

AD-A123 656

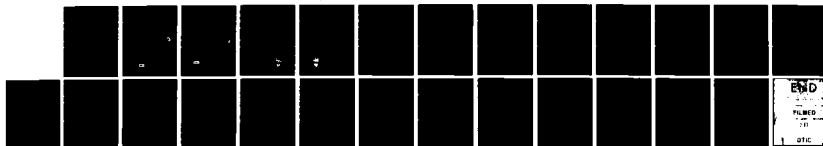
HUMAN RESOURCE MODELS: AN OVERVIEW(U) CENTER FOR NAVAL
ANALYSES ALEXANDRIA VA NAVAL STUDIES GROUP B D ROSTKER
NOV 82 CNA-PP-370 N00014-76-C-0001

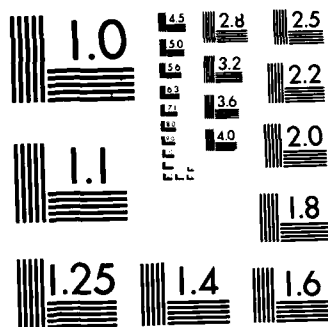
1/1

UNCLASSIFIED

F/G 5/9

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

ADA 123656

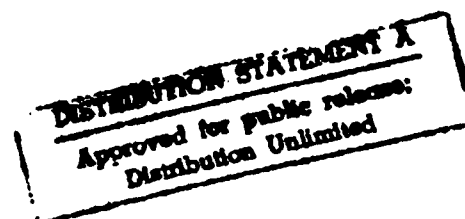
HUMAN RESOURCE MODELS: AN OVERVIEW

Contract # N00014-76-C-0001

Bernard D. Rostker



DTIC FILE COPY



CENTER FOR NAVAL ANALYSES

2

HUMAN RESOURCE MODELS: AN OVERVIEW

Bernard D. Rostker

DTIC
JAN 21 1983
H



Naval Studies Group

CENTER FOR NAVAL ANALYSES

2000 North Beauregard Street, Alexandria, Virginia 22311

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

HUMAN RESOURCE MODELS AN OVERVIEW

INTRODUCTION

A recent Secretary of the Navy frequently reminded his staff that "People are our most important resource." The subject of this chapter is how human resource models help the military departments manage their people so that the United States can meet its defense commitments.

The overview paper developed and illustrated some general principles about models and contrasted model types by specific area of application. This chapter illustrates the general principles by highlighting the different types of human resource models, and points out problems that model builders should consider when they develop new models of this type..

In the next pages, we will consider: (1) the basic nature of human resource models and what sets them apart from the other models discussed in this volume; (2) a discussion of the various types of human resource models; and (3) a look at the future of human resource modeling.

Classification For
REF ID: A1
REF ID: A1
Classification
Classification
Classification/Availability Codes
Large group
Dist Special
A

THE NATURE OF HUMAN RESOURCE MODELS

The reader will note that we use the term "human resource" rather than "manpower." In the military services, the terms "manpower," "personnel," "training," and "assignment" refer to systems that constitute separate organizational entities and management processes by which people are brought together with a weapon or support system in specific jobs to produce something called national defense. Though each system and the models that support it conceptually have their place in an integrated process of human resource management, little has been actually been done to develop the interactive models into a single human resource system. Following common usage, we will define the separate systems and later return to the notion of an integrated system for managing human resources. Usually, the system is viewed as:

- o Manpower: the process of determining the numbers and types of people necessary to accomplish a given task.
- o Personnel: the process of managing people, either directly by management action or indirectly through incentives that affect behavior, so that an appropriate type of person, as defined by the manpower process, is available to be "assigned" to a given unit.

- o Assignment: the process by matching members of the available pool of personnel to specific jobs.

- o Training: the process by which a person who has specific skills or attributes is given a new set.

Human resource models--for instance, and personnel--are basically different from the combat models discussed in other chapters. Like logistics models, human resource models tend not to be built to support one-time policy decisions; rather, they have become integral parts of the process of managing human resources. For example, models are used to determine how many people will be recruited and promoted each month, how much they will be paid, and where they will be used. Unlike logistics models, the use of human resource models in personnel management is not new.* Moreover, human resource models focus on the resource that is hardest to model, control, or predict--people. This places special demands on the modeler, as we shall see.

All human resource modelers must determine (1) how to describe people and what type of aggregation scheme to use, and (2) how to take account of the fact that, unlike other resources, people learn and modify their behavior in response to changing both factors, exogenous and endogenous.

* A. P. Smith points out that, as early as 1679, the Secretary of the Admiralty regulated the annual entry of officers into the British Navy, and that by 1779, career structures, retention rates, and promotion probabilities were regularly analyzed for the Royal Marines. The systematic collection of the statistics used in personnel planning dates from 1820 in the British Navy, and the basic personnel planning models were discussed in 1899 in the Naval Proceeding of the American Navy. See, A.P. Smith, "Defense Manpower Studies," Operational Research Quarterly, Vol. 19, No. 3.

Aggregation

Any attempt to model a human resource process starts with a decision to describe people according to a well defined aggregation scheme. The basic building block in a military human resource model is the occupational classification structure. In the Army and Marine Corps, the building block is the Military Occupation Specialty (MOS); in the Air Force, the Air Force Specialty Code (AFSC); and in the Navy, a Rating. Regardless of nomenclature, each occupational classification system is an aggregation of tasks into jobs, jobs into positions, positions into occupations, occupations into career fields, and career fields into occupational groups. What should be noted is: (1) that each level is a somewhat arbitrary aggregation of an underlying structure, (2) that once a level of aggregation is chosen for a model, variations in the substructure must be ignored, and (3) that the usefulness of a model is directly related to the appropriateness of the aggregation scheme.

There are many examples of human resource models at each level of aggregation. The Services have incorporated data about individual tasks as part of the "Instructional Systems Development" process for designing new training programs. The President's Commission on Military Compensation (PCMC), by contrast, used models that aggregated military personnel into cells containing all officers and all enlisted personnel for each year-of-service; for example, all officers in a given year-of-service were assumed--regardless of their background--to react in the same way to given changes in retirement policy.

