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OPERATIONS MODELING FOR ARMY MOBILIZATION(U)
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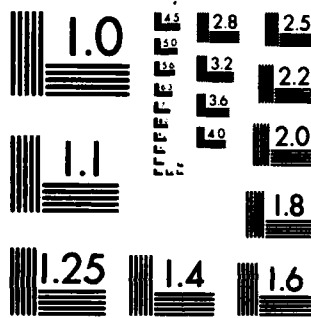
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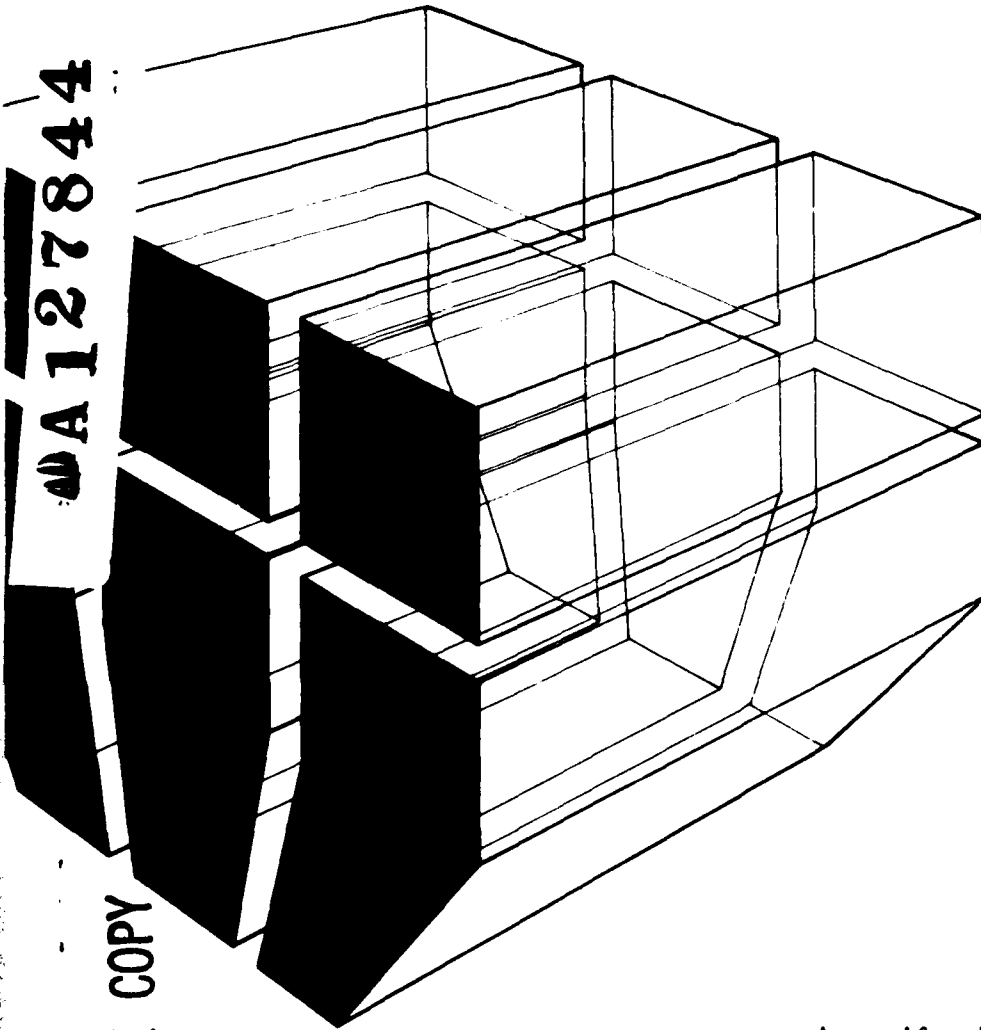
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OPERATIONS MODELING FOR ARMY MOBILIZATION

by
Steven Hottman
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FOREWORD

This study was performed for the Headquarters, U.S. Army Training and Doctrine Command (TRADOC), under Reimbursable Order GEFAE 115400106. Mr. Ray Spunzo, Chief of the Construction Directorate, and Mr. Lee Aikin, Chief of the Environment and Natural Resources Division, were the Technical Monitors. MAJ James Shamblen, MAJ Charles Clinger, and Mr. Phil Huber, also of TRADOC, coordinated significant phases of the study.

