STUDIES, ANALYSIS, AND GAMING AGENCY

ORGANIZATION, JOINT CHIEFS OF STAFF

# CATALOG
# OF
# WAR GAMING
# AND
# MILITARY SIMULATION MODELS

## 6TH EDITION



5th is limited

JOINT CHIEFS OF STAFF

SAGA-236-75

JUNE 1975

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STUDIES ANALYSIS AND GAMING AGENCY, Washington DC.

ORGANIZATION OF THE JOINT CHIEFS OF STAFF

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# CATALOG
# OF
# WAR GAMING AND MILITARY SIMULATION MODELS

(6th) Edition).

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9 Final rept.,


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## ABSTRACT

This catalog contains a brief description of 152 military simulations and models which are in general use throughout the Department of Defense. The models and simulations are categorized as to application. Thus, there are 46 Strategic Forces models, 22 General Purpose Land Forces models, 14 General Purpose Air Forces models, 19 General Purpose Naval Forces models, 11 General Purpose Combined Arms models, 32 Logistics models, 3 Personnel models, 3 Communications-Electronics models and 2 Politico-Military simulations. All models are listed alphabetically, and are indexed by short and long title and model type. The model descriptions were submitted by 38 proponents and reflect the efforts of 47 separate developers. The description for each model includes: proponent, developer, purpose, general description, input, output, limitations, hardware, software, time requirements, security classification, frequency of use, users, and point of contact for additional information. The inclusion of a specific model in the catalog was at the discretion of its proponent, and thus does not in any way constitute indorsement of the model by the Organization of the Joint Chiefs of Staff.

# FOREWORD

1. Purpose:

This catalog provides the Joint Staff, the Unified and Specified Commands, and the Services with information on a number of computer-based war gaming and military simulation models. This document identifies simulation models typically used by the Department of Defense to analyze problems involving strategic and general purpose force levels, their related logistics, postures and tactics, weapons systems effectiveness, and other comparisons/trade-offs. Some of the models are also used for education and training purposes, and for politico-military exercises.

It is hoped that this document will encourage and enhance the interpersonal exchange of model and gaming information, and increase communication and coordination between interested agencies. It is recognized that the models listed do not necessarily have universal application. The catalog can, however, greatly assist in eliminating significant duplication of effort, especially with respect to the acquisition or formulation and development of new models. This can normally be achieved by using the appropriate available model(s), with little or no modifications.

2. Scope:

This catalog is limited to models in current use within the Defense establishment. It does not provide a detailed nor exhaustive listing and description of all available models. Additions and deletions made relative to the fifth edition of this catalog were principally based upon the criterion of usage. This eliminated models of limited utility for current studies, and included those recently developed/modified and in general use by DOD agencies. Incomplete models and those in development were carefully evaluated before inclusion. Emphasis was placed upon well-documented models. In those instances where a particular model's application prospects were extremely limited, it was considered for deletion. Similarly, utility programs or routines used solely for information retrieval and pure mathematical calculations were normally not included. Models which were essentially the same but known by various names were entered once. Although these criteria were generally adhered to in determining the final disposition of all models, the judgments of the proponent agencies were considered to be most important.

This edition of the catalog is broader in scope and in greater detail than the previous edition. Although the increase in the number of models included is not great, the variety of models is substantially greater. Politico-Military simulations, weapons-testing systems, and educational gaming are included along with the more customary battle simulations, logistics models, damage assessment, and nuclear exchange models.

The information content of each model description is considerably greater than in the previous edition of the catalog. Specifically, data on the model's level of resolution and aggregation, details of its hardware and storage requirements, the completeness of documentation, its time requirements, the frequency of its use, its users, and its linkages (if any) to other models have been included.

3. Method:

Model descriptions have been expanded substantially from previous editions. The format was standardized to be of greater assistance to the analytic community. This feature should reduce the time expended in initial research, and provide a basis for rudimentary model comparison and evaluation relative to the application being considered.

This catalog uses the standard data collection sheet shown in Appendix E. Each organization contributing to this catalog identified those models it desired to have included and provided the supporting data. All models are listed alphabetically, and are indexed by short and long title and model type.

4. Comment:

The sixth edition of the catalog contains about half of the models listed in the fifth edition. Each organization determined its own input; and thus, the omission of any model is the result of each organization's own decision. The results suggest, therefore, that the computer models which are current and active in the community change a great deal from year to year.

As a consequence of this apparent rapid change in model requirements, SAGA requests the aid of model developers and users in maintaining the catalog as current as possible. Accordingly, your assistance is solicited in providing information on all new model developments and capabilities, modifications to existing models, and deletions of obsolete models. This information should be forwarded in the format of the data collection sheet noted earlier to:

Organization of the Joint Chiefs of Staff
Studies, Analysis & Gaming Agency
Office of the Scientific & Technical Advisor
The Pentagon, Room 1E941
Washington, D. C. 20301

Based on the quantity of changes and additions received, addenda and/or complete revisions will be published periodically.

## ALPHABETICAL INDEX OF MODELS BY SHORT TITLE

## ALPHABETICAL INDEX OF MODELS BY SHORT TITLE
(Cont'd)

**TITLE:** ABM-I-General War Antiballistic Missile System Model

**PROPONENT:** National Military Command System Support Center

**DEVELOPER:** Computer Sciences Corporation

**PURPOSE:** The ABM-I Model is a system of computer programs designed for use as a tool in investigating interactions between offensive and defensive missile systems in a general war environment. It also provides a reference point for the calibration of existing highly aggregated wargaming models.

**GENERAL DESCRIPTION:** The ABM-I model is designed to permit a detailed analysis of general war situations involving a variety of force postures, strategies, and initial conditions. ABM-I is an event driven model and is capable of modeling two opposing forces, with each site being defended by an ABM defense system. The interactions among the opposing offensive and defensive forces are simulated simultaneously.

**INPUT:**

- Detailed characteristics and location of targets
- Detailed characteristics of missiles and payloads
- Detailed characteristics of ABM defense systems

**OUTPUT:**

- Summary reports
- History of events
- Graphic displays of game

**MODEL LIMITATIONS:**

- 2500 Offensive Missiles
- 8000 ABMs
- 15000 Threat Objects
- 300 Radar Sites
- 300 Command and Control Sites
- 2000 Missile sites
- 500 ABM Launch Site

**HARDWARE:**

- Computer: CDC 3800 and IBM 360/50
- Operating System: DSOS, NMCSSC Version and HASP
- Storage Required: 72K and 450K
- Peripherial Equipment: CalComp 718 Plotter

**SOFTWARE:**

- Programming Language: FORTRAN, ALC, COMPASS
- Documentation: General War Antiballistic Missile System (ABM-I), NMCSSC Computer Systems Manual 68-68, 1 May 1972

TIME REQUIREMENTS:

- o 1 man month to prepare input
- o 14 hours computer time
- o 6 hours CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Currently not being used

USERS: Assistant to the Chairman, JCS, for Strategic Arms Negotiations, (ACSAN)

POINT OF CONTACT: Computer Sciences Corporation
400 Army Navy Drive
Arlington, Virginia 22202
Telephone: 521-5280

KEYWORD LISTING: General War; Anti Ballistic Missile; Ballistic Missile Defense; ABM-1 Model; Offense Allocation; LaGrange Multipliers; Simulation; Computerized War Gaming

**TITLE:** ACM - Air Campaign Model

**PROPONENT:** United States Arms Control and Disarmament Agency

**DEVELOPER:** Ketron, Inc.

**PURPOSE:** ACM is a computerized, analytical model designed to study differences in force postures resulting from possible force reductions. It simulates aircraft types, their interactions, and their mission allocations. Allocations may be specified or optimized using conservative pure strategies.

**GENERAL DESCRIPTION:** ACM is a two-sided, deterministic model involving land and air forces. It is designed to consider various types of aircraft and types of missions in a full scale tactical air war. Simulated time is treated on a time-step basis. Dynamics programming and probability are the primary solution techniques used to analyze the impact of tactical aircraft reductions.

**INPUT:**

- Types of aircraft
- Defense and offense kill probabilities
- Resource levels
- Period to be simulated
- Objective functions and weights

**OUTPUT:**

- Allocation of aircraft resources by mission
- Sorties delivered
- Surviving aircraft

**MODEL LIMITATIONS:**

- No explicit command and control simulation
- Maximum of four aircraft types per side
- Maximum of 8 missions per aircraft type

**HARDWARE:**

- Computer: CDC 6600
- Minimum Storage Required: 50K

**SOFTWARE:**

- Programming Language: FORTRAN IV
- Documentation under development

**TIME REQUIREMENTS:**

- 2 hours to structure data base once data is available
- CPU time is problem dependent

**SECURITY CLASSIFICATION:** UNCLASSIFIED

FREQUENCY OF USE: Model still under test

USERS: US Arms Control and Disarmament Agency

POINT OF CONTACT: US Arms Control and Disarmament Agency
Operations Analysis Division
320 - 21 Street, N.W.
Washington, D.C. 20451

KEYWORD LISTING: Analytical Model; Limited War; Land and Air Forces; Computer Model; Two-Sided; Deterministic; Time-Step

TITLE: AEM Hedge - Arsenal Exchange Model

PROPONENT: Office of the Deputy Assistant Secretary of Defense, Program Analysis & Evaluation (PA&E)

DEVELOPER: Science Applications, Incorporated (SAI)

PURPOSE: AEM Hedge is a computerized, analytical general war model that provides a capability for quantifying strategic force analyses and allows hedging against uncertainty. The AEM model can simulate two world powers with three components: Strategic forces (ICBMs, SLBMs, and bombers), non-retaliatory military resources, and non-military resources. In addition, a third power can be considered which has no retaliatory forces but may be targeted by one power having strategic forces. Area and terminal defenses of several types, with or without leakage, may be possessed by either or both sides.

An exchange may be initiated by either side. Each side may possess a variety of simultaneous objectives (which may or may not be shared or known by the opponent) including hedges against parametric uncertainties and catastrophic failures. The exchanges are sequential with the last strikes (if at least two strikes are performed) including the non-military resources. Several pure counterforce exchanges may precede the last two strikes. The effects of mis-estimating parametric values may be evaluated following an exchange.

GENERAL DESCRIPTION: AEM Hedge is a two-sided, deterministic model involving land, air and sea forces. Simulated time is treated on an event store basis. The primary solution techniques used are LaGrange multipliers, linear programming, mixed-integer programming, game theory and probability.

INPUT:

- Scenario variables
- Weapon variables
- Target variables
- Weapon and target hedge variables
- Forward defense variables
- Area defense variables
- Budget optimization parameters
- Optimum terminal defense deployment vehicles
- Allocation constraints
- Multi-goal objectives

OUTPUT:

- Summaries in terms of the weapon allocation and value destroyed
- Extensive summary of input data
- Output options allow extremely detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- Geography is not explicitly considered.
- SAM and ABM defenses are highly aggregated representations.

HARDWARE:

- Computer: IBM 360/50, IBM 360/65, CDC 6400, GE 635, UNIVAC 1108/1110, Honeywell 6000, IBM 370
- Operating System: OS Release 20 (IBM); SCOPE (CDC)
- Minimum Storage Required: 375K bytes
- Peripheral Equipment: Standard scratch disk plus permanent disk for war file

SOFTWARE:

- Programming Languages: FORTRAN IV
- Documentation is available. The model is dynamic and under constant revision. Documentation is updated periodically. A formal training program, both in model usage and methodology, exist.

TIME REQUIREMENTS:

- 1 day to acquire and structure base data in model input format
- 10-30 seconds CPU time per model cycle for one-strike allocation; one to 10 minutes for two-strike scenario
- 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is Unclassified.

FREQUENCY OF USE (TIMES/YR): Several hundred

USERS:

- Principal: OASD(PA&E)
- Other: ACDA, Army CAA, USAF(SA), AFSC(FID), BMDSCOM

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D.C. 20301
Telephone: OX 5-5587

MISCELLANEOUS:

- It is currently planned to expand the model's general capabilities for strategic analysis including new scenarios.

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic; Event Store; Linear Programming

TITLE: AGM - Attack Generator Model

PROPONENT: Office of Preparedness, GSA

DEVELOPER: Mathematics and Computation Laboratory, OP/GSA

PURPOSE: The Attack Generator is a computerized, analytical model designed to provide a means of selecting the most effective use of a given enemy nuclear attack capability to attain specified objectives. The model assigns nuclear weapons to targets by target categories to maximize the expected contribution to the objectives. This capability assists in formulating potential enemy attacks in the study of nuclear hazard contingencies, in exploring enemy alternatives in the use of nuclear weapons following a nuclear exchange and in devising enemy nuclear attacks for sensitivity studies and exercises.

GENERAL DESCRIPTION: The Attack Generator is a one-sided, deterministic model involving air and nuclear forces. It can consider missiles and bombers on an individual basis if so desired and can aggregate up to the worldwide level. The primary solution techniques employed are probability and queuing theory.

INPUT:

- Weapon detonation information such as yield, height of burst, and circular error probable is provided with the weapon inventory.
- The necessary input pertaining to resources in potential target categories includes their location, characterization of physical vulnerability and relative measures of target value. For area targets, such as population and broad classes of industry, a system of target value aggregation is required to define the target for weapon assignment. The size should provide maximum aggregation within the limits of the expected effective weapons radius of the smallest weapon in the inventory.

OUTPUT:

- A weapons list on magnetic tape suitable as input for such models as READY and RISK II described elsewhere in this publication. The list includes weapon identification information, coordinates of the desired ground zero, and the aggregate pre-attack expected residual values for each target category. If desired, associated input information may be reported, such as detonation characteristics and the name of the target.

MODEL LIMITATIONS:

- The precision of results is subject to the same uncertainties as pertain to predictions of weapons effects and physical vulnerability in basic nuclear damage assessment routines.
- Potential targets which can be considered in one weapon application are limited to 4,000. Hence, consideration of a larger file requires consideration of the highest 4,000 in the first round with subsequent sequential runs for the remainder.

HARDWARE:

- Computer: UNIVAC 1108; CDC 3600
- Operating System: EXEC VIII; SCOPE
- Minimum Storage Required: 64K

SOFTWARE:

- Programming Language: FORTRAN V (1108); FORTRAN IV (3600)
- Documentation: ATTACK I, Attack Pattern Generator, TR-27 Rev. 1, Office of Preparedness, GSA, October 1973

TIME REQUIREMENTS:

- 6 weeks to acquire and structure base data in model input format
- Approximately one to two hours' CPU time, depending on scope of study
- Hours to days to analyze and evaluate results, depending on scope of study

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Three major studies UNCLEX-73, HAZARD-74, PONAST

USERS: OP

POINT OF CONTACT: OP - Dr. James C. Pettee
Office of Preparedness
General Services Administration
Washington, D.C. 20405
Telephone: 343-4227

MCL - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory
Office of Preparedness
Washington, D.C. 20405
Telephone: 343-6213

MISCELLANEOUS:

- The Attack Generator Model can provide input for the READY and RISK II Models in the form of a weapons list on magnetic tape.

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; One-Sided; Deterministic; Allocation

TITLE: Aircraft Loader Model

PROPONENT: OJCS (J-4)

DEVELOPER: Institute for Defense Analyses (IDA)

PURPOSE: The Aircraft Loader Model is a computerized, analytical logistics model designed to simulate aircraft loading and thereby to assist in estimating the number of airlift aircraft required to perform a stated transport mission. The model can be used in planning transport aircraft operations, in comparing numbers of aircraft loads (sorties) required for different aircraft types, and in studying alternative aircraft cargo compartment configurations.

GENERAL DESCRIPTION: The Aircraft Loader Model is a deterministic model involving air forces only. Aircraft are considered individually, in sequence. Requirements may be considered individually or else they may be grouped. Numerical analysis is the primary solution technique used.

INPUT:

- Weight allowable cabin load (WACL) for the aircraft type for the range or radius of operation
- Length, width and height of cargo-carrying space
- Number of passenger seats on the aircraft
- Allowable stacking height of bulk cargo
- Vehicle lists, including all self-propelled vehicles, weapons, prime movers, and towed loads to be loaded (detailed data are code number, item description, and number of pieces, weight, length, width, and height of each piece).
- Passenger list (number of passengers and unit weight)
- Bulk list which includes all other cargo to be loaded (code number, item description, number of boxes or pieces, weight, and cube)

OUTPUT:

- Statement of loadings for each aircraft by chalk number, consisting of a detailed listing for each aircraft of the vehicles, passengers, and bulk on each "loaded" aircraft (chalk number), the weight and floorspace of the vehicles and bulk cargo, item descriptions of these vehicle and bulk items, the number and weight of passengers loaded, and the remaining weight and floorspace of the aircraft which has not been used.
- When all loading has been completed, a summary of all sorties is printed showing:
  (1) Number of sorties required;
  (2) Vehicles, passengers, and bulk not loadable (for example, items which are too large, too heavy, or passengers for whom there are no seats on the aircraft);
  (3) Number, weight, and floorspace of vehicles loaded; weight and floorspace of bulk loaded;
  (4) Number of passengers loaded;
  (5) Total fleet weight, floorspace, and passenger seats that were available for loading

MODEL LIMITATIONS:

- The Sortie Generator technique is not designed to produce optimal loadings in the sense that the number of sorties estimated is a minimum estimate.
- The problem of fleets of mixed aircraft types is not addressed; the routine handles a single aircraft type at a time.

HARDWARE:

- Computer: IBM 360/50; HIS 6080;
- Operating System: OS/MVT for IBM; GCOS for HIS;
- Minimum Storage Required: 180K bytes; 36K words;
- Peripheral Equipment: Magnetic tapes and/or disk.

SOFTWARE:

- Programming Languages: COBOL and FORTRAN IV
- No documentation is available on the J-4 modified version, but the original version is covered in IDA/WSEG Research Paper P-100, "Aircraft Loading Considerations," January, 1964. Documentation is being updated.

TIME REQUIREMENTS:

- 1 month to acquire base date
- Little if any time to structure base data in model input format
- 10 minutes CPU time per model cycle
- 1 man-day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS: OJCS (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon, Washington, D.C. 20301
Telephone: OY 7-5464

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Computerized; Deterministic

TITLE: ALM - Airlift Loading Model

PROPONENT: USAF AF/SA

DEVELOPER: AF/SA

PURPOSE: ALM is a computerized, analytical logistics model designed to simulate the loading of military vehicles into cargo aircraft in order to determine the number of sorties required to deploy a force of any size. In addition, the model determines the loadability of military vehicles through the aircraft door and in the cargo compartment.

GENERAL DESCRIPTION: ALM is a one-sided model involving land and air forces. It is designed to consider any level of military unit and any combination of military units. The widest vehicles are loaded first, starting at the left fore corner of the cargo compartment. The widest vehicle that fits the gap remaining is loaded next. Loading proceeds fore to aft in the cargo compartment.

INPUT:

- o Aircraft characteristics
- o Vehicle characteristics
- o Numbers of vehicles in each unit
- o Movement order of vehicles
- o Loading order of aircraft

OUTPUT:

- o Computer printout of loadability of vehicles
- o Vehicles sorted by their dimensions and weight
- o Individual loads and loading summaries

MODEL LIMITATIONS:

- o 350 vehicle types
- o 5 aircraft types

HARDWARE:

- o Computer: GE 635
- o Operating System: GECOS
- o Minimum Storage Required: 33K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o A user's manual is currently in draft form. User's, operators' and programmer maintenance manuals will be prepared.

TIME REQUIREMENTS:

- Time to acquire and structure base data in model input format varies, depending upon the number of units to be loaded.
- Less than 5 minutes CPU time per model cycle
- 2-4 weeks learning time for users
- Approximately 1 hour to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Limited

USERS: AFSA Airlift Divisions

POINT-OF CONTACT: Headquarters US Air Force
Assistant Chief of Staff - Studies & Analysis
Computer Applications Group
The Lynn Building
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8420

MISCELLANEOUS:

- ALM supersedes the SLAM (Simulating the Loading of Aircraft with Military Cargo) Model.

KEYWORD LISTING: Analytical; Logistics; Land Forces; Air Forces; Computerized; One-Sided

TITLE: AMMORATES - Ammunition Rates

PROPONENT: U. S. Army Concepts Analysis Agency

DEVELOPER: U. S. Army Combat Developments Command
Model(s) has evolved through several stages. The latest developments have been done in-house.

PURPOSE: A series of models (routines) used in combination to determine non-nuclear ammunition requirements through combat simulations.

GENERAL DESCRIPTION: The AMMORATES model (system) consists of nine individual models (routines). These are:

- o Blue Artillery Model (BAM)
- o Casualty Assessment Model (CAM)
- o Anti-Armor Helicopter Combat Model (HOVARM)
- o Anti-Personnel Helicopter Combat Model (HOVER)
- o Infantry Combat Model (ICM)
- o Red Artillery Model (RAM)
- o Target Acquisition Model (TAM)
- o Tank-Anti-Tank Simulation (TATS)
- o Theater Rates Model (TRM)

The focal model of the AMMORATES system is the TRM which simulates a theater conflict, generating stylized combat periods as a framework in which combat simulation models are applied, to compute ammunition consumption rates for the several weapon-munition combinations.

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1696

MISCELLANEOUS: For detail, see descriptions of the individual models of the AMMORATES system.

- o BAM - Blue Artillery Model
- o CAM - Casualty Assessment Model
- o HOVARM - Anti-Armor Helicopter Combat Model
- o HOVER - Anti-Personnel Helicopter Combat Model
- o ICM - Infantry Combat Model
- o RAM - Red Artillery Model
- o TAM - Target Acquisition Model
- o TATS - Tank-Anti-Tank Simulation
- o TRM - Theater Rates Model

KEYWORD LISTING: Analytical Model, General War (Non-Nuclear, Ammunition Requirements.

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**TITLE:** AMPS - Air Movement Planning System

**PROPONENT:** U.S. Army Logistics Center

**DEVELOPER:** U.S. Army Logistics Center, Operations Analysis Directorate

**PURPOSE:** AMPS is a computerized, analytic, logistics model designed to plan, diagram and manifest individual aircraft loads of equipment and personnel for movement on C-5, C-141 and C-130 aircraft. The model develops optimum load plans to determine ability to accomplish a defined movement requirement.

**GENERAL DESCRIPTION:** AMPS is a deterministic model which can be used to plan movement of detachments through brigades. Specific characteristics, balance and safety constraints are considered in development of individual loads for each aircraft type.