A faulty aggregation scheme may lead to unexpected results. The Air Force assumes that all journeyman avionics mechanics (AFSC 32672A) are homogeneous in their skills and "universally" assignable with equal effectiveness to all models of the F-111, F-15, and F-16. There is some evidence that differences in the tasks that make up the specific jobs on the different aircraft make this assumption invalid.* The other Services make assignment on more specific classification structure which reflect training and experience on specific equipment. The Navy's Naval Enlisted Classification Code (NEC), for example, is used in conjunction with ratings to match people to specific jobs.

Behavior

The second problem that human resource modelers must face before they start building their models is how to account for people's ability to learn and change their behavior in response to factors incorporated in the model. Many human resource models use historical data on human responses deterministically, instead of realizing that the observed responses represent patterns of behavior that will themselves change as endogenous factors in the model change.

This practice is illustrated by personnel planning models that use the transition probability obtained from historical records that an officer will move over time from the n^{th} year-of-service cell to the $n+1$ year-of-service cell. The model and the historic transition probability are

* M.B. Carpenter-Huffman and B.D. Rostker, The Relevance of Training for the Maintenance of Advanced Avionics, R-1894-AF, December 1976, Rand Corporation.

used to explore the effect such policy changes as variations in promotion opportunities and tenure rules have on the officer profile. Yet the very act of changing the tenure rules or promotion opportunities alters not only the policy parameters of the model, but also the underlying transitional probabilities.* Failure to account for human behavior compromises seriously the usefulness of the model.

HUMAN RESOURCE MODELS

Manpower Models

Manpower requirements models are designed to tell the human resource planner how many of what types of people are needed to produce given levels of output. Models range from large-scale simulation types to statistical models that show the numbers and types of people historically used to accomplish a measured amount of work. Simulation models tend to explore manning situations beyond the range of direct observation. By and large, industrial engineering approaches, which emphasize statistical analysis of workload and manpower actually

* A number of economists (Warner, McCall, and Gotz) have estimated the changes in transition probabilities as promotion policies are altered and then have incorporated these "behavioral" relationships into traditional models for personnel planning. See John Warner, Military Compensation and Retention: An Analysis of Alternative Models and a Simulation of a New Retention Model, RC-436), Center for Naval Analyses, Aug 1981, and Glenn Gotz and John J. McCall, Estimating Military Personnel Retention Rates: Theory and Statistical Method, R-2542-AF, Rand Corporation, Jun 1980.

employed, have gained broad acceptance as the prime tools for determining manpower requirements.*

Conceptually, simulation models provide many advantages over traditional industrial engineering approaches. The structure of this simulation model enabled researchers to develop manpower requirements as a function of such elements as flying schedule, component reliability, and frequency of repair and to relate manpower explicitly to projected system output, such as sorties flown and ship operations. Unfortunately, simulations are often limited by the poor quality of the basic data.** SAMSON, developed by the Rand Corporation, is one such case. By at least one account noted in 1968, the quality of data from the Air Force's AFM 66-1 system*** was so poor that it was unable to support the simulations. (Ten years later, when this author had occasion to try to use the same 66-1 data, inconsistencies and incompleteness of the same data frustrated the analysis.)

All too often, simulation models prove the adage, "garbage-in/garbage-out." The usefulness of a model may well be limited by inability to obtain reliable data with which to estimate its parameters. The analyst needs to give as much attention to the data he "feeds" his model as to

* See Richard J. Niehaus, Computer Assisted Human Resources Planning, (New York: John Wiley & Sons; 1979).

** For a comprehensive review of simulation models in which human performance plays an important part see, A.I. Siegel and J.J. Wolf, "Digital Behavioral Simulation--State-of-the-Art and Implications," Applied Psychological Services, Inc., Wayne, Pennsylvania, 1982.

*** Chauncy F. Bell, "SAMSON: A Logistics Simulation," in E.S. Quade and W.I. Boucher, eds., Systems Analysis and Policy Planning, (New York: American Elsevier Publishing Company, Inc., 1968).

the model itself. When someone offers a source of data which reportedly collects everything for all subjects, as the 66-1 data does for Air Force and 3M data for the Navy, a wise analyst will run and hide. In general, there is nothing so useless as an unreliable census. A carefully controlled and managed sample will almost always provide more reliable and usable information than an undisciplined census.

A more common approach to developing manpower requirements falls under the heading of industrial engineering. Commonly, multiple regression statistical techniques are used to establish the relationship between work performed/output produced and the observed level of employment. Data used in the statistical analysis reflect the observed variation in the output and employment levels across a given type of unit, or over time, or both. Here lies a major problem. Having a statistically derived manpower factor that relates, for example, engine overhauls to manpower required is of only limited use to manpower planners. Planners must also identify the factors that determine the number of overhauls that will be performed in a given period.

Attempts have been made to develop comprehensive planning systems for manpower requirements. The Navy's Manpower Mobilization System (NAMMOS) is a computer-assisted manpower system used by Navy planners and programmers to determine scenario-dependent requirement for mobilization manpower. Industrial engineering workload algorithms, however, account for only 54 percent of the Navy's mobilization manpower requirement. Fixed manning tables account for 28 percent of the manpower, with 18 percent of the total requirement related to policy judgment.

A serious problem with both simulation models and industrial engineering statistical relationships as tools for determining manpower requirements is their general and often implicit assumption that the total manpower requirement is a direct function of the amount of work to be done, no consideration being given to the possibility of combining different types of labor to produce the same level of output at a different--and often lower--cost. Important questions of labor-labor substitutions are generally ignored.

An important application of economic research to questions of manpower requirements is use of the Constant Elasticity of Substitution (CES) production function and estimates of enlisted personnel productivity for a number of military occupations. Specifically, recent studies show the possibilities of increasing productivity with different mixes of labor. In general, higher skill occupations tend to overutilize first-termers, and lower-skill occupations tend to underutilize them. Moreover, though the present overall ratio of first-termers to career people falls within the range that would be selected on the basis of economic efficiency, the distributions within specific occupations are not.*

* See Mark J. Albrecht, Labor Substitution in the Military Environment: Implications for Enlisted Force Management, R-2330-MRAL, Nov 1979, Rand Corporation, and Glenn Gatz and C. Robert Roll, Defense Resource Management Study Supporting Papers: The First-Term Career Mix of Enlisted Military Personnel, Feb 1979.

