESEARCH PROGRAM**

1979

PROGRAM MANAGEMENT

SOUTHEASTERN CENTER FOR ELECTRICAL ENGINEERING EDUCATION, INC.

1. Project Title	
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1. General.

On December 7, 1979, Contract F49620-79-C-0038, United States Air Force Summer Faculty Research Program (USAF-SFRP), was awarded to the Southeastern Center for Electrical Engineering Education (SCEEE), Inc. Under this contract, sponsored by the Air Force Office of Scientific Research (AFOSR)/Air Force Systems Command, United States Air Force, SCEEE conducts the USAF-SFRP.

On December 7, 1978, Dr. Richard N. Miller, SCEEE Managing Director, was appointed SFRP Director. On January 5, 1979, Lt. Col. Michael V. Vasilik, the Contracting Officer's Technical Representative, visited the SCEEE Operations Office in Orlando, Florida, and brought with him the statement of program objectives for the 1979 SFRP, a list of research tasks at each participating Air Force laboratory/center, and the number of research associate positions authorized for the 1979 SFRP. All of this information is contained in the brochure SCEEE distributed to announce and nationally advertise the 1979 SFRP.

In order to expedite the initialization of the 1979 SFRP, the Contracting Officer, Captain Marion R. Harrington, on January 10, 1979, waived the requirement for the Contracting Officer to furnish written consent to the contractor prior to the release and dissemination of the 1979 USAF-SFRP brochure. In addition, on January 8, 1979, the Contracting Officer gave permission to extend the deadline for receiving applications from faculty members to February 15, 1979 to insure that the maximum number of applications possible could be received and evaluated before awards were made.

2. Recruiting, Selecting and Assigning the Research Associates/SCEEE Fellows.

a. Recruiting for the 1979 SFRP.

Because of the late start of the 1979 SFRP, every effort was made to get brochures directly to the faculty members who would be in a position to respond. The major thrust made in recruiting was to enlist the assistance of the university department chairman in institutions all across the US. These key individuals could then use the SFRP as a direct means of focusing the attention of their faculty members on sponsored research, specifically Air Force sponsored research. In this effort, brochures were mailed to five hundred department chairmen.

Three other secondary recruiting efforts were made. The first of these made use of the SCEEE mailing list to individuals in universities participating in programs held by SCEEE. Brochures were also sent to the laboratories participating in the SFRP so that the materials could be sent to any potential applicants known to the laboratories. The last of the secondary recruiting efforts involved the AFROTC units on university campuses distributing the brochures. The AFROTC units were eager to perform this function because their participation in the SFRP is viewed in a highly positive manner among the faculty.

In all, 3000 brochures were distributed in the 1979 SFRP recruiting effort. In response to this effort, 143 applications were received from qualified applicants, and 70 appointments were awarded.

b. Selection of the Research Associates.

During December, January, and February the SFRP Director made visits to several of the participating laboratories and made many telephone calls to key laboratory personnel to closely acquaint himself with the research areas in which the laboratories had the most pressing needs. In

addition, many hours were spent personally interviewing applicants over the telephone to accurately identify those professors having the skills needed in the laboratories.

These steps were then followed-up with close coordination with the laboratory contacts in selecting the right faculty members for each position. This process resulted in the selection of many faculty members for assignment to research locations for which they had not made application. This process thus pointed out major inaccuracies and inadequacies in the write-ups furnished by the laboratories for the brochure and also illustrated the high degree of flexibility most applicants had toward the research locations. Apparently the research topic area was viewed as being a much more important consideration than was the research location.

During this December - February period several additional laboratories and centers petitioned to be added to the SFRP and were accepted. Selecting faculty members to fill their authorized positions turned out to present no difficulties because of the thoroughness of knowledge of the applicants' qualifications. An additional item of singular significance in recovering from the late SFRP start was the SFRP Director's background. Without this experience the matching of skills and talents with needs would have been extremely difficult under the time constraints presented.

c. Assignment of Research Associates.

In most cases the Research Associates knew what their research topic area would be at the time of their selection because in most cases these applicants had been in direct contact with key personnel at the laboratory/center to which they were assigned. This part of the process had been encouraged in order to assure proper selection of the Research Associates. As a result, out of the 70 Research Associates selected, only one had been mis-assigned. This individual discovered his mis-assignment on the pre-

summer visit and subsequently withdrew from the program in sufficient time for his position to be filled with an alternate selectee. Again, the flexibility demonstrated by the applicants, together with SFRP Director's knowledge of both the applicants' areas of expertise and the needs at each research location made these 70 assignments possible. By the start of the summer research period on May 15, 1979, recovery from the late start of the 1979 SFRP was essentially complete, and all 70 authorized Research Associate positions had been filled.

3. 1979 Summer Faculty Research Program Administration.

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 the Pre-summer Visit. The purpose of the Pre-Summer Visit was basically three-fold: 1) to meet laboratory personnel, especially the Effort Focal Point with which the Research Associate would be most closely working and become personally acquainted with the laboratory facilities; 2) to finalize and formalize objectives for the Research Associates's summer research period and report these to SCEEE; and 3) to make arrangements for the lodging for the research period. The focus of this visit was on making sufficient preparation so that the summer research effort would be effective from the first day.

During this period preceding the summer research period, all Research Associates were provided with detailed written instructions and procedures for obtaining payment for their research efforts, travel reimbursement, and lodging cost reimbursement. As a result, no disbursement difficulties were encountered through the research period that could not be handled easily by telephone or short letter.

The Research Associates approached the summer research period eager to establish themselves as thorough, competent researchers in the eyes of their Air Force Colleagues. This was because virtually every Research Associate was interested in establishing the basis for his research. As a result, there were no complaints from the laboratories concerning the level of effort put forth by any Research Associate.

4. Evaluation of the 1979 SFRP.

a. General.

Perhaps the facet most descriptive of the value which the participating agencies place on the SFRP is that facet having to do with the demand for Research Associates at each of the research locations. When other laboratories and centers were added to the 1979 SFRP than previously participated, the former participants complained vigorously at having to yield any Research Associate positions to the newcomers. As a result, the SFRP Director recognized early in this year's program that additional positions need to be added whenever new research locations are added to those participating. Recommendations for keeping abreast of the demands for Research Associates have been forwarded by the SFPR Director to AFOSR.

b. Summary of Associate's Replies on Questionnaires.

To document the attitudes and responses of the associates and research colleagues, questionnaires were completed by each of these groups and returned to the Director. Answers have been placed directly on the questionnaire when they invited a yes/no answer. Comments by answers have been summarized between questions. The summary of these results follows.

PARTICIPANT'S QUESTIONNAIRE & SUMMARY

USAF/SCEEE SUMMER FACULTY RESEARCH PROGRAM
EVALUATION QUESTIONNAIRE
(TO BE COMPLETED BY PARTICIPANT)

Name _____ Title _____
Dept. (at home) _____ Home Institution _____
Research Colleague(s) _____
Laboratory Address of Colleague(s) _____
Brief Title of Research Topic _____

A. TECHNICAL ASPECTS

1. Was the offer of research assignment within your field of competency and/or interest?
YES _____ NO _____
2. Did you have a reasonable choice of research assignment? YES _____ NO _____ If no, why? _____
3. Was the work challenging? YES _____ NO _____ If no, what would have made it so? _____
4. 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 _____ in actual meaningful research? Other comments: _____
8. Do you feel that your work was an integral part of the mission and/or responsibility of the laboratory/division in which you were assigned? YES _____ NO _____ Do you feel that your work has or will contribute to this mission/responsibility? YES _____ NO _____ Comments: _____
9. Do you think that you have been stimulated to 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. _____
10. 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).

PARTICIPANTS QUESTIONNAIRE
Page Two

11. Were you asked to participate as a regular attendee in routine staff/group meetings in your laboratory? YES___ NO___ If yes, approximately how often did these occur and what was the nature of your participation?_____

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

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

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

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

Meaningful and stimulating experience	A	B	C	D
Technically challenging	A	B	C	D
Future research opportunity	A	B	C	D
Professional association	A	B	C	D
Enhancement of my academic qualifications	A	B	C	D
Enhancement of my research qualifications	A	B	C	D

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 summer fellowship offer, did this cause you any problems of commitment? YES___ NO___ If yes, please explain._____

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 evaluate the stipend level? Meager___ Adequate___ Generous___

PARTICIPANT QUESTIONNAIRE
Page Three

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 VOO____, apartment____? Name
and address of apartment complex and manager's name _____

9. Please suggest names (and give source) of organization, mailing lists, or other infor-
mation you think would be helpful in advertising next year's program._____

10. Considering the many-faceted aspects of administration of a program of this magnitude,
how do you rate the overall conduct of this program? Poor____ Fair____ 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

QUESTIONNAIRE EVALUATION SUMMARY
(68 of 70 PARTICIPANTS REPORTED)

A. TECHNICAL ASPECTS

1. Assignment in field of competency and/or interest? Yes - 68 No - 0
2. Reasonable choice of assignment? Yes - 67 No - 1
 - a. If no, why? Work on project of interest to laboratory management.
3. Work challenging? Yes - 68 No - 0
4. Relations with colleague satisfactory? Yes - 66 No - 2
 - a. If no, why? Very isolated in work. Poor attitude of laboratory staff.
5. Suggestions for improvement? Most indicated that no change was necessary and relationships were excellent. However, one location was criticized for the very poor attitude of the staff. This is the same location mentioned in item #4.
6. Afforded adequate facilities? Yes - 60 No - 8
 - a. Library facilities minimal. Interlibrary was slow. Space and secretarial assistance quite limited. Lab facilities were down due to move to new building. Insufficient technical support due to personnel sickness and leaves. Equipment was not prepared or complete.
7. Accomplishment in ten weeks? More than expected - 13 Less than expected - 12 About what expected - 43
 - a. Comments? A few negative comments about time required in preparing final report; several indicated program should be increased in length.
8. Work integral part of lab/division mission? Yes - 65 No - 3
 - a. The three Research Associates that checked no offered no comments in regard to the reason for their choice.

Work contributed to lab/division mission? Yes - 68 No - 0
9. Stimulated to continue? Yes - 68 No - 0
 - a. Many positive comments about the follow-on possibilities provided by mini-grants and other Air Force research programs conducted by SCEE.
10. Asked to present seminars? Yes - 34 No - 34
11. Participate as regular attendee in lab meetings? Yes - 32 No - 36
12. Traveled on behalf of laboratory? Yes - 16 No - 52
13. Special meetings? Most special meetings were either to exchange information on technical aspects of the research effort or in laboratory mission briefings.

PARTICIPANTS SUMMARY
PAGE TWO

14. Other comments on extra activities? Comments offered were in regard to presentations about their work to professional and other groups having similar interests.
15. Meaningful and stimulating? A - 58 B - 9 C - 1 D - 0
Technically challenging? A - 50 B - 16 C - 2 D - 0
Future research opportunities? A - 57 B - 11 C - 0 D - 0
Professional association? A - 43 B - 22 C - 2 D - 1
Enhancement of academic qualifications? A - 27 B - 32 C - 9 D - 0
Enhancement of research qualifications? A - 44 B - 23 C - 1 D - 0

B. ADMINISTRATIVE ASPECTS

1. First hear about program? Through USAF/SFRP Brochure - 27 Through Air Force acquaintances - 17 Through SCEE contacts - 13 Colleagues - 10 Other - 1
2. Aspect most influential in causing application? Possibility of follow-on research. Opportunity to work with superior facilities. Topic areas of interest.
3. Commitment to program a problem? Yes - 19 No - 49
a. If yes, explain? Late announcement - 11 No comment - 4 Acceptance decision required too early - 2 Having to decide among other opportunities - 1 Problem of getting ten weeks in summer - 1
4. Program information satisfactory? Yes - 56 No - 10 No response - 2
a. Comments? No information provided - 3 Housing difficulties - 2 Housing for family not available - 1 Pre-summer visit too short - 1 Assignment too early in summer to get housing - 1 Map not furnished - 1 Information late - 1
5. Problems in domestic aspects: Yes - 9 No - 57 No response - 2
a. If yes, explain? Housing - 6 No comment - 1 No reimbursement on rental car - 1 Drove 100 miles round-trip from home - 1
6. Stipend level? Meager - 22 Adequate - 43 Generous - 3
7. Preprogram visit? Not worth expense - 4 Convenient - 13 Essential - 47 No response - 4
8. Housing information? Apartment - 24 VOQ - 14 Both apartment and VOQ - 4 Home - 10 Rented house - 8 Motel - 3 Mobile home - 3 Relatives - 2
9. Mailing lists suggestion? Mailing lists suggestions have been tabulated for future use.
10. Program administration overall rating? Poor - 0 Fair - 11 Excellent - 57
a. Comments? SCEE and AFWL staff helpful and friendly. Processing of invoices was faster than anticipated. Give details of all

PARTICIPANTS SUMMARY
PAGE THREE

commitments at time of application. Two week wait for check is too long. Very responsive to my needs; supportive and flexible. Too much paperwork. Orlando office was available and ready to help. It was excellent! More information on mini-grant program needed.

11. A. Strong points of the program? (In order of frequency)

1. Personal contact with Air Force scientists.
2. Program structured so that follow-on research is encouraged.
3. Administration
4. Freedom to perform research beneficial to both the researcher and the Air Force.
5. Opportunity for university faculty to broaden their research horizons.

B. Weak points?

1. Stipend meager.
2. Short period of time for research.
3. None.
4. Little opportunity to visit other laboratories.
5. No support for graduate student.
6. Difficulty to get immediate follow-on research.

12. Other comments? Most comments elaborated on previous answers, but in general, the comments were congratulatory, complimentary, and positive.

