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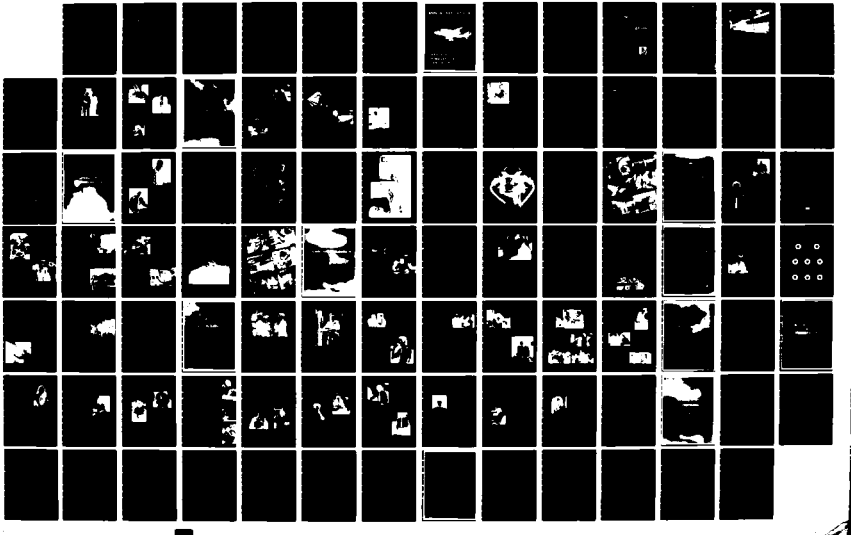

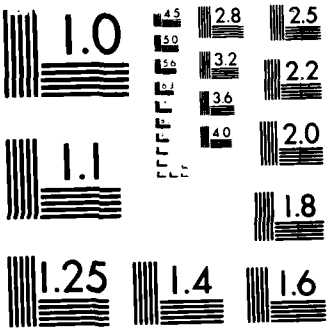

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AIR FORCE HUMAN RESOURCES LABORATORY

AIR FORCE HUMAN RESOURCES LABORATORY
ANNUAL REPORT - FISCAL YEAR 1985

Ruth M. Buescher

TECHNICAL SERVICES DIVISION
Brooks Air Force Base, Texas 78235-5601

January 1986

Final Technical Paper

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5601

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19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

This paper presents the Air Force Human Resources Laboratory (AFHRL) mission, corporate philosophy, and descriptions of its research and development (R&D) thrusts. Fiscal Year 1985 technical achievements and ongoing R&D are organized under each thrust area. It further outlines the AFHRL organizational structure, functions of divisions and staff offices, and available technical resources. It lists publications and presentations by Laboratory personnel during Fiscal Year 1985.

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ANNUAL REPORT - FISCAL YEAR 1985

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Brooks Air Force Base, Texas 78235-5601

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ANNUAL REPORT FY85

AIR FORCE HUMAN RESOURCES LABORATORY

AIR FORCE HUMAN RESOURCES LABORATORY (AFHRL)

A designated organizational element of the Air Force Systems Command, aligned under the Aerospace Medical Division.

DENNIS W. JARVI, Colonel, USAF
Commander

DR. EARL A. ALLUISI
Chief Scientist

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NOTICES

CONTACTS: A directory of AFHRL Command and Staff personnel and Division Chiefs is provided on the inside back cover.

NOTE: The findings in this report are not to be construed as an official position of the Department of the Air Force, unless so designated by other authorized documents.

Department of the Air Force
AIR FORCE HUMAN RESOURCES LABORATORY
Brooks Air Force Base, Texas 78235-5601

MISSION

To support the Air Force Mission,
Air Force Commanders,
and Air Force Personnel

Through Air Force Systems Command

By Technology Base R&D

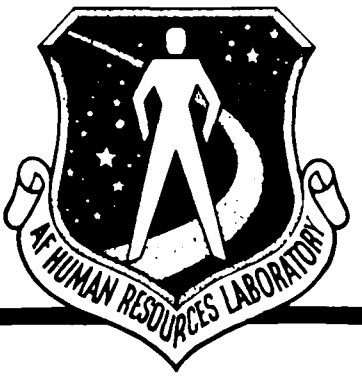
In the Technology Areas of

Manpower and Personnel
Education and Training
Simulation and Training Devices
Logistics and Human Factors

ORIGIN

In the late 1960s, the Secretary of the Air Force and the Air Force Chief of Staff decided to redefine the Air Force's research and development (R&D) efforts in the related areas of personnel and training. In August 1967, the augmented Psychology and Social Sciences Panel of the USAF Scientific Advisory Board conducted a study concerning such R&D work. In its report, the board developed certain standards needed for a successful program: (a) the requirement for managers of these R&D efforts to possess and display a keen interest in the entire program, (b) the proper allocation of sufficient funding commensurate to the work being accomplished, (c) the acquisition and retention of well-trained and highly qualified people, (d) the recognition that the "human factor" involved in personnel and training R&D makes it a unique entity that cannot be compared to the hardware R&D in the Air Force's respective physical science laboratories, (e) the need for R&D functions to be geographically close to the organizations that most effectively applied the results of that R&D work, and (f) the need for a proper balance between finding solutions to current problems and the achievement of long-range R&D goals. On July 1, 1968, the Air Force Human Resources Laboratory (AFHRL) was established with an organizational structure that has allowed it to effectively carry out its mission over the last 17 years.

AFHRL



"Military power...serves the cause of peace by holding up a shield behind which the patient, constructive work of peace can go on." Dwight D. Eisenhower

FY 85

THRUSTS	TECHNOLOGIES
MANPOWER & FORCE MANAGEMENT	ENLISTED SELECTION
	OFFICER SELECTION
	JOB ASSESSMENT
	MANAGEMENT DECISION AIDS
AIRCREW TRAINING EFFECTIVENESS	PART-TASK TRAINING
	AIRCREW PERFORMANCE MEASUREMENT
	TRAINING SYSTEMS
	R&D AIRCRAFT
	VISUAL SIMULATION
	INSTRUCTOR OPERATOR STATIONS
MAINTENANCE & COMBAT SUPPORT	LOGISTICS MODELING CONCEPTS
	INTEGRATED MAINTENANCE INFORMATION SYSTEMS
	MAINTENANCE & LOGISTICS COMPUTER-AIDED SYSTEMS
	INTEGRATED DESIGN SUPPORT TOOLS
TRAINING DESIGN & DELIVERY	COMPUTER-BASED INSTRUCTION
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	TACTICAL COMMAND & CONTROL DECISION AIDS

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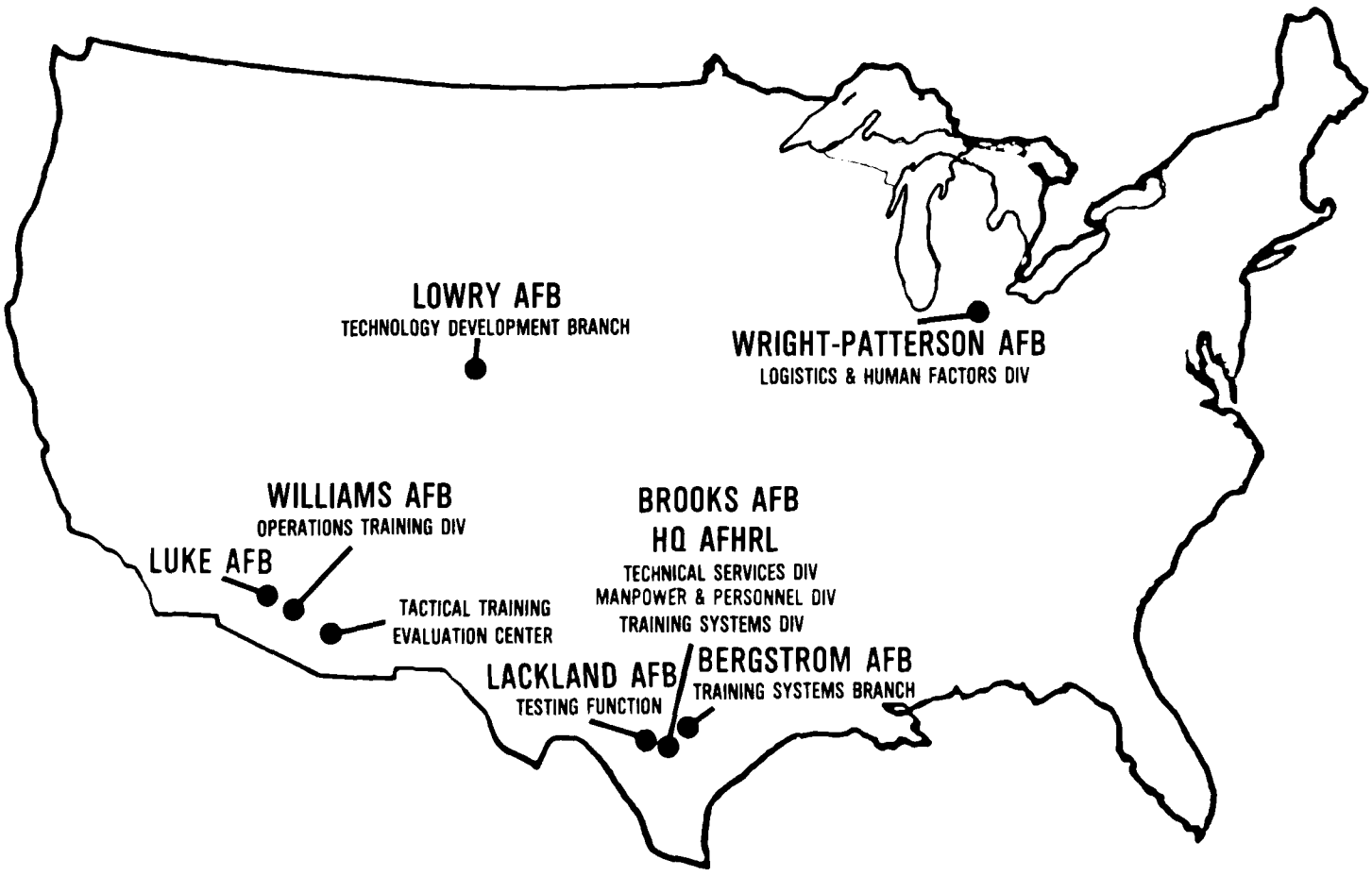


A MESSAGE FROM THE COMMANDER AND CHIEF SCIENTIST

The Air Force Human Resources Laboratory conducts research and development (R&D) in all areas of people-related Air Force needs. Our Laboratory is committed to providing the technology base and applications which will match technologically advanced weapon systems with appropriately skilled personnel, both military and civilian. Reading the newspaper on almost any given day makes us acutely aware of the urgency of our task to uphold the combat readiness of the U.S. Air Force. Hostile forces are real and bent on destroying the blessings of our way of life. As members of the Air Force, and as civilian employees of the Department of Defense, we together with our sister Services are charged with providing our Nation's defense. This prompts us to a strong sense of stewardship --to provide the highest level of productivity and technology development of which we are capable--to make the maximum contribution to the fighting strength of the Air Force.

This annual report highlights some of the features of our organization, major programs, resources, and products. We invite you to visit with us through this report, and to become better acquainted with AFHRL.

Those of you who have seen our previous Annual Reports will note that this year's report has been greatly modified. It has been designed to provide an update to the activities found in the FY84 Annual Report and to provide a more timely product. Please let us know whether this report better serves your needs.

DENNIS W. JARVI, Colonel, USAF
Commander

Colonel Michael C. Lane
Vice Commander

EXECUTIVE SUPPORT OFFICE

The Executive Support Office develops and implements policies, procedures, and standards relating to administration management and practices, military and civilian personnel and manpower actions, and materiel actions. The Office provides staff guidance, assistance, and surveillance over other echelons in areas of functional responsibility for the Laboratory Commander.

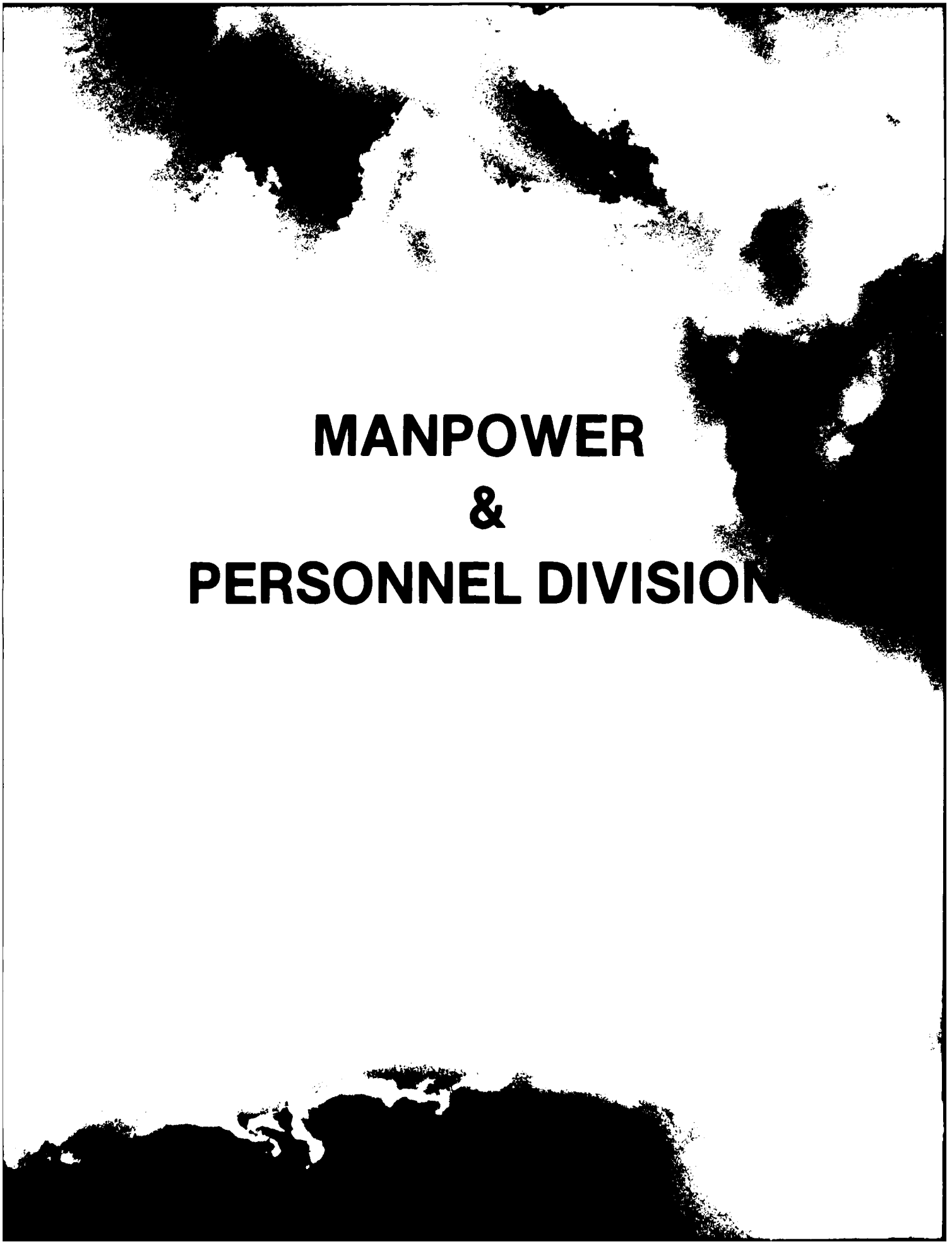
The Office Staff operates the following programs: manpower and organization, reports management, document security, military and civilian personnel administration (including training programs), and organizational supply. Further, the Executive Support Office is the principal focal point for host-tenant support agreements for the Laboratory and represents the Laboratory in dealings with other agencies and higher headquarters in all areas of functional responsibilities, and serves as focal point for Inspector General visits and reports.

Captain Neena R. Wright
Director, Executive Support Office

Dr. Herbert J. Clark
Director, Plans and Programs Office

PLANS AND PROGRAMS OFFICE

The Plans and Programs Office plans, implements, and monitors the execution of the AFHRL R&D program. The Office performs long-range planning, including front-end analyses, that combines higher headquarters guidance, Air Force user requirements, and technological opportunities. The Office Staff evaluates Independent Research and Development projects of industry, tracks Laboratory accomplishments, and prepares technology transition plans. Office personnel publish all planning documents and prepare all budget submissions to higher headquarters. The Office effects program implementation by processing all financial and budgetary documents. It monitors progress of all support, contractual, and in-house efforts, and provides resource management required to execute an effective R&D program.


MANPOWER
&
PERSONNEL DIVISION

MANPOWER AND PERSONNEL DIVISION

Selecting the most qualified applicants and placing them in the right jobs are essential to maintaining a combat-ready Air Force. To sustain an enlisted strength of over 485,000 and an officer corps of 106,000, the Air Force must access a large number of relatively untrained individuals. In fact, some 65,000 new airmen are brought into the Air Force each year and matched with jobs in 245 career fields. To keep the officer force fully manned requires some 9,000 new officers yearly for jobs in 235 career fields. Matching of people and jobs continues beyond initial accession since each year over 10,000 enlisted members change career fields.

To be an effective fighting force, not only must the newly accessed members be trained in their jobs but also, the entire force must continue to train to stay proficient in their skills. Each year 125,000 enlisted members attend formal training and many more participate in on-the-job training to retain and increase job skills and abilities. Initial and subsequent training of officers also comprises a significant portion of officer force management. For pilots and navigators alone, 1,600

Colonel Ronald L. Kerchner
Division Chief

Dr. Nancy Guinn Vitola
Technical Director

new pilots and 750 new navigators are trained each year. Of the 30,000 experienced rated officers, virtually all who are performing flying duties participate in some form of training each year. Costs of this training are substantial. For example, an FB-111 pilot costs over $1.3 million and the navigator for the same weapon system costs over $700,000. Enlisted courses range from a few thousand dollars per graduate to almost $100,000 for certain avionics technicians.

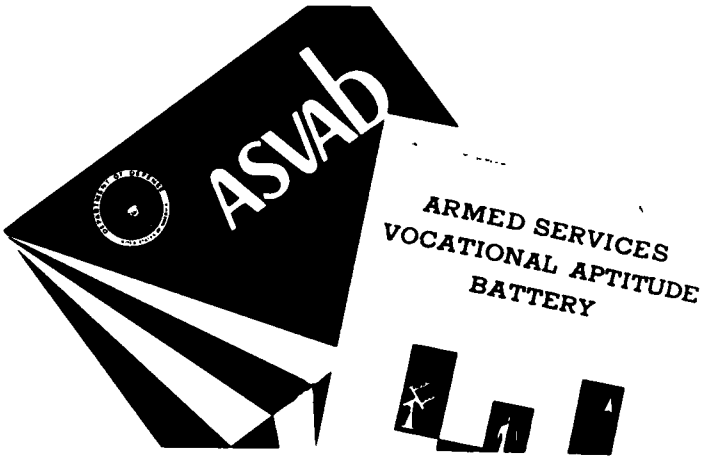
Selection, classification, and training are all part of force management which incorporates other aspects such as performance evaluation, promotion, and retention. At nearly $20 billion yearly, Air Force military personnel costs are a major budget item requiring effective force management to ensure the Air Force gets the most for its investment.

The Manpower and Personnel Division directs a comprehensive and long-term R&D program to develop the tools, procedures, and associated technologies to ensure more effective use of personnel resources. Specific R&D programs are designed:

1. To improve personnel evaluation techniques.

2. To determine appropriate job assessment procedures.

3. To provide Air Force manpower and personnel managers with new management decision aids.



PERSONNEL EVALUATION

The Air Force Human Resources Laboratory is tasked by Air Force Regulation 35-8 to provide valid instruments for both entry selection and job classification of Air Force officer and enlisted members. In addition, a joint-Services regulation (Air Force Regulation 33-6) designates the Laboratory as the joint-Services lead for R&D on the Armed Services Vocational Aptitude Battery (ASVAB), which is used DOD-wide for enlisted selection and classification. The major instrument for Air Force officer accessioning and classification is the Air Force Officer Qualifying Test (AFOQT). In addition to these two major test programs, the Laboratory is responsible for developing several special-purpose tests, such as the Electronic Data Processing Test (EDPT).

Enlisted and officer selection and classification tests must be developed such to ensure that the best available civilian talent is enlisted or commissioned into the Air Force and that there is an optimal match between their talent and the jobs to be performed. Yearly accessions vary dramatically in terms of ability to acquire new skills. It is important that selection instruments incorporate the latest theory and analytical approaches to ability testing to enhance information about the examinees' propensity for success in the military. Toward this end, the Laboratory conducts psychometric research ranging from exploration of new computer-based measures to broaden ability coverage in testing beyond that achievable via paper-and-pencil tests to investigation of computer adaptive test technology through development of new prototypes of paper-and-pencil instruments and development/maintenance of new forms of existing operational selection and classification batteries. Associated materials (e.g., manuals, technical data, norms) for effective standardized use in the operational testing programs must also be developed. Aircrew selection procedures receive special emphasis due to the extremely high costs of training pilots and navigators and the key role these personnel have in maintaining combat readiness. The paragraphs which follow summarize 1985 activity in this area.

