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ABSTRACTS OF ARI RESEARCH PUBLICATIONS, FY 1974 and 1975

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Research Institute for the Behavioral and Social Sciences

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**A Field Operating Agency under the Jurisdiction of the
Deputy Chief of Staff for Personnel**

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Technical Report 424

**ABSTRACTS OF ARI RESEARCH PUBLICATIONS,
FY 1974 and 1975**

**U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES
5001 Eisenhower Avenue, Alexandria, Virginia 22333**

**Office, Deputy Chief of Staff for Personnel
Department of the Army**

October 1979

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ARI Research Reports and Technical Reports are intended for sponsors of R&D tasks and for other research and military agencies. Any findings ready for implementation at the time of publication are presented in the last part of the Brief. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or Disposition Form.

FOREWORD

The Army Research Institute for the Behavioral and Social Sciences (ARI) publishes a series of abstracts that summarize the research on which final or interim reports have been published during each fiscal year. The series began in FY 1957. This Technical Report contains the abstracts for research publications for FY 1974 and 1975.

During this period, ARI became the Army's developing agency for behavioral and social science and a field operating agency under the Office of the Deputy Chief of Staff for Personnel. Two laboratories and nine operational field units provided a flexible research program on human resource needs and problems of the individual soldier, on team effectiveness, unit proficiency, and systems integration. The field units particularly emphasized providing responsive solutions to operational problems.

Other ARI research has culminated in the development, over the years, of instruments to aid in the selection, classification, and utilization of Army personnel; these instruments are indexed in ARI's Psychological Testing Programs in the U.S. Army as well as Department of the Army Pamphlet 310-8, Index of Army Personnel Tests and Measures, 23 December 1976.

Joseph Zeidner
JOSEPH ZEIDNER
Technical Director

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ABSTRACTS OF ARI RESEARCH PUBLICATIONS, FY 1974 AND 1975

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ABSTRACTS OF ARI RESEARCH PUBLICATIONS, FY 1974 AND 1975

INTRODUCTION

The present volume of abstracts, continuing the series begun in 1957, summarizes research publications of the Army Research Institute for the Behavioral and Social Sciences (ARI) for fiscal years 1974 and 1975. Each volume of the series provides a synopsis of research efforts which reached interim or final reporting stages during the period covered. The abstracts have been written, as far as possible, to describe the principal research findings in nontechnical terms; technical language is used to communicate efficiently the details of research analysis. Descriptions of the research program areas provide a context for the individual reports and are cross-indexed with the abstracts.

Publication Categories

ARI research publications are divided into separate, consecutively numbered categories appropriate to intended audience and function.

Research Reports describe completed research programs or projects which contribute directly to the solution of Army human factors problems in the broad areas of personnel management and enhancement of human performance, both of the individual and in the Army's manned systems. They are typically divided into two parts--a nontechnical report to management and a technical supplement.

Technical Papers present technical information on research methodology or basic psychological knowledge developed out of the work program. They are primarily of interest to technically trained research workers in the Defense Department and other Government agencies.

Research Problem Reviews are special reports to military management, prepared in response to questions raised by operating agencies when early answers were needed. They may include presentations to military management, interim bases for changes in personnel operations, and bases for research decisions. Distribution is usually limited to operating agencies with a direct interest in the content.

Research Memorandums are informal, intra-agency reports on technical research problems. They include the following types of content: details on the construction of experimental instruments, fragmentary or incidental data, and methodological developments relating primarily to in-house technical operations. Distribution is primarily to personnel engaged in research for ARI.

Distribution of ARI Publications

Initial distribution of each report is made directly by ARI. Research Reports are distributed primarily to operational and research facilities and their sponsors in the Defense Department, to other interested Government agencies, to the Defense Documentation Center (DDC), and to the Library of Congress, which in turn distributes to federal depository libraries. Technical Papers are distributed primarily to technically trained research workers, including those reached through DDC and Library of Congress channels.

Qualified requesters may obtain copies of Research Reports and Technical Papers directly from DDC (Cameron Station, Alexandria, Va., 22314). Anyone may obtain these documents from the National Technical Information Service (NTIS), Department of Commerce, Springfield, Va., 22151. The six-digit AD number given for each report is the accession number that should be used in requesting documents from DDC or NTIS.

Copies may also be obtained on loan from depository libraries in many metropolitan and university centers. A list of these libraries is given at the end of this publication.

Research Problem Reviews and Research Memorandums are operating, intra-agency administrative documents; they are rarely placed in DDC and NTIS. File copies may be maintained at ARI offices in Alexandria, Va., after the initial printed supply has been exhausted. These documents are summarized in this publication to provide a complete and more permanent record of the research projects.

ABSTRACTS OF RESEARCH PUBLICATIONS

Research Reports

RR 1178. Clarke, F. R., and Welch, R. I. (Stanford Research Institute). Jeffrey, T. E. (ARI). Development of a psychophysical photo quality measure. January 1974. (AD 776 369)

ARI research on surveillance systems determined how variations in the character of an image affect performance. This report describes development of an instrument to evaluate imagery for interpretability. Such an instrument would allow less-skilled personnel to effectively screen the imagery, thus saving much of the time of experienced image interpreters.

Previous research indicated that a catalog of images could be devised to serve as a psychophysical measure of photo interpretability. Such a catalog would consist of a standard set of images representing diverse scene content and image quality. Each image would have an index of interpretability based on the measured performance of interpreters. Using such a catalog, personnel could evaluate imagery from operational aerial missions by comparing it with the images in the catalog. The evaluation would estimate the accuracy and completeness to be expected of information derived from the new imagery. In the preliminary catalog, prediction of image interpreter performance had been based on judgments of the overall quality of the images, considering scale, sharpness, and complexity of the image. The present research developed a more comprehensive catalog of imagery based on additional factors and conditions that influenced quality.

Laboratory manipulation of representational operational images produced images varying in scale, atmospheric haze, and motion blur. Image interpreters were asked to detect and identify military targets under conditions involving various combinations of these independent variables. In a parallel experiment, which was designed to avoid bias from scene content and other factors, a target array was fabricated that positioned geometric shapes on background panels of black, white, and gray. Photographs of the array were degraded with respect to scale, haze, and motion blur to the same levels as the imagery used in the first experiment.

Degradation of image quality by variations in scale, haze, or motion blur, when each factor was considered alone, had little effect on interpreter performance in target detection or identification. When more than one characteristic was degraded in the same image, however, interpreter performance deteriorated significantly.

A simple model based on ground-resolved distance--a variable combining the effects of scale, haze, and image motion--effectively predicted performance on the varied imagery, as did use of the catalog

previously developed with variants in scale, sharpness, and scene complexity.

RR 1179. Maier, M. H., & Fuchs, E. F. Effectiveness of selection and classification testing. September 1973. (AD 768 168)

This report evaluates Army selection and classification testing programs in relation to job training success; it also examines the suitability of the tests for subgroups of manpower available to the Army. Twenty years of research and experience have demonstrated the effectiveness of selection and classification tests for identifying potential failures in Army training programs and for placing recruits in jobs that best utilize their abilities. Aptitude test scores indicate the proficiency level and grade a recruit can attain and the time required to bring a trainee to a minimum performance level. Selection and classification tests also identify general categories of input--for example, persons eligible for officer training. Test scores are related to rate of promotion in the Army and to civilian earnings after separation from service. The tests have been found to predict performance in job training for both blacks and whites. Although blacks make lower average scores, their training performance is correspondingly lower, comparable to training performance of whites with the same level of test scores.

RR 1180. Cohen, S. L. Comparative work environment perceptions of operating personnel within experimental and standard communication systems. February 1975. (AD A005 215)

An important segment of the research on monitor performance is devoted to work environment factors and communication analysis and processing. This report compares an experimental, semiautomated monitoring system with the standard procedure by means of a survey of operating personnel.

The experimental system underwent overseas performance evaluation from September 1970 to February 1971. The adequacy of the work environment as perceived by those operating the system was assessed in comparison with the standard communication system. Scanners in the experimental system and operators and transcribers in the standard system completed two questionnaires, one dealing with past training and communications experience and the other with individual perceptions of jobs in the systems. Responses were analyzed with special reference to acceptability of the equipment and working aids, adequacy of job assistance and performance feedback, supervisor/subordinate and peer/peer interaction, and the individual's perception of his or her role in the system.

Equipment and related work procedures of the experimental system were judged to be considerably better than those of the standard processing system. However, while personnel reported that they were able to

perform longer with no noticeable fatigue in the experimental system, they also noted that their performance was less proficient after the first 2 hours.

Neither system provided adequate procedures for peer/peer interaction. Insufficient feedback on performance; little positive recognition, guidance, or job assistance; and generally unsatisfactory work aids were mentioned.

The research has provided leads for improving the motivation of individuals in the system through improved use of feedback and the evaluation of such feedback in terms of system productivity.

RR 1181. Youngling, E. W., & Vecchiotti, R. A. (McDonnell Douglas Corporation); Bedarf, E. W., & Root, R. T. (ARI). Job requirements of G2 Air and image interpretation personnel. May 1974. (AD 780 815)

New surveillance systems and the demands of modern warfare impose changing requirements on G2 Air and image interpretation personnel. This report deals with the job requirements of the two personnel categories under current and projected conditions. The effort identified changes in duties and training required in these jobs to satisfy the intelligence requirements of Army commanders.

Data were collected using three complementary techniques: a comprehensive review of source documents, in-depth interviews with personnel familiar with the reconnaissance and surveillance system, and analysis of mailed questionnaires completed by active duty personnel in the system. Data were integrated and consolidated to identify the job functions performed. Detailed flow diagrams and task analyses of the Army reconnaissance and surveillance system were prepared, showing the skills, abilities, and knowledge required of the various personnel. Descriptions identified representative duties, job aids, and general qualifications required. Using the current system as baseline, a projection was made of the future system.

The G2 Air officer was found to function primarily in the role of planner and manager of surveillance resources. Need was noted for (a) more appropriate training for these officers, geared to asset management; and (b) an assignment procedure to insure that only appropriately trained officers are assigned to G2 Air positions. The job of the image interpreter tends to be more technically oriented, and image interpreters should be given more specialized training, with improved allocation of training emphasis (greater emphasis on some subject areas, less on others).