Personnel Models

One traditional feature of military personnel systems is that it has an "in-at-the-bottom, up-through-the-ranks" structure. These systems are frequently modeled as a Markovian process, where movement through the system is determined by a set of transitional probabilities.* These probabilities are either explicit policies--only a specified percentage of a cohort will be allowed to pass to the next year--or averages of observed behavior over time. In general application today, personnel planners and managers use three kinds of models: steady state, dynamic, and transition.

The most common model is the static or steady-state model, in which the entire flow system is in equilibrium; i.e., the total number of people who enter the system is equal to the number who leave. Although such models help us understand the long-run effects of policy changes on personnel profiles, they do not show how today's personnel profile will look next year, if the transition probabilities are modified, directly by policy or indirectly through incentives and behavior.

* See Richard C. Grinold and Kneale T. Marshall, Manpower Planning Models, (New York: North Holland, 1977), and J.W. Merck and K. Hall, A Markovian Flow Model: The Analysis of Movement in Large-Scale (Military) Personnel Systems, Rand Corporation, R-514-PR, Feb 1971.

Dynamic model takes a given, non-equilibrium distribution of personnel and applies a Markovian process to obtain a new personnel profile for a specific period in the future. Thus, though the steady-state/equilibrium solution is not calendar specific, the results of a dynamic model do change from period to period.

In real-world applications, desirable steady-state policy solutions are often rejected when the near-term effects, as determined by applying the policies through a dynamic model, are shown to be unacceptable. An example is the analysis of alternative retirement systems developed by the President's Commission on Military Compensation. The steady-state analysis of alternative systems showed the benefits of proposed changes in the retirement rules. But, applying the new policies to the existing force, as was done in a dynamic analysis, revealed the magnitude of the increases in near-term costs associated with the proposals. The proposals were never adopted.

In recent years, transition models have gained in importance. The Army's ELIM-COMPLIP system and the Navy's ADSTAP program are such goal-linear programming models. They incorporate constraints and objective functions, such as manpower requirements and budget ceilings,* and are used to help formulate personnel policies and monitor progress against

* See A. Charnes and W.W. Cooper, Management Models and Industrial Application of Linear Programming, (New York: Wiley 1961).

goals, budgets, and force levels.* They are designed to describe the force structure that will come closest to satisfying a given set of manpower requirements given existing personnel constraints. Such applications are useful in the development of "optimal" combinations of policies that deal with a number of real-world constraints simultaneously.

Assignment Models

Manpower models are designed to help personnel planners determine the numbers and types of people needed to perform specific tasks. Personnel models are used to predict the likely outcomes of changes in a personnel policy. Assignment models, by contrast, are designed to match given individuals with given jobs in such a way as to maximize some objective function, subject to a set of constraints.

As used today, assignment models are employed in the initial classification and assignment process, as well as the reassignment of individuals. Examples of the former are the Air Force's PROMIS/PJM system, the Navy's PRIDE/CLASP system and the Army's REQUEST/PIM system. As structured, these models match men and jobs/school seats. They often consider the attributes of assignees, their preferences, and the goals of the Service.

* For a brief discussion of the use of ELIM, see: Betty W. Holtz and James M. Worth, "The Army's Approach to Improved Strength Forecasting," Defense Management Journal, Vol. 18, No. 2.

It should be noted that these matches are not optimal over time. A specific match depends on the time that an individual, billet, or school seat is entered into the model, as well as matches performed. The Army recently proposed a multiyear, multimillion-dollar program to expand the present personnel allocation/assignment system and develop a new one that will more than match recruits against the minimum eligibility requirements for job/school seats. Noting the sequential nature of the personnel process, the Army wants to expand its assignment models to be able also to look ahead and answer such questions as these: (a) What is the effect of filling a training seat with a minimally qualified volunteer? (b) What is the "cost" of deliberately leaving a training seat empty? and (c) What is the probability that a more qualified person will become available to fill some specific training seat in the next 24 hours somewhere in the U.S.?

A word of caution for those who develop assignment models: If such models are to be used, they must recognize that their subjects are human, not inanimate, and that people intervene in the assignment process. Many technically elegant models are never used because they are too mechanistic in their approach. Models can help in the assignment process. However, it is not realistic to believe that assignments can be made by computer without human intervention.

Training

The last human resource to consider is training. It can be argued that everything undertaken by the military in preparation for war is training. Though this is generally correct, distinguishing among types of training is useful:

- o Formal training of individuals usually takes place in a dedicated schoolhouse setting, e.g., basic training and initial skill training.
- o Unit/crew training sometimes takes place in established training environments but is also part of fleet and unit training exercises.
- o On-the-job training is incidental to everyday work.
- o Formal and informal skill progression training is among the requirements for promotion.

The magnitude and diversity of the Department of Defense's training suggest the potential range of models of various kinds. Manpower models help planners determine the numbers of instructors and support personnel needed to train a given number of personnel. Assignment models help make sure that people with a given set of attributes are assigned to specific courses of instruction. Scheduling models help insure the smooth flow of students through the "training pipeline." Simulation

models have been developed to help course planners judge the effects of alternative course design, equipment levels, instructor manning, and student flow rates on the operation of the training system.*

Future Development of Human Resource Models

Earlier, human resource models were considered along the standard lines of manpower, personnel, assignment, and training. Future work will surely refine and extend models in each of these areas. The more innovative modelers, however, are increasingly aware that the functions and activities of the various organizations charged with managing human resources are intimately related. Decisions to change a training curriculum will result in changing work patterns and be reflected in changes in the statements of manpower requirements. Changes in retention patterns affect personnel policies, manpower requirements, and the ability of individual units to conduct on-the-job training.