**INPUT:**

- Cargo list
- Aircraft list

**OUTPUT:**

- Load Plans
- Manifests

**MODEL LIMITATIONS:**

- Cargo examined by cube, weight and center of gravity only rather than specific dimensions
- Vehicle tie down space determined on worst case basis rather than specifics

**HARDWARE:**

- Computer IBM 360
- Operating System OS or DOS
- Minimum Storage Required 256K
- Peripherals: One disk, two tape units

**SOFTWARE:**

- COBOL
- Documentation - Users documentation available
  - Technical documentation under preparation

**TIME REQUIREMENTS:**

- Prepare data base - 1 man month
- CPO - 1 hour

**SECURITY CLASSIFICATION:** UNCLASSIFIED

__USERS__: U.S. Army Logistics Center

__POINT OF CONTACT__: U.S. Army Logistics Center
Operations Analysis Directorate
Ft. Lee, VA 23801

__MISCELLANEOUS__: This model supersedes CAPS, (Computerized Airlift Planning System) and AAMS (Automated Air Movements System)

__KEYWORD LISTING__: Analytic, Logistics, Computerized, Aircraft loading, air movement

TITLE: ANSR - Analysis of SAFEGUARD Repertoire

PROPONENT: U.S. Army Ballistic Missile Defense Program Office

DEVELOPER: Stanford Research Institute - Huntsville

PURPOSE: ANSR is a computerized analytical, damage assessment/weapons effectiveness model that determines the area coverage capability of the SAFEGUARD System or other midcourse intercept BMD system against either an ICBM or SLBM threat. The capability and flexibility of the program allows it to be used for the general study of effectiveness of BMD deployments having one or more batteries for area defense.

GENERAL DESCRIPTION: The model is two sided, deterministic and was primarily designed to accommodate one battery, one target and one re-entry vehicle with a range of possible manipulation. The model was primarily designed for 12 search radars, 40 tracking radars, 30 interceptor farms, 350 ICBM or SLBM launch points, 215 target or impact points with a range of possible manipulation to include any combination of above. The ratio of Game Time to Real Time (for fully or partially manual models) is about 10 seconds of central processor time for each launch point-impact point combination.

INPUT: Location and configuration of the defense radars. The parameters of each radar, such as maximum instrumented range, minimum elevation angle, scan penalty, and minimum signal-to-noise ratio for detection. The ballistic missile parameters, such as launch and impact points, re-entry vehicle and tank radar cross sections and separation rate between the re-entry vehicle and tank. Interceptor flyout curves and other interceptor data, such as minimum intercept altitude, and divert rate. Miscellaneous information such as integration time interval, and various indicator flags.

OUTPUT: The output is a listing of important offense and defense parameters or conditions existing at some significant event or time during an engagement; for example, radar parameters and interceptor and re-entry vehicle locations at intercept time. ANSR is designed so that six different analyses may be performed: (1) Determine single or multiple battery coverage for a specified target list against either an SLBM or ICBM attack, (2) computer battle space, (3) generate the periphery of a footprint given an initial impact point, (4) generate a footprint given a grid of impact points, (5) output offense trajectory profiles only, and (6) generate radar tracking data only.

MODEL LIMITATIONS: Maximum of 12 search radars and 40 tracking radars each having from one to four phases array faces. Maximum of 30 interceptor farms with no more than two types of interceptors. Maximum of 350 ICBM or SLBM launch points. Maximum of 215 target or impact points.

HARDWARE:

- Type of Computer - CDC 6400
- Operating System - Scope 3.4
- Minimum storage required - 100,000 Octal

SOFTWARE:

- Programming language - Fortran IV
- Documentation - No formal documentation available

TIME REQUIREMENTS:

- Acquire base data - N/A
- Structure data in model input format - N/A
- CPU time per model cycle - Variable depending upon option
- Learning time for players - 0 to 2 months
- Analyze and evaluate results - 1 day

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 100 times per year

USERS: SRI and BMDSCOM

POINT OF CONTACT: J. O. Carroll, H. A. Lewis, J. L. Dyer, J. A. Harvilla, Stanford Research Institute, Huntsville, Alabama, 35804, Tel: 205-837-3050

MISCELLANEOUS: ANSR is linked to Submarine Launch Assignment, Targeting, and Effectiveness Models (SLATEM). ANSR is capable of generating a list of SAC bases that can be attacked by avoiding the defense from each SLBM launch point; this list is then input into SLATEM as possible launch points for use against SAC bases. It is not planned to add new capabilities to this model.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Computerized; two sided; deterministic; time step.

TITLE: APAIR, Mod 2, 2.5, 2.6 - ASW Program Air Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: J. D. Kettelle Corp.

PURPOSE: APAIR is a computerized analytic model which simulates interaction between an enemy submarine and one aircraft permitting study of a complete engagement through attack, reattack and kill.

GENERAL DESCRIPTION: The model is two-sided, stochastic involving one aircraft vs one submarine, however, multiple runs can increase the number of platforms. Time is in time-step mode. The model accounted for addressees, weapons, fire control, sensors, platform noise and kinematics, environment, tactics and a user formulated scenario.

INPUT:

- Sensor, weapon, fire control, platform and environment characteristics
- Tactics
- Scenario

OUTPUT:

- Printout and plot of statistically derived quantities
- Summary of replication history

MODEL LIMITATIONS:

- One airplane vs one submarine
- No countermeasures
- No false targets

HARDWARE:

- Computer: DCC 6400, 6600, 6700 and IBM 360
- Minimum Storage Required: 100 to 250K

SOFTWARE:

- FORTRAN IV
- Documentation SAOR 69-10 APAIR MOD 2, ASW Programs Air Engagement Model (U) Abstract (Uncl) (AD 860 260L) Vol. 1, Part 1: Users Manual (Uncl) (AD 860 261L) Vol. 1, Part 2: Sample Application (Conf) (AD 509 866L) Vol. 2, Part 1: Programmers Manual (Uncl) (AD 860 262L) Vol. 2, Part 2: Program Listing (Uncl) (AD 860 263L) SOATM 71-12 APAIR MOD 2.6 ASW Programs Air Engagement Model (U) Vol. 1; Users Manual (Uncl) (AD 890 139L).

TIME REQUIREMENTS:

- Structure data base/man month
- CPU time 30 sec. per replication

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 45 times per year

USERS: Manager, ASW Systems Program
NAVAIRSYSCOM

POINT OF CONTACT: Mgr, ASW Systems Project
Navy Department
Washington, DC 20360

KEYWORD LISTING: Computerized, analytic, ASW, time-step, two-sided

**TITLE:** APSUB MOD 2 - ASW Program Submarine Engagement Model

**PROPONENT:** Chief of Naval Operations, OP-95

**DEVELOPER:** Naval Weapons Laboratory/MASWSP

**PURPOSE:** APSUB MOD 2 is a computerized, analytical, limited war model that has been used extensively for weapon studies and for pre and postexercise analysis and exercise design. The model is primarily concerned with studying the effectiveness of ASW missions, studying in detail the interaction between opposing vehicles, and determining optimum tactics and optimum use of sensors.

**GENERAL DESCRIPTION:** APSUB MOD 2 is a two-sided, stochastic model involving sea forces only. It is capable of considering submarine encounters on a one-to-one basis and can aggregate up to any number of submarines on both friendly and enemy sides. Simulated time is treated on a time step basis. Probability theory and a decision logic table are the primary solution techniques used.

**INPUT:**

- o Tactical scenario
- o Detailed data on weapons, sensors and equipments

**OUTPUT:**

- o Computer printout from which analysis can be done
- o Data reduction for each replication
- o Across replications and computer pilots
- o 5 options ranging from summary data to detailed battle history

**MODEL LIMITATIONS:** Oriented toward one-to-one encounters

**HARDWARE:**

- o Computer: CDC 6700, UNIVAC 1108, IBM 360
- o Minimum Storage Required: 35K
- o Peripheral Equipment: Printers
  Plotting options exist that would require a plotter.
  4 Tape drives

**SOFTWARE:**

- o Programming Languages: FORTRAN IV
- o Both user's documentation and technical documentation:
  Abstract (AD 909 474L)50
  Technical Description (AD 525 118L)
  Programmer's Manual (AD 9092546)

TIME REQUIREMENTS:

- An extensive data base is available at the developing site for most applications.
- 30 seconds CPU time per model cycle
- 2-3 days learning time for users
- 20 days to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 25 times per year

USERS:

- Principal: MASWSP
- Other: Naval Laboratories

POINT OF CONTACT: Manager, ASW Systems Project
Navy Department
Washington, D.C. 20360

MISCELLANEOUS:

- APSUB MOD 2 supersedes the NWL Submarine Encounter Simulation Model.
- Continual updating is planned in the areas of sonar, fire control and weapons.
- A computer-assisted version of APSUB MOD 2 is currently being prepared. Extensive documentation for this version is being developed and will be available shortly.

KEYWORD LISTING: Analytical Model; Limited War; Sea Forces; Computerized; Two-Sided; Stochastic; Time Step; Anti-Submarine Warfare

TITLE: APSURF Mod I, ASW Programs Surface Ship Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: J. D. Kettelle Corporation/MASWSP

PURPOSE: APSURF is a computerized, analytical model for the simulation of an ASW engagement between an enemy submarine and a Task Force or convoy of surface ships, including helicopters and LAMPS. Covers complete engagement from search to attack, reattack and kill.

GENERAL DESCRIPTION: The model is a two-sided, stochastic, Monte Carlo simulation, considering 25 surface ships, 25 helicopters/LAMPS, and one submarine. Time is covered in a time step mode. Weapons, fire control, sensors, platform noise and kinematics, environment and tactics are considered.

INPUT:

- o Sensor characteristics
- o Weapon characteristics
- o Platform characteristics
- o Fire control characteristics
- o Tactics
- o Scenario

OUTPUT: Printout and plots of all statistically derived quantities.

MODEL LIMITATIONS:

- o One enemy submarine
- o No countermeasures

HARDWARE:

- o Computer: CDC 6400, 6600, 6700, IBM 360
- o Minimum Storage Required: 250K plus 4 tape drives

SOFTWARE:

- o FORTRAN IV
- o Documentation: Abstract AD881384L; Users manual AD881385L, AD881386L; Programmers manual AD881387L, AD881388L.

TIME REQUIREMENTS:

- o Prepare data - 1 man-month
- o CPU time - 30 seconds
- o Analyze results - 3 weeks

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 30 times per year

USERS: MAWSP, CRUDESDEVGRU

POINT OF CONTACT: Manager, ASW Systems Project Office
Navy Department
Washington, D.C. 20360

KEYWORD LISTING: Analytical, ASW, Air and Sea, Computer Model, Two-sided, Stochastic, Time step, Submarine.

**TITLE:** APSURV - ASW Program Surveillance Model

**PROPONENT:** Chief of Naval Operations (OP-95)

**DEVELOPER:** Tetra-Tech, Inc.

**PURPOSE:** APSURV is a computerized, analytical model which simulates ASW interaction between an enemy submarine and a surveillance system which detects the submarine, thereby permitting study of the search, detect, and localization process for the sensors.

**GENERAL DESCRIPTION:** APSURV is a two-sided, stochastic model for ASW operations involving one submarine against one sensor at a time for up to 20 sensors. Time is treated in a time-step mode.

**INPUT:**

- o Submarine track
- o Propagation loss
- o Ambient noise
- o Sensor characteristics
- o Submarine tactics

**OUTPUT:**

- o Computer printout and plots of statistics and derived quantities

**MODEL LIMITATIONS:** No false targets are simulated.

**HARDWARE:**

- o Computer CDC 6000, UNIVAC 1108, IBM 360
- o Minimum Storage Required 100K

**SOFTWARE:**

- o FORTRAN IV
- o Documentation: Mod - Defense Documentation Center Numbers
  0 - AD511 611L, AD511610L
  1 - AD 513 177L

**TIME REQUIREMENTS:**

- o Structure data base 1 month
- o CPU time - 20 seconds

SECURITY CLASSIFICATION:

- o Mod 0 - SECRET
- o Mod 1 - CONFIDENTIAL

**FREQUENCY OF USE:** 25 times/year

**USERS:** OP-95
OP-96

POINT OF CONTACT: Manager ASW Systems Project
Navy Department
Washington, D.C. 20360
Telephone 202-692-9141

KEYWORD LISTING: Analytical, ASW, Submarine, Computerized, Two-Sided, Time Step

TITLE: AREA DOMINATION II

PROPONENT: Hq. US Army (DCSOPS)

DEVELOPER: Research Analysis Corporation

PURPOSE: AREA DOMINATION II is a manual, analytical model designed to depict a US commander employing advanced STANO means, air mobile infantry and fire support reaction forces against enemy light infantry units whose mission is primarily to capture objectives within the US commander's tactical area of responsibility. The model's chief focus of concern is to develop an improved technique for determining the influence on US Army force structure of employing forces to dominate terrain, not by the customary physical occupation, but by the use of advanced surveillance, target acquisition, and night operations (STANO) means, together with highly mobile ground combat and fire support reaction forces. In addition, the model is concerned with the relationships among (a) operational capabilities of STANO means, (b) size and composition of US combat force, (c) strength of the enemy force, (d) size of the area dominated, and (e) degree of domination.

GENERAL DESCRIPTION: AREA DOMINATION II is a two-sided, closed, stochastic model involving land and air forces. The smallest unit it can consider is a platoon on the Red side and a company on the Blue side. The largest formation it can consider is a regiment on the Red side, and any number of companies on the Blue side. Four hours of game time are required to simulate a day of battle. Simulated time is treated on a time step basis.

INPUT:

- o Map with terrain types
- o Troop strengths and disposition of Red forces
- o Detection probabilities by various STANO means
- o Casualty production as a function of opposing strengths.

OUTPUT:

- o Output is in the form of raw game data requiring analysis to establish outcome.

MODEL LIMITATIONS:

- o Red forces have no appreciable anti-aircraft capability.

HARDWARE:

- o None; the model is fully manual.

SOFTWARE:

- o Documentation: RAC-TP-417, "An Improved Technique for Evaluating the Structure of US Army Forces in an Area Domination Role," February 1971, UNCLASSIFIED. AD881983L.

o 2 man-months to structure data in model input format.

o 4 hours of game time per day of battle.

o 4 hours learning time for players.

o 1 month to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Occasionally

USERS: US Army, DCSOPS

POINT OF CONTACT:

Force Structure Department
Research General Corporation
McLean, Virginia 22101
Telephone: (703) 893-5900

MISCELLANEOUS:

o This model supersedes AREA DOMINATION I.

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Air Forces; Manual; Two-Sided; Stochastic; Time Step.

**TITLE:** ASGRAM - Anti-Submarine Graphical Resource Allocation Model

**PROPONENT:** CNO (OP 96)

**DEVELOPER:** Planning Analysis Group, Johns Hopkins Applied Physics Laboratory and Strategic Analysis Support Group, OP-96

**PURPOSE:** ASGRAM is an interactive, computer-assisted graphics model used for both analysis and training. It is designed to simulate the allocation of anti-submarine forces to a submarine threat. It has been used to study the capability of existing naval force levels in the detection and tracking of hostile submarine surge deployments. It has not been used for other studies. It may be used to study support and force allocation doctrines or to study the distribution of forces and resources among existing airbases.

**GENERAL DESCRIPTION:** ASGRAM is an interactive, time-step Monte-Carlo simulation possessing both deterministic and stochastic elements. Air and sea forces are involved. The model considers surface ships, submarines, and aircraft on an individual basis with a maximum of 99 friendly ships (destroyers or submarines), 190 VP aircraft, and 50 hostile submarines. This represents the ASW threat and defensive forces for one ocean. Simulated time is treated on a time step basis. The ratio of game time to real time is 1:60, when the maximum number of units is used. The primary solution technique is kinematic with probabilistic assessment of interactions between Red and Blue forces.

**INPUT:**

- Course tracks for hostile submarines
- Probability of detection of SOSUS against hostile units along their input tracks
- Various probabilistic assessment factors

**OUTPUT:**

- Battle history, sorted as desired
- Contact summary

**MODEL LIMITATIONS:**

- 100 friendly ships (destroyers or submarines)
- 200 VP aircraft
- 50 hostile submarines
- Because the model is interactive, the time to complete a single replication will depend directly on the number of units and the game's scenario.

**HARDWARE:**

- Computer: IBM 360/91
- Operating System: Time Sharing Option
- Storage Required: 400K
- Peripheral Equipment: IBM 3270 CRT display, TEKTRONIX 4015 Graphics display terminal, hard copy device

SOFTWARE:

- Programming Language: P L/1
- Documentation: "Anti-Submarine Graphical Resource Allocation Model (ASGRAM), Version II", APL/JHU/PAG No. 58-74, CNO/OP-96-CM-3360, December 1974

TIME REQUIREMENTS:

- 1/2 man month to prepare input
- 10 hours per 30 game days playing time (see model limitations)
- Approximately 30 seconds CPU time per model cycle
- 3 hours training time for players
- 1 week to analyze and evaluate results (dependent upon number of units and scenario)

SECURITY CLASSIFICATION: SECRET

POINT OF CONTACT: Mr. Thomas P. Modelski
Planning Analysis Group
John Hopkins Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland 20910
Telephone: 589-7700

FREQUENCY OF USE: Used extensively for three major studies

PRINCIPAL USER: Strategic Analysis Support Group (SASG), OP-96

MISCELLANEOUS:

- ASGRAM takes input from the APSURV Model in the form of detection probabilities generated by APSURV for the SOSUS system.

KEYWORD LISTING: Analytical; Training; General War; Limited War; Air Forces; Sea Forces; Computer-Assisted; Two-Sided; Mixed Stochastic/Deterministic; Time Step; Graphics; Resource Allocation

TITLE: ASWAS - ASW Air Systems Model

PROPONENT: CNO (OP-96)

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, Johns Hopkins University

PURPOSE: ASWAS is a computerized, analytical model designed to simulate search, localization, tracking, attack and reattack by a single aircraft against a single submarine. The primary focus of concern is ASW missions such as SOSUS, flaming datum, barrier, and screening. In addition, it addresses the problem of developing optimum localization tactics for aircraft.

GENERAL DESCRIPTION: ASWAS is a two-sided, stochastic model involving air and sea forces. It considers an individual aircraft versus a single submarine. Sonobuoys are considered units, and the model can handle up to 31 of these. Simulated time is treated on an event store basis. Approximately three hours of battle are simulated in one second. The primary solution technique is kinematic, with probabilistic event assessment.

INPUT: ASW scenario

OUTPUT:

- o Event-by-Event history.
- o Statistical analysis.

MODEL LIMITATIONS:

- o No convergence zone capabilities.
- o One aircraft and one submarine per replication.
- o Maximum of 31 sonobuoys.

HARDWARE:

- o Computer: IBM 7090/7094.
- o Operating System: FORTRAN Monitor System
- o Minimum Storage Required: 70K octal.

SOFTWARE:

- o Programming Language: FAP (FORTRAN Assembly Program)
- o Documentation: "ASW Air Systems Model (ASWAS)," PAG No. 19-68, OM 3360.
- o The above represents complete user's and technical documentation.

TIME REQUIREMENTS:

- o 1 week to prepare input (1 man-week).
- o Approximately .03 seconds CPU time per model cycle (approximately 3 minutes run time per 100 replications).
- o 2 weeks to analyze and evaluate results.

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Annually

USERS: Strategic Analysis Support Group, OP-96

POINT OF CONTACT: Mr. Thomas Modelski
Planning Analysis Group
Johns Hopkins Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland 20910
Telephone: 589-7700

MISCELLANEOUS: ASWAS supplied inputs to ASGRAM in the form of tactical effectiveness of various units; probabilities of detection and probabilities of kill. ASWAS was also used in studying helo detection capabilities within towed array uncertainty areas.

KEYWORD LISTING: Analytical Model; Limited War; Damage Assessment/Weapons Effectiveness; Air Forces, Sea Forces; Computerized; Two-Sided; Stochastic; Event Store.

**TITLE:** ATLAS - A Tactical, Logistical and Air Simulation

**PROPONENT:** U.S. Army Concepts Analysis Agency (CAA)

**DEVELOPER:** Research Analysis Corporation

**PURPOSE:** ATLAS is a computerized, analytical model designed to assist the planner/analyst by simulating conventional theater level combat operations over an extended period, and to examine the overall trends, effects, and interactions of ground, air and logistic forces in conventional theater level warfare. It is basically a planner's war game, providing the tool for examining theater level force interactions so that the planner/analyst may examine and evaluate theater level contingency planning, force effectiveness and force requirements. The daily movement of a FEBA is analyzed as a function of firepower, terrain, posture, residual personnel strengths, and logistic support. The model is also concerned with the scheduling of reinforcements and logistic capability of lines of communication.

**GENERAL DESCRIPTION:** ATLAS is a two-sided, deterministic model involving land and air forces. It was primarily designed to consider division level ground forces and aircraft by mission. The model may be manipulated, however, to consider units down to brigade or battalion level, if the gamer can accept division casualty and movement "rates." The model was designed to consider combat operations by "sector." Each "sector" was designed to represent a corps level force. Up to ten sectors (corps) can be simulated in a representation of theater level combat. Time is treated on a time step basis (24-hour increments). The primary solution technique is average expected value results evaluated deterministically.

**INPUT:**

- In general, inputs fall into four major categories:
  (1) Environmental inputs which structure the theater;
  (2) Ground force inputs of committed and scheduled forces and their associated characteristics;
  (3) Logistic inputs which establish supply requirements and constraints;
  (4) Air inputs which provide performance, vulnerability, and other characteristic data on aircraft, airbases, and SAM sites

**OUTPUT:** Model output is in computer printout form somewhat similar to the input data format. Output is tabulated on a daily basis and reflects the current status of forces at a given time. The planner/analyst must incorporate model results into his analysis of the theater scenario. Selective detailed and summary output is available. Output may be requested for specific days and for specific submodels (ground, air or logistics) or for a comprehensive theater summary. Retrievals of selected data items are also available using the ATLAS data conversion and retrieval programs.

**MODEL LIMITATIONS:** In ATLAS, the battle assessments are primarily dependent on the ratios of the opposing forces computed from firepower scores (FPS). The Index of Combat Effectiveness (ICE) values are modified by casualties or lack of supplies to form a net ICE. At the present state of gaming, weapon firepower effects are assumed to be linearly additive with no enhancement (or degradation) for training, morale, combined arms, and command and control. These factors are usually unknown at the lead time at which the force planner works. Therefore, the planner must emphasize in his analysis those combat factors that he can control or that are calculable. The expression of average expected results, based solely on comparative modified firepower scores, can be misleading or even wrong unless all the ingredients of battlefield success are considered and found to be essentially in balance.

**HARDWARE:**

- Computer: IBM 360/50 or 360/65; CDC 3600 or 6000; UNIVAC 1108
- Operating System: IBM S/360: MFT/MVT and HASP with O.S. Release 19.6; CDC 6000 Series: SCOPE 3+.; UNIVAC 1108; EXEC VIII
- Minimum Storage Required: 186K bytes of core for IBM machines; 120K for CDC
- Peripheral Equipment: Up to two 9-track tape drives and/or a 2316 disk pack for IBM machines; up to two drives for CDC 6000 series

**SOFTWARE:**

- Programming Language(s): FORTRAN IV and ALC (IBM 360 Series) FORTRAN IV (CDC 6000 Series)
- Documentation: "Computerized Quickgame" RAC TP-266 (AD 387510)
  "ATLAS: A Tactical, Logistical and Air Simulation: RAC-TP 338 (AD 850355)
  SHAPE TM 242
  NMCSSC CSM UM 91-69
- User's documentation is complete. Technical documentation is not complete, although considerable technical documentation exists in draft form.