RR 1182. Helme, W. H., Willemin, L. P., & Grafton, F. C. Prediction of officer behavior in a simulated combat situation. March 1974. (AD 779 445)

This report is one of a series marking the culmination of the officer prediction research program and the impact of the findings on ARI's on-going officer evaluation and career development research program. The first publication of the series (Technical Research Report 1172) presented important dimensions of officer leadership behavior derived from analyses of more than 2,000 single observations and judgments by trained military staff on officer participants during a 3-day Officer Evaluation Center (OEC) simulation of a combat situation. The second publication (Technical Research Report 1173) presented the major psychological factors derived from officer responses to tests in the experimental Differential Officer Battery (DOB), which was administered to officers in the sample at entry on active duty. This study examines the hypothesis of differential prediction by analyzing the extent to which DOB scale and factor scores are differentially related to the various leadership behavior and behavioral dimensions of later performance in the Officer Evaluation Center exercise.

Factor scores on the DOB representing major dimensions of officer characteristics were correlated with two sets of factor scores representing officer performance in the simulated combat environment--30 task-specific scores and 8 factor scores on major cross-situational dimensions of officer leader behavior. Parallel DOB factor analysis produced 92 psychological factor scale scores and 17 major factorial dimensions of officer characteristics. In relating the 17 major DOB dimensions to the 8 major OEC dimensions, OEC combat leadership performance was well predicted only by the DOB leadership factor (.36), reflecting an outdoor/combat self-reliance pattern. In contrast, OEC technical-managerial leadership was best predicted by the DOB scientific and general knowledge factors, which also predicted OEC tactical staff and technical staff skills. The best predictor of OEC technical staff skills, however, was the DOB mechanical technology factor (.40), which was not predictive of the other major OEC dimensions. In sum, officer characteristics as measured by the DOB were found to be differentially predictive of officer behavior in situations representing the two major leadership dimensions, combat and technical/managerial.

These findings can be used for more effective assignment of officers to appropriate early training and initial duty tours and to assess the career potential of cadets or junior officers--particularly at the early career decision points of entry to advanced ROTC, Regular Army commissioning, branch choice, and early assignments.

The predictive and evaluative techniques developed are well suited to being used in the comprehensive Officer Personnel Management System as a means of developing an appropriate primary and secondary skill for each officer, and, at middle grade levels, a means of differentiating career direction into command and technical/administrative progression.

RR 1183. Sternberg, J. J., & Banks, J. H. (ARI); Widener, T. A., Jr. & Jennings, J. W. (Manned Systems Sciences). Selected elements of a battalion integrated sensor system: Device and mix effectiveness. January 1974. (AD 781 515)

The experimentation described in this report was part of an extended research program to enhance the effectiveness of company and battalion ground surveillance elements through the combined use of ground surveillance radars, night vision devices, and other sensors as a battalion-integrated sensor system. The phase of the research reported here (a) provided human performance data and information on the relative performance of different man-device systems, considering multiple measures of effectiveness to determine which systems best complemented each other; and (b) examined various work methods and search techniques to determine how various devices and mixes of devices can be most effectively employed.

The empirical data obtained on effectiveness of the devices and mixes, when combined with other considerations including cost effectiveness, provide a basis for deciding which mixture of devices is most effective. The results on placement and use of the devices and mixes suggest improved doctrine and training procedures.

RR 1184 (C). Cohen, S. L., & Turney, J. R. Comparison of operator gisting skills in LEFOX GREY and standard systems (U). November 1974. CONFIDENTIAL. (AD C000 382)

(U) An experimental, semiautomated communication processing system, LEFOX GREY, was tested in a field operation parallel to the standard system. Comparisons were made to determine if differences in the output of the two systems were attributable to system differences or to differences in operator proficiency. Operators in the two systems did not differ in gisting ability. Any differences found in output could therefore be attributed to aspects of the man-machine interface of the systems. Operators in both systems produced better gists on the message containing more items of critical information. The difference was found both in percentage of correct identifications and in rated quality of the gist.

RR 1185. Bell, D. B., & Holz, R. F. Summary of ARI research on military delinquency. June 1975. (AD A012 764)

Military delinquency has been the subject of ARI research for several years. The program has primarily furnished information and evaluative instruments to the Army. Initial attempts to identify potential delinquents have been complemented by plans and programs to help such individuals develop in more positive directions. While the idea that potential troublemakers can be identified before they enter the service is appealing, data do not support the practicality of such

an approach. Experimental screening instruments and techniques can be applied only at the cost of rejecting large numbers of recruits who would make good soldiers. Since 1970, research has been directed at improving the prediction and reduction of delinquency among personnel in Basic Combat Training (BCT) and in active units.

Field experiments were conducted in 1972 and 1973 to evaluate a system for early identification and preventive treatment of new recruits with potential discipline problems. A temperament-profile test selected about 10% of a BCT sample as discipline risks. The individuals were referred to the company commander for counseling interviews. There was some indication that singling out persons for special treatment as disciplinary risks actually increased the chances of disciplinary problems.

Current direction is development of correlates of delinquency and discipline based on the social structural situation functioning within the Army and achievement/failure patterns among Army personnel.

RR 1186. Ramsay, D. A. Summary of ARI research on drug and alcohol abuse. May 1975. (AD A009 730)

ARI conducted research on drug and alcohol abuse from 1971 through 1975. Several programs were instituted: determination of the extent and nature of drug and alcohol abuse in the Army and assessment of the effectiveness of drug education programs in preventing abuse; investigation of the relationship between Army social and organizational factors, such as leadership and morale, and drug abuse; investigation of the relationships between drug and alcohol abuse and company-level leadership; and exploration of constructive alternatives to drug abuse. Much of the information was gathered using anonymous self-report questionnaires and by in-depth interviews with individuals or groups.

The research on social-organizational influences on drug abuse, which studied otherwise similar units having unusually high and low records of drug abuse, found significant association of drug abuse with low morale, boredom, dissatisfaction with job, and low opinion of officers, particularly at company level, and of the Army.

Suggested remedial actions have emerged from the surveys: present only factual information as part of drug education programs; emphasize human relations programs; lend training and command support to company-level leaders; and encourage participation in active sports and in mood-changing techniques as alternatives to drugs.

No correlation was found between amount of alcohol consumed and any social-organizational or value-attitude factor.

Technical Papers

TP 240 (C). Root, R. T., & Myers, L. B. (HRB-Singer); & Narva, M. A. (ARI). Effects of acquisition parameters on interpretability of infrared imagery (U). December 1974. CONFIDENTIAL. (AD C000 358)

(U) Infrared sensing systems permit the acquisition of intelligence information under an extended range of weather conditions, provide round-the-clock collection capability, and permit the collection of information not obtainable with other systems. This research investigated the influence of various factors involved in the acquisition of infrared imagery upon the interpretability of the imagery and to determine what information may be obtained under various conditions. Inexperienced interpreters, after a brief training course, were asked to interpret sets of imagery that presented selected combinations of acquisition parameters in order to discover the influence of each parameter on interpretability. The results can be useful in planning imagery acquisition missions.

TP 242. Powers, J. R. III, Brainard, R. W., & Abram, R. E. (Battelle Memorial Institute); & Sadacca, R. (ARI). Training techniques for rapid target detection. September 1973. (AD 768 194)

Imagery acquired through reconnaissance systems is a prime source of military intelligence. The volume and varied quality of such imagery, which increases with each advance in sensor capabilities, place severe demands on the image interpreters, who must derive timely and accurate intelligence from the raw imagery. This research evaluated training techniques for improving the performance of interpreters in searching imagery and detecting targets.

The two systematic search strategies devised for the experiment were designed to reduce inefficient search behavior and to increase the completeness with which images are searched. One, a geometric scan pattern, insured that all areas of an image were searched. The second, a tactical search strategy, concentrated search on the most probable areas of target location, such as lines of communication and points of congestion. To complement the search strategies, a speeded free-search technique was developed to reduce visual fixation time and expand the interpreter's perceptual field (the area within which targets can be reliably detected in a single eye fixation). A fourth and control condition allowed practice under free-search conditions without emphasis on speeded performance. Pretraining and posttraining target detection performance was compared for the eight subjects assigned to each of the four conditions. A separate study evaluated an error avoidance technique, or error key, designed to alert interpreters on nontargets often identified as targets.

Training in both geometric and tactical search strategies increased the number of target detections over pretraining performance.

However, almost 80% of this increment was due to the greater number of inventive errors. Subjects in the speeded search group gained the most speed, taking less time per image than subjects in the control group, without degradation in the other indexes of performance. A comparison of results of the two systematic search methods with results of the two free-search methods (speeded search and control groups) indicated that, although training in the systematic search strategies resulted in significantly greater detection completeness, it also resulted in a significantly larger overall error rate and produced more inventive errors. Accuracy was significantly better under the free-search conditions. Time differences between the systematic and free-search procedures were not significant. Of the two systematic strategies, geometric search yielded slightly better performance.

Training in inventive error avoidance through use of an error key was effective in reducing inventive errors and in shortening search time per image. Use of this technique in conjunction with rapid detection training could result in considerable improvement in interpreter detection performance.

TP 246. Robins, J. E., Buffardi, L., & Ryan, T. G. (Bunker-Ramo). Research on tactical military decision making: Application of a decision prediction concept in a SIMTOS environment. March 1974. (AD 780 812)

Management information systems, used judiciously, can appreciably reduce human information-handling requirements and expedite decision-making during the military command and control process. This ARI project has the ultimate goal of empirically relating tactical information requirements and the decision process to the effective command and control of Army forces in the field. This is the second experiment of a series on this project.

The first experiment, described in ARI Technical Research Note 229, established several promising measures of decisionmaking quality for prospective use as predictor variables. These predictors were a composite of the subject's career experience, staff college academic records, the subject's information processing and assimilation pattern, and possibly the number of relevant facts the subject obtained in processing tactical information. This second experiment provided an additional test of the hypothesis that decision quality can be predicted by the measures developed in the first experiment.

Predictors of decision quality developed earlier were reexamined against a background of an extended defensive planning scenario incorporating computerized data retrieval. The scenario was administered individually to 20 senior field grade officers, 4 at a time. Each officer, assuming the role of a G3 operations officer, planned a division defense, in sector, against an expected attack by two mechanized infantry Aggressor divisions. Decision quality was scored according to

standards developed by the Command and General Staff School at Fort Leavenworth, Kans. The predictors maintained substantial predictive stability in the present simulated tactical operations system (SIMTOS) setting, yielding a multiple correlation coefficient of .79, which reduced to .59 when corrected for shrinkage. Specifically, the four predictors were (a) recency at Command and General Staff College (CGSC), (b) CGSC class standing, (c) number of information requests made early in the decisionmaking process in relation to decision quality, and (d) time between final information request and decision.