RESEARCH COLLEAGUE'S QUESTIONNAIRE & SUMMARY

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

COLLEAGUE QUESTIONNAIRE

Page Two

Also, please evaluate:

Opportunity to stimulate group activity	A	B	C	D
Professional association	A	B	C	D
Program administration	A	B	C	D

B. ADMINISTRATIVE ASPECTS

1. When did you first hear of this program? _____
2. Were you involved in the screening and prioritizing of the faculty persons' applications for your lab? YES _____ NO _____ If yes, do you have any suggestions for improvement of the procedure used? _____
3. How do you rate the importance of the expense-paid pre-program visit to the work site? Not worth expense _____ Convenient _____ Essential _____ Please add any comments: _____
4. Considering the calendar "window" of ten weeks (limited by varying college and university schedules), please comment on the program length. Were you as a team able to accomplish more than _____, less than _____, about what you expected _____? Comments: _____
5. Would you desire another Faculty Associate to be assigned to you and/or your group/division next summer? YES _____ NO _____ If no, why not? _____
6. Other remarks: _____

THANK YOU

QUESTIONNAIRE EVALUATION SUMMARY
(67 of 70 RESEARCH COLLEAGUES REPORTED)

A. TECHNICAL ASPECTS

1. Personal knowledge of Associates capabilities? Yes - 40 No - 27
 - a. Research colleagues reported that any prior personal knowledge of the Associates capabilities ranged from past published literature and experience to telephone conversations, pre-summer visits, and a review of their resumes.
2. Was Faculty Associate prepared? Yes - 64 No - 3
 - a. One Associate not prepared was an alternate; however, he was rated outstanding in all respects of his research period. Another Associate not prepared had had no computer experience which was necessary for his project; however, he did accomplish a project that was necessary for the laboratory. Another Associate chose to do his research in another area.
3. Comments on preparedness, etc? Most comments were very positive with phrases like "hard-working," "highly competent," "excellent preparation," and "great deal of prior knowledge in specific field" appearing many times.
4. Comments on cooperativeness, etc? Most comments were similar to those in item #3. Positive phrases like "very cooperative and highly motivated," "outstanding," and "a stimulating asset to the laboratory staff" appeared in many of the remarks.
5. Increase in Associates research potential? Yes - 66 No - 1
 - a. The one Associate rated "no" was rated this way because his research colleague felt his work "to be not particularly great." All other comments were very positive indicating that the Research Associates had gained new techniques and a better understanding of the USAF.
6. Work performed contribute to overall lab mission? Yes - 62 No - 5
 - a. The Associates rated "no" were done so because: "There was not enough time to complete objectives;" "It's not reasonable to expect a contribution to the lab mission from this program. It's purpose is to acquaint university researchers with relevant research opportunities;" and no comments offered. Other comments were very positive and along the lines of the positive comments offered in items #3, #4, and #5.
7. Were technical relations with Associate satisfactory? Yes - 65 No - 2
 - a. The colleagues rating "no" offered no comment except to state: "This question is ambiguous; our relations were satisfactory, but his technical ability is in another domain." Other comments were very positive.
8. Did Faculty Associate stimulate others? Yes - 63 No - 4
 - a. The Research Associates rated "no" were rated that way because: "Faculty Associate was busy working on his project;" "The opportunity and time were not available;" and no comments offered.

COLLEAGUES SUMMARY
PAGE TWO

Other comments indicated that the Research Associates' opinions were greatly respected and the SFRP allowed the laboratories to exchange important research ideas with the Associates.

9. Will summer experience and performance form basis for continuation?

Yes - 64 No - 3

- a. Those Associates rated "no" were done so because: "We hope that he will come here under the URRP program;" "He has his own interest that is not relevant to the program I am directing;" and no comment. Other comments were very definite about continuation of the Associates work at their institutions and under other Air Force contracts.

10. Basic research resource identified?

A - 42 B - 16 C - 6 D - 0

Did not respond - 3

Opportunity to simulate group activity?

A - 35 B - 23 C - 8 D - 1

Professional association?

A - 51 B - 14 C - 1 D - 0

Did not respond - 1

Program administration?

A - 29 B - 25 C - 10 D - 0

Did not respond - 3

B. ADMINISTRATIVE ASPECTS

1. When first heard of program? Most answered that they had known about it for several years due to past SFRP participants. Other colleagues stated that they just learned of the program this year.

2. Involved in screening and prioritizing? Yes - 25 No - 42

- a. Few comments received.

3. Expense-paid pre-program visit? Not worth expense - 1 Convenient - 20
Essential - 44 Did not respond - 2

4. Calendar "window" of ten weeks to accomplish research? More than expected - 14 Less than expected - 6 About what expected - 47

- a. Several comments were received expressing a desire to lengthen the research period.

5. Want another participants? Yes - 67 No - 0

6. Other comments? Most of the comments received indicated that the program was "an invaluable service to both parties" and should definitely be continued.

LABORATORY REPRESENTATIVE'S QUESTIONNAIRE & SUMMARY

USAF/SCEEE SUMMER FACULTY RESEARCH PROGRAM
EVALUATION QUESTIONNAIRE
(TO BE COMPLETED BY LABORATORY REPRESENTATIVE)

Laboratory/Center _____
Name _____

1. How do you rate the correspondence, verbal and telephone communications, and other aspects concerning program administration? Poor _____ Average _____ Excellent _____ How could it be improved? _____

2. The participant selection process is two-fold: academic and technical. Did you have sufficient time to conduct the technical selection processing of applications? YES _____ NO _____ If no, how much time do you suggest? _____
Was the method used satisfactory? YES _____ NO _____

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 (or Commander's) briefing, tour, and/or other formal means of welcome and introduction for the associate(s) assigned to your organization? YES _____ NO _____ If yes, please give description. _____

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 _____ Please give description. _____

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.

LABORATORY REPRESENTATIVE QUESTIONNAIRE
Page Two

9. (CONTINUED)

<u>List Name(s)</u>	<u>Poor</u>	<u>Average</u>	<u>Excellent</u>	<u>Superior</u>
---------------------	-------------	----------------	------------------	-----------------

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

THANK YOU

QUESTIONNAIRE EVALUATION SUMMARY
(17 of 23 LABORATORY REPRESENTATIVES REPORTED)

1. Rate correspondence? Poor - 0 Average - 5 Excellent - 12
a. Be improved? Resumes sent to labs earlier.
2. Sufficient time for selection? Yes - 9 No - 7 Did not respond - 1
a. How much time? 2-3 weeks prior to selection.

Was method satisfactory? Yes - 8 No - 7 Did not respond - 2
3. Number of associates satisfactory? Yes - 12 No - 4 Did not respond - 1
a. How many desired? 7-9; 4; up to 3; at least 7.
b. How determined? Number of proposed problems. Previous contact. Based on a long range problem. Current and projected R & D backlog. Based on needs and problems. Goal of placing one professor in each of the seven technical divisions at RADC. Specific requirements.
4. Rate pre-program visit? Not worth expense - 0 Convenient - 3
Excellent - 14
5. Ten-week period an optimum amount of time? Yes - 14 No - 3
a. What length? 12-14 weeks; should be variable according to laboratory and associates.
b. Comments? Longer times would be more productive but probably would be unworkable from the faculty associate's viewpoint/schedule. Even one more week might be useful. Ten weeks appears as optimum for availability of professors between the end of the spring term and the beginning of the fall term.
6. Establish seminar program? Yes - 7 No - 10
a. Give description? Informal program; weekly seminars.
7. Conduct briefing? Yes - 7 No - 10
a. Give description? Individual sponsor/associate basis; mission briefings; tour; standard newcomers' briefing; commander's welcome.
8. Exit exercise? Yes - 11 No - 6
a. Give description? Seminar; final wrap-up session; one-to-one basis; private interview with focal point; technical briefing at group level; informal briefing by division; seminar and private interview.
9. Quality of participants Poor - 0 Average - 2 Excellent - 24
Superior - 24
10. Comments? Pleasure working with SCEEE/AFOSR and Associate; need resumes earlier; higher salary; need a listing of the recommended do's and don'ts; get started earlier; stronger emphasis on purpose of program.

5. Conclusions and Recommendations.

a. The emphasis of the conducting of the 1979 USAF-SFRP has been on developing the basis for continuing research of interest to the Air Force. This apparently represented a change of some magnitude in program philosophy, as data from previous years indicates that follow-on research efforts by the participating faculty members had been in a decreasing trend. Throughout the entire year the Mini-Grant Program was emphasized as the vehicle to be used for continuing the summer research work back at the faculty member's institution. In addition, efforts were also made to introduce the Research Associates to other USAF-sponsored research programs such as the Post-Doctoral Program, the Senior Investigator Program, and the Research in Biotechnology Program. Indications are that all of these efforts have paid off, as the number of Mini-Grant Program applications submitted to date indicates that the Research Associates are actively pursuing continuing Air Force research sponsorship.

b. There is considerable evidence that the USAF-SFRP is furthering the research objectives of the Air Force. The principal evidence of this is the heavy demand for Research Associates at an increasing number of Air Force organizations. Not only did many of the previously participating organizations indicate a need for more Research Associates than were assigned to them, but several new organizations requested that they be added to the SFRP. This increasing demand has outstripped the 70-position supply, and so more positions should be added to the program for FY-80, particularly if more Air Force organizations are added to those participating.

c. It also appear that the scientific and engineering educators view the programs as forwarding their research objectives, because requests for FY-80 application information and forms have been received from over 130 individual faculty members. In addition, several university offices of

of sponsored research and several department heads have requested this same information.

d. Because of the increase by the Navy and NASA in the stipend they offer for their summer research programs to \$450/week, it is strongly recommended that a similar adjustment be made for the USAF-SFRP in order for this program to remain competitive.

e. Overall, the USAF-SFRP appears to be in excellent condition to meet growing Air Force research needs. Indeed, it is being increasingly looked to by Air Force organizations to provide the needed future research support.

APPENDIX I

1. Program Statistics
2. List of 1979 Participants
3. Participant Laboratory Assignments

1979 USAF/SCEEE SUMMER FACULTY RESEARCH PROGRAM

Conducted by
SOUTHEASTERN CENTER FOR ELECTRICAL ENGINEERING EDUCATION, INC.

PROGRAM STATISTICS

1. Number of Air Force Installations (Laboratories/Centers) - 24

2. Applications Received (First Choice as Follows) - 143

AFAEDC	(Arnold)	- 5	AFCEC	(Tyndall)	- 6
AFHRL/PE	(Brooks)	- 0	CEEDO	(Tyndall)	- 5
AFSAM	(Brooks)	- 5	FFJSRL	(USAFA)	- 10
AFRPL	(Edwards)	- 7	AFHRL/FTF	(Williams)	- 1
AFATL	(Eglin)	- 18	AFAL	(W-PAFB)	- 8
AFRADC	(Griffiss)	- 17	AFAMRL	(W-PAFB)	- 7
AFGL	(Hanscom)	- 8	AFAPL	(W-PAFB)	- 6
AFRADC/ET	(Hanscom)	- 7	AFBRMC	(W-PAFB)	- 3
ESD	(Hanscom)	- 0	AFFDL	(W-PAFB)	- 11
AFWL	(Kirtland)	- 9	AFHRL/ASR	(W-PAFB)	- 3
AFHRL/TTY	(Lowry)	- 1	AFLC	(W-PAFB)	- 1
SAMTEC/TOEI	(Patrick)	- 0	AFML	(W-PAFB)	- 5

3. Number of Participants - 70

Number holding Doctorate Degree	- 68
Number holding Masters Degree	- 2
Number holding Professor Rank	- 18
Number holding Associate Professor Rank	- 23
Number holding Assistant Professor Rank	- 28
Number holding Instructor Rank	- 1

4. Average Age of Participants - 40.4 years

5. Distribution of Participants Location

AFAEDC	(Arnold)	- 3	AFCEC	(Tyndall)	- 2
AFHRL/PE	(Brooks)	- 2	CEEDO	(Tyndall)	- 2
AFSAM	(Brooks)	- 3	FFJSRL	(USAFA)	- 3
AFRPL	(Edwards)	- 1	AFHRL/FTE	(Williams)	- 2
AFATL	(Eglin)	- 6	AFAL	(W-PAFB)	- 5
AFRADC	(Griffiss)	- 4	AFAMRL	(W-PAFB)	- 3
AFGL	(Hanscom)	- 6	AFAPL	(W-PAFB)	- 3
AFRADC/ET	(Hanscom)	- 2	AFBRMC	(W-PAFB)	- 3
ESD	(Hanscom)	- 1	AFFDL	(W-PAFB)	- 5
AFWL	(Kirtland)	- 5	AFHRL/ASR	(W-PAFB)	- 2
AFHRL/TTY	(Lowry)	- 1	AFLC	(W-PAFB)	- 1
SAMTEC/TOEI	(Patrick)	- 1	AFML	(W-PAFB)	- 4

PROGRAM STATISTICS - PAGE TWO

6. Disciplines Represented - 29

Aerospace Engineering	1	Geog. & Environ. Studies	1
Administrative Sciences	1	Industrial Engineering	3
Atmospheric Science	1	Indust. & Systems Eng.	2
Biological Science	1	Management	1
Biology	1	Management & Marketing	1
Biomed. & Environ. Health Sci.	1	Manufacturing Technology	1
Chemical Engineering	1	Mathematics	2
Chemistry	4	Mechanical Engineering	3
Civil Engineering	2	Mech. & Aerospace Eng.	1
Civil & Mech. Engineering	1	Optometry	1
Economics	1	Physics	8
Electrical Engineering	21	Physics & Space Science	1
Elect. & Computer Eng.	3	Psychology	3
Electronic Data Processing	1	Systems Science	1
Engineering Technology	1		

7. Number of Colleges/Universities Represented - 53

Akron, University of	New York/Fredonia, State University
Alabama, University of	College of
Antioch College	North Carolina A & T University
Boston University	Notre Dame, University of
Brandeis University	Ohio State University (2)
California/Berkeley, University of (2)	Oklahoma, University of
Central Florida, University of (2)	Oklahoma State University
Clark University	Oregon State University
Colorado/Colorado Springs, University of	Pacific Union College
Colorado State University	Pennsylvania State University -
Denver, University of	Behrend College
Evansville, University of	Rhode Island, University of (3)
Florida Institute of Technology (2)	Rose-Hulman Institute of Technology (2)
Georgia Institute of Technology	San Jose State University
Houston, University of (3)	South Carolina, University of
Illinois/Chicago Circle, University of	Southeastern Massachusetts University
Indiana University - Purdue University/ Ft. Wayne	Syracuse University (2)
Kent State University	Tennessee State University (2)
Kentucky, University of	Texas, University of
Marquette University	Texas Tech University
Miami, University of	Tufts University
Michigan, University of	Utah State University
Mississippi, University of	Virginia Polytechnic Institute
Mississippi State University (5)	and State University (2)
Missouri/Columbia, University of	Western Carolina, University of
Nebraska/Omaha, University of	West Florida, University of
New Jersey Institute of Technology (2)	West Virginia Tech
	Wichita State University
	Wright State University