Learning Abilities Measurement Program

The Learning Abilities Measurement Program (Project LAMP) is a major research effort, sponsored by the Air Force Office of Scientific Research, investigating the computerized measurement of human information processing abilities. While the project is devoted to basic research, it is nevertheless goal oriented. A major goal is to develop new tests for inclusion in future personnel selection and classification programs that measure how individuals think, remember, solve problems,

and acquire knowledge and skills. Project LAMP capitalizes on the capabilities of microcomputers to measure abilities not easily evaluated by paper-and-pencil tests. Among the candidates for investigation are information processing speed (associated with such processes as encoding, comparing, choosing, retrieving from memory, memory searches, etc.); attentional resources; attentional shifts; working memory capacity; efficiency of movement toward automaticity; visual and auditory memory; knowledge organization; and abilities to handle multitasking. Plans call for evaluation of these new measures in terms of their ability to predict subsequent learning and performance behaviors measured under laboratory conditions. This research recognizes and addresses the problem of a 25-year stagnation in the state of the art in ability measurement. It is expected to lead to a new generation of tests that will provide information on many important abilities not currently evaluated by ASVAB.

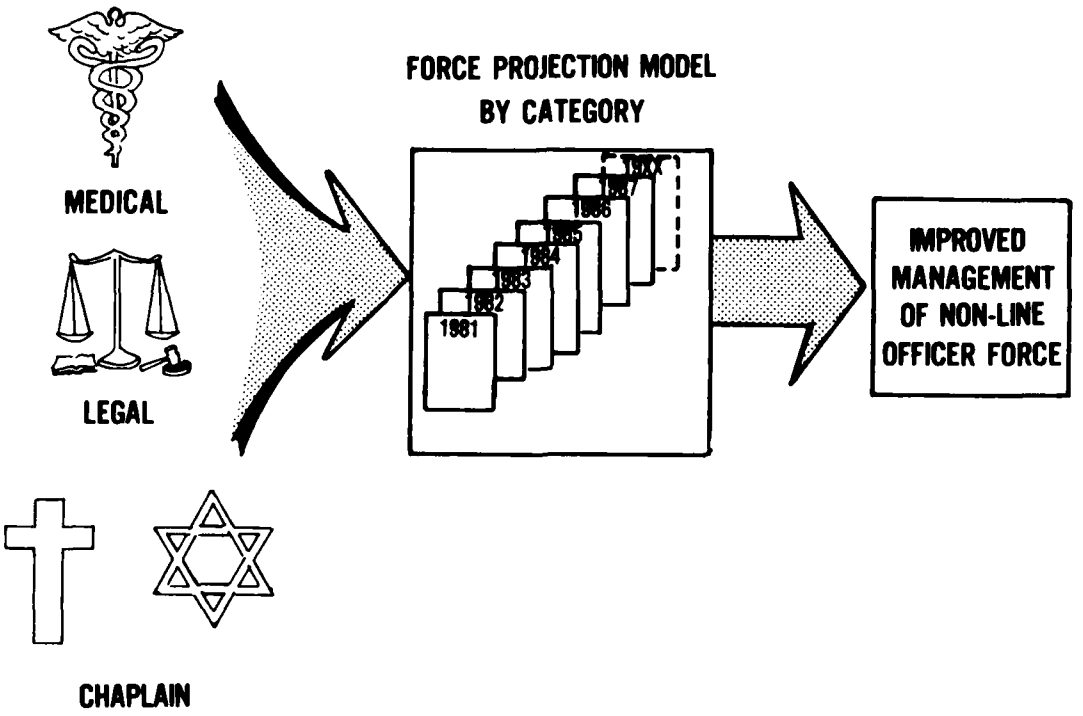
Enlisted Test Programs

The ASVAB is the primary enlisted selection and classification test for all the Military Services and the Coast Guard. Each year, it is administered to more than 2 million persons nationwide. The Laboratory must develop new forms of the ASVAB both for production testing and for the DOD Student Testing Program and must provide supporting research for both programs. This year the Laboratory fulfilled one of its primary test development responsibilities with the successful implementation of ASVAB Forms 11, 12, and 13 in the new 1980 youth population score scale. The initial operational test and evaluation of those new forms has begun. Successful resolution of issues surrounding test performance differences on the speeded ASVAB subtests, due to printing differences, was achieved. In support of the enlistment testing program, studies were completed which established deliberate failure keys (for mobilization backup) for the newly implemented tests. Another study examined possible alternative forms of the Armed Forces Qualification Test (AFQT), which is the joint-Services qualification measure of the ASVAB. Items for the follow-on forms of the ASVAB to be implemented in 1987 were developed and experimentally tested at the Air Force Recruit Training Center at Lackland AFB, as were the test items to be used for the follow-on versions of the ASVAB used in the DOD Student Testing Program. In fulfilling necessary R&D support for the DOD Student Testing Program, a technical supplement was developed for the Counselor Manual used by school counselors in the nation's high schools. Additionally, work was begun on the occupational validation of the Student Testing ASVAB. This large effort will validate the ASVAB-14 against job performance for 12 civilian occupations. Results will enhance the ability of school counselors to guide the occupational choice of high school students.

Officer/Civilian Test Programs

The Manpower and Personnel Division conducts R&D pertaining to the development and validation of instruments/procedures used for officer selection, classification, and career development. During FY85, R&D was conducted to maintain, validate, and improve the Air Force Officer Qualifying Test (AFOQT). Approximately 4,500 experimental items in various cognitive ability areas were written, arranged in test booklets, and pretested at Lackland AFB. Test scoring and preliminary item analysis activities have been completed. Work to identify the best experimental items has begun. These items will be evaluated as candidates for operational use in the upcoming AFOQT Form P. Plans were

NON-LINE OFFICER PROJECTION MODEL



formulated to produce and evaluate an additional 4,000 items in FY86, primarily for use in subsequent versions of the test. In addition, an investigation that will validate the AFOQT against several relevant criteria has begun. Validation against technical training school criteria has been completed, and plans have been formulated to validate the instrument against job performance and officer effectiveness criteria. Research activities also involve other instruments and procedures related to selection and classification of officers and civilians. English language tests have been field tested at overseas bases. Data from this investigation will be used to improve these tests before they are used by civilian personnel officers in the selection and placement of foreign nationals working at overseas air bases. In addition, work is ongoing to validate the Officer Training School (OTS) and Air Force Reserve Officer Training Corps (AFROTC) selection systems. These two selection processes are being compared. Each system will be validated against performance criteria obtained prior to commissioning and at several points during the career cycle. Officer research goals and activities have been reviewed and revised. Research pertaining to current and future forms of the AFOQT will continue to be emphasized. However, R&D activities will be broadened, with more emphasis placed on classification and career development instruments and procedures.

Aircrew Selection Programs

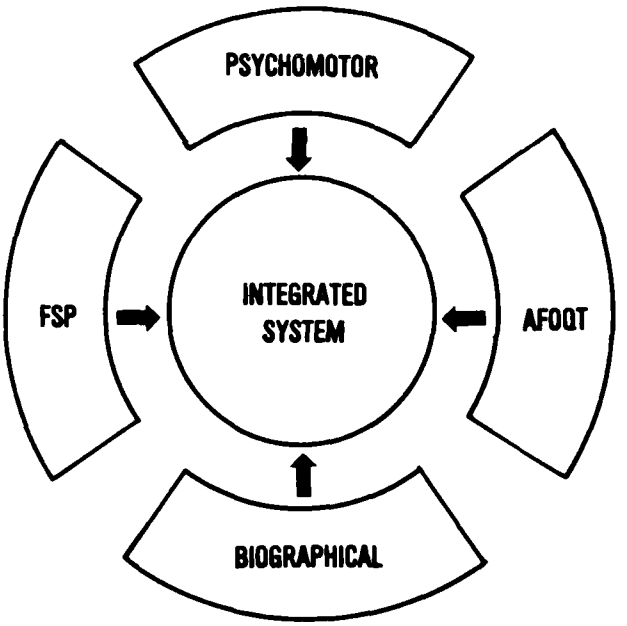
Selection for Pilot Training - At the request of Air Training Command (ATC), an analysis of the Flight Screening Program (FSP) was completed. FSP is the light-aircraft training program given to applicants who have had no previous flying experience (i.e., private pilot's license). The results were briefed to ATC and submitted for publication as a technical report. It was found that FSP had a positive effect in lowering Undergraduate Pilot Training (UPT) attrition, but this effect was due mainly to the training received during FSP rather than to the screening which occurred. One group of subjects sampled received an extra 6 hours of FSP training and had a much lower attrition rate

than those receiving the normal FSP program. Additional recommendations were made to enhance the screening performance of the FSP by integrating available student performance data with psychomotor testing. Field testing of the Integrated Selection System began in September 1985 and is expected to be completed in early 1987. Parallel work continued on AFROTC candidates for UPT with testing of cadets at the Lackland AFB summer camp. An integrated system comparable to the FSP model will be developed when a sufficient number of ROTC students have graduated from UPT to support a data analysis. An operational methodology for employment of psychomotor tests was established.

Selection for Navigator Training - The development of a Basic Navigator Battery continued with the completion of an interim report analyzing the combined validity of the Basic Navigator Battery and the AFOQT for reducing attrition in Undergraduate Navigator Training. R&D continues on development of navigator tests for operational use.

Track Selection for Specialized Undergraduate Pilot Training - In a joint effort with the AFHRL Operations Training Division, a computerized data retrieval system is being installed in the Air Combat Maneuvering Instrumentation (ACMI) range at Luke AFB. This system will provide "real world" performance data from live air-to-air engagements to establish criteria for selections into the Fighter/Attack/Reconnaissance (FAR) track of the proposed Specialized Undergraduate Pilot Training (SUPT) pilot training program. The system being installed at Luke AFB is scheduled to be operational in June 1986, when PMS research enters the data-gathering phase. Performance data from the FSP, UPT, Lead-In Fighter Training (LIFT) and Combat Crew Training Units (CCTUs) training continued to be integrated into the research database for development of pilot performance criteria. These criteria will be used in development of systems for accessions into UPT and assignment into the FAR track or Tanker/ Transport/Bomber (TTB) training track of SUPT. This database supported limited analyses during 1985 but will not contain enough subjects who have completed all phases of pilot training until 1988 to conduct definitive analyses.

INTEGRATED SYSTEM DEVELOPMENT



ADVANTAGES: BEST MIX OF SIGNIFICANT PREDICTORS MAXIMIZE PREDICTION OF UPT SUCCESS

Euro-NATO Joint Jet Training Program (ENJJPT) - A preliminary analysis comparing the performance of ENJJPT graduates with that of USAF UPT graduates was completed in late FY85. Initial findings reflected little difference in the performance of graduates of the two training programs, based on grades from LIFT. A more

detailed examination of CCTU and ACMI performance will follow in FY86.

JOB ASSESSMENT

A wide range of measurement technologies are necessary for Air Force manpower, personnel, and training (MPT) managers to effectively set and implement force structure and utilization policy. Job assessment research concentrates on identifying the characteristics and personnel requirements of jobs and also the measurement of how individuals and groups of individuals perform those jobs. Measures of jobs are used by the Air Staff to monitor and realign the system for organizing and classifying jobs into specialties and for determining the numbers and characteristics of personnel to be assigned to the specialties. The job classification structure, which presently contains 235 separate career fields, governs all phases of personnel acquisition and utilization. Individual career fields have different recruiting quotas, entry standards, technical training programs, assignment options, promotion criteria and reenlistment goals. Air Training Command uses the job measures to identify training requirements and to ensure that training matches the tasks performed on the job. Air Force initial skills training alone costs $400 million annually to administer. Basic Job Skills and Aptitude Requirements were two major FY85 research efforts aimed at providing technologies for measuring job and training requirements.

Measures of how well individuals and groups perform their jobs provide the other side of the MPT job assessment needs. Measures of how well individuals can perform their jobs are essential if MPT policymakers and planners are going to be able to evaluate the bottom line. These measures must show whether the classification structures, aptitude standards, training systems, and personnel policies and procedures are effective in getting the current job done while ensuring that the personnel could meet war time demands if called upon to do so. In FY85, two major research efforts were aimed at providing those job performance measures: Job Performance Measurement and Productivity Research.

Basic Job Skills

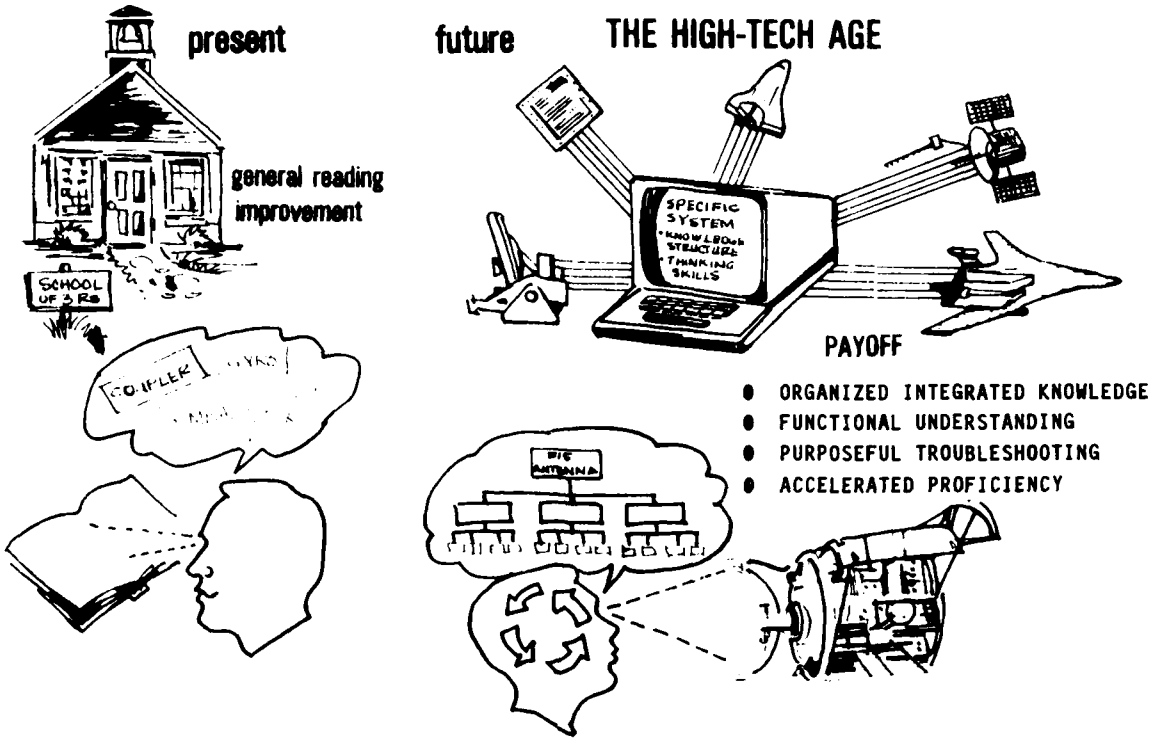
The increasing complexity of modern weapons systems and the resulting need for highly trained maintenance personnel have led to a comprehensive evaluation of what skills are necessary to become proficient in today's technologically sophisticated workplace. The basic job skills R&D program focuses on three related objectives: 1) determining what basic skills are required on Air Force jobs, 2) assessing capabilities of personnel assigned to perform them, and 3) developing training programs that accelerate acquisition of needed technical skills. For purposes of this R&D, basic skills are defined as the core-knowledge and knowledge-activating processes that are common to gaining proficiency in a number of related job families. The analysis is concentrating on 125 Air Force specialties. Task analysis methods are being developed to capture behavioral as well as cognitive skill requirements in a broad range of occupational categories. Among the training delivery options being explored are intelligent computer-assisted instructional systems which interact with the learner to diagnose skill deficiencies and provide expert assistance in completing course objectives. The results of this work should enable first-term personnel to gain proficiency quicker on a broader range of complex technical skills. During FY85, initial investigations were successfully completed which led to initiation of the full-scale R&D program.

Aptitude Requirements

A measurement technology now under development employs experts' ratings of task learning difficulty to produce an occupational level-of-learning difficulty that can be meaningfully compared across occupations. The technology is based on the occupational analysis procedure implemented by the Air Force Occupational Measurement Center (AFOMC), although it represents a significant extension and enhancement of this procedure. The Occupational Learning Difficulty Index has been proposed for use in a wide range of management decisions concerning the classification and training of enlisted personnel. First, the index can be applied to

BASIC JOB SKILLS TRAINING

(PE 63704F/PROJECT 2949)



determine job aptitude requirement minimums stated in Air Force Regulation 39-1. This would ensure that the highest aptitude requirement minimums are specified for job specialties highest in learning difficulty. Second, the index can be used within the computer-based, person-job-match system to determine initial job offers for Air Force enlistees. The purpose of this application is to ensure that enlistees having the highest aptitudes are offered specialties highest in learning difficulty. Finally, the index can be referenced for the purpose of identifying the most appropriate mode of training (i.e., classroom or on-the-job training) for enlisted skills.

Job Performance Measurement

The Air Force began a long-term R&D effort in FY83 to systematically obtain job performance measures that will serve as criteria for validating selection systems and for evaluating training programs and the effects of personnel policies and procedures. The technology is also necessary to meet a Congressional mandate to validate enlisted selection tests against job performance measures rather than training outcomes.

A new work sample methodology, Walk-Through Performance Testing (WTPT), is the basis for this developmental effort. This methodology is a task-level job performance measurement system that combines on-site evaluation and interview procedures to provide a high-fidelity measure of individual task-oriented capability. A wide range of alternative and more cost-efficient job performance measures have been developed in addition to the WTPT. These include task-level, dimensional, global, and Air Force-wide ratings by peers, supervisors, and job incumbents.

Job performance, WTPT, and rating forms data were collected on approximately 300 first-term airmen jet engine mechanics (the feasibility

test specialty) by the end of FY85. The analyses will be completed in early FY86. Job performance measures for three additional specialties were also developed, and data collection will begin in FY86.

Productivity

Past research demonstrates that feedback, goal setting, and incentives improve the performance of individuals doing simple jobs. These encouraging results suggested this R&D to determine the effects of feedback, goal setting, and incentives on the productivity of groups performing the complex jobs typical of the work done in operational Air Force organizations. In addition, this effort will suggest a solution to the important methodological problem of aggregating productivity measures from lower to higher organizational levels. The effort has four major objectives: (a) to field test the generalizability of feedback, goal setting, and incentives to operational organizations; (b) to determine how much these enhancements increase productivity and how acceptable they are to Air Force personnel; (c) to design detailed procedures for developing and aggregating productivity indices; and (d) to develop practical manuals that explain how managers can design and implement the measurement and enhancement technologies.

Two specific technologies are being developed. The first measures levels of productivity, and the second enhances productivity. The Methodology for Generating Efficiency and Effectiveness Measures (MGEEM) has successfully established automated productivity measurement systems in two field test organizations. MGEEM handbooks, for use by unit level personnel rather than by professional facilitators, have been developed and will be field tested in early FY86. MGEEM has also been used to produce productivity baseline data and post-test data in two units where a prototype feedback and goal setting technology was field tested. In the field tests, productivity increased 35 to 50 percent over a 6-month period after installation of a goal setting and feedback system. A non-monetary incentive system will be field tested in FY86.

MANAGEMENT DECISION AIDS

Managing a complex organization requires use of sophisticated decision modeling, analysis, and simulation capabilities to gain both an efficient and effective view of available resources. At the entry point, information gained about personnel qualifications of all enlisted accessions must be considered simultaneously with Air Force job requirements to produce an optimal job placement. Since jobs vary considerably in what they require, as do job applicants, considerable leverage can be gained in better allocating available talent to current vacancies. As personnel progress through their first and subsequent reenlistments, they gain skills and expertise which enable advancement through the ranks. Promotion systems must be designed to select the most capable.

Finally, the overall force structure must be maintained in equilibrium to avoid personnel surpluses or shortages which could be costly in the event of mobilization. Retention is a key driver of the entire personnel system, not only in determining the number of replacements needed but also in terms of cost-avoidance. Highly trained and experienced personnel are very costly to replace. Estimated replacement training costs for various categories of maintenance personnel range from $5000 to more than $18,000. Highlights of the Division's operations research and statistical modeling program are summarized below.

Person-Job-Match Technology. In order to match people and jobs, the Person-Job-Match (PJM) technology uses job information from task analysis and information about each individual's capabilities and desires from mental tests, physical examinations, and questionnaires. The Procurement Management Information System (PROMIS), used operationally by the Recruiting Service since 1976, incorporates PJM technology to select and classify nonprior-service personnel. The Processing and Classification of Enlistees (PACE) system is used by Air Training Command to classify approximately 50% of the new recruits who were assigned only to broad occupational areas (Mechanical, Administrative, General, and Electronics) by PROMIS.

Current R&D is aimed at (a) using the ASVAB subtest scores and Vocational Interest-Career Examination (VOICE) to refine data available in the current PROMIS for matching people and jobs, (b) replacing the current sorting process used in PACE for classification with a procedure that considers all possible assignments and picks the best ones, and (c) designing an enhanced PROMIS system which considers more variables and uses more advanced techniques to determine the best PJM.

Weighted Airman Promotion System (WAPS). The Weighted Airman Promotion System (WAPS) is used in promoting enlisted personnel to the grades of staff sergeant, technical sergeant, and master sergeant. The system consists of six promotion selection factors (two test scores, two seniority factors, one decorations score, and one job performance factor) and corresponding weights that are used to compute a total weighted-factor promotion score for each individual considered for promotion. Each year, counting the two cycles for promotion to staff sergeant and one cycle each for promotion to technical sergeant and master sergeant, WAPS selects approximately 45,000 people for promotion out of nearly 240,000 eligibles.

Since WAPS became operational in 1970, extensive research dealing with the system has been conducted. A research study was designed in 1985 to address the following objectives: (a) develop separate weighted formulas for each of the three grades within WAPS, (b) consider the completion of Command Non-Commissioned Officer Academy as an additional selection factor for promotion to E-7, (c) evaluate various weighting schemes for the Airman Performance Rating (APR) factor, (d) investigate the use of standardized scores for the test factors, and (e) analyze the establishment of a separate weighted formula for those Air Force specialty codes which have no Specialty Knowledge Test (SKT).