The experiment thus supported the concept of decision quality predictability and demonstrated the feasibility of developing a fully automated information retrieval system in which decisionmakers can query their computerized data base from an input/output CRT display.

TP 247. McKendry, J. M., Wilson, R. C., Mace, D. J., & Baker, J. D. Application of a method for determining information requirements in a field army. August 1973. (AD 767 262)

The Army is developing several automated data processing systems designed to maximize combat effectiveness. These mobile systems are aimed at expediting tactical staff operations in the field. The goal of all systems is to provide vital information to staff officers in sufficient detail at appropriate times.

A prototype version of one command/control system, termed the Tactical Operations System (TOS), was tested by the U.S. Seventh Field Army in West Germany. Manually conducted field and command-post exercises had been analyzed to determine which operations and functions could and should be automated. During the analyses, the flow of information through the manual system had been found to be slow and error prone. This research was conducted to establish a criterion measure to use in evaluating the automated TOS.

Because the TOS was not built as an automated system from the ground up (it automated functions that were typically performed manually), the benefits achieved by selective introduction of automation could be assessed. One criterion selected was the thoroughness of dissemination of the information; that is, the percentage of messages arriving at the proper destination. The requirement for this research was to determine which of the geographically separate users should receive messages containing specified classes of information.

A survey instrument was devised listing 61 common information items, with subdivisions indicating level of information detail desired. Responding were 86 experienced staff officers from four staff elements--G2 Intelligence, G3 Operations, Fire Support Coordination, and CBRE (Chemical, Biological, and Radiological); from two corps--Infantry and Armored divisions; and from three echelons of command--Army, Corps, and Division. The officers checked the items most important to them in the field and the amount of detail they needed on

each item. The officers' subjective judgments were converted to scores that permitted each officer's response to receive equal weight, even though the number of items considered crucial varied from officer to officer.

Interest patterns were found to be almost exclusively a function of the staff element in which the officer served. G2 and G3 personnel required the greatest variety of information. Within each staff element, there was general agreement on which items were most important, whereas there was general disagreement between staff elements. This contrast indicates that the specific interest patterns for each element should be viewed separately in determining information requirements.

The results provided a criterion for assessing how thoroughly information was disseminated within the given system. More generally, the methodology and techniques employed could be used to generate staff/user requirements for a variety of Army tactical information systems and could also influence data-base structure and display design.

TP 248 (C). Root, R. T., & Young, R. B. (HRB-Singer); & Narva, M. A. (ARI). Characteristics of reference keys for use in the interpretation of infrared imagery (U). December 1974. CONFIDENTIAL. (AD C000 538)

(U) ARI's surveillance systems research program produces scientific data bearing on the extraction of information from surveillance displays, and on the efficient storage, retrieval, and transmission of this information within an advanced computerized image interpretation facility. The present report deals with determining the most effective content of reference keys for use in interpreting infrared imagery.

TP 249. Sidorsky, R. C. Alpha-Dot: A new approach to direct computer entry of battlefield data. January 1974. (AD 774 841)

A major problem in using computers in real-time tactical operations is that in most tactical situations data from a large number of widely separated information sources must be communicated and processed rapidly. The ability of automated data processing systems to assist battlefield commanders depends on the rapid entry and processing of data obtained by front-line observers. Thus, a need exists for input/output devices that are small, low in cost, simple in design and operation, and adaptable to a variety of communication needs.

A new coding technique, the Alpha-Dot system, was explored for feasibility in increasing the effectiveness of tactical data systems. In this five-key coding technique, data are input using familiar shapes in a form directly compatible with computers and other binary data processors. The technique can be used in a variety of devices and procedures for two-way communication; for example, data can be input via keyboards, pressure sensitive tablets, CRTs, paper forms, and other

means. In the present experiment, 10 enlisted personnel entered both free-form and formatted versions of simulated enemy situation spot reports. Learning time and rate and accuracy of data entry using the Alpha-Dot keyboard were compared to operator performance on a standard typewriter.

No special skill was required to operate the device. All trainees were able to input messages satisfactorily after 2 or 3 minutes of instruction. Learning time for skilled operation was short. Nine of the ten trainees memorized the character set within 1½ hours of practice and were then able to transmit messages without reference to the guide chart. Rate of data entry compared favorably with use of the standard keyboard. After less than 5 hours of practice, free text messages were entered at 80% of each trainee's standard keyboard rate. Formatted (TOS-type) messages, however, were transmitted at a rate equal to or exceeding that of the standard keyboard. Thus, the Alpha-Dot technique appears to have potential for increasing the speed, accuracy, and flexibility of input of battlefield data by front-line observers.

TP 250. Johnson, E. M. Numerical encoding of qualitative expressions of uncertainty. December 1973. (AD 780 814)

Intelligence information processing systems ideally would maximize combat effectiveness by best use of human capabilities, augmented by computer support. This report provides data for more effective evaluation of information in intelligence processing.

Intelligence is seldom perfect, and evaluations containing inadequate data and doubtful conclusions must at times not only be the basis of decisions but can also be extremely useful. The user of an intelligence evaluation will naturally be influenced by the degree of certainty that has been attached to it. The evaluator has the responsibility of determining the degree of uncertainty of a given statement and of communicating this to the users of the intelligence. However, there is no standard terminology in use to describe the probability of occurrence of predicted events.

This experiment tried to determine if the encoding of qualitative expressions of probability is influenced by context or group membership and to examine the nature of the scale used by individuals in mapping probability phrases into numerical equivalents. The experiment involved the encoding, on a 0 to 100 scale, of 15 probability phrases in each of three sentence contexts. The phrases covered a wide range of probabilistic meaning; the three sentence contexts involved a weather forecast, a prediction of personal success, and an intelligence report. The two groups of subjects were 14 enlisted personnel and 14 extension college students.

There were no significant differences in the encoding of probability phrases into numerical equivalents among the three sentence contexts,

between enlisted personnel and college students, or as a function of age, sex, or educational level. Individuals were relatively consistent in their own encoding of given phrases across sentences, but individuals differed from other individuals, often radically. Cluster analysis of the assigned numerical encodings indicated an underlying asymmetric probability scale with a small number of intervals.

The findings indicate that use of qualitative phrases to communicate the probability of accuracy of intelligence data will often result in a high degree of misunderstanding. Numerical scales appear to be a promising method of encoding that could also facilitate the use of probability theory and decision theory as tools in intelligence analysis.

TP 251. Johnson, E. M. The effect of data source reliability on intuitive inference. July 1974. (AD 784 097)

The introduction of tactical data systems for the Army in the field can substantially increase the amount and variety of data channeled into the intelligence system. A large proportion of these data will be unreliable or of low resolution or completeness. Although often discarded, such data could contribute to the production of intelligence if improved methods and techniques of processing could be developed.

This study examined the human ability to consider the reliability of a data source and the strategies people use to process unreliable data when intuitive, probabilistic inferences are required. Reports from data sources of given reliability and diagnosticity were presented to 22 persons in a series of two-hypothesis decision problems. On each problem, each person indicated the most likely of the two hypotheses and the subjective odds favoring that hypothesis.

Subjective odds varied as a function of the data diagnosticity and source reliability. The subjects generally failed to extract as much certainty as was possible from the data; subjective odds were conservative with respect to odds computed by a normative Bayesian model. In most cases, however, as reliability decreased, subjective odds increased relative to Bayesian odds until they were generally greater than Bayesian odds at the lowest level of reliability.

Individual protocols and data analyses indicated that the subjects were using nonoptimal inference strategies in which reliability was incorporated as a multiplicative weighting factor. This strategy can lead to increasingly inaccurate responses as reliability decreases and data diagnosticity increases, if the diagnostic impact of the data "if it were true" is correctly evaluated.

TP 252. Nordlie, P. G. (Human Sciences Research); & Thomas, J. A. (ARI). Black and white perceptions of the Army's Equal Opportunity and Treatment programs. May 1974. (AD 919 587)

In support of the Army's Race Relations/Equal Opportunity and Treatment programs, ARI conducted a survey to determine to what extent the programs were known to Army personnel in the field and to assess the views of black and white personnel on the two programs.

Five data collection instruments (three questionnaires and two interview schedules) were administered to three sample groups during the summer of 1972. The samples were obtained from 13 Army installations, eight in CONUS and five overseas. The primary sample--consisting of 3,656 enlisted personnel, stratified by grade and with equal numbers of blacks and whites--was administered a written questionnaire. The second sample--127 officers in command positions--completed a questionnaire and were also interviewed. The third sample--126 officers and NCOs with specific responsibilities in the Army's Race Relations and Equal Opportunity Treatment programs--also completed the written questionnaire and were interviewed.

In this 1972 survey, the sample of whites indicated the belief that the Army was relatively free of discrimination. The sample of blacks indicated the belief that the Army was discriminatory. The difference was correlated with grade; officers and higher enlisted grades tended to consider race problems to be less serious than did the lower enlisted grades. Most of the officers and enlisted men in the sample who had participated in race relations training endorsed that program.

TP 253. Downey, R. G. Associate evaluations: Nominations vs. ratings. September 1974. (AD 785 550)

Two methods of associate (peer) evaluations are most often used in Army personnel management--(a) a rating procedure in which each member of a rating group assigns numbered ratings on a given criterion to other members of the group and (b) a nomination procedure in which each member of a rating group selects a given number of individuals at the top and bottom of the scale. In this study, the feasibility of using a nomination procedure as a substitute for associate ratings was examined in terms of reliability and of relationship to a degree-of-acquaintance score, other leadership measures, and Army school grades. Three methods of associate evaluation--one rating and two nomination procedures--were compared. Data were collected on 125 Army officers attending Branch Basic School.

The three procedures were similar in reliability, with some indication that using too many individuals in a nomination technique might lower reliability. No differences between techniques were noted in correlation with other scores except for the degree-of-acquaintance score; the nomination technique involving fewer individuals nominated

had a significantly lower relationship with that variable. Since the measures produced essentially similar results, the nomination method is preferred for operational use because it saves rather time and effort, is administratively simple, and is more acceptable to rating groups.