PROGRAM STATISTICS - PAGE THREE

8. Number of States Represented - 29

Alabama	New York
California	North Carolina
Colorado	Ohio
Florida	Oklahoma
Georgia	Oregon
Illinois	Pennsylvania
Indiana	Rhode Island
Kansas	South Carolina
Kentucky	Tennessee
Massachusetts	Texas
Michigan	Utah
Mississippi	Virginia
Missouri	West Virginia
Nebraska	Wisconsin
New Jersey	

1979 USAF/SCEEE SUMMER FACULTY RESEARCH PROGRAM

LIST OF PARTICIPANTS

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Degree: PhD., Electrical Eng., 1976
Specialty: Numerical Solution of
Electromagnetics Problems
Assigned: AFWL (Kirtland)

Degree: PhD., Metallurgical Eng., 1973
Specialty: Metallurgy, Metallography,
Alloying, Materials requirements
Assigned: AFML (Wright-Patterson)

Degree: PhD., Chemistry, 1961
Specialty: Physical Chemistry,
Reaction Kinetics
Assigned: AFGL (Hanscom)

Degree: PhD., Physics, 1970
Specialty: Plasma Physics, MHD, Fluid
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Propagation and Doppler Radar, Acoustics,
Tomography
Assigned: AFATL (Eglin)

Degree: PhD., Electrical Eng., 1967
Specialty: Communications, Error
Correcting Codes, Signal Tracking
Electronics
Assigned: AFATL (Eglin)

Degree: PhD., Physics, 1950
Specialty: Microwave Absorption &
Dielectric Relaxation of various
materials, Microwave Measurements,
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new techniques to evaluate toxic
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DEGREE, SPECIALTY, & LABORATORY
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Degree: PhD., Organizational Behavior,
1977
Specialty: Behavioral Science as it
applies to Management of Organizations
Assigned: AFHRL/ASR (Wright-Patterson)
[REDACTED]

Degree: PhD., Civil Eng., 1970
Specialty: Structural Eng. &
Mechanics
Assigned: AFATL (Eglin)
[REDACTED]

Degree: PhD., Physiological Optics, 1978
Specialty: Visual Science, Eye
Movement Control Systems, Information
Processing for Motor Control
Assigned: AFHRL/FTE (Williams)
[REDACTED]

Degree: PhD., Aeronautics, 1978
Specialty: Bluff Body Separated Flows,
Laser Doppler Velocimetry
Assigned: AFFJSRL (USAF Academy)
[REDACTED]

Degree: PhD., Physiological Psychology,
1973
Specialty: Sensory Processors
Assigned: USAFSAM (Brooks)
[REDACTED]

Degree: PhD., Electrical Eng., 1978
Specialty: Multivariable Control
Systems
Assigned: AFATL (Eglin)
[REDACTED]

Degree: PhD., Statistics, 1972
Specialty: Multivariate Analysis and
Application of Statistics to different
Disciplines
Assigned: AFAMRL (Wright-Patterson)
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DEGREE, SPECIALTY, & LABORATORY
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Degree: PhD., Zoology, 1969
Specialty: Development Biology
Assigned: AFAMRL (Wright-Patterson)

Dr. Arlyn J. Melcher
Professor of Administrative Sciences
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Degree: PhD., Industrial Relations,
1964
Specialty: Organizational Analysis
Assigned: AFBRMC (Wright-Patterson)

Dr. Bonita H. Melcher
Assistant Professor of Management
University of Akron
Akron, OH 44325
(216) 375-7037

Degree: DBA, Organization Theory &
Administration, 1975
Specialty: Organization Design
Assigned: AFBRMC (Wright-Patterson)

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New Jersey Institute of Technology
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Specialty: Automatic Control Systems,
Application of System Analysis to
Biomedical Engineering
Assigned: AFAMRL (Wright-Patterson)

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Associate Professor of Electrical Engineering
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Degree: PhD., Electrical Eng., 1972
Specialty: Control Systems
Assigned: AFWL (Kirtland)

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Dept. of Industrial and Systems Engineering
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(614) 422-2178

Degree: PhD., Industrial Eng., 1956
Specialty: Industrial Engineering,
Engineering Economics, Productivity
Improvement
Assigned: AFBRMC (Wright-Patterson)

Dr. Stephen E. Mudrick
Assistant Professor
Dept. of Atmospheric Science
University of Missouri-Columbia
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Degree: PhD., Meteorology, 1973
Specialty: Dynamic Meteorology,
Numerical Modeling of Atmosphere
Assigned: AFGL (Hanscom)

1979 PARTICIPANTS
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NAME/ADDRESS

DEGREE, SPECIALTY, & LABORATORY
ASSIGNMENT

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Associate Professor of Physics
Pacific Union College
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Degree: PhD., Physics, 1972
Specialty: Raman Spectroscopy &
Mie Scattering
Assigned: AFRPL (Edwards)
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Degree: PhD., Physical-Organic
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Specialty: Physical-Organic Chemistry,
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Assigned: AFATL (Eglin)
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DEGREE, SPECIALTY, & LABORATORY
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Degree: PhD., Mechanical Eng., 1970
Specialty: Structural Optmization
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[REDACTED]

Degree: PhD., Psychology, 1976
Specialty: Cognitive Psychology
Assigned: AFHRL/TTY (Lowry)
[REDACTED]

Degree: PhD., Electrical Eng., 1969
Specialty: Electromagnetics, Signal
Processing, Acoustics
Assigned: ESD (Hanscom)
[REDACTED]

Degree: PhD., Electrical Eng., 1966
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Physics and Technology, Solar
Cells, Semiconductor Crystal Growth,
III-V Compound Semiconductors,
Photodetectors, Microwave Devices,
Characterization of Semiconductors
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Degree: PhD., Environmental Science
and Eng., 1974
Specialty: Industrial Hygiene
Assigned: USAFSAM (Brooks)
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Degree: PhD., Educational Psychology,
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Specialty: Educational Psychology,
Cognitive Development
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Degree: PhD., Industrial Eng., 1977
Specialty: Operations Analysis,
Analysis of Capital Investment, Health
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1979 PARTICIPANTS

Page Nine

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DEGREE, SPECIALTY, & LABORATORY
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Degree: PhD., Electrical Eng., 1979
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Degree: PhD., Electrical Eng., 1964
Specialty: Systems (Decision
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Dr. Richard H. Tipping
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Degree: PhD., Physics, 1969
Specialty: Molecular Spectroscopy
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Dr. Pramod K. Varshney
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Electrical and Computer Engineering
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Degree: PhD., Electrical Eng., 1976
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Dr. Ghasi R. Verma
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Degree: PhD., Mathematics, 1957
Specialty: Mathematics
Assigned: AFFDL (Wright-Patterson)
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Dr. Ta-hsien Wei
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North Carolina A & T State University
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Degree: PhD., Physics, 1964
Specialty: Systems Engineering
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1979 PARTICIPANTS

Page Ten

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Dr. Gerald A. Woelfl
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DEGREE, SPECIALTY, & LABORATORY
ASSIGNMENT

Degree: PhD., Applied Math, 1948
Specialty: Electromagnetic Theory
and Applications
Assigned: AFAPL (Wright-Patterson)

Degree: PhD., Education & Business
Administration
Specialty: Systems Analysis and
Design, Electronic Data Processing
Assigned: AFHRL/PE (Brooks)

Degree: PhD., Physics, 1957
Specialty: Theoretical Physics,
Quantum Optics, Statistical
Mechanics
Assigned: AFRADC/ET (Hanscom)

Degree: PhD., Mechanical Eng., 1976
Specialty: Viscous Flow, Analytical
and Approximate Methods
Assigned: AFAEDC (Arnold)

Degree: PhD., Civil Eng., 1971
Specialty: Highway and Construction
Materials
Assigned: AFESC (Tyndall)

Degree: PhD., Physics, 1974
Specialty: Electrical Engineering
Materials
Assigned: AFAL (Wright-Patterson)

Degree: PhD., Organic Chemistry, 1949
Specialty: Coordination Chemistry,
Organic Chemistry
Assigned: AFAL (Wright-Patterson)

PARTICIPANT LABORATORY ASSIGNMENT

1979 USAF/SCEEE SUMMER FACULTY RESEARCH PROGRAM

AFAEDC **AIR FORCE ARNOLD ENGINEERING DEVELOPMENT CENTER**
(Arnold Air Force Station)
1. Dr. Warren Bowden - Rose-Hulman Institute of Technology
2. Dr. Charles Nuckolls - University of Central Florida
3. Dr. Dennis Wilson - University of South Carolina

AFHRL/PE **AIR FORCE HUMAN RESOURCES LABORATORY**
(Brooks Air Force Base)
1. Dr. Jane Rysberg - Ohio State University
2. Dr. Bronel Whelchel - Tennessee State University

USAFSAM **UNITED STATES AIR FORCE SCHOOL OF AEROSPACE MEDICINE**
(Brooks Air Force Base)
1. Dr. James Gessaman - Utah State University
2. Dr. John Lakey - University of Evansville
3. Dr. Stephen Rappaport - University of California

AFRPL **AIR FORCE ROCKET PROPULSION LABORATORY**
(Edwards Air Force Base)
1. Dr. Bill Mundy - Pacific Union College

AFATL **AIR FORCE ARMAMENT DEVELOPMENT AND TEST CENTER**
(Eglin Air Force Base)
1. Dr. Manuel Huerta - University of Miami
2. Dr. Frank Ingels - Mississippi State University
3. Dr. Allen Kelly - Oklahoma State University
4. Dr. Gordon Lee - Colorado State University
5. Dr. Maurice Neveu - State University College of Fredonia/NY
6. Dr. Walter Stanaland - University of Western Florida

AFRADC **AIR FORCE ROME AIR DEVELOPMENT CENTER**
(Griffiss Air Force Base)
1. Dr. Adel Aly - University of Oklahoma
2. Dr. James Cadzow - Virginia Polytechnic Institute/State Univ.
3. Dr. John Oldfield - Syracuse University
4. Dr. Pramod Varshney - Syracuse University

AFGL **AIR FORCE GEOPHYSICS LABORATORY**
(Hanscom Air Force Base)
1. Dr. Chi Hau Chen - Southeastern Massachusetts University
2. Dr. Michael Henschman - Brandeis University
3. Dr. Madhoo Kanal - Clark University
4. Dr. Steven Mudrick - University of Missouri/Columbia
5. Dr. Edwin Strother - Florida Institute of Technology
6. Dr. Richard Tipping - University of Nebraska/Omaha

AFRADC/ET **AIR FORCE ROME AIR DEVELOPMENT CENTER**
(Hanscom Air Force Base)
1. Dr. John Owens - University of Texas
2. Dr. Charles Willis - Boston University

PARTICIPANT LABORATORY ASSIGNMENT (Continued)

ESD ELECTRONICS SYSTEMS DIVISION
(Hanscom Air Force Base)
1. Dr. Douglas Preis - Tufts University

AFWL AIR FORCE WEAPONS LABORATORY
(Kirtland Air Force Base)
1. Dr. Clarence Bell - Texas Tech University
2. Dr. William Davis - Virginia Polytechnic Institute/State Univ.
3. Dr. John Foley - Mississippi State University
4. Dr. Donald Hanson - University of Mississippi
5. Dr. Jerrel Mitchell - Mississippi State University

AFHRL/TTY AIR FORCE HUMAN RESOURCES LABORATORY
(Lowry Air Force Base)
1. Dr. Steven Poltrock - University of Denver

SAMTEC/TOEI SPACE AND MISSILE TEST CENTER
(Patrick Air Force Base)
1. Mr. Barry Bullard - University of Central Florida

AFESC AIR FORCE ENGINEERING TECHNOLOGY OFFICE
(Tyndall Air Force Base)
1. Mr. Willard Fey - Georgia Institute of Technology
2. Dr. Paul Grogger - University of Colorado/Colorado Springs
3. Dr. William Gunther - University of Alabama
4. Dr. Gerald Woelfl - Marquette University

AFFJSRL AIR FORCE FRANK J. SEILER RESEARCH LABORATORY
(United States Air Force Academy)
1. Dr. William Carper - Wichita State University
2. Dr. Keith Koenig - Mississippi State University
3. Dr. Edgar Tacker - University of Houston

AFHRL/FTE AIR FORCE HUMAN RESOURCES LABORATORY
(Williams Air Force Base)
1. Dr. John Hadjilogiou - Florida Institute of Technology
2. Dr. Robert Kenyon - University of California

AFAL AIR FORCE AVIONICS LABORATORY
(Wright-Patterson Air Force Base)
1. Dr. Malcolm Calhoun - Mississippi State University
2. Dr. Aaron Collins - Tennessee State University
3. Dr. Rangaiya Rao - San Jose State University
4. Dr. John Wolfe - University of Houston
5. Dr. Richard Yalman - Antioch University

AFAMRL AIR FORCE AEROSPACE MEDICAL RESEARCH LABORATORY
(Wright-Patterson Air Force Base)
1. Dr. Jack Lee - Wright State University
2. Dr. Robert Lyng - Indiana Univ. - Purdue Univ./Ft. Wayne
3. Dr. Andrew Meyer - New Jersey Institute of Technology

PARTICIPANT LABORATORY ASSIGNMENT (Continued)

AFAPL

AIR FORCE AEROPROPULSION LABORATORY

(Wright-Patterson Air Force Base)

