JULY 1966

THE FRANK J. SEILER RESEARCH LABORATORY

OFFICE OF AEROSPACE RESEARCH
UNITED STATES AIR FORCE

FOREWORD

The Frank J. Seiler Research Laboratory was established at the United States Air Force Academy to conduct research with a full-time staff in chemistry, applied mathematics and aerospace mechanics, to provide a means for supporting faculty research in those areas of interest to the Office of Aerospace Research, and to foster and encourage scientific research among cadets.

The laboratory was approved by the Air Staff in June 1962 and was dedicated by Dr. Brockway McMillan in October 1963. A competent scientific staff is engaged in three general projects; system optimization, programming and control, fluid dynamics, and physical chemistry and organic chemistry. A Burroughs B5000 computer was installed in June 1964 and was modified to the B5500 configuration early in 1965. The chemistry laboratory, devoted entirely to basic research, was opened in March 1964.

Colonel Frank J. Seiler, for whom the laboratory is named, retired from the Air Force in 1961 after more than twenty years of active duty. He is remembered for his devotion to increasing the stature of in-house Air Force laboratories and improving the career opportunities for young officer-scientists. He was the second commander of the Office of Air Research, later renamed the Office of Aerospace Research. Upon retirement in 1961 he became research coordinator for the University of Washington. He passed away suddenly in October 1962.

I hope this booklet will help you to become better acquainted with this OAR laboratory, especially our people and their work. Our activity meshes closely with the current academic program at the USAF Academy, but we also continually seek new ways to relate our research to future capabilities for the Air Force. Toward this end our scientists work closely with members of many governmental, academic and industrial institutions. If you wish additional information on the laboratory or its research, please contact me or a member of the research staff.

GAGE H. CROCKER, Colonel, USAF
Commander

The Frank J. Seiler Research Laboratory
United States Air Force Academy, Colorado

Mission

The mission of the Frank J. Seiler Research Laboratory is

a. To conduct basic research in chemistry.

b. To conduct basic research in aerospace mechanics.

c. To conduct research in applied mathematics.

d. To support selected faculty and cadet research, the product of which is within the scope of the OAR mission.

e. To operate a general purpose scientific digital computer in support of the mission of the Frank J. Seiler Research Laboratory and the USAF Academy.

Background

The development of the USAF Academy from legislative approval in April 1954 to graduation of its first class in June 1959 was a task of considerable magnitude. The curriculum was modified during this period to depart from the long-standing tradition of other service academies where each cadet took each prescribed subject regardless of past academic achievement. The USAF Academy initiated an enrichment program to challenge each cadet to advance as far as possible academically during his four years at the Air Force Academy. The establishment of the enrichment program brought great advantages to the cadet and to the Air Force, but it demanded a versatile faculty with appropriate advanced degrees to satisfy the need for advanced courses, including subjects normally considered part of a graduate program. It soon became apparent that classes subsequent to the first graduating class would produce an increasing number of cadets who would be able to pursue enough work at the graduate level to qualify for graduate degrees according to accepted standards. As a first step, the Engineers Council for Professional Development granted accreditation in 1962 for the Engineering Sciences Curriculum.

With academic progress and a faculty with increasing numbers of doctoral degrees came the inevitable pressure to support research for both faculty and cadets. Since the product of faculty research could be of considerable benefit to the Air Force if funded and oriented appropriately, and since cadet research experience would produce officers who were

qualified and interested in careers in research and development, it was decided to approach the Air Force Systems Command and the Office of Aerospace Research for assistance and advice before asking for direct appropriation of funds for an independent research activity at the Academy. Because faculty interest and ability were more closely related to the OAR research activities, OAR's February 1962 proposal to establish a small in-house laboratory at the Academy seemed most compatible with the aims of all concerned. The proposal was approved in all echelons of the Air Force and the laboratory was formally established with the assignment of two officers on 1 September 1962.

Even before the formal establishment of the laboratory, specifications were being prepared for a computer of sufficient size to allow digital computing to be made a required part of the Air Force Academy curriculum, to provide the means for teaching advanced science and engineering courses, and to support research in all departments. Justifying, selecting and delivery of the computer proved difficult and time consuming, but a Burroughs B5000 computer became operational in June 1964. In January 1965, the computer was modified to the B5500 configuration; it is modular and can be expanded to meet future requirements as needs arise.

Organization and Resources

The plans for the Frank J. Seiler Research Laboratory were made in an austere environment and economy has been a major consideration. It was realized that the full-time scientific staff had to be large enough to provide a catalytic or "critical mass" effect but not much larger. The manpower authorization was set at 37 people, where it remains today. Eighteen are scientists and the remaining are supporting staff positions. The laboratory budget remains fairly static at around $350,000.

Manning

The scientific staff is composed entirely of military officers. Major Lowell A. King is Director of the Chemistry Division. He obtained his Ph.D. at the Iowa State University in 1963. He is on leave to the laboratory for one year from the Department of Chemistry of the USAF Academy. Major Bernard S. Morgan, Jr., is Director of the Aerospace Mechanics Division. He obtained his Ph.D. degree from the University of Michigan in 1963. He was assigned to this laboratory in July 1965 after completing studies at the Armed Forces Staff College. Lt. Colonel William D. Marsland, Jr., is Director of the Computer Division. He has completed his coursework for a Ph.D. at the University of Michigan and is presently working on his thesis. He

is also an Associate Professor of Mathematics at the Air Force Academy.

The military scientist posts were filled by highly qualified company grade officers for the most part. Among the eighteen officers now on duty in the laboratory there are eleven with doctoral degrees, five with a dissertation to complete for the Ph.D., and two with M.S. degrees. All of the scientific staff have been given faculty status as research associates, or with one of the professorial ranks where teaching experience warrants. Manning charts are located in the rear of this section.

Several members of the staff have taught courses, and this activity is encouraged to the extent that it either relieves a faculty member to do research or does not detract from research efforts. The teaching activity is encouraged because of the belief that teaching is just as desirable for a good researcher as research is for a good teacher. The policy has resulted in good rapport between Air Force Academy faculty and FJSRL staff and was partially responsible for attracting highly motivated cadets to participate in FJSRL research projects. One scientific space in chemistry is used for rotating faculty members into FJSRL for one year tours when outstanding research projects are proposed. Research being undertaken by the laboratory staff is self-initiated and approved by the laboratory commander for support.

Projects are coordinated in the usual manner with agencies within and outside the Air Force. Noticeable, to an extent not anticipated, is the mutual support and interest which has developed among staff members in research being undertaken by colleagues. It has resulted in a very desirable focusing of effort. It is an effective way for a laboratory as small as this one to succeed in making scientific progress.

Participation of Faculty

The USAF Academy has a faculty research program under the Director of Faculty Research. Approximately fourteen manpower spaces have been set aside by the Dean of the Faculty for faculty members who desire extended full-time research in any of the specialties found in the academic departments. There are also provisions for part-time research within departments. In special cases where interests of the faculty are closely allied to interests of this laboratory, it is possible to exchange individuals between the laboratory and faculty.

Funding of faculty research in those areas of direct interest to OAR is possible through FJSRL resources. Faculty members may propose projects for FJSRL support in a manner similar to proposals made by faculty members of civilian schools to OSR, except that support is limited to providing equipment, supplies, and travel, if absolutely

necessary, and does not include salary or indirect costs. This kind of support is provided to two or three faculty members during each year. Another service rendered by FJSRL is a program for assigning scientists to OAR installations during the summer recess as working researchers. Faculty members and cadets are sent to OAR activities for periods of from three to ten weeks. Arrangements are made well in advance so that time spent at the laboratories is as profitable as possible to all concerned. From ten to fifteen officers and cadets are assigned to this program each summer. It is felt that the benefits of this program are substantial to all agencies and individuals and well worth the modest expense.

Equipment

Considerable equipment has been purchased by the laboratory, and a sincere attempt has been made to obtain only that equipment which will have multiple use and will encourage a wide spectrum of experimentation. A list of the major equipment is shown in the back of this brochure.

Future Plans

In approving the establishment of the Frank J. Seiler Research Laboratory, Dr. McMillan stated that it should become a "showcase". This is our aim.

Plans for this laboratory envision a non-expanding level of effort and a budget with only cost-of-living increases to provide a stable and fertile environment in which to perform research. The emphasis is and will remain on quality. It was hypothesized in 1962 that the laboratory could be manned almost entirely with officers, could produce worthwhile research, could secure cadet participation, and could improve the opportunity for research among the faculty. In the first years of operation the laboratory has succeeded on all counts beyond expectations. By 1971 the Air Force Academy will expand from 2500 to 4400 cadets. This will not necessitate an expansion of the Frank J. Seiler Research Laboratory staff or facilities. It is conceivable that the computer may have to expand, but it is hoped that the catalysis provided by the small full-time research staff will continue to stimulate the larger faculty just as it does now.