The results of this project will provide Air Force enlisted promotion policymakers with a current, scientifically defensible basis for making improvements to the operational WAPS and will enhance the goals of equitable and visible promotions. This, in turn, will assure that the best and most deserving enlisted personnel are selected for promotion to the important mid-level grades and impact positively on retention rates, quality of performance, and morale.

Air Force Enlisted Retention Model. An econometric model of individual reenlistment decisions was constructed to analyze the impact of demographic variables (e.g., education and sex) and policy variables (e.g., bonus) on the retention of airmen by Air Force specialty (AFS). The model was developed for 224 AFSs across first, second, and career reenlistment decision points. To support model development, a large-scale historical airman database was constructed to represent 29 years of enlisted personnel data, Air Force pay series and policy data, and related civilian pay information. The results of the econometric analysis have been incorporated into the Air Force Retention Analysis Package (AFRAP). This computer model operating on an IBM personal computer allows the user to estimate the impact of changes in the econometric model's variables on reenlistment rates by AFS. The user is also able to evaluate how these changes would affect the year-group distribution within the specialty.

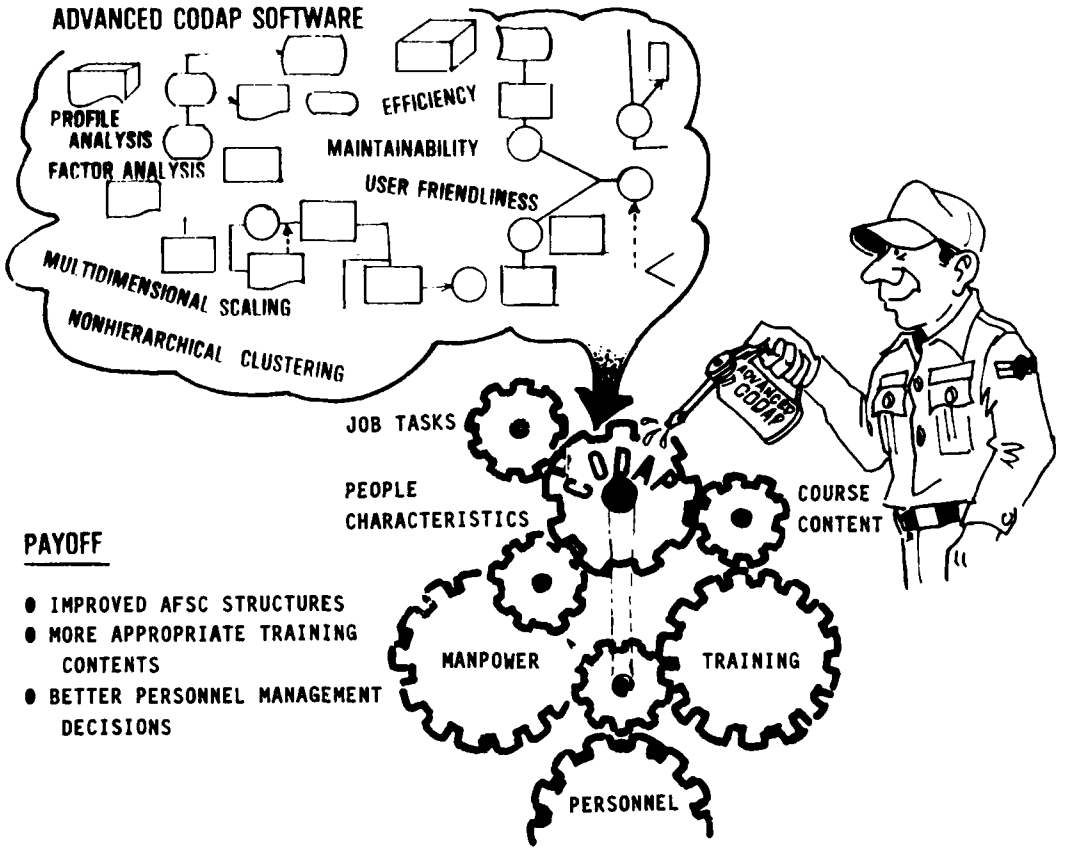
Products from this research have been used by the Air Staff Manpower and Personnel Analysis Center and the Bonus Pay Branch in the Force Programs Directorate. The Office of the Assistant Secretary of Defense supported the purchase of the AFRAP software, which has been demonstrated to personnel managers and researchers in each Military Service, as well as to other Air Staff and Air Force Manpower Personnel Center offices. Results of the model and the AFRAP software can be applied to pay and bonus decisions, force structure analysis, and retention studies. Work continues to refine the model and validate the econometric results.

Comprehensive Occupational Data Analysis Programs (CODAP). The purpose of the Comprehensive Occupational Data Analysis Programs (CODAP) is to enhance the occupational measurement technology that supports analyses of job structures, entry-level prerequisites, training requirements, and specifications for enlisted promotion tests. The current occupational measurement technology began 20 years ago as a software system of approximately 15 general-purpose programs. However, in order to keep pace with the rapidly expanding needs of

occupational researchers and analysts, the system was forced to expand unsystematically into an aggregate of more than 60 general-purpose programs. Files maintained in the system were put in a variety of formats and stored on a variety of media by a succession of programmers using a variety of programming standards and styles. New and advanced developments that have been needed in the system for some time require that many of the existing programs run more efficiently and interface more easily. All of these problems will be addressed in stages as part of the proposed enhancement. This should enable measurement technology to stay abreast of advances in analysis methodology throughout the remainder of this decade without sacrificing system maintainability or expandability.

A series of advanced development tasks has been initiated to restructure the CODAP system and organize recent changes to the system to enhance its efficiency, maintainability, and versatility. One objective is to improve and standardize the current occupational analysis procedures and to generate efficiencies in the analysis process that will improve the quality of the products with significantly less expenditure of scientist and analyst work-hours and computer processing time. The second objective of this effort is to provide thorough, consistent documentation that will permit programmers and programming technicians to operate and debug the system without excessive expenditures of time and effort. The restructured occupational measurement software system (designated ASCII CODAP) was delivered at the end of FY85.

OCCUPATIONAL MEASUREMENT TECHNOLOGY (63704F - PROJECT 2948)

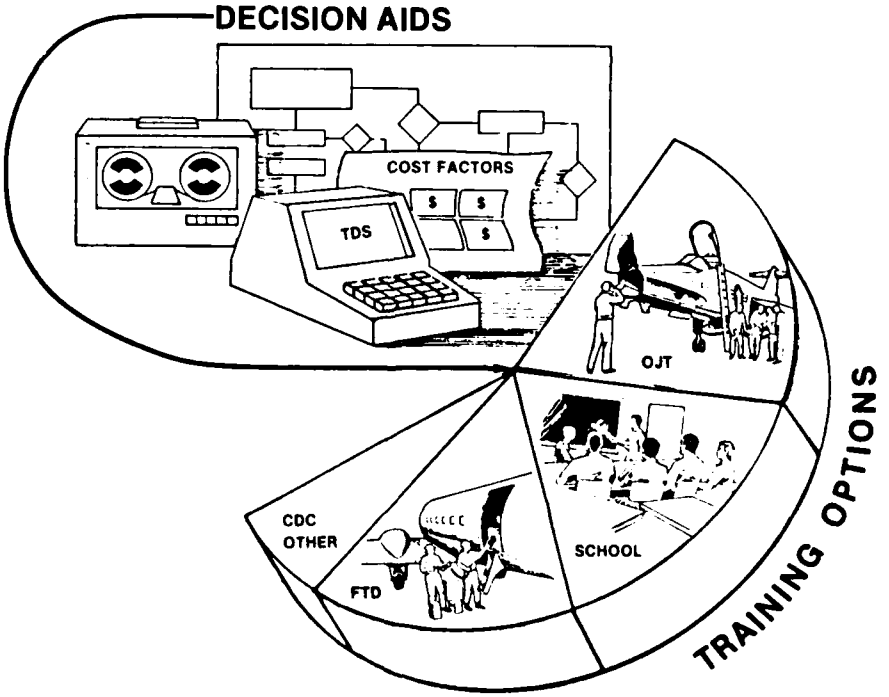


Training Decisions System. A basic problem in developing overall training plans for Air Force career ladders is deciding what to train (training content decision), where to train (appropriate settings), and when to train (at various points throughout an airman's career). Because of the scope and complexity of Air Force training, many decisions with major impacts on training are made independently by management without the benefit of coordination and relevant data.

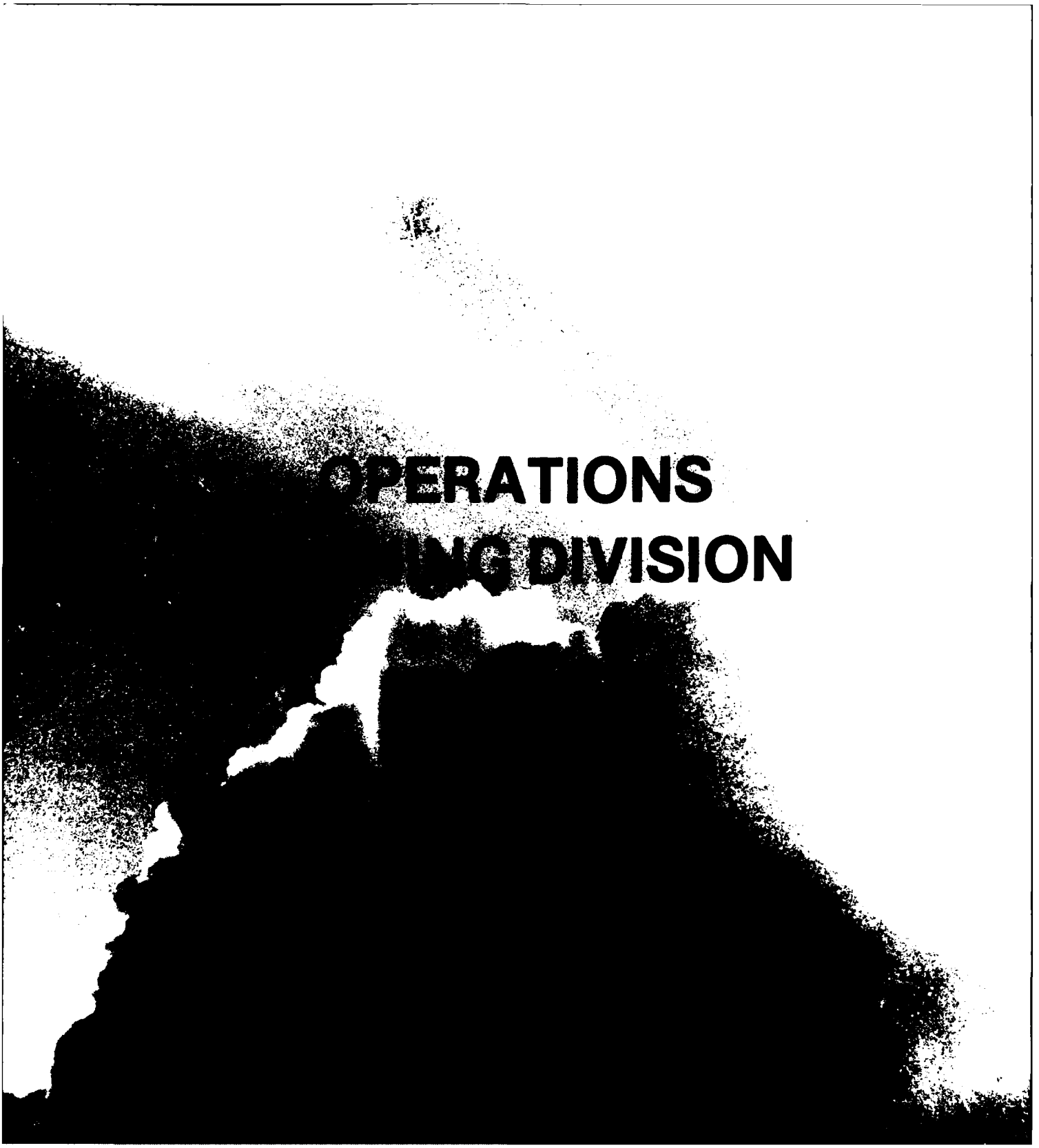
The Training Decision System (TDS) is being developed to provide a more unified, practical, integrated approach to training problems. All relevant data will be considered at once for decision making. The interactive, computer-based system will aid decision makers by developing four subsystems: (a) for determining where tasks should be trained, and to what proficiency levels; (b) for considering optional patterns of airman utilization; (c) for estimating cost and resource capacity consequences of utilization and training alternatives; and (d) for integrating the first three subsystems and seeking optimal training solutions.

Currently, task clustering techniques are being considered with inputs from subject-matter experts, career ladder identification is being validated, and cost/resource capacity data are being gathered for two of four Air Force specialties. The other two specialties will be considered in the near future. A transition plan, outlining implementation plans and user training requirements, has been formulated.

TRAINING DECISIONS SYSTEM (TDS)



Further information on any of these projects is available from the points of contact listed on page 80.


PERATIONS
MC DIVISION

OPERATIONS TRAINING DIVISION

The Operations Training Division of AFHRL has a unique role as the only Air Force agency devoted to the exploitation of science and technology to improve aircrew training. The Division's R&D programs dynamically contribute to the effectiveness and efficiency of operational training throughout the Air Force. Formed in 1969 as that integral part of the AFHRL responsible for flying training, the Operations Training Division performs its mission through two primary functions: (a) behavioral R&D to solve flying training problems through improved technology and (b) engineering R&D to develop devices that become vehicles for research and training. The people who staff these two areas form a diverse multidisciplinary team of specialists ranging from psychologists, research instructor pilots, and human factors specialists to aerospace engineers, mathematicians, and computer technologists. With this uncommon mix of expertise, the Division converts training needs into the knowledge and products needed to improve the combat effectiveness of the operational commands.

Colonel Carl D. Eliason
Division Chief

Dr. Milton E. Wood
Technical Director

TRAINING EFFECTIVENESS PLAN

As a result of a Simulator Broad Area Review convened at Headquarters, Air Force Systems Command (AFSC) in February 1984, AFHRL was tasked to develop an aircrew simulator training effectiveness R&D plan. This training effectiveness plan was to focus on efforts which addressed training performance measurement and the general question of how much fidelity is enough with regard to current and emerging aircrew simulation capabilities.

In May 1984, the AFHRL training effectiveness plan consisting of eight major R&D issues was briefed to Headquarters, AFSC, and was favorably received. Based on concerns by the Aerospace Medical Division regarding the importance of defining and optimizing the total aircrew training system, top priority was given to R&D which explores training system design. R&D addressing motion and force issues (Force Cueing System Fidelity) was given last priority and was supported only on an overceiling basis because of the extensive research already

completed on centerline-thrust aircraft. The issues and priorities are as follows:

Priority	Issue
1.	Training System Design
2.	Visual Scene Fidelity
3.	Sensor Scene Fidelity
4.	Instructor Operator Station Design
5.	Aircrew Performance Measurement
6.	Cost-Training Effectiveness Relationships
7.	Simulator Instructional Strategies
8.	Force Cueing System Fidelity

In general, the training effectiveness plan asks the following kinds of R&D questions:

1. How do you assemble the many components of a total training system?
2. What level of fidelity is needed for specific training situations?
3. How should instructor stations be designed?
4. What measures can be used to quantify training effectiveness?
5. What cues are most effective for learning specific skills?

Since implementation of the training effectiveness plan, the Operations Training Division has pursued a comprehensive program of R&D. Laboratory direction of the training effectiveness plan, has been formalized through a Program Management Directive for Training Effectiveness R&D and is monitored by the AFHRL Plans and Programs Office.

The second, third, and fourth issues are of special interest to the Deputy for Simulators at the Air Force Aeronautical Systems Division, and special training effectiveness working groups have been formed to assure coordination and approval of relevant training effectiveness R&D between that Division and AFHRL. A memorandum of agreement between these organizations has formally established the training effectiveness working groups under the cognizance of a Training Effectiveness R&D Conference that meets twice a year to share training effectiveness information.

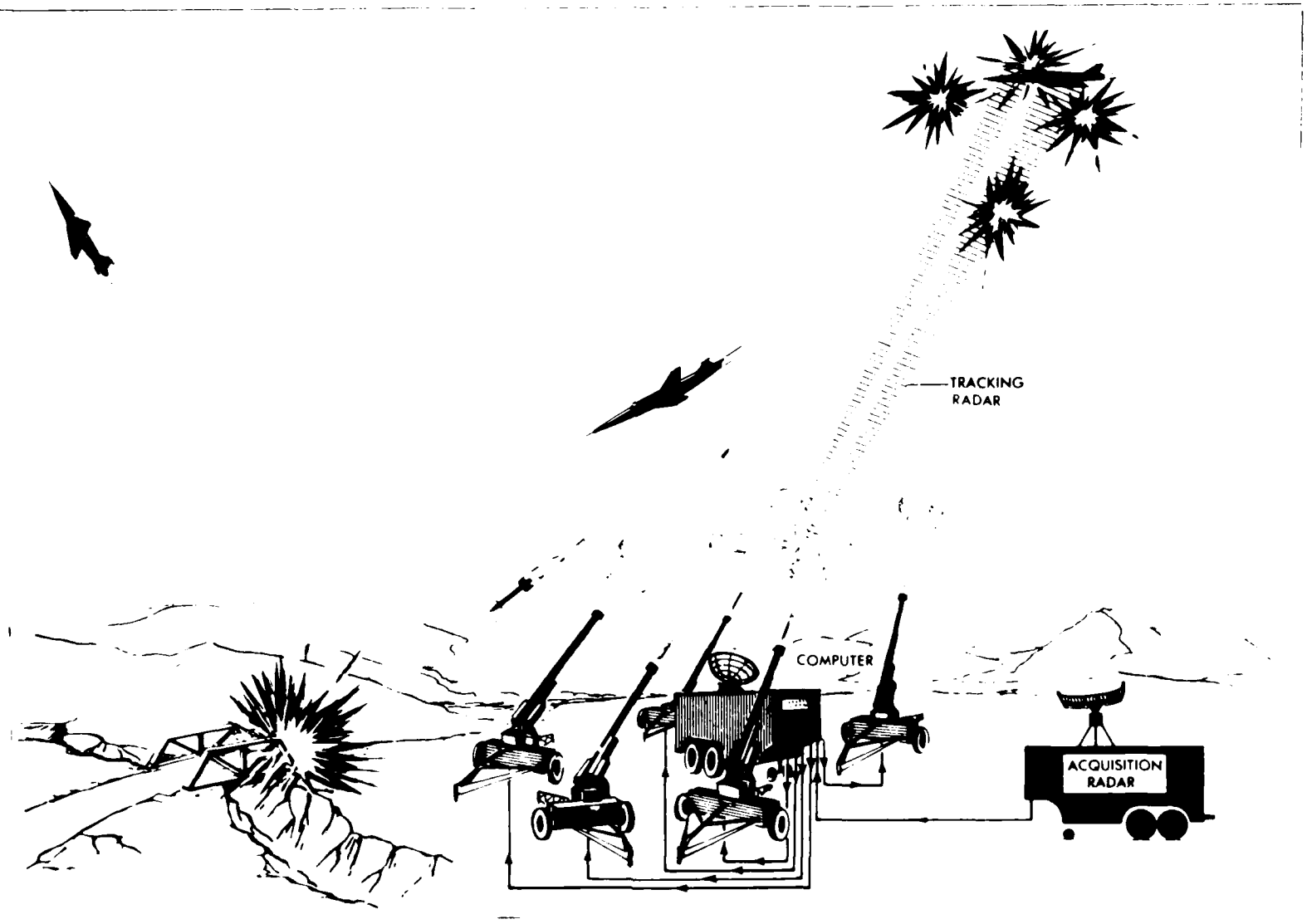
Due to the expanding role of the Deputy for Simulators into the domain of manpower, personnel, and training requirements, the formation of a fourth training effectiveness working group in support of Issue 1, Training System Design, will be considered during the Training Effectiveness R&D Conference at Eglin AFB in early FY86.

The training effectiveness plan is generating a significant database in the seven R&D areas comprising the plan. Financial support of the plan ranges across all program elements and projects available to the Operations Training Division, plus occasional funding from the Air Force Aeronautical Systems Division. The formal reporting of the final products is accomplished through AFHRL technical reports and technical papers.

ELECTRONIC COMBAT TRAINING EFFECTIVENESS

Proficiency in electronic combat (EC) is increasingly recognized as essential to success in modern conflict. For the aircrew with a primary mission of air-to-surface or air-to-air weapons employment, EC proficiency involves recognizing and responding to threat situations, by avoiding, countering, or even destroying threat systems. Also, knowledge and employment of weapon system capabilities are required in order to take advantage of threat system limitations.

The Air Force needs a systematic overall strategy for the acquisition of training systems to support EC training. EC-capable ranges for inflight training are limited in number due to the lack of sufficient airspace and the high cost of threat simulators and range instrumentation systems. Flight simulators are often deficient due to cost and difficulties in maintaining the hardware and software current with the aircraft EC systems. Such considerations have led the Tactical Air Command toward systems such as the On-Board Electronic Warfare Simulator (OBEWS) for inflight training and the EC part-task trainer (EC PTT) for ground training. However, data are required for determining what contribution the various systems can make to training (i.e., what task they can train and to what level), as well as on how to develop an integrated training program.



Electronic Combat

The Operations Training Division is currently working on the development of an integrated EC-training program for the F-16 aircraft. This program can serve as a model for other weapon systems and is a critical element in the Air Force Roadmap for EC Training. Studies have already been completed on feedback requirements for EC range systems, retention of EC skills, and transfer of training from the flight simulator to a range exercise. Future studies will address the EC-training capabilities of the EC PTT, the F-16 Operational Flight Trainer (OFT), and OBEWS, as well as the requirements for high resolution visual cueing to support end-game training. The results of these efforts will be used in the development and evaluation of an integrated EC-training program.