1. Dr. Garabet Gabriel - Notre Dame University
2. Dr. Ta-hsien Wei - North Carolina A&T State University
3. Dr. Herschel Weil - University of Michigan

AFBRMC

AIR FORCE BUSINESS RESEARCH MANAGEMENT CENTER

(Wright-Patterson Air Force Base)

1. Dr. Arlyn Melcher - Kent State University
2. Dr. Bonita Melcher - University of Akron
3. Dr. William Morris - Ohio State University

AFFDL

AIR FORCE FLIGHT DYNAMICS LABORATORY

(Wright-Patterson Air Force Base)

1. Dr. Yelagalawadi Acharya - West Virginia Tech
2. Dr. Donald Chiang - Rose-Hulman Institute of Technology
3. Dr. Keith Hagenbuch - Pennsylvania State Univ./Behrend College
4. Dr. Michael Pappas - New Jersey Institute of Technology
5. Dr. Ghasi Verma - University of Rhode Island

AFHRL/ASR

AIR FORCE HUMAN RESOURCES LABORATORY

(Wright-Patterson Air Force Base)

1. Dr. William Kane, Jr. - University of Western Carolina
2. Dr. William Ohley - University of Rhode Island

AFLC

AIR FORCE LOGISTICS COMMAND

(Wright-Patterson Air Force Base)

1. Dr. Michael Smith - Oregon State University

AFML

AIR FORCE MATERIALS LABORATORY

(Wright-Patterson Air Force Base)

1. Dr. Alan Edelstein - University of Illinois/Chicago Circle
2. Dr. Charles Hays - University of Houston
3. Dr. Prasad Kadaba - University of Kentucky
4. Dr. Nicholas Odrey - University of Rhode Island

APPENDIX II

1. Listing of Research Reports Submitted in 1979
Summer Faculty Research Program
2. Abstracts of 1979 Associates' Research Reports

RESEARCH REPORTS

1979 USAF-SCEEE SUMMER FACULTY RESEARCH PROGRAM

<u>VOLUME I</u> <u>Report No.</u>	<u>Title</u>	<u>Research Associates</u>
1	Thermodynamic and Aerodynamic Analysis of of High Speed Ejectors	Dr. Yelagalawadi Acharya
2	Optimum Design of Built-in-Test Diagnostic System	Dr. Adel A. Aly
3	Effects of Nuclear Blast Double Shock on Airborne Aircraft	Dr. Clarence A. Bell
4	Icing Testing with Models-Similitude Considerations	Dr. Warren W. Bowden
5	Shipboard Antenna Placement Optimization- (SAPO)	Mr. Barry D. Bullard
6	ARMA Spectral Estimation: An Efficient Closed Form Procedure	Dr. James A. Cadzow
7	A Study of Two Avionics Multiplex Simulation Models: SNS and MUXSIM	Dr. Malcolm D. Calhoun
8	Laser Candidate and Energetic Material Studies	Dr. William R. Carper
9	A Non-Linear Maximum Entropy Method for Spectral Estimation	Dr. Chi-Hau Chen
10	Computer Codes Applicable to the Determini- nation of Ejection Seat/Man Aerodynamic Parameters	Dr. Donald C. Chiang
11	Petri Net-Related Models for Avionics Systems	Dr. Aaron S. Collins
12	Bounding Signal Levels at Wire Terminations Behind Apertures	Dr. William A. Davis
13	Photoconductivity of Extrinsic Silicon	Dr. Alan S. Edelstein
14	System Analysis of the Environmental Tech- nical Information System (ETIS)	Mr. Willard Fey
15	The Uniqueness of Phase Retrieval From Intensity Measurements	Dr. John T. Foley
16	High Speed Electromagnetic Transients on Superconducting Coils	Dr. Garabet J. Gabriel

RESEARCH REPORTS (Continued)

<u>Report No.</u>	<u>Title</u>	<u>Research Associates</u>
17	Part I: Effects of Dehydration and Heat on Acceleration Response in Man Part II: Relationships Between Total Body Sweating Rate and Localized Sweating Rate	Dr. James A. Gessaman
18	The Utilization of Geothermal Resources at United States Air Force Bases	Dr. Paul K. Grogger
19	A Critical Evaluation of the USAF Methodology for Assessing the Socioeconomic Impact of Proposed Base Realignments	Dr. William D. Gunther
20	Analysis of the Advanced Simulator for Pilot Training (ASPT): Computer System Architecture	Dr. John Hadjillogiou
21	Optimized Holography of Microscopic Particles	Dr. Keith M. Hagenbuch

VOLUME II

22	Electromagnetic Diffraction by a Narrow Slit in an Impedance Sheet--E--Polarization	Dr. Donald F. Hanson
23	Part I: Technology Assessment on the Critical and Strategic Status of Tantalum Metal Part II: Technology Assessment Concerning the Current Status of Alloy and Coating Development Programs for Refractory Metal Systems Containing Cb, Mo, Ta, and W	Dr. Charles Hays
24	Gas Phase Reactions of Some Hydrated Ions	Dr. Michael J. Henchman
25	Detonation Physics of Nonideal Explosives with Analytical Results for Detonation Failure Diameter	Dr. Manuel A. Huerta
26	Cepstrum Analysis Techniques for Possible Applications to Seismic/Acoustic Ranging	Dr. Franklin M. Ingels
27	A NMR Study of Absorbed Water in the Anodized Oxide Layer and Paper Spacer of Electrolytic Capacitors	Dr. Prasad K. Kadaba
28	On Remote Sensing of the Atmospheric Temperature: An Analysis of the Discrepancy Between the Measured and Calculated Values of the Radiance	Dr. Madhoo Kanai
29	A Heuristic Model of Air Force Maintenance Performance	Dr. William Kane, Jr.

RESEARCH REPORTS (Continued)

<u>Report No.</u>	<u>Title</u>	<u>Research Associates</u>
30	An Evaluation of a Method for Assessing Aircraft Structural Damage from Multiple Fragment Impact	Dr. Allen E. Kelly
31	Groundwork for Oculomotor Research in Simulators	Dr. Robert V. Kenyon
32	Redesign of a Laser Doppler Velocimeter System for Unsteady, Separated Flow Studies	Dr. Keith Koenig
33	Electromyographic Correlates of Flight-Crew Performance	Dr. John R. Lakey
34	Investigation of Time-to-Go Algorithms for Air-to-Air Missiles	Dr. Gordon K. F. Lee
35	Some Statistical Analysis Issues for System Simulation Research	Dr. Jack C. Lee
36	Effects of Hydrazine on Pregnant ICR Mice	Dr. Robert D. Lyng
37	Organizational Analysis of an Acquisition Organization	Dr. Arlyn J. Melcher
38	Organizational Analysis of An Acquisition Organization	Dr. Bonita S. Melcher
39	Dynamics of Two-Dimensional Eye-Head Tracking	Dr. Andrew U. Meyer
40	Optimization of the Feed Forward Technique for Beam Control in the APT	Dr. Jerrel R. Mitchell
41	Predicting the Impacts of USAF Personnel Cuts	Dr. William T. Morris
42	Attempts to Simulate "Realistic" Atmospheric Motion with a Simple Numerical Model	Dr. Stephen Mudrick

VOLUME III

43	Plume Properties Measurement Research in a Solid Rocket Motor Exhaust	Dr. Bill Mundy
44	A Search for New Fuel Components in Non-Ideal Explosives Mixtures	Dr. Maurice C. Neveu
45	Vibration Diagnostics for Turbofan Engines	Dr. Charles E. Nuckolls
46	Goal Programming: Functional Decomposition and Consideration Within an Integrated Computer-Aided Manufacturing Decision Support System (IDSS)	Dr. Nicholas G. Odrey

RESEARCH REPORTS (Continued)

<u>Report No.</u>	<u>Title</u>	<u>Research Associates</u>
47	A Computer Model of Saccadic Suppression	Dr. William J. Ohley
48	Special-Purpose Processors for the Image-Processing Requirements of Automatic Feature Extraction Systems	Dr. John V. Oldfield
49	Magnetostatic Wave Decay and Filter Devices	Dr. John M. Owens
50	Improved Methods for Large Scale Structural Synthesis	Dr. Michael Pappas
51	Educational Implications of Cognitive Research on Imagery	Dr. Steven E. Poltrock
52	Adaptive Signal Processing for Array Antennas	Dr. Douglas Preis
53	Deep Levels in $\text{Al}_x\text{Ga}_{1-x}\text{As}$	Dr. Rangaiya A. Rao
54	Development of Air-Sampling and Analytical Method for Diisocyanates	Dr. Stephen M. Rappaport
55	Civilian Appraisal System	Dr. Jane A. Rysberg
56	A Study of Opportunistic Maintenance Policies for the F100PW100 Aircraft Engine	Dr. Michael C. Smith
57	Error Analysis for a Radio-Frequency Systems Simulation Facility	Dr. Walter D. Stenaland
58	A High Altitude Tethered Aerostat System Study	Dr. Edwin F. Strother
59	Pattern Recognition/Image Processing in Optical Tracking	Dr. Edgar C. Tacker
60	Atmospheric Absorption of Radiation by H_2O and CO	Dr. Richard H. Tipping
61	Study and Evaluation of SIIDS and ADPT Systems	Dr. Pramod K. Varshney
62	Stability Analysis of the Lower Branch Solutions of the Falkner-Skan Equations	Dr. Ghasi R. Verma
63	Inductance Matrix of a Permanent Magnet Alternator	Dr. Ta-hsien Wei
64	Analysis for Coherent Anti-Stokes Raman Spectroscopy (CARS)	Dr. Herschel Weil

RESEARCH REPORTS (Continued)

<u>Report No.</u>	<u>Title</u>	<u>Research Associates</u>
65	An Investigation of One and Three Parameter Item Response Models with Implications for Computerized Adaptive Testing	Dr. Bronel R. Whelchel
66	Modulated Spontaneous Raman Effect for Laser All-Optical Frequency Standards	Dr. Charles R. Willis
67	Unsteady Laminar Boundary Layers Due to Transverse Cylinder & Free Stream Oscillations	Dr. Dennis E. Wilson
68	Response of Airfield Pavement to Large Magnitude Dynamic Loads	Dr. Gerald A. Woelfl
69	Analysis of the Role of High Brightness Electron Guns in Lithography	Dr. John C. Wolfe
70	Impurities in Communications Grade GaAs	Dr. Richard G. Yalman

ABSTRACT

Thermodynamic and Aerodynamic Analysis

of

High Speed Ejectors

by

Y.V.G. Acharya

Ejectors have been used for quite a long time for pumping fluids. While the approximate performance of ejectors is well known due to a variety of tests from which engineering designs have evolved, there is yet quite a lot of unknown areas in the analytical design of ejectors. An early attempt by the author⁽¹⁾ gave some insight into the incompressible ejector. The bibliography of work done during the intervening period is quite long⁽²⁾

Recently the problem has been further investigated⁽⁴⁻⁶⁾ and the present study is a reevaluation of the efficiency and the thrust augmentation of high speed ejectors. A brief introduction is given; after which the problem for one dimensional flow including turbulence and friction is stated and the general equations derived.

These equations are solved by lumping together the effect of the turbulence and friction by a friction factor. These solutions can be considered as only a first approximation.

Actually one has to take into account the effects of compressibility on the turbulence factors as well as the effect of structure of the flow for supersonic jets and its interaction with the boundary layer. These are left for a later investigation.

OPTIMUM DESIGN OF BUILT-IN-TEST DIAGNOSTIC SYSTEM

By

ADEL A. ALY

ABSTRACT

In this report, the problem of cost effective design of diagnostic and fault isolation procedures for BIT systems is investigated. The cost of BIT varies from a group of LRU's to another; also the probability of failure for LRU's within the module are different. The problem is to find the optimum sequence of tests (BIT) to be executed to isolate a failed unit such that the expected cost is minimized.

An optimum procedure based on Branch-and-Bound concept are developed. Several dominance and reductions rules are introduced. A small example is solved to demonstrate the efficiency of the developed algorithm.

EFFECTS OF NUCLEAR BLAST
DOUBLE SHOCK ON AIRBORNE AIRCRAFT

by

Clarence A. Bell

ABSTRACT

The response of aircraft to nuclear blasts is of considerable importance. Blast input from bombs detonated above ground consists of a primary blast and a reflected blast. This report describes studies of response of aircraft to two blast inputs, the first from the primary blast and the second from the reflected blast, which occur within a short time interval. Preliminary analyses indicate that response may be more severe when determined from a two-blast analysis.

ICING TESTING WITH MODELS - SIMILITUDE CONSIDERATIONS

by

Warren W. Bowden

ABSTRACT

Research on icing, anti-icing, and/or de-icing of aircraft surfaces would be less expensive and more flexible if it could be done using small-scale models. The reliable scale-up of test results from models depends, in theory, whether or not similitude can be maintained between the full scale equipment and its model.

The author (a) surveyed the literature on the application of similitude and the use of models in icing-, anti-icing- and de-icing- testing; (b) collected together the most valuable work on this subject; and (c) reviewed it critically with the aim of developing practical procedures for scaling up test results from models.

The conclusions resulting from this review are as follows:

(1) Most of those who have studied the use of models, scale-up and similitude in icing/anti-icing/de-icing of aircraft surfaces conclude that it is possible to scale up results from models.

(2) However, some authors express doubts whether valid scale-up is possible.

(3) Experimental data confirming (or disproving) valid scale-up are limited, mostly qualitative and not at all convincing one way or the other.

The author made recommendations as follows:

(1) Initiate a research program to establish whether or not icing, anti-icing and/or de-icing on models can be scaled up.

(2) Set up test equipment so as to maximize flexibility in the choice of individual test objectives.

(3) Develop computer programs to aid in the establishment of test conditions for models and the scale-up (or scale-down) of design data.

Contacts with NASA-Lewis makes it appear that a cooperative venture in this area between NASA-Lewis and Arnold Center is possible.