8. Major Bernard S. Morgan, Jr.
"A Computational Procedure for the Sensitivity of an Eigenvalue"
Electronics Letters, June 1966

9. Captain Daniel D. Traficante
"Flourine-19 Magnetic Resonance Study of Secondary Deuterium Isotope Effects of the Methyl Group"
Journal of the American Chemical Society, 87, 4917(1965)

10. 1st Lt. Jon M. Veigel
"Synthesis and Aquation Kinetics of cis-chlorisothiocyanatobis-(ethylenediamine)chromium(III)-cations"
Inorganic Chemistry, 4, 1569 (1965)

11. Captain Daniel D. Traficante
"Carbon-13 Chemical Shifts of the Carbonyl Group IV. Dilution Curves for Acetic Acid in Representative Solvents"
Journal of the American Chemical Society, 88(2), 220-223 (1966)

Technical Reports

1. Captain James E. Funk
SRL-65-0001
"SLASH -- Algol Simulated Hybrid Computer"
31 May 1965

2. Captain Robert W. Burton
SRL-65-0002
"An Experimental Investigation of a Two Slot Transmission Line on Nonplanar Surfaces"
14 September 1965

3. 1st Lt. Allan F. Schanzle
SRL-65-0003
"Dynamical and Stability Characteristics of a Class of Period Symmetric Horseshoe Shaped Orbits in the Jupiter-Sun Restricted Three Body Problem"
20 December 1965

4. Major Bernard S. Morgan, Jr.

SRL-65-0004
"Computational Procedures for Sensitivity Coefficients in Time-Invariant Multivariable Systems"
13 October 1965

5. Captain Charles F. Stebbins

SRL-65-0005
"Design, Construction, and Calibration of the FJSRL 17" Low Density Shock Tube"
To appear 30 June 1966

6. 1st Lt. Allan F. Schanzle

SRL-65-0009
"Regularization and Power Series Solution for the Third Order Representation of the Restricted 3 Body Problem"
December 1965

Papers Accepted for Presentation

1. Captain Dirk H. deDoes

"Time Optimal Position and Angular Velocity of a Spinning Vehicle"
AAS Space Flight Mechanics Specialist Conference
Denver, Colorado
6-7 July 1966

Papers Accepted for Publication

1. Major Bernard S. Morgan, Jr.

"Sensitivity Analysis and Synthesis of Multivariable Systems"
IEEE Transactions on Automatic Control

2. 1st Lt. Gerald Cook

"An Application of Half-Cycle Posicast"
IEEE Transactions on Automatic Control

3. 1st Lt. Gerald Cook

"A Model of the Human Eye Positioning Mechanism"
Bulletin of Mathematical Biophysics

4. 1st Lt. Gerald Cook	"Use of an On-Line Computer" Archives of Ophthalmology

Other Articles Published

1. Major Bernard S. Morgan, Jr.	Review of "Relation between structural compliance and allowable friction in a servomechanism" Applied Mechanics Reviews, Vol. 19, No. 1, January 1966
2. Captain Rinaldo F. Vachino	Review of "A Steepest-ascent solution of multiple-arc optimization problems" Applied Mechanics Reviews, Vol. 19, No. 1, January 1966
3. 1st Lt. Gerald Cook	Review of "On the fuel-optimal singular control of nonlinear second-order systems" Applied Mechanics Reviews, Vol. 19, No. 3, March 1966

OAR Research Reviews Published

1. Major Bernard S. Morgan, Jr.	"Back Pack on the Moon" Published in November 1965 OAR Research Review
2. Captain James E. Funk	"SADSAC" Published in December 1965 OAR Research Review
3. 1st Lt. Allan F. Schanzle	"A Class of Periodic Orbits in the Restricted Three Body Problem" Published in January 1966 OAR Research Review

PROGRESS
(as of July 1966)

	Prior to July 1965	Jul 65 - Jul 66
Journal Articles Published	6	18
Papers Presented	19	10
Technical Reports Issued	5	8
Papers Accepted by Journals	2	3
Papers Being Prepared (by July 1966)	9	16
Technical Reports Being Prepared	4	4
Work Underway Leading to Reports	14	14
Faculty Projects Being Supported include:	10	14
Particle-Accelerator		
Shock Tube		
Scheduling		
Chemistry (6)		
Antenna Research		
Satellite Tracking		
Experimental Investigation of Radioactive Nuclides		
Automatic Digital Data Recording System		
Raman Spectroscopy		
Summer "Fellowships" 1966:		
Faculty		7
Cadets		5

Accomplishments

Papers Presented

1.	Major Bernard S. Morgan, Jr.	"Computational Procedures for Sensitivity Coefficients for Multivariable Systems" 3rd Annual Allerton Conference on System and Circuit Theory Monticello, Illinois 21 October 1965
2.	Major Bernard S. Morgan, Jr.	"Topics in Control Theory" (Seminar) Washington University St. Louis, Missouri 5-6 April 1966
3.	Captain Rinaldo F. Vachino	"A Computational Procedure for Optimum Trajectory and Optimum Control Problems" OAR Research Applications Conference Washington, D. C. 5 April 1966
4.	Lt. Colonel Orlando J. Manci, Jr.	"Minimum Fuel Trajectories with Soft Landings" Region Six IEEE Conference Tucson, Arizona 27-28 April 1966
5.	Captain John F. Schaefer	"On the Control of Unstable Mechanical Systems" IFAC Conference London, England 20-25 June 1966
6.	1st Lt. Gerald Cook	"Dynamics of the Saccadic Eye-Movement Mechanism" Marquette University 25 June 1966
7.	1st Lt. Jon M. Veigel	"Synthesis and Aquation Kinetics of cis-chlorisothiocynatobis-(ethylenediamine)chromium(III)-cation and of cis and trans-isothiocynatoaquobis(ethylenediamine)-chromium(III)cations"

150th ACS Meeting
Atlantic City, New Jersey
September 1965

Papers Published

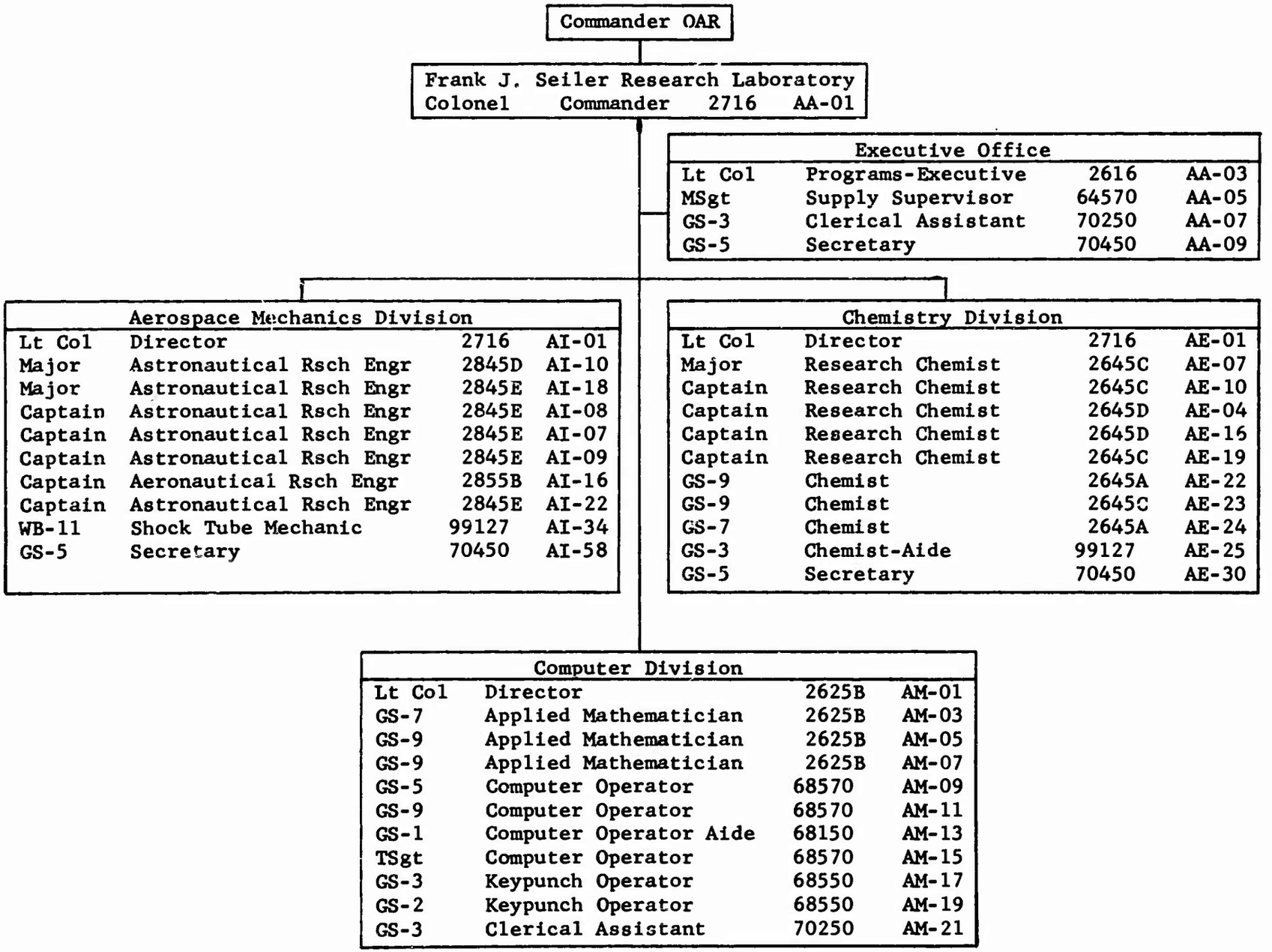
1.	Captain Robert W. Burton	"An Experimental Investigation of a Two-Slot Transmission Line on Nonplanar Surfaces" IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-13, No. 3, pages 303-306, May 1965
2.	Major Bernard S. Morgan, Jr.	"Computational Procedures for Sensitivity Coefficients for Multivariable Systems" Proceedings of Third Allerton Conference on Circuit and System Theory, pages 252-259, October 1965
3.	Professor Elmer G. Gilbert	"Some Critical Remarks on a New Numerical Method for Simulation of Dynamical Systems" Simulation, January 1966
4.	1st Lt. William R. Alford	"Uncountably Many Involutions in S^3" Proceedings of American Math Society, February 1966
5.	Captain Rinaldo F. Vachino	"Steepest Descent with Inequality Constraints on the Control Variables" SIAM Journal on Control, February 1966
6.	Captain John F. Schaefer	"Control of Unstable Mechanical Systems" Proceedings of OAR Research Applications Conference, 5 April 1966
7.	Captain Rinaldo F. Vachino	"A Computational Procedure for Optimum Trajectory and Optimum Control Problems" Proceedings of OAR Research Applications Conference, 5 April 1966