TP 254. Kneppreth, N. P., Gustafson, D. H., & Leifer, R. P. (University of Wisconsin); & Johnson, E. M. (ARI). Techniques for the assessment of worth. August 1974. (AD 784 629)

"Worth" refers to the subjective or intuitive values with which a person evaluates an object or course of action. Individuals appear to evaluate objects or courses of action on the basis of numerous criteria, many of which are not quantifiable in objective terms. Such subjective criteria are combined by the decisionmaker into an intuitive value scale by which the worth of objects or actions is evaluated. Worth assessment refers to the process of transforming and measuring these subjective scale values on an objective, real-world scale. It involves the entire process of identifying, measuring, and combining factors to create a conscious, articulated worth structure as a basis for decisionmaking.

The mathematical theory of worth assessment has been well established, and a large number of models and methods have been developed. In this paper, several methods of measuring worth are reviewed, classified, and presented in usable form. Four classes of method are differentiated: the ordinal, which yields an ordinal preference scale; the direct, which yields numerical preferences; the gamble, using probability; and the multivariate, for multiple or dependent factors. Seven general methods are reviewed in detail; in each case, a specific example is given, with step-by-step procedures and possible variations, training and equipment needed, advantages and disadvantages, possible pitfalls, types of results, ways of checking accuracy, and sources of further information.

No single method is best for every situation. Rather, the assessment method chosen must meet the requirements of both the problem and the decisionmaker.

TP 255. Levine, J. M. (American Institutes for Research); & Eldredge, D. (ARI). Effects of ancillary information upon photointerpreter performance. September 1974. (AD 785 706)

This research evaluated the improvement in photointerpretation performance achieved by providing ancillary intelligence information to the interpreter. The research is presented in two sections: a reprint from Human Factors, 1972, 14(6), 549-560; and an appendix that supplements the journal article with detail on the photointerpretation task studied and the methodology employed.

Thirty-two trained surveillance officers identified single annotated targets within controlled and matched sets of imagery. For each annotation, the subject's task was to provide a vector of subjective probabilities, each probability representing the estimated likelihood that a particular target name was the correct identifier for the annotated item.

Half the subjects were provided with ancillary intelligence information at the time they evaluated the image displays; the other half made their evaluations without information, then made a second and revised evaluation using the ancillary information. Four modes of performance were examined: no information, simultaneous information/image interpretation, post information (the revised evaluation), and computer integration (in which a computer integrated interpreter no-information evaluations with the ancillary information). Half the information supplied was qualitative in nature, half was quantitative; information variables, which included target difficulty, credibility, and consistency, were arranged so that their influence on interpreter performance could be assessed. A two between-subject, seven within-subject factorial research design was employed.

Provision of ancillary information enhanced accuracy of identification, regardless of whether the information was qualitative or quantitative or whether information was presented at the same time as the evaluation or afterward. Interpreters, looking at the imagery and aided by ancillary information, performed better than the computer, which would use incongruent information a person might choose to disregard. Information variables affected interpreter performance interactively; except for imagery difficulty, which affected performance directly, the influence of any variable was a function of the levels of one or more other variables. The degree of improvement in interpreter performance can be expected to depend more on the characteristics of the information and the difficulty of the imagery than upon the manner in which the information is provided.

TP 256. Holz, R. F. (ARI); & Gitter, A. G. (Boston Area Academic Consortium). Assessing the quality of life in the U.S. Army. September 1974. (AD 784 352)

This study was concerned with the development of a data base reflecting the social and psychological factors underlying the quality of life in the Army.

Unstructured in-depth interviews with first-term enlisted men provided data for developing a descriptive set of aspects considered significant in the quality of Army life. The resulting 16 attitudinal indicators were the basis for a self-administered questionnaire distributed to a sample of 1,193 first-term enlisted personnel in May and June 1973. Not all personnel provided data on every item. Thus, N's vary for specific variables. General data on satisfaction are based on a reduced sample of 1,000.

Length of time in service, post location (isolated or near an urban area), and race were significantly related to the quality of life ratings. Specifically, medical/dental care, education, and post facilities were considered most satisfactory; haircut regulations, the Army's "hurry up and wait" pattern of procedures, and housing were most frequently listed as causes of dissatisfaction. Volunteers, as opposed to draftees and draft-motivated volunteers, evaluated the quality of Army life as "better" and indicated greater willingness to reenlist after their first tour.

TP 257. Olmstead, J. A., Cleary, F. K., Lackey, L. L., & Salter, J. A. (Human Resources Research Organization). Development of leadership assessment simulations. October 1974. (AD 772 990)

In support of the Army's pilot program to establish an assessment center at the U.S. Army Infantry School at Fort Benning, Ga., leadership assessment modules were designed for use with three levels of personnel--student noncommissioned officers entering the NCO Educational System, students entering the Infantry Officer Basic Course and Officer Candidate Course, and student officers entering the Infantry Officer Advanced Course. All three modules involved the simulation of military leadership situations. In addition, it was planned to train personnel of the Fort Benning Assessment Center in the use of the materials.

Based on 11 leadership dimensions identified as appropriate for assessment, three realistic simulation scenarios were developed to elicit the behavior to be evaluated in the three groups. The modules were provided with full instructions and materials for conducting the exercises, assessing performance, and training controller/assessor personnel.

Organizational simulations were judged to provide a contribution to the assessment process not attainable with other techniques. The simulations reproduce the complex hierarchical organization and pressures under which military leaders function.

TP 258. Bowen, R. J., Feehrer, C. E., Nickerson, R. S., & Triggs, T. J. (Bolt, Beranek and Newman). Computer-based displays as aids in the production of Army tactical intelligence. February 1975. (AD A007 819)

One way computers can be used effectively in processing Army tactical intelligence is through the development of interactive situation display techniques. In an interactive system, personnel and computers can be coupled in real time so that the strengths of each compensate for the weaknesses of the other. Introduction of computers into the intelligence process should neither supplant humans nor simply relieve them of clerical chores, but should extend and augment their capabilities. The computer's ability to generate complex displays nearly

instantaneously, coupled with human ability to specify the displays to be generated, is the basis for a truly synergetic collaboration.

This project studied the use of tactical exercise materials in conceptualizing and formulating possible computer-display procedures and formats. Development of techniques was illustrated by a set of data displays and by suggested graphic analytic aids. Salient conclusions were as follows: (a) Military exercises and, by inference, actual tactical engagements can be translated into data-base structures for generating computer-based situation displays. (b) Computer-display techniques appear to offer easier, more rapid integration of data concerning enemy activity and posture and estimates of enemy capability than can other approaches. (c) Even a relatively primitive interactive computer-display capability has potential for aiding the analysis and interpretation of tactical intelligence data. Thus, analytically developed display techniques can provide the basis for initial on-line, man-in-the-loop experimentation. These techniques are forerunners of iterative experimentation for evolving a family of computer-display techniques to aid analysis and interpretation of intelligence data.

Methods are suggested for transposing military exercises into data-base structures in support of computer-generated situation displays. Concepts of mass and movement analyses using interactive displays are developed. Problems of software, memory, and information organization are considered.

TP 259. Bayroff, A. G., Ross, R. M., & Fischl, M. A. Development of a programmed testing system. December 1974. (AD A001 534)

This research developed an automated system for administering, scoring, and recording results of multiple-choice tests. The system is designed for tests tailored to the ability of the examinee; a more difficult question is presented after each correct response, an easier question after each incorrect response. Previous research on branching tests, in which the item sequence becomes a function of the pattern of correct/incorrect responses of the examinee, indicated that branching tests offer the prospect of increased reliability per unit of testing time in comparison with conventional tests. In addition, state-of-the-art research indicated the feasibility of constructing a machine to present test items following the branching pattern, to record and score responses, and to determine the next item for presentation.

Accordingly, an interim system was developed that would serve as the pilot for an eventual machine-testing system while providing the means for further research on branching tests. The interim system consists of an examinee station with a projection screen, a pushbutton panel, and cathode-ray tube (CRT); a proctor station with message keyboard and CRT; and the control computer. Testing proceeds at the examinee's pace, within administrative limits. The proctor has only emergency duties once testing begins. The system is an off-the-shelf model utilizing the ARI computer.

TP 260. Samet, M. G. Subjective interpretation of reliability and accuracy scales for evaluating military intelligence. January 1975. (AD A003 260)

An essential initial operation in intelligence processing is the evaluation of information. According to Army Combat Intelligence Field Manual 30-5, evaluation includes determining the pertinence of the information, the reliability of the source, and the plausibility or truth ("accuracy") of the information. Reliability appears to be judged mainly from previous experience and represents an estimate of the relative frequency with which reports from a given source turn out to be true. Accuracy refers to the probability that the reported content is true in light of all other available information.

The standard rating system widely used by the Army and other organizations indicates source reliability on a six-level scale (A-F) and accuracy on a 6-point scale (1-6). The object of this research was to assess the adequacy of the two scales and the relationship between them.

Intelligence officers (N = 37) completed tasks designed to measure their attitudes toward the scales and their knowledge about them. They recorded their judgments as to which report in each of 100 pairings of reports with different joint accuracy and reliability ratings was more likely to be true, estimated the probability that a report carrying a specific source reliability rating would also carry a specific accuracy rating and vice versa, and assigned numerical values of the probable truth of reports with given levels of reliability, accuracy, and reliability-accuracy combinations.

About one-fourth of the officers rated reliability and accuracy as independent dimensions; three-fourths rated reliability as highly correlated with accuracy. The accuracy rating dominated interpretation of the joint accuracy and reliability rating. Numerical (i.e., probabilistic) interpretations of scales were relatively consistent within individuals, but varied widely between them. The interdependence of the two scales and the dominance of "accuracy" in the interpretations suggests that a single scale, less ambiguous and more sensitive to all available information, would provide more useful intelligence evaluations.

TP 261. Cook, R. F. (ARI); & Morton, A. S. (Arthur D. Little). An assessment of drug education-prevention programs in the U.S. Army. January 1975. (AD A003 308)

This paper reports on a 1971 survey of the effectiveness of education in reducing drug abuse in Army units. The impact of drug education on patterns of drug abuse was assessed through a cross-sectional survey of 1,716 enlisted personnel in 16 Army posts and through a separate-sample, pretest-posttest evaluation of a drug education program at one

post. In addition, group interviews were conducted with 191 enlisted personnel.

Drug education programs in the Army, at the time of the survey (1971), were less related to changes in immediate drug use than were related demographic factors such as population density at last civilian residence, age, or length of time at a post. Civilian studies have corroborated this finding.