SHIPBOARD ANTENNA PLACEMENT OPTIMIZATION - (SAPO)

by

Barry D. Bullard

ABSTRACT

A search was conducted to determine the most accurate and available means for optimum top-side antenna placement aboard Advanced Range Instrumentation Ships (ARIS). The goal of the search was to develop a user-oriented computer program of shipboard antenna placement optimization for use by TOEIS engineers at the Air Force Eastern Test Range. It was determined that for electromagnetic compatibility considerations (near-field), the computer algorithms PECAL/DECAL represented the bases for the best technique. The Numerical Electromagnetic Code (NEC) was determined to represent the best technique for the analytical calculation of antenna far-field radiation patterns in complex shipboard environment. Utilization of NEC in the determination of antenna placement for optimum far-field characteristics is discussed.

ARMA SPECTRAL ESTIMATION:
AN EFFICIENT CLOSED FORM PROCEDURE

by
James A. Cadzow

ABSTRACT

In this report, a method for generating an ARMA spectral estimate from a finite set of observations of a random time series is presented. The method's development is based upon a fundamental recursive relationship which characterizes the autocorrelation sequence of a time series that possesses a rational spectrum. When statistical estimates of the autocorrelation elements (obtained from the given time series observations) are substituted into this fundamental relationship, a set of equation errors results. The optimum ARMA spectral estimate is obtained by selecting relevant coefficients so as to minimize a quadratic functional of these equation errors. In examples treated to date, this ARMA spectral estimator has provided significantly superior performance when compared with the maximum entropy method.

A STUDY OF TWO AVIONICS MULTIPLEX SIMULATION MODELS: SNS AND MUXSIM

by

Malcolm D. Calhoun

ABSTRACT

Simulation is an invaluable aid in the development of Avionic Systems as required by the United States Air Force. To this end, the Air Force Avionics Laboratory (AFAL) at Wright-Patterson Air Force Base, Ohio has developed two simulation models to assist in the evaluation of multiplex avionics systems: (1) Multiplex Simulator (MUXSIM), and (2) System Network Simulator (SNS). A lack of utilization of these models led to the study reported herein. This paper describes the methods of use of these two simulators; also, attributes and deficiencies of the simulators are delineated. Included in the report is a literature survey of related simulation efforts. Since a major part of this study was devoted to utilization of MUXSIM and SNS, a User's Guide is included in the Appendix. Recommendations for further work on the simulators is included in the report.

LASER CANDIDATE AND ENERGETIC MATERIAL STUDIES

by

William Robert Carper

ABSTRACT

The search for a chemical laser operating in the visible and ultraviolet spectral regions has been extended to SeF and TeF. The flame emission spectrum has been obtained and a vibrational analysis completed for both compounds. The spectroscopic analysis indicates that the internuclear distances vary considerably between the ground and excited states of SF, SeF and TeF. The results support the concept of SeF and TeF as potential laser candidates.

The energetic materials, RDX and HMX have been analyzed by mass spectral and ESR studies to determine their mode of thermal decomposition. The evidence supports the formation of gaseous free radical chains which are highly reactive and volatile. Future studies in this area are suggested.

A NON-LINEAR MAXIMUM
ENTROPY METHOD FOR
SPECTRAL ESTIMATION

by

C. H. Chen

ABSTRACT

The increased demand for high resolution spectral analysis makes it necessary to improve the popular Burg's maximum entropy method for spectral estimation. This report describes the computer implementation of a non-linear method proposed by P. F. Fougere for spectral estimation, which provides not only a much higher resolution than the Burg's method but also removes the line-splitting phenomenon for sinusoidal signals. Particular emphasis is placed on the complex signals as the real signals can be considered as a special case of complex signals. After a brief introduction of the method, computer results are presented which clearly illustrate the superiority of the non-linear method. The problems of parameter selection and computational complexity are examined. Suggestions for further research on this method are also given.

COMPUTER CODES APPLICABLE TO THE DETERMINATION

OF

EJECTION SEAT/MAN AERODYNAMIC PARAMETERS

by

DONALD C. CHIANG

ABSTRACT

A careful survey of computer codes applicable to the determination of ejection seat/man aerodynamic parameters was carried out. The current state of the art capability in computational aerodynamics was identified through an integration of several means including Defence Documentation Center (DDC) literature search, consultation with concerned industry and government agency, inputs from individuals interested in the subject as well as survey of research literature at large. Several computer program codes from government sources were found to be applicable. They range in scope from relatively simple to highly sophisticated, from an engineering tool to a research oriented program. But a considerable amount of preliminary work is required before these computer codes can be applied to the ejection seat/man configuration. Suggestions for further research in this area are also included.

PETRI NET-RELATED MODELS FOR AVIONIC SYSTEMS

by

Aaron S. Collins

ABSTRACT

Avionic systems are evolving toward concurrent processing computer architectures, and digital technology is becoming more functional in structure as very large scale integration continues to progress. Petri nets and Petri net-related models have been proposed as functional models for the design, simulation, and analysis of integrated hardware-software systems, particularly those which involve concurrent processing. Petri nets, LOGOS, the SARA Graphic Model of Behavior (GMB), Evaluation nets, and colored Petri nets were studied and compared, and an avionic subsystem was partially modelled. It was concluded that the combination of the GMB format restricted to LOGOS primitive structure would be of more general use than any of the individual models studied.

BOUNDING SIGNAL LEVELS AT WIRE TERMINATIONS BEHIND APERTURES

by

William A. Davis

ABSTRACT

This report develops techniques for bounding the voltages and currents at terminations on a wire which is excited by incident electromagnetic energy coupled through an aperture. The internal interaction and coupling problems are considered. The theory of aperture coupling for low frequencies is reviewed and the quasi-static aperture problem is modeled by dipole moments and the corresponding polarizabilities. Bounding methods are considered and the bound of an inscribing ellipse is chosen. The interaction with a wire and modifications to the coupling are developed using spatial approximations. The analysis identifies a new capacitive term in the aperture loading. Bounds are developed for the power waves launched on the wire structure and the termination signal levels bound with a term included for multiple reflections. Tighter bounds are obtained by separating the incident field into individual parts typically characterized by poles in the complex frequency domain.

PHOTOCONDUCTIVITY OF EXTRINSIC SILICON

by

Alan S. Edelstein

ABSTRACT

As part of a materials characterization program on extrinsic Si we have developed a photoconductivity apparatus. We have tested the system by measuring the temperature dependence of the photocurrent and ionization energy of the holes in In doped Si for In at 20K and found that the long wavelength cut off occurs at $8.37 \pm 0.3 \mu\text{m}$. This technique has the advantage of being very sensitive and can be applied to both the donor and acceptor levels. Another possible application of the technique is given.

SYSTEM ANALYSIS OF THE
ENVIRONMENTAL TECHNICAL INFORMATION SYSTEM (ETIS)

by

Willard Fey

ABSTRACT

The Environmental Technical Information System (ETIS) was developed to assist planners and base engineers in complying with the National Environmental Policy Act and the Air Force and Army regulations relating to it. As an on-line, efficient, simplified-format guide, it is effective in supporting environmental impact assessment and reporting. As the system's usage expands and its capabilities are broadened to include pollution abatement reporting, the experimental, non-standard format of the system becomes less acceptable. This report attempts to evaluate the present ETIS configuration and to review its future possibilities. Recommendations are then made to encourage lower development and operating costs, greater task effectiveness, and broader utilization. A multiservice, consolidated environmental data management and analysis system is suggested. Its operation would be similar to that of ETIS, but would be written in a military standard language, be located to utilize computer communications network connections, and be operated within the military with data management support from professional groups. The consolidated system would be developed in small self-sustaining increments over a five year period to avoid disruptive changes, major expenditures and impractical operations.

The consolidated environmental system could then provide environmental data and analyses inputs to an Air Force comprehensive planning assistance program. This would relate and evaluate the environmental, financial, energy, personnel and facilities resources and constraints so that base project and command realignment proposals could be compared and their feasibility tested on-line. The comprehensive planning system requirements could serve to clarify and unify the objectives and activities of the AF Engineering and Services Center divisions which presently analyse many aspects of planning and operations.

THE UNIQUENESS OF PHASE RETRIEVAL
FROM INTENSITY MEASUREMENTS

by

John T. Foley

ABSTRACT

The question of the uniqueness of the determination of the phase of a wavefield from the knowledge of its intensity in the aperture plane and focal plane of a thin lens is investigated. It is shown that if the wavefield intensity across the lens is uniform and the phase is represented by means of the nine lowest order Zernike polynomials, that the phase can be determined uniquely (except for the well-known twin solution ambiguity) from its focal plane intensity. The twin ambiguity is discussed in physical terms which allow one to eliminate it. Similar results are obtained for a Gaussian distribution of intensity in the aperture. Suggestions for further research in this area are offered.

HIGH SPEED ELECTROMAGNETIC TRANSIENTS

ON SUPERCONDUCTING COILS

by

G. J. Gabriel .

ABSTRACT

Superconducting coils are prime candidates for energy storage in pulsed high power applications, where electromagnetic transients play an important role. An investigation of such transients on a Nb-Ti coil at 10°K, 77°K and room temperature were carried out utilizing reflections when the coil is excited by low power pulses having 10 nsec duration. While the theoretical and experimental results are preliminary, they verify the role of turn-to-turn coupling and suggest the need for further investigations on a more refined and elaborate scale. The experimental data tentatively support the viewpoint of a coil as a multi-conductor coupled transmission line.

PART I: EFFECTS OF DEHYDRATION AND
HEAT ON ACCELERATION RESPONSE IN MAN

by

J. A. Gessaman

ABSTRACT

The G-tolerance of two subjects was tested at air temperatures of 18°C and 40°C under normal hydration and 3% dehydration conditions. Two centrifuge acceleration stress profiles were employed: 1. A gradual onset of 1 G/15 sec without an anti-G suit and 2. a SACM II profile with an anti-G suit. In the absence of dehydration both subjects performed better at 40°C than at 18°C on the SACM II profile. Both subjects were significantly less tolerant to G stress when dehydrated.

PART II: RELATIONSHIPS BETWEEN TOTAL
BODY SWEATING RATE AND LOCALIZED SWEATING RATE

by

J. A. Gessaman

ABSTRACT

Water loss by sweating in hot environments is a useful index of heat stress. Nude weight loss is the most direct method of measuring water loss but is an impractical method in many aerospace environments. I evaluated the accuracy of predicting whole body sweat rates from local sweat rates measured on the forearm, forehead, chest, thigh and leg during exercise and at rest. During exercise the observed values averaged 15% more than the predicted and at rest the observed values averaged 37 % more. The factors contributing to these discrepancies is discussed.

THE UTILIZATION OF GEOTHERMAL RESOURCES

AT UNITED STATES AIR FORCE BASES

by

P. K. Grogger

ABSTRACT

The use of geothermal energy is one of the few energy sources which may be an answer to our present and future energy crisis.

The Air Force installations on the continental United States as well as Alaska and Hawaii, were evaluated as to the possibility of utilizing geothermal energy to develop electricity, produce process steam, or heat and/or cool buildings. Twenty-five bases have suspected geothermal resources available. Because of either need and available technology seven installations were rated priority I, six were rated priority II and priority III and IV totaled ten.

Geological and geophysical data indicate further investigation of the priority I installations, Saylor Creek Range, Idaho, Ellsworth AFB, South Dakota, Charleston AFB, South Carolina, Kirtland AFB, New Mexico, Vandenberg AFB, California, Luke AFB, Arizona, and Williams AFB, Arizona, should be accomplished as soon as possible.

The use of geothermal energy will decrease the need for fossil fuels by the USAF and during times of short supply allow such fuels to be used for the Air Force's primary mission, military defense.

A CRITICAL EVALUATION OF THE USAF METHODOLOGY FOR ASSESSING
THE SOCIOECONOMIC IMPACT OF PROPOSED BASE REALIGNMENTS

by

William D. Gunther

ABSTRACT

The Air Force Engineering Services Center is considering the adoption of a computer-based socioeconomic impact model for all their impact statements. This model, developed by SRI International analyzes both "loser" and "gainer" installations and evaluates employment, income, population, and housing attributes. Additional attributes are evaluated in a series of hand calculations, but these are not part of the computer based model.

This paper critically evaluates the "loser" portion of the proposed methodology and makes a series of recommendations. The objective of each recommendation is to provide either documentation for a particular approach taken, or to restructure a section which in the researcher's view, is questionable.

ANALYSIS OF THE ADVANCED SIMULATOR FOR PILOT TRAINING (ASPT):
COMPUTER SYSTEM ARCHITECTURE

by

Dr. John Hadjilogiou

The goal of this research was to investigate the matter of reliability in a class of distributed information processing systems composed of highly autonomous nodes, e.g. CPU's, connected through common-shared memory modules. Distributed systems are often claimed to be inherently more reliable than systems based on a large central processor. That is, given that a distributed system is properly designed, it offers better reliability. This claim is based on several factors. First, distributed systems by their very nature provide opportunities for redundancy. Second, error propagation is restricted by physical separation of processes and resources. And finally, individual nodes in the distributed system may be less complex than a large central processor and, as a result, ought to have lower probability of failures. Basically, distributed systems have a potential for being more reliable than systems based on a large central processor; however, this potential needs to be exploited through proper design.

Reliability of an information processing system is not merely a question of the hardware components. Software errors, synchronization failures, and errors of the human users must be anticipated and handled gracefully. The only way to design a reliable system is to make it "fault-tolerant", or robust in the face of a large variety of internal failures and misuse.

This report documents the engineering design and development of the ASPT general purpose computer system in its present configuration and contains recommendations for future modification and expansion.

OPTIMIZED HOLOGRAPHY OF MICROSCOPIC PARTICLES

BY

K. M. Hagenbuch

ABSTRACT

A systematic application of holographic geometries leads to optimized optical systems for producing high resolution holograms of particles in the size range 10-50 microns. It is found that where as in-line geometry with pmagnification of the dust is the simplest experimentally to employ, off-axis image plane holograms give the highest resolution with lowest noise. Loss of contrast in double exposure holograms is counteracted by image subtraction both in the recording and in the reconstruction process. Recommendations for additional research are made.