The material presented in this report is derived from a presentation delivered to a symposium sponsored by the Society for Computer Simulation, "Modeling and Simulating Microcomputers," held January 28 and 29, 1982, in San Diego, CA. The work was performed by the Environmental (EN) and Facility Systems (FS) Divisions of the U.S. Army Construction Engineering Research Laboratory (CERL), and by Analysis and Technology Inc. (A&T) of North Stonington, CT. The Mobilization Facilities Planning Systems (MFPS) Development Study was conducted by CERL-EN under the general supervision of Dr. Harold Balbach, Principal Investigator, and Dr. Ravinder K. Jain, Chief of CERL-EN, and supported by CERL-FS under Mr. James Johnson and Mr. Edward Lotz, Chief of CERL-FS. Mr. Richard Gauthier was A&T project engineer and was responsible for developing the program. In addition to the authors, Ms. Aileen Renta-Babb of CERL-EN and Mr. Scott MacArthur of CERL-FS assisted in important phases of this work. Appreciation also is expressed to Ms. Mary Scala of the CERL Support Office for her help in writing this report.

COL Louis J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

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OPERATIONS MODELING FOR ARMY MOBILIZATION

1 INTRODUCTION

Background

Without a flexible, reliable mobilization strategy, the Army cannot respond effectively to an outside threat to the nation's security or to a national emergency. During a mobilization crisis, thousands of troop units and their associated equipment (including armor, artillery, and helicopters) will have to be deployed or reassigned rapidly, often within hours.

To plan realistically for mobilization, the Army must know exactly how many troops each of its installations can house, feed, train, and prepare for deployment at any given time. Most important, the Army must be able to predict the performance of processes and facilities vital to successful mobilization, so problems can be identified and solutions developed.

Each Army command headquarters and installation maintains a mobilization plan which reflects how each individual command or installation can participate in an Army-wide mobilization crisis. Although these plans are updated regularly, the updating is done manually. To investigate if the mobilization planning might be improved via a computer-based system, the U.S. Army Training and Doctrine Command (TRADOC) asked the U.S. Army Construction Engineering Research Laboratory (CERL) to develop an automated mobilization planning system.

Objective

The objective of this study was to develop and demonstrate a pilot computer-aided Mobilization Facilities Planning System (MFPS) and to identify key factors for consideration in mobilization planning.

Approach

1. Identify facilities and capabilities vital to the support of mobilization.
2. Collect and aggregate data on the key facilities identified in Step 1 (including data on the projected demand on those facilities) into a computer database.
3. Based on the information gathered during Step 2, develop a computer program (including algorithms to relate facilities to their demands) that can be used to indicate feasible troop movements against limited resources and time factors.
4. Develop and demonstrate a Pilot MFPS.

2 MFPS: FUNCTIONAL REQUIREMENTS

The effects of troop movements on the loading of installation facilities must be anticipated at the earliest stages of mobilization planning. To support mobilization properly, the Army must know exactly where and when shortfalls will occur in such key facilities as housing, utilities, training capabilities, and medical services. Thus, the Army must have a facility status-reporting and requirements system that is reliable, rapid, and contingency-oriented. This is the role of the MFPS.

The MFPS is a *demand/supply comparison* system. The system produces status and requirements data that the Army can use to define feasible or advantageous troop movements and to identify factors which limit the abilities of key military and civilian facilities. It is designed as a planning and facilities scheduling aid, not a decision-making device. As an effective indication of installation status and capabilities, users can manipulate database information to construct variations in any assigned scenario for determining responses to real or anticipated mobilization demands. Thus, the MFPS can model the effects of alternate mobilization scenarios within minutes, as opposed to the days required using manual-based modeling.

Another concept critical to the MFPS development is local control; i.e., the system must reside where it is being used. It must not be affected by long-distance communications problems. It should be updated and maintained by the command mobilization planners who rely on its output.

Basic System Requirements

Basic functional requirements for the MFPS are:

1. It must reside at the planning site on a stand-alone micro- or mini-computer (with preference given to existing or in-use systems).
2. It must be interactive and user-friendly.
3. It must be installation- and multi-installation-specific.
4. It must reflect the changes in assets and demands as a function of time.
5. It must produce results as graphs (for summary briefings) and as tables (for detailed analyses).
6. It must be versatile enough to allow newly identified factors to be added easily to its database and modeling capabilities.

Overall Development Approach

The Pilot MFPS was designed so its software could be verified on an available large computer system. Although the Pilot MFPS was developed on a large commercial computer system, its software was designed for use on mini- and microcomputers which can be expected to be available on specific sites (i.e., local control).

There are many advantages to low-cost, self-contained mini- and micro-computers. These devices are independent of often tenuous communication links and are well suited to the local control goal of the MFPS because they are easy for field commands and installations to house and maintain.

To insure the system is user-friendly, the MFPS input language is conversational English. Several self-teaching options are available, depending on the user's skill and system experience. The typical user was assumed to have neither prior experience with computers nor detailed knowledge of Army planning and facilities jargon. Up to four levels of explanation are available for each user response asked for by the system. Each level has more detail about a response than the one preceding it. If a user gives an incorrect response, the system will suggest the user ask for "..HELP." HELPfiles explain, in detail, what the user needs to do to answer the system's questions correctly.