**TIME REQUIREMENTS:**

- 2-4 months to acquire base data, depending on Service responses
- 1 man-month to structure data in model input format
- CPU time per model cycle: CDC 6000 Series: .2 minute
  IBM 360 Series: .6 minute
- 1-2 months learning time for players
- 2 to 40 man-hours per run to analyze and evaluate results

**SECURITY CLASSIFICATION:** Model Software: up to CONFIDENTIAL, depending on version

FREQUENCY OF USE: 50 times per year

**USERS:**

- Principal: GPFD SAGA, DA ACSFOR, and DCSOPS
- Other: U.S. Army CAA, SHAPE Hq., CINCPAC and COMUSKOREA

**POINT OF CONTACT:** UNIVAC version - United States Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: 301 (295-1645)

CDC version - Gaming and Simulations Department
General Research Corporation
McLean, Virginia 22101
Telephone: (703) 893-5900

IBM version - General Purpose Forces Division (GPFD)
Studies, Analysis and Gaming Agency (SAGA)
Office of the Joint Chiefs of Staff (OJCS)
Pentagon, Washington, D.C. 20310
Telephone: OX 5-9003

MISCELLANEOUS:

- ATLAS has computerized interfaces with the ATLAS Data Conversion and Retrieval Programs and with the Simulation for the Assessment of Tactical Nuclear Weapons (SATAN II) Programs. The manual gamer interfaces with the SAGA TANGO family of models. The user also has the option of linking up to the FASTALS model in the FOREWON planning system.
- ATLAS is an improved version of the original RAC Computerized Quickgame.

KEYWORD LISTING: Analytical Model; Limited War; Logistics; Land Forces; Air Forces; Computerized; Two-Sided; Deterministic: Time Step

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TITLE: ATR - Air Transport of Radiation

PROPONENT: Defense Nuclear Agency (RATN)

DEVELOPER: Science Applications, Inc.

PURPOSE: The ATR code provides detailed descriptions of the free-field nuclear environments for all burst-target configurations in the atmosphere. The code utilizes field free input commands and performs a typical calculation in less than a computational second.

GENERAL DESCRIPTION: The ATR code contains parametric models of a comprehensive data base of air transport calculations performed by discrete ordinates techniques. The data base was generated for neutrons, secondary gamma rays, prompt gamma rays, and x-rays as a function of source energy, range, detector energy, and angle to a distance of 550 gm/cm$^2$ of infinite homogeneous air. Results at all configurations of distance and density are obtained by integral mass scaling upon these infinite, homogeneous air results. Effects of the interface between air and ground and of non-uniform air density at high altitudes are treated as perturbation corrections.

INPUT: All input utilizes a field free nmemonic command structure.

- o Burst-target configuration
- o Source spectra and weapon yield (internal sources are available if desired)
- o Output specifications

OUTPUT: All at user option with a full complement of units (km, kft, miles, gms/cm$^2$, cal/cm$^2$, etc.).

- o Full energy angular dependent

| | |
|---|---|
| fluence | energy fluence |
| current | energy current |

dose (several internal dose responses plus user specified)

- o Several convenient summary printout options
- o Constraint calculation (finds the range for a given dose)

HARDWARE:

- o Operational on Univac 1108, CDC 7600/6600, IBM 360/91, GE 635, Dec 10
- o Uses no external storage devices
- o Requires approximately 60K

SOFTWARE:

- o Fortran IV
- o "Users Guide to Version 2 of ATR (Air Transport of Radiation)," L. Huszar, L. Nesseler, W. Woolson, DNA 3144Z (SAI-73-534-LJ), April 1973.

TIME REQUIREMENTS:

- Less than 1 man-hour to define problem in ATR command structure
- Less than 1 second computational time on Univac 1108 for typical problems
- Data formatted for easy interpretation.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Used at several installations on a day-to-day basis.

USERS: (Representative list)

Ballistics Research Lab (BRL)
Defense Nuclear Agency (DNA)
Army Nuclear Agency (ANA)
Air Force Weapons Lab (AFWL)
Science Applications, Inc. (SAI)

POINT OF CONTACT: Dr. William A. Woolson
Science Applications, Inc.
1200 Prospect Street, P. O. Box 2351
La Jolla, California 92037
Telephone: (714) 459-0211

KEYWORD LISTING: Radiation transport, secondary gamma-ray, x-ray, atmosphere, computerized, neutron, prompt gamma-ray, dose, fluence.

TITLE: BAM - Blue Artillery Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: The Blue artillery model is used for analysis.

GENERAL DESCRIPTION: The Blue artillery model is a computerized, deterministic model. It accepts the acquired target list from the Target Acquisition Model and assigns the deployed artillery batteries to fire missions based upon the target list. The assignment of batteries is guided by a set of rules programed into the model. Simulated time is treated on an event stored basis. The solution technique used is that of a computer simulation algorithm.

INPUT:

- Acquired target list which includes target location, type, size, and environment
- Location of all Blue artillery batteries

OUTPUT:

- Computer printout of a list of time sequenced fire missions
- A summary of rounds fired by round type, casualties achieved, and armor losses to artillery fire

MODEL LIMITATIONS: Limited to ten types of artillery, two environment, and 16 types of targets.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: Exec 8
- Minimum Storage Required: 32K
- Peripheral equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Blue Artillery Model, December 1974, USACAA. Available in the Defense Documentation Center
- The above publication is a complete users and technical documentation

TIME REQUIREMENTS:

- Approximately one man month to acquire basic data
- 0.25 man months to structure data in model input formed
- Two minutes CPU time

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Three times per year

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1696

MISCELLANEOUS: The Blue Artillery Model provides input data to the Theater Rates Model.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Artillery; Deterministic

TITLE: BUILDUP

PROPONENT: OJCS (J-4)

DEVELOPER: General Research Corporation (GRC)

PURPOSE: The BUILDUP model determines the buildup of commodities at their destinations after they have traveled through multimodel transportation networks. It provides the analyst with a tool to determine the sensitivity of the buildup rate to changes in many parameters of the transportation system.

GENERAL DESCRIPTION: BUILDUP is a multi-sided, deterministic model involving land, sea, or air vehicles. The heart of the program is an algorithm for minimizing the time to move "packages" through multimodel transportation networks without losing the identity of the package. This algorithm selects from all feasible routes from the origin to destination that route which permits the package to arrive at its destination on the earliest day.

INPUT DATA REQUIREMENTS: Card images from detailed files generated by the Movement Requirements for Studies and Analysis (MORSA) file and updated from RAPIDSIM simulations via processing programs.

- o Number of periods being simulated
- o Number of vehicle classes
- o Onload time
- o Offload time
- o Speed, in kilometers per day, for each vehicle class

OUTPUT:

- o Output is in the form of computer listings reflecting:

  (1) The link origin
  (2) The link terminal
  (3) The mode of the link
  (4) The length of the link
  (5) The capacity of the link
  (6) The time to traverse the link in days
  (7) Vehicle limit by class
  (8) Speed in km/day for each vehicle class

MODEL LIMITATIONS:

- o Maximum number of links - 1600
- o Maximum number of nodes - 450
- o Maximum number of modes - 20
- o Maximum number of vehicles - 20
- o Maximum number of days - 40
- o Maximum number of packages - 900

HARDWARE:

- o Computers: CDC 6400; HIS 6080; IBM 360
- o Operating System: SCOPE (CDC); GCOS (HIS); OS (IBM)
- o Minimum Storage Required: 35K words (CDC); 55K words (HIS); 250K bytes (IBM)
- o Peripherial Equipment: Tape and disk drive

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: Users Manual, General Research Corporation, March 1974
- Technical documentation is not available

TIME REQUIREMENTS:

- 10 manhours to structure input
- 30 minutes CPU time per model cycle
- 1-10 mandays to analyze results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS:

- Principal: OJCS (J-4)
- Other: Assistant Secretary of Defense
  Program Analysis and Evaluation
  SAGA

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
Pentagon, Washington, D.C. 20301
Telephone: OX 7-5464

MISCELLANEOUS: The BUILDUP model can be processed via MULTICS.

KEYWORD LISTING: Analytical Model; Computerized; Transportation; Deterministic

TITLE: CADENS IV - CONUS Air Defense Engagement Simulator

PROPONENT: US Army Air Defense School, Directorate of Combat Developments

DEVELOPER: US Army Air Defense School, Directorate of Combat Developments

PURPOSE: The CONUS Air Defense Engagement Simulator (CADENS-IV) represents interactions which occur between varying deployments of air and ballistic missile defensive systems and attacks by integrated strategic forces. The CADENS model is designed to simulate either a one-sided or two-sided wargame up to a size global in nature. The CADENS model provides a flexible tool for evaluation of continental air defense effectiveness, and global games anticipated in Red Integrated Strategic Operations Plans (RISOP).

GENERAL DESCRIPTION: The CADENS model is a rigid two-sided event stepped (with the exception of the dynamic AWACS search), Monte Carlo, multi-replication simulator. Both nuclear and non-nuclear effects are played. The offensive systems exercised are: 1) ICBMs with MRV, MARV, and MIRV; 2) SLBMs; 3) SLCMs; 4) bombers with ASMs or gravity bombs; 5) ASM; 6) FOBs; 7) AWACS-Killers with on-board radars. The defensive systems exercised are: 1) fighter-interceptor with on-board ground control a/o airborne control; 2) SAM defenses with AADCPs; 3) AWACS; 4) $C^3$; 5) tankers; 6) ABM defenses; 7) OTH-B. The CADENS-IV model consists of 5 interrelated, stand alone, but sequentially linked programs. 1) Input Editor, 2) Preliminary Event Generator, 3) Engagement Simulator Start, 4) Main Game, and 5) Output Editor. Damage is determined to be light, moderate, or heavy with accompanied time penalties. Radar blackout is exercised as to its effect on radar performance and missile flyout. End game damage assessment is provided by requesting burst punched card output. The analyst may select to exercise only a ballistic missile exchange, a single SAM defense (or battery), a large scale air-to-air battle, or any combination over any size geographical area. The sizing of the CADENS-IV model is as follows:

| | |
|---|---|
| o Area of Play | Up to Global |
| o # Defenses | 63 |
| o Defense Entities: | 444 |
| Per Defense: | 127 $C^2$ Sites, 127 Sensor sites |
| By Type: | 127 FUs or Airbases |
| | 63 AWACS Complexes |
| o Offensive Cells/Objectives | 4095/28665 |
| o SAM System Types | 63 |
| o Fighter Interceptor Types | 7 at 63 F.I. Base Types |
| o Sensor Types | 63 |
| o ABM System Types | 63 |
| o Threat Types | 31 |

INPUT: Except for a few control cards used for the 5 programs, all data requirements are handled by the Input Editor Program. A complete global game exercising the complete strategic spectrum would require the following inputs in the order listed:

- o Control Cards
- o Threat Characteristics
- o $C^2$ Characteristics
- o Sensor Characteristics
- o F.I. Base Characteristics
- o Aircraft Characteristics
- o Aircraft Weapon Characteristics
- o SAM Missile Characteristics
- o ABM Missile Characteristics
- o SAM Defenses
- o FI Defenses
- o ABM Defenses
- o Communications
- o ICBM/SLBM Attack Plan
- o AST Attack Plan

OUTPUT: The output Editor Program is structured to allow for selectivity of desired output. The analyst may request all replications history of game play, in a time ordered, chronological sequence, or sorted according to the numbered defense, or all three sorts for all replications. By placing a few control cards, you can extract only the data desired, at the level of granularity and for any or all replications, summaries of each replication, and the average value of the desired data for all replications. In addition, the chronological order by replication of all bursts can be punched in a readable format to determine level and time of damage occuring to targets that do not participate in the game play.

MODEL LIMITATIONS:

- o No interface between SAM and AWACS
- o The AAA gun is not modeled
- o Terrain is assumed smooth earth
- o ECM is programmer controlled through input

HARDWARE:

- o Computer CDC 6000 series
- o SCOPE, 3.3
- o Two magnetic tape drives
- o Core 14,700 Octal

SOFTWARE:

- o FORTRAN IV
- o Compass
- o Documentation available from USAACS, Ft. Bliss, Texas

TIME REQUIREMENTS: A small air battle of 10-20 hostile tracks penetrating a single defensive region exercised over ten replications requires approximately 30 minutes of CPU time. A large to moderate size game exercising 1000 missile tracks or more requires approximately 3 hours of CPU time. A maximum game of 1700 missile tracks and 650 bomber tracks across a total continental defense posture requires approximately 4 hours CPU time.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Weekly

USERS: NORAD-J5, USAADS

POINT OF CONTACT: US Army Air Defense School (ATSA-CD-SS)
Fort Bliss, Texas 79916
Telephone: (915) 568-7500
Autovon: 978-7500/6238

KEYWORD LISTING: Analytical model; Strategic Forces; ICBM/SLBM, ABM, SAM OTH-B AWACS, F.I., A.F.I., AWACS Killers, Blackout, Blast, Nuclear Effects, Fratricide, SLCM, FOBs, Radar, Monte Carlo, Stochastic, Event Step.

TITLE: CAM - Artillery Casualty Assessment Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest development has been done in-house.

PURPOSE: The Artillery Casualty Assessment Model is a computerized model used for analysis. It assesses casualties and armor losses achieved by indirect fire weapon systems.

GENERAL DESCRIPTION: The Artillery Casualty Assessment Model is a one-sided, stochastic model involving land forces only. It is capable of considering anywhere from one battery volley to thirty battalion volleys. Simulated time is treated on an event store basis. Monte Carlo is the primary solution technique used.

INPUT:

- o Target size, environment, and posture sequence
- o Weapon firing errors and lethal areas for munitions

OUTPUT: Printout of casualties for each volley fired at target

MODEL LIMITATIONS:

- o Circular targets only
- o Lethal areas only

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Exec 8
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Artillery Casualty Assessment Model, December 1974, USACAA. Available in the Defense Documentation Center
- o The above represents complete user's documentation and complete technical documentation

TIME REQUIRED:

- o 1 month to acquire base data
- o 2 man-weeks to structure data in model input format
- o 2 minutes CPU time per model cycle

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 3000 times per year

USER: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1696

MISCELLANEOUS: The Artillery Casualty Assessment Model provides input to the Blue and Red artillery models.

KEYWORD LISTING: Analytical Model; General (Nonnuclear); Land Forces; Computerized; One-Sided; Stochastic; Event Store

**TITLE:** CAM-SAAB - Countering Anti-Ship Missiles - Simulated Air-to-Air Battle

**PROPONENT:** Chief of Naval Operations (OP-96)

**DEVELOPER:** Center for Naval Analyses

**PURPOSE:** CAM-SAAB is a computerized fleet air defense model designed to ascertain the level of attrition that defensive interceptor aircraft can inflict upon the missile-carrying aircraft of attack formations. The model determines the effect of using various fleet interceptors such as F4s or F14s, with various weapon loads and with varying radar configurations.

**GENERAL DESCRIPTION:** CAM-SAAB is a two-sided model having both deterministic and stochastic elements. Only air forces are involved. The model is designed to consider from one to one hundred individual defensive aircraft versus from one to fifty offensive groups. Offensive groups may consist of any member of aircraft from one to some practical limit of about thirty. The model can aggregate up to fifty such raid groups versus one to four aircraft carrier fleets. (Aircraft are either in the game or not. Unlike many such games, no fractional aircraft fly). Simulated time is treated on an event-store basis. The primary solution technique used is probability. Individual aircraft maneuver and engage in three-dimensional space.

**INPUT:**

- Fleet and raid makeup and position
- Weapon characteristics
- Radar characteristics
- Weather conditions
- Interceptor launch strategy
- Interceptor/raid escort tactics

**OUTPUT:**

- Summary data of raid/defensive aircraft destroyed, number of ASMs launched, etc.
- Detailed results of individual interceptions.
- Detail and summary outputs are available for each iteration. Detailed step-by-step printouts are also available for each event within a selected iteration. Tape outputs are also available of the step-by-step printouts, and of the detail and summary outputs for analysis programs. Subsequent programs summarize across iterations.

**MODEL LIMITATIONS:**

- The only interceptors provided for are F4s and F14s.
- The only missiles provided for are the Phoenix, Sparrow (E, F), and Sidewinder.
- Maximum of 6 AEW, 12 CAP, 100 DLI, and 50 raid groups.
- Maximum of 1 task group center.

HARDWARE:

- o Computer: CDC 3600, CDC 3800, CDC 3400.
- o Operating System: SCOPE
- o Minimum Storage Required: 32K, but 65K is preferred.
- o Peripheral Equipment: 2 scratch units (disk or drum files, or scratch tapes).

SOFTWARE:

- o Programming Language: FORTRAN, COMPASS (ASSEMBLY)
- o Documentation consists of a Model Description, Input Specifications, General Flow Description, Narrative Description of Major Routines, Radar and Geometrical Equations Used, Vectoring and Engagement Relationships. Both user's documentation and technical documentation are complete. Certain technical documents are classified confidential.

TIME REQUIREMENTS:

- o 6 months to acquire base data.
- o 2 man-weeks to structure data in model input format.
- o 30 seconds CPU time per model cycle.

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 100 per year

USERS: Center for Naval Analyses

POINT OF CONTACT: Center for Naval Analyses
1401 Wilson Boulevard
Arlington, Virginia 22209
Telephone: (703) 524-9400

MISCELLANEOUS:

- o CAM-SAAB is linked to CAM/SAM (Countering Anti-Ship Missiles - Surface to Air Missile Submodel) which deals with ASMs after launching. CAM-SAAB indicates the numbers and sources of these missiles after the air-to-air battle.
- o CAM-SAAB supersedes FAA and SAAB.

KEYWORD LISTING: General War (Non-Nuclear); Air Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Event Store.

TITLE: CAMP - Computer-Assisted Match Program

PROPONENT: U.S. Army Concepts Analysis Agency

DEVELOPER: U.S. Army Concepts Analysis Agency

PURPOSE: CAMP is a system of file processing programs that interface the FOREWON Force Planning System with strategic mobility simulation models by generating detailed time-phased movement requirement to include both unit-related and non-unit-related movement requirements.

GENERAL DESCRIPTION: CAMP generates detailed movement requirements. It selects actual units to meet type unit requirements, determines unit movement characteristics, establishes required delivery dates, origins, destinations and modes of shipment. Resupply, accompanying supply replacements and fillers are calculated based on theater level consumption and resupply policies.

INPUT:

- Type unit requirements such as those provided by the FASTALS model
- Force Accounting System (FAS) force file
- TUCHA (Type Unit Characteristics) File
- Geographic Location Codes
- POMCUS and Preposition War Reserve Data
- Resupply, Consumption and Casualty rates

OUTPUT:

- Detailed, summary and selective retrievals based on standard force planning codes
- Hard copy and tape files which describe each individual time-phased movement requirements. Movement requirements can be formatted for input to the SMOBSMOB strategic mobility simulation model or in MORSA format for submission to JCS.

MODEL LIMITATIONS

- Large amount of data and long execution times. A large portion of execution time is attributable to I-O operations

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum storage required: 60K words
- Peripheral equipment: Mass storage devices

SOFTWARE:

- Programming Language: ANSI COBOL
- Documentation: None other than program source

TIME REQUIREMENTS:

- o Acquire data base: 2 weeks
- o Load data files: 1 week
- o Initial force match: 2 weeks
- o Force modification and generation of movement requirements: 2 weeks
- o Analysis of results: 2 weeks

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 times per year

USERS: USACAA, ODCSOPS, ODCSLOG, OJCS-J4

POINT OF CONTACT: Joint and Strategic Forces Directorate
U.S. Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014

MISCELLANEOUS

- o CAMP is currently being reworked to achieve time and storage efficiencies and provide more documentation. New capabilities are planned to interface DEPREP formatted data.

KEYWORD LISTING: Model, Computer, Force Planning

TITLE: CAM/SAM - Countering Anti-Ship Missiles - Surface-to-Air Missile Submodel

PROPONENT: Chief of Naval Operations (OP-96)

DEVELOPER: Center for Naval Analyses

PURPOSE: CAM/SAM is a computerized model that addresses the problem of ship-based surface-to-air missiles (SAM) defense against attacking air-to-surface missiles (ASM) and surface-to-surface missiles (SSM). Assumptions in the model limit battle time to less than one hour (the model is primarily designed for a 20-30 minute engagement), but the model is designed for consecutive runs (provided that input data is updated) using the end of the previous engagement as the start time for the second engagement. In addition, the model addresses the following problems: (1) SAM anti-ship missile interactions; (2) interceptor engagements; (3) electronic countermeasures; (4) guns (platforms and/or missiles); (5) sensitivity studies on the vulnerability of shipboard systems simulated, including task configuration.

GENERAL DESCRIPTION: CAM/SAM is a two-sided, stochastic model designed to consider a task force (whose ships are ranked by four levels of priority) against any number of attacking ASMs or up to 60 ships (of 15 classes) with 10 radar classes, 5 jamming locations, 2 jamming power levels, 50 SAM batteries (of 10 classes) and up to 4 batteries per ship (including BPD), with 6 fire control channels and 4 launcher rails per battery. It can also consider anywhere from one attacking enemy missile to 99 ASMs launched, or up to 50 ASM launch sources, with any number of missiles being launched from any source. SAM and ASM may be nuclear, conventional or mixed. Attacking missiles are limited to 5 weapons classes. Simulation of a minute of combat requires a minute of computer time. The primary solution techniques used are Monte Carlo, mechanized bookkeeping, and probability-random numbers to test survivability.

INPUT:

- Detectability ranges for each radar class.
- Description of radar classes.
- Description of jamming sources.
- Description of enemy weapon classes.
- Description of SAM classes (Talos, Tarrier, etc.).
- Detection and lock-on delay distributions for each radar class.
- Description of ship classes.
- Ship positions.
- ASM descriptions or ASM launch source descriptions.
- ECM interference levels.
- Miscellaneous game inputs and print options.

OUTPUT: Output runs the spectrum from stop action reports on all systems and missiles to summaries of any number of iterations, including mean and standard deviations. Plots and histograms are also available. Some options are:

- Data array sequentially printed.
- List of events stored and retrieved.
- Ship, SAM and ASM status arrays at end of game.
- Intercept time and coordinates.
- Priority assessment event printout.
- Jamming strobe arrays.
- Reaction decision event printout.
- Lock-on/decision-to-fire event printout.
- SAM launch event.
- Intercept event.
- ASM impact event.

- o Kill assessment event.
- o ASM launch/detection event printout.
- o Random targeting information.
- o Partial input arrays.
- o Targeting list.
- o Intercept diagram of SAM trajectories.
- o Event Sequence printout for each SAM battery.

MODEL LIMITATIONS:

- o See General Description (above) for maxima of ships, radars, batteries, missiles, etc.
- o Maximum duration of 99.99 minutes.

HARDWARE:

- o Computer: CDC 3800
- o Operating System: SCOPE
- o Minimum Storage Required: 26.5K
- o Peripheral Equipment: Plotter (optional), load and go tape or card reader

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a set of appendices to NAVWAG Study No. 62, "Countering Anti-Ship Missile Study," CONFIDENTIAL. Appendix I of Volume 6 illustrates the computer model and describes inputs.
- o User's documentation is complete through September 1971. Technical documentation is complete through December 1970. Beyond the Appendix I mentioned above, there is no complete user guide or programmer manual.