ELECTROMAGNETIC DIFFRACTION BY A NARROW SLIT

IN AN IMPEDANCE SHEET--E-POLARIZATION

by

Donald F. Hanson

ABSTRACT

Composite materials have come into use lately in aircraft construction because of their high strength and low weight. This report examines the shielding effectiveness of a narrow slit in a composite material. This corresponds to a joint or seam between two composite panels. For low frequency incident fields, the composite can be effectively modelled as an infinitely thin impedance sheet. The literature on impedance sheets is reviewed and a general integral equation formulation for impedance sheets is described. Since only narrow slits (seams) are of practical interest, a quasi-static (low frequency) approach is developed. The solution to the problem is expressed as series of integrals of Chebyshev or Legendre polynomials. This gives preliminary results for this problem. Suggestions for further work are given which will make the results given here useful in engineering.

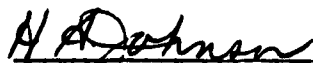
Part I:
Technology Assessment
on the Critical and Strategic
Status of Tantalum Metal

ABSTRACT

Because of a deep concern about the limited supply of tantalum resources for the Aerospace industry, the possible formation of tantalum cartels and overt political activities by some tantalum-rich nations, this study on the tantalum situation was initiated and thereby justified. Although of short duration and limited scope, this study attempts to focus on the tantalum problems that face primarily the Aerospace industry of today and in the future. Specific recommendations are given with the intention that these suggestions might lead to some definite undertakings for meeting the projected needs for tantalum metal.

August 1979

Approved:


H. A. Johnson, Chief
AFML/LTM
WPAFB, Ohio 45433


Dr. Charles Hays
Summer Faculty Research Associate
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Part II:
Technology Assessment
Concerning the Current Status of
Alloy and Coating Development Programs
For Refractory Metal Systems
Containing Cb, Mo, Ta and W

ABSTRACT

Because of an ever increasing demand for improved materials with better serviceability at higher operating temperatures, this report evaluates the literature on Cb, Mo, Ta and W to determine the status for alloy development and coating development programs. Although of short duration and limited scope, this report reviews the work done on refractory alloys and coatings through collective examinations for greater dissemination of information that is not, generally, well known. The detailed findings of a massive Computer-Aided-Literature search are presented and specific recommendations are also given.

August 1979

Approved:


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GAS PHASE REACTIONS OF SOME HYDRATED IONS

Michael J. Henchman

ABSTRACT

As major positive ion constituents of the stratosphere and mesosphere, the hydrated oxonium ions, $\text{H}_3\text{O}^+ \cdot n\text{H}_2\text{O}$, are of considerable interest. These ions together with the complementary negative ions $\text{OH}^- \cdot n\text{H}_2\text{O}$, are also important in aqueous solution chemistry. Using isotopically labeled reactants and a double mass spectrometer system, we have studied the gas phase reactions of the simpler members of these series of ions, i.e. H_3O^+ , OH^- , and $\text{OH}^- \cdot \text{H}_2\text{O}$, with neutral water molecules in the range of interaction energies from a few tenths of an electron volt up to a few electron volts. The results indicate that, under the energetic beam conditions of this work, both direct proton transfer and some incomplete scrambling of atomic constituents occurs in the reactions of H_3O^+ with water, with increasing tendency toward direct transfer at higher energies. Earlier work at thermal energies showed that direct proton transfer did not occur, and that isotopic scrambling in the intermediate complex was complete. Under beam conditions, proton transfer in the reactions of OH^- and $\text{OH}^- \cdot \text{H}_2\text{O}$ with water is found to involve a direct reaction, without scrambling in an intermediate complex. These results can be rationalized in terms of the reaction energetics and the number of energy minima in the reaction coordinate diagram.

**DETONATION PHYSICS OF NONIDEAL EXPLOSIVES WITH
ANALYTICAL RESULTS FOR DETONATION FAILURE DIAMETER**

by

Manuel A. Huerta

ABSTRACT

The main causes of nonideal behavior in explosives are examined. An elaboration of the ZND model for 1-dimensional steady detonations is presented as a reference frame from which to examine the effects of reversible chemical reactions endothermic reactions, etc. Mathematical models for 2-dimensional detonations are studied and a preliminary analytical method of solution is presented. The method provides analytical expressions for the detonation failure diameter in terms of the parameters of the detonation. The results obtained help to clarify previous results obtained by other authors using numerical methods. Suggestions for further research are given.

CEPSTRUM ANALYSIS TECHNIQUES FOR POSSIBLE APPLICATIONS
TO SEISMIC/ACOUSTIC RANGING

by

Franklin M. Ingels

ABSTRACT

The use of mines implanted by airdrop for target location, identification and destruction is a topic of current interest in the Air Force. The sensors for such mines must be capable of locating and identifying the target, but must also be capable of deciding whether the target is within range.

Multiple sensors may be used to determine the range, however, the geometry of emplacement, a factor which is critical to the range calculation, is difficult to control when implanting from the air. Using one sensor, it is possible to determine range if two signals are received which arrive from different modes of propagation. One is also faced with the signal processing algorithm if one sensor is used, since the two signals are in essence summed together.

Cepstral analysis offers the potential to determine the differences in time of arrival of two signals detected with the same sensor.

This report describes cepstral analysis, illustrates some results obtained for various synthetic signals, and comments on the limitations and possible applications of cepstral analysis for the ranging problem.

A NMR STUDY OF ADSORBED WATER IN THE
ANODIZED OXIDE LAYER AND PAPER SPACER OF
ELECTROLYTIC CAPACITORS

by

Prasad K. Kadaba

ABSTRACT

The nature of adsorbed water in the anodized oxide layer and the paper spacer of electrolytic capacitors has been studied, primarily, through Nuclear Magnetic Resonance (NMR) measurements. Thermogravimetric analysis (TGA) of the anodized aluminum foil has also been carried out with a view to corroborate the NMR data. ^1H signal from the paper spacer is much stronger than that from the sealed anodized aluminum sample. The signal from the anodized sample shows a narrow peak and a doublet. The narrow peak is, probably, due to rapidly diffusing water molecules and the doublet due to immobilized water. The signal from the paper sample did not show any splitting and had a line width of 0.07 gauss. The activation energy corresponding to motional diffusion of adsorbed water molecules in the paper sample is 9.2 Kcal./mole. Suggestions for further research in this area with a view to delineate the detailed molecular dynamics of the adsorbed water molecules are given. A brief discussion of the Maxwell-Wagner model of dielectric polarization effect relating to the capacitor is also given.

ON REMOTE SENSING OF THE ATMOSPHERIC TEMPERATURE:
AN ANALYSIS OF THE DISCREPANCY BETWEEN THE MEASURED
AND CALCULATED VALUES OF THE RADIANCE

by

Madhoo Kanai

ABSTRACT

An attempt is made to analyze the discrepancy between the measured values and calculated values of the radiance. In the ground truth analysis of the satellite temperature sounding of the atmosphere by the Defense Meteorological Satellite, McClatchey of AFGL has shown that the discrepancy is of systematic nature. A possible explanation has been suggested by Dr. J. King of AFGL that in the calculated values of the radiance a black body type of a radiator may not represent the appropriate source function for the equation of transfer. Following that suggestion, we have derived the appropriate equation relating the discrepancy of the radiance to the deviation of the source function from the black body function. Some specific examples of possible techniques for the source function are suggested based on expansions about the e-folding pressure level. The e-folding pressure is defined as the quantity $P^* = K_v^{-1}$, where K_v is the averaged absorption coefficient. In particular, the direct approximation is obtained by replacing the transmittance function by a delta function. In that case, we show that the deviation of the radiance is exactly equal to the deviation of the source function from the black body function.

A HEURISTIC MODEL OF AIR FORCE MAINTENANCE PERFORMANCE

by

William D. Kane, Jr., Ph.D.

ABSTRACT

The economic and political pressures on defense spending have Air Force managers seeking ways to fulfill mission requirements at lower costs. Since a substantial proportion of the defense budget is spent on maintenance, increases in efficiency in this area have a strong payoff potential. This effort was designed to produce a model of Air Force maintenance with which a larger effort to research maintenance performance would begin. The model was to be one which would lend itself to changes over time due to feedback from ongoing research. The original intent has been realized and a systems thinking model of individual maintenance performance has been developed up to the testing stage. The uniqueness of the model stems from its inverted approach as it focuses on optimizing individual outcomes by displaying the organization as inputs to the individual. The technician is the throughput stage within which the individual exerts effort and displays coping behaviors. The output stage is system performance in two dimensions--effectiveness and efficiency.

AN EVALUATION OF A METHOD FOR ASSESSING
AIRCRAFT STRUCTURAL DAMAGE FROM
MULTIPLE FRAGMENT IMPACT

by

A. E. Kelly

ABSTRACT

The finite element method was proposed for the evaluation of residual strength of damaged aircraft structures (1). Implementation of the method was by the general purpose finite element program NASTRAN. In this report the analysis procedure is reviewed and the method for structural analysis is evaluated. Results from the analysis of a 14-bar truss may be used as a guide to evaluate the accuracy of the method to predict the response of damaged structures. Recommendations are made for the use of the differential or geometric stiffness method for structural analysis, as well as the development of test data to validate the methodology.

GROUNDWORK FOR OCULOMOTOR RESEARCH IN SIMULATORS

by

Robert V. Kenyon, Ph.D.

ABSTRACT

Eye position and eye movement information reflect the processing of visual and vestibular information as well as higher cognitive processes in the human operator. Oculomotor behavior, such as that exhibited by experienced pilots, can aid researchers in understanding the human processing of various sensory inputs necessary to perform highly skilled motor coordination tasks. Few simulators currently possess the capability to record oculomotor information. This report concerns the development of this capability in the Williams AFB Advanced Simulator for Pilot Training (ASPT). Essential parameters to consider in augmenting simulator capabilities are outlined. Status on implementation of eye position recording system in the ASPT is reported.

REDESIGN OF A LASER DOPPLER VELOCIMETER SYSTEM FOR

UNSTEADY, SEPARATED FLOW STUDIES

by

K. Koenig

ABSTRACT

As part of a detailed investigation of the flow field about wings undergoing large amplitude, unsteady motions, a two-component laser Doppler velocimeter (LDV) has been assembled at the Frank J. Seiler Research Lab. Operational difficulties, however, have necessitated a redesign of the system configuration and optical components. This report outlines the system, its difficulties and the proposed reconfiguration. Also included are detailed discussions on pertinent optical considerations, especially concerning changes in polarization upon reflection and refraction and characteristics of prisms. The final design for the LDV system features a stacked arrangement in which the laser and optics are horizontal with the optics above the laser. The four beams are turned through 90° and brought, parallel, down to the final focusing lens which forms the desired probe volume in the wind tunnel test section. This design should be nearly optimal in terms of ease of operation, measurement accuracy, ease of construction and structural rigidity.

ELECTROMYOGRAPHIC CORRELATES

OF

FLIGHT-CREW PERFORMANCE

by

J.R. Lakey

ABSTRACT

A tutorial review is presented concerning the application of electromyographic techniques to flight-crew assessment problems. Basic physiologic and human-factors perspectives are reviewed to furnish acquaintance with underlying assumptions of such application. It is suggested that current clinical electromyography provides an easily adaptable technology for initial application attempts.

A survey of that electromyographic research related to performance factors reveals remarkable consistent findings that encourages the application of these techniques to flight workload and fatigue problems of immediate Air Force concern. General recommendations are offered toward the successful development of this application.

INVESTIGATION OF TIME-TO-GO ALGORITHMS
FOR AIR-TO-AIR MISSILES

by

Gordon K. F. Lee

ABSTRACT

The design of optimal controllers for air-to-air missiles has resulted in much interest. Many control laws require knowledge of a good estimate of the time-to-go (tgo) before intercept. This report presents an algorithm for estimating time-to-go using the current relative position and velocity characteristics of the missile and target. By constructing an objective function representing terminal miss distance, one is able to obtain an iterative scheme for estimating tgo. Simulation studies using a smart target algorithm and this methodology have yielded good results which show improvement over conventional algorithms for estimating tgo. A comparative investigation of the methodology developed in this report with other algorithms is presented.

SOME STATISTICAL ANALYSIS ISSUES
FOR SYSTEM SIMULATION RESEARCH

by
Jack C. Lee

ABSTRACT

Some issues concerning system simulation research are posed and some preliminary results are given. Suggestions for further research are also given.

Effects of Hydrazine on Pregnant ICR Mice

by

Robert D. Lyng

ABSTRACT

As more women enter jobs formerly held by men there is a risk that exposure to some chemicals may cause birth defects in an unborn child. To determine the teratogenic potential of a chemical, it is frequently necessary to test the compound in more than one animal species. The objective of this project was to determine the usefulness of ICR Mice as a test species. Hydrazine was injected intraperitoneally on days 6,7,8 and 9 of gestation at concentrations of 4, 12, 20, 30 and 40 mg/kg body weight. Physiological saline was administered in the same manner to a control group. Hydrazine in concentrations up to 20 mg/kg body weight had no significant effect on the number of implantations per female, the mean number of viable fetuses per litter or the mean number of resorptions per litter. At concentrations of 30 and 40 mg/kg hydrazine was fetotoxic and 4 of 21 females died at a concentration of 40 mg/kg. As the dose was increased from 4 to 30 mg/kg there was an increasing percentage of litters with soft tissue anomalies with exencephaly and hydronephrosis produced most often. Skeletal abnormalities were produced at a higher frequency and at lower concentrations than soft tissue abnormalities. Supernumerary ribs accounted for most of these defects. Pregnant mice receiving 12 and 20 mg/kg showed a lower rate of weight gain during the injection period than those receiving saline or 4 mg/kg. After the injection period, from days 9 through 11, the mice receiving 12 and 20 mg/kg had the highest rate of gain.

ORGANIZATIONAL ANALYSIS OF AN ACQUISITION ORGANIZATION

by

Arlyn J. Melcher

and

Bonita S. Melcher

ABSTRACT

An empirical study was made of the factors impacting upon the functioning of an operating unit in the government involved in carrying out the complex task of purchasing nonroutine products and services. The study was directed at the questions of (1) In what way does the technology of the job and design of the managerial system impact upon organizational processes and mission statement? (2) How have changes in workload and cuts in manpower affected the functioning of the organization and mission attainment?