TP 262. Strub, M. H. Automated aids to on-line tactical data inputting. February 1975. (AD A010 350)

In an automated information system, input operators must convert free-text information rapidly and accurately into computer-readable format as they enter it into the data base. The primary objective of the present experiment was to evaluate (a) a computer-assisted message inputting aid (CAMI) that automatically presents (via a second display device) information useful for completing the format, and (b) a checklist method of formatting free-text information into computer-acceptable terminology. The two inputting aids were compared under two methods of formatting. Results from the four experimental conditions were also compared with a fifth condition in which the operator used only a handbook of instructions and a blank-screen CRT. Participants were 60 enlisted personnel, divided into five groups for assignment to the five conditions.

No significant differences in accuracy or speed could be attributed to use of the CAMI aid or to the checklist format. The fifth, a blank-screen condition, required significantly longer.

An unexpected but important finding was that over 80% of the total input errors were of types that would not have been detectable by computer error-checking routine. By separating total error rates into categories, the probable ratio of detectable to undetectable errors could be determined, and the frequency of undetected errors in a real-world on-line situation estimated. Since computerized error detection is not likely to be a complete solution to the problem of accuracy, operator proficiency will continue to be important.

The experiment was part of a continuing program to provide directly usable design information for the Army.

TP 263. Wilson, S. R., & Flanagan, J. C. (American Institutes for Research); & Uhlaner, J. E. (ARI). Quality of life as perceived by 30-year-old Army veterans. February 1975. (AD A007 207)

This paper describes an intensive investigation of the impact of Army service on a representative sample of veterans--draftees and volunteers, men and women--who entered the Army before 1968 and who thus

could evaluate their military service in terms of its effects on the quality of their lives.

A sample of 200 men and 50 women who had participated in the Project TALENT national survey of secondary school students in March 1960 and who were known to have entered the Army before 1968 was selected to be representative of all such individuals. Each of these persons who could be located and with whom an interview could be scheduled--166 men and 49 women--participated in a 3-hour interview. The information from this interview, including a review of their lives before, during, and after Army service to about age 30, was analyzed with the Project TALENT information from the computer data bank.

For the group as a whole, Army service had had a positive effect on the quality of their lives. They reported their needs as having been "very well met" for 5 of the 6 areas (from a set of 18) that they rated as most important to them: health and personal safety, relations with wife, occupational role, understanding and appreciating self, and material well-being and security for the future. The component rated as only "well met" was having and raising children.

Half the men who volunteered for Army service had no career or job plans at time of entry. About 45% indicated that they would like to see changes in the Army classification system that would help them get more meaningful information on their own interests and abilities in relation to Army opportunities.

Only 40% of the women had completed their first enlistment in the Women's Army Corps. The women did not regard the training they had received as interesting to the same extent as did the men. While indicating that they thought their assignments were productive, few women felt that the work contributed significantly to their career development or personal growth.

Research Problem Reviews

RPR 73-2. Nordlie, P. G. (*Human Sciences Research*); & Thomas, J. A. (ARI). Race relations and equal opportunity in the Army. December 1973. Out of print.

This report was intended to be a resource book for personnel in the Army's Equal Opportunity/Race Relations programs. The volume provides a summary of the EO/RR problems, policies, actions, and programs designed to improve race relations. Part I describes Army policy and efforts to combat problems in the area, including impact of the procedures in accession and retention of personnel, career development and progression, military justice, off-post discrimination, and extent of compliance. Part II, dealing mainly with race relations, discusses education and training, research projects, and special programs of information, interracial communications, and cultural

recognition (visibility). Part III deals specifically with EO/RR efforts in the Reserve components.

RPR 74-1. Downey, R. G. Army officers: An investigation of the present officer career structure. February 1974.

The development and utilization of Army officers is a long-term process extending from precommissioning to retirement from active duty. This process merges the elements of training, experience, and selection into an efficient and effective structure ideally of maximum benefit to the Army and to the individual.

The present officer career structure was examined, primarily to identify (a) points of significant change in career direction, (b) the data base for these changes, and (c) the points where differential measures of officer performance--or "indices"--might be introduced. Policy and guidance documents on career development were reviewed, and interviews were conducted with career management officers. The information was used for a logical analysis of procedures and outcomes in terms of their relationship to problems of evaluating individual performance and potential.

The current Army officer career structure can be viewed as a multi-step/multipath system in which the various steps and paths are closely related. The structure creates a situation where officers can, early in their careers, be "lock-stepped" into either a positive or a negative progression. Each critical career point contributes to this pattern. The data base used to make career decisions was found to be limited. However, the technology for developing an expanded data base does exist. Such a base can be developed through a more comprehensive file of valid evaluative measures and through a systematic method of collecting evaluative information that would insure timeliness and universality.

These and other findings in the area of officer career management systems can be utilized by the Army in the revision of career procedures, including assignment factors, Order of Merit lists, and promotion. The findings can aid the Army in developing programs to introduce improved evaluative procedures for officers.

RPR 74-2. Medland, F. F., Yates, L. G., & Downey, R. G. Associate ratings of senior officer potential. June 1974.

Research was done to determine the potential utilization and value of a peer evaluation program for senior officers for use in identification of promotion potential, nomination for high level military schools, Command designation, and special assignments.

Peer nominations were obtained, by mail, from two independent samples (total, 1,775; return rate, 78%) of active duty Army colonels. The instructions required that the raters identify the officers about whom they could make a reasoned judgment, then indicate those they considered to possess the potential for promotion to General Officer.

The peer nominations were found to be administratively feasible, but accepted by less than half the respondents. The most acceptable point of application was among the more junior respondents, to the effect that the peer ratings would be used for senior service college selection and possible promotion later. The spread of scores indicated that the technique yields adequate differentiation and reliability for operational use once the problem of acceptability is solved. The utility of peer nomination for selection, promotion, senior service college, duty assignment, and periodic assessment was established. However, to attain maximum utility, peer nomination must be acceptable to the groups involved.

RPR 74-3. Downey, R. G. *Operating characteristics of the Order of Merit lists.* December 1974.

The statistical properties and operational nature of the predictor variables used in the officer Order of Merit List (OM) were analyzed to determine the utility of the evaluations for personnel management decisions. This report suggests appropriate differential weights to be applied to the component measures for specific career management purposes.

Individual records were analyzed for 838 Infantry and Air Defense officers being considered for nomination to Command and General Staff College (C&GSC) and Senior Service College (SSC). In addition to the weights used for scoring, the measurement characteristics of the variables and the relationships among the selection factors were investigated. In view of the comparatively small sample and inclusion of only two Army branches (both combat arms), findings were considered tentative. The following suggested guidelines resulted from the study:

Scores should be standardized for all selection factors so that the weights used match the weights intended by management.

Military education might be eliminated as part of the OML because most officers have equal education levels.

The present procedures for scoring the OER should be changed to eliminate an artificial and unreliable spread in scores that could lead to an erroneous interpretation.

Use of branch subjective scores should be reviewed; such scores seem to be too closely related to each other and to other similar scores.

Differences in distribution of evaluative variables between branches suggest that branch-specific OML scoring might be investigated. Differences found in the weights for C&GSC and SSC suggest that further changes in selection factors for the two programs should be investigated.

RPR 74-4. Malone, T. B., Micocci, A. J., & Bradley, J. G. (Essex Corporation). Man-machine evaluation of the M60A2 tank system. December 1974.

Before the M60A2 tank was added to the weapons inventory of the U.S. Army in Europe, an Intensified Confirmatory Troop Test was conducted by the Modern Army Selected System Test, Evaluation, and Review (MASSTER), Fort Hood, Tex. The test was intended to facilitate transition from the previous tank system. Six specific areas were evaluated: personnel selection, training, operational and maintenance procedures, manuals and publications, equipment design, and communications. Objectives were (a) to identify human factors (man-machine interface) problems of the M60A2 tank system and (b) to recommend action to minimize the number of these problems and their impact on system efficiency.

The tank system was evaluated during three phases: (a) crew and maintenance personnel training, (b) gunnery training, and (c) field training exercises culminating in a battalion Army Training Test. A list of findings was formulated by a team of armored officers and human factors psychologists, and a number of specific recommendations on procedures, policies, and system design were developed to improve training and reduce existing safety hazards.

RPR 74-5. Downey, R. G. Development of a measure of Army leadership climate: The Military Leadership Behavior Survey. December 1974.

In 1972, the director of Human Resources Development, Office of the Deputy Chief of Staff for Personnel, requested a measure of leadership climate that would enable the Army to chart the past and present status of leadership climate in operating units. In responding to the request, ARI pointed out the need for basic research in the development of more germane research techniques. This report is concerned with the development of a method of measuring facets of the leadership climate in the Army.

The ARI project built upon prior research by the U.S. Army War College and the CONARC Leadership Board, as well as research by Human Resources Research Organization (HumRRO) under contract to ARI. The ARI research program resulted in development of a new survey technique for measuring leadership climate--the Military Leadership Behavior Survey. The survey consists of 53 questions used to describe the leader's behavior from the point of view of the superior, the respondent, or the subordinate. The respondent is asked to give a subjective view about what the leader does and what he or she should do. The

subjective view of a leader's behavior correlates imprecisely with objective behavior. Yet, it is the subjective perceptions, not the objective behavior, that influence the actions of unit personnel and that can be modified most effectively through an educational program. The survey developed here is not appropriate for use in an evaluative or punitive procedure.

The dimensions measured were found to be reliable and consistent, but the degree of relationship among the measures points to a tendency to respond from a generalized frame of reference. However, the relationship of the measures to job satisfaction and leader performance can indicate potential problems.

RPR 75-1. Shiflett, S., & Cohen, S. L. Initial results of an organizational survey in an Air Defense Command. April 1975.

In organizational effectiveness research, diagnostic instruments are developed to identify problem areas; organizational development techniques are used for intervention to correct the problems; and results of the intervention are evaluated in terms of job satisfaction and productivity or effectiveness. ARI developed such a program in one Army agency, as reported in ARI Research Reports 1180 (U) and 1184 (C). To find out if the program and the Work Environment Questionnaire (WEQ) developed in that study were sufficiently generalizable to be applied in a variety of organizational situations, a second and quite different Army agency, the 32d Army Air Defense Command (AADCOM), was surveyed with a modified version of the WEQ. The present report gives an overview of this preliminary assessment of the instrument and procedures and discusses aspects of morale and of performance measures indicated as suitable for final evaluation of the WEQ. The long-term goal of the program is to develop a highly generalized set of diagnostic instruments and intervention techniques applicable in any number of Army settings.