In the past year, the Operations Training Division has assisted Headquarters, USAF in developing an integrated and comprehensive plan (i.e., the Roadmap for EC Training) and in identifying requirements for the EC PTT. The Division has also participated in the Tactical Air Forces EC-Training Study Group and has supported the Air Force Armament Division in the design of a training effectiveness evaluation for the OBEWS system. Ongoing programs will upgrade the threat modelling capabilities for tactical training R&D (THREATVAL) and will examine the sensitivity of tactics effectiveness to pilot performance variations (TACTRAIN).

The overall goal of these efforts is to develop a technical database on EC training, specify EC PTT design requirements, and provide an objective basis for a systematic investment strategy for EC-training systems.

PART-TASK TRAINING

The Air Force needs low-cost, effective aircrew training devices that will improve the proficiency and readiness of aircrews. The search for advanced, low-cost training systems implies decreasing use of aircraft and expensive simulators and increased use of part-task trainers for many of the basic procedural, perceptual, and cognitive aspects of aircrew training.

Aircrew Surveys

The Operations Training Division has completed a series of surveys using experienced aircrews. The purpose was to identify the types of tasks and levels of training complexity that can be most appropriately supported by high technology, low-cost training media. These media include microcomputer graphics systems and interactive videodiscs.

Part-Task Methods R&D

While various inexpensive technologies have the potential of satisfying part-task training requirements, the fundamental issue is selection of proper training methodology, rather than device design. A project now underway will provide the Air Force with a theoretical and empirical foundation on which to base part-task trainer design.

Thus far, a comprehensive review of theoretical and empirical research in part-task training has been completed. This effort has produced a foundational database for extending methods R&D. In addition to the literature review, a second product is an automated decision support system that recommends part-task training solutions for specific types of tasks. Current R&D is focused on task analysis and cognitive and mathematical modeling of selected types of tasks. These efforts will extend the database and expand the power and flexibility of the decision support system.

Technology Transfer

One of the goals of part-task training R&D is the rapid transfer of technology to the field. Two experimental products have been developed and validated: an EC part-task trainer for the Tactical Air Command (TAC) and a Fuel Savings Advisory System (FSAS) part-task trainer for the Military Airlift Command (MAC).

The EC trainer simulates common Radar Warning Receiver (RWR) equipment and electronic countermeasures (ECM) systems used in many tactical aircraft. Training tasks include equipment

Part-Task Threat Recognition Trainer

operation, malfunction analysis, symbology interpretation, and optimum ECM responses. The training effectiveness of this device has been established empirically in extensive field testing. Results show that the performance of students trained on the RWR part-task trainer is consistently superior to that of students trained via conventional (classroom) methods. As a result of this R&D, TAC is in the process of procuring RWR trainers for their operational training units. This R&D product has been recognized by TAC as a valid means of enhancing the combat readiness and survivability of its aircrews.

The FSAS part-task trainer was developed as a cost-effective alternative to training in the actual aircraft. The basic operations of the FSAS are simulated by a microcomputer-based graphics systems, and the student simulates operating the system via a touch screen. Device training effectiveness was assessed by training two groups of C-141 pilots to use the FSAS; one group was trained via the microcomputer, and the other was trained in the actual aircraft. All students were trained to the same proficiency level, and the training times were recorded for each student. The experiment demonstrated conclusively that the low-cost trainer was fully as effective as the aircraft for training pilots in basic FSAS operations. Empirical results were applied to cost data to derive a cost benefit ratio of 173 to 1 (aircraft training cost vs. microcomputer training cost). This represents a cost avoidance of more than 10 million dollars as applied to training of current C-141 and C-5 aircrews in FSAS basic operations.

These part-task training demonstrations underscore the power of this level of technology to improve aircrew proficiency and readiness while reducing training costs.

COMBAT MISSION TRAINER

Today's tactical force faces a tremendous threat in the role of ground target attack. The hostile environment includes several types of surface-to-air missiles, radar/computer-directed antiaircraft guns, and communications jamming equipment, as well as enemy fighters. To complicate things further, the enemy ground threats are mobile and can be moved quickly. Also, the enemy movements that must be interdicted tend to be made under cover of night or in bad weather to frustrate the aircraft offenses by forcing them to rely on night or bad weather sensors to navigate and locate targets.

The solution to these problems is to fly multi-aircraft formations at high speed and very low altitudes; e.g., following the bottoms of valleys or other low places to avoid detection by enemy radar. These aircraft would have infrared and radar sensors to supplement or replace visual out-the-cockpit imagery and also would carry sophisticated electronic warfare equipment to jam enemy missiles, anti-aircraft guns, and communications. However, training the pilots to fly such complex, coordinated multiship, multisensor missions is very difficult. The ideal situation would be to practice against the enemy threats over enemy terrain with the aircraft teams flying together. Reconnaissance can determine exactly what the enemy terrain is like and where their threats are currently located. Thus, if there was a multiship, multisensor simulator that would provide practice over simulated enemy terrain, pilots could train for these complex missions in a realistic environment before having to actually fly them. They could develop and perfect their coordinated tactics and skills against the expected threat environment. For such operational simulators to be usable for tactical front-line forces, they would need to be sufficiently transportable and low cost so that a reasonable number could be located at front line bases or at least at regional training centers.

Developing such a simulator is the major challenge facing the Operations Training Division during the 1980's. Previous simulators have been single-ship, with emphasis on simplified visual out-of-the-cockpit scenes. Threats were modelled in a simplified manner. Only recently have nighttime (infrared) and all-weather (radar) imagery been included, and then just for a single-ship. Such imagery has not been correlated with visual scenes. Furthermore, the simulators have been very large, non-transportable, and expensive. Obviously, there is still a long way to go to achieve the needed

Fiber-Optic Helmet-Mounted Display

combat-mission training capability, but progress is being made from two directions. The first is a full-capability, but expensive and non-transportable, "brassboard" system that will allow investigation into just what is and is not important in simulating a "full-up" multiship mission under modern combat conditions. The other is a limited-capability, low-cost, transportable two-ship simulator using a small-sized, helmet-mounted visual display system that projects the scene directly into the pilot's helmet. This Fiber-Optic Helmet-Mounted Display (FOHMD) effort, being conducted jointly with the Canadian Government, will result in a helmet-display, head- and eye-tracked, two-ship system.

The FOHMD project avoids the high cost and transportability problems inherent with large visual display domes. This system projects the visual scene from "light valves" via fiber-optic bundles through lenses mounted on a helmet, then directly into the pilot's eyes. As the pilot's head is moved, the visual scene being projected into the pilot's eyes has to move correspondingly. Also, as the pilot's eyes are rotated with respect to the head, a high-resolution inset in the visual scene needs to be moved with respect to the rest of the scene. This means that the simulator must know the position of the pilot's head and also the pilot's eyes. This is referred to as "head- and eye-tracking," and doing it properly is a key R&D issue. Future R&D on this device will be concentrated on refining the helmet display system and on investigating two-ship training using low-cost visual scene generation and distributed microcomputer-based computations of the flight equations. When the system is fully developed, it could lead to the final development by the Simulator SPO of an early two-ship tactical simulator capability that would be transportable and low in cost.

In parallel with the FOHMD, a "full up" multiship, multisensor, brassboard combat mission trainer (CMT) simulator is being assembled for R&D purposes. It will incorporate and apply most of the advanced R&D projects at the Operations Training Division. It will utilize the Advanced Visual Training System (AVTS), which has the high resolution and scene detail needed for air-to-ground combat at high speed and low altitudes. It will utilize highly detailed threat models (missiles and antiaircraft guns), detailed such that pilots can try to detect and avoid the threat. The most advanced multisensor infrared and radar imagery will be used in the multimode cockpit displays. In addition to the FOHMD, the CMT will use new dome technologies that allow smaller domes or full field-of-view projection. Tying this all together will be the new R&D Instructor Operator Station (IOS) that can handle multiple aircraft and sensors and a large number of enemy threats. In this advanced IOS, artificial intelligence features will handle threats (to make them "smart") and other station features such as communications with the pilots via speech synthesis and speech recognition. The IOS will also allow measurement of mission performance on a number of parameters.

The objective of the brassboard CMT will be to determine what features of full-up combat need to be simulated and in what amount of detail; i.e., what is important and what is not. This training effectiveness evaluation will be done not only through experiments planned and conducted by research psychologists but also by the practical judgment of experienced pilots. The final development agency (Simulator SPO) needs to know what features are important and in what detail, and this vital information will be determined by the training effectiveness scientists using the brassboard full-up simulator. The low-cost, transportable multiship simulator that is needed to train and rehearse combat missions will then be made available in sufficient quantities for front line pilots.

Further information on any of these projects is available from the points of contact listed on page 80.

LOGISTICS & HUMAN FACTORS DIVISION

LOGISTICS AND HUMAN FACTORS DIVISION

The Logistics and Human Factors Division of AFHRL was organized in 1980 to focus computer science, human factors, operations research, and engineering skills in an interdisciplinary systems approach to research and development of new logistics and command/control capabilities. The Air Force 2000 Study and the Air Force Logistics Long Range Planning Guide state the need for more flexible, mobile, dispersed operation of tactical air forces. The Secretary of the Air Force has directed a concerted effort to exploit technical data automation in industry and government. The Air Force is also pushing forward with an expanded military role in space. The Logistics and Human Factors Division is in the forefront with key technology programs that will help achieve these aims.

Colonel Donald C. Tetmeyer
Division Chief

Bertram W. Cream
Acting Division Chief (29 Jul to 30 Sep 85)

MAINTENANCE IN COMBAT

More dispersed and mobile tactical aircraft operations will require technicians who are generalists rather than the present highly specialized force. Otherwise, the increased manpower costs for each aircraft would be prohibitive. However, new aircraft will be even more complex and technically sophisticated in order to maintain a combat edge.

Integrated Maintenance Information System

If technicians are to operate effectively as generalists, they will need much better diagnostics and maintenance aids. Such aids will be tailored to technicians' needs for each job. They will provide thorough, easily understood, step-by-step instructions for unfamiliar jobs, or quick prompts and checklists for well known tasks. The technician's window on this information will be a small, lightweight, rugged, easily carried stand-alone computer and data display for flight-line use. It can be plugged into an aircraft data bus for interactive troubleshooting and will allow dialogue with expert systems aids. It will have a radio link to

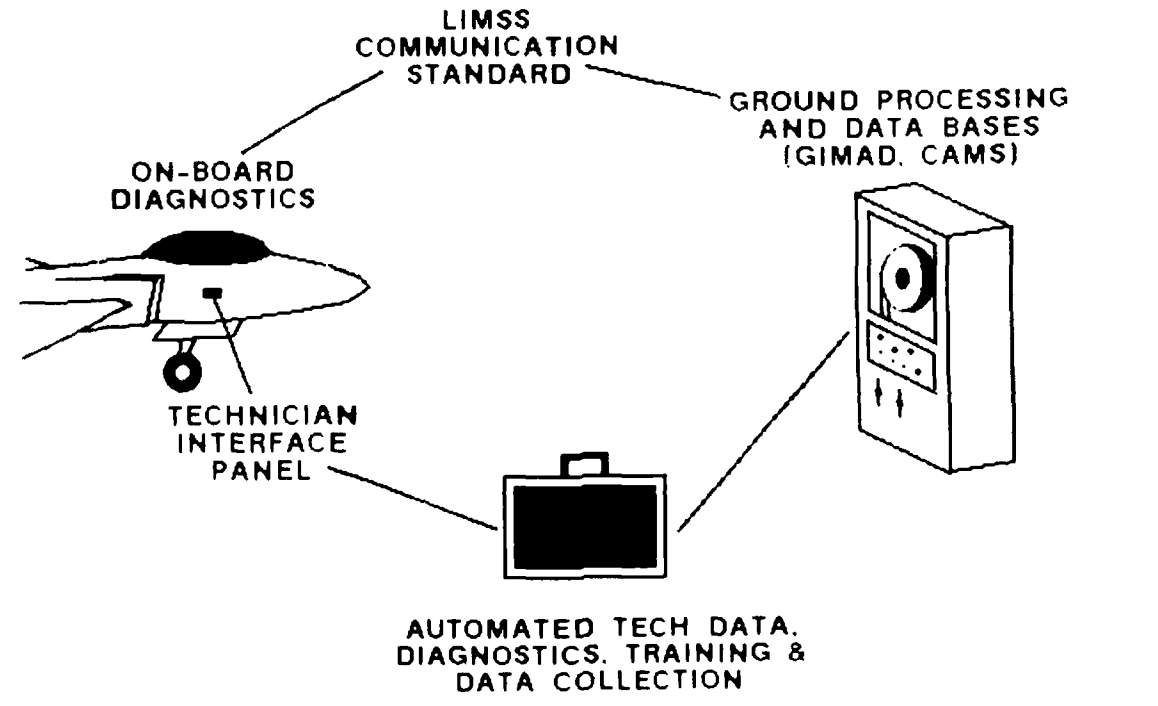
maintenance control and any available central database. The technician can plug in data cartridges that provide battle damage assessment assistance as well as normal technical orders and diagnostic aids. These capabilities are being developed in a multi-phased program called Integrated Maintenance Information System (IMIS).

The first phase was the iterative development and tests of methods for displaying technical data on a screen so that it is most useful to the technician. This involved a break with the traditional page structure of technical orders in familiar book form. Information access is most flexible and responsive when the data are structured as elements in a computer database and when each screen image is constructed as needed from the basic graphics and procedures. With this system, the technician can easily move through the job with the desired level of detail instantly calling up information on parts, explanation of theory, schematic tracing, or test equipment hookup, yet maintaining overall perspective and task sequence. Diagnostics assists are graphic and dynamic. The display system was tested at Grissom AFB in 1985, and specifications were produced for data development and electronic coding.

In the second phase, authoring software to produce data economically in this electronic form will be developed and tested by the end of 1986. An experimental model of the portable flightline display computer is currently under contract and will be field tested in 1987-88. Tests at an F-16 site will include diagnostic interaction with the aircraft data bus.

The final phase of IMIS will be a complete development of the interactive diagnostics to include expert system aids and communication links with supply, maintenance control, and historical databases. When IMIS is implemented on the Advanced Tactical Fighter, the data will be updated electronically to the field through data management and communication links provided as Phase IV of the Air Force Technical Order System.

INTEGRATED MAINTENANCE INFORMATION SYSTEM



Maintenance in Combat Environments

The Logistics and Human Factors Division is also conducting several projects aimed at assessing and improving maintenance capability under severe wartime conditions. A set of computer simulation models and data collection techniques was developed for F-16 units in Europe and is now being validated at F-111 aircraft sites. In 1986, field research will be conducted under controlled conditions to quantify and understand the limitations that chemical warfare imposes on the ability to do a representative range of maintenance tasks. Another project, Small Unit Maintenance Manpower Analysis, is developing structured methods for establishing the set of tasks that a single technician should perform; this will be used to define job duties and training of the new maintenance generalists.

PROVIDING LOGISTICS RESOURCES

The conditions of wartime flying impose different stress and demands on the weapon systems and the supporting logistics systems than are experienced in peacetime. Weapons delivery and electronic countermeasures are the most obvious examples. Deployment to a different theater and climate can also result in substantial changes from the previous patterns of demand. In order to adequately plan for wartime support, the Air Force needs databases and analysis methods that are sensitive to wartime variables. The Logistics and Human Factors Division is assembling an extensive database of worldwide combat maintenance experience and is developing analytical techniques that can be used to combine this information with other weapon system reliability measures to improve predictive capability. One aspect of this work is the joint development (with the Air Force Flight Dynamics Laboratory) of methods to plan the resources essential for Aircraft Battle Damage Repair. A new project starting in FY86 will explore the application of expert systems and information systems analysis to improve the efficiency and responsiveness of spare parts acquisition to meet these combat resource needs.

IMPROVING RELIABILITY AND MAINTAINABILITY

Several projects are in process that will enable more reliable and maintainable weapon systems to be fielded in a shorter time and at lower costs. The Unified Data Base for Acquisition

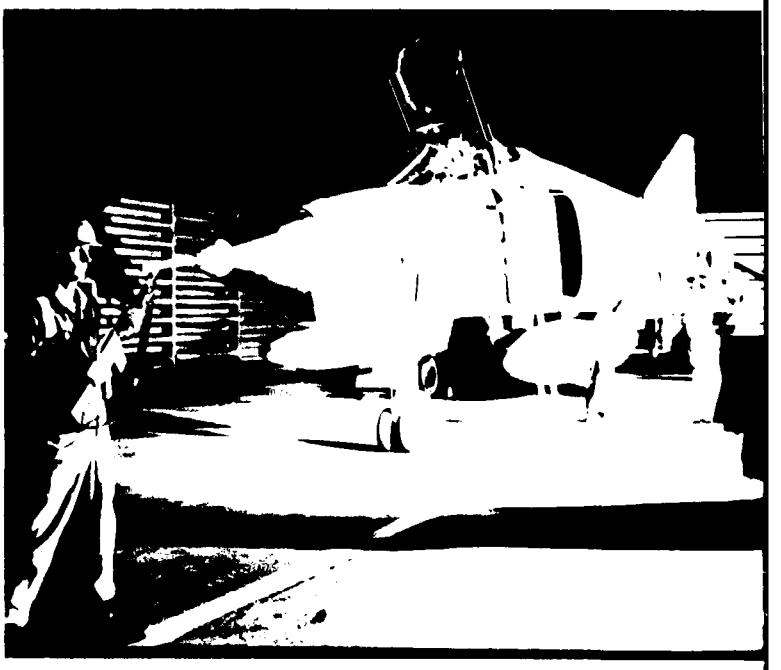
Logistics is developing and testing an interactive automated database, for logistics support analysis, that will be interfaced with computer-aided design. This system will have application on the F-15E aircraft program, as well as on space and missile programs. The Mission Reliability Model is an automated technique for optimizing the design of new self-reprogramming architectures that are impossible to analyze with traditional reliability models. The Mission Reliability Model shows the designer how to maximize mission success with the minimum redundancy. It has been tested and used in design of the Integrated Communication Navigation Information Avionics and has wide applicability to many new aircraft and space systems designs.

Maintenance and Logistics in Computer-Aided Design

A key technology that promises enormous leverage for AFHRL investment is the development of computer-aided design software for logistics analysis. The defense industry is going to computer-aided design for hardware design and engineering analysis. Recent developments in computer storage, computer graphics, and computer networks now make it possible to perform maintenance and reliability analysis iteratively with design, almost at the point of design inception. A design team can include reliability and maintainability engineers with networked computer work stations. A recent demonstration of redesign of the Ground Launched Cruise Missile produced 10-fold improvements using a computer display of a technician's tools, arm, and hand in graphic analysis of accessibility. Also graphic thermal mapping was used to show where relocation of components could significantly reduce heat stress failures. A second demonstration is underway in the design of the F-15E aircraft. A graphic model will be used in designing the capability for munitions loading and servicing within the tight space constraints of a hardened aircraft shelter. Longer term projects include the development of even more accurate, anthropometric, fully mobile human models for use in such graphic analyses, as well as other automated reliability and testability analysis routines.

Integrated Design Support

A joint project is underway with the Flight Dynamics Laboratory to develop the architecture, data interface standards, and control software for fully integrated design, logistics, and manufacturing data systems. The architecture development and Phase I demonstration will be completed in 1986. This work is being performed by a consortium headed by Rockwell Corporation and is using the B-1B aircraft structural design as the test application. An industry technical assessment group meets quarterly to review the



progress and assure widespread applicability and generality of the results.

COMMAND/CONTROL TEAM PERFORMANCE

The Logistics and Human Factors Division is working with the Tactical Air Warfare Center, U.S. Air Forces in Europe, Rome Air Development Center, Tactical Air Command, Tactical Air Force Interoperability Group, Electronic Systems Division, and Armstrong Aerospace Medical Research Laboratory to improve training and performance of tactical command and control teams. A model training program was developed and used to smooth the introduction of the German EIFEL system into the U.S. NATO forces. Detailed system information architecture and automated task analyses databases have been developed for the Blue Flag Exercises and for certain logistics control functions in Europe. Such analyses form the basis for process review, simulation of alternative procedures, and training. Techniques for developing credible system architectures and task analyses of wartime functions that cannot be directly observed is one of the major technological goals of this work.

The in-house tactical team performance and decision training/simulation research facility has been upgraded with advanced software. This facility will now be of greater use in studying the decision-making process of air tasking order development. This software is also transportable for data collection in field exercise environments. A new facility and expanded computer capability to be completed in FY86 will significantly enhance the research program in human information processing and decision making in functionally distributed, physically dispersed tactical command and control systems. This research provides the theoretical and conceptual foundation for development and test of improved decision making/training methods. The Laboratory is also planning a direct data link to the Battle Management Simulation Facility at Rome Air Development Center where new operational hardware and automated decision-aiding systems are developed.