Professional Manning of the Frank J. Seiler Research Laboratory

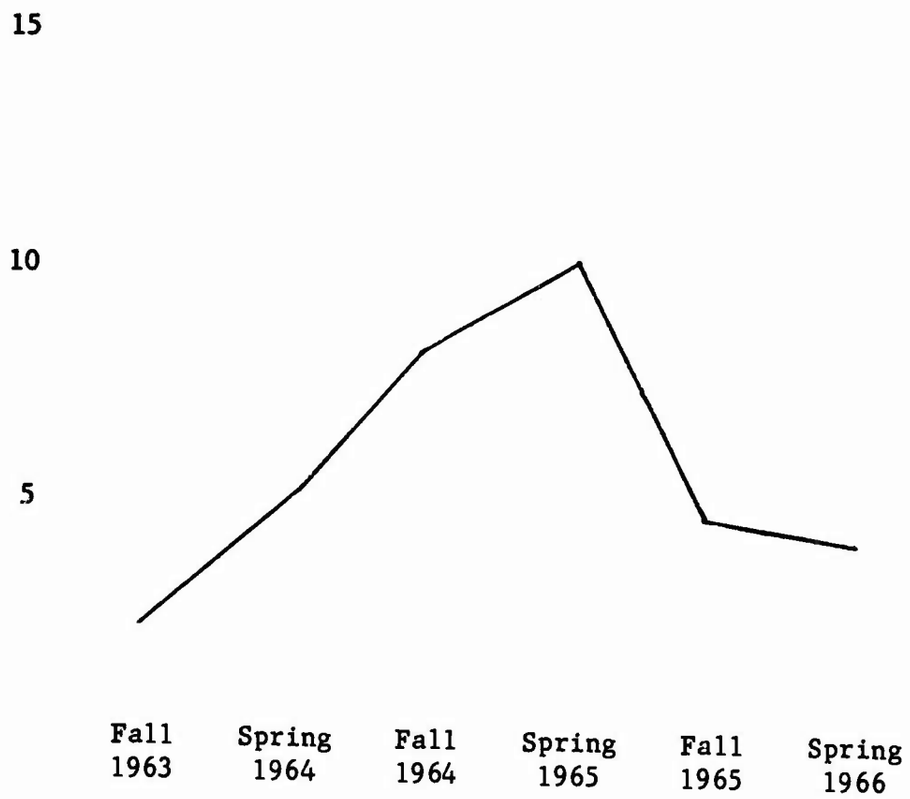
Name	Rank	Degree ScD PhD	Degree ABD*	Degree MS	Tour Ends
Command					
G. H. Crocker	Col	X			Feb 69
J. P. Brooks	Lt Col			X	Jul 67
Chemistry					
L. A. King	Maj	X			Jul 67
A. D. Brown, Jr.	Maj	X			Jul 70
R. J. Penick	Capt	X			Jul 67
C. J. Cheer	1st Lt	X			Jan 67
G. J. Gauthier	1st Lt	X			Jul 69
R. W. Rudolph	1st Lt	X			Jul 69
J. M. Veigel	1st Lt	X			Apr 68
Aerospace Mechanics					
B. S. Morgan, Jr.	Maj	X			Jul 69
R. F. Vachino	Maj		X		Aug 67
D. H. deDoes	Capt		X		Oct 69
J. E. Funk	Capt			X	Aug 66
R. A. Geesey	Capt		X		Oct 69
J. F. Schaefer	Capt	X			Mar 69
C. F. Stebbins	Capt		X		Jul 67
G. Cook	1st Lt	X			Aug 68
Computer					
W. D. Marsland, Jr.	Lt Col		X		Jul 67

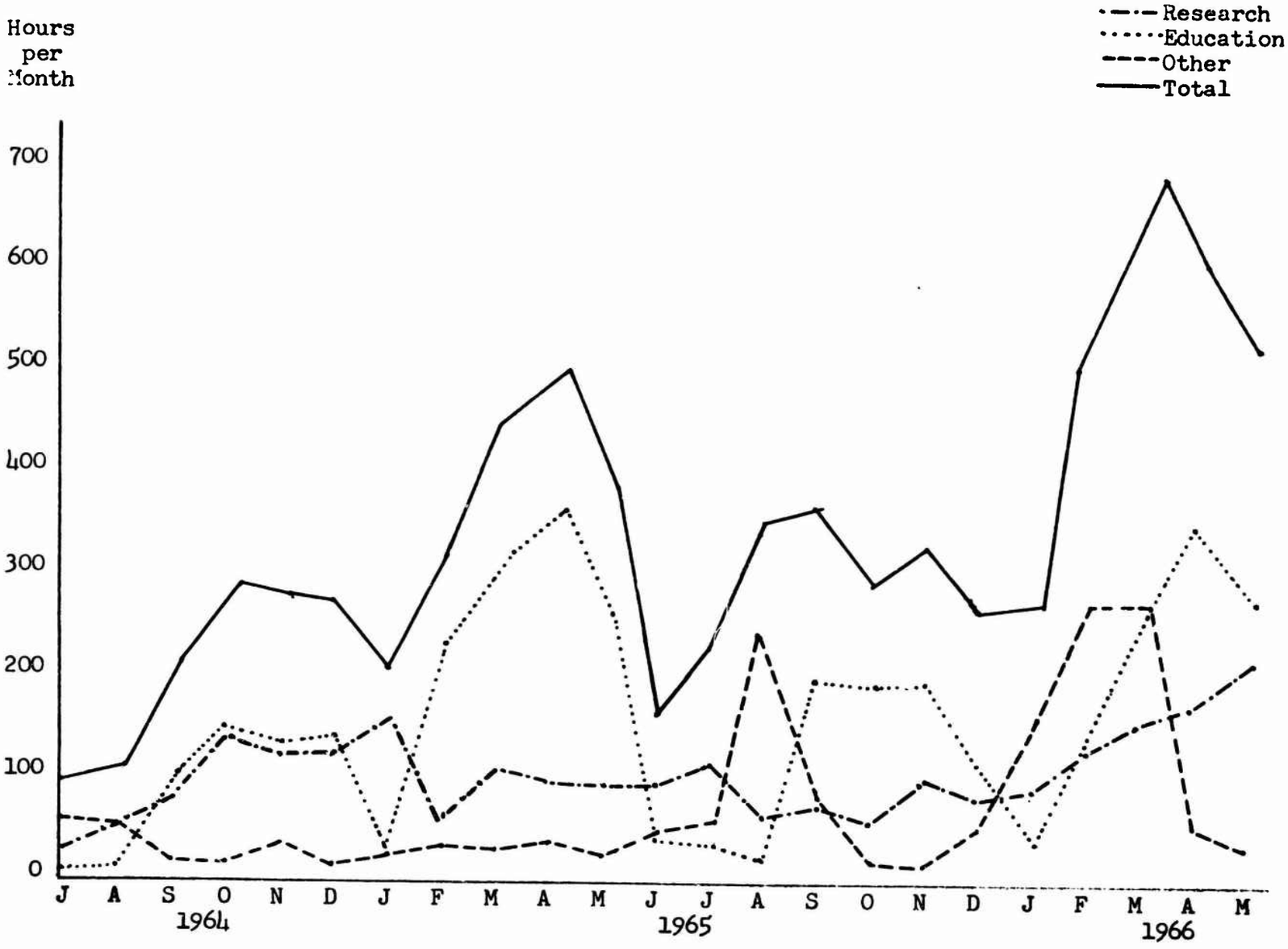
ABD* - All But Dissertation

July 1966


Commander OAR
Frank J. Seiler Research Laboratory
Colonel Commander 2716 AA-01
Executive Office
Lt Col Programs-Executive 2616 AA-03
MSgt Supply Supervisor 64570 AA-05
GS-3 Clerical Assistant 70250 AA-07
GS-5 Secretary 70450 AA-09
Aerospace Mechanics Division
Lt Col Director 2716 AI-01
Major Astronautical Rsch Engr 2845D AI-10
Major Astronautical Rsch Engr 2845E AI-18
Captain Astronautical Rsch Engr 2845E AI-08
Captain Astronautical Rsch Engr 2845E AI-07
Captain Astronautical Rsch Engr 2845E AI-09
Captain Aeronautical Rsch Engr 2855B AI-16
Captain Astronautical Rsch Engr 2845E AI-22
WB-11 Shock Tube Mechanic 99127 AI-34
GS-5 Secretary 70450 AI-58
Chemistry Division
Lt Col Director 2716 AE-01
Major Research Chemist 2645C AE-07
Captain Research Chemist 2645C AE-10
Captain Research Chemist 2645D AE-04
Captain Research Chemist 2645D AE-16
Captain Research Chemist 2645C AE-19
GS-9 Chemist 2645A AE-22
GS-9 Chemist 2645C AE-23
GS-7 Chemist 2645A AE-24
GS-3 Chemist-Aide 99127 AE-25
GS-5 Secretary 70450 AE-30
Computer Division
Lt Col Director 2625B AM-01
GS-7 Applied Mathematician 2625B AM-03
GS-9 Applied Mathematician 2625B AM-05
GS-9 Applied Mathematician 2625B AM-07
GS-5 Computer Operator 68570 AM-09
GS-9 Computer Operator 68570 AM-11
GS-1 Computer Operator Aide 68150 AM-13
TSgt Computer Operator 68570 AM-15
GS-3 Keypunch Operator 68550 AM-17
GS-2 Keypunch Operator 68550 AM-19
GS-3 Clerical Assistant 70250 AM-21