Although every Service has combined manpower and personnel under a single Deputy Chief of Staff, little has been done to develop an integrated system. The existence of such tools as the CES production function and its lack of use by Service planners to explore alternative

* Polly Carpenter-Huffman, "MODIA: Overview of a Tool for Planning the Use of Air Force Training Resources," R-1700-AF, Rand Corporation, Mar 1977.

manpower and personnel structures reflect the continuing fragmentation among the various human resource subsystems.*

A second factor a future model builder should consider is how his model will be used. In any year, many more human resource models are developed than are actually used by the Services in the planning or management of personnel. All too often, the modeler develops an elegant technical model, only to find that it is not relevant to the management process he was supposedly trying to affect.

The case of MODIA provides an important lesson. MODIA was designed to help Training Command personnel examine the details of course design and course operation during the planning stage of the process of instruction system development. Though MODIA was a technical success, it was never used by the Air Force. MODIA reflected the desire of the Air Force leadership to search out cost-effective alternatives. But, it was designed to be used at a local training center during the development of a curriculum. Unfortunately, no one--neither Air Force leadership nor MODIA's developers--asked whether those who were to use the new tool had any incentive to search out alternatives. A 1974 field test of MODIA

* A notable exception is the work by S. Craig Moore to describe and model basic interactions of the Air Force's manpower, personnel, and training systems. See Bruce Armstrong and S. Craig Moore, Air Force Manpower, Personnel, and Training: Roles and Interactions, R-2429-AF, Rand Corporation, June 1980, and B.E. Armstrong, S.W. Chapel and S.C. Moore, Air Force Manpower, Personnel, and Training System: Vol. II--Analysis of the Enlisted Authorization/Assignment and Manpower Requirements Personnel Objectives Subsystems, N-1476-AF, Rand Corporation, May 1980.

revealed that course planners did not operate in an environment of constrained resources and tended to game MODIA to justify the course designs they favored.

The Air Force leadership which commissioned MODIA and supported its development, never understood the incentive structure of those who would use it. The developers of MODIA did not understand how their model would fit into the management structure of the Air Training Command. The question of implementation was addressed only after the model was developed. If adequate attention had been paid earlier, a different--and one hopes--more useful product might have been developed.

The experience of MODIA is a good way to end our discussion of human resource models. These models are generally used to manage people. Substantial bureaucratic structures have been built up to perform the personnel, manpower, training, and assignment functions. Models and modelers who support these organizations must not only be skilled technicians but must also understand how a specific model fits into the larger often implicit, human resource system and must be aware of the incentives of those who will use their models.

CNA PROFESSIONAL PAPERS - 1978 TO PRESENT*

- PP 211
Mizrahi, Maurice M., "On Approximating the Circular Coverage Function," 14 pp., Feb 1978, AD A054 429
- PP 212
Mangel, Marc, "On Singular Characteristic Initial Value Problems with Unique Solution," 20 pp., Jun 1978, AD A058 535
- PP 213
Mangel, Marc, "Fluctuations in Systems with Multiple Steady States. Application to Lancheater Equations," 12 pp., Feb 78 (Presented at the First Annual Workshop on the Information Linkage Between Applied Mathematics and Industry, Naval PG School, Feb 23-25, 1978), AD A071 472
- PP 214
Weinland, Robert G., "A Somewhat Different View of The Optimal Naval Posture," 37 pp., Jun 1978 (Presented at the 1976 Convention of the American Political Science Association (APSA/IUS Panel on "Changing Strategic Requirements and Military Posture"), Chicago, Ill., September 2, 1976), AD A056 228
- PP 215
Colle, Russell C., "Comments on: Principles of Information Retrieval by Manfred Kochen," 10 pp., Mar 78 (Published as a Letter to the Editor, Journal of Documentation, Vol. 31, No. 4, pages 298-301), December 1975), AD A054 426
- PP 216
Colle, Russell C., "Lotka's Frequency Distribution of Scientific Productivity," 18 pp., Feb 1978 (Published in the Journal of the American Society for Information Science, Vol. 28, No. 6, pp. 366-370, November 1977), AD A054 425
- PP 217
Colle, Russell C., "Bibliometric Studies of Scientific Productivity," 17 pp., Mar 78 (Presented at the Annual meeting of the American Society for Information Science held in San Francisco, California, October 1976), AD A054 442
- PP 218 - Classified
- PP 219
Huntzinger, R. LeVar, "Market Analysis with Rational Expectations: Theory and Estimation," 60 pp., Apr 78, AD A054 422
- PP 220
Maurer, Donald E., "Diagonalization by Group Matrices," 26 pp., Apr 78, AD A054 443
- PP 221
Weinland, Robert G., "Superpower Naval Diplomacy in the October 1973 Arab-Israeli War," 76 pp., Jun 1978 (Published in Seapower in the Mediterranean: Political Utility and Military Constraints, The Washington Papers No. 61, Beverly Hills and London: Sage Publications, 1979) AD A055 564
- PP 222
Mizrahi, Maurice M., "Correspondence Rules and Path Integrals," 30 pp., Jun 1978 (Invited paper presented at the CNRS meeting on "Mathematical Problems in Feynman's Path Integrals," Marseille, France, May 22-26, 1978) (Published in Springer Verlag Lecture Notes in Physics, 106, (1979), 234-253) AD A055 536
- PP 223
Mangel, Marc, "Stochastic Mechanics of Molecule Molecule Reactions," 21 pp., Jun 1978, AD A056 227
- PP 224
Manger, Marc, "Aggregation, Bifurcation, and Extinction in Exploited Animal Populations," 48 pp., Mar 1978, AD A058 536
*Portions of this work were started at the Institute of Applied Mathematics and Statistics, University of British Columbia, Vancouver, B.C., Canada
- PP 225
Mangel, Marc, "Oscillations, Fluctuations, and the Hopf Bifurcation," 43 pp., Jun 1978, AD A058 537
*Portions of this work were completed at the Institute of Applied Mathematics and Statistics, University of British Columbia, Vancouver, Canada.
- PP 226
Raiston, J. M. and J. W. Marz, "Temperature and Current Dependence of Degradation in Red-Emitting GaP LEDs," 34 pp., Jun 1978 (Published in Journal of Applied Physics, 50, 3630, May 1979) AD A058 538
*Bell Telephone Laboratories, Inc.
- PP 227
Mangel, Marc, "Uniform Treatment of Fluctuations at Critical Points," 50 pp., May 1978, AD A058 539
- PP 228
Mangel, Marc, "Relaxation at Critical Points: Deterministic and Stochastic Theory," 54 pp., Jun 1978, AD A058 540
- PP 229
Mangel, Marc, "Diffusion Theory of Reaction Rates, I: Formulation and Einstein-Smoluchowski Approximation," 50 pp., Jan 1978, AD A058 541
- PP 230
Mangel, Marc, "Diffusion Theory of Reaction Rates, II Ornstein-Uhlenbeck Approximation," 34 pp., Feb 1978, AD A058 542
- PP 231
Wilson, Desmond P., Jr., "Naval Projection Forces: The Case for a Responsive MAF," Aug 1978, AD A054 543
- PP 232
Jacobson, Louis, "Can Policy Changes Be Made Acceptable to Labor?" Aug 1978 (Submitted for publication in Industrial and Labor Relations Review), AD A061 528