Other work getting underway in FY85 included research on the potential of photogrammetry-based, computer-image-generated, dynamic visual simulations for training mission planning and other command and control functions. The Air Force Electronic Systems Division's Combat Identification System/Information Subsystem is being used as an initial testbed for AFHRL research on modeling the impact of automation of command and control processes. The aim is to develop data and modeling techniques that can be used by the Air Force Electronic Systems Division and Rome Air Development Center during design to simulate the effect of specific automation alternatives on overall function and

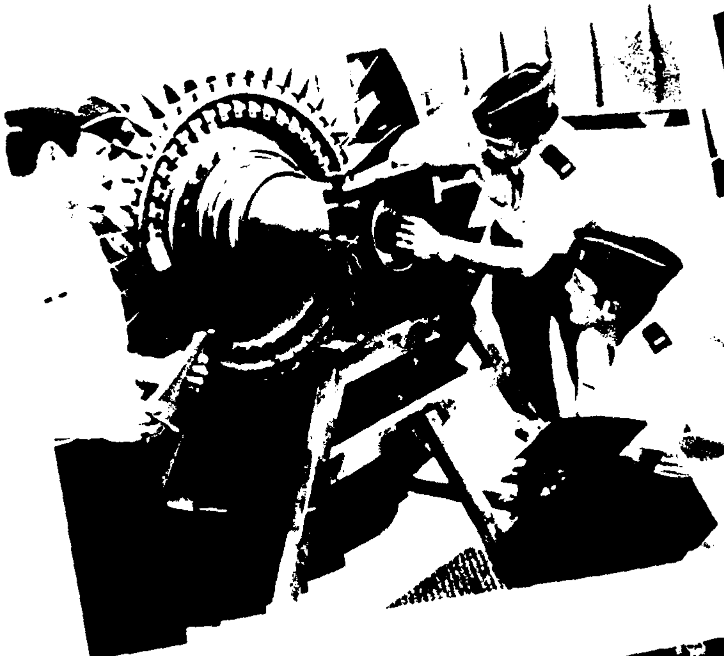
system performance. Also in FY85, a preliminary study was completed on training for wartime logistics command and control functions in Europe. The next step is development of a prototype program to train American logistics controllers on the NATO procedures that would be followed in the event of a European war. Cutting across all these efforts is the development of an automated and user-friendly database for command and control task and architecture data that can be used as the basis for training program development and performance simulation.

AUTOMATED TECHNICAL INFORMATION

AFHRL has responsibility for the research and development needed to achieve the goals of the Automated Technical Information initiative. Much of the ongoing work, such as the Integrated Maintenance Information System and Integrated Design Support, directly supports this initiative. The Logistics and Human Factors Division is installing an integrated and fully networked in-house computer capability to enable the development and test of new specifications and standards and of software for interchange of text and graphics between dissimilar computer systems. In addition, plans are underway for accelerated research on a more economical automated and user-friendly database management approach to handle system architectural and task analysis data. This "Meta Model" of the data will cut across every major project in the Division program. It attacks what appears to be the biggest technical roadblock to the exploitation and expansion of integrated information processing throughout industry and the DOD.

Maintenance Technician Prepares his Charge for the Coming Day's Flight

Further information on any of these projects is available from the points of contact listed on page 81.

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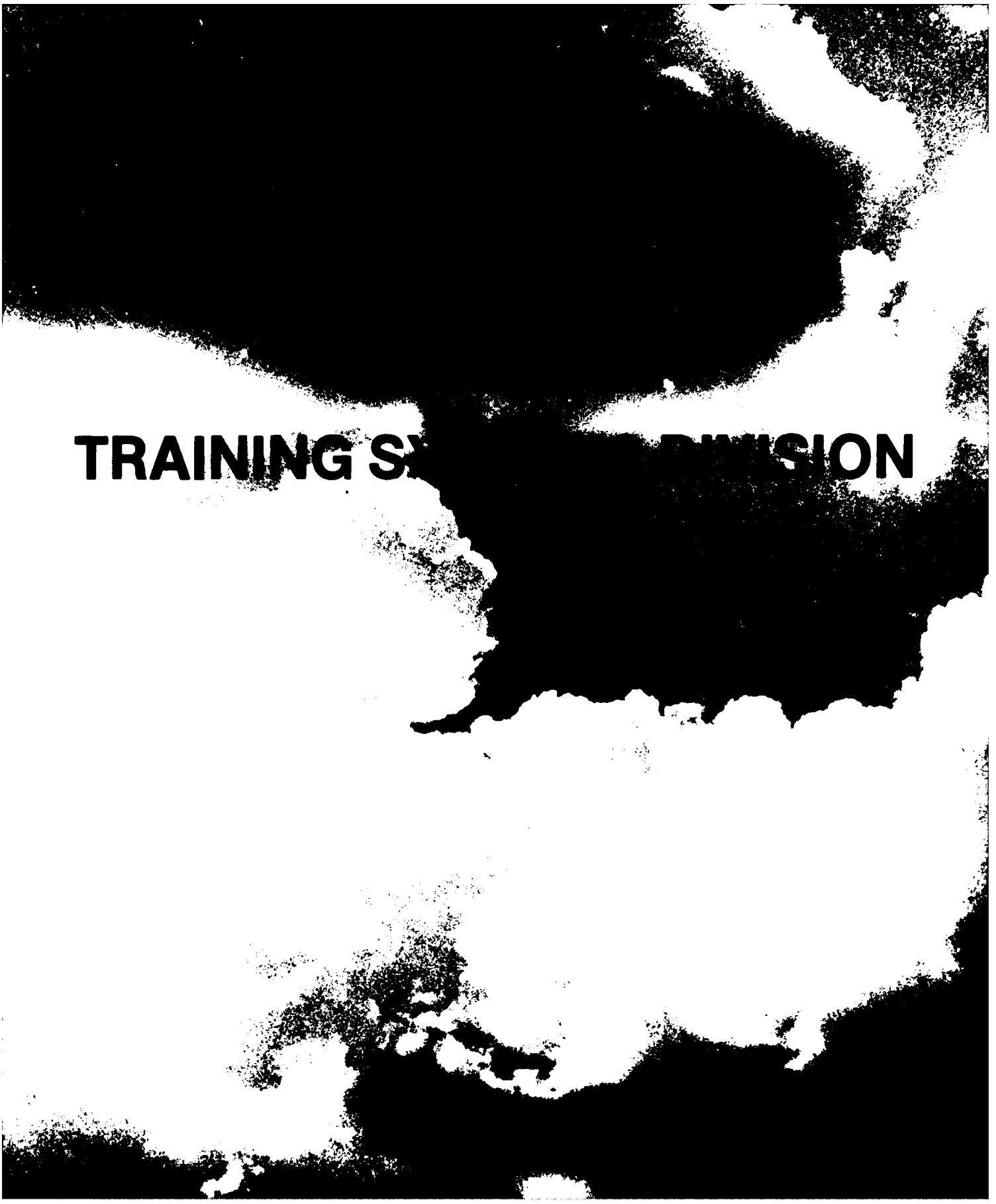

TRAINING S
ION

TRAINING SYSTEMS DIVISION

Colonel Gene A. Berry
Division Chief

The Training Systems Division is in the process of moving from Lowry AFB, Colorado, to Brooks AFB, Texas, and is presently located at the two bases. The primary objective of the Division is to develop improved individual and unit training methods and strategies for skills development, leading to effective job performance. Specific technical programs include development and demonstration of improved training methods, instructional and learning strategies, and training design and evaluation technologies. Other projects include (a) development of tools for computer-based training, (b) simulation of maintenance activities, and (c) application of artificial intelligence technology to training and enhanced job performance.

The Division's Training Design and Delivery Thrust is structured to develop, integrate, and demonstrate improved training systems and technologies for initial skill, on-the-job, and unit training programs. The thrust objective is addressed through work in two subthrusts: Skills and Performance Specification Systems and Training Management and Delivery Systems.

The Skills and Performance Subthrust addresses R&D on the content and process of instruction, instructional and learning strategies, definition of training and performance requirements, performance assessment and evaluation, training quality control, cognitive and motivational aspects of instruction, and artificial intelligence applications to instructional delivery and support. The Training Management and Delivery Subthrust addresses R&D on development and management of instruction for both classroom and on-the-job training. Included are efforts pertaining to the use of computer-aided/managed instruction and maintenance simulation. Overall, the Training Systems Division has an applied research focus, with exploratory development work occurring in both Division subthrusts. The basic research activities of the Division are oriented mainly toward skills acquisition and intelligent systems, while advanced development work is mainly in the area of on-the-job training.

Dr. Joseph Yasutake
Technical Advisor

TRAINING DESIGN AND DELIVERY R&D

As the twenty-first century approaches, training in the Air Force will continue to be a critical and resource-intensive component for achieving mission success. However, training will likely move from the traditional methods of classroom instruction and journeyman-apprentice job structures to more position and job-site oriented training. This change is needed because increasingly complex weapon systems and supporting

maintenance equipment are being deployed. Such complexity will create challenges in developing and using training technologies that will support the technicians in accomplishing their jobs. The Training Systems Division will meet these challenges by developing rigorous R&D procedures and by refining technologies that will accomplish the following tasks:

1. Develop affordable, maintainable, state-of-the-art computer-based instructional systems to effectively address present and future training needs.

2. Develop and apply artificial intelligence technology to training and job-aiding, thereby enhancing the job-readiness of the technicians.

3. Develop and demonstrate a prototype system to manage, administer, and evaluate the on-the-job training program; to ameliorate its present labor/paper intensiveness and its competition with mission requirements; and to enhance surge-accommodati n capability.

4. Enable the Air Force to establish the requirements for and to evaluate the efficacy of potential and operational technology applications through better techniques for training design and performance evaluation.

COMPUTER-BASED INSTRUCTION

The development, delivery, and evaluation of instruction using computer support has made increasingly larger inroads in the civilian sector. Compared to traditional instruction, computer-based instruction clearly has superior capability for variable learning speeds and adaptability to the state of the learner. However, adoption of this technology within the military has been less regular and has often met problems of institutional change. Another major obstacle to a more widespread adoption of this technology is the lack of flexible yet standardized general purpose instructional development/management computer software.

Instructional Support Software System

In the 1970's, AFHRL developed a large-scale computer-based instructional system employing both computer-aided and computer-managed instruction. This system was designed to develop and manage the training for a large number of students in several training courses, using a large mainframe computer that would also support R&D on related training issues. The successful demonstration of this system led to the Instructional Support Software System (ISS), which is based on the design principles of modular construction, machine independence, and utilization of a higher-order language (Ada). The end result is a Government-owned software package, for computer-based instruction, that is machine and operating system independent, and that is easily modifiable to permit incorporation of future hardware and software advances. The ISS can be used to address a training requirement without being dependent on a particular vendor-supplied hardware/software package. Also, the users can tailor the system, through modular design, to their unique needs rather than having to restrict or modify their requirements to fit the system.

The ISS has successfully undergone acceptance testing by the development contractor and is currently undergoing final development/enhancement efforts for computer-managed instruction. The system is being further tested in several operational contexts by various Air Force organizations:

1. The Strategic Air Command (SAC) at Beale AFB, California, is using ISS on a Pacific Micro PM200 to develop aircrew training.

2. Also, SAC at Dyess AFB, Texas, is using ISS on a VAX 11/780 to develop aircrew training for the B-1B bomber.

3. The Air Training Command (ATC) at Lowry AFB, Colorado, is using ISS to develop an Electronics Principles course.

Other Air Force units are also preparing to use the system in their training programs.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is the study of intelligent behavior and its application to the development of machines that perform tasks or that aid in the performance of tasks normally requiring human intelligence. Traditional areas

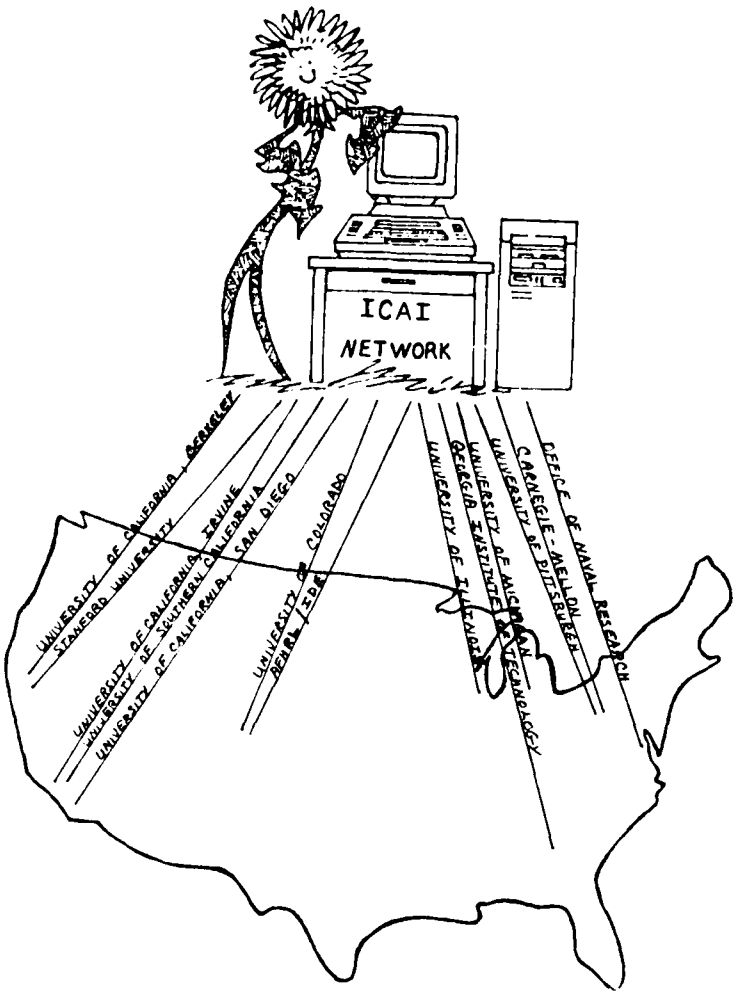
of R&D in the field have been automatic methods for solving problems, "understanding" and translating languages, proving theorems, and recognizing speech. These topics, when placed in a training and job performance context, appear obvious candidates for augmenting the ability of technicians to do their jobs and to facilitate the initial skill acquisition required of an apprentice. The Air Force has recognized that AI technology is among the most important for addressing anticipated and current needs related to dormant and dispersed systems, training the generalist and "one-deep" technician, and troubleshooting complex systems. Future progress in this field will depend on the development and demonstration of both practical and theoretical knowledge.

Knowledge Acquisition/Intelligent Authoring Aids

The design of training and the subsequent evaluation of the outcomes of such training represent a potentially high-impact focus for application of artificial intelligence technology. A joint-Services R&D initiative addresses the development of intelligent computer-assisted instruction (ICAI) tools. The major goals of the effort are to design and implement a student diagnostic model for ICAI and to build a knowledge acquisition system and associated authoring aids for the student model, as well as an instructional model. Follow-on R&D will test these tools in specific military applications.

Speech Recognition

The development of reliable speech recognition systems for training and job aiding has the potential for significantly facilitating the interaction of the student or technician with technical material. A developmental contract project has been initiated to extend and evaluate a new methodology for machine recognition of speech. Rather than utilizing the traditional statistical approaches, this methodology will utilize word identification processes. The goal is to achieve more accurate recognition plus the ability to dynamically add new words to the machine vocabulary.



Knowledge Engineering

An expert system or artificial intelligence system with inadequate or sparse knowledge is clearly a contradiction in terms. Thus, the most critical and time-consuming process in the development of expert systems is the construction of the knowledge base for the domain under study. This is called knowledge engineering; i.e., building enough knowledge of facts and relations among these facts to be qualified as an expert. An R&D project will design a methodology for multiple knowledge representation to address this critical artificial intelligence component by determining the potential for different representational systems residing and interacting within a single expert system.

AIR FORCE ON-THE-JOB TRAINING

In many ways, on-the-job training (OJT) is the critical arena in which training technology may have the greatest potential for enhancing the mission readiness of Air Force personnel. For example, OJT is an essential ingredient in maintaining adequate skills and combat readiness throughout an airman's career. Upgrading to fully qualified skill status is primarily accomplished through OJT. The Air Force OJT program encompasses enlisted personnel with widely diverse aptitudes and backgrounds. In addition to encompassing all enlisted personnel, Air Force OJT involves all specialties and affects all command missions. At any given time, more than 80,000 airmen in over 300 specialties are participating in OJT upgrade/qualification training. The importance, scope, and diversity of the OJT program result in a variety of problems from both a training and a management standpoint and make OJT both expensive and difficult to manage.

Advanced On-The-Job Training System

The Training Systems Division has established an operating location at Bergstrom AFB, Texas, to address both the way the Air Force develops and conducts OJT and the way it keeps track of the skill status of the airmen in and out of the system. The 4-year Advanced On-The-Job Training System (AOTS) project will systematically design, develop, and test a prototype that applies state-of-the-art technology to OJT. The AOTS is composed of four subsystems, and each includes a set of related components designed to accomplish those functions required for the development and operation of an effective OJT system. Four systems comprise the AOTS: (a) management, (b) evaluation, (c) computer support, and (d) personnel and support requirements for the system. The AOTS subsystems will be integrated into a total functional system that will be demonstrated and tested to determine its operational capabilities as a prototype OJT system. The system will be developed, demonstrated and tested in a 1-year side-by-side comparison versus the current OJT system, all within the work centers of an operational wing. The system design, development, and evaluation will include the active Air Force, the Air Force

Reserve, and the Air National Guard. The development contractor is currently on-site at Bergstrom AFB and is beginning the initial design and critical design reviews. Upon successful acceptance testing, the AOTS should provide the Air Force with a sophisticated systems approach to ensuring mission readiness with capabilities for the identification of performance and training requirements, management of job-site training, evaluation of airman task performance, evaluation of training program effectiveness, and OJT management analysis data provided to appropriate Air Force training management levels.

COURSE DESIGN AND PERFORMANCE EVALUATION

The effective use of any innovative training technology requires that the standards for success be validly identified so the correct behavior can be trained, and once completed, the effect of the training can be judged. ICAI is one approach to the establishment of effective training and to the assessment of the requirements of the learner. Other approaches involve development of computer-aided models and aids for systematic course design, as well as development of valid alternatives to assessing training outcomes.

Computer-Aided Task Analysis

Task analysis methods and databases as currently used do not adequately support training design and development. There is a great disparity between methods of task analysis based on equipment design versus methods based on occupational survey methods. Computer-based aids are needed to provide a better interface between existing databases, a better fit between advanced methods of task analysis and Air Force environments, and an adjunct to human decision making. The objective of this effort is to develop a cognitive model of the task analysis process and then to design, develop, and test an integrated set of computer-based aids (based on this model) for task analysis to support training in the job environment.

This development of this automated task analysis support capability will provide a powerful tool for the systematic analysis of job requirements and their subsequent translation to training requirements. This task will be especially suitable for utilization by subject-matter experts.

Operational Unit Job Proficiency Assessment

The development of a valid, generalizable methodology for assessing task performance proficiency in a day-to-day, operational environment is a critical element in assessing the effects of large-scale training innovations, such as the AOTS. Such a methodology is also essential in monitoring the job/mission readiness of personnel. This effort will develop a task-sampling methodology appropriate for making valid inferences to the task population within a given Air Force specialty. Also, a complete measurement scoring methodology is to be developed to gauge the job readiness of the targeted specialty. This effort will provide a critical link for measuring performance proficiency by developing a methodology appropriate for operational settings, such as on-the-job training. Thus, it will serve vital job certification and quality control functions essential to ensure mission readiness.

Further information on any of these projects is available from the points of contact listed on page 81.

TECHNICAL SERVICES DIVISION

TECHNICAL SERVICES DIVISION

The Technical Services Division, located at Brooks, provides support to AFHRL Headquarters and the four R&D divisions. This support includes the management and operation of the scientific data-processing center of AFHRL. The Division develops, maintains, and updates automated personnel and training R&D databases. The Division also provides consultative and programming support in the formulation of studies and the application of statistical techniques in support of other Laboratory Divisions and other Air Force offices. The major organizational elements within the Division are the Computer Programming Branch and the Computer Operations Branch. The Division also includes the Information Resources Management Office, and the Scientific and Technical Information Office.

Dr. Robert A. Bottenberg
Division Chief

COMPUTER PROGRAMMING BRANCH

The Computer Programming Branch provides three services:

1. Software Development.
2. Database Management.
3. Research Processing.

Software Development. The Technical Services Division develops, maintains, documents, and provides training in the use of general purpose computer software. This software includes the broad categories of (a) language translators, such as precompilers and interpreters, (b) utility programs, such as sort/merge and report writers, (c) applications programs, such as correlation-regression analysis and multidimensional frequency distributions, and (d) subroutine libraries containing common computing algorithms. The Technical Services Division is responsible for more than 460 general purpose and statistical analysis programs and over 3,080 pages of user guides to those programs.

Database Management. The Human Resources Laboratory database is composed of a series of databases containing information on personnel and training systems. These data are organized into readily accessible databases for support of R&D studies of the personnel system, to display selected information from a single database, and to consolidate information on a common subgroup from two or more databases. These data reflect personal characteristics on officer and enlisted personnel at time of entry to active duty, performance outcomes during flying or technical training, career status at periodic intervals, and information related to reenlistment or separation. Special files will be created to meet long-term study requirements, and longitudinal files will be constructed to facilitate studies in career development. Work is underway to build dynamic database systems for officers and airmen capable of providing responses to operational and research investigators. These database systems will eliminate the requirements for many small, fragmented databases and greatly reduce the start-up time and cost of many personnel R&D efforts.

Major master personnel files are maintained historically on Air Force enlisted and officer personnel and include enlisted strength files from 1964, officer strength files from 1960, officer effectiveness report files from 1956, flying training files from 1964, and Air National Guard and Reserve files from 1970. These files are received from various Air Force agencies, such as the Air Force Manpower and

MAJOR MASTER RESEARCH FILES

ENLISTED STRENGTH

SINCE 1964

OFFICER STRENGTH

SINCE 1960

OER HISTORICAL

SINCE 1955

AIRMAN REENLISTMENT AND LOSS

SINCE 1955

AIRMAN ENTRY

SINCE 1955

TECHNICAL TRAINING

SINCE 1956

FLYING TRAINING

SINCE 1964

AIR NATIONAL GUARD AND RESERVE

SINCE 1970

UTILITY PROGRAMS

PERSONNEL RESEARCH STUDIES

Personnel Center, Air Training Command, Air University, and Air Reserve Personnel Center. Special longitudinal files, such as the airman gain/loss and officer gain/loss, are developed in-house from these databases and significantly reduce data processing requirements in many personnel and training R&D studies.