CADET PROJECTS WITH FJSRL





COMPUTER WORK LOAD

TITLE: Identification of the Orthonitrate Ion

CHIEF INVESTIGATOR: Major Lowell A. King

DESCRIPTION: The existence of the orthonitrate ion [NO_4^{3-}] has been reported in the literature on the basis of interpreted experimental data from molten alkali nitrate systems. Theory has indicated that a nitrogen atom is too small to accomodate a fourth oxygen around it, although many other atoms have the fourth oxygen - e.g., phosphate, arsenate, etc. Proof of existence of this triply charged nitrate on the basis of absorption spectrophotometry and x-ray will be attempted.

TITLE: Kinetics of the Gluconic Acid-Gluconolactone System

CHIEF INVESTIGATOR: Major Lowell A. King

DESCRIPTION: Reversibility of reactions, rate constants, rate controlling reactions, and reaction equilibria are all of theoretical interest to chemists, and of practical interest to chemical manufacturing and pharmaceutical organizations. The gluconic acid-gluconolactone system is a model system with marked opportunity for such investigation since a number of reactions occur, all of which can be followed by a variety of means.

TITLE: Carbon Dioxide Formation Cell

CHIEF INVESTIGATOR: Major Lowell A. King

DESCRIPTION: Accuracy and precision of thermodynamic constants are of continuing interest to all chemists. Precise measurement of the voltages and overvoltages of a cell as follows: Pt, O_2/oxyanionic fused electrolyte/C, CO_2 will be made. The fused salts to be used are a mixture of borates, and over a temperature range of 400-1000 C. The reversibility of the cell and the polarization of the hollow graphite electrode used will be determined. In addition to the theoretical value of this work, extension to fuel cell use is quite probably feasible. The application of the cell to fuel cell use is not envisioned as a part of this work.

TITLE: A New Oxidative Ring Expansion

CHIEF INVESTIGATOR: 1/Lt Clair J. Cheer

DESCRIPTION: The reaction of 1-vinyl-and 1-isopropenylcycloalkanols with a source of positive chlorine (t-butylhypochlorite) produces the ring enlarged 2-chloromethyl-and 2-chloromethyl-2-methylcycloalkanones in fair to excellent yield depending on ring size. The purpose of this study is to investigate the analogous reaction with peroxy acids to produce the homologous 2-hydroxymethyl-and 2-hydroxymethyl-2-methyl-cycloalkanones. In this case the intermediate epoxy-alcohols should be readily isolable and convertible to products by a variety of conditions. The products in turn should readily undergo base catalyzed deformylation to produce useful synthetic intermediates.

TITLE: Approaches to the Synthesis of a Non-Classical Carbanion

CHIEF INVESTIGATOR: Captain Daniel D. Traficante and 1/Lt Clair J. Cheer

DESCRIPTION: Reports of non-classical carbonium ions are numerous and their chemistry has been studied extensively. However, there have been no reports of a non-classical carbanion. Attempts will be made to prepare endo-cyclobutano-7-anti-halomethylnorbornane and cis-2-halomethyl-cis-cis-cis-tricyclo (5-2-0-0 3, 6) nonane whose carbanions show promise of possessing non-classical carbanionic character.

TITLE: The Reaction of Thionocarbonates of 1, 3-Diols with Desulfurating Agents - A Projected Cyclopropane Synthesis

CHIEF INVESTIGATOR: 1/Lt Clair J. Cheer

DESCRIPTION: Corey has recently demonstrated that the reaction of thionocarbonates of 1,2-diols with trimethyl-phosphite affords olefins stereospecifically and in high yield. The stereo-specificity indicates that the decomposition of the inter-mediate carbene to olefin is probably sychronous. The possi-bility of utilizing the reaction to prepare cyclopropanes from the thionocarbonates of homologous 1,3-diols is anticipated and will be investigated.

TITLE: The Photolysis of Organic Fluorine Compounds

CHIEF INVESTIGATOR: 1/Lt Jon M. Veigel

DESCRIPTION: The pyrolysis of halogenated per-fluoro ethanes (e.g., 1,2-dibromo-1-chloro-1,2,2-trifluoroethane) has been investigated, and possible free-radical mechanisms postulated to account for observed products. The same systems also undergo photolytic reactions. The photolysis will be studied to discover similarities with the pyrolytic system, and to more closely define reaction parameters.

TITLE: Photolysis of Octahedral Complex Ions of Chromium (III)

CHIEF INVESTIGATOR: 1/Lt Jon M. Veigel

DESCRIPTION: The kinetics of acid hydrolysis and stereochemical course of reaction for a series of chromium (III) complexes have previously been determined. These compounds also undergo hydrolysis caused by ultraviolet and visible light. A study of these photochemical reactions and comparison with the purely thermal reactions may be of value in determining reaction mechanisms.

TITLE: Aquation of cis-Oxalatotriethylenetetraminechromium (III)

CHIEF INVESTIGATOR: 1/Lt Jon M. Veigel

DESCRIPTION: The study of the acid hydrolysis of the cis-oxalatotriethylenetetraminechromium (III) cation is part of an effort to investigate the kinetics and stereochemical course of reaction of octahedral complexes. Most data currently available deal with diacidobis(ethylenediamine) complexes of Co(III) and Cr(III). The extension of aquation reactions to diacido complexes with relatively non-reactive ligands other than ethylenediamine should permit more valid generalizations about octahedral reaction mechanisms.

TITLE: Restricted Rotation About the Carbonyl Group: Acid Strengths with Optically Active Bases

CHIEF INVESTIGATOR: Major John I. Riggs, Jr.

DESCRIPTION: This work is concerned with showing that acid strengths and the positions of equilibrium of acid-base reactions can be determined using optically active acids and bases. The approach used is to react selected weak acids with optically active dextroamphetamine (free base) in equimolar amounts, and by determining the optical rotation of the resulting solutions to be able to determine the positions of equilibrium and some information on acid strengths.

TITLE: Physical Properties of Gangliosides

CHIEF INVESTIGATOR: Captain Ronald J. Penick

DESCRIPTION: During the last two decades, a family of related compounds termed gangliosides have become the subject of intensive research in the field of neurobiochemistry. Recently samples of the individual members of this family have been isolated and characterized with regard to composition and structure. The complex nature of these molecules have resulted in peculiar properties, which probably have immediate bearing upon their physiological function. This function is at present still unidentified. The objective of this study will be to attempt evaluation of the relative degree of acidity of the carboxylic acid groups contained in the molecule and other such physical properties. Techniques such as conductimetric studies, which will include conductimetric tetrations and specific conductance as a function of concentration, will be used to study some of these properties. Osmomety studies will be attempted to evaluate molecular aggregation leading toward micelle formation in aqueous solution.

TITLE: The Effect of Ultrasonic Energy on the Pyrolysis of n-Butane

CHIEF INVESTIGATOR: Captain Arnold H. Pelofsky

DESCRIPTION: Little work has been done on the effect of ultrasonic energy on a gaseous phase chemical reaction. Three groups have shown, however, that ultrasonic energy does in fact effect a gaseous reaction, but they have not tried to explain it theoretically. It is the purpose of this study to not only theoretically explain the mechanics of this reaction but to derive a correlation which will predict product distribution, given certain experimental parameters. This is accomplished by comparing the product distribution of thermally cracked n-butane with the introduction of ultrasonic energy and without ultrasonic energy.

TITLE: Dissociation of Bisulfate Ion

CHIEF INVESTIGATOR: Captain Richard E. Lindstrom

DESCRIPTION: The dissociation constant for the bisulfate ion has been determined through a number of experimental techniques. The object of this project is to obtain a more precise value for this constant using a salt mixture rule proposed by T. F. Young of the University of Chicago and tested by the above investigator. The necessary data will be obtained through the use of dilatometer techniques.

TITLE: Isolation of High Temperature Molecules in Crystalline Matrices

CHIEF INVESTIGATOR: Captain G. Dana Brabson

DESCRIPTION: S_2 has been isolated on inert gas matrices at 4 and $20^{o}K$ and studied spectroscopically. The technique is being extended to include alkali halide matrices by simultaneous deposition of alkali halide and S_2 molecules on an optically transparent target followed by spectroscopic investigation of the resulting sample.

TITLE: Extension of the Kalman Filter

CHIEF INVESTIGATOR: First Lieutenant Gerald Cook

DESCRIPTION: A well known result in the field of optimal control theory is Kalman's development of the control law which minimizes quadratic cost functions of the error and control. This result is restricted to linear systems where the magnitude of the control function is unbounded. Two slightly different problems which have not been treated are the following: (1) The quadratic cost function of the control is constrained to be less than or equal to some value and the quadratic error function is minimized. This system makes the optimum use of a limited amount of control energy. (2) The quadratic error is given an upper bound and the quadratic control function is minimized. Here one is willing to tolerate a certain amount of error and at the same times wishes to minimize the control energy. It is proposed to study those two problems first from a theoretical point of view and then to solve some numerical examples.