*CNA Professional Papers with an AD number may be obtained from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22151. Other papers are available from the Management Information Office, Center for Naval Analyses, 2000 North Beauregard Street, Alexandria, Virginia 22311. An Index of Selected Publications is also available on request. The index includes a Listing of Professional Papers; with abstracts; issued from 1969 to June 1981.

- PP 233
Jacobson, Louis, "An Alternative Explanation of the Cyclical Pattern of Quits," 23 pp., Sep 1978
- PP 234 - Revised
Jondrow, James and Levy, Robert A., "Does Federal Expenditure Displace State and Local Expenditure: The Case of Construction Grants," 25 pp., Oct 1979, AD A061 529
- PP 235
Mizrahi, Maurice M., "The Semiclassical Expansion of the Anharmonic-Oscillator Propagator," 41 pp., Oct 1978 (Published in Journal of Mathematical Physics 20 (1979) pp. 844-855), AD A061 538
- PP 237
Maurer, Donald, "A Matrix Criterion for Normal Integral Bases," 10 pp., Jan 1979 (Published in the Illinois Journal of Mathematics, Vol. 22 (1978), pp. 672-681)
- PP 238
Utgoff, Kathleen Classen, "Unemployment Insurance and the Employment Rate," 20 pp., Oct 1978 (Presented at the Conference on Economic Indicators and Performance: The Current Dilemma Facing Government and Business Leaders, presented by Indiana University Graduate School of Business). AD A061 527
- PP 239
Trost, R. P. and Warner, J. T., "The Effects of Military Occupational Training on Civilian Earnings: An Income Selectivity Approach," 38 pp., Nov 1979k, AD A077 831
- PP 240
Powers, Bruce, "Goals of the Center for Naval Analyses," 13 pp., Dec 1978, AD A063 759
- PP 241
Mangel, Marc, "Fluctuations at Chemical Instabilities," 24 pp., Dec 1978 (Published in Journal of Chemical Physics, Vol. 69, No. 8, Oct 15, 1978). AD A063 787
- PP 242
Simpson, William R., "The Analysis of Dynamically Interactive Systems (Air Combat by the Numbers)," 160 pp., Dec 1978, AD A063 760
- PP 243
Simpson, William R., "A Probabilistic Formulation of Murphy Dynamics as Applied to the Analysis of Operational Research Problems," 18 pp., Dec 1978, AD A063 761
- PP 244
Sherman, Allan and Horowitz, Stanley A., "Maintenance Costs of Complex Equipment," 20 pp., Dec 1978 (Published By The American Society of Naval Engineers, Naval Engineers Journal, Vol. 91, No. 6, Dec 1979) AD A071 473
- PP 245
Simpson, William R., "The Accelerometer Methods of Obtaining Aircraft Performance from Flight Test Data (Dynamic Performance Testing)," 403 pp., Jun 1979, AD A075 226
- PP 246
Brechtling, Frank, "Layoffs and Unemployment Insurance," 35 pp., Feb 1979 (Presented at the Nber Conference on "Low Income Labor Markets," Chicago, Jun 1978), AD A096 629
- PP 248
Thomas, James A., Jr., "The Transport Properties of Dilute Gases in Applied Fields," 183 pp., Mar 1979, AD A096 464
- PP 249
Glasser, Kenneth S., "A Secretary Problem with a Random Number of Choices," 23 pp., Mar 1979
- PP 250
Mangel, Marc, "Modeling Fluctuations in Macroscopic Systems," 26 pp., Jun 1979
- PP 251
Trost, Robert P., "The Estimation and Interpretation of Several Selectivity Models," 37 pp., Jun 1979, AD A075 941
- PP 252
Nunn, Walter R., "Position Finding with Prior Knowledge of Covariance Parameters," 5 pp., Jun 1979 (Published in IEEE Transactions on Aerospace & Electronic Systems, Vol. AES-15, No. 3, Mar 1979)
- PP 253
Glasser, Kenneth S., "The d-Choice Secretary Problem," 32 pp., Jun 1979, AD A075 225
- PP 254
Mangel, Marc and Quenbeck, David B., "Integration of a Bivariate Normal Over an Offset Circle," 14 pp., Jun 1979, AD A096 471
- PP 255 - Classified, AD B051 441L
- PP 256
Maurer, Donald E., "Using Personnel Distribution Models," 27 pp., Feb 1980, AD A082 218
- PP 257
Thaler, R., "Discounting and Fiscal Constraints: Why Discounting is Always Right," 10 pp., Aug 1979, AD A075 224
- PP 258
Mangel, Marc S. and Thomas, James A., Jr., "Analytical Methods in Search Theory," 86 pp., Nov 1979, AD A077 832
- PP 259
Glass, David V.; Hsu, Ih-Ching; Nunn, Walter R., and Perin, David A., "A Class of Commutative Markov Matrices," 17 pp., Nov 1979, AD A077 833
- PP 260
Mangel, Marc S. and Oope, Davis K., "Detection Rate and Sweep Width in Visual Search," 14 pp., Nov 1979, AD A077 834
- PP 261
Villa, Carlos L.; Zvijac, David J. and Ross, John, "Franck-Condon Theory of Chemical Dynamics. VI. Angular Distributions of Reaction Products," 14 pp., Nov 1979 (Reprinted from Journal Chemical Phys. 70(12), 15 Jun 1979), AD A076 287
- PP 262
Petersen, Charles C., "Third World Military Elites in Soviet Perspective," 50 pp., Nov 1979, AD A077 835
- PP 263
Robinson, Kathy L., "Using Commercial Tankers and Container-ships for Navy Underway Replenishment," 25 pp., Nov 1979, AD A077 836