TIME REQUIREMENTS:

- o About 2 months to acquire base data.
- o Up to 1 man-month to structure data in model input format.
- o Approximately 1 minute CPU time for an average iteration, although this varies with the size of the game.
- o Maximum of 1 month learning time for users.
- o Up to six months to analyze and evaluate results.

SECURITY CLASSIFICATION: The model is CONFIDENTIAL. Input is SECRET.

FREQUENCY OF USE: Twice annually.

USERS: Principal: Center for Naval Analyses
Other: Carderoc, Applied Physics Laboratory, Pentagon

POINT OF CONTACT: Center for Naval Analyses
1400 Wilson Boulevard
Arlington, Va. 22209 (Telephone: (703) 524-9400)

MISCELLANEOUS:

- o CAM/SAAB provides input to the CAM/SAM in the form of the numbers and sources of ASMs after air-to-air battle.
- o CAM/SAM supersedes the FAAW-III Model.
- o It is currently planned to add a more realistic nuclear game to the model, including psi effects, etc.

KEYWORD LISTING: Limited War; Air Forces; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store.

**TITLE:** CARMONETTE VI - Computer Simulation of Small Unit Combat

**PROPONENT:** U.S. Army Concepts Analysis Agency (CAA)

**DEVELOPER:** Research Analysis Corporation

**PURPOSE:** CARMONETTE VI is a computerized, analytical model designed to simulate small unit battles (up to two battalions per side) with emphasis on unit movement, target detection, weapon firing and assessment of results. The model's chief focus of concern is the assessment of different weapon mixes with different kinds of weapon effects. In addition, it is also concerned with the assessment of the effects of tactics and of sensors and detection devices on battle outcomes.

**GENERAL DESCRIPTION:** CARMONETTE VI is a two-sided model involving land forces and armed helicopters. It is primarily designed to consider units ranging from the individual soldier or vehicle up to units of platoon size. The lower limit of this range may be manipulated to make the smallest group considered as large as a platoon, and the upper limit may be altered to consider up to two battalions. One minute of CPU time is required to game four to six minutes of battle. Simulated time is treated on an event store basis. The model is stochastic, using as its primary solution technique random number determination of success and of time duration for certain events.

**INPUT:** Troop lists; weapon lists; weapon accuracy; weapon performance data; weapon lethality; sensor performance data; vehicle mobility characteristics; vehicle vulnerability; tactical scenario; terrain characteristics. A total of 35 inputs must be completed.

**OUTPUT:** Output is in the form of computer printout listing all events assessed, with a summary of all casualty events, and summation of kills by target type and weapon types. Also available are summaries of weapon engagements (firings) shown by target type, rounds fired, personnel and vehicles killed for each of the selected range brackets.

**MODEL LIMITATIONS:**

- Maximum of 36 weapon types (both sides)
- Maximum of 48 weapon units (each side) with up to 63 killable elements (personnel) per unit
- Max is 63 x 62 grids of selectable size (5m to 250m)
- Does not treat logistics
- Player cannot change tactics during a single game; he must write a new scenario and a new game
- Results are highly dependent on detailed inputs

**HARDWARE:**

- Computer: CDC 6400, or CDC 6000 Series, UNIVAC 1108
- Operating System: SCOPE 3.3, EXEC VIII
- Minimum Storage Required: 65K words in memory
- Peripheral Equipment: 3 tape drives, 1 disk

SOFTWARE:

- Programming Language(s): FORTRAN and COMPASS
- Documentation: CARMONETTE III: RAC R28, in 3 volumes (Volume 1, AD822400L; Volume 2, AD827900; Volume 3, AD825000)
  CARMONETTE IV: The use of CARMONETTE IV in Assessing the Combat Effectiveness of Small Units Equipped with Night Vision Devices (in draft; AD514519L)
  CARMONETTE V: Equal Cost Firepower (in draft)
  CARMONETTE VI
- Both user's documentation and technical documentation are complete, although not available in one document.

TIME REQUIREMENTS:

- 1 month to acquire base data
- 2-3 man-months to structure data in mode input format
- 300 seconds playing time for 50 minute battle
- 150 to 6-0 seconds CPU time per model cycle
- 2-3 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times per year

USERS: Principal: ACSFOR, CDC CONFOR GP

POINT OF CONTACT: U.S. Army CAA
Bethesday, MD 20014
Telephone: (202) 295-1645

MISCELLANEOUS: CARMONETTE VI supplies assessment data to RAC's Division Battle Model (DBM). CARMONETTE game results are processed by linear regression techniques to generate assessment equations for DBM.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic Event Store

**TITLE:** CAROM - Career Area Rotation Model

**PROPONENT:** Air Force Human Relations Laboratory, Operation Research Section (AFHRL/ORS), Manpower & Personnel Systems Branch, Occupational and Manpower Research Division

**DEVELOPER:** Decision System Associates, Inc.

**PURPOSE:** The Career Area Rotation Model is a computerized analytic model that simulates the interaction and impact of numerous policy decisions on optimal tour rotation, manning, career progression, skill upgrading, and attrition for an occupational specialty grouping. The model assesses policy alternatives in terms of tour length, sequence of tour types, grade and skill substitution rules, attrition factors, promotion eligibility criteria, promotion rates, etc.

**GENERAL DESCRIPTION:** The Career Area Rotation Model is entity level and one-sided, and has both deterministic and stochastic elements. Only Air Force enlisted personnel (after initial technical training) are considered by occupational specialty or grouping of specialties. Simulation is one period (one month or longer) at a time for up to 30 years. A modified Ford-Fulkerson assignment algorithm is used to optimally assign airmen to billets, and a Monte Carlo procedure is used to simulate random processes.

**INPUT:**

- Strength requirements for Grades E2 through E9 for each of four types of tour categories
- Grade-substitution policy for each tour category
- Promotion policy and rates
- Attrition factors
- Records of new accessions to the career field

**OUTPUT:**

- Tabular summaries of all relevant promotion, deployment, accession and attrition activities
- Output tape of personnel records, including detailed history while on board and final description

**MODEL LIMITATIONS:** Total manning of an occupational grouping is limited to approximately 100,000 men per simulation period.

**HARDWARE:**

- Computer: UNIVAC 1108 and CDC 6600
- Operating System: Standard
- Minimum Storage Required: CDC version - 256K bytes; UNIVAC version - 79K words
- Peripheral Equipment: tape units, card reader, printer

**SOFTWARE:**

- Programming Language: FORTRAN IV and Assembler
- User's Documentation: AFHRL-TR-73-49, Career Area Rotation Model User's Manual; additional technical documentation in preparation

TIME REQUIREMENTS:

- Approximately 1 week to acquire and structure data base in model input format
- 1-15 seconds CPU time per simulation cycle
- Less than 4 hours total computer time for most large occupational groupings

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS:

- AFHRL for development
- AFMPC for operational use

POINT OF CONTACT: AFHRL/ORS, Manpower & Personnel Systems Branch
Occupational & Manpower Research Division
Lackland Air Force Base, Texas 78236
Telephone: AUTOVON 473-2711

MISCELLANEOUS: Development is continuing to modify and enhance the computer model.

KEYWORD LISTING: Simulation; Computer Model; Gaming Model; Assignment; Tour Rotation; Policy Assessment

TITLE: CAS/DAM - (Casualty/Damage Assessment)

PROPONENT: NELC (Naval Electronics Laboratory Center) and
USMC/MCDED (Marine Corps Development and Education Command)

DEVELOPER: CSC (Computer Sciences Corporation)

PURPOSE: Casualty and Damage Assessment simulation for TWAES (Tactical Warfare Analysis and Evaluation System) which includes:

- o Mortar
- o Artillery
- o Close Air Support (CAS)
- o Small Arms Fire (Ground Combat)
- o Tanks and Recoilless Rifles
- o Naval Gun Fire (NGF)

GENERAL DESCRIPTION: Computes Casualty and Damage Assessments based on:

- o Combat Power Ratio of Opposing Forces
- o Troop Performance
- o Dispersion
- o Weapon Type ($ Volume of Fire)
- o Protective Cover
- o Fatigue
- o AMMO Remaining
- o Unit Type and Size and Organic Equipments Remaining

INPUT: Fielded umpires with combat units submit digital coded messages to TWAES Center where computer system maintains status files. Controllers in TWAES Center request CAS/DAM as appropriate. Also, CAS/DAM is activated by delivered weapon support. Target area is searched for actual unit location.

OUTPUT: Casualties and equipment damage is displayed/printed to controllers in TWAES Center which are in turn transferred to fielded umpires by voice communications. Umpire distributes Casualty and Damage Assessment by using pre-prepared booklets of CAS/DAM cards. Units take appropriate action. Digital messages are submitted as CAS/DAM is issued so that unit status is properly updated and combat power maintained.

MODEL LIMITATIONS: None

HARDWARE:

- o Computer: UNIVAC AN/UYK-7
- o Peripheral Equipment: Disk and magnetic tapes
- o 720 Sanders A/N Displays
- o GE Light Value (4PJ500A1) Large Screen Display
- o CONRAC 1902C Color 650 Displays

SOFTWARE:

- o Programming Language: CMS-2
- o Documentation Available from CSC:
  1. Functional Specification
  2. Program Performance Specification

TIME REQUIREMENTS: Real-Time System

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100/Day During Exercise
10-20 Exercises/Year
Exercise Duration is 3-5 Days

USERS: USMC - FMF
MAB Exercises, MAF Exercises, BnTac Tests, etc.
Camp Pendleton and Camp Lejune

POINT OF CONTACT: Mr. G. W. Gibson, NELC Code 231
Marine Corps Base
Camp Pendleton, Calif. 92055
(714) 725-2614

MISCELLANEOUS:

- System will be delivered to MCTSSA in 1976 for continued maintenance. Three systems being developed; one for each MAF.

KEYWORD LISTING: Casualty/Damage Assessment; Combat Power; Real-Time Simulation, USMC; Field Exercises

TITLE: CEM - Concepts Evaluation Model

PROPONENT: U.S. Army Concepts Analysis Agency

DEVELOPER: Research Analysis Corporation

PURPOSE: CEM is a computerized, analytical model designed to portray the course of theater-level, non-nuclear war in terms of FEBA location, condition of opposing forces, and expenditure of resources. The primary problem addressed is that of determining the effects of force structure on force performance in theater-level warfare.

GENERAL DESCRIPTION: CEM is a two-sided, deterministic model involving land and air forces. It is designed to consider groupings as small as a brigade on the Blue side and a division on the Red side, and can aggregate up to the level of a theater army (and air force). Simulated time is treated on a time step basis. The model uses only basic arithmetic and logical operations as its primary solution techniques.

INPUT:

- Terrain map
- Military objectives
- Troop lists
- TOEs
- Weapon firepower indices
- Resupply and replacement rates

OUTPUT:

- Computer printout stating (periodic) FEBA location, state of opposing forces and resources expended

MODEL LIMITATIONS:

- Blue brigade structure cannot be changed during a war
- Reserve units (if any) consist of exactly one of the next lower echelon unit
- Logistic operations highly aggregated

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: Level 31
- Minimum Storage Required: 120,000 decimal words
- Peripheral Equipment: 2 tape drives and/or disk

SOFTWARE:

- Programming Languages: FORTRAN V
- Both user's documentation and technical documentation are complete.

TIME REQUIREMENTS:

- 2 months to acquire base data
- 18 man-months to structure data in model input format
- 10 seconds CPU time per twelve-hour cycle
- 2 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 25 times per year

USERS: U.S. Army Concepts Analysis Agency

POINT OF CONTACT: U.S. Army Concepts Analysis Agency
Methodology and Resources Directorate
8120 Woodmont Avenue
Bethesda, MD 20014

MISCELLANEOUS:

- It is presently planned to improve the representation of logistic operations and their effects on combat capability of a force.

KEYWORD LISTING: Analytical Model; General War (Non-Nuclear); Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: COLLIDE - An Aggregated Conversion Model for Air Combat

PROPONENT: USAF/SA

DEVELOPER: USAF/SA

PURPOSE: Collide is a computerized analytical model designed to compute airborne interceptor probability of detection and conversion to armament launch position for given target characteristics and tactics.

GENERAL DESCRIPTION: Collide is a one-sided, deterministic model which simulates a one to one airborne intercept. Time simulation uses event store. Game-time to real time is approximately 1:100.

INPUT:

- Air to air missile launch envelopes
- Target vector
- Interceptor vector, "G" available and detection range
- Heading crossing angle

OUTPUT:

- Probability of detection and conversion for various approach angles
- Optimum approach angle
- Total for random approach angles

MODEL LIMITATIONS: Does not include capability to combine effects of simultaneous radar/IR/visual search.

HARDWARE:

- Computer: GE 635
- Minimum Storage Required: 25K

SOFTWARE:

- FORTRAN IV

TIME REQUIREMENTS:

- 2 months to assemble data base
- CPU time: several seconds

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per month

USERS: USAF/SA

POINT OF CONTACT: Assistant Chief of Staff, Studies and Analysis
Hq US Air Force (AF/SASI)
Washington, D.C.
Telephone OX 5-4180

KEYWORD LISTING: Analytic, Limited War, Air, Acomputer model, One-sided, Deterministic, Event Store

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TITLE: COMBAT II

PROPONENT: DNA

DEVELOPER: The BDM Corporation

PURPOSE: COMBAT II is a computerized model of simultaneous air/ground combat at the theater level with the capability to play conventional, nuclear, or mixed interactions. It is an aggregate model designed to provide an overview of theater level mixed combat exchanges and to determine what is driving the battle outcome.

GENERAL DESCRIPTION: COMBAT II is a differential equations model. Detailed time histories of the combat systems are obtained by numerically integrating a coupled system of nearly a hundred ordinary differential equations. Time histories include the number of remaining units at various locations, targets of every type killed within the system, supply flows, deployments, and attritions due to each enemy source. Systems considered in COMBAT II are ground force units (with a proportionate share of conventional artillery), nuclear artillery, tactical missiles, aircraft, supplies, and nuclear warheads. Model equations are symmetrical for red and blue. Asymmetries are dealt with through data input.

INPUT:

- Allocation factors
- Acquisition factors
- Kill factors
- Maximum expenditure rates

OUTPUT: The time history of nearly eleven hundred parameters are output on tape. The COMBAT II output tape is input to a post processor program to produce any of the following:

- Computer printout and plot of the time history of any parameter.
- Conservation table for any combat system. The conservation table gives a rigorous accounting at each location throughout the battle of units remaining, losses from each enemy source, expenditures against each enemy target, resupply, etc.
- Decomposition table summarizing throughout the battle the contributions of each combat system to the outcome. The decomposition table and conservation tables enable the analyst to see the contribution of each factor and to identify driving parameters at any point of the battle.

MODEL LIMITATIONS:

- FEBA movement is considered in three segments (fronts) only.
- Terrain, weather, day and night effects on target acquisition and movement rates are not calculated explicitly. Provisions are made for accounting for these effects by manual inputs.
- There are no provisions to represent local breakthrough, overrun, encirclement, and capture.

HARDWARE:

- o Computer: CDC 6000-7000 system
- o Operating System: Local or remote job entry
- o Storage Required: 100K and two on-line files (disk or tape)
- o Peripheral Equipment: Card reader or RJE terminal, printer

SOFTWARE:

- o Programming Language: FORTRAN (CDC extended)

TIME REQUIREMENTS:

- o Preparation time for a completely new problem is approximately three man days
- o Preparation time for a minor excursion on an existing problem is as little as one half hour
- o Typical run time for a ten day war (including post processor time) is under two CPU minutes. (Run time is somewhat data dependent).
- o Analysis time for output to a completely new problem is less than one day.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Used extensively for on-going theater force balance studies

USERS: The BDM Corporation for DNA

POINT OF CONTACT: Mr. John R. Bode
The BDM Corporation
1920 Aline Avenue
Vienna, Virginia 22180
Telephone: 703/893-0750

KEYWORD LISTING: Differential Equation; Analytical; Conventional-Nuclear; Ground/Air Forces; Time-Histories; Sensitivity Analysis

TITLE: COMMEL II, Integrated Tactical & Communications Simulation

PROPONENT: U.S. Army Concepts Analysis Agency

DEVELOPERS: Improvements & expansion (in process) by USACAA, originally developed by Philco/CEIR/URS Corps

PURPOSE: COMMEL is a computerized, analytical, general war battle model designed to process input data to develop a battle between division sized forces. Its primary function is to provide the user with a convenient, realistic, dynamic, ground combat environment in which he can observe in detail, as in an actual military operation, the performance of a proposed Communications-Electronics concept to explore in a wide variety of conditions the fundamental characteristics and qualities of combat communications phenomena. Its primary employment occurs at that point within an experimental or research sequence at which a judgment or determination of the value of a concept or system must be made in terms of its contribution to the combat effectiveness of the using military organization or the point at which basic information is required as to the nature of the interactions between fundamental communications concepts and combat effectiveness.

GENERAL DESCRIPTION: COMMEL is a two-sided, stochastic model capable of considering units ranging in size from company to division. Simulated time is treated on a time step basis. Primary solution techniques include probability, queuing and "shortest route" algorithm.

INPUT:

- o Tactical data, including unit locations, weapon effectiveness, intelligence exchange and terrain data
- o Communications systems parameters
- o Message generation parameters

OUTPUT: Raw data. Tactical and communications post-processing to be added

MODEL LIMITATIONS: Computer memory size limitations constrain the complexity and quantity of input data

HARDWARE:

- o Computer: CDC 3300
- o Operating System: MSOS (Mass Storage Operating System)
- o Minimum Storage Required: 27,500 words
- o Peripheral Equipment: Card reader, printer, tape drives, disk

SOFTWARE:

- o Programming language: FORTRAN IV, CDC 3000 series COMPASS
- o Documentation: incomplete and inaccurate; to be revised upon completion of current evaluation and modification effort

TIME REQUIREMENTS:

- o Data base acquisition: unknown
- o Data structured for input: unknown
- o Run times: 1 hr wall clock incl 30 min CPU, for each 1 hour simulated
- o Output analysis: estimated to be 6 man-months, improvements underway

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: TBD

USERS: USACAA

POINT OF CONTACT: Mr. J. Clark
U.S. Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1534

MISCELLANEOUS: COMMEL II supersedes COMMEL

KEYWORDS: Simulation, Communications, Stochastic, Division Model

TITLE: COMPLEXER (not an acronym)

PROPONENT: Studies, Analysis, and Gaming Agency (SAGA)

DEVELOPER: Organization of the Joint Chiefs of Staff (SAGA/SFD)

PURPOSE: COMPLEXER is a collection of three programs designed to model effects of various weapons on selected target complexes and then produce tabular and geographical data on this limited war interaction.

GENERAL DESCRIPTION: The COMPLEXER programs present a model dealing with limited number of targets and weapons. The first program, Target Data Inventory (TDI), gathers installations with a specified major reference number from the input tape. COMPLEX, the second program, analyzes the interaction of specified weapons upon target complexes. COMPLOT, the last program, plots maps for a more detailed look at targets within a specified major reference number.

INPUT:

- Target base with population sorted by major reference number, with the following minimum information where appropriate: major reference number, category, latitude, longitude, VNTK, capacity, and radius
- Weapon information consisting of yield, CEP, and PA.

OUTPUT:

- Computer printouts giving target damage data and location of targets on map

MODEL LIMITATIONS:

- 202 targets (can be increased by changing source code)
- Unlimited weapon types

HARDWARE:

- Computer: HIS 6080, IBM 360
- Minimum storage: 32K
- Peripheral equipment: card reader and printer
- Note: COMPLEXER is operational from remote terminals

SOFTWARE:

- Programming language: FORTRAN
- Documentation: COMPLEXER Users Guide

TIME REQUIREMENTS:

- Time to acquire base data varies from one day to several weeks
- Approximately one day to structure data in model input format
- 5 to 60 minutes CPU time depending on the number of attack options in consideration

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Monthly

USER: SAGA

POINT OF CONTACT: NMCSSC/B225
Pentagon, Washington, D.C. 20301
Telephone: OX 7-2392

KEYWORD LISTING: Computer Model; Strategic; Weapons effects

TITLE: CONTACA

PROPONENT: U.S. Army Concepts Analysis Agency (CAA)

DEVELOPER: U.S. Army Concepts Analysis Agency (CAA)

PURPOSE: CONTACA is a computerized, dynamic, two-sided tactical aircraft sortie generator and mission allocator model. From an inventory of air forces, CONTACA generates effective sorties and allocates the sorties to eight possible missions. The model may be used independently or in conjunction with larger, more sophisticated war gaming models.

GENERAL DESCRIPTION: CONTACA is a two-sided, deterministic model involving air forces only. Six aircraft types and eight air missions are simulated per side. The model is designed to consider theater level combat. There are two options for the allocation of aircraft to the various missions. One is, the status of the air war is reflected through aircraft ratios that are calculated by the model; these ratios, in turn, influence mission allocation. Another is, a direct player input in which is stipulated the percent of each aircraft type dedicated to one or more of the eight missions. Simulated time is treated on a time step basis. Probability is the primary solution technique used.

INPUT:

- o Six aircraft types and eight missions per side
- o Standard military capability descriptors
- o Definitions of defensive measures in terms of operational factors and attrition rates applicable to individual aircraft types
- o Percent of sorties, by aircraft type, allocated to various missions

OUTPUT: Detailed daily output relative to sortie generation, mission allocation, and protective status of aircraft (sheltered and in sanctuary) while they are on the ground.

MODEL LIMITATIONS: No damage assessment provided except for aircraft destroyed on the ground.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 20K
- o Peripheral Equipment: FASTRAND format mass storage

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation: Players and Technical Manual, and Program Listings
- o Both user's documentation and technical documentation are complete. The Players and Technical Manual presently exist only in draft form.

TIME REQUIREMENTS:

- o 2 weeks to acquire base data
- o 1 man-week to structure data in model input format
- o 2 minutes CPU time per model cycle (typical 90-day confict)
- o 2 weeks learning time for users
- o 3 days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS: USA CAA

POINT OF CONTACT: U.S. Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1652

MISCELLANEOUS: This tactical air model was developed, by the Army, to provide an indication of the influence of a given air concept of operation and mission allocation on the number of direct air support sorties generated by both sides on a day-by-day basis. CONTACA could supply effective sorties figures and mission allocation data to any model that required such input.

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; Two-Sided, Deterministic; Time Step

TITLE: CREST - Computer Routine for Evaluation of Simulated Tactics

PROPONENT: USN (OP-96)

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, John Hopkins University

PURPOSE: CREST is a computerized, analystical model that evaluates the effectiveness of one unit successfully evading one or more adversaries. Although the simulation is presented in terms of a CVA maneuvering to evade a number of nuclear and/or conventional submarines, the model is adaptable to many encounter-evasion situations. The game is designed to examine the survival of a CVA with SONAR screen against a force of submarines. The CVA mission may be to transit through an area or to maneuver in the area. The CVA and the submarines in the model may be given detection and speed parameters similar to other units; for example, merchant ships and surface raiders may be simulated.

GENERAL DESCRIPTION: CREST is a two-sided, stochastic model involving sea forces only. It is capable of considering one CVA versus a maximum of 120 SS/SSNs. Outcomes are assessed semi-rigidly. Simulated time is treated on a time step basis. A 30-hour (100 trials) real time simulation requires approximately two minutes of computer time. The primary solution techniques used are Monte Carlo simulation of decision processes and kinematics for unit motion.