* * * *

TITLE: Solutions of Optimal Control Problems by Approximations

CHIEF INVESTIGATOR: First Lieutenant Gerald Cook

DESCRIPTION: A few optimal control problems can be solved analytically and the control function expressed as an operation upon the state of the system. The more complex problems (among which the realistic ones usually fall) must be solved by numerical means such as steepest descent, dynamic programming or other techniques which require much computer storage and considerable time for a solution, often more time than is permissible for real-time computation. For this reason solutions mut be precomputed and therefore many advantages of feedback are lost. It is proposed to combine analytic techniques with the computer in a manner which will cost some accuracy, but hopefully will decrease computation time so that real-time solutions will be possible. The problem will be broken up into a series of sub-problems with unspecified boundary conditions. Each sub-problem will be approximated to the extent that it can be solved analytically. The boundary conditions of the sub-problems will then be chosen in such a manner as to optimize the overall problem. Clearly the smaller the range of the sub-problems, the better the approximations which will be made on these sub-problems and thus the computation time. A trade-off between accuracy and computation time is incurred and will determine the choice of range size of the sub-problems.

* * * *

TITLE: Control System Study of the Human Eye Movement Mechanism

CHIEF INVESTIGATOR: First Lieutenant Gerald Cook

DESCRIPTION: In order to understand the human eye-movement system, the following approach has been utilized. With the hypothesis that the system is made up of a controller (brain) operating on a physical plant (eyeball, muscles, socket, etc.) eye-movement experiments were conducted to demonstrate the overall behavior. Then a literature search was conducted which led to a mathematical representation of the plant. This was sufficient information to permit estimation of the controller behavior. The estimate could then be compared with the actual control function (electromyograms, which are physically measurable) to test the validity of the model. As a point of interest, the actual system behavior has been compared to its theoretical minimum time behavior.

* * * *

TITLE: Time Optimal Attitude and Velocity Control of a Spinning Vehicle

CHIEF INVESTIGATOR: Captain Dirk H. deDoes

DESCRIPTION: The time optimal position and velocity control of a spinning vehicle is determined through an application of Pontryagin's Maximum Principle and a linear perturbation scheme. The iterative procedure employed is simplified by using the general techniques of invariant embedding.

* * * *

TITLE: Simulation of a Hybrid Computer on a Digital Computer

CHIEF INVESTIGATOR: Captain James E. Funk

DESCRIPTION: The objective is to obtain an Algol source language program which can be used as a tool especially adapted to the solution of general control theory problems on the Burroughs B5500 computer. The program will be general enough to be used for most systems of differential equations.

* * * *

TITLE: Time Domain Solutions for Statistical Detection Problems

CHIEF INVESTIGATOR: Captain Roger A. Geesey

DESCRIPTION: The objective is to develop simpler design procedures which lead to easily mechanized devices for use in statistical detection problems. Existing procedures for detection of continuous time stochastic processes utilize frequency domain analysis and include such techniques as the Karhunen-Loeve expansion. However, it is generally difficult to construct the optimal detector from a solution expressed by an infinite orthogonal expansion in terms of the Karhunen-Loeve coefficients. It is desired to investigate the time-domain formulation of the detection problem to obtain a time-domain specification of the detector. Such a solution will facilitate the construction of optimal signal processors required in advanced radar developments and deep space communication systems. An essential portion of this investigation is the study of representations for continuous time stochastic processes.

* * * *

TITLE: General Computer Solution of Polynomial Equations

CHIEF INVESTIGATOR: Lieutenant Colonel William D. Marsland, Jr.

DESCRIPTION: The objective is to develop a numerical technique for the solution of polynomial equations of degree n, including equations with multiple roots, "ill-conditioned" equations, and equations with complex roots.

* * * *

TITLE: Sensitivity Analysis and Synthesis of Multivariable Systems

CHIEF INVESTIGATOR: Major Bernard S. Morgan, Jr.

DESCRIPTION: The objective is to obtain procedures applicable to the design and analysis of multivariable (multiple input-multiple output) systems in which changes in the system parameters occur. Multivariable systems, such as aerospace vehicles, representable by a system of first order differential equations will be emphasized.

* * * *

TITLE: Adaptive Bang-Bang Control of an Unstable Mechanical System

CHIEF INVESTIGATOR: Captain John F. Schaefer

DESCRIPTION: To extend an adaptive control technique developed for a specific fourth-order time-varying unstable system containing a single unknown parameter. A linearized model of the physical plant has one unstable mode and two non-decaying modes. The available control is bounded in amplitude, and a bang-bang control law is used.

* * * *

TITLE: Artificial Satellite Orbit Shifting without Mass Expulsion Utilizing Gravity Gradient

CHIEF INVESTIGATOR: Captain John F. Schaefer

DESCRIPTION: To investigate the potential of a new technique for varying the orbital parameters of a planetary satellite. The method employs an on-board energy source to vary the moment(s) of inertia of the spinning vehicle. Librational energy is exchanged for orbital energy via an interaction mechanism with the planet's gravitational potential.

* * * *

TITLE: Investigation of Extremely Fast Heat-Transfer Problem and the Mass Transfer Structure of a Plane Shock Wave

CHIEF INVESTIGATOR: Captain Charles F. Stebbins

DESCRIPTION: The heat transfer profile of the shock will be observed and an attempt will be made to derive experimentally the velocity distribution function. If the velocity distribution function is obtainable, the desired profiles will be calculated using basic kinetic theory. The surface accommodation coefficient will be studied in a very fast transient situation to enable calibration of the instrumentation involved. The very fine cold wire will be used as the primary instrumentation for this project. The experiments are to be performed in the FJSRL 17" shock tube. Theoretical work in free-molecule flow is being accomplished to provide mathematical comparisons for calibration of the probes. The major technical problems involve calibration, at present, and finding the optimum mathematical model of the shock with which to compare the primary results.

* * * *

TITLE: The Cold-Wire Instrument in Extremely Fast Heat-Transfer Problems

CHIEF INVESTIGATOR: Captain Charles F. Stebbins

DESCRIPTION: The very fine cold-wire will be examined as a possible instrument for use in extremely fast heat transfer problems, the most current problem being that of shock structure determination. A study of strain effects upon resistance change and an optimization technique for wire diameter selection will be conducted. The surface accommodation coefficients are being studied to determine feasibility of using the wires in various problems. The theoretical aspects of the problem will involve a re-evaluation of existing literature and a development of an optimization curve pending study of the behavior of the accommodation coefficient. The experimental portion of the project is about to commence and will encompass a detailed study of wire response to known step function inputs.

* * * *

TITLE: Design and Application of a Fast-Response Pressure Transducer

CHIEF INVESTIGATOR: Captain Charles F. Stebbins

DESCRIPTION: Shock tube pressure measurements require an instrument capable of fractional-microsecond response and with a sensitivity of not less than 1 millivolt/mm Hg pressure step. Such instruments are not commercially available. An additional problem is the presence of radial and other ringing modes in the transducer which tend to obscure the details of the pressure measurement. Some progress in this field has been made; the current project will attempt to refine a pilot model transducer.

* * * *

TITLE: Optimization Techniques by the Method of Steepest Descent

CHIEF INVESTIGATOR: Captain Rinaldo F. Vachino

DESCRIPTION: The purpose of this project is to extend the usefulness of the iterative technique based on the Method of Steepest Descent such that this technique will be applicable to the solution of variational problems with piecewise continuous controls.

* * * *

TITLE: Impact of Defense Spending

CHIEF INVESTIGATOR: Captain James M.L. Karns

DESCRIPTION: This will be an inquiry into intertemporal adjustments which have occurred within a regional economy, i.e., El Paso County, Colorado, by Department of Defense organizations during the years 1940-1965.

* * * *

TITLE: Experimental Investigation of Radioactive Nuclides

CHIEF INVESTIGATOR: Major Raymond H. Kelley

DESCRIPTION: The objective is to conduct an experimental investigation of radioactive nuclides in order to determine half-lives, characteristic radiations and their energies, energy level diagrams and reaction cross sections for the production of certain nuclides.

* * * *

TITLE: Application of Raman Spectroscopy to Shock Tube Studies

CHIEF INVESTIGATOR: Major Robert W. Milling

DESCRIPTION: This study will use the phenomenon of Raman scattering to determine the rate parameters of a high temperature gas in a shock tube. The light scattered by a test gas will be observed with a spectrograph using electron multiplier photo tubes. Since the intensity of the Raman lines is proportional to the number density, the time history of the Raman intensity will yield both dissociation and vibrational relaxation rates.

* * * *

Computer Division

The Computer Division supports the research efforts of the Aerospace Mechanics Division and the Chemistry Division, as well as research by the Academy faculty and cadets. In addition, the Division will provide support for all Academy programming courses. Cadets have taken programming courses on an elective basis, but beginning in September 1964 programming became a required course.

Among current projects of FJSRL which require use of the computer are a steepest ascent problem, simulation of an analog computer on a digital computer, determination of the system transfer-function matrix and sensitivity coefficients for the transfer-function matrix in terms of system parameters, simulation of human eye movement, and optimal control problem studies. Academy staff and faculty projects include orbital trajectory studies, course scheduling, preparation of a list processing language, wind tunnel data reduction, statistical studies of candidate selection data, simulation of growth of molds, modeling historical events and situations to analyze and predict future events, and a number of statistical studies on test data.