The methodology was to apply Melcher's structural-process model to the analysis of the organization. Data was collected with standardized questions, interviews and with observations of the ongoing operations. The study and a more detailed supplement (2) concluded that level of efficiency and mission attainment of the operating purchasing unit was sharply impeded by a combination of structural arrangements. These included over centralization, rapid policy changes where local personnel had little opportunity to provide input on proposed changes, civil service regulations that impeded proper staffing of positions and motivation of personnel, and reductions in manpower staffing where the unit had little discretion in adapting to the manpower cuts. Proposals were made to improve the functioning of the operating purchasing unit, while retaining some of the constraints needed to achieve coordination among a wide variety of purchasing units.

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DYNAMICS OF TWO-DIMENSIONAL EYE-HEAD TRACKING

by

Andrew U. Meyer

ABSTRACT

This project is concerned with two-dimensional target tracking, where eye and/or head motion is used for control. Particular attention has been devoted to a tracking method involving electrooculography (EOG) and to one using a Honeywell remote oculometer. Both tracking methods involve eye-head coordination, but in different ways. Experimental work was carried out at the tracking laboratory of the Aerospace Medical Research Laboratory at Wright-Patterson AFB. The tests, conducted with fifteen human subjects, involved tracking of targets in two-dimensional quasi-random (sum-of sines) motion. All tests were conducted at three different target amplitude (envelope) levels, in order to study possible nonlinear effects. The recorded data are being processed to obtain frequency response spectra and a statistical evaluation of the tracking performance. The tracking methods are discussed and recommendations for further research are given.

OPTIMIZATION OF THE FEED FORWARD TECHNIQUE
FOR BEAM CONTROL IN THE APT

by

Jerrel R. Mitchell, PhD

ABSTRACT

The Airborne Pointing and Tracking (APT) System is an integral part of the Airborne Laser Laboratory. In order to reduce the susceptibility of the system to noise and disturbances, studies were initiated in which the Automatic Alignment System (AAS) was used in a feed forward technique.^{1,2} The work presented here is an extension of this.

A filter is placed in one of the paths between the APT and the AAS. For various cases of a "fly-by" type scenario, the coefficients of the filter are optimized so as to minimize the root mean square error (RMS) of the beam angle. This is done in the frequency domain with a computer code. The results show that with the feed forward scheme and with the optimal filter the RMS error can be reduced from ten to a hundred fold.

PREDICTING THE IMPACTS OF USAF PERSONNEL CUTS

by

William T. Morris

ABSTRACT

This research program aims at the development of methods which will offer simple, practical assistance to Air Force Managers involved in:

- 1. Predicting the impacts of personnel cuts as a part of the budget justification process.**
- 2. Managing the process of taking personnel cuts in their organization.**

The program outlines the development methods for the specific case of Air Logistics Centers based on inexpensive modifications of existing manpower management systems. It then addresses the more general problem of the development of methods for coping with cuts at other types of USAF organizations.

ATTEMPTS TO SIMULATE "REALISTIC" ATMOSPHERIC MOTION WITH A
SIMPLE NUMERICAL MODEL

by

Stephen Mudrick

ABSTRACT

A previously developed, three-dimensional, numerical model is used to simulate the development of atmospheric cyclone waves. The initial conditions for the integrations consist of an east-west oriented atmospheric jet which varies only in the north-south and vertical directions, upon which is superimposed a perturbation of a given east-west wavelength. Attempts are made to increase the realism of the simulations by increasing the realism of the initial conditions. Three different approaches are used: a) The amplitude of the superimposed perturbation is increased greatly from that used previously, thus introducing more north-south wave amplitude in the upper-level flow; b) the wavelength of the perturbation is taken to be different than that associated with the fastest growing perturbation, and c) an east-west oriented surface frontal zone is included in the initial state. These attempts are only partially successful with approach b) yielding the best results.

The use of the more realistic initial conditions provides a more stringent test of a short wavelength filter developed at AFGL by Dr. R. Shapiro.

PLUME PROPERTIES MEASUREMENT RESEARCH
IN A SOLID ROCKET MOTOR EXHAUST

by

Bill Mundy

ABSTRACT

The objective of this experiment is to characterize the gaseous and particulate properties of solid rocket motor exhaust plumes. The effort involves in situ plume measurements using an IR emission/absorption system, a UV emission system, and a Mie scattering system (which utilizes laser scattering and transmission instrumentation)¹. The IR measurements contain information about the average gas temperature of the plume, the UV system investigates the UV signatures of the plume and the Mie data is related to the size of the particulates in the plume.

This report contains a description of the diagnostic system and its refinement.

A SEARCH FOR NEW FUEL COMPONENTS
IN NON-IDEAL EXPLOSIVES MIXTURES

by

M.C. Neveu

ABSTRACT

A number of compounds were synthesized and tested for explosive properties as well as for the formation of eutectic mixtures with ammonium nitrate. In the class of nitro-azo compounds studied, one of these, C.I. 12075, was found to have good explosive characteristics when mixed with ammonium nitrate. The tetrammonium nitrate of anthraquinone and its nitro derivative were synthesized. These did not show the explosive properties that might have been expected on the basis of their structures. The tetranitro derivatives of two isomeric biphenols were synthesized. Their ammonium and potassium salts showed excellent explosive characteristics. No formation of eutectic mixtures with ammonium nitrate was observed for any of the compounds studied.

VIBRATION DIAGNOSTICS FOR
TURBOFAN ENGINES

by

C. E. Nuckolls

ABSTRACT

The feasibility of gas turbine engine condition assessment by analysis of the signal from a case mounted accelerometer is discussed. Case responses due to other excitations, such as multiple pure tones due to blade passage, overwhelm and obscure that due to the distressed component, such as a rotor bearing. Techniques for extraction of a periodic signal from noise are discussed. Recommendations are made with regard to a experimental program to verify feasibility of the technique and other possible schemes for condition monitoring.

GOAL PROGRAMMING: FUNCTIONAL DECOMPOSITION AND
CONSIDERATION WITHIN AN INTEGRATED COMPUTER-AIDED
MANUFACTURING DECISION SUPPORT SYSTEM (IDSS)

by

Nicholas G. Odrey

ABSTRACT

Intrinsic to the Integrated Computer-Aided Manufacturing (ICAM) Air Force program is the incorporation of various analytical techniques to the architectures derived for manufacturing from developed methodologies. This report presents the methodology of the mathematical programming technique termed goal programming and illustrates a tutorial example of the technique using accepted ICAM Definition (IDEF) methodology. Consideration is given to the implementation of the goal programming technique to the ICAM Decision Support System (IDSS). A general functional model decomposition is also presented for the goal programming technique.

A COMPUTER MODEL OF SACCADIC SUPPRESSION

by

William J. Ohley

ABSTRACT

Suppression of vision during the course of voluntary saccadic eye movements has been well documented. However, the mechanisms which result in these observations are not clear. Moreover, the amount and types of visual suppression reported differ widely. It is not presently possible to accurately predict the efficacy of suppression for an individual in a given situation. However, the exploitation of suppression has been suggested for visual display systems. Thus, based on currently available data, this report provides a preliminary model for quantitative prediction of saccadic suppression. The model relies on the use of the line spread function, modulation transfer function, and temporal transfer function in conjunction with convolution mathematics and a postulated psychophysical detection process. Results are shown which facilitate explanation of typical suppression experiments. This is done by considering the visual system to be at least two-dimensional in time and space. The effects of visual stimulation during saccades are then seen to be a combination of the interaction between the time-space properties of the stimulus, those of the visual system, and a psychophysical detector. Since the model is composed entirely of software, it should be possible to examine a larger and more complex number of visual situations than would be experimentally feasible. In this way, baseline engineering design requirements can be specified. Furthermore if initial development of hardware proves difficult, the model, with suitable refinements, could provide an effective means for exploring alternative solutions. Suggestions for further research are also given.

SPECIAL-PURPOSE PROCESSORS
FOR THE IMAGE-PROCESSING REQUIREMENTS
OF AUTOMATIC FEATURE EXTRACTION SYSTEMS

by
J.V. Oldfield

ABSTRACT

Image processing systems for feature extraction require complex operations on large quantities of image data. After considering these requirements in detail, the author has proposed a special-purpose computer system (PXP) for pixel processing and display. This employs vector operations on up to 9 pixels simultaneously, and should result in much faster execution of many feature extraction tasks, particularly those which affect the interactive user. The paper includes an outline of the system architecture and informal descriptions of typical algorithms. It discusses implementation possibilities using widely-available microprocessor components, and recommends that further development be undertaken with the aid of a high-level hardware description language (SMITE) and emulation system (QM-1), both of which will be available at Rome Air Development Center.

MAGNETOSTATIC WAVE DECAY AND FILTER DEVICES

J.M. Owens

ABSTRACT

Magnetostatic waves (MSW) propagating in epitaxial yttrium iron garnet have been under serious investigation as complex signal processing elements for the past 3 years. This report presents the results of a study in two areas of MSW signal processing technology. First, the use of MSW delay lines as electronically variable time devices, with possible application in phased array antennas. Second, evaluation of element weighting techniques applicable to transversal filter implementation in MSW. The first area of study has yielded a number of simple MSW delay lines with delays adjustable from < 10 n sec to > 100 n sec, insertion losses of less than 4 dB and bandwidth of > 200 MHz. The second area of study has shown that width weighting is an effective transversal filter weighting technique.

IMPROVED METHODS FOR LARGE SCALE STRUCTURAL SYNTHESIS

by

M. Pappas

ABSTRACT

The report describes two potential improvements in techniques for large scale structural synthesis; methods for control of oscillation found to occur in many optimality criteria procedures and a primal mathematical programming algorithm. The central idea for oscillation control is the use of the gradients of a potentially active constraint set to prevent serious violation of one of the set when a move is made on the basis of only the active constraints. The mathematical programming procedure uses a modified feasible directions method.

Results of numerical experiments using these methods on two classical ten bar truss examples are very encouraging. Serious oscillations using earlier optimality criteria procedures were eliminated in all cases. The mathematical programming method was found to be comparable in effectiveness to the optimality criteria procedures.

Further research is required to refine these methods and substantiate the initial successes.

EDUCATIONAL IMPLICATIONS OF COGNITIVE RESEARCH ON IMAGERY

by

Steven E. Poltrock

ABSTRACT

The current research and goals of the Human Resources Laboratory Technical Training Division are reviewed. Mental imagery is identified as an area of research with potential contributions to these goals. The cognitive research on mental imagery is extensively reviewed, with emphasis on three questions: (1) How does imagery function? (2) What situations are appropriate for imagery strategies? (3) Who can effectively use imagery in learning situations? The effectiveness of mental imagery as a strategy for learning is established. The report concludes with recommendations for applications of mental imagery in educational or training situations and recommendations for further research.

ADAPTIVE SIGNAL PROCESSING FOR ARRAY ANTENNAS

by

D. Preis

ABSTRACT

This report presents an overview of signal processing for array antennas. Included is a convenient chronological literature survey. These references are discussed by category. The following topics are considered: introductory review and survey articles, adaptive filtering, array antennas, benchmark papers and fundamental contributions in the field, algorithms, optimal and suboptimal processing, partially adaptive arrays, experimental studies and sensitivity considerations. The generalized adaptive array is discussed as a multivariable system and basic processing architectures are summarized. Key features, research trends, and deficiencies are discussed. Also included are recommendations for future research and development.

DEEP LEVELS IN $\text{Al}_x\text{Ga}_{1-x}\text{As}$

by

Dr. Rangaiya A. Rao

ABSTRACT

Deep levels in Fe-doped $\text{Al}_x\text{Ga}_{1-x}\text{As}$ layers were investigated by using the photoluminescence and the Deep Level Transient Spectroscopy techniques. Sharp photoluminescence bands around 0.37 eV were measured in $\text{Al}_x\text{Ga}_{1-x}\text{As}:\text{Fe}$ samples grown on undoped and Cr-doped GaAs Substrates. The x-values ranged from 0.06 to 0.47. The 0.37 eV emission was very weak or absent in $\text{Al}_x\text{Ga}_{1-x}\text{As}:\text{Fe}$ layers grown on GaAs:Te substrates. These layers showed broad bands near the band edge. DLTS peaks were observed in three samples with carrier densities in the range $10^{15} - 10^{16} \text{ cm}^{-3}$. One such peak for $\text{Al}_{0.71}\text{Ga}_{0.29}\text{As}:\text{Fe}$ has been analyzed and is found to be a hole trap at 0.75 eV above the valence band edge.

DEVELOPMENT OF AIR-SAMPLING AND ANALYTICAL METHOD
FOR DIISOCYANATES

Stephen M. Rappaport

A method has been developed for the collection and analysis of diisocyanates in air. Air is drawn through a filter impregnated with 1-naphthylenemethylamine (NMA) which reacts with the diisocyanate to produce a stable urea. The method should be suitable for the collection of diisocyanates in either vapor or aerosol form. The urea is dissolved in methanol and analyzed by high performance liquid chromatography (HPLC). The method was evaluated with 1,6-hexamethylene diisocyanate (HDI). Results indicated HDI vapor to be efficiently trapped by the filter. Analysis gave a quantitation limit of ~2ng/ injection which allows airborne HDI to be measured at 0.002ppm in a 10-L air sample. Additional development should reduce the limit of quantitation and simplify the analysis.

CIVILIAN APPRAISAL SYSTEM

BY

JANE A. RYSBERG

ABSTRACT

The Civilian Appraisal System was conceived by the Civil Service Reform Act of 1978. Its birth place for the Air Force's Civil Service population is the Human Resources Laboratory, Brooks AFB. Appraisal has come to mean an objective description of performance which can be used for evaluations promotion actions, and recommendations for bonuses or specialized training. The creation of the Appraisal System requires the combined talents of educators, psychologists and human factors engineers, as well as the support and technical expertise of mathematicians, and computer and media specialists. The labors of this diverse population have been divided into modules based on the purpose of a specific aspect of the System. As the Civilian Appraisal project is ongoing, the following report is composed of a brief introduction to the need for the project, its present structure, and a specific look at the integrated work of the Appraisal personnel as it provided a basis for work done under the Summer Fellowship.