Research Processing. The AFHRL Technical Services Division provides large-scale statistical services and data-processing support for Laboratory R&D programs. These services are performed in response to approved work requests initiated by all AFHRL divisions. These same services are available to approved agencies outside AFHRL. Work requests are initiated on behalf of the outside customers and then processed in the same manner as those for the AFHRL divisions. In addition to processing these work requests, the Division performs a quality review of all work performed to ensure complete and accurate results. Annually, the Division services over 200 R&D data processing requests.

COMPUTER OPERATIONS BRANCH

The Computer Operations Branch manages and operates a Computer Center which includes a large-scale, general-purpose Sperry 1100 computer system to support R&D programs of AFHRL and the Aerospace Medical Division (AMD) at Brooks AFB, the Occupational Measurement Center (OMC) and the Air Force Manpower and Personnel Center (AFMPC) at Randolph AFB. A Digital Equipment Corporation VAX 11/780 computer system provides Automated Management Information Systems in support of R&D projects within AFHRL and also provides an interface with the Defense Data Network (DDN). A Wang Laboratories VS 90 computer system provides office automation support within AFHRL.

The Computer Center includes a magnetic tape library which houses between 15,000 and 20,000 active tape reels. These tape reels contain historical data from Air Force personnel files which include master files, working files created in the conduct of data processing work requests, and system and application software.

The Sperry 1100 computer system provides the computer capability needed to support the R&D projects of the Laboratory. The Sperry 1100 system supports major programming languages including FORTRAN, COBOL, and database management systems including Sperry's DMS 1100 and System 2000. There are over 300 people authorized use of the 1100 System via dial-up telephone lines, dedicated telephone lines (servicing Williams AFB and Randolph AFB), and direct connected terminals at AFHRL, Brooks. Sperry 1100 users include AFHRL and AMD scientists and contractors, as well as survey analysts from OMC and AFMPC.

The VAX 11/780 computer system, using the Oracle Data Base Management System (DBMS), provides automated Management Information Systems (MIS) in direct support of R&D projects within AFHRL. Presently, personnel throughout AFHRL use the System 2000 DBMS on the Sperry 1100 system to support MIS requirements. All MIS presently on the Sperry 1100 computer will be transitioned to the VAX 11/780.

The Wang VS 90 computer system provides office automation support within AFHRL. This system provides local automated word processing capability and electronic mail service to the remote AFHRL divisions and HQ AFSC. The Wang terminals and printers located throughout AFHRL (Bldg 578) allow users to create, edit, reuse and print research reports, correspondence, etc. and store documents on magnetic disks for

later retrieval as needed. The electronic mail function allows transmission of correspondence, research reports, etc. to all AFHRL divisions and HQ AFSC.

SCIENTIFIC AND TECHNICAL INFORMATION OFFICE

The Scientific and Technical Information (STINFO) Office plans and directs the STINFO program, including the Technical Library, to meet the information needs of Laboratory scientists and technicians in managing, monitoring, and conducting R&D, as well as to publicize the work of the Laboratory and its achievements. STINFO personnel identify the information and publicity needs of the Laboratory and develop news articles, newsletters, reports, brochures, and displays to meet those needs. The Office's Technical Editing function reviews, processes, and publishes results of R&D projects in the form of technical reports, journal articles, special reports, professional papers, and other documents. Technical Editing personnel provide guidance to authors and contract monitors to ensure that publications comply with Government regulations and professional standards. They also monitor distribution of AFHRL publications and maintain records for responding to informational requests from the user and scientific communities. The Office provides liaison services between the AMD Public Affairs Office and the Laboratory. The Office obtains clearance of information for public release; arranges for visits and services of reporters, photographers, and audiovisual specialists; and performs special public relations and information assignments as required. Finally, the Office maintains the AFHRL historical archives, answers historical inquires, and provides information for the AMD History.

Technical Library

The services provided by the AFHRL library include the acquisition of books, journals, and other library materials. Services are provided for the command staff offices and the divisions on Brooks AFB, as well as for divisions and offices located in other geographical areas. The library has on-line access to the Dialog Information Services, Inc., at Palo Alto, California; the Defense Technical Information Center's Defense RDT&E On-Line System, at Alexandria, Virginia; and the OCLC, a national library network, through the AMIGOS Bibliographic Council, Inc., Dallas, Texas. During the fiscal year, the Library staff accomplished 191 on-line literature searches.

Library holdings at the end of FY85 were 13,400 books and bound volumes of journals, 10,862 technical reports and 470 journal subscriptions.

INFORMATION RESOURCES MANAGEMENT OFFICE

Audio and Video/Graphics Teleconferencing

Since July 1984, all the remote divisions of AFHRL and the headquarters are equipped with a video/graphics teleconferencing system. This system simultaneously links all the AFHRL sites, thereby providing for a fully interactive, multipoint video/graphics teleconference. The system is capable of creating, storing, and retrieving digital color imagery consisting of text, graphs, and/or photographs and subsequently displaying these images locally on large screen display systems or on color monitors. Using this system, full-scale audio and color video teleconferences can be conducted using a normal telephone access line.

Management Information System

The Information Resources Management Office is also the focal point for collecting and displaying data used in the management of the AFHRL technical program. The software for input of data at the source has been completed. All the divisions are now on line to input and retrieve work unit, JOCAS, and TDY source data for MIS products. Automated data transfer is being done for data to support DOD and AFSC databases. Personnel throughout AFHRL retrieve data and produce reports using the AFHRL database and System 2000. The Office can provide various types of color output, such as textual slides, pie charts, bar graphs, and line graphs, suitable for viewgraph and 35mm projection.

FY85 ACCOMPLISHMENTS

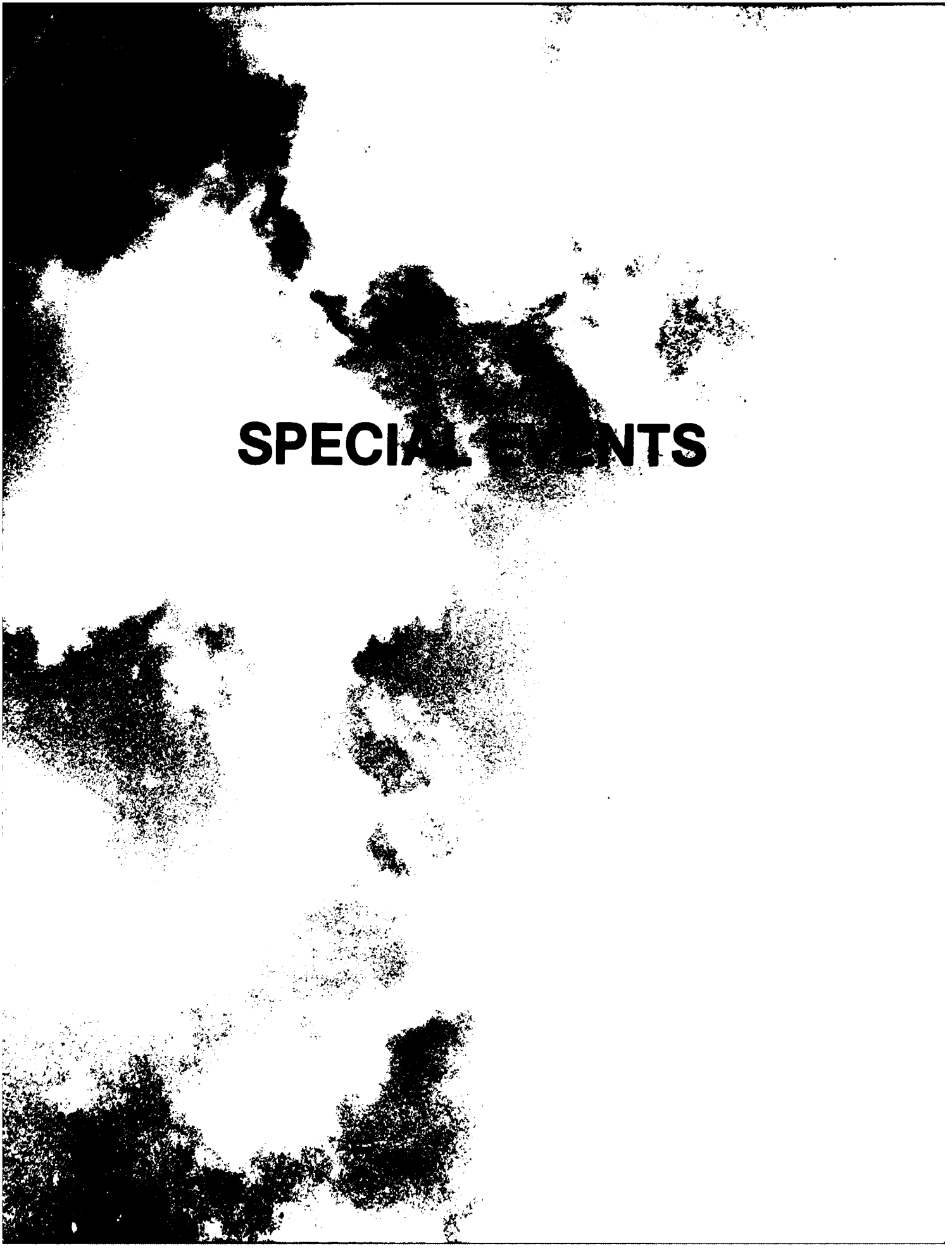
Several special studies were conducted for USAF Headquarters and MAJCOM Headquarters offices. A study conducted for HQ USAF/MPAC developed retention and continuation rates for enlisted accessions in each of the years 1974-1983, with data broken out in various demographic categories. In another study for HQ AFSC, promotion statistics were analyzed for staff sergeant, technical sergeant, and master sergeant, and data were provided comparing performance of Air Force Systems Command NCOs with NCOs from other Major Commands on the six factors in the Weighted Airman Promotion System. A series of studies comparing line officer promotion rates for captains, majors, and lieutenant colonels within the Aerospace Medical Division, Air Force Systems Command, and total Air Force were completed. These studies included promotion statistics over the past 10 years, and focused on several background factors such as Professional Military Education, education level, general officer endorsements, and the ratee's Air Force specialty. Other studies on officer retention were carried out for AFMPC/MPCMRS.

Several features were added to the Advanced Technology Multimedia Communications System. These included multipoint which enables a briefer at any one of the four Laboratory locations to control the visual display on the screen. Other features enable the briefer to insert handwriting on a chart being displayed at each of the locations, and to transmit to the various sites images captured on a television camera. Software was installed to expand the range of graphics and to ease the task of preparing graphics material.

Significant progress was made in converting Laboratory management information systems from the host Sperry 1100 computer to the VAX 11/780. Equipment was installed in all Laboratory divisions to support access and retrieval of data from the VAX. A 512K-word memory module was added to the Sperry 1100 system to bring total main memory to 2M words. Procurements were initiated for an additional Sperry processor, and delivery orders were announced for a front-end processor, a tape subsystem to replace the current system, and a major expansion to the disk subsystem. Procurements were also initiated to upgrade the VAX with additional memory, and for a communications network which will provide VAX access to a large number of users.

An effort is near completion, in which a large volume of data processing work request documentation has been converted to microfiche. Hard-copy documentation is being staged for destruction.

Sixty-five Laboratory personnel were provided in-house training. Courses in 19 functional areas were conducted, including the use of personal computers, software languages, and the application of utility routines. Software developed in-house was copied and made available to requesters from other Air Force, Federal, and state agencies.


SPECIAL EVENTS

COLONEL JARVI ASSUMES AFHRL COMMAND

Colonel Dennis W. Jarvi assumed command of AFHRL June 17, 1985. He succeeds Colonel Anthony F. Bronzo, Jr., who is now Vice Commander of the Aerospace Medical Division.

Col Jarvi, a native of Negaunee, Michigan, graduated from Michigan Technology University with a Bachelor of Science Degree in Mechanical Engineering. In 1964, he entered pilot training at Webb AFB, Texas. Before reporting to his first assignment flying the F-101 at Charleston AFB, South Carolina, Col Jarvi served a short stint in the F-102 at Perrin AFB, Texas, and in the F-101 training program at Tyndall AFB, Florida. Flying out of Korat at RTAFB, Thailand, Col Jarvi flew 100 combat missions in the F-105 over North Vietnam in 1967-1968.

Following assignments to Kadena Air Base, Okinawa, and McConnell AFB, Kansas, he led the USAF/German Air Force Fighter Weapons School at Luke AFB, Arizona, flying the F-104. Upon graduation from the Canadian Forces' Command and Staff College in Toronto, Canada, in 1976, he flew the F-104 with the NATO Allies in Europe. In 1979, Col Jarvi was assigned to Wright-Patterson AFB, Ohio, as Chief of the Crew Station and Human Factors Division in the Directorate for Equipment Engineering. Later, he became the program director of a classified advanced aeronautical system. He is a graduate of the Defense Systems Management College and Air War College and holds an MBA from the University of Utah.

COLONEL NEWTON AWARDED THE LEGION OF MERIT

Colonel Tyree H. Newton was awarded the Legion of Merit for his outstanding service as Vice Commander of the Air Force Human Resources Laboratory from 15 August 1984 to 31 July 1985. On many occasions, he assumed full command responsibility for the Laboratory, with the complete confidence of the Commander. He prepared comprehensive studies and directives for the functional reorganization and realignment of people, resources, and programs of the Laboratory Headquarters and Divisions. His guidance for the relocation of the Training Systems Division greatly facilitated the integration of personnel and training R&D activities of critical importance to the Air Force. This movement of approximately 40 positions will centralize AFHRL expertise in personnel and training R&D, bring these services closer to primary user agencies, and be accomplished with the least possible impact on the people involved. He skillfully coordinated agreements and facilities with Tactical Air Command headquarters and with Bergstrom AFB officials to initiate the Advanced On-the-Job Training System R&D project, which will have a tremendous payoff for Air Force technical training programs. He supervised the merger of the Scientific and Technical Information Office and the Technical Editing Office, which improved the utilization of resources and strengthened the AFHRL scientific and technical information program.

DR. CHRISTAL WINS DONALD B. HAINES AWARD

Dr. Raymond E. Christal

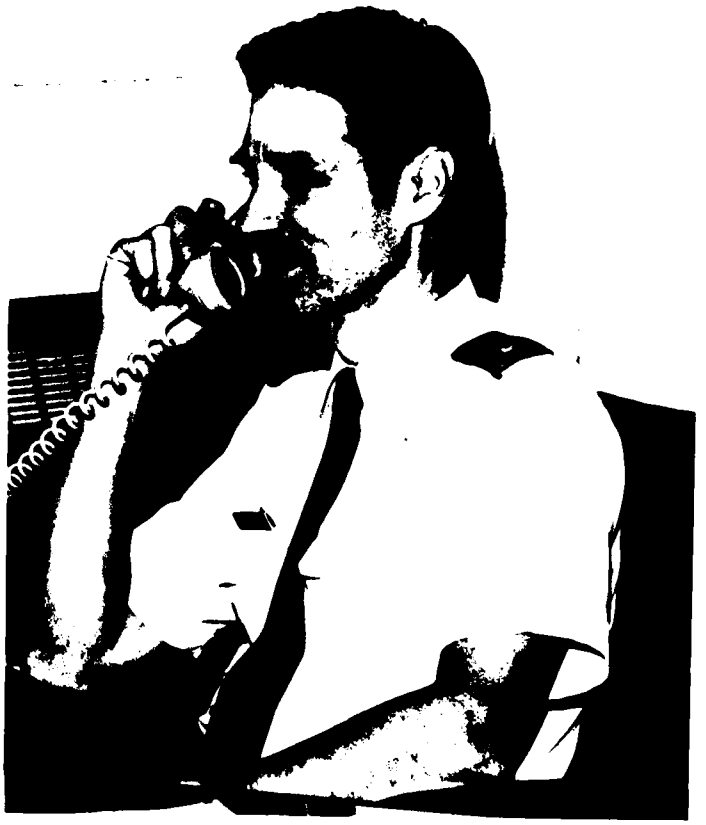
The AFHRL Donald B. Haines Award for FY85 was granted to Dr. Raymond E. Christal of the Manpower and Personnel Division. Dr. Christal has developed at AFHRL the technical foundation for what is fast becoming an internationally recognized Center of Excellence in Cognitive Ability Research. He has been primarily responsible for initiating and providing technical direction and leadership for basic research in the Learning Abilities Measurement Program (LAMP).

Project LAMP is unique in the DOD and reflects the belief that there exists a window of opportunity for significant and dramatic advances in the area of assessing human abilities. Microcomputers have become generally available to provide the capacity for measuring unique aspects of mental functioning. Artificial intelligence researchers have provided the means for developing sophisticated tutoring courses that yield measures of individual learning efficiency suitable for use as criterion measures. Cognitive psychologists have been making progress in identifying the fundamental components of human cognition. Results from this work should alter significantly the tests used to evaluate applicants to military service in the 1990s and beyond.

MANAGEMENT AWARD TO COL TETMEYER AND DR. VITOLA

The AFHRL Management Award for FY85 was conferred jointly on Colonel Donald C. Tetmeyer, Chief of the AFHRL Logistics and Human Factors Division (LR), and on Dr. Nancy Guinn Vitola of the AFHRL Manpower and Personnel Division.

Col Tetmeyer's accomplishments have had, and continue to have, a major impact on the readiness support capability of fielded and future Air Force weapon systems. The redirection of the Division's R&D program into the logistics area has greatly enhanced the Laboratory's ability to directly help improve the supportability of Air Force weapon systems. Col Tetmeyer achieved this redirection by integrating his knowledge of Air Force needs to improve weapon system supportability; his professional knowledge and technical skills in the areas of operations research, engineering, and behavioral science; and his analysis of the needs of the logistics community.



Colonel Donald C. Tetmeyer

The integration of the R&D programs of the LR Division with other R&D programs has the benefits of cross-fertilization of ideas, avoiding duplication of work, and cost-sharing of expensive efforts. Col Tetmeyer redefined the skill mix of his staff to include multi-discipline teams (operations research analysts, computer scientists, engineers, and behavioral scientists) and to include a greater proportion of military personnel with field experience. These changes have given the LR Division a far greater capability to accomplish the high-technology R&D that is in its new mission.

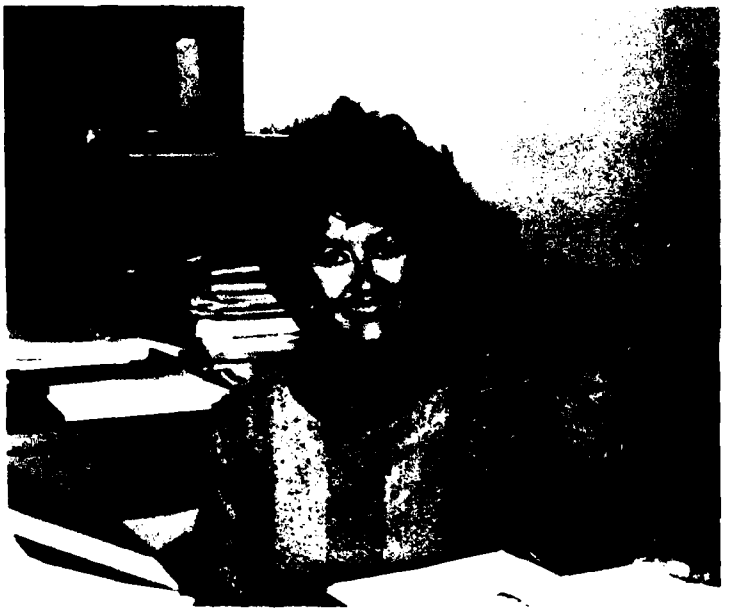
Dr. Nancy Guinn Vitola shared the AFHRL Management Award with Colonel Tetmeyer. Her exceptional performance as Technical Director and Division Chief, Manpower and Personnel Division was cited as the basis for this award. Using extraordinary management and technical skills, a keen understanding of Air Force needs, and a deep understanding of how emerging technology can support those needs, Dr. Vitola has developed the broadest and most comprehensive R&D program of its kind in the DOD. During the year she served as its Chief, the Manpower and Personnel Division began a 7-year program to measure the success of on-the-job performance of thousands of military personnel. The results of this work will have far-reaching consequences throughout the DOD.

Under Dr. Vitola's direction, a multi-million-dollar research program was initiated to address the critical issue of what knowledge is required by apprentice airmen to perform their jobs successfully and to progress in their later careers. The conceptual design of this work extends far beyond simple literacy skills and is now envisioned to include all higher order cognitive skills necessary to operate in a high-technology environment. The results of this work could revolutionize the way that Air Force technical training programs are designed.

MERITORIOUS CIVILIAN SERVICE AWARD
TO DR. NANCY GUINN VITOLA

Dr. Nancy Guinn Vitola received the Air Force Award for Meritorious Civilian Service for exceptional performance as Technical Director and Chief, Manpower and Personnel Division from 1 April 1984 to 1 April 1985. During that time she was responsible for direct management of 87 technical and support personnel assigned to the Division and an approximate annual budget of 5 million dollars. The personal efforts and contributions of Dr. Vitola pervade the Division's entire R&D program. "Through her technical leadership and skilled management, a working environment has been established in which major scientific programs of direct relevance to the Air Force can be designed, funded, and executed according to the highest professional standards. Dr. Vitola's personal integrity, competence, and foresight form the cornerstone of the Division."

DR. SHERRI P. GOTT'S PAPER CITED AS BEST



Sherri P. Gott

Dr. Sherri P. Gott recently received the Air Force Systems Command Certificate of Merit. Brigadier General Charles F. Stebbins, Deputy Chief of Staff for Science and Technology (AFSC), cited Dr. Gott's coauthorship of the paper "Complex Systems in the Workplace: What do Technicians Really Need to Know?" as deserving of this recognition. Dr. Gott's paper was selected as the best Air Force paper in the Life Sciences and Engineering Symposium. Working as a personnel research psychologist in the Manpower and Personnel Division, Dr. Gott described an R&D effort to design a system for measuring and training the skills that are fundamental to early proficiency in technology-laden workplaces.