The Burroughs B5500 is designed around the ALGOL language. A compiler for COBOL is available as well as a translator and diagnostic program for FORTRAN II and IV. The computer is ideally suited for the USAFA-FJSRL applications.

Several short courses on ALGOL programming have been run since December 1963. FJSRL sponsored a computer workshop for the Academy faculty during the month of February 1965. During the fall semester 1964 the FJSRL staff assisted cadets and faculty members in ALGOL programming problems encountered in the new prescribed computer programming course being given for the first time. This assistance was phased out as the faculty became familiar with ALGOL. The staff has also been contacted by other Air Force agencies, ADC and Randolph Air Force Base, for advice on ALGOL and has assisted on several occasions in the translation of FORTRAN into ALGOL.

The computer is presently in a two-shift operation. In December 1965 the magnetic drum was replaced by a disk file and one module of core memory was added. This improvement will extend the useful life of the computer appreciably by allowing more efficient use of the two processors in the simultaneous processing of two problems.

Colonel Gage H. Crocker

Colonel Gage H. Crocker is Commander of the Frank J. Seiler Research Laboratory.

Prior to his present assignment he taught in the Department of Aeronautics at the Air Force Academy and was Professor and Head of that department from September 1962 until February 1965. In that assignment he directed cadet instruction in the areas of thermodynamics, gas dynamics, propulsion and flight mechanics.

[redacted] He graduated as valedictorian of his class from Staunton Military Academy, Virginia in 1939 and earned his Bachelor of Science in Aeronautical Engineering at the Massachusetts Institute of Technology in February 1943. Upon graduation from Officer Candidate School, he received a reserve commission as 2nd Lieutenant in the Army Air Corps and was assigned to the Aircraft Laboratory, Wright Field, Ohio as a project officer for development of aircraft design criteria. In 1944 he was sent to the California Institute of Technology and after receiving his Master's Degree in Aeronautics returned to duty with the Aircraft Laboratory.

As one of the officers in the first graduate guided missiles course at the University of Michigan he received a Master's Degree in Aeronautical Engineering in 1948. This was followed by a four year assignment in the Guided Missiles Section at Wright Field as project officer on development of air-to-air missiles - primarily the Falcon GAR series. In 1952 he was assigned to Hq USAF as staff officer developing operational requirements for air defense missiles in the Directorate of Requirements.

In 1957 he was graduated from the USAF Air Command and Staff School. Following additional residence work at the University of Michigan he was assigned to the USAF Academy, Department of Aerodynamics in 1959. While teaching courses in aerodynamics he completed his doctoral thesis and was awarded a PhD in Aeronautical and Astronautical Engineering from the University of Michigan in February 1961.

Colonel Crocker is an Associate Fellow of the American Institute of Aeronautics and Astronautics, a past Chairman of the Rocky Mountain Section of the Institute of Aerospace Sciences, a member of the American Association for the Advancement of Science, American Society of Engineering Education, Research Society of America, Air Force Association, American Ordnance Association, Sigma Xi and Phi Kappa Phi. He has served as a visiting lecturer in the AEDC - University of Tennessee Summer Institute and is listed in American Men of Science. He is the co-author of a number of papers on turbulence associated with blunt body flow.

[redacted]

Lt. Colonel John P. Brooks

Lt. Colonel Brooks is assigned to the Frank J. Seiler Research Laboratory as programming and executive officer. His duties include plans, budgets, forecasting of financial requirements, personnel and executive officer responsibilities.

Lt. Colonel Brooks' recent assignments include: two years at HQ OAR in the plans and programs office; one year at HQ Air Force Systems Command in basic research planning; three years in the Materials Laboratory at Wright-Patterson AFB, Ohio as materials research supervisor and executive officer; and a one year tour with the Army at their Chemical Center, Edgewood, Maryland as a Chemist. When he was recalled to active duty during the Korean conflict, Lt. Colonel Brooks was a B-29 pilot at Lowry AFB, and later was a munitions officer at Castle AFB, California.

During the time Lt. Colonel Brooks was out of the service from 1946-1950, he attended the University of Colorado obtaining a B.S. in 1948 and an M.A. in 1950 in the field of Organic Chemistry. At the same time he was elected to Sigma Xi, honorary scientific society, and became a member of the American Chemical Society.

[redacted]

Lt. Colonel William D. Marsland, Jr.

Lt. Colonel William D. Marsland, Jr., of Amityville, New York, was assigned to the Frank J. Seiler Research Laboratory of the Office of Aerospace Research at the United States Air Force Academy as Director of the Computer Division in January 1963. He has had a number of years of experience in teaching special weapons and mathematics. His most recent assignment was as Assistant Professor of Mathematics at the Air Force Academy in which capacity he taught computer programming, numerical analysis, and differential equations to cadets.

[redacted] His attendance at the New York State College for Teachers was interrupted by World War II. Upon completion of meteorological training at the Massachusetts Institute of Technology, he was commissioned as a 2nd Lieutenant in the Army Air Corps and served as an Air Traffic Control Officer in Prestwick, Scotland for the Air Transport Command.

In February 1946, Lt. Colonel Marsland returned to New York State College for Teachers and earned his Bachelor of Arts degree in 1947 and his Master of Arts degree in 1948 with a major in mathematics. At New York State College for Teachers he played varsity basketball for three years, and was president of the Men's Athletic Association in his senior year. He was listed in Who's Who in American Colleges and Universities in 1947. He taught general science and mathematics in the public schools in Troy, New York and Roslyn, New York for three years. In August 1951 he was recalled to active duty by the United States Air Force. He was assigned to the Armed Forces Special Weapons Project at Sandia Base, Albuquerque, New Mexico where he served as an instructor in the nuclear aspects of special weapons. In January 1955 Lt. Colonel Marsland was selected as a member of the original staff of the Department of Mathematics at the United States Air Force Academy, then temporarily located at Lowry Air Force Base, Denver, Colorado. In June 1957 he was sent for further graduate study at the University of Michigan, working toward a doctorate in mathematics. He returned to the Academy Department of Mathematics in June 1960 where he taught advanced courses in mathematics for the following 2½ years.

Lt. Colonel Marsland is a member of the American Mathematical Society, the Society for Industrial and Applied Mathematics, the Mathematical Association of America, and the Association for Computing Machinery. He is presently Secretary of the Special Interest Committee on Digital Computer Programmer Training of the Association for Computing Machinery.

[redacted]

[redacted] He attended New York State College for Teachers at Albany, New York where he earned his Bachelor of Arts degree in 1947 and his Master of Arts Degree in 1948.

Lt. Colonel Marsland was recalled to active duty by the United States Air Force in 1951 in the grade of 1st Lieutenant. He was promoted to Captain in January 1955, to Major in July 1962, and to Lt. Colonel in May 1966. His medals and decorations include the Air Force Commendation Medal, the Good Conduct Medal, Armed Forces Reserve Medal, National Defense Service Medal, World War II Victory Medal, and campaign medals for the American and European theaters.

Major Alfred D. Brown, Jr.

Major Alfred D. Brown, Jr., was recently assigned to the Frank J. Seiler Research Laboratory, Office of Aerospace Research, United States Air Force Academy, Colorado, as a research chemist.

Major Brown's initial duty assignment was with the Air Technical Intelligence Center, Wright-Patterson AFB, Ohio where he served as a Materials Specialist from May 1954 until August 1957. He reentered Auburn University in September 1957, assigned to the Air Force Institute of Technology, and received the M.S. degree in Organic Chemistry in June 1959.

[redacted] He entered Auburn University in September 1949 and graduated with a B.S. degree in Chemical Engineering in March 1954, receiving a commission as Second Lieutenant in the USAF at that time.

He served from 1959 through 1963 at the Air Force Rocket Propulsion Laboratory in various capacities including Project Engineer for liquid propellant research, Project Engineer for in-house solid propellant research and testing, and as a member of the Advanced Planning Staff for the Rocket Propulsion Laboratory.

He graduated from Squadron Officer School, Class 59C, and from the Air Command and Staff College, Class of 1964.

Major Brown again entered Auburn University in June 1964, assigned to the Air Force Institute of Technology, and completed requirements for the Ph.D. degree in Organic Chemistry in June 1966, and is scheduled to graduate in August 1966. He is a member of Phi Lambda Upsilon and the American Chemical Society. His primary fields of research have dealt with heterocyclic compounds, organo-phosphorus compounds, and rocket propellants. He has been awarded the Air Force Commendation Medal, and holds the Air Force Outstanding Unit Award ribbon.

[redacted]

Major Lowell A. King

Major Lowell A. King was assigned to the Frank J. Seiler Research Laboratory, Office of Aerospace Research, U. S. Air Force Academy, Colorado, as Director of the Chemistry Division in June 1966. Major King is on leave from his duties as Tenure Associate Professor of Chemistry at the Air Force Academy.

[redacted] He received a B.S. in chemistry in 1953 from Iowa State University, and as an AFROTC graduate was commissioned in the U. S. Air Force. His first assignment was a master's program under AFIT at Washington University; he received an A.M. in radiochemistry from that institution in 1955.

After short tours at Sandia Base, New Mexico, and Travis Air Force Base, California, Major King was assigned to the Materials Laboratory, Wright Air Development Center, Ohio. There he was a Group Leader and Research Chemist. He conducted research in radiation effects and monitored basic and applied research contracts with industry and universities regarding radiation chemistry and radiation effects.