- PP 264
Weinland, Robert G., "The U.S. Navy in the Pacific: Past, Present, and Glimpses of the Future," 31 pp., Nov 1979 (Delivered at the International Symposium on the Sea, sponsored by the International Institute for Strategic Studies, The Brookings Institution and the Yomiuri Shimbun, Tokyo, 16-20 Oct 1978) AD A066 837
- PP 265
Weinland, Robert G., "War and Peace in the North: Some Political Implications of the Changing Military Situation in Northern Europe," 18 pp., Nov 1979 (Prepared for presentation to the Conference of the Nordic Balance in Perspective: The Changing Military and Political Situation," Center for Strategic and International Studies, Georgetown University, Jun 15-16, 1978) AD A077 838
- PP 266
Utgoff, Kathy Classen, and Brechling, Frank, "Taxes and Inflation," 25 pp., Nov 1979, AD A081 194
- PP 267
Trost, Robert P., and Vogel, Robert C., "The Response of State Government Receipts to Economic Fluctuations and the Allocation of Counter-Cyclical Revenue Sharing Grants," 12 pp., Dec 1979 (Reprinted from the Review of Economics and Statistics, Vol. LXI, No. 3, August 1979)
- PP 268
Thomason, James S., "Seaport Dependence and Inter-State Cooperation: The Case of Sub-Saharan Africa," 141 pp., Jan 1980, AD A081 193
- PP 269
Weiss, Kenneth G., "The Soviet Involvement in the Ogaden War," 42 pp., Jan 1980 (Presented at the Southern Conference on Slavic Studies in October, 1979), AD A082 219
- PP 270
Remnek, Richard, "Soviet Policy in the Horn of Africa: The Decision to Intervene," 52 pp., Jan 1980 (To be published in "The Soviet Union in the Third World: Success or Failure," ed. by Robert H. Donaldson, Westview Press, Boulder, Co., Summer 1980), AD A081 195
- PP 271
McConnell, James, "Soviet and American Strategic Doctrines: One More Time," 43 pp., Jan 1980, AD A081 192
- PP 272
Weiss, Kenneth G., "The Azores in Diplomacy and Strategy, 1940-1945," 46 pp., Mar 1980, AD A085 094
- PP 273
Nakada, Michael K., "Labor Supply of Wives with Husbands Employed Either Full Time or Part Time," 39 pp., Mar 1980, AD A082 220
- PP 274
Nunn, Walter R., "A Result in the Theory of Spiral Search," 9 pp., Mar 1980
- PP 275
Goldberg, Lawrence, "Recruiters Advertising and Navy Enlistments," 34 pp., Mar 1980, AD A082 221
- PP 276
Goldberg, Lawrence, "Delaying an Overhaul and Ship's Equipment," 40 pp., May 1980, AD A085 095
- PP 277
Mangel, Marc, "Small Fluctuations in Systems with Multiple Limit Cycles," 19 pp., Mar 1980 (Published in SIAM J. Appl. Math., Vol. 38, No. 1, Feb 1980) AD A086 229
- PP 278
Mizrachi, Maurice, "A Targeting Problem: Exact vs. Expected-Value Approaches," 23 pp., Apr 1980, AD A085 096
- PP 279
Walt, Stephen M., "Causal Inferences and the Use of Force: A Critique of Force Without War," 50 pp., May 1980, AD A085 097
- PP 280
Goldberg, Lawrence, "Estimation of the Effects of A Ship's Steaming on the Failure Rate of Its Equipment: An Application of Econometric Analysis," 25 pp., Apr 1980, AD A085 098
- PP 281
Mizrachi, Maurice M., "Comment on 'Discretization Problems of Functional Integrals in Phase Space'," 2 pp., May 1980, published in "Physical Review D", Vol. 22 (1980), AD A094 994
- PP 283
Dismukes, Bradford, "Expected Demand for the U.S. Navy to Serve as An Instrument of U.S. Foreign Policy: Thinking About Political and Military Environmental Factors," 30 pp., Apr 1980, AD A085 099
- PP 284
J. Kellison,* W. Nunn, and U. Sumita,** "The Laguerre Transform," 119 pp., May 1980, AD A085 100
*The Graduate School of Management, University of Rochester and the Center for Naval Analyses
**The Graduate School of Management, University of Rochester
- PP 285
Remnek, Richard B., "Superpower Security Interests in the Indian Ocean Area," 26 pp., Jun 1980, AD A087 113
- PP 286
Mizrachi, Maurice M., "On the WKB Approximation to the Propagator for Arbitrary Hamiltonians," 25 pp., Aug 1980 (Published in Journal of Math. Phys., 22(1) Jan 1981), AD A091 307
- PP 287
Cope, Davis, "Limit Cycle Solutions of Reaction-Diffusion Equations," 35 pp., Jun 1980, AD A087 114
- PP 288
Golman, Walter, "Don't Let Your Slides Flip You: A Painless Guide to Visuals That Really Aid," 28 pp., (revised Aug 1982), AD A092 732
- PP 289
Robinson, Jack, "Adequate Classification Guidance - A Solution and a Problem," 7 pp., Aug 1980, AD A091 212
- PP 290
Watson, Gregory H., "Evaluation of Computer Software in an Operational Environment," 17 pp., Aug 1980, AD A091 213
- PP 291
Maddala, G. S.* and Trost, R. P., "Some Extensions of the Nerlove Press Model," 17 pp., Oct 1980, AD A091 946
*University of Florida