Dr. Gott suggests that instructional materials should "provide a general framework and conceptual model up front to introduce and thus harness complex sets of variables; present information in meaningful, tightly cohesive chunks; model chunks after the naturally occurring structures that are known to characterize a learner's developing knowledge; and ... target instruction at specifiable, discrete components within a complex skill." These procedures would seem to have direct application to the utilization of artificial intelligence in computer-based instruction.

DAN BERKANT AWARD GOES TO MS. SALVATIERRA

Ms. Margie A. Salvatierra, secretary to Dr. Alluisi, the Chief Scientist of AFHRL, received the 1985 Dan Berkant Award recognizing outstanding civilian service toward the achievement of the USAF mission.

Ms. Salvatierra is a native Texan and a career Civil Service employee. She received her degree in mid-management from San Antonio College and is pursuing a bachelor's degree in management at Southwest Texas State University.

She continuously demonstrates outstanding leadership and management of Dr. Alluisi's office during frequent temporary duty absences by the Chief Scientist. She is often required to make contact with local, state, and Federal officials, as well as with business, educational, and scientific leaders. Ms. Salvatierra has earned Sustained Superior Performance awards for the past 2 years. A member of the Federally Employed Women's Program, Ms. Salvatierra has served as the 2nd and 1st vice president of this organization.

Margie A. Salvatierra

AFHRL CELEBRATES ANNIVERSARY

AFHRL celebrated its 43rd anniversary 15 November 1984 with a 2-day open house, and San Antonio Mayor Henry G. Cisneros proclaimed 11 to 17 November "Air Force Human Resources Laboratory Week." The open house included briefings, videotape presentations, and technical demonstrations by Laboratory personnel, as well as an Air Force Systems Command sound-slide presentation in the Air Force Orientation Group theater van.

BRIGADIER GENERAL DOPPELT VISITS AFHRL DIVISIONS

The Commander of the Aerospace Medical Division, Brigadier General Frederic F. Doppelt, spent two weeks during November/December 1984 visiting all AFHRL divisions. Gen Doppelt's purpose was to get to know the people, facilities, and programs of the Laboratory. On these visits, he spent much time with the young people, both military and civilian.

"There is no question but that our young people are bright and excited by their jobs, and they are doing a tremendous job," he said.

"Our people are unique. They are very well trained. They know what they want to do, and they know where they are going. They have to be the best caliber of people that I've seen anywhere in my career," added Gen Doppelt.

AFHRL ORGA
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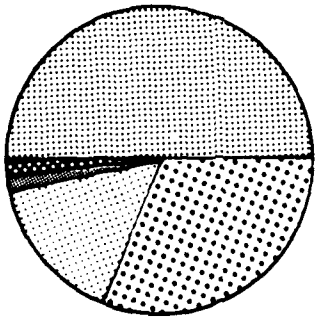
FISCAL HIGHLIGHTS

FUNDING SUMMARY (1000)

	FY83	FY84	FY85
LABORATORY DIRECTOR'S FUND	790	815	945
RESEARCH 6.1	1,156	830	752
EXPLORATORY DEVELOPMENT 6.2	23,786	29,421	30,557
ADVANCED DEVELOPMENT 6.3	16,789	15,215	19,291
INTERSERVICE TRANSFERS & REIMBURSABLES	8,547	10,966	9,781
TOTAL	51,068	57,247	61,326

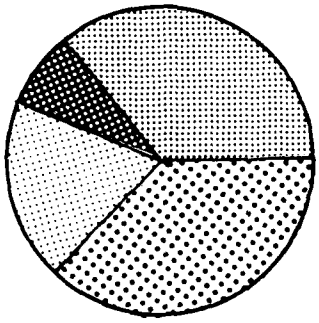
FY85

DISTRIBUTION OF FUNDING

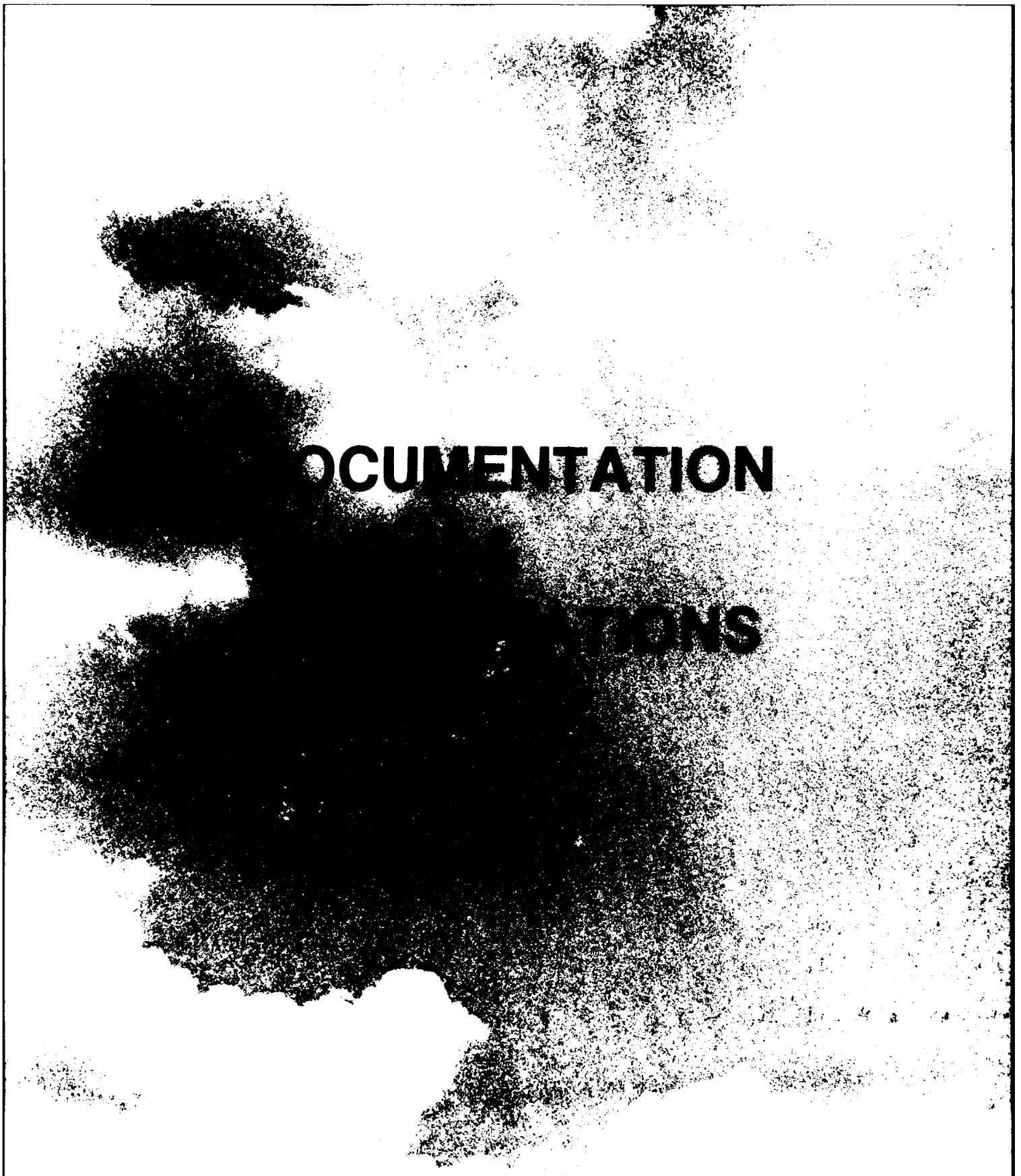


- 6.2 LABORATORY DEVELOPMENT (50%)
- 6.1 RESEARCH (2%)
- LABORATORY DIRECTOR'S FUND (1%)
- INTERSERVICE TRANS & REIMB (16%)
- 6.3 ADVANCED DEVELOPMENT (31%)

FUNDING BY DIVISION ALL SOURCES



- OPERATIONS TRAINING (21.9)
- TRAINING SYSTEMS (5.1)
- MANPOWER & PERSONNEL (11.5)
- LOGISTICS & HUMAN FACTORS (23.0)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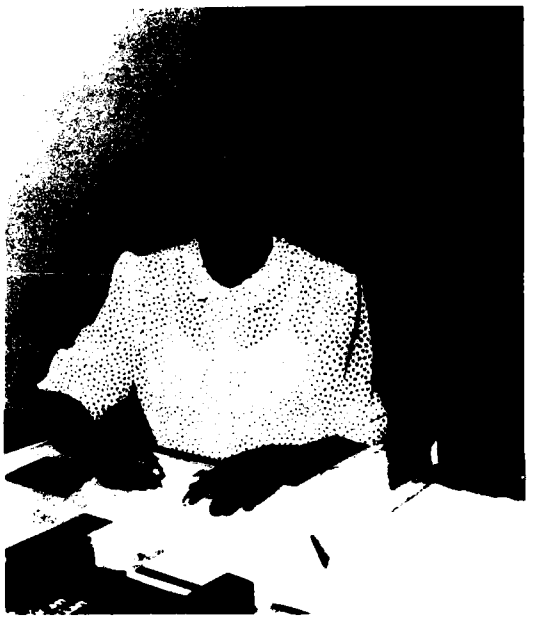

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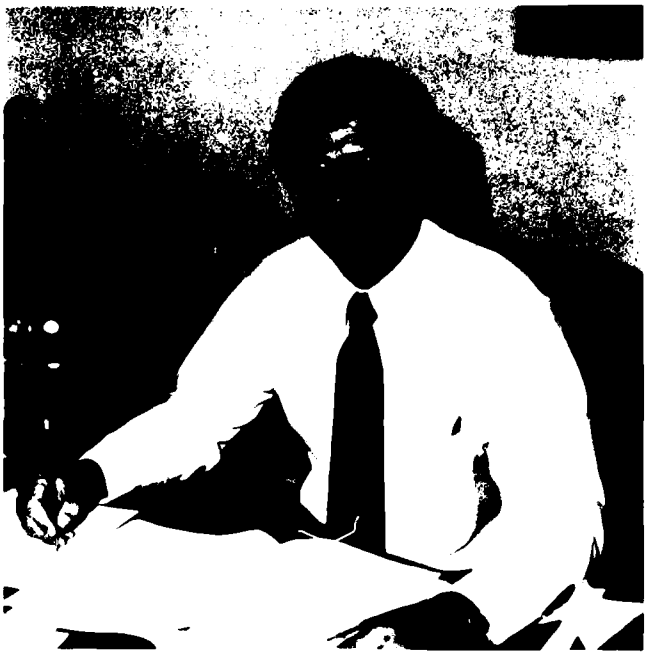

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Nullmeyer, R. T., & Rockway, M. R. (1984, October). Effectiveness of the C-130 Weapon System Trainer for tactical aircrew training. 6th Interservice/Industry Training Equipment Conference, Washington, D.C.

Nullmeyer, R. T., & Rockway, M. R. (1985, March). Relationships among aircrew performance measures for evaluating flight simulator training effectiveness. Eastern Simulation Conference, Norfolk, VA.

Robert T. Nullmeyer

Owen, D. H. (1985, June). Global optical flow and texture variables useful for detecting and guiding self motion. Third International Conference on Event Perception and Action, Uppsala, Sweden.

Pina, M. (1984, November). Goal programming model for assignment of personnel under the Air Force Elective Assignment Program. 1984 Air Force/Navy Science and Engineering Symposium, Norfolk, VA.

Pritchard, R. D. (1984, November). Increasing productivity in Air Force jobs through feedback, goal setting, and incentive systems. Paper presented to the Society of Logistics Engineers, Austin, TX.

Richardson, J. J. (1985, March). The Air Force's intelligent maintenance aid program. 1985 Association for the Development of Computer-Based Instructional Systems Conference, Philadelphia, PA.

Short, L. O., & Lowe, J. K. (1985, August). The relationship of work group meetings to solve problems and set goals with perceptual organizational variables: Some implications for consultants. Paper presented at the 45th Annual Meeting of the Academy of Management, San Diego, CA.

Stewart, J. E. (1985, September). Learning in an air refueling part-task trainer: Preliminary data analysis. Human Factors Society Convention, Baltimore, MD.

Summers, R. H. (1984, November). Nondestructive inspection: Improved capabilities of inspectors. 1984 Air Force/Navy Science and Engineering Symposium, Norfolk, VA.

Tetmeyer, D. C. (1984, November). Maintenance aids for the future. Paper presented at the American Defense Preparedness Association Logistics R&D Conference, Ft. Worth, TX.

Tetmeyer, D. C. (1985, July). Air Force Human Resources Laboratory activities in automated technical information. Paper presented at the Annual Air Force Logistics R&D Conference, Dayton, OH.

Tetmeyer, D. C. (1985, July). Logistics systems R&D. Paper presented at the Future Look '85 Conference, Homestead AFB, FL.

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Vaughan, D. S. (1985, May). Training decisions system. Paper presented at the National Security Industrial Association Conference, San Antonio, TX.

Vaughan, D. S., Yadrick, R. M., Perrin, B. M., & Mitchell (1985, September). Clustering tasks into training modules in the Air Force training decisions system. Army Occupational Users Conference, Alexandria, VA.

Weaver, C. N., & Carpenter, J. B. (1985, March). Recent changes in what workers want from their jobs: 1973-1974 versus 1980-1982. Paper presented to the Southwest Division of the American Institute of Decision Sciences, New Orleans, LA.

Weaver, C. N., Haney, D. L., Chun, S. Y., & Liu, C. M. (1985, March). Marital status in the work related attitudes of females. Paper presented to the Southwestern Society of Economists. New Orleans, LA.

Woltz, D. J., & Christal, R. E. (1985, April). The relation of processing and storage in working memory. Paper presented at the Annual Meeting of the Western Psychological Association, San Jose, CA.

Wood, M. E. (1985, January). Toward a cost-training effectiveness methodology for aircrew training devices. The NATO Defense Research Group, Panel VII, Symposium on Training Effectiveness in Brussels, Belgium.

CONFERENCES/WORKSHOPS HOSTED IN FY85

Air Force Productivity Office Time Management Seminar. July 1985. Brooks AFB, TX.

Basic Job Skills Research Advisory Group. Research progress review attended by contractors and representatives from the Air Staff, ATC, MPC, TAC, and AFHRL divisions. February 1985. Brooks AFB, TX.

Human Computer Graphics Models Workshop. April 1985. Wright-Patterson AFB, OH.

Joint Service Job Performance Measurement Working Group. April 15-17, 1985. Brooks AFB, TX.

National Academy of Science Committee on the Performance of Military Personnel. April 18-19, 1985. Brooks AFB, TX.

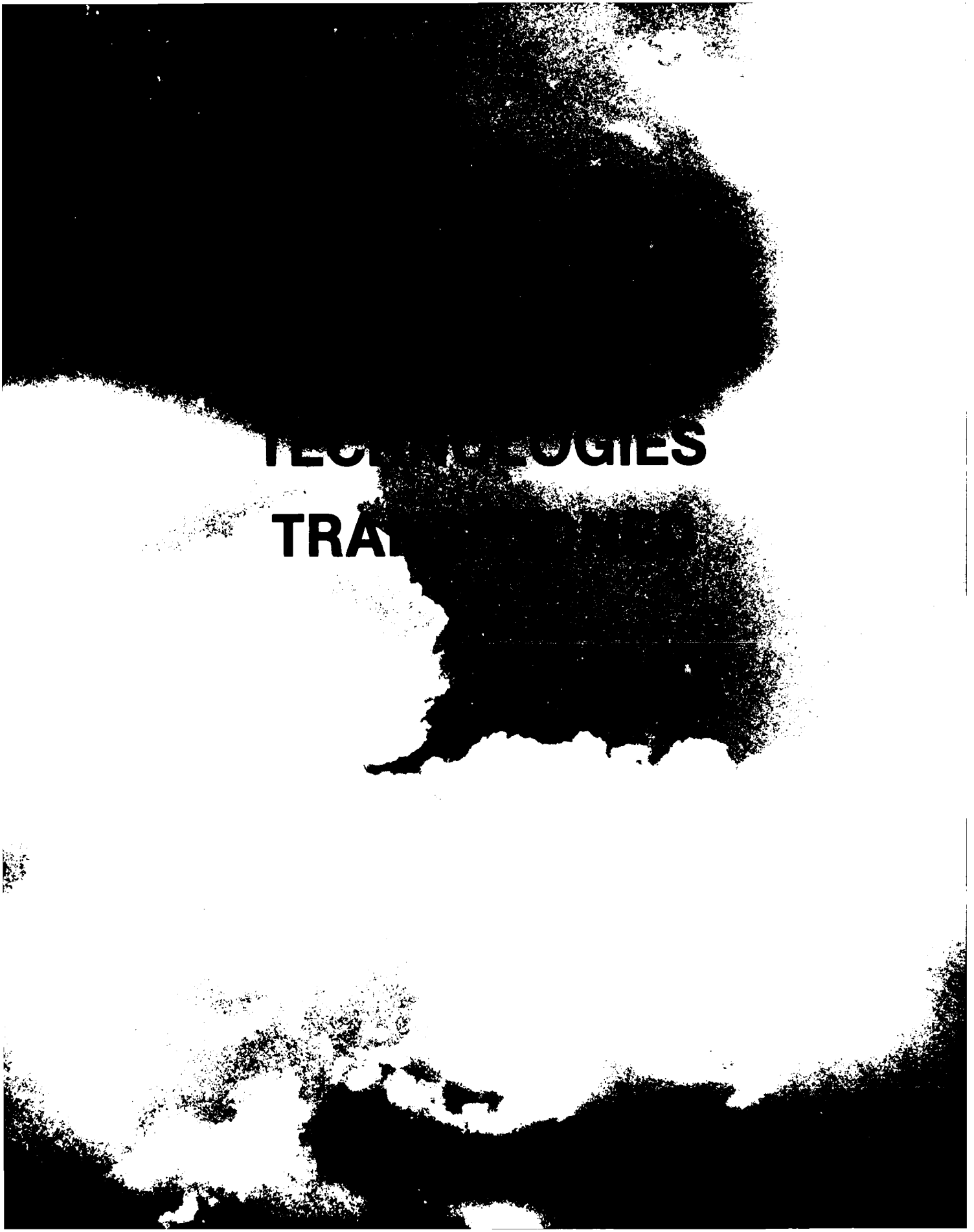
National Security Industrial Association Conference. 7-9 May. San Antonio, TX.

Operator Capacity Limits in Complex Information Systems Workshop (Part 1). June 1985. Dayton, OH.

Operator Capacity Limits in Complex Information Systems Workshop (Part 2). August 1985. Dayton, OH.

Training Decisions System Advisory Group. Research progress review attended by contractors and representatives from AF/MPPTS, AF/LEYE, AFOSP, AFMPC, ATC, USAFOMC, and AFHRL divisions. January 1985. Brooks AFB, TX.

Training Impact Model Advisory Group. Research progress review attended by contractors and representatives from the Air Staff, ATC, MPC, and AFHRL divisions. April 1985. Brooks AFB, TX.