During the period June 1959 to May 1961, Major King was Instructor of Chemistry at the Air Force Academy. In May 1961, Major King returned to Iowa State University under AFIT. He received his PhD in inorganic and physical chemistry in July 1963. He then returned to the Air Force Academy where he remained in the Department of Chemistry until July 1964. He spent the 1964-1965 academic year on leave with the Frank J. Seiler Research Laboratory. He was promoted to Assistant Professor of Chemistry in August 1963, and to Associate Professor of Chemistry in January 1964. Major King was appointed a Tenure Associate Professor of Chemistry in March 1966.

[redacted]

Major King is a member of the American Chemical Society, the American Association for the Advancement of Science, the Colorado-Wyoming Academy of Science, Phi Kappa Phi, Sigma Xi, and Phi Lambda Upsilon. He holds the Air Force Commendation Medal.

Major Bernard S. Morgan, Jr.

Major Bernard S. Morgan, Jr., was assigned as Director, Aerospace Mechanics Division, the Frank J. Seiler Research Laboratory, in July 1965.

Major Morgan is a recent graduate of the Armed Forces Staff College, Norfolk, Virginia. He has served as a project scientist in the Air Force Office of Scientific Research, first as a physicist in the General Physics Division and then as an electronics engineer in the Applied Mathematics Division. In 1962 Major Morgan was cited as the outstanding young scientist in the Washington, D. C. metropolitan area by the Washington, D. C. Academy of Sciences.

From 1958 to 1960 Major Morgan taught graduate courses in Aeronautical Engineering while a member of the Aeronautical Engineering Department of the Air Force Institute of Technology. His early career as an Air Force officer was spent as a detachment commander of a TM-61 Mobile Training Detachment. His detachment was the first to be deployed overseas when it was sent to Bitburg AB, Germany, in 1954. His detachment was also stationed at Patrick AFB, Florida, and Chanute AFB, Illinois.

Major Morgan spent two years in the United States Navy as a petty officer and received a Secretary of Navy's appointment to the United States Naval Academy. He was graduated from Annapolis in June 1951 and was commissioned in the U. S. Air Force. He is also a graduate of the University of Michigan from which he has received the degrees of Master of Science in Aeronautical Engineering, Master of Science in Instrumentation Engineering, and Doctor of Philosophy in Instrumentation Engineering.

Major Morgan is a member of the Technical Advisory Committee for the IEEE Professional Group on Automatic Control, a reviewer for the Applied Mechanics Reviews, and an ASME representative to the Theory Committee of the American Automatic Control Council. He is a member of IEEE, AIAA, SIAM, SIGMA XI, and Tau Beta Pi. Major Morgan has published more than 12 papers in the areas of automatic control, multivariables systems and nonlinear systems.

[redacted]

Captain Dirk H. deDoes

Captain deDoes reported to the Frank J. Seiler Research Laboratory for duty as a research associate in October 1965. He was previously assigned to the Air Force Institute of Technology as a graduate student.

[redacted] After graduating from Verdugo Hills High School, Tujunga, California in June 1956, Captain deDoes entered San Diego State College. Upon completion of his undergraduate studies in June 1961, he was awarded a B.S. degree with honors (with distinction in Engineering and Air Science). He was a distinguished military graduate and accepted a regular commission upon completion of his studies.

Captain deDoes entered active duty on 4 September 1961. His first assignment was to the Graduate School, University of Southern California, under the Air Force Institute of Technology Civil Institutions Engineering Program. He received a Master of Science degree in Aerospace Engineering in February 1963. Captain deDoes continued with his academic work at the University of Southern California and was admitted to candidacy for the PhD degree in Aerospace Engineering on 4 March 1965.

Captain deDoes holds a private pilot's license. In addition to this, his extracurricular activities include: archery, tennis, golf, hunting, fishing, and skiing. [redacted]

Captain James E. Funk

[redacted] he entered the University of Colorado, Boulder, Colorado. Upon completion of his undergraduate studies in June 1958, he was awarded a B.S with honors in Aeronautical Engineering, a B.S. in General Business, and a reserve commission as a second lieutenant in the United States Air Force. While at the University of Colorado, he became a member of Tau Beta Pi and Sigma Tau, engineering honorary fraternities.

Captain Funk entered active duty as a second lieutenant on 24 August 1958, at the Air Force Special Weapons Center at Kirtland AFB, New Mexico, where he worked as a Test Project Officer evaluating special weapons handling equipment. While assigned at Kirtland AFB he attended a Special Weapons Orientation Course at Sandia Base, New Mexico, in 1959, after which he assisted in the testing and evaluation of the "Clip-in Weapon Suspension System" for SAC aircraft.

In August 1961, he was reassigned to the Air Force Institute of Technology, Wright-Patterson AFB, Ohio. While at the resident school he was awarded a regular commission in May 1962. He graduated in August 1963, receiving a Master of Science degree in Astronautics.

Subsequently, he was assigned to The Frank J. Seiler Research Laboratory, OAR, at the USAF Academy and shortly afterwards, on 1 October 1963, he received a promotion to captain.

[redacted]

Captain Roger A. Geesey

Captain Roger Alan Geesey reported to the Frank J. Seiler Research Laboratory on 5 October 1965 for duty as a Research Associate in the Aerospace Mechanics Division.

[redacted] In September of that year, he entered Lehigh University, Bethlehem, Pennsylvania and pursued the curriculum in Electrical Engineering. In June 1958, he graduated from Lehigh with a degree of Bachelor of Sciences in Electrical Engineering and received an Air Force Commission as 2nd Lieutenant with the completion of the 4 year ROTC program at Lehigh.

An Air Force active duty assignment to the Rome Air Development Center at Griffiss Air Force Base, New York, began on 24 November 1958. This assignment was with the Data Processing Branch of the Intelligence Laboratory, and the duties concerned developing new computer techniques for data handling.

The Air Force Institute of Technology assigned Captain Geesey to Stanford University in September 1961 for graduate study. A course of study in Electrical Engineering at Stanford led to the degree of Master of Sciences in June 1963. Graduate study was continued on a PhD program and research for a thesis program was initiated prior to reporting to duty at FJSRL.

The technical field pursued by Captain Geesey is that of Statistical Communication Theory. In particular, a study for detection of random signals in noise with emphasis on the continuous time problem is presently being pursued.

[redacted]

Captain Geesey is a member of the Institute of Electrical and Electronic Engineers. His personal interests include skiing, golfing, photography, amateur radio, and music appreciation.

Captain Ronald J. Penick

Captain Ronald J. Penick has been assigned to the Frank J. Seiler Research Laboratory, Office of Aerospace Research, United States Air Force Academy, Colorado, as a research chemist.

Captain Penick reported to the Frank J. Seiler Research Laboratory from the Department of Chemistry and Physiology, United States Air Force Academy, where he was assigned as an instructor in chemistry.

[redacted] In September 1952, he entered Miami University in Oxford, Ohio. He graduated from there in 1956 with a B.A. degree and received a reserve commission as a second lieutenant. He entered the Miami University graduate school as a category C student in September 1956 and received his M.S. from there in February 1959. During this period of study he spent one year as a teaching assistant and one year on a research fellowship.

Captain Penick spent his initial active duty tour with the 1035th Special Weapons Squadron at McClellan AFB, California. During this period he also taught five semesters part-time at Sacramento State College in the Chemistry Department. He received his regular commission in 1961.

In September 1962, he entered the Ohio State University on an AFIT assignment. Captain Penick received his PhD in Biochemistry in June 1965. His area of graduate research was devoted to the study of gangliosides from human and beef brain.

[redacted]

Captain John F. Schaefer

Captain Schaefer reported to the Aerospace Mechanics Division of the Frank J. Seiler Research Laboratory in April 1965, after completing his studies at Stanford University.

[redacted]

Following schooling at Keesler AFB, Mississippi, Capt Schaefer was assigned as Assistant Maintenance Officer for Flight Test Radar at Wright-Patterson AFB in August 1959. After eight months in this capacity, he became a Flight Test Engineer at Wright-Patterson AFB and was involved in the in-flight testing of newly developed radar, navigation, and electronic counter-measures equipment.

Captain Schaefer was assigned to AFIT in June 1961, and reported to Stanford University at that time as an Electrical Engineering graduate student. He took the M.S. degree in 1963 and the Ph.D. in June 1965. He is a member of Sigma Xi and the Institute of Electrical and Electronic Engineers.

[redacted]

Captain Charles F. Stebbins

[redacted] Captain Stebbins attended the USAF Academy and was graduated in 1961 with a navigator's rating and a major in Aeronautics. Upon graduation Captain Stebbins was selected to attend the California Institute of Technology in Pasadena, where he received his Master of Science degree in Aeronautics and his Aeronautical Engineer's degree. His thesis topic concerned the heat transfer structure of a plane shock layer.

In July of 1963, Captain Stebbins was assigned to the Frank J. Seiler Research Laboratory. Captain Stebbins authored a paper entitled, "Sitting Time and Strain Effects in a .00005" Diameter Cold Wire for Shock Tube Use," published as a Seiler Research Laboratory technical report. Captain Stebbins is in the process of calibrating a low density shock tube at the USAF Academy, which is in the final stages of completion. With the completion of this facility, Captain Stebbins will continue his work in the structure of shock waves and in heat transfer and surface effects in free-molecule flow. He has taught aircraft stability and control for the Aeronautics Department and vector mechanics for the Mechanics Department of the USAF Academy.