The revised questionnaire was administered to more than 300 enlisted personnel from a representative sample of batteries in the command. Preliminary results indicated a number of organizational and job-related areas having impact on performance, job satisfaction, and motivation that might be amenable to intervention efforts; the results supported the generalizability of the diagnostic dimensions previously delineated. The instruments, in providing an overview of the situation within the command, can be used as feedback to command and staff personnel. As part of an organizational effectiveness research program, the instruments and procedures employed here can be used to deal with Army problems amenable to solution by such strategies as job enrichment, team development, and management by objectives.

RPR 75-2. Savell, J. M., & Babin, N. Research on race and ethnic relations in the Army. June 1975.

This report summarizes ARI research on racial and ethnic interrelations in the Army from 1972 through 1974. The report also includes a brief account of race relations research done before 1972. ARI research produced the Racial Attitudes and Perceptions Survey (RAPS) for measuring perceived discrimination, attitudes toward racial interactions, and racial climate at specific installations. ARI also developed ratings for evaluating the performance of Race Relations/Equal Opportunity (RR/EO) personnel, a resource book to aid RR/EO personnel, and Department of the Army Pamphlet 600-16, "Improving Race Relations in the Army--Handbook for Leaders." References cite background and contract reports on race relations.

Research Memorandums

RM 73-1. Willemin, L. P., & Sait, E. M. Development of the NCO Evaluation Battery. November 1973.

During 1972, ARI personnel cooperated with personnel of the U.S. Army Engineer School, Fort Belvoir, Va., in leadership assessment and development within the Engineer Officer Basic Course. School personnel requested a similar effort for the Engineer Noncommissioned Officer Basic Course. The request included development of a diagnostic battery for administration to incoming students for trial use in performance counseling and training, subject to follow-up validation.

The NCO Evaluation Battery was developed by selecting content from factor-analyzed scales of the Differential Officer Battery, primarily on the basis of relationship to performance on tasks constituting the evaluation exercise at the Officer Evaluation Center and on the specific nature of item content. The final NCO Evaluation Battery consists of two instruments, a cognitive test and a self-description inventory.

RM 73-2. Kessler, J. J., & Maier, M. H. An evaluation of the Army Radio Code Aptitude Test. November 1973.

The Army Radio Code Aptitude Test is a quick work sample to indicate the speed with which individuals learn Morse Code. As a basis for deciding whether the test should be shortened, answer sheets of 488 Army recruits were analyzed. Although the final portions of the test are administered at increased speeds and appear to be frustrating to some examinees, this increase in difficulty may contribute to the prediction of training success. The decision was to retain the test in its present form.

RM 73-3. Erickson, J. M., & Levit, R. A. (Honeywell, Inc.). Development and application of a decision aid for tactical control of battlefield operations: Bibliographic sort of the decision aiding literature. December 1973.

A bibliography on decision aiding and decisionmaking in man/computer systems was selected primarily from post-1960 research literature. Selections met at least one of the following criteria: (a) contained a working decision aid in a man/computer decisionmaking environment; (b) contained a model of decisionmaking from which an aid could be derived; (c) contained useful information on tactical information processing; and (d) contained useful information on methodological aspects of decision aiding in man/computer contexts. The literature is presented in four ways: alphabetically by first author, alphabetically by author within year of publication, alphabetically by keyword, and alphabetically within each of 17 classifications.

RM 73-4. Downey, R. G. Associate ratings and senior service school selection. December 1973.

A student project at the Army War College in 1970 tested the utility of associate ratings in selecting officers suitable for attendance at senior service colleges. In 1971, the Army War College provided ARI with data for additional analysis. The primary objective was to determine the reliability of associate ratings and the relationship between the ratings and board action for selection.

Associate ratings from two samples of raters were obtained on officers eligible for senior service school attendance. For raters receiving two or more ratings from each school, it was found that (a) acquaintance and suitability scores were moderately related to each other within a school sample but were not related across schools; (b) suitability scores were moderately related between schools ($r = .29$) and suitability scores for the Army War College sample were related to board ranks assigned to selected officers ($r = .29$); (c) the Command and General Staff College sample produced higher suitability scores than the Army War College sample; and (d) officers selected by the board were rated more suitable as a group by associates than were officers not selected and not considered.

RM 73-5. Siegel, A. I., Wolf, J. J., & Leahy, W. R. (Applied Psychological Services, Inc.). A digital simulation model of message handling in the Tactical Operations System. I. The model, its sensitivity, and user's manual. November 1973.

The report presents results of research on implementation of a quantitative model of human performance in information systems. The principal efforts were to (a) define the most influential psychosocial variables inherent in the mission of interest, (b) incorporate these

into a logic for a digital simulation model, and (c) develop a computer program reflecting this model. The Tactical Operations System (TOS), for which the model was developed, includes model features involving predictive capability and system effectiveness measures. Results of a series of model sensitivity tests under a variety of parametric input conditions are reported. The information required for model application is provided as a user's manual.

RM 73-6. Siegel, A. I., Wolf, J. J., Leahy, W. R., & Bearde, J. L. (Applied Psychological Services, Inc.). A digital simulation model of message handling in the Tactical Operations System. II. Extensions of the model for interactivity with subjects and experimenters. December 1973.

This report describes extensions and improvements to a digital computer model previously developed to simulate the actions of operational field army personnel in processing messages during a Tactical Operations System (TOS) mission (Research Memorandum 73-5). The computer model was made interactive by means of cathode ray tube displays to enable an experimenter to initiate and control computer simulation runs and to allow TOS operators at a computer terminal to perform selected tasks during the simulation. A revised version of the earlier user's manual is presented along with the Interactive Model User's Manual.

RM 73-7. Smith, K. H. Validity analysis of the Group Awareness Test of the Differential Officer Battery. December 1973.

This report describes the initial construction, item analysis, and later validation study and evaluation of the Group Awareness Test when considered as part of the total Differential Officer Battery in predicting factor scores of Officer Evaluation Center performance.

Although some consistency in patterns of relationship was revealed in the present analysis, the internal analysis conducted earlier and reported in Research Memorandum 68-10 casts serious doubt on the effectiveness of this test in measuring any clear patterns of attitude estimation by the examinee. The values from the present analysis cast further doubt on the value of this particular approach to the measurement of leadership potential and indicate that little would be gained by including the test in operational officer assessment.

RM 74-1. Vetter, B. M. (Scientific Manpower Commission). Military utilization of a sample of graduate scientists and engineers, 1968-1971. January 1974.

This report is based primarily on results of a 1973 questionnaire sent out by the Scientific Manpower Commission (SMC) and completed and

returned by 621 men. This sample was the result of attrition of 3,000 who responded to a news item in Science magazine in June 1967 inviting science graduates about to be inducted into the Army to contact SMC concerning placement assistance in the Army. In addition to statistics based on responses, the report includes an analysis of comments written by many of the men in the sample, particularly those assigned to science and engineering jobs in the Army.

RM 74-2. Edison, W. J., & Eastman, R. F. Cluster analysis of occupational data with focus on task rather than people. January 1974.

An important tool of the job analyst is a method of grouping tasks into clusters. Cluster analysis is a technique by which entities are formed into relatively homogeneous groups based on similarity measures. A modification of the usual clustering procedure, obverse cluster analysis, constructs clusters of tasks on the basis of the number of individuals who perform the tasks. The present paper discusses several methods of cluster analysis: (a) the Computerized Occupational Data Analysis Program (CODAP), developed by the Air Force and used by the Navy and Marine Corps, identifies individuals or groups who perform similar jobs; and (b) a system developed by ARI that uses the same input as CODAP but with a modification--obverse clustering--that locates the tasks that the greatest number of individuals perform in common and combines those tasks into a cluster. In addition to clustering tasks, the ARI addition to the CODAP system puts out an ordered list of tasks that reflects the content of the clusters and provides information about hierarchies of task clusters.

In a comparison analysis, empirical task clusters derived by the CODAP obverse method resulted in moderate overlap with rationally derived duty modules. Obverse clustering could be used to identify unit and individual performance criteria based on actual duties performed and to forecast equipment and maintenance needs based on measures of use by personnel.

RM 74-3. Plog, S. C., & Kahn, O. I. Reenlistment and retention of effective women in the Women's Army Corps: An exploratory research investigation. February 1974.

This study was completed for the Director of the Women's Army Corps to "identify the likely causes of failure to reenlist on the part of effective women." A total of 94 women were included in the research: 45 enlisted women were interviewed using a detailed questionnaire, an additional 42 participated in focused groups, and 7 participated in unstructured interviews with WAC officers. Interviews were completed at six Army posts on the East Coast, West Coast, and Southwest.

A majority of the women interviewed (77%) indicated that joining the Army was a good decision. Among the sample, 36% planned to reenlist, 17% were undecided, and 47% had decided to leave the Army. Primary reasons for reenlistment, in order of importance, were reenlistment benefits, satisfaction with current work assignment, and opportunity to change one's MOS.

RM 74-4. Colson, K. R., Freeman, F. S., Mathews, L. F., & Stettler, J. A. (Northrop Corporation, Electro-Mechanical Division). Development of an informational taxonomy of visual displays for Army tactical data systems. February 1974.

This is a detailed account of research conducted to develop a taxonomy of visual displays for the Army's tactical data systems. A major problem in effective display system design and development has been the lack of a comprehensive frame of reference and associated terminology that can be used to characterize displays and the functions they perform as part of a large information processing system. The taxonomy provides a structure for defining, evaluating, and comparing displays based on the user's information needs. An attempt was made to evaluate the taxonomy using operational display systems. The report includes background and references.

RM 74-5. Maier, M. H. A comparison of three-subtest AFQT and four-subtest AFQT. March 1974.

The AFQT-9, AFQT-10, and the AFQT score obtained from the Armed Services Vocational Aptitude Battery (ASVAB) had only three subtests: Arithmetic Reasoning, Word Knowledge, and Pattern Analysis. The 25 items comprising the Tool Knowledge test have been deleted. Shortening the test could have affected individual performance, especially for low scoring persons, since individuals with low scores on the AFQT usually obtained higher mean scores on the Tool Knowledge test than on the other subtests. Score distributions of the three-subtest and four-subtest batteries were compared to determine the effects of the altered form.

The three-subtest AFQT resulted in a score distribution similar to that of the four-subtest AFQT. No part of the distribution was systematically different on the two forms.