TECHNOLOGIES
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MANPOWER AND PERSONNEL DIVISION

FY80 PRODUCTS	USERS
Task Analysis Handbook	Air Training Command (ATC)
Armed Services Vocational Aptitude Battery (ASVAB) Forms 8, 9, and 10	Office of the Assistant Secretary of Defense, Manpower, Reserve Affairs & Logistics (OASD/MRA&L), All Services
Senior Executive Appraisal System (SEAS) and General Manager Appraisal System (GMAS)	HQ USAF, Directorate of Civilian Personnel (MPK) HQ USAF, Office of Civilian Personnel Operations (OCPO)
Recruiter Resource and Goal Allocation Model	HQ Air Force Recruiting Service (USAFRS)
Organizational Assessment Package (OAP)	Leadership and Management Development Center (LMDC)
Weighted Airman Promotion System (WAPS) Impact Analysis	HQ USAF, Directorate of Personnel Plans (MPX)
Enhanced Likelihood Function Estimation (LIFE) Model	USAFRS
Air Force Occupational Research Data Bank (ORDB)	USAF Occupational Measurement Center (USAF/OMC)

FY81 PRODUCTS	USERS
Job Performance Appraisal System (JPAS) and Civilian Potential Appraisal System (CPAS)	HQ USAF/MPK, OCPO
Enlistment Screening Test (EST), Forms 81A and 81B	OASD/MRA&L, All Services
Safety Training Priorities	Air Force Inspection and Safety Center (AFISC)
Job Aptitude Requirements	Air Force Manpower and Personnel Center (AFMPC), ATC
Modification of Person-Job-Match System	AFMPC, ATC
Standardized Position-Oriented Training System (SPOTS)	HQ USAF, Directorate of Personnel Programs (MPP)
Mission Impact Generalized Explanatory Base Operating Support Model (GEBOS-M)	HQ USAF, Directorate of Manpower and Organization (MPM)
Computer Adaptive Testing (CAT) Study on Sample Size vs Item Pool Size	OASD/MRA&L, All Services
Handbook on Costs of the First-Term Enlisted Force	HQ USAF/MPX

Air Force Officer Qualifying Test (AFOQT) Form O and Officer Screening Composites	USAFRS, Officer Training School (OTS) Air Force Reserve Officer Training Corps (AFROTC)
FY82 PRODUCTS	**USERS**
Air Force Reading Abilities Test (AFRAT)	ATC, All Major Commands (MAJCOMs)
National Labor Market Research	HQ USAF/MPX
Occupational Retraining Guidelines for Retrainee Management	HQ USAF/MPP, AFMPC
Test Battery for Air Traffic Controllers	AFMPC, ATC, Air Force Communications Command
Physical Strength and Stamina Requirements	Armstrong Aerospace Medical Research Laboratory (AAMRL)
Enlisted Assignment/Reassignment System (EARS)	HQ USAF/ MPX, AFMPC
FY83 PRODUCTS	**USERS**
Modified Non-Appropriated Fund (NAF) Supervisory Appraisal Form	OCPO
Alternative Weighting Systems for the WAPS	HQ USAF/MPX
Classification of Situational Constraints in Air Force Work Settings	LMDC
Enhanced Hierarchical Grouping Computer Program (HIER-GRP)	USAF/OMC, All Services
ASVAB Forms 11, 12, and 13	OASD/MRA&L, All Services
Historical Airman Database (HAD) Applications	HQ USAF/MPX, OSD
FY84 PRODUCTS	**USERS**
Counselor's Manual and Technical Supplement for ASVAB Form 14	OASD/MRA&L, All Services
Revised NAF Employee Appraisal Form; Revised CPAS Rating Factors and Weights	OCPO
Air Force Systems Command (AFSC) Incentive Awards Survey	HQ AFSC/DPC
Relationships of ASVAB Forms 8, 9, and 10 and Air Force Technical School Grades	AFMPC, ATC
Subgroup Norms for ASVAB Form 14	OASD/MRA&L

Validations of AFOQT	AFMPC, HQ USAF/MPX, OTS, AFROTC
Improved Pilot Selection Systems	ATC
Statistical Study of Enlisted Retention Trends	HQ USAF/MPX
Procurement Management Information System (PROMIS) R&D	AFMPC, ATC, USAFRS
Validation of English Diagnostic Test for Journalism-Related Programs	HQ AFSC/DL
Skills Projection Analysis	HQ USAF/MPM
Improved Selection Procedures for Air Force Physicians	Air Force Medical Service Center
Mathematical and Statistical Software Index for AFHRL Univac 1100 Computer System	USAF/OMC, School of Aerospace Medicine
Learning Difficulty Indices for Refinement of Aptitude Requirements	AFMPC, USAF/OMC
Jet Engine Mechanic Job Performance Measures	HQ USAF/MPX, AFMPC, OASD/MRA&L, All Services
Development of Computerized Adaptive Testing (CAT) Item Pools	OASD/MRA&L, All Services
Development of 1980 Norms and Conversion Tables for the Enlistment Screening Test (EST)	OASD/MRA&L, All Services
Enhanced Comprehensive Occupational Data Analysis Programs (CODAP)	USAF/OMC, All Services.

OPERATIONS TRAINING DIVISION

FY80 PRODUCTS	USERS
Simulator for Air-to-Air Combat (SAAC) Visual Dysfunction Study	Air Training Command (ATC), Tactical Air Command (TAC)
Interface Between SAAC and the Advanced Simulator for Pilot Training (ASPT)	ATC, TAC
ASPT Multiple Moving Models Update	ATC, TAC
A-10 Manual Reversion Flight Control System Simulation R&D	ATC, TAC

FY81 PRODUCTS	USERS
Force Cue Requirements for A-10 Air-to-Surface Weapons Delivery Simulation	TAC and USAF Tactical Air Warfare Center (USAF/TAWC)
Improved F-16 Back-Up Fuel Control (BUC) Restart	ATC, TAC
Transfer of Training from ASPT to RED FLAG under High-Threat Conditions	ATC, TAC
Operational Test and Evaluation Handbook for Aircrew Training Devices	Air Force Operational Test and Evaluation Center (AFOTEC), MAJCOMs
Measurement of In-Flight Electronic Warfare Officer (EWO) Performance	Strategic Air Command (SAC)
Visual Acquisition of Air Combat Maneuvering Targets in the SAAC	TAC
Desk-Top Trainer Demonstration	TAC, Military Airlift Command (MAC), SAC
Linear Systems Analysis of B-52 Weapons Delivery Accuracy	SAC
Guidelines for Management of Nonflying Intervals for Skills Maintenance	MAJCOMs
Surface Attack Mission Simulation	TAC, Simulator Systems Program Office (SIMSPO)
Recommendations for G-Cueing Devices in Fighter-Type Simulators	TAC, SIMSPO
Vertical Cue Requirements for Simulated Low-Altitude Flight	TAC, SIMSPO

FY82 PRODUCTS	USERS
C-130E Weapon System Trainer Operational Test and Evaluation (OT&E)	MAC
U-2/TR-1 Cockpit Procedures Trainer (U-2 CPT)	SAC
Biological Correlates of Pilot Workload and Stress	Air Force Office of Scientific Research (AFOSR)
Visual Display System Functional Requirements	Aeronautical Systems Division (ASD/EN)
A-10 Combat Scenario Development and Evaluation: Low-Altitude Simulation Training	TAC
F-16 Stores Management System (SMS) Training Study	TAC, MAC, SAC

FY83 PRODUCTS	USERS
Integrated Simulator/Airborne Performance Measurement System for C-5A	MAC
Directed Energy (Laser) Flash Effects Study	TAC, Army
Comparison of Some Flight Simulator Visual Displays	MAJCOMs, ASD/EN
Assessment of Workload and Prediction of Performance by Combined Psychophysiological and Behavioral Techniques	AFOSR, Arizona Air National Guard
Fiber Optic Helmet-Mounted Display	ASD, Armstrong Aeromedical Research Laboratory (AAMRL), Army, Navy
Low-Altitude Data Base Development and Evaluation Research	TAC
Field of View (FOV) for Selected F-16 Weapons Delivery Tasks	TAC
Radar Warning Receiver/Electronic Countermeasures Part-Task Trainer (RWR/ECM PTT)	TAC, SAC, MAC
Generic Threat Recognition Trainer	SAC

FY84 PRODUCTS	USERS
C-130E Weapon System Trainer Operational Test and Evaluation	MAC
Advanced Visual Technology System	Army
The Tactical Training Center: An Integration of Advanced Simulator and Range System Concepts	TAC, Training Data Analysis Center (TDAC)
A-10 Close Air Support Performance in a Flight Simulator: Effects of Visual Display Field-of-View	TAC
A Unitary Measure of Performance for the Close Air Support Mission	TAC
Aircrew Training Task Surveys	MAC, SAC
Investigation of Real Versus Collimated Imagery in Flight Simulator Visual Display	ASD, MAJCOMs
Artificial Intelligence Research in Pilot Training-Visual Attention	AFOSR, Defense Advanced Research Products Agency (DARPA)

LOGISTICS AND HUMAN FACTORS DIVISION

FY80 PRODUCTS	USERS
Models of Maintenance Resource Interactions	Air Force Wright Aeronautical Laboratories (AFWAL)

FY81 PRODUCTS	USERS
Handbook for Selection of Format Options for Procurement of Technical Data	Air Force Logistics Command (AFLC), Air Force Institute of Technology (AFIT) SPOs, Technical Order Management Agencies (TOMAs)
Air Force Aircraft Battle Damage Repair Study	AFLC, Air Force Logistics and Engineering (HQ AF/LE), US Air Forces in Europe (USAFE), ASD, Air Force Acquisition Logistics Division (AFALD), AFWAL
Draft Military Specifications for Maintenance Task Analysis and Logic Tree Troubleshooting Aids	ASD
Sensor Simulation for Target Acquisition Training	ASD

FY82 PRODUCTS	USERS
Analysis to Improve the Maintenance Environment	AFLC, MAJCOMs, AF/LE
Tactical Air Warfare Center Support	USAF/TAWC
Three-Dimensional Display for Training Weapons Directors	TAC, ATC
Acquisition of Supportable Systems Evaluation Technology (ASSET)	AFSC, ASD, AFLC, Army, Navy
Sneak Circuit Analysis Applied to Development of Fault Isolation Procedures	TAC, AFALD, Air Force Coordinating Office for Logistics Research (AFCOLR), AFLC, ASD, Air Force Logistics Management Center (AFLMC)

FY83 PRODUCTS	USERS
Unified Data Base Technology	AFALD, B-1 SPO
Logistics Analyses for the Integrated Communications Navigation Identification Avionics (ICNIA) System	AFWAL
Maintenance Demand Metrics for Peacetime Operations	AFLC, AFALD, TAC
Analysis to Improve the Maintenance Environment (Missiles and Reserve Forces)	AFLC, AF/LE, SAC, Air Force Reserve (AFRES)

FY84 PRODUCTS	USERS
Pilot Study of Wartime Demand Rates for Aircraft Electronic Countermeasures Equipment	AFLC, AFWAL, TAC
Impact Analysis Techniques	AFLC, AFALD, AFWAL
Tactical Battle Management Software Simulation (TBMS) System	Electronic Systems Division (ESD), Rome Air Development Center (RADC), USAFE, TAC
Tactical Command and Control Combat Planning and Attack Capability (COMPAC)	ESD, RADC, USAFE, TAC

TRAINING SYSTEMS DIVISION

FY80 PRODUCTS	USERS
Writers Aid Computer Program	AFSC
Development and Validation of the Learning Strategies and Skills Training Program	ATC
Evaluation of the High-Fidelity 6883 Maintenance Simulator	SIMSPO, ATC
Development of the On-the-Job Training (OJT) Capacity Model	HQ USAF/MPP

FY81 PRODUCTS	USERS
A Testing and Instructional System Based on Microterminal and Microfiche Devices	ATC
Computer Dialog for Graphics Simulation Programs	ASD, ATC, MAC, SAC, Space Command
Handbooks and Model Specifications for the Design and Development of Maintenance Simulators	ASD, B-1 SPO, F-15 SPO, SIMSPO
Functional Literacy Task Inventory	USAF/MPP

FY82 PRODUCTS	USERS
Computerized Adaptive Measurement of Achievement	ATC, Army, Navy
Forward-Looking Resource Scheduling (FLRS)	TAC
Maintenance Training Analysis and Functional Specification Development for a Minuteman Maintenance Training Simulator	ASD, SAC

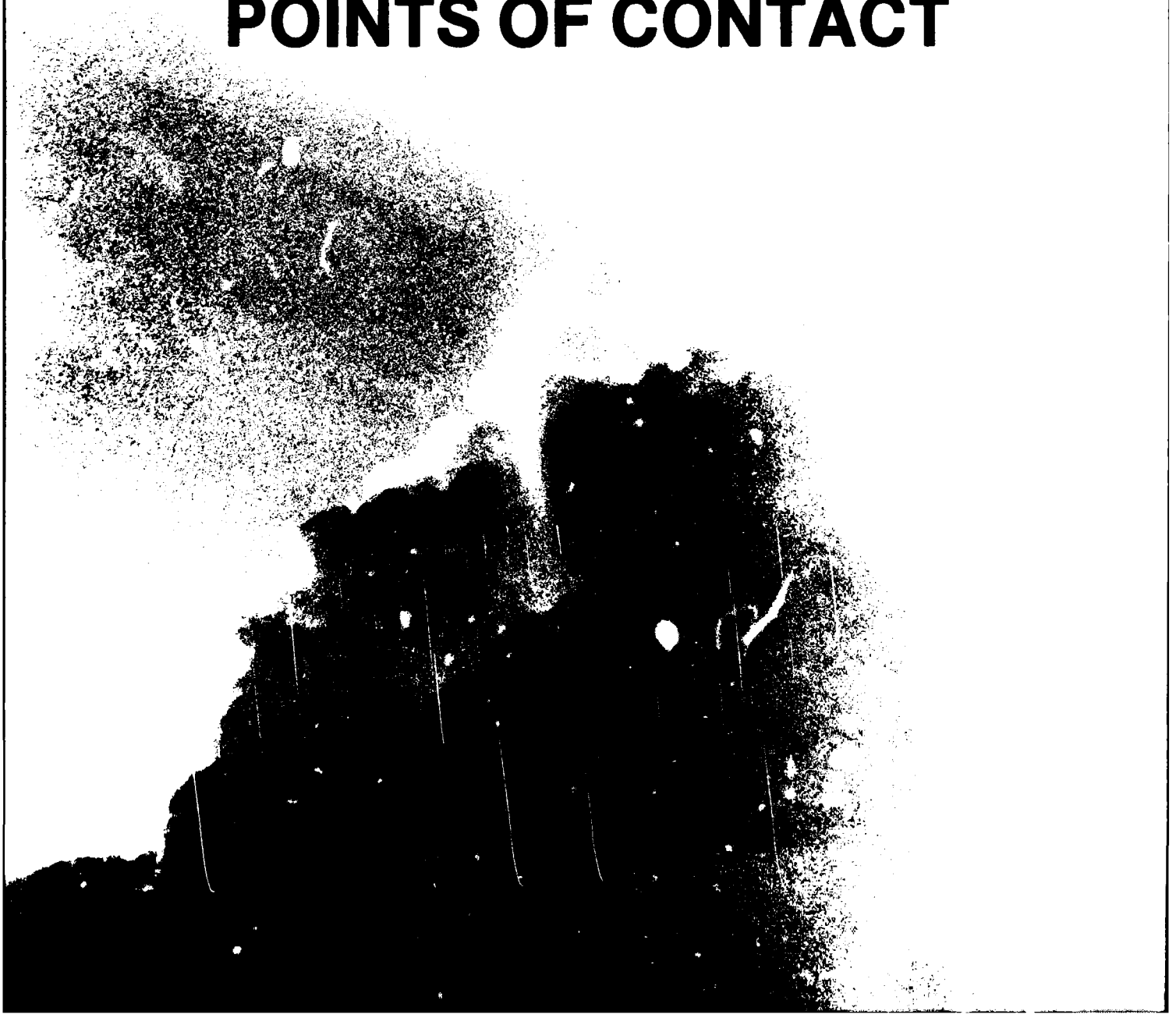
Individualized Student Pre-Course Skill Training for Computer-Managed Instruction	ATC, Army, Navy
Computer-Assisted Instruction (CAI) Courseware Development	AFMPC, Department of Energy (DOE), SAC, Navy
Development of the Flat-Panel 6883 Simulator	ASD, ATC

FY83 PRODUCTS	USERS
Improved USAF Non-Destructive Inspection Technician Capabilities	AFLC
Personnel Requirements for Non-Conventional Instruction	ATC
Development of Instructional Treatment Alternatives Applicable to Technical Training	ATC
Comparative Evaluation of High- and Low-Fidelity 6883 Maintenance Simulators with Actual Equipment	ASD
Acquiring Better Maintenance Trainers	SIMSPO, ATC

FY84 PRODUCTS	USERS
Instructional Support Software (ISS)	ATC, MAJCOMs
Ada Manpower and Training Requirements	Joint Ada Program Office
Ada Computer-Aided Instruction (CAI) Courseware Development	Joint Ada Program Office
Integrated Training System (ITS) for Air Force OJT	AFSC, TAC
Development Procedures for Task Evaluation Forms	TAC
CAI Decision Handbook	ATC
Field Evaluation of a Low-Cost Microcomputer Fische-Based Simulation System for Flight Simulator Troubleshooting Training	SAC
Computer-Based Training (CBT) Selection Assistance for Space Command	Space Command
Intelligent Systems Technology	AFSC

Maintenance Training Simulator Synthesis Study	SIMSPO
Graphics/Actual Equipment Maintenance Training Study	SIMSPO, ATC

POINTS OF CONTACT



RESEARCH & DEVELOPMENT PROJECT	POINT OF CONTACT	PHONE
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Aircrew Selection Programs (p. 7)	Dr. Jeffrey E. Kantor	(512) 536-3222 AV: 240-3222
Air Force Enlisted Retention Model (p. 12)	Mr. Larry T. Looper	(512) 536-2912 AV: 240-2912
Air Force Officer Qualifying Test (p. 5)	Ms. Jacobina Skinner	(512) 536-2257 AV: 240-2257
Aptitude Requirements (p. 9)	Mr. Joseph L. Weeks	(512) 536-3551 AV: 240-3551
Armed Services Vocational Aptitude Battery (p. 5)	Dr. Malcolm J. Ree	(512) 536-3256 AV: 240-3256
Basic Job Skills (p. 9)	Dr. Sherrie P. Gott	(512) 536-3551 AV: 240-3551
Comprehensive Occupational Data Analysis Programs (p. 13)	Mr. William J. Phalen	(512) 536-2932 AV: 240-2932
Job Performance Measurement (p. 10)	Dr. Jerry W. Hedge	(512) 536-3551 AV: 240-3551
Learning Abilities Measurement Program (p. 5)	Dr. Raymond E. Christal	(512) 536-3570 AV: 240-3570
Person-Job-Match Technology (p. 11)	Dr. Manuel Pina, Jr.	(512) 536-2242 AV: 240-2242
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Training Decisions System (p. 14)	Mr. Wayne B. Archer	(512) 536-3648 AV: 240-3648
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OPERATIONS TRAINING DIVISION		
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Electronic Combat Training Effectiveness (p. 17)	Dr. Tom Killion	(602) 988-6561 AV: 474-6561
Part-Task Training (p. 19)	Dr. Bernie Edwards	(602) 988-6561 AV: 474-6561
Training Effectiveness Plan (p. 16)	Lt Col Roy Kilgore	(602) 988-6561 AV: 474-6561

LOGISTICS AND HUMAN FACTORS DIVISION

Automated Technical Information (p. 31)	Capt Paul Condit	(513) 255-3871 AV: 785-3871
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Integrated Design Support (p. 28)	Mr. T. N. Bernstein	(513) 255-6992 AV: 785-6992
Integrated Maintenance Information System (p. 25)	Capt Joseph Von Holle	(513) 255-2606 AV: 785-2606
Maintenance and Logistics in Computer-Aided Design (p. 28)	Mr. Al Herner	(513) 255-3871 AV: 785-3871
Maintenance in Combat Environments (p. 27)	Mr. Richard Weimer	(513) 255-2606 AV: 785-2606

TRAINING SYSTEMS DIVISION

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Computer-Aided Task Analysis (p. 38)	Maj Martin J. Costellic	(512) 479-2666 AV: 685-2666
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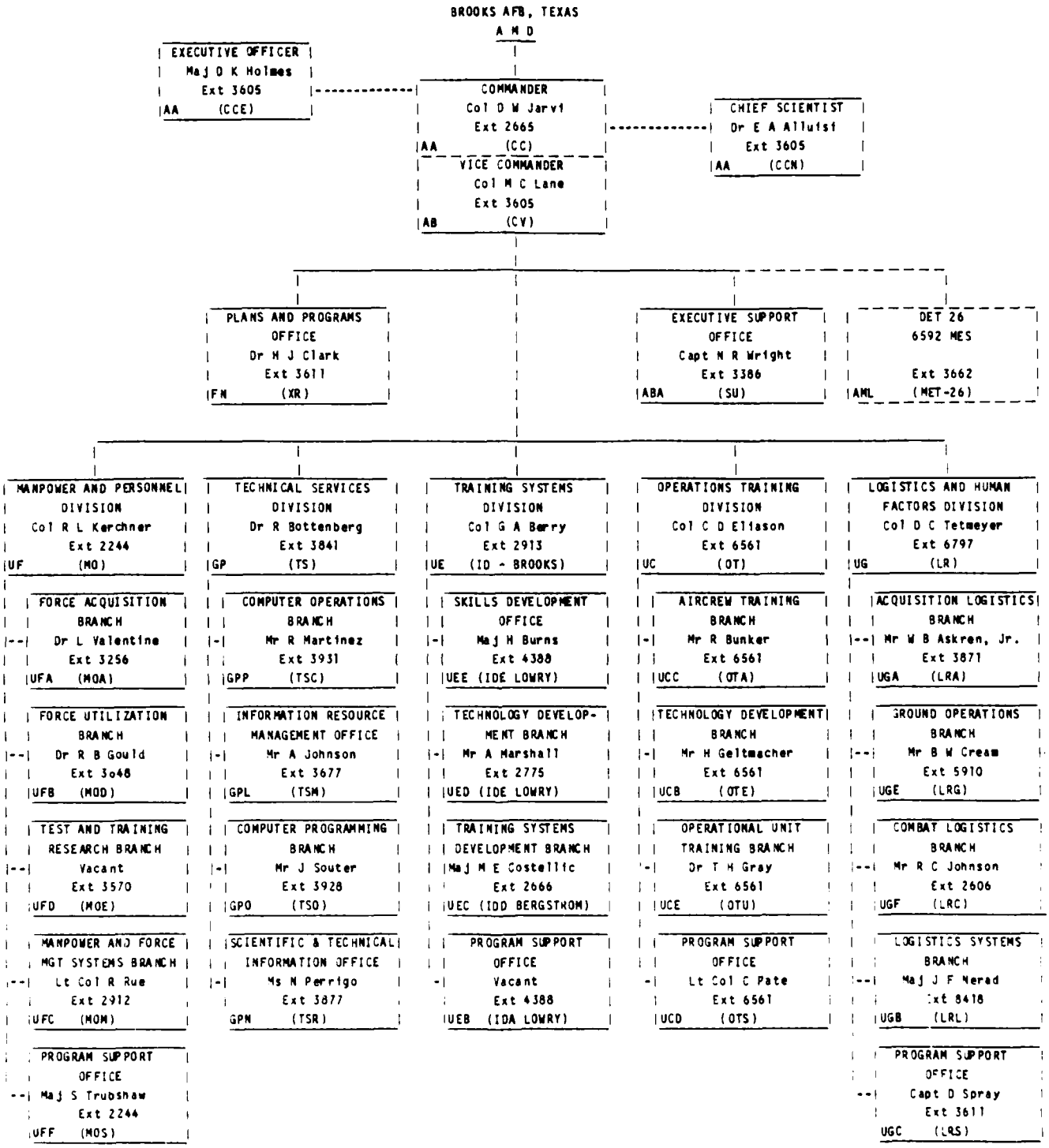

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