INPUT:

- CVA normal and evasion speeds
- SS/SSN patrol and attack speeds
- Detection ranges
- Kill probability and weapon firing range for SS/SSN vs. CVA

OUTPUT: Time-step battle history, or various levels of summary output are available.

MODEL LIMITATIONS:

- Maximum of 120 SS/SSNs
- The CVA and SONAR screen or escorts cannot kill submarines.
- CVA speed must exceed submarine speed.

HARDWARE:

- Computer: IBM 360/91, IBM 7090/7094
- Operating System: OS 360 (360/91); IBSYS (7090/7094)
- Minimum Storage Required: 32K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: "Computer Routine for Evaluation of Simulated Tactics (CREST)," Command Manual, Users Manual, Listings, PAG No. 17-68, CM 3350.
- Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- 3 days to prepare input.
- Approximately 1 second CPU per model cycle (3 minutes run time for 100 trials).
- 3 days to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: OP-96

POINT OF CONTACT: Mr. Charles G. Frankhauser
Planning Analysis Group
Johns Hopkins University
Applied Physics Laboratory
8612 Georgia Avenue
Silver Spring, Maryland 20910
Telephone: 589-7700

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Time Step.

TITLE: DACOMP - Damage Assessment Computer Program

PROPONENTS: Defense Nuclear Agency (DNA)

DEVELOPER: Engineering Systems Division, Stanford Research Institute

PURPOSE: DACOMP was developed to apply the SEER III single-weapon fallout model to the analysis of full-scale strategic nuclear attacks. The program was designed to determine the radiological fallout effects on population centers and to assess damage in terms of fatalities and casualties. DACOMP has been used in a damage assessment exercise involving an attack of 1,261 nuclear weapons against 3,615 population resource points in the United States. The program was run for three different attack dates. Although the computer program was designed for strategic nuclear studies at the national level, it can be applied to tactical nuclear studies over a more limited area.

GENERAL DESCRIPTION: DACOMP is a dynamic simulation model using the falling rates of representative particles and the winds aloft over the study area to determine the transport and final deposition of radioactive debris from nuclear bursts. The program accepts wind data from up to 100 weather observation stations and generates the wind field over the entire area of study for four observation times. The fallout dose received at each resource center from all weapons is determined, and, using the distribution of population with various shelter protection factors, the program computes the expected number of fatalities and casualties.

INPUT:

- Population resource data
- Weapon laydown
- Wind data
- Shelter protection factors

OUTPUT:

- Outside dose for each resource center
- Number of fatalities and casualties for each resource center
- Number of fatalities and casualties for each state
- Total number of fatalities and casualties nationwide

MODEL LIMITATIONS:

- 10 shelter distributions
- 4 wind observation times
- 12 wind levels
- 10 weapon types

HARDWARE:

- Computer: CDC 6400
- Operating System: Batch
- Storage Required: 45K
- Peripheral Equipment: 1 tape file for resource data is required, a second tape file for weapon data is optional, three scratch files

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: "Utilization of the SEER Fallout Model in a Damage Assessment Computer Program (DACOMP)," DNA 3608F, 27 February 1975

TIME REQUIREMENTS:

- Population resource data preparation
- Weapon laydown preparation
- 5 seconds CPU time per weapon for 3600 resource points, 2.5 seconds per weapon for 200 resource points

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Limited

USERS: Stanford Research Institute

POINT OF CONTACT: Mr. Paul W. Wong
Engineering Systems Division
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
Telephone: (415) 326-6200

KEYWORD LISTING: Fallout Damage Assessment; Utility of the SEER Model; Damage Assessment Computer Program (DACOMP); Military Model and Simulation

TITLE: DASH III - A computerized system for performing detailed assessments of the hazards of nuclear attacks - third update.

PROPONENT: Defense Civil Preparedness Agency (DCPA)

DEVELOPER: DCPA with System Sciences, Inc. (SSI)

PURPOSE: The Dash system has been designed and implemented for the primary use of analysts and planners who seek to perform comparative evaluations of the effects of all types of nuclear attacks under various conditions. The purpose is to provide the analyst with a system for obtaining both detailed and aggregate assessments for all weapon effects upon any grouping of population, shelters, and associated survival systems, or any other items for which data exist.

GENERAL DESCRIPTION: DASH III employs commonly used algorithms for blast, fallout and fire effects from nuclear weapons. The number and size of attacks, weaponry, items to be assessed, targeting philosophy, and environmental conditions-winds and weather are selected by analyst. Fallout shelter generation and shelter allocation, movement to shelter with constraints from late warnings, may be handled automatically. The system is highly modularized and operates under an executive control system. The analyst may select the modules (subsystems) to be wmployed in the solution of a particular problem. Certain investigations, such as shelter alternatives, may be conducted during later stages of the computer run without reprocessing previous weapon, environment, and population sata or weapon effects computations. The system is able to handle simultaneously several attack sizes, attack variations, and population time frames.

INPUT:

- o Resource points - population, military or industrial facilities, etc. Data may include detailed vulnerability parameters for each point, or a generalized vulnerability by target class may be assumed.
- o Weapon parameters - yield, fission ratio, height of burst, reliability, and delivery error. Weapon aim points may be specified point by point, or generated automatically by targeting subsystem for one or more attacks.
- o Specification of modules to be employed - one of several fallout model options or variations, shelter allocation or movement to shelter routines.

OUTPUT:

- o Detailed point, regional, or national effects summaries
- o Comparison of effectiveness of various shelter options
- o Average results and standard deviations for attack variations.

MODEL LIMITATIONS:

- o 30 attacks handled simultaneously
- o 31 weapon categories
- o Limitation of shelter points in movement area - number changes dependent upon various parameters.

HARDWARE:

- o Computer: CDC 3600 - 3800
- o Operating System: SCOPE
- o Storage Required: 64K
- o Peripheral Equipment: 5 tape drives, card reader, hard copy device, optional fallout graphics device.

SOFTWARE:

- o Programming Language: JOVIAL J3
- o Documentation: The Dash System - 4 volumes, October 1971, available from Defense Civil Preparedness Agency

TIME REQUIREMENTS:

- o Prepare Data Base: Manday to man month
- o CPU Time Per Cycle: 4 hours minimum

Data Output Analysis: Man day to man month

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Daily

PRINCIPAL USER: Defense Civil Preparedness Agency

POINT OF CONTACT:

Mr. John Vaccara
Defense Civil Preparedness Agency
Damage Estimation and Operation Analysis Division
Commonwealth Building
Rosslyn, Va. Tel. 694-1858

KEYWORD LISTING: Analysis, attack, blast, computerized, damage, fallout, fire, general war, limited war, nuclear, shelters

TITLE: DCAPS - Dual Criteria Aimpoint Selection Program

PROPONENT: Defense Nuclear Agency (VLWS)

DEVELOPER: Science Applications, Inc.

PURPOSE: DCAPS is a computer program used to select single weapon aimpoints. It simultaneously maximizes the damage to targets and minimizes damage to designated non-targets. It can also be used to evaluate target/non-target damage from an input aimpoint (DGZ) data base. A necessary condition for aimpoint selection is that the damage specifications on the primary target be met. In all cases, the aimpoint which kills the target and minimizes damage to nearby non-targets is given. In many cases, alternative aimpoints are also given which maximize damage to nearby secondary targets while simultaneously killing the primary target and limiting damage to non-targets.

GENERAL DESCRIPTION: DCAPS is a deterministic model using standard target damage evaluation procedures. It determines a lethal aimpoint region (LAIR) within which the primary target kill criteria are met. It then searches this region for desirable aimpoints based on user supplied damage criteria. Several alternatives are available for damage specification. Up to 500 targets/non-targets can be processed as a group. Up to 50 weapon types (combinations of yield, accuracy, and height-of-burst) can be considered.

INPUT:

- o Weapon list (yield, accuracy, height-of-burst)
- o Target kill requirements
- o Non-target survival requirements
- o Program control options
- o Target/non-target data base
- o Optional strike file data base
- o Optional secondary weapon list

OUTPUT:

- o Selected aimpoints
- o Damage to targets
- o Damage to non-targets
- o Damage to other installations

MODEL LIMITATIONS:

- o Fixed targets
- o 500 installations
- o 50 weapon types
- o Single weapon aimpoints

HARDWARE:

- o Computer: IBM 360, Honeywell 6080, UNIVAC 1108, and DEC 10 systems
- o Storage Required: 50 K words decimal
- o Peripherial Equipment: Hard copy device

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: DCAPS Program Final Report, available July 1975

TIME REQUIREMENTS:

- Data Base: a few minutes if data files are available
- CPU Time: about 15-20 seconds per aimpoint on UNIVAC 1108
- Data Output Analysis: user dependent

SECURITY CLASSIFICATION: Confidential

FREQUENCY OF USE: Used extensively at SAI and other DOD organizations

POINT OF CONTACT: Captain John Anderson
Headquarters, Defense Nuclear Agency (VLWS)
Washington, D. C. 20050
Phone: (703) 325-7403

MISCELLANEOUS: DCAPS is under active development. Planned improvements include updated damage methodology, a simple fallout model, and an interactive timesharing version.

KEYWORD LISTING: Dual Criteria, Analytic, Damage Evaluation, New Guidance, Fixed installations, Targets, Non-targets, Evaluation, Aimpoint Selection, Designated Ground Zero.

TITLE: DIVOPS- Division Operations Model

PROPONENT: USA Combined Arms Combat Developments Activity

DEVELOPER: BDM/CARAF

PURPOSE: The DIVOPS model is a computerized, deterministic model of ground combat with close air support developed specifically for use in the ARAFCAS study (Army Requirements for Air Force Close Air Support). It produces a time history of results of combat (weapon and personnel losses, force locations, ammunition consumption, etc.) over a period ranging from several hours to a day or more.

GENERAL DESCRIPTION: The DIVOPS model is a two-sided, deterministic model involving maneuver and field artillery forces, attack helicopters, air defense artillery, and tactical air (represented as sorties). Other Army forces are represented as targets only. The model consists of state variables, which describe the status of combat at any instant in time, and process models, which determine how the values of the state variables change.

INPUT:
- Force and Supply inventory and deployment data.
- Weapon and other system performance data.
- Tactical decision rules.

OUTPUT:
- Time history of weapon system and personnel losses.
- Surviving force strengths, positions, and statuses for each time period.
- Ammunition stocks for each time period.
- Target acquisitions, fire support allocations, and close air support sorties flown in each model time period.

MODEL LIMITATIONS:
- No air-to-air combat representation.
- Night combat is either not represented or is represented as day combat (except fire support).
- Maneuver force engagements at river lines and in urban areas are not represented.
- All effects produced on or by maneuver units at the FEBA are computed in the model for an average unit in a Blue brigade or Red division.

HARDWARE:
- Computer: CDC 6500
- Representative Storage: 140 K words
- Peripheral Equipment: Card reader and printer.

SOFTWARE:
- Programming Language: ANSI FORTRAN
- Documentation: Executive summary, users manual, programmers manual.

TIME REQUIREMENTS:

- Several man-months for new scenario.
- Five minutes execution time per 24 hours simulated combat.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Only used for ARAFCAS

USERS: USACACDA

POINT OF CONTACT: Mr. Ronald Magee
USACACDA, Combat Operations Analysis Directorate
Fort Leavenworth, Kansas 66027
Telephone: AVN 552-3245

KEYWORD LISTING: Analytical model; two-sided; deterministic; computerized; close air support; division level.

TITLE: DIVWAG - Division War Game Model

PROPONENT: Combined Arms Combat Developments Activity

DEVELOPER: Combat Developments Research Office, Computer Sciences Corporation

PURPOSE: DIVWAG is a computer-assisted, analytical, general war model. Based upon game orders to the units, the model performs the firepower, mobility, target acquisition, and combat service support functions. The chief focus of concern is the evaluation of a division sized force at a level of resolution which will permit determination of the impact on force effectiveness of changes in mixes of weapons and other systems. In addition, the model considers available logistical support and other combat and combat service support functions, to include Army and Air Force air support.

GENERAL DESCRIPTION: DIVWAG is a two-sided model having both deterministic and stochastic features. Land and air forces are simulated. The model is primarily designed to consider units ranging in size from a maneuver battalion task force to a division. The lower limit of this range may be manipulated to consider a maneuver company team. Simulated time is treated on an event store basis. The ratio of game time to real time is 1:3. Probability and analytical algorithms are the primary solution techniques used.

INPUT:
- o Terrain and weather data.
- o Weapons and equipment characteristics.
- o Weapons effects data.
- o Decision tables for establishing priorities for fires and levels of attack.
- o Consumption rates.
- o Unit TO&Es.
- o Task organization.

OUTPUT:
- o For each period: a set of computer printout reports which provide the information essential for accomplishing the period turnaround.
- o For a game: raw data requiring analysis in summary, tabular form.

MODEL LIMITATIONS: Does not portray dismounted riflemen in ground combat Communications are not simulated. Total number of units for both sides is 1000. 200 items of equipment are played for each side.

HARDWARE:
- o Computer: CDC 6500
- o Operating System: SCOPE 3.4.2
- o Minimum Storage Required: 3 million words
- o Peripheral Equipment: 1 disc drive, 3 tape drives, card reader and printer.

SOFTWARE:

- o Programming Language: FORTRAN, COMPASS.
- o Documentation published on 15 August 1972. An updated version is available dated April 1973 but not published. A User's Manual, a Technical Manual, and a Programmer's Manual will be provided with the documentation.

TIME REQUIREMENTS:

- o 3 months to acquire base data.
- o 15 man-months to structure data in model input format.
- o 60 calendar days playing time for 48 hours of continuous combat.
- o 1.7 hours CPU time per 2 hours of combat.
- o 6-months learning time for players.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 2 times per year

USERS: Not applicable

POINT OF CONTACT: Col. T. DeShazo
Chief, War Games Division
USA CACDA, Combat Operations Analysis Directorate
Fort Leavenworth, Kansas 66027
Telephone: AVN 552-4008
(913) 684-4008

MISCELLANEOUS: DIVWAG superseded DIVTAG II.

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Computer-Assisted; Two-Sided; Mixed Deterministic/Stochastic; Event Store.

TITLE: DOSDIS - Prompt Effects and Dose Distribution Model

PROPONENT: Stanford Research Institute

DEVELOPER: Stanford Research Institute

PURPOSE: The DOSDIS computer model was developed to estimate the prompt effects of nuclear bursts and to assess damage to military units and civilian population centers.

GENERAL DESCRIPTION: DOSDIS uses data presented in DNA EM-1, "Capabilities of Nuclear Weapons" (1 July 1972) to determine blast casualties for ten personnel postures and to compute the neutron radiation dose, the secondary gamma ray dose, and the fission product gamma ray dose received by survivors of blast effects and conventional weapons' fire. Immediate ineffectives and long term fatalities due to radiation are estimated for a maximum human biological response is used. The model is designed for a two-sided multiple burst attack with military units either stationary or mobile. The model also provides the user with the option of including weapon circular error probables (CEPs) to determine the actual ground zero of each weapon burst and the option of including CEPs to determine the actual location of each military unit or population center. These latter CEPs are input to account for target acquisition errors. A summary table provides an estimate of the total number of immediate inneffectives, long term fatalities, and survivors by unit types or by countries.

INPUT:

- Weapon laydown
- Resource data
- Maneuver data, when applicable
- Functional titles for printout

OUTPUT:

- Individual weapon affecting each unit
- Table indicating the distribution of blast survivors of each unit in various prompt dose levels, the immediate ineffectives and the long term fatalities
- Summary tables of immediate ineffectives, immediate effectives, long term fatalities and long term survivors by 20 minor functional categories (or countries) in each of two major functional categories (or alliances)

MODEL LIMITATIONS:

- 36,000 stationary units or 6,000 maneuverable units
- 1,300 weapons
- 99 weapon types
- 10 personnel postures
- 8 weapon warhead designs
- 20 time frames
- 0.01 to 10,000 kt weapon yield

HARDWARE:

- Computer: CDC 6400
- Operating System: Batch
- Storage Required: 70K
- Peripheral Equipment: 2 optional tape files for resource and weapon laydown data and 9 scratch files

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: "DOSDIS--A Computer Model to Estimate the Prompt Effects of Nuclear Bursts and to Assess Damage to Military Units and Civilian Population," SRI Project No. 90COV, April 1975

TIME REQUIREMENTS:

- 5 seconds CPU time for processing 40 weapons against 50 maneuverable units

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Mr. Paul W. Wong
Engineering Systems Division
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
Telephone: (415) 326-6200

FREQUENCY OF USE: Used extensively in three studies

PRINCIPAL USER: Stanford Research Institute

KEYWORD LISTING: Prompt Nuclear Effects; Neutron Radiation; Secondary Gamma Rays; Fission Product Gamma Rays; Military Fatalities and Casualties; Collateral Damage

TITLE: DSL - Detailed Ship Loading Model

PROPONENT: CNO (OP-96)

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory Warfare Analysis Department

PURPOSE: DSL is a computerized model that prepares standard-format loading plans for the embarkation of troop supplies and equipment aboard a single amphibious ship. The model functions with the Mechanized Embarkation Data System (MEDS) to automatically prepare and document detailed ship loading plans for the embarkation of an amphibious assault force. Loading plan printout shows the placement of major equipment items and other cargo in accordance with the principles of tactical loading.

GENERAL DESCRIPTION: DSL is a one-sided, deterministic model involving land and sea forces. It is designed to consider units ranging in size from an embarkation team to an embarkation group. Heuristics is the primary solution technique used.

INPUT:

- Embarkation team card decks prepared by the Marine Corps' Mechanized Embarkation Data System (MEDS)
- For some ship types, a serial assignment table, an assault schedule, and a landing sequence table are also required

OUTPUT: Stowage diagrams for each hold-compartment of the ship being loaded, along with required reports described in Marine Corps Force Order P3120.6B

MODEL LIMITATIONS:

- Restricted to load planning for one ship at a time
- Restricted to the following ship types: LSD, LST, LPD, LPH, LKA, and LPA

HARDWARE:

- Computer: IBM 7030 and IBM 360
- Operating System: OS
- Minimum Storage Required: 38K 64-bit words and 85K 32-bit words
- Peripheral Equipment: card reader, printer

SOFTWARE:

- Programming Languages: FORTRAN IV, STRAP-II, ALC
- Documentation: (1) NWL Technical Report TR-2175, The Detailed Ship Loading (DSL) Model - AKA and APA Ship Types (Command Manual)
  (2) NWL Technical Report TR-2350, The Detailed Ship Loading (DSL) Model - LKA and LPA Ship Types (Programming Maintenance Manual)
- The above documents refer to the first generation DSL Model. Neither user's documentation nor technical documentation is complete. All programs are undergoing extensive modifications. Documentation will follow and is now in progress.

TIME REQUIREMENTS:

- 2 1/2 hours to structure data in model input format
- 3-10 minutes CPU time per model cycle
- A few minutes to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Monthly

USERS:

- Principal: Marine Corps Division Embarkation Sections
- Other: Navy/Marine Corps Planning Staffs

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 663-7406 or 663-8645

MISCELLANEOUS:

- DSL uses embarkation team card decks prepared by MEDS (Marine Corps Mechanized Embarkation Data System).
- This version of DSL supersedes the first generation DSL Model.
- Extensive modifications to the model are currently in progress to introduce complete conformity to MEDS, to orient programs to the Marine Corps IBM 360 computer system, and to include greater planning flexibility and better loading procedures.

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Sea Forces; Computerized; One-Sided; Deterministic

NAME: DWEEPS

PROPONENT: Lawrence Livermore Laboratory

DEVELOPER: Lawrence Livermore Laboratory

PURPOSE: DWEEPS is a digital computer code for simulating the employment of tactical nuclear weapons against a static or dynamic representation of ground forces and for assessing the resultant military casualties and damage and collateral civilian damage. The code has been used to investigate relationships among target intelligence capabilities, weapon system characteristics, employment doctrine, military effects, and collateral damage.

GENERAL DESCRIPTION: Two versions of the code have been developed; (1) a version for a CDC -7600 computer utilizing hardcopy I/O, and (2) an interactive version for a XDS Sigma 7 computer with graphical I/O capability. Both codes are one-sided, Monte Carlo, and mixed deterministic and stochastic. Target intelligence is time stepped and weapons employment is event stepped in the CDC 7600 version. The graphical I/O version is time stepped. Both are currently dimensioned for 50 nuclear weapons, 1000 military units of any aggregation, and 1000 locations of civilians. The codes assess military and civilian casualties and damage resulting from prompt nuclear radiation, thermal radiation, and blast. Multiple weapon effects and bonus military effects are considered.

INPUT:

- o Military force data base
- o Civilian data base
- o Target intelligence capabilities
- o Weapon employment plan

OUTPUT: Detailed and summarized assessments of military and civilian casualties and damage.

MODEL LIMITATIONS: The codes are one-sided, nuclear only, and do not consider terrain effects.

HARDWARE: (CDC 7600 version)

- o Computer: CDC 7600
- o Operating System: Livermore Time Sharing System
- o Storage Required: 100 K
- o Peripheral Equipment: Hard copy device

HARDWARE: (Sigma 7 version)

- o Computer: XDS Sigma 7
- o Operating System: Interactive time sharing system
- o Storage Required: 50 K
- o Peripheral Equipment: Hard copy device, tape drive, and user terminals consisting of keyboard, CRT display screen, function box, and lightpen

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "DWEEPS: A Computer Code for Simulating the Employment of Tactical Nuclear Weapons (U)", UCRL-51429, Lawrence Livermore Laboratory, July 1973 (SRD).

TIME REQUIREMENTS: Both versions require from a few days to a few weeks to prepare military and civilian data bases. Analysis of target intelligence and development of a weapon employment plan require a couple hours when using the CDC 7600 version, but only a few minutes on the Sigma 7. Employment of 20 weapons against a division-sized force requires about one-half a minute of CDC 7600 computer time. The same simulation can be performed on the Sigma 7 in about 15 minutes. This includes display of target intelligence, development of a weapon employment plan, simulated employment of the weapons, damage assessment, and display of the results. Analysis of the results requires from a few minutes to a couple hours depending on the objectives of the user.

SECURITY CLASSIFICATION: Unclassified without data base

FREQUENCY OF USE: About 100 times per year

POINT OF CONTACT: Robert P. Gard
University of California
Lawrence Livermore Laboratory
P. O. Box 808 L-95
Livermore, Calif. 94550

KEYWORD LISTING: Tactical nuclear, collateral damage, simulation, ground war, interactive, military effects, employment doctrine

TITLE: DYNTACS - Dynamic Tactical Simulator

PROPONENT: USA Combined Arms Combat Developments Activity

DEVELOPER: Systems Research Group, The Ohio State University

PURPOSE: DYNTACS is a computerized, dynamic combat simulation capable of portraying units up to battalion size. It produces damage assessment by conducting a Monte Carlo battle. Terrain, intelligence, maneuver, weapons systems (both direct and indirect fire), command and control, and others are all considered within the model. DYNTACS' chief focus of concern is weapon system and combat mix evaluation. This is done by analysis of the interplay between weapons systems, terrain, command and control, communications, etc. DYNTACS is modular and has the flexibility to apply pertinent subroutines to specific situations.