The database is installation-specific. A particular installation's facilities and other assets (e.g., utilities) plus its planned mobilization troop movements and other demands are grouped. Because the algorithms linking assets and demands reside in the database, equations can be refined during routine data update, without modifying the software.

The algorithm constants also reside in the database. Thus, asset and demand parameters can be modified globally during any single modeling run. That is, once a user changes a constant (e.g., changing a space allowance for a trainee billet from 72 to 65 sq ft), every equation using that constant during the rest of that particular modeling will reflect the change. Since each installation's database segment contains the algorithm constants for that installation, nonstandard attributes (e.g., climate extremes) are considered implicitly.

An installation's attributes are not arbitrarily specified as assets or demands in the database. They may be either or both. For instance, a given amount of barracks space can be considered an asset, but that barracks space is also a demand on the installation's utilities system. The MFPS design recognizes this dual role, and the system handles the situation routinely.

The results of a given modeling run may be presented as tables or graphs, or both. Tabular output is useful in planning activities where more precise results are needed. Histograms are used for overall scenario assessment or staff briefings. The graph output presents the same results as the tabular, but accents the time dependence of a particular scenario change.

The Pilot MFPS

Initial development of MFPS focused on a single key mobilization factor (housing), and a typical TRADOC installation (Fort Leonard Wood, MO). The Pilot MFPS ran on a commercial dial-up IBM system in FORTRAN 77. Line-printer graphics were used, although screen-graphics are anticipated for the final system. Terminal widths of 72 or 132 characters are available, and any number and mix of weeks from 1 to 157 (Mobilization weeks 0 through 156) may be requested.

The Fort Leonard Wood database contained asset information taken from the Integrated Facilities System (IFS) report, Fort Leonard Wood's proposed mobilization construction request, and the Nonindustrial Facility Use (NIF) projections (i.e., civil). Demand information was extracted from the mobilization plan, the Mobilization Table of Distribution and Allowance (MOBTDA), and the units' Tables of Organization and Equipment (TOE).

The pilot program was designed to model housing demand vs the installation's housing assets as a function of time.

Demands were in five categories:

1. Hospital patients
2. Trainees (basic and advanced)
3. Officers
4. General support force (training cadre, installation support, administration)
5. Deploying units (during assembly, training, and departure operations).

Housing assets were in six categories:

1. Pre-existing facilities
2. Diverted facilities
3. Field (tent camps and bivouacs)
4. Nonindustrial facilities (off-installation rentals)
5. Hasty construction
6. Programmed new military construction (semipermanent and permanent).

The program calculated events during a mobilization modeling session in mobilization (M) weeks -- from M+0 to M+157. The user could model all, or any part of this event calendar, e.g., from M+7 through M+13 or from M+5 to M+10.

Pilot Test Description

The test of the pilot system involved a user completely unfamiliar with the system, using only a single instruction sheet. The user was able to make simple modifications in demand, then assets, and finally combinations of the two for a complex scenario change. The results were as expected and verified by hand calculation. Graphic output format modifications requested by the user were noted and have now been implemented.

Pilot System Hardware

The developmental MFPS was transferred to and executed on a Wang 2200 VS, located at HQ-TRADOC, Fort Monroe, VA. This single computer outputs to several video terminals and printers. Its central processing unit has 512 K bytes of memory. Two 90-megabyte disc drives and a nine-track tape drive provide mass storage. A line printer and a controller link its various terminals. A Tektronix 4054 Graphic Display system has been added, with electrostatic and eight-color, pen-plotter output.

Sequential disk data files were used for security and to record usage levels. The security file restricts access to the computer code and database. The usage file automatically monitors the level of program use, so high usage times and inefficient code can be detected.

Data is stored via a random access disk file, to allow easy and frequent access to the database.

Pilot System Software

The Pilot MFPS software used, in part, a program developed by CERL for an environmental management modeling system. This software, and the MFPS-specific modifications, allows multilevel addressing which accommodates a predefined data structure. Only two routines give actual access to the database (one for reading and one for writing), so the software is very portable.

The Wang version code is written in FORTRAN, with some BASIC for operating system routine calls.

Planned System Enhancements

Code has been written to include all TRADOC installations in the housing version of MFPS. Planned enhancements to the system include:

- a. Utilities
- b. Training capability and facilities
- c. Support capability and facilities
- d. Medical facilities.

Other concerns can and will be added as the system's utility is recognized and the user community grows.

3 CONCLUSION

The scope and flexibility of mobilization planning can be widened by adapting computerized modeling techniques to the planning process.

The Pilot MFRS described in this report is designed to operate on a micro- or minicomputer resident at commands involved in mobilization planning. The system is user-friendly and system software is portable. Because the system resides where it is being used, long distance data-transfer communication problems are avoided and users have direct control over database loading and manipulation.

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