RM 74-6. Kaplan, H., & Fischl, M. A. Evaluation of high density format for AFQT answer sheet. April 1974.

The DIGITEK Optical Scanner is used at Armed Forces Examining and Entrance Stations to obtain total and subtest scores on the Armed Forces Qualification Test (AFQT) with a single pass of the answer sheet. Two AFQT forms, introduced prior to DIGITEK installation, required five

passes to obtain the required scores. To take full advantage of the time-saving feature of DIGITEK scoring, items of the two AFQT forms were rearranged and the answer sheet redesigned to permit one-pass scoring.

Experimental administration and scoring of the revised test materials showed that the new, high-density answer sheet could be used in the operational program without restandardization. The greater difficulty noted in the tool functions and spatial relations subtests was found to result from reduction of illustration size in the test items, not from changes in the answer sheet. The illustrations were enlarged before the revised forms were introduced operationally.

RM 74-7. Strub, M. H., & McConnaughey, P. Tactical planning (offensive and defensive) minimum essential information requirements. October 1974.

This research identified minimum essential information requirements for offensive and defensive tactical planning. The basis of identification was the number of officers requesting the information during the course of offensive or defensive scenario play. While the controlled environment of the experiment placed some restrictions on the generalizability of the requirements identified, the results reflect a body of information items consistently requested by experienced Army officers. The hierarchical structure of the data base permitted the delineation of these requirements by category and level of detail. The information should serve as a basis of comparison and synthesis with information requirements identified by other means, such as surveys and ad hoc analytic groups.

RM 74-8. Hoyt, W. G., Butler, A. K., & Bennik, F. D. (System Development Corporation). Application of tactical data systems for training: Volume II--AI/DEVTOS automation studies. July 1974.

This report addresses the feasibility of using automated tactical data systems for training as well as tactical support. The Developmental Tactical Operations System (DEVTOS) was analyzed to determine if it could support computer-aided instruction (CAI). Existing computer-aided instruction programs and procedures were surveyed and analyzed to determine their availability and feasibility within DEVTOS. This report describes and evaluates DEVTOS software and hardware, recounts the survey of CAI systems, and summarizes the development and capabilities of PLANIT (Programming Language for Interactive Teaching), which is the CAI system considered most effective and least costly to implement.

A CAI system can be interfaced with the DEVTOS without drastic reprogramming of either the instruction system or the DEVTOS.

RM 74-10. Bell, D. B., Kristiansen, D. M., & Seeley, L. C. Initial considerations in the development of the Early Experience Questionnaire (EEQ). July 1974.

The Secretary of the Army, in 1973, asked for a review of existing Army standards for the admission of enlisted personnel. The purpose was to determine whether changes could be made in the then current requirements to increase the number of personnel admitted into the service and yet maintain and improve the caliber of the recruits. In response, ARI undertook two lines of research. The first was an attempt to balance selection factors such as age, education, mental aptitude, and criminal behavior into a single index called the Military Aptitude Predictor (MAP). The second line of research explored instruments and procedures that might be added to the MAP to increase the predictive scope. The Early Experience Questionnaire was the result. The instrument was based on previous ARI research that had shown that certain preservice experiences are related to discipline failures in the first tour of service. This report recounts the construction of the instrument, initial field testing, and tentative evaluation.

RM 74-11. Leahy, W. R., Lautman, M. R., Bearde, J. L., & Siegel, A. I. (Applied Psychological Services, Inc.). A digital simulation model of message handling in the Tactical Operations System. III. Further extensions of the model for increased interaction. August 1974.

This report is the third of three describing MANMODEL, a simulator yielding measures of system performance under different mixes of equipment, personnel, and procedures. Modifications to increase its fidelity and utility included incorporating "interrupt" data and the ability to collect data in an interactive mode, using any combination of real and simulated subjects, and then immediately to simulate the entire interactive process.

A preface by James D. Baker, Supervisory Project Director, discusses the ARI effort generally, traces the history of MANMODEL, and projects further work toward validating the simulator and the challenges to psychological research posed by the expanded techniques envisaged.

RM 74-12. Downey, R. G. Factor analysis of leadership measures from a training program. October 1974.

Recent leadership research has emphasized the interactive influence of leaders and the organizational structure in which they operate. Research by ARI has established broad, behavioral dimensions of leadership in a simulated combat situation. The objective of this analysis was to identify the implicit dimensions of leadership as evaluated by the training staff as part of an Army officer training program. The measures factor analyzed were those being used by the school staff.

Three broad leadership factors were tentatively identified: cognitive/verbal leadership skills, leadership behavioral style, and leadership performance. These three factors were closely related to evaluative concepts used in training and assessment programs. The cognitive/verbal skills factor was related to academic orientation or general mental abilities; leadership behavioral style to evaluations of characteristics by self, peers, and superiors; leadership performance to applied exercises evaluating performance.

RM 74-13. Bell, D. B., Bolin, S. F., & Houston, T. J. Development of the Background and Opinion Questionnaire 72. December 1974.

This research provided technical background for the development and initial field testing of the Background and Opinion Questionnaire (BOQ) 72. This instrument was devised as part of ARI research on disciplinary problems in the Army and was designed to identify individuals for referral for a special interview by the company commander. The interview was to be structured based on questions and responses in the BOQ. The instrument is composed of 25 items arranged in four areas.

The BOQ-72 was found to be a statistically valid test, better than currently available instruments for predicting disciplinary failure in Basic Combat Training. However, in view of the time and effort required to administer the test and its failure to add to the prediction achieved by the simple variable of high school graduation, serious question is raised as to whether its use is justified.

RM 74-14. Patten, S. M. (Syracuse University Research Corporation). An inductive taxonomy of combat intelligence data. December 1974.

Technological advances have led to the more efficient collection of a greater variety and quantity of combat intelligence data than in the past. To effectively handle the increased volume of data, the intelligence analyst working on a specific problem must be able to selectively obtain information relevant to the problem without becoming bogged down in irrelevant information. To achieve an efficient information retrieval capability, whether using a manual or automated procedure, it is desirable for data to be stored in a form compatible with the requirements of the analyst.

This report presents an outline of one approach to data organization and provides the information taxonomy produced when this methodology was applied to one message set. While a number of information categories were unique to this message set, the taxonomy is expected to constitute a valuable starting point for future efforts of this type.

RM 74-15. Williamson, R. L., & Frankfeldt, E. The development and standardization of the revised Motor Vehicle Driver Selection Battery I, MDB I. December 1974.

The Motor Vehicle Driver Selection Battery I (MDB I) is part of the test program used to classify enlisted personnel at the time they enter the Army. It is given to new personnel who do not have valid civilian driver's licenses. A passing score is required for duties that involve driving a motor vehicle. The objective of the present study was to update and shorten the three tests of the MDB I: Attention to Detail, Driving Know-How, and the Self-Description Blank (Transport). Phase I of the study was concerned with converting the hand-scored Attention to Detail test to a machine-scorable instrument. Phase II consisted of internal analysis of the Self-Description and the Driving Know-How tests to determine which items were out-of-date or no longer appropriate. Phase III standardized the revised battery. The revised version was implemented in July 1973.

RM 75-1. Maier, M. H. (ARI); & Fink, C. D. (Human Resources Research Organization). Analysis of a self-paced instructional program in the clerical field. March 1975.

The Army, along with the other services, puts considerable emphasis on self-paced instruction. The apparent advantages are reduction of training time and reduction of instructional support, both of which should lead to a more effective use of valuable training resources.

ARI completed an analysis of a self-paced course for clerk-typist to determine how the method was working after operating for 4 years. Content of the course includes the programmed instructional texts and tests given at the completion of each text and at the end of the course. Evaluation of course and concomitant attitudes and disciplinary records revealed no special problems in the group taking the self-paced course. Observations from some instructors revealed that some saw disadvantages--lack of official recognition, difficulty in maintaining the currency of course content, and lack of clear definition of a proper role and function in the classroom. Instructors trained to conduct classes through platform lectures felt limited in function. The feeling seems to be that self-paced texts are good and should be used, but that they do not take the place of live teachers in instruction and counseling.

RM 75-2. Shields, J. L. Speed listening for message classification. March 1975. (FOR OFFICIAL USE ONLY)

(U) This study was designed to determine if operational personnel untrained in listening to time-compressed auditory material could accurately identify the subject matter when listening to communications played at speeds faster than the original recording. The data supported

investment of additional experimentation. Of particular value would be research to determine the gains from experience and training in using speech compression devices for quick scanning of communications, and to determine the most efficient methods for using speech compression devices when the processor is allowed to control the speed and pitch of the communication.

RM 75-3. Savell, J. M., & Woelfel, J. C. (ARI); & Collins, B. (Con-temporary Research, Inc.). Attitudes concerning job appropriateness for women in the Army. June 1975.

Between December 1973 and December 1974, the number of women in the Army and the percentage of women in various kinds of jobs, including nontraditional jobs, increased substantially. A study was conducted to find how Army personnel generally, both men and women, were reacting to this development. This report provides some preliminary data reflecting these reactions. An anonymous questionnaire containing 174 items was administered to a combined sample of approximately 800 soldiers at selected installations in the continental United States.

Most of the jobs examined were considered appropriate for women by the majority of men and women responding. Proportionally more women than men said they thought that women were able to handle a wide variety of nontraditional jobs and take an active role in the Army. Proportionally more officers than enlisted personnel endorsed this expansion of women's role, with female officers more frequently recommending a general and pervasive expansion of women's roles in the military.

RM 75-4. Farrell, J. P. Night training by simulating the night visual environment during the day. June 1975.

This paper reports on ARI research to develop a night training technique by simulating a night visual environment during daytime. It describes results of preliminary field tests and states plans for subsequent research.

Characteristics for acceptable light-attenuating goggles to simulate nighttime conditions were specified, and mock-ups were developed for a feasibility test. In preliminary field tests involving nap-of-the-earth flying, the goggles effectively simulated actual night conditions for most aviation tasks. Piloting tasks were performed without difficulty. With the attenuation used, navigation was possible while flying away from the sun but not while flying into the sun. The mock-up goggles used, however, were too fragile for larger scale laboratory or field tests. A sturdier version is needed for field testing on a larger scale and for a series of perceptual laboratory tests.