GENERAL DESCRIPTION: DYNTACS is a two-sided, stochastic model involving land and limited aerial platform forces. It is restricted to considering individual vehicles unless major reprogramming is done. These vehicles may comprise up to a battalion or a task force. Simulated time is treated on an event store basis. Probability is the primary solution technique used. The ratio of game time to real time is approximately 1:1.5 for battalion level simulation on an IBM 360/91.

INPUT:
- o Detailed parameters to define each weapon system portrayed.
- o Number of vehicles, crew-served weapons, and artillery tubes.
- o Digitized terrain data, detailed analysis of terrain, human factor times, etc.

OUTPUT:

- o A force strength organization table describing information types as to attacker, defender with position coordinates, type of weapon, speed and proposed objective.
- o Line of sight tables indicating intervisibility between all elements (weapons).
- o Plot of battlefield with position of elements to depict actual elements' movements.
- o Movement, intelligence and firing information for each type of contact an element makes with another element.
- o Periodic summary of casualties, and a final summary of all firing events from all elements with detailed information describing the outcome.
- o All output formats can be varied as required. The event listing can be set to produce listings at any time period. Currently, event listing is set to record every 30 seconds if an event has not occurred.
- o Special analysis output to provide summaries of specific data elements for a particular supported study.

MODEL LIMITATIONS:
- o Cost of running.
- o Preparation time.
- o Complexity of logic.
- o Cannot portray dismounted infantry or personnel casualties.
- o No target location errors for direct fire weapons.

HARDWARE:

- o Computer: IBM 360/91
- o Operating System: ASP
- o Minimum Storage Required: 1000K
- o Peripheral Equipment: Disc storage unit, 1 tape drive, 1 printer.

SOFTWARE:

- o Programming Languages: FORTRAN IV, data in Assembler Level F.
- o Documentation is in 12 volumes with the following AD numbers: 409899, 427793, 447494, 471302, 801900, 815023, 850367, 864919, 864920, 864922, and 864923. Additional volumes essential to complete understanding are AD 604693, 471300, 471301, 366070(S), 378607(C).
- o Both user's and technical documentation are quite complete for the size of the model. There are areas where the documentation is being improved.

TIME REQUIREMENTS:

- o 3 months to acquire base data.
- o 6 man-months to structure data in model input format.
- o 25 minutes CPU time per model cycle.
- o 1-2 months to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 3 studies/year

USERS: MICOM, ARMCOM, TRASANA, USACACDA

POINT OF CONTACT: Mr. David Farmer
USACACDA, Combat Operations Analysis Directorate
Ft Leavenworth, Kansas 66027
Telephone: AVN 552-3193

KEYWORD LISTING: Stochastic Model, Damage Assessment/Weapons Effectiveness, Helicopters, High Resolution, Computerized, Battalion Level.

**TITLE:** ETNAM - European Theater Network Analysis Model

**PROPONENT:** Office of the Joint Chiefs of Staff (J-4)

**DEVELOPER:** Research Analysis Corporation

**PURPOSE:** ETNAM is an optimizing logistics model designed for the analysis of intra-theater strategic deployment. Its primary purpose is to allow the user to select the least-cost transport fleet mix or augmenting fleet mix, as well as the least-cost routes over which this fleet may be disposed, for up to 150 origin/destination pairs. Included in the model's focus of concern are force sizing, network capability, interdiction, and location of ports of embarkation.

**GENERAL DESCRIPTION:** ETNAM involves land, air and sea forces. The user may partition the units to be moved into twenty or less categories. The model is deterministic. The primary solution technique is linear programming using the column generation technique for network problems.

**INPUT:**

- o Movement requirements
- o Transportation resources availabilities
- o Resource productivities and costs
- o Network capacities
- o Origin and destination of movements

**OUTPUT:**

- o Output is in the form of computer printouts giving network and resource utilization, routes generated, quantities moved, resource and network link and node shadow prices, and other sensitivity analysis data (RHS ranging).

**MODEL LIMITATIONS:**

- o Single time period
- o 700 network links
- o 50 resources
- o 20 transportation modes
- o 20 commodities to be moved
- o 150 origin/destination pairs

**HARDWARE:**

- o Computers: CDC 6400, IBM 360/65; HIS 6080
- o Operating System: SCOPE (CDC); OS/360 (IBM); GCOS (HIS)
- o Minimum Storage Required: 60K words (CDC); 512K bytes (IBM); 45K words (HIS)
- o Peripherial Equipment: Tape and disk drives

SOFTWARE:

- Programming Language(s): FORTRAN
- Documentation: DCA documentation: DCA 952-803-42(a)
  ETNAM Operational Capability Description, Revision 1 (AD 734403)
  ETNAM SD Users Manual, Vol I, Revision 1 (AD 734404)
  ETNAM SD Analytical Manual, Vol III, Revision 1 (AD 734405)
  ETNAM SD Vol IV, Data Base (AD 734406), Part 1 and Part 2 (AD 518600L); Part 2 is classified SECRET
- Both user's and technical documentation is complete. ETNAM was documented under DCA standards.

TIME REQUIREMENTS:

- ETNAM SC Vol IV (listed above) details the data bases which have been collected to date for approximately seven major areas
- 1 man-month to structure data in model input format
- 1-2 hours CPU time per model cycle for a typical problem
- 2 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times annually

USERS:

- Principal: J-4
- Other: RAC; SHAPE; CINCEUR: CINCPAC

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Adviser Office
Pentagon, Washington, D. C. 20301
Telephone: OX 7-5464

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces
Sea Forces; Computerized; Deterministic

TITLE: FAIRPASS - Fighter Aircraft Penetration Assessment

PROPONENT: USAF (AF/SA)

DEVELOPER: AF/SA

PURPOSE: FAIRPASS is a computerized analytical model designed to aid in the evaluation of aircraft tactics in attacking targets defended by antiaircraft guns. The model computes the probability of acquiring and killing aircraft attacking a target defended by antiaircraft guns. The aircraft can employ jamming equipment and defensive maneuvers to try to avoid effective fire from the gun sites. The approach, attack, and exit phases are examined. The program considers optical and radar acquisition capabilities, degraded by electronic countermeasures to obtain an estimate of the time of detection. After detection occurs, the aircraft are exposed to fire from the AA batteries constrained by environmental and weaponry limitations. The position of the aircraft is computed every tenth of a second. Detection is computed every half-second. The guns are controlled by dynamic firing doctrine to fire at a particular aircraft based on the threat to the target and the threat to the gun site itself. The guns continue to fire, accumulating $P_k$, until the aircraft are beyond the range of the guns.

GENERAL DESCRIPTION: FAIRPASS is a two-sided, deterministic model involving air forces only. The smallest group that it was primarily designed to consider is one gun trained on one aircraft. As many as 70 gun sites may be considered, however, trained on as many as five aircraft. Simulated time is treated on a time step basis. Probability and vector analysis are the primary solution techniques used.

INPUT:

- Aircraft characteristics: output of jamming equipment, aerodynamic data, flight path control parameters, weapon release altitude and velocity, attack dive angle and direction relative to target, and the reflective area and vulnerable area.
- Environmental data: ceiling, visibility, and masking angles of gun sites
- Defensive weapon characteristics: gun locations, firing rates, minimum and maximum gun elevations, maximum effective ranges, ballistic dispersions, radar power, bandwidth, frequency, antenna gain, and generated noise level

OUTPUT: Detailed history of the flight path of each aircraft and projectile during the simulation. Each aircraft's position, acceleration and velocity vectors, pitch, roll and heading angles and cumulative probability of kill are given for every increment of simulation time. The site origin, time to fire, gun azimuth, and elevation, time of closest approach to aircraft, direction cosines relative to aircraft at near miss, near miss distance, velocity, and the aircraft at which the projectile was fired are given for every projectile. In addition, a three-dimensional plot can be produced.

MODEL LIMITATIONS:

- Maximum of five aircraft attacking a target area defended by a maximum of seventy gun sites
- The program can accumulate statistics on a maximum of 164,000 projectiles fired from seven different gun types

HARDWARE:

- Computer: IBM 7094
- Operating System: IBSYS 13
- Minimum Storage Required: 32K
- Peripheral Equipment: 1301 disk storage unit, 16 tape drives

SOFTWARE

- Programming Language: FORTRAN IV
- Documentation is rudimentary.

TIME REQUIREMENTS:

- Less than 1 day to structure base data in model input format
- 5 minutes to 2 hours CPU time per model cycle
- 1 month learning time for users
- Time to analyze and evaluate results varies considerably.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 400 per year

USERS: AFSA

POINT OF CONTACT: Headquarters, USAF
Assistant Chief of Staff, Studies and Analysis, AF/SAA
Lynn Building
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8036

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Air Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: FAST, Fratricide Avoidance Sequencer and Timer

PROPONENT: Science Applications, Inc.

DEVELOPER: Science Applications, Inc.

PURPOSE: FAST is a general scheduling program for foreign or U. S. ICBM systems. Scheduled launch and impact times are determined while satisfying input specified environmental, hardware and operational constraints.

GENERAL DESCRIPTION: FAST requires an ICBM allocation or application which specifies sortie-target matchups and vehicle time of flights. The information can be provided by other computer program (e.g., OSAGE, QUICK, etc.) or by the analyst. FAST is designed to calculate booster launch and RV impact times in minimum launch and impact spans for either U. S. or foreign ICBM systems while satisfying environmental, operational and hardware constraints. Fratricide, generally the major constraint, is treated using dynamic time-varying target exclusion footprints for persistent environments and static exclusion footprints for prompt environments. The FAST computer program can treat 2000 ICBMs, 10 launcher types with up to 10 RVs per launcher, and 8000 RVs.

INPUT:

- A scenario tape or card deck (e.g., allocation information)
- Static and time-dependent exclusion footprints (fratricide)
- Four user input cards denoting constraints, first possible launch and impact times, and the deploying side.

OUTPUT:

- Updated scenario tape with launch times (optional).
- Two tabular summaries of launch and impact times in minutes and seconds; one summary sorted by launcher index, the other by launch times.
- Launch and impact histograms.

MODEL LIMITATIONS:

- Scenario must contain at least one pretimed defense suppression vehicle.
- 2000 ICBMs.
- 10 launcher types
- 10 RVs per ICBM maximum
- 8000 RVs

HARDWARE:

- Computer: UNIVAC 1100 series, CDC 7600
- Operating System: Batch mode
- Minimum Storage Required: 60 K words decimal
- Peripheral Equipment: Tape drives and a printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Peculiarity: UNIVAC 1100 and CDC 7600 Series dependence due to word packing and direct access file procedure
- o Documentation: "FAST, FRATRICIDE AVOIDANCE SEQUENCER AND TIMER USERS GUIDE VERSION II", M. Stoddard, SAI-75-520-LJ. Science Applications, Inc., La Jolla, California, February 1975 (U).

TIME REQUIREMENTS:

- o Data Base Preparation
  1. Scenario deck is usually output from force application programs. c.f. OSAGE, QUICK. If generated by hand, a preparation time is dependent on scenario size, but may take a week or more.
  2. Time-dependent exclusion footprint data can be obtained by the use of FTPRNT or a similar type computer program.
  3. 1/2 hour to prepare four user input cards which control impact step size, denote constraints and desired treatment of targets, and the deploying side.
- o CPU Time: Execution time is dependent on computer (e.g., 1108 vs. 1110), impact step size, number of LFs involved, distance between referenced DGZs and yield dependent footprint sizes. A case which involved 108 LFs and 300 RVs, half of which were air burst, with 5 sec. impact step size and total avoidance footprints took 3 min. and 52 sec. of execution time on the UNIVAC 1108.
- o Data Output Analysis: 1 day to 1 week (dependent on scenario size).

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Several times a week

USERS: National Military Command System Support Center (NMCSSC), Foreign Technology Division (FTD) of Air Force Systems Command, Science Applications, Inc.

MISCELLANEOUS: Modification for use on machines with word size less than 36 bits is difficult because of data packing.

POINT OF CONTACT: Ms. M. Stoddard
Science Applications, Inc.
P. O. Box 2350
La Jolla, California 92037
Telephone: (714) 459-0211

KEYWORD LISTING: Scheduling; Force Scheduling and Resolution; Timing; Force Timing; Fratricide Avoidance; ICBM timing.

TITLE: FASTALS - Force Analysis of Theater Administration and Logistics Support

PROPONENT: U.S. Army Concepts Analysis Agency

DEVELOPER: General Research Corporation

PURPOSE: FASTALS is a computerized, analytical model that provides an automated force roundout methodology for the Army Staff. The model simulates the workloads which would be generated under the combat conditions in order to identify the troop units needed to make the force self-supporting, taking into account constraints imposed by the player. The model may be used to assess the effects of different user constraints and supply policies in accomplishing the logistics functions.

GENERAL DESCRIPTION: FASTALS is a one-sided, deterministic model involving land forces only. It is designed to consider groupings as small as a company or battalion, although units as small as a team or as large as a division can be considered. The model is treated in fixed steps, usually 10- or 30-day increments, requiring approximately 30 seconds of CPU time for each time period simulated. Network analysis and table look-up are the primary solution techniques used.

INPUT:

- Logistic network description for the theater of operations
- Time phased list of combat units, and their postures
- Logistics tables of stockage, consumption, construction, medical factors, etc.
- Logistics rules

OUTPUT: Computer printout of time-phased troop deployments, workloads generated, and supply consumption/stockage by time period. Supplemental programs can be invoked to:

- Provide a detailed description of the flow of supplies through the transportation network
- Produce multi-item plots of capabilities versus requirements for logistics activities
- Compare the trooplists generated by several runs

MODEL LIMITATIONS:

- Maximum of 10 time periods, including D-day
- Typically, only U.S. Forces are used
- Data base preparation is detailed and extensive

HARDWARE:

- Computer: IBM 360/65 or UNIVAC 1108
- Operating System: HASP (IBM); EXEC VIII (UNIVAC)
- Minimum Storage Required: 52k 36 bit words
- One disc drive or three tape drives

**SOFTWARE:**

- Programming language: FORTRAN V
- User Documentation: RAC-R-86, Appendix C, provides a description of the program and provides guidance for the preparation of input data. Several program changes have been introduced which render this document inaccurate, but usable with pen and ink changes.
- Technical Documentation: None. The computer program has many comments to guide the analyst.

**TIME REQUIREMENTS:**

- 1-3 months to acquire base data
- 6 man-weeks to structure data in model input format
- 3 minutes CPU time per model cycle
- 1 month to analyze and evaluate results

**SECURITY CLASSIFICATION:** UNCLASSIFIED

**FREQUENCY OF USE:** 100 times per year

**USERS:**

- Principal: Assistant Chief of Staff for Military Operations (DCSOPS)
- Other: WSEG, TSG, OSD

**POINT OF CONTACT:** USA CAA - FDE
Mr. Tim Hurley (301 295-1655)
8120 Woodmont Avenue
Bethesda, MD 20014

**MISCELLANEOUS:**

- ATLAS, CEM or other theater level war game model provides combat data for input. CAMP examines the feasibility of the FASTALS generated deployment list. SIGMALOG may be used to evaluate the detailed logistics function. Semi-automated interface exist or are being built for these models.

**KEYWORD LISTING:** Analytical Model; General War; Land Forces; Computerized; One-Sided: Deterministic; Time Step

TITLE: FCIS - Force Cost Information System

PROPONENT: Headquarters, U.S. Army, Office of the Comptroller

DEVELOPER: U. S. Army Management Systems Support Agency (USAMSSA)

PURPOSE: FCIS is a computerized, analytical, politico-military model that provides rapid cost estimates, for planning purposes, for various Army forces, force postures, and changes in force postures. The model provides costs for actual and hypothetical TOE units and for force structures such as theater forces, division force equivalents, and initial and sustaining support increments (these forces can be at different Authorized Levels of Organization.

GENERAL DESCRIPTION: FCIS is a one-sided, deterministic model involving land forces only. It is designed to consider units ranging in size from a team to a force. Simulated time is treated on a time step basis. Arithmetic is the primary solution technique used.

INPUT: The FCIS taps the COSTALS bank of cost data. Input consists of the Standard Requirements Codes (SRC's) for actual force units. Hypothetical structures are presently costed by modifying actual SRCs.

OUTPUT:

- Output in variable formats is available in hard copy.
- Data for a selection of SRCs is published in the Army Force Planning Cost Handbook, a by-product of the FCIS.
- A conversational capability, via a cathode-ray tube display device, allows Army staff analysts direct access to COSTALS, making possible rapid response on questions such as the aggregate costs of force structures.
- Detailed and summary retrievals are available for all units in the data bank. Selective retrievals and summations via hard-copy and CRT output are available on request.

MODEL LIMITATIONS: The model depends upon the Standard Requirements Codes (SRCs) for actual force units.

HARDWARE:

- Computer: IBM 360/65
- Operating System: O. S. Release 20
- Minimum Storage Required: 150K bytes
- Peripheral Equipment: Disk drive, tape drives (7 and 9 track), CRT (IBM 2260), printer, and card reader

SOFTWARE:

- Programming Language: FORTRAN IV
- Neither user's nor technical documentation is complete, due to the fact that expansion and refinement of the FCIS is going on continuously. Brief general descriptions and some programmer documentation are available.

TIME REQUIREMENTS:

- 3 months or less to acquire base data
- 1 month or less to structure data in model input format
- 75 minutes CPU time per model cycle

SECURITY CLASSIFICATION: Model algorithms are UNCLASSIFIED. In some cases, data and/or output are CONFIDENTIAL or SECRET.

FREQUENCY OF USE: Weekly

USERS:

- Principal: Department of the Army
- Other: Contractors, Office of the Secretary of Defense, and Allied nations

POINT OF CONTACT: Headquarters U. S. Army
Office of the Comptroller
ATTN: DACA-CAF, Rm 2A680
Washington, D.C. 20310
Telephone: OX 5-2065/6 (AUTOVON 225-0265/6)

MISCELLANEOUS:

- The FCIS provides input to the Force Cost Assessor portion of the FOREWON System, the Battalion Slice Model, and a variety of Army Staff exercises. The FCIS also uses some data from the Force Planning Information System (FPIS).
- FCIS supersedes the Army Force Planning Cost Information System (AFPCIS), COSTALS
- It is planned to make the COSTALS bank "SRC-free," i.e., to permit costing a force from a list of its equipment and personnel. Additional efforts include modification for correlation with Army budgetary factors and costs, and incorporation of a capability for sensitivity analysis.

KEYWORD LISTING: Analytical Model; Politico-Military; Land Forces; Computerized; One-Sided; Deterministic; Time Step

**TITLE:** Fire Support Simulation

**PROPONENT:** CNO (OP-96) and CMC

**DEVELOPER:** Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

**PURPOSE:** The Fire Support Simulation is a computerized, analytical model that is used to quantify the effectiveness of mixes of supporting arms weapon systems, including air, artillery, and naval gun systems. In addition, it also considers the expenditure of ammunition in the course of the primary exercise.

**GENERAL DESCRIPTION:** The Fire Support Simulation is a one-sided, deterministic model involving land, air and sea forces. It is capable of considering artillery batteries, naval gunfire ships, and attack aircraft squadrons on an individual basis if desired, but can also consider any logical, tactical organization of these units. It is capable of aggregating up to the level of a Marine Amphibious Unit (MAU) or a Marine Amphibious Force (MAF) support mix. Simulated time is treated on an event store basis. Five hundred minutes of real time are simulated in one minute of computer time. Simulation is the primary solution technique used.

**INPUT:**

- Military scenario (targets, weather, etc)
- Weapon characteristics
- Weapon effectiveness data

**OUTPUT:**

- Raw game data, game summaries, and quantified measures of the mix effectiveness
- Both selected game time printouts and selected detail of printouts are available

**MODEL LIMITATIONS:** The model is not segmented, and thus is limited as to the size of the mix that can be evaluated.

**HARDWARE:**

- Computer: IBM 7030, CDC 6700
- Operating System: OS
- Minimum Storage Required: 20K

**SOFTWARE:**

- Programming Languages: FORTRAN (CDC 6700) and STRAP (IBM 7030)
- Documentation: General documentation is contained in the Fire Support Study, Final Report
- Neither user's documentation nor technical documentation is complete

TIME REQUIREMENTS:

- 1 to 6 months to acquire base data
- 2 man-months to structure data in model input format
- 20 minutes CPU time per model cycle
- 1 month learning time for users
- 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Extensively

USERS: Navy/Marine Corps Fire Support Requirements Studies

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (CODE KC)
Dahlgren, Virginia 22448
Telephone: 663-7406 or 663-8645

MISCELLANEOUS:

- The Requirements Model provides input to the Fire Support Simulation, which in turn provides input to the MIx Preference Program
- The Fire Support Simulation supersedes the Supporting Arms Model
- Options for the tactical use of aircraft in the model have been added in the FORTRAN version

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Sea Forces; Computerized; One-Sided; Deterministic; Event Store

TITLE: FORDIM - Force Distribution Model

PROPONENT: OJCS (SAGA) GPFD

DEVELOPER: Organization of the Joint Chiefs of Staff (SAGA/GPFD)

PURPOSE: To assist in the analysis of the relationship between opposing forces over time, but not engaged in combat. The forces on each side are known as Red and Blue forces. Forces on both sides are described in terms of the resources comprising each unit. These resources can be weapons, personnel, indices of combat effectiveness, etc. The blue units are positioned in sectors daily and in reserve in accordance with input instructions by allocating the blue resources of each unit in a sector or in reserve. Red forces are then positioned in sectors or in reserve allocating the resources of the units to sectors or in reserve in accordance with one or more of four allocation procedures. Red unit integrity may or may not be maintained depending on which of the two FORDIM submodels is employed. Force ratios are computed by resource by sector. Resources can also be multiplied by an input value and force ratios of values will also be computed.

GENERAL DESCRIPTION: FORDIM comprises two submodels which are two-sided deterministic models of force mobilization over time. It is designed to run on the HIS 6080 or on the IBM 360/67 computer in CMS or in batch. One submodel distributes the Red resources to sectors without regard to unit integrity while the other distributes Red units to sectors which distribution can be trained by unit frontage.

INPUT: The input to the model is a brief description of the theater, scenario data and Force descriptions in terms of each units resources, arrival date, frontage and sector assignment.

OUTPUT: The output is a daily picture of the theater, opposing forces and the ratios of the resources and resource values.

MODEL LIMITATIONS: The model is constrained to 10 sectors, 150 units on each side and 50 resources per unit.

HARDWARE:

- o Honeywell 6080
- o Storage Required: 35K

SOFTWARE:

- o FORTRAN IV - IBM
- o FORTRAN Y - HIS

TIME REQUIREMENTS:

- o ten CPU seconds per 30-day comparison

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times /year

USERS: SAGA (OJCS)

POINT OF CONTACT: General Purpose Forces Division (GPFD)
Studies, Analysis, and Gaming Agency (SAGA)
Organization of the Joint Chiefs of Staff (OJCS)
The Pentagon, Washington, D.C. 20301
Telephone: OX 5-9003

MISCELLANEOUS: FORDIM comprises two unclassified submodels. In addition to providing data directly for analysis, the theater laydown can be used as input to a theater level ground combat simulation.