- PP 292
Thomes, James A., Jr., "The Transport Properties of Binary Gas Mixtures in Applied Magnetic Fields," 10 pp., Sept 1980 (Published in Journal of Chemical Physics 72(10), 15 May 1980)
- PP 293
Thomes, James A., Jr., "Evaluation of Kinetic Theory Collision Integrals Using the Generalized Phase Shift Approach," 12 pp., Sept 1980 (Printed in Journal of Chemical Physics 72(10), 15 May 1980)
- PP 294
Roberts, Stephen S., "French Naval Policy Outside of Europe," 30 pp., Sept 1980 (Presented at the Conference of the Section on Military Studies, International Studies Association Kiawah Island, S.C.), AD A091 306
- PP 295
Roberts, Stephen S., "An Indicator of Informal Empire: Patterns of U.S. Navy Cruising on Overseas Stations, 1869-1897," 40 pp., Sept 1980 (Presented at Fourth Naval History Symposium, US Naval Academy, 26 October 1979, AD A091 316)
- PP 296
Dismukes, Bradford and Petersen, Charles C., "Maritime Factors Affecting Iberian Security," (Factores Maritimos Que Afectan La Seguridad Ibeica) 14 pp., Oct 1980, AD A092 733
- PP 297 - Classified
- PP 298
Mizrahi, Maurice M., "A Markov Approach to Large Missile Attacks," 31 pp., Jan 1981, AD A096 159
- PP 299
Jondrow, James M. and Levy, Robert A., "Wage Leadership in Construction, 19 pp., Jan 1981, AD A094 797
- PP 300
Jondrow, James and Schmidt, Peter,* "On the Estimation of Technical Inefficiency in the Stochastic Frontier Production Function Model," 11 pp., Jan 1981, AD A096 160
*Michigan State University
- PP 301
Jondrow, James M., Levy, Robert A. and Hughes, Claire, "Technical Change and Employment in Steel, Autos, Aluminum, and Iron Ore, 17 pp., Mar 1981, AD A099 394
- PP 302
Jondrow, James M. and Levy, Robert A., "The Effect of Imports on Employment Under Rational Expectations," 19 pp., Apr 1981, AD A099 392
- PP 303
Thomson, James, "The Rarest Commodity in the Coming Resource Wars," 3 pp., Aug 1981 (Published in the Washington Star, April 13, 1981)
- PP 304
Duffy, Michael K.; Greenwood, Michael J.* and McDowell, John M.,** "A Cross-Sectional Model of Annual Interregional Migration and Employment Growth: Intertemporal Evidence of Structural Change, 1958-1975," 31 pp., Apr 1981, AD A099 393
*University of Colorado
**Arizona State University
- PP 305
Nunn, Laura H., "An Introduction to the Literature of Search Theory," 32 pp., Jun 1981
- PP 306
Anger, Thomas E., "What Good Are Warfare Models?" 7 pp., May 1981
- PP 307
Thomson, James, "Dependence, Risk, and Vulnerability," 43 pp., Jun 1981
- PP 308
Mizrahi, M.M., "Correspondence Rules and Path Integrals," Jul 1981. Published in "Nuovo Cimento B", Vol. 61 (1981)
- PP 309
Weinland, Robert G., "An (The?) Explanation of the Soviet Invasion of Afghanistan," 44 pp., May 1981
- PP 310
Stanford, Janette M. and Tai Te Wu,* "A Predictive Method for Determining Possible Three-dimensional Foldings of Immunoglobulin Backbones Around Antibody Combining Sites," 19 pp., Jun 1981 (Published in J. theor. Biol. (1981) 88, 421-439
*Northwestern University, Evanston, IL
- PP 311
Bowes, Marianne, Brechling, Frank P. R., and Utgoff, Kathleen P. Classen, "An Evaluation of UI Funds," 13 pp., May 1981 (Published in National Commission on Unemployment Compensation's Unemployment Compensation: Studies and Research, Volume 2, July 1980)
- PP 312
Jondrow, James; Bowes, Marianne and Levy, Robert, "The Optimum Speed Limit," 23 pp., May 1981
- PP 313
Roberts, Stephen S., "The U.S. Navy in the 1980s," 36 pp., Jul 1981
- PP 314
Jehn, Christopher; Horowitz, Stanley A. and Lockman, Robert F., "Examining the Draft Debate," 20 pp., Jul 1981
- PP 315
Buck, Ralph V., Capt., "Le Catastrophe by any other name...", 4 pp., Jul 1981
- PP 316
Roberts, Stephen S., "Western European and NATO Navies, 1980," 20 pp., Aug 1981
- PP 317
Roberts, Stephen S., "Superpower Naval Crisis Management in the Mediterranean," 35 pp., Aug 1981
- PP 318
Vego, Milan N., "Yugoslavia and the Soviet Policy of Force in the Mediterranean Since 1961," 187 pp., Aug 1981
- PP 319
Smith, Michael W., "Anti-air Warfare Defense of Ships at Sea," 46 pp., Sep 1981 (This talk was delivered at the Naval Warfare System and Technology Conference of the American Institute of Aeronautics and Astronautics in Washington on December 12, 1980; in Boston on January 20, 1981; and in Los Angeles on June 12, 1981.)