MAJOR RESEARCH AREAS AND FIELD UNITS REPRESENTED

The period covered by these abstracts extends from 1 July 1973 to 1 July 1975. Some publications dating from the earlier part of this period represent projects formulated by the two research laboratories prior to their incorporation in ARI. Incorporation necessarily involved considerable reorganization of the two laboratories and of the research areas in order to encompass the broadened research requirements. However, continuity in the major--and essential--research programs has been maintained as new programs have been initiated. The research areas described here are those represented by the publications abstracted in this volume. They do not include the entire work program in effect during the period covered.

Individual Training and Performance Research Laboratory

Included in this broad program are research efforts dealing with the management of the Army's manpower resources, both officer and enlisted.

Individual Training and Manpower Development Technical Area. This Technical Area was responsible for the research that provided the basis for most of the standards for admission into the service and the utilization of the Army's human resources. The manpower management procedures developed were based on concepts of differential classification and an innovative approach to training and evaluation. Areas of concentration were problems in procuring trainable enlisted personnel; work included development of effective procedures for selection, classification, assignment, performance evaluation, and retention. In each of these processes, ARI research and technology supported the Enlisted Personnel Management System.

Research efforts focused on analysis of how well classification tests predicted success on the job; the effect of assigning enlisted women in jobs formerly performed by men; and the identification of individual assets not previously measured, including career motivation and leadership potential, communication skills, and the ability to deal with others individually or as a member of a team. A substantial research effort was devoted to training and evaluation in a unit environment in which skill development and testing constituted an integrated process.

Another research area dealt with developing technology and procedures for improving the career development and management of officers in support of the Army's Officer Personnel Management System. This work included intensive studies on computer-assisted career guidance counseling, job dimensions and behavioral matching, and counseling aids to integrate counselee, counselors or counseling devices, and management information systems.

Leadership Performance Technical Area. The mission of this Technical Area was the conduct of research on special manpower procurement requirements, including the identification of officer potential and special capabilities and the development of a new officer evaluation system. An integrated research effort was conducted in support of the Officer Personnel Management System and its evaluation procedures. Another program was directed toward the identification of critical career decision progression points; the definition of career progression requirements, the evaluation of differential leadership potential, motivation, morale, and behavior following assignment; and the development of individual officer indices of performance potential and of procedures for utilizing these indices in career development.

Before the Officer Career research effort began, a program was conducted to provide a way to identify officers--or prospective officers--who have aptitudes and other characteristics required for success in various leadership positions. Research Report 1182 is one of several reports that mark the culmination of Officer Prediction research and assess the impact of findings on programs of officer evaluation and career development.

This research included identifying operationally feasible career progression points for evaluation of the differential performance and potential of individual officers; it combined evaluation factors into officer indices to be used in assignment to specific programs, including selection for attendance at advanced military schools, promotion, or special assignment. In developing a system for measuring the leadership potential, qualities, and proficiencies of personnel assigned to the ROTC and to the Officer Basic Course and NCO Officer courses, emphasis was on new and improved assessment techniques for differential assessment and commitment factors related to leadership roles.

The leadership training and development effort provided research-based methodology for the development of Army leaders and enhancement of the effectiveness of leadership training. Work included analysis of the dynamics of face-to-face interaction and the application of systems engineering and experimental learning principles to command situations.

Social Processes Technical Area. The Social Processes Technical Area, in operation from 1972 to 1975, was instituted to explore problems of social dynamics and interactions and the adjustment of the soldier to the modern Army. The objective was to enhance morale and reduce the need for disciplinary action, thus promoting an increase in the military competence of units.

A special information-gathering and procedure developmental effort addressed the complex problems related to drug and alcohol abuse. The Army's Equal Opportunity Treatment and Race Relations programs were the subject of research dealing with experimental managerial procedures to promote racial harmony and to modify adverse attitudes and social

climate. Included was a survey to elicit attitudes toward women in the Army.

On a broader scale, the long-term study of the American soldier in the 1970s was a survey of attitudes and values in relation to quality of life, individual adjustment, and interpersonal and intergroup relationships. Attitudinal and behavioral data were obtained on the socialization and adaptation of soldiers to various aspects of Army life.

Organization and Systems Research Laboratory

This laboratory addressed human factors needs and problems of soldiers in the context of Army units, emphasizing team effectiveness. Programs dealt with means of increasing the skills of groups of individuals, maintaining and enhancing unit performance in the field, and the integration of systems concepts through analysis on the interactions of personnel, equipment, and procedures.

Systems Integration and Command and Control Technical Area. The principal objective of the programs in this area was to enhance total system effectiveness by determining the optimal allocation of functions among man, machine, and man/machine combinations. New work methods, aids, and procedures were developed to take advantage of each element and achieve the most appropriate configuration. This objective was approached primarily through laboratory experimentation and system simulation in which the performance and interaction of various system components were related to total system effectiveness.

The objective of Surveillance Systems research was to improve the utility of intelligence information generated by the Army's surveillance systems. Work included research on procedures, displays, man-machine functions, and interactions within and among these systems. Problems investigated affected improvement of information extraction from displays and the efficient storage, retrieval, and transmission of the information within an advanced, computerized, image interpretation facility. Research results are used in the design of future systems and in the development of techniques for enhancing performance in all phases of the interpretation process.

A basic part of this research was the effort to determine how interpreter performance was affected by variations in the content and quality of the image. Methods were developed for screening images for interpretability; search strategies were devised for more rapid and accurate production of information from various kinds of images. Research also considered the sensor equipment from which imagery is obtained and the requirements of commanders and other users of intelligence information.

The Intelligence Systems research effort was concerned with the problems of advancing man/computer technology and the application of this technology to improving tactical intelligence processing. A major objective was to determine basic capabilities and limitations of humans as information processors and to devise ways to utilize human capabilities and compensate for limitations. Research was directed at finding ways to improve human performance in judgmental tasks as applied to intelligence information. This effort involved intensive study of human processing of unreliable data in order to find ways to improve such processing and to produce usable intelligence information.

The Command Systems research segment dealt with a wide range of human factors problems in the assimilation and utilization of tactical information and in decisionmaking in command and control systems. Developers and users of current and prospective systems were provided with directly applicable findings on such subjects as techniques and aids for rapid and accurate handling, assimilation, and transfer of information; individual and system performance measures; systems integration of the various processes in information processing; minimum essential information requirements; problems in the automation of source data; and data input by front-line observers. A principal problem in military data processing systems has been that the computerized systems are difficult for untrained operators to use. One Command Systems effort was directed toward simplifying the man/computer interface for the less-experienced operator.

Team Performance Technical Area. Primary objectives were the enhancement of human performance capabilities in military units and improvement in the quality of unit functioning. Projects included methods of enhancing the effectiveness of communications processing, the investigation of selective attention and feedback, the development of effective methodology for the acquisition of data on performance capability, and research to expand the limits of perception and performance and to reach new human performance levels.

A specialized effort on aircrew performance developed principles and data as a basis for improving human performance in complex Army aviation systems, such as nap-of-the-earth flight, utilization of sensor displays, and general support.

Research was performed to improve group performance in a number of military systems through analysis of work environment factors and diagnosis of organizational problems and their impact on job performance.

Unit Training and Evaluation Systems Technical Area. Programs in unit training related to the Army's need to improve readiness posture and to assess readiness, including readiness of weapons systems at the small unit level. Models were developed for analyzing training effectiveness and methods were devised for tactical training of small combat units.

ARI Field Units

ARI Field Units complement the research programs of the two laboratories and provide support to Army users in specialized branches and units. The units also provide technical advisory service to operational units on personnel and human factors problems.

Fort Benning Field Unit. This field unit provides new and improved techniques for leadership assessment, development, selection, and training in direct support of the U.S. Army Infantry School Center. Topic areas include assessment exercises for self-development, leadership training, and feedback in officer and NCO Basic Infantry Courses and for final selection of Infantry Officer Candidate School candidates. The unit is also responsible for research to develop performance-oriented extension courses for soldiers.

Presidio of Monterey/Fort Ord Field Unit. This unit focuses on performance-oriented training, research to improve literacy training, and training of low-ability personnel. In addition, research is conducted on small tactical units to attain effective system performance through enhanced operator performance with surveillance, target acquisition, and night observation equipment. The ARI group at Monterey is concerned with the development of technology to support combat readiness, including laser engagement, individual training and evaluation in the unit environment, and the development and use of a combat readiness test bed.

Fort Hood Field Unit. This unit provides human factors field test experimentation support to Headquarters, Modern Army Selected System Test Evaluation and Review group (MASSTER) and assists ARI Technical Areas in field research and identification of problems requiring laboratory study. In addition to its supportive role, 50% of the mission is conducting research on field methodology, message inputting techniques, information processing, air-ground target acquisition problems, and other areas generated in the field environment and needing timely solutions.

U.S. Army, Europe (USAREUR) Field Unit. Unit personnel assist the ARI Technical Areas in the identification of problems needing laboratory research and in the conduct of ARI field research within USAREUR. Consultative support and field research is provided to Headquarters, USAREUR. One program of unit research concentrates on training requirements, job satisfaction, morale, and other human factors problems specific to USAREUR.

Far East Research Unit, Korea. The unit serves as liaison between ARI and the Army Command in Korea on behavioral and social science problems.

Fort Bliss Field Unit. This unit develops human performance enhancement techniques for air defense and field artillery.

Fort Rucker Field Unit. This unit conducts a specialized effort on Army aviation problems, including selection for flight training, simulation techniques and their utilization, and training for nap-of-the-earth flight.

Fort Knox Field Unit. This unit is a center for research on performance motivation in training and evaluation of armor personnel, including crew performance and motivational and morale variables in the training school and center environment.

Fort Leavenworth Field Unit. Research is conducted on problems of human resources in the combined arms, including command effectiveness at senior levels.

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RESEARCH AREAS AND FIELD UNITS

Individual Training and Performance Research Laboratory

Individual Training and Manpower Development Technical Area: 4, 7, 19, 27, 29, 30, 31, 33, 34, 35

Leadership Performance Technical Area: 6, 15, 18, 23, 24, 25, 27, 28, 29, 33

Social Processes Technical Area: 7, 8, 15, 17, 20, 21, 22, 27, 34, 36

Organization and Systems Research Laboratory

Systems Integration and Command and Control Technical Area:

Surveillance Systems: 3, 5, 9, 12

Intelligence Systems: 13, 14, 16, 18, 20, 34

Command Systems: 10, 11, 12, 16, 21, 28, 29, 31, 32, 33

Team Performance Technical Area: 4, 7, 25, 26, 35, 36

Fort Ord Field Unit: 7

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