A STUDY OF OPPORTUNISTIC MAINTENANCE
POLICIES FOR THE F100PW100 AIRCRAFT ENGINE

BY

MICHAEL C. SMITH, Ph.D.

ABSTRACT

Application of carefully selected part level screening intervals to components of the F100PW100 engine can result in substantial economic and tactical benefits without introducing complex base level maintenance procedures. This report describes three approaches to developing an optimal screening policy: (1) single screens, (2) a computed screen, and (3) multiple screens. The multiple screen approach which uses base and depot level part screens is recommended as a short run maintenance policy while further refinement of the computed screen approach and a supporting information system are recommended for long run consideration. Examples of each approach are presented using data available at the time the research was done. Recommendations for future investigations are included.

ERROR ANALYSIS FOR A RADIO-FREQUENCY SYSTEMS SIMULATION FACILITY

by

Walter D. Stanaland

ABSTRACT

Error analysis associated with radio-frequency simulation facilities must consider error determination methods as well as error reduction designs. This study effort is devoted to both considerations. For error identification, the mean-square error, which occurs between transmitter and receiver detector output, is identified and computer modeling has been started. For design improvements, a time domain sensitivity comparison function has been defined for the first time.

The mean-square error definition includes a computer program which defines the input auto-correlation function, output auto-correlation function, crosscorrelation function, and convolution integral. The summation of terms remains unfinished.

A HIGH ALTITUDE TETHERED AEROSTAT SYSTEM STUDY

by

E. F. STROTHER

ABSTRACT

The advantages of a High Altitude Tethered Aerostat/Balloon system are discussed briefly. Since the tether itself is the single factor which will dominate the design of the balloon and performance of the system, a comparison and brief evaluation of various tether materials is given. Despite some handling problems, Kevlar, an aramid fiber with a specific tensile strength four to five times that of steel is the most promising tether material at the present time. The use of Kevlar cable makes it entirely feasible to operate a single natural shape balloon in the minimum wind field region which lies between 65,000 to 70,000 feet above MSL. Significant problems remain, however, associated with the deployment of a partially inflated tethered balloon through the lower altitude region of high dynamic pressure. Possible solutions to this deployment problem are given. Existing computer simulations of High Altitude Tethered Aerostat/Balloon systems are evaluated and recommendations for further work are presented. The list of 65 references at the end of this paper represents the most important contract reports and published papers relevant to high altitude tethered systems.

PATTERN RECOGNITION/IMAGE PROCESSING
IN OPTICAL TRACKING

by

Edgar C. Tacker

ABSTRACT

The availability of advanced microprocessor technology opens up new opportunities for exploring tracking schemes that up to now would not have been considered due to excessive computational complexity, weight, or cost. This report describes an approach that utilizes a particular method of image feature selection and decision analysis. Preliminary results are stated and a comprehensive set of recommendations for future research is given.

Also discussed is the progress made by this author in establishing a seminar series and workshop/conference on image processing and pattern recognition, to be held at the USAFA this coming year.

ATMOSPHERIC ABSORPTION OF RADIATION BY H₂O AND CO

by

Richard H. Tipping

ABSTRACT

A theoretical investigation of the absorption of radiation by H₂O molecules in the earth's atmosphere was carried out. This was concerned primarily with an attempt to modify the usual Lorentzian line shape to obtain a more realistic description of the absorption in the far wings of spectral lines. The modified line shape was then used to investigate the continuum absorption in the 0 - 1200 cm⁻¹ region where the absorption is very sensitive to the assumed line shape. The importance of collision induced effects in the absorption spectrum of water was also estimated. While multipole - induced single transitions produce negligible effects, double transitions and the interference between the allowed and the induced dipole moments may lead to significant contributions to the continuum. The atmospheric absorption by carbon monoxide was also considered, and new line positions and strengths were determined for 574 lines belonging to four isotopic species. These should be accurate to 0.001 cm⁻¹ in position and to a few percent in strength. This data set includes all lines of CO whose strength exceeds 10⁻²⁴ molecules/cm² at the standard temperature of 296 K.

STUDY AND EVALUATION OF SIIDS AND ADPT SYSTEMS

by

Pramod K. Varshney

ABSTRACT

In this report, findings based on the study of the Standard Integrated Information Distribution System (SIIDS) and the Automatic Data Processing Telecommunication (ADPT) system are presented. Two proposed designs of SIIDS are discussed and evaluated. ADPT testbed, which has recently been installed at the Rome Air Development Center, is described. An experimental plan for the ADPT testbed is suggested. The ADPT testbed can be employed to run simulation experiments which will provide useful information regarding integrated switching and other concepts related to packet communication networks.

STABILITY ANALYSIS OF THE LOWER
BRANCH SOLUTIONS OF THE FALKNER-SKAN EQUATIONS

BY

G. R. Veuma

ABSTRACT

In this report a series of similar separated flows for different pressure gradient parameters are analysed. The amplification factors and propagation velocities in all these different cases are determined and the most significant modes are identified.

INDUCTANCE MATRIX OF A PERMANENT MAGNET ALTERNATOR

by

T. H. Wei

ABSTRACT

Different methods of getting the inductance matrix of an alternator are given. The inductance matrix is very important in the analysis and simulation of a pulsed power system. This report gives an approximate 6x6 inductance matrix for a permanent magnet alternator based on magnetic circuit analysis, which has traditionally been used for devices design. Each matrix element is an expression of machine geometry and construction materials. The inductance matrix can be implemented in a computer program, presumably with less memory space and shorter running time in comparison with the implementation of finite element method. Suggestions for further theoretical research in the inductance matrix are given.

Analysis for Coherent Anti-Stokes Raman Spectroscopy (CARS)

by

Herschel Weil

ABSTRACT

Equations have been formulated to describe the generation of CARS spectra under physical assumptions corresponding to experimental work being conducted at AFAPL to develop CARS as a diagnostic tool for the evaluation of combustion processes. A number of physical effects including competing scattering processes have been included to improve the quantitative linkage between the directly measurable spectral parameters and the quantities of primary interest, namely molecular concentrations and temperatures. The resulting equations are a set of coupled nonlinear differential equations. These have been solved numerically for one set of conditions to study saturation effects for the CARS intensity due to depletion of the vibrational ground state population by a strong pump wave.

AN INVESTIGATION OF ONE AND THREE PARAMETER
ITEM RESPONSE MODELS WITH IMPLICATIONS FOR
COMPUTERIZED ADAPTIVE TESTING

by

Bronel R. Whelchel

ABSTRACT

"Adaptive" testing is one of a number of terms used to describe a procedure whereby the test items that comprise an individual's test are selected during the test itself. Some of the other terms used interchangeably with adaptive testing include tailored testing, branched testing, programmed testing, and individualized testing. The term "adaptive" was chosen because these tests adapt themselves to the examinee; different persons answer different items, with the items chosen sequentially to suit the individual examinee's performance.

The general objective of computer driver adaptive testing is to accurately estimate an individual's position on the underlying trait the test purports to measure. Conventional paper-and-pencil test administration typically suffers from several sources of error in the measurement of an individual's ability. Conventional peaked tests are designed to discriminate most effectively at a single ability level and thus assume that most individuals taking the test fall into this category. When they do not, the accuracy of estimation of their status on the trait becomes progressively more inaccurate as their ability deviates from this point.

The result of this lower precision of measurement is lower overall reliability, and lower validity as well (Weiss, 1974). Lord (1970, 1971a, 1971c, 1971d, 1971e) and Hick (1951) have concluded that a test score most accurately reflects an individual's ability when the probability of a correct response to an item is .5 for that individual. Conventional tests obviously cannot meet the requirements of .5 probability for all examinees as all items must be given to all examinees.

A second source of error results from not extracting all the information contained in an examinee's answers to questions. Conventional tests typically use number or proportion of items correct or some transformation of total test score and disregard item discrimination. Two recent developments have enabled the psychometrician to more accurately assess the status of individuals on measureable traits: Adaptive testing and latent trait test theory. Adaptive testing enables adapting each test to fit characteristics of each individual test. Thus, it allows the presentation of the most informative items to an examinee to be used as the basis of that individual's test score. Latent trait test theory allows the calculation of ability estimates in the same metric for each examinee and permits comparisons among scores even though each may have taken a different subset of items Lord, 1970; Wood, 1973).

The following contractors to the Office of Naval Research are engaged in adaptive testing studies: The Psychometric Methods Program, University of Minnesota, the Tailored Testing Research Laboratory University of Missouri, Department of Psychology, University of Southern California. The AFOSR and AFHRL have adaptive testing contracts with Professors Ron Hambleton and Hariharan Swaminathan at the University of Massachusetts. The proposed study does not duplicate other efforts but rather is complimentary. Results of the proposed effort will advance the state of knowledge in this important area.

As was evident from paper presented at the 1979 adaptive testing conference (CAT' 79) there is an interest in real data comparisons of one and three parameter item response models. It is possible that adaptive testing procedures might have a high utility for small groups when the one parameter model is used. The proposed efforts would compare one and three parameter models in a student population. The independent variables would be one and three parameter item calibration procedures and the dependent variables would be test scores and correlation with an external criterion. Hopefully, computer adaptive testing will from a military standpoint reduce test taking time 25% therefore, reducing the cost of such efforts by 30%.

MODULATED SPONTANEOUS RAMAN EFFECT FOR
LASER ALL-OPTICAL FREQUENCY STANDARDS

by

C. R. WILLIS

ABSTRACT

The purpose of this report is to investigate the feasibility of using the Modulated Raman Effect in laser all-optical frequency standards. After a brief review of all-optical frequency standard programs at the Electro-optical Device Technology Branch, we derive the equations of motion for the density matrix of the hyperfine levels of the ground state for atoms undergoing a modulated Raman effect. We show that the spectrum of the modulated Raman effect is the same as the unmodulated Raman effect. Consequently, for stationary atoms the spectrum depends only on the narrow lines of the ground hyperfine states and is independent of the broad excited state line-shape. We conclude with a list of remaining extensions of the present work that are needed to establish the viability of Raman effect for all-optical frequency standards.

UNSTEADY LAMINAR BOUNDARY LAYERS DUE TO
TRANSVERSE CYLINDER & FREE STREAM OSCILLATIONS

by

D. E. Wilson

ABSTRACT

The purpose of the present investigation is twofold: first, the response of a laminar boundary layer on a circular cylinder to small periodic transverse fluctuations of the free stream velocity is investigated. And secondly, the kinematically similar problem of a periodic transverse oscillation of the cylinder with respect to a steady uniform free stream is considered.

The solution is accomplished by first expanding the stream function in terms of ϵ , where ϵ is the ratio of the transverse velocity component to the undisturbed free stream velocity. The resulting equations are then solved by an asymptotic expansion in terms of the reduced frequency. Due to the singular nature of the perturbation problem, an inner and outer region are defined and the method of matched asymptotic expansions is employed. The result is compared to a numerical solution valid for all frequencies. In addition, an exact solution valid only in the stagnation point region is presented for comparison.

RESPONSE OF AIRFIELD PAVEMENT TO LARGE

MAGNITUDE DYNAMIC LOADS

by

Gerald A. Woelfl

ABSTRACT

The evaluation of rapidly repaired bomb damaged runways requires determining the dynamic response of pavement due to large dynamic loads. This report recommends using one of the sophisticated computer codes currently available for a conventional static analysis of airfield pavements, but with the use of appropriate dynamic material properties to predict the dynamic response of pavement. In order to select the appropriate dynamic material properties, the stress variation as a function of time is developed for pavements subjected to moving wheel loads. A review of the literature indicates that the elastic properties and fatigue strength of Portland Cement Concrete are relatively the same for dynamic as for static loading. The dynamic response of asphalt concrete, granular base and subbase material, and subgrade soil, however, is significantly improved relative to the response of these materials to static loads. Further, the dynamic behavior of granular material is time-independent, but for asphalt concrete and subgrade soils, especially cohesive soils, the dynamic properties vary with aircraft velocity (ie, rate and duration of loading). Recommendations for further research in this area are also given.

ANALYSIS OF THE ROLE OF HIGH BRIGHTNESS
ELECTRON GUNS IN LITHOGRAPHY

BY

JOHN C. WOLFE

ABSTRACT

The development of reliable, high brightness, temperature-field (TF) emission electron guns promises greater flexibility in electron beam lithography. Detailed pattern analysis of two IC mask sets was performed for the purpose of identifying those areas of electron beam lithography where high brightness guns could be applied to advantage. Significant throughput advantages can be realized in both VSS Vector Scanning Systems and in ultra-high speed Raster Scanning Systems.

IMPURITIES IN COMMUNICATIONS GRADE GaAs

by

Richard G. Yalman

ABSTRACT

Molecular beam and chemical vapor phase ($\text{Ga/AsCl}_3/\text{H}_2$) epitaxy are used to grow device quality GaAs at the Electronic Research Branch, Electronic Technology Division, Avionics Laboratory, Wright-Patterson Air Force Base, Ohio. Reproducible growth of communications grade GaAs has not been achieved. Practical considerations for the reduction of impurities in these materials are confined to the manipulation of the physical arrangement and chemistry of the "as is" systems. Because the order of desired impurities in GaAs is 1 ppb additional attention must be given to clean rooms, additional traps, modification of flushing and burn-out techniques, elimination of teflon and silicon grease, the in-house preparation of bulk GaAs, and changes in the composition of the carrier gases in the $\text{Ga/AsCl}_3/\text{H}_2$ system. A new reactor system has been designed and is being assembled for the determination of growth parameters. A complete determination of the equilibrium state within the reactor tube as a function of furnace profile, composition and pressure of carrier gas and Ga/As, Cl/H and O/H ratios would aid in the statistical design of a new set of experiments with this equipment.