- PP 320
Trost, R. P.; Lurie, Philip and Berger, Edward. "A Note on Estimating Continuous Time Decision Models," 15 pp., Sep 1981
- PP 321
Duffy, Michael K. and Ladman, Jerry R., "The Simultaneous Determination of Income and Employment in United States--Mexico Border Region Economies," 34 pp., Sep 1981
*Associate Professor of Economics, Arizona State University, Tempe, AZ.
- PP 322
Warner, John T., "Issues in Navy Manpower Research and Policy: An Economist's Perspective," 66 pp., Dec 1981
- PP 323
Bomse, Frederick M., "Generation of Correlated Log-Normal Sequences for the Simulation of Clutter Echoes," 33 pp., Dec 1981
- PP 324
Horowitz, Stanley A., "Quantifying Seapower Readiness," 6 pp., Dec 1981 (Published in Defense Management Journal, Vol. 18, No. 2)
- PP 326
Roberts, Stephen S., "Western European and NATO Navies, 1981," 27 pp., Jul 1982
- PP 327
Hammon, Colin, Capt., USN and Graham, David R., Dr., "Estimation and Analysis of Navy Shipbuilding Program Disruption Costs," 12 pp., Mar 1980
- PP 328
Weinland, Robert G., "Northern Waters: Their Strategic Significance," 27 pp., Dec 1980
- PP 329
Mangel, Marc, "Applied Mathematicians And Naval Operators," 40 pp., Mar 1982 (Revised)
- PP 330
Lockman, Robert F., "Alternative Approaches to Attrition Management," 30 pp., Jan 1982
- PP 331
Roberts, Stephen S., "The Turkish Straits and the Soviet Navy In the Mediterranean," 15 pp., Mar 1982 (Published in Navy International)
- PP 332
Jehn, Christopher, "The RDF and Amphibious Warfare," 36 pp., Mar 1982
- PP 333
Lee, Lung-Fel and Trost, Robert P., "Estimation of Some Limited Dependent Variable Models with Application to Housing Demand," 26 pp., Jan 1982. (Published in Journal of Econometrics 8 (1978) 357-382)
- PP 334
Kenny, Lawrence W., Lee, Lung-Fel, Maddala, G. S., and Trost R. P., "Returns to College Education: An Investigation of Self-Selection Bias Based on the Project Talent Data," 15 pp., Jan 1982. (Published in International Economic Review, Vol. 20, No. 3, October 1979)
- PP 335
Lee, Lung-Fel, G.S. Maddala, and R. P. Trost, "Asymptotic Covariance Matrices of Two-Stage Probit and Two-Stage Tobit Methods for Simultaneous Equations Models with Selectivity," 13 pp., Jan 1982. (Published in Econometrica, Vol. 48, No. 2 (March, 1980))
- PP 336
O'Neill, Thomas, "Mobility Fuels for the Navy," 13 pp., Jan 1982. (Accepted for publication in Naval Institute Proceedings)
- PP 337
Warner, John T. and Goldberg, Matthew S., "The Influence of Non-Pecuniary Factors on Labor Supply," 23 pp., Dec 1981
- PP 339
Wilson, Desmond P., "The Persian Gulf and the National Interest," 11 pp., Feb 1982
- PP 340
Lurie, Philip, Trost, R. P., and Berger, Edward, "A Method for Analyzing Multiple Spell Duration Data," 34 pp., Feb 1982
- PP 341
Trost, Robert P. and Vogel, Robert C., "Prediction with Pooled Cross-Section and Time-Series Data: Two Case Studies," 6 pp., Feb 1982
- PP 342
Lee, Lung-Fel, Maddala, G. S., and Trost, R. P., "Testing for Structural Change by D-Methods in Switching Simultaneous Equations Models," 5 pp., Feb 1982
- PP 343
Goldberg, Matthew S., "Projecting the Navy Enlisted Force Level," 9 pp., Feb 1982
- PP 344
Fletcher, Jean, W., "Navy Quality of Life and Reenlistment," 13 pp., Nov 1981
- PP 345
Utgoff, Kathy and Thaler, Dick, "The Economics of Multi Year Contracting," 47 pp., Mar 1982. (Presented at the 1982 Annual Meeting of the Public Choice Society, San Antonio, Texas, March 5-7, 1982)
- PP 346
Rostker, Bernard, "Selective Service and the All-Volunteer Force," 23 pp., Mar 1982
- PP 347
McConnell, James, M., "A Possible Counterforce Role for the Typhoon," 24 pp., Mar 1982
- PP 348
Jondrow, James, Trost, Robert, "An Empirical Study of Production Inefficiency in the Presence of Errors-in-The-Variables," 14 pp., Feb 1982
- PP 349
W. H. Breckenridge, O. Kim Malmin, "Collisional Intramultiplet Relaxation of Cd(5s5p³P_{0,1,2}) by Alkane Hydrocarbons," 7 pp., Jul 1981. (Published in Journal of Chemical Physics, 76(4), 15 Feb 1982)

PP 350

Levin, Marc, "A Method for Increasing the Firepower of Virginia Class Cruisers," 10 pp., Apr 1982. (To be published in U.S. Naval Institute Proceedings)

PP 351

Coutre, S. E.; Stanford, J. M.; Hovis, J. G.; Stevens, P. W.; Wu, T. T., "Possible Three-Dimensional Backbone Folding Around Antibody Combining Site of Immunoglobulin MOPC 167," 18 pp., Apr 1982. (Published in Journal of Theoretical Biology)

PP 352

Barfoot, C. Bernard, "Aggregation of Conditional Absorbing Markov Chains," 7 pp., June 1982 (Presented to the Sixth European Meeting on Cybernetics and Systems Research, held at the University of Vienna, Apr 1982.)

PP 353

Barfoot, C. Bernard, "Some Mathematical Methods for Modeling the Performance of a Distributed Data Base System," 18 pp., June 1982. (Presented to the International Working Conference on Model Realism, held at Bad Honnek, West Germany, Apr 1982.)

PP 354

Hell, John V., "Why the Short-War Scenario is Wrong for Naval Planning," 6 pp., Jun 1982.

PP 356

Cyike, Steven; Goldberg, Matthew S.; Hogan, Paul; Malis, Lee; "Estimation of the Personal Discount Rate: Evidence from Military Reenlistment Decisions," 19 pp., Apr 1982.

PP 357

Goldberg, Matthew S., "Discrimination, Nepotism, and Long-Run Wage Differentials," 13 pp., Sep 1982. (Published in Quarterly Journal of Economics, May 1982.)

PP 358

Akst, George, "Evaluating Tactical Command And Control Systems--A Three-Tiered Approach," 12 pp., Sep 1982.

PP 361

Quanbeck, David B., "Methods for Generating Aircraft Trajectories," 51 pp., Sep 1982.

PP 362

Horowitz, Stanley A., "Is the Military Budget Out of Balance?," 10 pp., Sep 1982.

PP 363

Marcus, A. J., "Personnel Substitution and Navy Aviation Readiness," 35 pp., Oct 1982.

PP 366

Spruill, Nancy L.; Gastwirth, Joseph L., "On the Estimation of the Correlation Coefficient From Grouped Data," 9 pp., Oct 1982. (Published in the Journal of the American Statistical Association, Sep 1982, Vol. 77, No. 379, Theory and Methods Section.)

PP 370

Rostker, Bernard D., "Human Resource Models: An Overview," 17 pp., Nov 1982.

END

FILMED

2-83

DTIC