KEYWORD LISTING: Mobilization; Force Ratio; Computer model

TITLE: FORECAST II

PROPONENT: U.S. Army Concepts Analysis Agency (CAA)

DEVELOPER: U.S. Army Concepts Analysis Agency (CAA)

PURPOSE: FORECAST II is a computerized, analytical model that provides rapid response definition of expected results from an offensive nuclear strike force for player defined strike strategies. The model assesses the effects of nuclear weapon detonated against a discrete aiming point and against targets collocated with the aiming point. The model thereby enables the analyst to assess the differences in damage results based on variances in weaponeering.

GENERAL DESCRIPTION: FORECAST II is a one-sided, stochastic model involving land and air forces. It is designed to consider individual aircraft and/or missiles if the user desires, and can aggregate to any level up to the nuclear air and missile strike force of either side. Simulated time is treated on an event store basis. The primary solution techniques used are expected value, probability, and the DIA Nuclear Damage Assessment Methodology.

INPUT:

- Standard military descriptors of delivery systems, nuclear weapons and conventional weapons to be simulated
- Loss rates applicable to delivery systems
- Target definitions, using elements of the Joint Resource Assessment Data Base (NMCSSC)
- Target list strike plan

OUTPUT: Detailed and summary daily output, including tabulation of sorties expected, allocation against the strike list, delivery system and weapon losses, and damage to primary and collocated targets. Damage to targets is reflected in a target bank maintained by the model. Data is prepared by the model for use in subsequent applications.

MODEL LIMITATIONS:

- 20 delivery systems
- 20 nuclear weapons
- 10 conventional weapons
- The model requires the availability of the Joint Resource Assessment Data Base from NMCSSC

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 28K
- Peripheral Equipment: 2 tape drives, and FASTRAND format mass storage

SOFTWARE:

- Programming Language: FORTRAN V, ASSEMBLER LANGUAGE
- Documentation consists of a Technical Manual and Program Listings. Both user's documentation and technical documentation are complete and are available from U.S. Army Concepts Analysis Agency

TIME REQUIREMENTS:

- 1 month to acquire base data
- 1 or more man-months to structure data in model input format
- CPU time per model cycle varies, depending on the size of the problem
- 2 man-weeks learning time for users

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2 times per year

USERS: USA CAA

POINT OF CONTACT: U.S. Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1689

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; One-Side; Stochastic; Event Store

TITLE: FOREWON - Automated Force Planning System

PROPONENT: U.S. Army Concepts Analysis Agency (CAA)

DEVELOPER: Research Analysis Corporation

PURPOSE: FOREWON is a computer-assisted automated planning system designed to assist the Army Staff in its determination of short-range and mid-range requirements for division forces and certain special mission forces, and in its prediction of the capabilities of those forces. The FOREWON system consists of a Preliminary Force Designer (PFD), Combat Simulator (ATLAS), Theater Roundout Model (FASTALS), Objective Force Designer (OFD), and a Force Cost Assessor (FCA). These models are described separately in appropriate sections of this catalog. The system accepts as inputs a set of worldwide situations that call for the presence of application of U.S. military forces, and derives a single objective force competent to achieve desired military objectives should any one of the set of distinct situations arise. The capability of attaining these military objectives can be analyzed within designated constraints such as total dollar cost limits or manpower allocation.

GENERAL DESCRIPTION: FOREWON is a one-sided, deterministic model involving land forces only. It is primarily designed to consider forces at the theater level. Simulated time is treated on a time step basis. Mathematical simulation is the primary solution technique used.

INPUT: See descriptions of the individual component models.

OUTPUT: See descriptions of the individual component models.

MODEL LIMITATIONS: See descriptions of the individual component models.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: See descriptions of the individual component models.

SOFTWARE:

- Programming Language: FORTRAN V
- Both user's documentation and technical documentation are complete. See descriptions of individual component models for details.

TIME REQUIREMENTS: See descriptions of the individual component models.

SECURITY CLASSIFICATION: UNCLASSIFIED or SECRET

FREQUENCY OF USE: The entire system was used, as a system, four times.

USERS: Hq. U.S. Army (DCS OPS)

POINT OF CONTACT: USA CAA
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1655

KEYWORD LISTING: Analytical Model; General War; Limited War; Logistics; Land Forces; Computer-Assisted; One-Sided; Deterministic; Time Step

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TITLE: FOZ - Footprints by OZ

PROPONENT: Chief of Naval Operations, OP-604

DEVELOPER: Academy for Inter-Science Methodology

PURPOSE: A computerized, analytical system for creating optimal allocation of MIRV'd SLBMs within capability of delivery vehicle.

GENERAL DESCRIPTION: The Model allocates MIRV weapons to targets to maximize target coverage subject to the constraint that the utility (number of missiles targeted) from each SSBN and/or missile field must be equalized to the maximum extent possible. The model is designed and structured to achieve fast run time and to provide a complete analysis of the given MIRV problem. Input missile performance parameter requirements are such that detailed missile design and performance parameters are not required. FOZ consists of two major programs.

a. FOZAUX. FOZAUX reduces the number of missile combinations that must be analyzed by the model and reduces computer core storage requirements. This reduction is realized by aggregating, or combining, targets into groups that can be represented by a single geographic position for each group.

b. FOZ. The FOZ program analyzes the target and missile location data to determine feasible combinations of targets which might be grouped into footprints. FOZ forms footprints by targeting missiles from the more difficult-to-target patrol areas first and performs an analysis to provide information relating to feasible alternative patrol area - footprint matchups. FOZ also deaggregates the aimpoint data and formats the various printed reports available from the model.

INPUT:

- Target base (DGZs)
- MIRV characteristics
- Footprint size
- Booster range
- Launch areas

OUTPUT: Computer printout assigning weapons to targets.

HARDWARE:

- CDC 6600
- 300K storage

SOFTWARE:

- FORTRAN IV

Ref: MIRV Footprint Theory Study (U), OP-604, 1 JUN 74

TIME REQUIREMENTS:

- 2000 DGZ's Footprinted from 15 potential SSBN patrol areas in about 20 minutes CP time.

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Chief of Naval Operations, OP-604

USERS: Chief of Naval Operations, OP-604

FREQUENCY OF USE: 300 runs per year

MISCELLANEOUS: SIRNEM provides DGZs and assesses damage.

KEYWORD LISTING: Analytic, Strategic, Footprint, Computerized, Missile.

TITLE: FTPRNT - Footprint

PROPONENT: Science Applications, Inc.

DEVELOPER: Science Applications, Inc.

PURPOSE: FTPRNT is a fast running, easy to use computer program designed to investigate reentry vehicle (RV) heatshield or nosetip recession due to dust and/or condensate (rain/ice) particulate erosion. The program is designed to calculate time-dependent target exclusion areas, or footprints, associated with a prior surface or near-surface nuclear burst. These footprints can be associated with specified levels of total recession, backface temperature or trajectory offset. FTPRNT also calculates exclusion profiles which are profiles of either total recession, backface temperature or trajectory offset as a function of distance down-range from the burst point. It has been used extensively to define fratricide target exclusion footprints and exclusion profiles for current and postulated future U. S. and foreign reentry vehicles.

GENERAL DESCRIPTION: For an input RV design configuration, FTPRNT determines the reentry trajectory for specified reentry conditions, with a 3 degree of freedom calculation. It computes ablation-only surface recession and backface temperature. FTPRNT then determines the desired footprint boundary by flying the RV through the nuclear cloud to various aimpoints; the various aimpoints are optimally selected by the program-automatically. For each RV flight to a given aimpoint, FTPRNT determines the dust and/or rain/ice environment encountered and computes the coupled ablation/erosion response of the RV heatshield using a multi-parameter response calculational technique. In a different mode of operation, FTPRNT can be used to determine exclusion profiles.

INPUT:

- o Namelist data for overall run options, RV design data.
- o Additional Namelist recession parameter and mass loss correlation data if certain options are exercised.
- o VORDUM nuclear dust cloud direct access data
- o WAIVOR nuclear condensate cloud direct access data.

OUTPUT:

- o Surface ablation/erosion, backface temperature, erosion trajectory offset, momentum encountered, kinetic energy encountered for each aim point; plot of footprint or profile; detailed environment and response data on option.

MODEL LIMITATIONS:

- o Up to 5 nuclear bursts; (all bursts must be same yield)
- o All particles assumed to cause erosion--no pebble penetration

HARDWARE:

- o Computer: UNIVAC - 1100 series, IBM - 360/370 series, CDC - 7600
- o Operating System: Batch or Time Sharing
- o Storage Required: 30 K decimal words
- o Peripheral Equipment: Card reader, Disk, Line printer

SOFTWARE:

- o Programming Language: FORTRAN - IV
- o Documentation: "The FTPRNT Program", Volumes I-III, SAI-74-631-LJ, September 1974.

TIME REQUIREMENTS:

- o Two days training time
- o 10 min to prepare input

SECURITY CLASSIFICATION: Unclassified

POINT OF CONTACT: Mr. Anton J. Dorr
Science Applications, Inc.
P. O. Box 2350
La Jolla, California 92037
Telephone: (714) 459-0211, ext. 241

FREQUENCY OF USE: Almost daily over past year

PRINCIPAL USERS: FTD (PDBI), SAC (DOXTM), BMDSCOM, Science Applications, Inc.

MISCELLANEOUS:

- o FTPRNT requires VORDUM dust and/or WAIVOR rain/ice environment data in a direct access data file format; such files are currently available for various burst conditions.
- o FTPRNT output is used for input to the FAST program.

KEYWORD LISTING: Target Exclusion Area; Footprint; Profile; Dust; Rain; Ice; Condensate; Ablation; Erosion; RV; Fratricide; Reentry

TITLE: GACAM - Ground Air Campaign Model

PROPONENT: OJCS/SAGA (GPFD)

DEVELOPER: Institute for Defense Analyses (IDA)

PURPOSE: GACAM is a computerized analytical model designed to simulate highly aggregated conventional theater level combat, including the interactions of ground, air and logistics, with the purpose of assisting force planners to analyze the interactions and effectiveness of major General Purpose Force units in integrated theater level combat.

GENERAL DESCRIPTION: GACAM is a two-sided, deterministic model involving land and air forces. It is primarily designed to consider units of division size (for ground forces) or sortie by mission (for aircraft) although smaller ground units may be input. All forces are aggregated to the theater level for the simulation. The primary solution technique employed is probability. Simulated time is treated on a time step basis.

INPUT: Model inputs are derived from a scenario and include the ground and air orders-of-battle, average theater level casualty rates and rates of advance, the distribution of aircraft by type and mission, resources arriving into the theater by day, and performance and effectiveness parameters in addition to expected attrition factors.

OUTPUT: All output is in the form of computer printouts giving the daily movement of the Forward Edge of the Battle Area (FEBA), casualties, and status of forces. Analysis is required to incorporate model results into the scenario. In addition, detailed daily status of force outputs and/or cumulative summary output may be requested at intervals specified by the user.

MODEL LIMITATIONS: Interactions in GACAM are based on comparative modified firepower scores which do not consider the intangibles such as training, morale combined arms effects and command-and-control. The expression of average results based solely on these modified scores can be highly misleading. In addition, the aggregation of the model at the theater level precludes analysis of discrete units or of theater detail such as terrain. These must be reflected in the preparation of the input.

HARDWARE:

- o Computer: IBM 360/50; IBM 360/65, Honeywell 6080
- o Operation System: MVT/HASP; IBM O.S. Release 19.6; Honeywell GCOS.
- o Minimum Storage Required: 220K (IBM); 40K (HONEYWELL)
- o Peripheral Equipment: Can execute from 9-track tape drives or disk packs

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: (1) IDA Working Paper WP-31, "Description of the Methods Study Ground-Air Campaign Model (GACAM): Revised WP-16," September, 1970.
  (2) IDA Report 165, Volume 2, "Ground'Air Campaign Model," April, 1971.
- User's documentation is complete. Technical documentation is not.

TIME REQUIREMENTS:

- 4-6 months to acquire base data (depends on Service response)
- 2 man-months to structure data in model input format
- .166 second CPU time per day of combat (IBM); .6 seconds (HONEYWELL)
- 40 hours to analyze and evaluate results per base case; 4-8 hours per excursion

SECURITY CLASSIFICATION: Program: UNCLASSIFIED
Output: Up to and including TOP SECRET

FREQUENCY OF USE: Weekly

USERS:

- Principal: General Purpose Forces Division, SAGA
- Other: IDA (CDC 6400); U.S. Army CAA (IBM 7090)

POINT OF CONTACT: General Purpose Forces Division (GPFD)
Studies, Analysis, and Gaming Agency (SAGA)
Office of the Joint Chiefs of Staff (OJCS)
The Pentagon, Washington, D.C. 20301
Telephone: OX 5-9003

MISCELLANEOUS:

- GACAM interfaces manually by analysis with the SAGA "TANGO" family of models (i.e., ATLAS, CEM II, SATAN, CASCADE III, etc.) to examine various aspects of integrated theater level warfare.

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time Step

**TITLE**: GFE-III - Gross Feasibility Estimator

**PROPONENT**: OJCS (J-4)

**DEVELOPER**: NMCSSC

**PURPOSE**: GFE-III is a computerized, analytical logistics model designed as a rapid deployment planning tool to produce quick estimates of closure dates for cargo and personnel at multiple destinations. The model will simulate the deployment of movement requirements to various destinations under various time and facility constraints with varying levels of air and sea transportation resources. Thus, it may be used to assist in examining the feasibility of deployment plans and the effectiveness of transportation resources in support of such plans. The model produces day-by-day totals of cargo and personnel arrivals at the various discharge points with the number of days required to deliver each cargo category within each movement requirement. The model attempts to move requirements as fast as possible and does not honor required delivery dates.

**GENERAL DESCRIPTION**: GFE-III is a one-sided, deterministic model that simulates individual vehicles and individual requirements. However, both vehicles and requirements may be grouped to suit the user's needs, and these groupings can vary in size at the user's option.

Numerical analysis is the primary solution technique used. Simulated time is treated on an event store basis.

**INPUT**:

- Movement requirements
- Ship resources
- Airlift resources
- Air and sea port constraints
- Attrition of shipping
- Planning factors (land speed from origin of movement to POE, ship speeds, and convoying factors if applicable)
- Link distances in the transportation network

**OUTPUT**:

- Listings of input data
- Intermediate listings showing the daily status of movement requirements
- Optional output data specified by the user from nine options which are essentially summations of selected portions of the intermediate output
- The foregoing include such data as the utilization of ships and aircraft, air and sea channel movements summaries, airfield utilization (sorties per day), tonnage handled at ports of embarkation and debarkation, and graphic presentations showing the cumulative closure of each movement requirement priority group by mode of transportation.

MODEL LIMITATIONS:

- 64 movement channels within the configurations of eight origins.
- 8 each sea and aerial ports of embarkation and debarkation
- 8 each convoy marshalling areas and convoy dispersal areas
- 100 ship groups
- 15 convoy escort groups
- 30 aircraft types
- 40 movement requirements per priority group which are unlimited. The latter consist of personnel and cargo categorized as bulk, outsize and nonair-transportable.

HARDWARE:

- Computers: IBM 360/65; HIS 6080
- Operating System: OS/MVT (IBM); GCOS (HIS)
- Minimum Storage Required: 320K bytes (IBM); 97K words (HIS)
- Peripheral Equipment: Tape and disk drives

SOFTWARE:

- Programming Languages: FORTRAN IV (IBM); FORTRAN Y (HIS)
- Documentation: (1) General Description: CSM-GD 37A-72<br>(2) User's Manual: CSM-UM 37A-72
- The above two documents constitute complete user's documentation and are being updated and republished in 1975. There is no technical documentation.

TIME REQUIREMENTS:

- 1 man-week to structure input data in model input format
- 1 hour CPU time per model cycle
- 1 man-week to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times annually

USERS:

- Principal: OJCS (J-4)
- Other: CINCPAC, CINCEUR, CINCLANT

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Adviser Office
The Pentagon, Washington, D.C. 20301
Telephone: OX 7-5464

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Sea Forces; Computerized; One-Sided; Deterministic; Event Store

TITLE: GIANT - Geometric Interceptor Analysis Technique

PROPONENT: USAF (AF/SA)

DEVELOPER: AF/SAA

PURPOSE: GIANT exists in both computerized (GE 635) and computer-assisted (JOSS TSS) form. It is an analytical model designed to aid in the conduct of map war games of air defense problems. The primary problem addressed is the aggregated simulation of fighter/interceptors attacking bombers which have intruded into a defended air space.

GENERAL DESCRIPTION: The JOSS TSS version of GIANT is deterministic; the GE 635 version uses a mixture of deterministic and stochastic elements. Only air forces are simulated. The model considers individual interceptors vs. individual bombers if desired. It can aggregate up to hundreds of interceptors, located on up to fifty bases, vs. hundreds of bombers aggregated in up to fifty raids. It is primarily designed, however, to consider eight interceptors at each of twenty bases vs. 300 bombers in each of ten raids. Simulated time is treated on an event store basis. The primary solution technique is probabilities applied to terminal encounter of interceptors attacking bombers after time/distance and geographical problems have been solved.

INPUT:

- Control variables
- Number of attacking bombers, speed, heading, detection time and location, and weapon release times
- Interceptor performance capabilities, range, speed, combat time, time delay for takeoff and climb to altitude, number of firing passes, probability of kill.
- Number of interceptors at each base
- Bases from which interceptors are to scramble and recover (by geographic coordinate)

OUTPUT:

- Summary of the number of bombers killed and surviving at various mileages from the target at the time the attack occurred
- Interceptor points and times
- Recovery bases available to interceptors
- Interceptor attrition due to reliability and availability times for reassignment
- Summary of bombers killed

MODEL LIMITATIONS:

- 300 bomber raids, maximum of 100 bombers per raid
- 50 interceptor bases
- 50 types of interceptors
- Due to the length of the program, the JOSS system is restricted to small numbers of interceptor bases and bomber raids to avoid exceeding working storage limits.

HARDWARE:

- Computer: GE-635; JOSS TSS (RAND Santa Monica PDP-6)
- Operating System: GECOS (GE); JOSS TSS at the RAND Corporation (JOSS)
- Minimum Storage Required: 25K (GE); maximum storage specified under the JOSS Time Sharing System, i.e., ca.10K

SOFTWARE:

- Programming Languages: FORTRAN IV or JOSS
- Documentation: Draft user's guides for both the GE and JOSS versions.
- Documentation is being prepared for the GE-635 version. User's documentation is complete for the JOSS version.

TIME REQUIREMENTS:

- 3 days to acquire base data
- 3 days to structure data in model input format
- 45 minutes playing time for the JOSS computer-assisted version
- 1-1/2 minutes CPU time per model cycle
- 3 games learning time for players of the computer-assisted version
- 6 days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 40 times per year

USERS:

- Principal: AF/SASI
- Other: ADC Ops Analysis, NORAD War Gaming Directorate

POINT OF CONTACT: HQ USAF
Assistant Chief of Staff, Studies and Analysis (AF/SA)
The Pentagon, Washington, D.C. 20330
Telephone: OX 5-3379

MISCELLANEOUS: It is currently planned to add the ability to commit interceptors to and from CAP points (GE-635 version only).

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Air Forces; Computerized; Computer-Assisted; One-Sided; Deterministic; Mixed Deterministic/Stochastic; Event Store

TITLE: HALL

PROPONENT: Office of the Deputy Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Incorporated (SAI)

PURPOSE: HALL is a computerized, analytical model which allows quick analysis of the survivability of aircraft fleeing an SLBM attack. The model allows multiple aircraft types, multiple SLBM warhead types and trajectories, and a large variety of basing schemes.

GENERAL DESCRIPTION: HALL is an expected value model which sacrifices detail for more rapid analysis and allows examination of all parameters of interest through its various input options. The model uses a set of aircraft bases either defined by input or internally computed, assigns an aircraft bed-down, and generates an attack plan against those bases and the aircraft escaping from those bases. The primary solution techniques used are La Grange multipliers, linear programming, and probability.

INPUT:

- SLBM Weapon variables.
- Target (aircraft) variables.
- Basing variables.
- SSBN variables.
- Attack preference variables.

OUTPUT:

- Summaries of the assumptions made in the run and the survivability results.
- Output options allow extremely detailed output or highly aggregated summaries.

MODEL LIMITATIONS:

- Expected value calculations are performed.
- Pure weapon strategies are computed.
- No complexing of the target structure due to aircraft altitude variations.

HARDWARE:

- Computer: Honeywell 6080
- Operating System: MULTICS (MIT)
- Minimum Storage Required: N/A
- Peripheral Equipment: Standard scratch disk plus permanent disk.

SOFTWARE:

- Programming Languages: FORTRAN IV.
- Documentation is available.

TIME REQUIREMENTS:

- 1 minute or less to structure base data in model input format.
- 5-10 seconds CPU time per model cycle.
- 1 hour or less to analyze and evaluate results.

SECURITY CLASSIFICATION:

- The model is Unclassified.
- Data is up to Top Secret.

FREQUENCY OF USE: Several hundred times per year.

USERS:

- Principal: OASD(PA&E)
- Other: CIA, AFWL, GRC

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: OX5-9180

KEYWORD LISTING: Aircraft, Survivability, SLBM Attack, Strategic Analysis, Operations Research, Models, Linear Programming, HALL.

TITLE: Hospital Model (Medical)

PROPONENT: Assistant Superintendent, Combat Developments and Health Care Studies, Academy of Health Sciences

DEVELOPER: Assistant Superintendent, Combat Developments and Health Care Studies, Academy of Health Sciences

PURPOSE: The Hospital Model is a computerized, analytical, resource utilization model that simulates a hospital (up to 1,000 beds) with the purpose of estimating optimum capabilities, modifying TOEs and examining hospitalization requirements in a combat zone more effectively. The model deals exclusively with the operation of a combat zone hospital. It is primarily interested in examining (and pointing out) the critical parameters in a given theater situation. Some specific problems addressed are: (1) optimum evacuation policy for given patient workload; (2) utilization of treaters in different hospital areas; (3) number of X-rays and lab tests given to a patient mix; (4) number of beds necessary for given evacuation policy.

GENERAL DESCRIPTION: The Hospital Model is a stochastic model involving land forces only. It is primarily designed to consider theater level forces, but can handle almost any small group of men. Simulated time is treated on a time step basis. Fifteen days of real time are simulated in 1 hour of computer time. The primary solution techniques used are queuing theory (used throughout the system) and probability (used extensively in referencing patient class data such as recovery times, death rates, etc.).

INPUT:

- o Patient class related information (i.e., probability of occurrence, recovery time, treatment time, death rate, etc.)
- o Staffing levels in different areas and wards
- o Number of beds, evacuation policy, etc.

OUTPUT:

- o Utilization of treaters
- o Equipment levels (i.e., X-ray plates, etc.)
- o Totals for admissions, evacuations, returns to duty, divisions, beds filled, etc.
- o Options available are limited to interim printouts, end-of-replication printout (for 15 days), and average of several replications printout.