[redacted]

Captain Rinaldo F. Vachino

[redacted]

During the following four years he attended the Newark College of Engineering, from which he was graduated in 1953 with the degree of Bachelor of Science in Electrical Engineering and with a commission in the Air Force. For a year following graduation he worked with the Radio Corporation of America in the field of transistor design and development.

In April 1954 he was called to active duty and attended the Airborne Electronics School at Keesler AFB, Mississippi. His first assignment was to Westover AFB, Massachusetts, where he served as an electronics officer, in charge of field maintenance of armament and electronics equipment.

In August 1956 he was assigned to the Air Force Institute of Technology, from which he graduated in 1958 with an MS degree in Electrical Engineering, specializing in Guidance and Control. From 1958 to 1961 he served with the Synthesis and Analysis Division, Directorate of Engineering, Wright-Patterson AFB, Ohio. In this position he participated in various trajectory studies of missiles and satellites, in stability and control of winged and reentry vehicles, and in the operational analysis of STOL, VTOL and B70 aircraft.

During the period from August 1961 to August 1963 he was assigned to the University of Michigan to pursue further graduate studies in Aerospace Engineering.

In August 1963 he joined the Frank J. Seiler Research Laboratory at the Air Force Academy. Since that time he has engaged in the extension of present methods for solving optimization problems, and the digital computational algorithms for finding the solutions to these problems. He has applied the results of these studies to a number of problems.

1/Lt Clair J. Cheer

Lieutenant Cheer reported to The Frank J. Seiler Research Laboratory for his initial active duty assignment in January 1964. He came to this assignment upon completion of his graduate studies as a Category C United States Air Force Reserve Officer.

[redacted] In that same year he entered Kenyon College in Gambier, Ohio, and received a Bachelor of Arts degree in Chemistry from that institution in 1959. At the same time he was commissioned a Second Lieutenant in the USAF and awarded a Category C delay to pursue graduate studies in chemistry.

In the fall of 1959 he entered the graduate school of Wayne State University in Detroit, Michigan, as a teaching assistant. In June of 1964 Lieutenant Cheer was awarded the Ph.D. degree for his work on approaches to the syntnesis of bicyclic monoterperoids and a chlorinative ring enlargement. These studies have been both published in The Journal of Organic Chemistry as full papers.

[redacted]

He is a member of the American Chemical Society, The Division of Organic Chemistry of the American Chemical Society, The Society of the Sigma Xi and Phi Lambda Upsilon, honorary chemical fraternity.

1st Lieutenant Gerald Cook

[redacted]

Lt. Cook entered Virginia Polytechnic Institute in 1956 under the cooperative engineering program. His industry periods were spent with the manufacturing division of Vick Chemical Company, Greensboro, North Carolina. In June 1961 he received with honors his B.S. degree in electrical engineering. In July 1961 he was commissioned a 2nd Lieutenant in the United States Air Force.

The following four years Lt. Cook was a graduate student at M.I.T., being an N.S.F. Fellow three of these years. In June 1965 he received his Sc.D. degree in electrical engineering.

During his years as a graduate student Lt. Cook worked one summer for IBM in data communication terminal development and a year part-time for the M.I.T. Instrumentation Laboratory on guidance for the Apollo spacecraft. He also served as a teaching assistant for one summer and as a research assistant in the Electronic Systems Laboratory for one year. He is a member of Tau Beta Pi, Eta Kappa Nu, Phi Kappa Phi, Sigma Xi, and IEEE.

[redacted].

1st Lt. George J. Gauthier

1st Lt. George J. Gauthier has been assigned to the Frank J. Seiler Research Laboratory, Office of Aerospace Research, United States Air Force Academy, Colorado, as a research chemist.

Lt. Gauthier reported to the Frank J. Seiler Research Laboratory for his initial active duty assignment. He comes to this assignment following completion of his graduate studies as a Category C United States Air Force Reserve Officer.

[redacted] In the fall of 1958 he entered the University of Notre Dame, Notre Dame, Indiana. He was graduated in June 1962 with a B.S. degree in chemistry, and commissioned a second lieutenant, USAF Reserve. Lt. Gauthier was then given a Category C delay to attend graduate school.

He entered the graduate school of the University of New Hampshire in the fall of 1962. While a graduate student, he was a research fellow supported by grants from the National Cancer Institute and National Institutes of Health. His PhD in Organic Chemistry was awarded in June 1966. Lt. Gauthier's research concerned the reactions of nucleophiles with pyridinium ions.

[redacted]

Lt. Gauthier is a member of the American Chemical Society and the Division of Organic Chemistry, American Chemical Society. He is also a member of Sigma Xi.

1st Lt. Ralph W. Rudolph

Lt. Ralph W. Rudolph came to the Frank J. Seiler Research Laboratory for his initial active duty assignment. Previous to this assignment he completed his graduate studies at the University of Michigan as a Category C United States Air Force Reserve Officer.

[redacted]

In the fall of 1958 he entered the Pennsylvania State University, University Park, Pennsylvania. He received a B.S. in Chemistry in June 1962, with high distinction, and was commissioned a second lieutenant, USAF Reserve, as a Distinguished Military Graduate. Lt. Rudolph was then granted a Category C Delay to attend graduate school.

[redacted]

He entered the Horace H. Rackham School of Graduate Studies, University of Michigan, in the fall of 1962 after spending a summer with Eastman Kodak in Rochester, New York. While a graduate student he was a teaching fellow, and later a research assistant, as well as the recipient of several fellowships. His M.S. in Chemistry was awarded in May 1964 and he fulfilled the requirements for his PhD in Inorganic Chemistry in May 1966. Lt. Rudolph's doctoral dissertation was concerned with the preparation, properties, and chemistry of difluorophosphine ligands.

Lt. Rudolph is a member of the American Chemical Society, Sigma Xi, Phi Lambda Upsilon, Phi Kappa Phi, and Phi Eta Sigma.

First Lieutenant Jon M. Veigel

First Lieutenant Jon M. Veigel has been assigned to the Frank J. Seiler Research Laboratory, Office of Aerospace Research, United States Air Force Academy, Colorado, as a research chemist.

Lieutenant Veigel reported to the Frank J. Seiler Research Laboratory for his initial active duty assignment. He comes to this assignment from the E. I. du Pont de Nemours and Co. where he was employed as a research chemist following completion of his graduate studies as a Category C United States Air Force Reserve Officer.

[redacted] In the Fall of 1956 he entered the University of Washington, Seattle, Washington. He was graduated in March 1960 with a B.S. degree in chemistry, and commissioned a second lieutenant, USAFR, as a Distinguished Military Graduate. Lieutenant Veigel was then given a Category C delay to attend graduate school.

He entered the graduate school of UCLA in the Fall of 1960. While a graduate student he was a teaching assistant, and later a research assistant. His Ph.D. in Physical Chemistry was awarded in January 1965. Lieutenant Veigel's research concerned the synthesis and aquation of cis-chloroisothiocyanatobis (ethylenediamine)-chromium (III) and related cations.

[redacted]

Lieutenant Veigel is a member of the American Chemical Society and the Division of Inorganic Chemistry, American Chemical Society. He is also a member of Sigma Xi.

List of Major Equipment

Major Equipment on Hand

Analytical Nuclear Magnetic Resonance Spectrometer
Model A-60 with V6030 Room Temperature Probe -
Varian Associates
X-Ray Equipment, Norelco
Carbon-Hydrogen-Nitrogen Analyzer - F&M Scientific
Automatic Gas Chromatograph - F&M Scientific
Thin Layer Chromatography - Desage-Brinkman
Beckman Model DU Spectrophotometer - Beckman
Instruments, Inc.
Beckman Model IR4 Infrared Spectrophotometer
Spinning Band Columns
X-Ray Diffraction Cameras and Associated Equipment
Organic Chemistry Micro-Glassware Kit
Abbe Refractometer
International Automatic Centrifuge
Zone Refiner Apparatus - Fisher Scientific
Beckman Zeromatic pH Meter
Gel Electrophoresis Apparatus
Tube and Muffle Furnaces and Controllers
Isolator Lab (Dry Box) - Fisher
Differential Thermal Analysis Apparatus
Precision Fractionation Apparatus - Todd Scientific
X-Y Recorder - Moseley
Burroughs B5500 Digital Computer
Cal Comp 570/565 Plotter
Electron Paramagnetic Resonance Spectrometer -
Alpha Scientific
Precision K-3 Potentiometer, Leeds & Northrup
Leeds & Northrup Galvanometer (DC Null, high sensitivity)
Low Density Shock Tube and Instrumentation
Pulse Height Analyzer
Water Baths
Cathetometer
Beckman Research pH Meter
Beckman GC-4 Gas Chromatograph
Photolysis Reaction Chamber
Microdensitometer
Single Crystal Apparatus, X-Ray
High Vacuum System
Cryogenic Liquid Facilities
Hilger-Watts E612 Spectrograph
Spectra-Physics CW Laser Model 130
Harrison Labs Power Supply #6522A

Major Air Force Academy Items Being Used by FJSRL

GC 2-A Gas Chromatograph (Beckman, modified by FJSRL)
DK-2A Spectrophotometer (Beckman, UV-Vis, modified by FJSRL)
Perkin-Elmer IR-137 Infrared Spectrophotometer
Pace Analog Computer
Jarrell-Ash 1.4 Meter Emission Spectrograph