MODEL LIMITATIONS:

- o Maximum of 280 patients in process at one time (ward patients are not included in this limit).
- o Beds classified as belongings to the medical section do not become available to the surgical section when they are needed there.
- o Patients are diverted if treater is not available.
- o Only 15 different treaters can be considered in each treatment area.
- o Maximum of 1,000 beds

HARDWARE:

- Computer: Control Data 6500
- Operating System: Scope 3-4.2
- Minimum Storage Required: 140K - 250K
- Peripheral Equipment: 8 tape units (or combination of 8 disk/tape files)

SOFTWARE:

- Programming Language: FORTRAN
- User's documentation is complete; technical documentation is sketchy.
- Formats for input data are complete. Some routines are flowcharted.
- Each routine has a one-page outline.

TIME REQUIREMENTS:

- Time to acquire base data is unknown.
- 9 man-days to structure data in model input format
- 20-30 minutes CPU time per model cycle
- 2 man-weeks learning time for users
- 2 man-weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Test only (once daily average)

USERS: Assistant Superintendent, Combat Developments and Health Care Studies

POINT OF CONTACT: Chief, Systems Design and Analysis Division
Academy of Health Sciences, US Army
Fort Sam Houston, TX 78234
Telephone: AUTOVON 471-6430

MISCELLANEOUS: The Hospital Model can be used by itself or it can accept input directly from a patient workload model.

KEYWORD LISTING: Analytical Model; Health Care Delivery, Land Forces; Computerized; Stochastic; Time Step

TITLE: HOVARM - Anti-Armor Helicopter Combat Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: HOVARM is a computerized model used for analysis. It simulates an armed helicopter attack on hard targets, assesses the damage, computes ammunition expenditures, and expected aircraft losses. The chief focus of concern is the amount of ammunition expended by airborne weapons, armor losses inflicted on ground units, and aircraft losses.

GENERAL DESCRIPTION: HOVARM is a two-sided, deterministic model involving helicopter forces only. It is designed to consider from 1 to 10 aircraft against 1 to 20 targets. Simulated time is treated on a time step basis. Expected value is the primary solution technique used.

INPUT:

- Target must be defined in detail, including coordinates of each tank, AAA gun, etc.
- Terrain masking for each aircraft pass must be defined
- Aircraft expenditures, weapon Pks, and aircraft speeds must be defined

OUTPUT: Summary end-of-simulation printout of ammunition expenditures by airborne weapons, armor losses inflicted on ground units, and aircraft losses.

MODEL LIMITATIONS:

- Assumes aircraft is under ground control to the point where the target has been selected and identified
- No FEBA penetration in depth is simulated

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: Exec 8
- Minimum Storage Required: 32K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Helicopter Antiarmor Model, December 1974, USACAA. Available in the Defense Documentation Center
- The above is a complete user and technical documentation

TIME REQUIREMENTS:

- 1 month to acquire base data
- 2 minutes CPU time per model cycle

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 60 times per year

USERS: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 664-4708

MISCELLANEOUS: HOVARM provides input information for the Theater Rates Model of the Ammunition Rates Methodology.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Helicopter Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: HOVER - Anti-Personnel Helicopter Combat Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. Latest developments have been in-house.

PURPOSE: HOVER is a computerized model used for analysis. It simulates armed helicopter attacks against personnel targets. It is chiefly concerned with casualties inflicted on group targets by helicopters, helicopters lost, and ammunition expended on target.

GENERAL DESCRIPTION: HOVER is a two-sided, stochastic model involving land and air forces. There is no logical limit to the maximum or minimum size of the units the model can consider, but it is normally used against targets ranging in size from a platoon to a company. Simulated time is treated on an event store basis. Monte Carlo is the primary solution technique used.

INPUT:

- Weapon firing errors
- Lethal areas
- Ammunition load
- Weapon firing rates

OUTPUT: Printout of expected aircraft losses, expected ammunition expenditures and expected casualties.

MODEL LIMITATIONS: Maximum of 20 ground AAA weapons

HARDWARE:

- Computer UNIVAC 1108
- Operating System: Exec 8
- Minimum Storage Required: 32K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Helicopter Antipersonnel Model, December 1974, USACAA. Available in Defense Documentation Center
- The above represents complete user's documentation and complete technical documentation

TIME REQUIREMENTS:

- 1 month to acquire base data
- 2 minutes CPU time per model cycle

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 60 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1696

MISCELLANEOUS: HOVER provides input information to the Theater Rates Model of the Ammunition Rates Methodology.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: ICM - Infantry Combat Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. Latest developments have been in-house.

PURPOSE: The Infantry Combat Model is a computerized model used for analysis. It assesses ammunition expenditures from infantry weapon systems, as well as casualties from infantry engagements, for both Red and Blue units.

GENERAL DESCRIPTION: The Infantry Combat Model is a two-sided, stochastic model involving land forces only. It is designed to consider a total of three to four platoons. In theory, it could aggregate up to any limit, but the model has never been used with more than four platoon-sized units on each side. Simulated time is treated on a time step basis. The model is basically Monte Carlo, using probability theory where appropriate, with the object of simulating infantry engagements as realistically as possible.

INPUT:

- o Troop strength and organization for both Red and Blue
- o Pk for weapons simulated
- o Firing rates for weapons simulated
- o Objectives for both the attacking unit and defending unit

OUTPUT: Casualties, infantry weapon expenditures of ammunition, and indirect fire expenditures of ammunition in support.

MODEL LIMITATIONS: Will not resolve below platoon level for attacking force.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Exec 8
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Infantry Combat Model, December 1974, USACAA. Available in Defense Documentation Center
- o The above represents complete user's documentation and complete technical documentation

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 week to structure data in model input format
- o 3 minutes CPU time per model cycle

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 400 times per year

USERS: US Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1696

MISCELLANEOUS: The Infantry Combat Model provides input information to the Theater Rates Model or the Ammunition Rates Methodology.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Computerized; Two-Sided; Stochastic; Time Step

TITLE: IDAGAM I - IDA Ground Air Model I

PROPONENT: OJCS (SAGA/GPFD)

DEVELOPER: Institute for Defense Analyses (IDA)

PURPOSE: IDAGAM I is used in theater-level force structure studies of ground and air conventional conflict. For movement and overall attrition calculations, IDAGAM does not use firepower scores, rather a choice to include an antipotential potential method to calculate the value of a weapon, based on that weapon's capability to destroy the value of the opposing weapons. Attrition by weapon type, is calculated using the opposing weapons densities, capabilities and allocation of fire.

GENERAL DESCRIPTION: IDAGAM I is a deterministic, model of a conventional theater-level air and ground combat between two opposing forces. The geographical structure of the model consists of a series of nonintersecting sector, each sector consisting of intervals, each of which have a type terrain and posture assigned to them by the user. A region consists of one or more sectors at a specified distance from the FEBA and there is a communication zone for each side located to the rear of the regions.

The model currently plays the following resources. It may however be recompiled to alter these dimensions.

1. People-three categories: combat, combat support and service support.

2. Weapons-up to 12 types including SAMs and AAA's.

3. Divisions-up, to six types.

4. Supplies-the model plays only one type measured in tons.

5. Aircraft-up to 10 types.

6. Airbases-two national airbases in each region and one notional airbase in the communications zone, thus the model considers airbases at three different ranges from the FEBA.

7. Aircraft Shelters-one type in fixed locations.

8. Aircraft Mission-consisting of up to seven primary and five secondary missions.

9. Air Munitions-up to 9 types loaded on notional aircraft for delivery on close air support missions.

IDAGAM is a fixed time-step model usually in days. The user may add, delete, and/or change forces or parameters at the beginning of specified time periods.

The user has a choice from among eight attrition equations for the air-model interaction including binomial, exponential and Lanchester and among several methods of computing ground capability.

INPUT: The model needs some 600 input variables and arrays. Each input data card is uniquely identified for input into a base case set of data.

OUTPUT: All output is in the form of computer printouts of user selected summaries.

1. Detailed Report (Used for debugging)

2. Daily Selected Summary Tables

3. Selected Summary Report (1 page)

MODEL LIMITATIONS: IDAGAM does not simulate a breakthrough type situation. Logistic aspects of the model are very aggregated. Model is expected value vice Monte Carlo which could be argued to be a limitation.

HARDWARE: HIS 6080

SOFTWARE: FORTRAN Y

TIME REQUIR"MENTS: Six CPU minutes per 15 day game.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 150 - 200 times per year

USER: SAGA(OJCS)

POINT OF CONTACT: General Purpose Forces Division (GPFD)
Studies, Analysis, and Gaming Agency (SAGA)
Office of the Joint Chiefs of Staff (OJCS)
The Pentagon, Washington, D.C. 20301
Telephone: OX 5-9003

KEYWORD LISTING: Ground Air; Deterministic Computer Model; Theater-level; Conventional combat

**TITLE:** INFERS - Interindustry National Feasible Economic Recovery System

**PROPONENT:** Office of Preparedness - GSA

**DEVELOPER:** Mathematics and Computation Laboratory - OP/GSA

**PURPOSE:** INFERS is a computer oriented input-output system for assisting in the analysis of plans for economic recovery from a major national disaster. Its design was initiated by the need for use in formulating the plan for recovery from a nuclear attack in general war. The chief focus of concern is to select those final demand requirements for the economy which can be feasibly handled by the surviving production capacities, and at the same time best serve national recovery objectives.

**GENERAL DESCRIPTION:** INFERS is a one-sided, deterministic model that simulates the U. S. economy through its interindustry relationships either as a whole or in terms of individual economic sectors. The model considers 173 economic sectors using the national interindustry input-output table. A maximum of 12 priority final demand components can be processed in any single run of the system. Simulated time is treated on an event stored basis. The model employs the economic interindustry input-output analysis techniques and attempts to satisfy initial estimates of final demand requirements according to a designated priority sequence. This attempt is subjected by INFERS to the constraint of available surviving production capacities when the total capacities required to satisfy a priority final demand exceeds its available capacities. An estimate is computed of the adjustments that could be made to the priority final demands. INFERS computes, on request, additional tables which can be used to assist in determining feasible modifications of final demand patterns which are consistent with the available capacities. The model also computes the manpower and electricity requirements for the patterned final demand, using precomputed coefficients. If the user wishes to know the distribution of the output of any specific sector amongst the 173 purchasing industires, this information can be provided.

**INPUT:** The model requires an initial estimation of each of the priority final demand requirements and of the total production capacities at the 173 I-O sector level of the system.

**OUTPUT:** The system produces the following six edited tables through the standard printer: (a) initial final demand requirements, (b) capacity utilization for each priority final demand, (c) initial gross estimates of adjustments to final demand, (d) manpower and electricity requirements, (e) total requirements of the output of specified sectors relating to final demand, and (f) distribution of the output of specified sectors relating to total production requirements. Options are available to produce only needed tables.

**MODEL LIMITATIONS:**

- The system is based on the concepts and techniques of economic input-output analysis. Consequently, its limitations are the same as those of input-output analysis itself.
- The system presently uses the year 1963, 173-sector level input-output table derived from the U. S. Department of Commerce, Office of Business Economics, 1963 national input-output table.
- Maximum of 12 priority final demand components can be considered.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Maximum Storage Required: 60K
- Peripheral Equipment: Data Matrix Tape

SOFTWARE:

- Programming Language: FORTRAN V
- Documentation: Technical-and-user's documentation is in preparation.

TIME REQUIREMENTS:

- Time required for initial estimation of priority final demands and surviving capacities depends on user's knowledge and experience in the area.
- Less than one minute of CPU time per run should be adequate.
- Time required to analyze the results depends on the user's knowledge of input-output analysis and its inherent weaknesses and strengths.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used many times for analysis of interindustry input-output structure.

USERS:

- Principal: OP
- Other: Federal non-defense departments and agencies with emergency responsibilities

POINT OF CONTACT: OP - Mr. Albert Schulman
Office of Preparedness
General Services Administration
Washington, D. C. 20405
Telephone: 343-8865

MCL - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory
Office of Preparedness
General Services Administration
Washington, D. C. 20405
Telephone: 343-6213

MISCELLANEOUS:

- Initial estimation of final demands or surviving capacities must be made through other models (e.g. READY, DITT, etc.)
- INFERS supersedes POST.
- The YEAR 1967 input-output table is being prepared to be used by this system, and the table will be at a 176-sector level.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Civilian Population; Computerized; one-sided; deterministic; Time Step; Economic Recovery

TITLE: Interceptor War Game Model

PROPONENT: HQ NORAD, Aerospace Defense Command (ADC/XPQYA)

DEVELOPER: HQ NORAD, Aerospace Defense Command (ADC/XPQYA)

PURPOSE: The Interceptor War Game Model is a computerized, analytical general war model designed to determine the most probable results to be obtained by a postulated manned interceptor defense system versus a plausible manned bomber raid threat. It is used to determine proposals for optimum interceptor force sizing and basing. The model contains the five functions basic to a bomber raid and interceptor defense: (1) Move a number of raids of arbitrary size over defined penetration routes; (2) calculate the intersections of the penetration routes with selected radar coverage; (3) search eligible interceptor bases and commit flights against the raids at the earliest possible time; (4) compute the probability of kill results of the successful intercepts by a combination of Monte Carlo and deterministic methods; and (5) return the interceptor flights to the nearest recovery base for turnaround.

GENERAL DESCRIPTION: The Interceptor War Game Model is a one-sided model having a mixture of deterministic and stochastic elements. Only air forces are involved. It is designed to consider bombers, interceptors, bases and radars on an individual basis if desired and can aggregate each up to a maximum of one hundred. Simulated time is treated on an event store basis. Monte Carlo is the primary solution technique used.

INPUT:

- o Radar data: Location and altitude and range capabilities.
- o Fighter/interceptor (F/I) bases data: Location, type and numbers of F/Is on the base.
- o Interceptor aircraft data: Maximum allowable time to intercept, speeds, turnaround time, fire control system, coefficients for equation of time versus distance curve, armament, probabilities of kill for various altitudes and speeds, reliabilities and commitment policies.
- o Raid information data: Number of penetrators in each raid, timing and raid path.

OUTPUT:

- o Input parameter listings which establish initial conditions for the run.
- o Chronological events list giving time of events in minutes and hundredths of minutes from simulation time zero, raid number, raid size, and penetrator velocity; or the number and type of interceptors, their commitment and/or recovery base, the event, results of the event, location and simulation time.
- o Summary reports: (1) interceptor summaries; (2) total kill summaries; (3) kill summaries by raid; (4) summaries of activities by raid; (5) summary of interceptor data by raid.

MODEL LIMITATIONS:

- o 100 bases
- o 6 types of interceptor aircraft
- o 127 total penetrator aircraft
- o 100 raids
- o 10 legs per raid path
- o The command-and-control decision to commit a flight is assumed positive in all cases
- o North latitude and west longitude are assumed

HARDWARE:

- o Computer: Philco HIS 6060
- o Operation System: COSMOS (Colorado Springs Maintenance and Operating System)
- o Minimum Storage Required: 192K

SOFTWARE:

- o Programming Language: SIMSCRIPT I.5
- o Documentation: Both user's documentation and technical documentation are complete

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 man-week to structure data in model input format
- o 5 minutes CPU time per model cycle
- o 1 man-week to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Annual

USERS: ADC - XPY

POINT OF CONTACT: HQ NORAD, Aerospace Defense Command (XPQYA)
Ent Air Force Base, Colorado 80912
Telephone: Autovon: 692-6061/2795
AC (303) 635-8911, Ext 6061/2795

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; One-sided; Mixed Deterministic/Stochastic; Event Store.

TITLE: IUA - Individual Unit Action

PROPONENT: USA Combined Arms Combat Developments Activity

DEVELOPER: Lockheed Missiles and Space Company;
Booz-Allen Applied Research

PURPOSE: IUA is a computerized, stochastic simulation of a tank-antitank battle. It provides a means of assessing the relative combat effectiveness of various combinations of tank and antitank weapon systems in attack, defense and delay postures.

GENERAL DESCRIPTION: IUA is a two-sided model having both deterministic and stochastic elements. The model plays primarily land combat forces and artillery. It was designed to consider units ranging in size from an individual tank-antitank weapons systems to a reinforced battalion. IUA uses Monte Carlo techniques to compute detections, engagements and kills. A base case required approximately 45 minutes of computer time. However, battles reflecting changes in force structure and weapon parameters of the base case can be run in approximately 15 minutes of computer time.

INPUT:
- o Terrain area descriptors
- o Tactical plan
- o Weapon system performance data: mobility, vulnerability, firepower, and lethality characteristics.

OUTPUT:
- o Event output: firings and impact only.
- o 19 output formats displaying statistical ratios and loss summaries by weapon type, kill type, round type, range and other criteria, allowing simulation results to be analyzed and costed.
- o Range analysis: range distribution of firings and kills by weapon-target type.
- o Force effective indicator: exchange ratio of Blue losses to Red losses.

MODEL LIMITATIONS:
- o 72 attacker maneuver weapons.
- o 40 attacker overwatch weapons.
- o 60 ground defender weapons.
- o 5 each Army aviation weapons for Red and Blue.
- o Army aviation, TAC air, and TAC air are inadequately played.
- o Dismounted infantry are not played.
- o Tactical rules are rigid.
- o Communications, ground or air surveillance not played.

HARDWARE:
- o Computer: CDC 6500
- o Operating System: CDC SCOPE 4.2.3.1
- o Minimum Storage Required: 120,000 words (overlaid and segmented)
- o Peripheral Equipment: Majority of data files are on permanent disk files. Printer and card reader.

SOFTWARE:

- Programming Languages: FORTRAN IV, COMPASS
- Documentation: "Tank, Antitank and Assault Weapons Requirements Study," Models and Information Systems Division, Combat Systems Group, Scientific Advisory Group, Fort Leavenworth, Kansas
- User's documentation is complete; technical documentation is not. Programmer documentation has not been adequately updated during revisions to the model.

TIME REQUIREMENTS:

- 2 man months for Terrain preparation
- 2 man months to structure and verify weapons data currently available from Ballistics Research Laboratory.
- 45 minutes CPU time per initial runs (15 minutes for each sensitivity fun)
- 6 man weeks to make runs and analyze results.

SECURITY CLASSIFICATION: The model is Unclassified. But data is classified and coded.

FREQUENCY OF USE: Once per year

USERS:

- Principal: Armor Agency
- Other: Infantry Agency

POINT OF CONTACT: Mr. Herb Westmoreland
USACACDA Combat Operations Analysis Directorate
Fort Leavenworth, Kansas 66027
Telephone: Avn 552-3193

KEYWORD LISTING: Deterministic Model; Damage Assessment/Weapons Effectiveness; Land Forces; Computerized; Two-sided; Mixed Deterministic/Stochastic; Event Sequenced.

TITLE: LDB - Logistics Data Base

PROPONENT: US Army Logistics Center (TRADOC)

DEVELOPER: RAC and Computer Sciences Corporation

PURPOSE: LDB is a computerized, analytic, logistics model designed to provide detailed logistics data for wargaming, force structure analysis, contingency planning and combat development studies. Provide requirements for Army field forces for personnel, equipment, resupply, transportation, and costs.

GENERAL DESCRIPTION: LDB is a one-sided, deterministic model dealing with land forces from company level to theater Army forces.

INPUT:

- Army Master TOE file
- Army Master Data file
- Supply Bulletin 700-20 data
- Replacement factors
- Worldwide asset position
- Ammunition allowances
- Petroleum consumption rates

OUTPUT: Printout of requirements selected by unit by time element.

MODEL LIMITATIONS: Multiple runs required for dynamic requirements.

HARDWARE:

- Computer: CDC 6500
- Operating System: SCOPE
- Minimum Storage Required: 2 Disc Packs

SOFTWARE:

- COBOL
- Documentation limited to program listings, user's guide under preparation.

TIME REQUIREMENTS:

- Sturcture data base - 1 man month
- CPU time - 5 minutes to 5 hours

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 500-1000 times per year

USERS: US Army Logistics Command
US Army Training and Doctrine Command

**POINT OF CONTACT:** Logistics Data Branch
ATTN: ATCL-OSL
US Army Logistics Center, Ft. Lee, VA 23801
AUTOVON 687-734-6138

**KEYWORD LISTING:** Logistics, Model, Computerized Land Forces, one-sided, Deterministic

TITLE: LFWG - Landing Force War Game

PROPONENT: U.S. Marine Corps

DEVELOPER: USMC (War Games Branch, Development Center, MCDEC)

PURPOSE: LFWG is a manual, analytical model that investigates all features of Marine Corps air and ground functions in amphibious operations and subsequent operations ashore with particular, emphasis on the landing force aspects of amphibious operations. The chief focus of concern is support of Marine Corps studies: tank mix, tactical mobility, fire support requirements, and Seaborne Mobile Logistic System.

GENERAL DESCRIPTION: LFWG is a two-sided, stochastic model involving land, air and ship-to-shore sea forces. It is capable of considering groupings as small as an infantry company, artillery battery or individual aircraft. The largest unit that the model was primarily designed to consider is the company. This scope has been expanded to a Marine Amphibious Force and a Marine Amphibious Brigade. Simulated time is treated on a time step basis. The ratio of game time to real time is one hour to two days. Probability and game theory are the primary solution techniques used.

INPUT:

- o Political scenario
- o Troop lists, including major items of equipment
- o Environmental data
- o Firepower potentials
- o Weapons effects
- o Equipment capabilities and limitations

OUTPUT:

Raw game data requiring analysis. Options available are:
- o Unit histories by game interval
- o Target lists
- o Ammunition expenditures
- o Logistic usage

MODEL LIMITATIONS:

- o Provides no final answers
- o Time-consuming
- o Requires large staff
- o Cannot account for intangible factors such as morale, training, etc.

HARDWARE: The model is manual, therefore an IBM 407 accounting machine is the only hardware used.

SOFTWARE:

- o LFWG Rule Manual, available at USMC War Games Branch
- o Both user's and technical documentation are complete. The LFWG Rule Manual is under constant revision and update.

TIME REQUIREMENTS:

- o 1-3 months required to acquire base data
- o 1 man-month to structure data in model input format
- o Playing time is normally 3 months
- o 1 month learning time for players
- o 1-2 months to analyze and evaluate results for war game purposes; unknown for supported study.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: 4 times annually

USERS: Study groups

POINT OF CONTACT: Head, War Games Branch
Development Center
Marine Corps Development and Education Command
Quantico, Virginia 22134
Telephone: (703) 640-2255

MISCELLANEOUS: It is planned to convert the LFWG Model to computer-assisted form.

KEYWORD LISTING: Analytical; Limited War; Land Forces; Air Forces; Sea Forces; Manual; Two-Sided; Stochastic; Time Step.

**TITLE:** LOTRAK II - ASW Localization Model (Phase 1 and 2)

**PROPONENT:** CNO (OP-96)

**DEVELOPER:** Planning Analysis Group, Applied Physics Laboratory, John Hopkins University.

**PURPOSE:** LOTRAK is a computerized, analytical model that simulates search, detection, classification, localization, tracking, attack and reattack by two helicopters (Phase 1) and two destroyers (Phase 2) against a single submarine, two destroyers with LAMPS against a single submarine, and a VP against a single submarine (Phase 3). The model is primary concerned with ASW missions, destroyer effectiveness, helicopter effectiveness, and weapon effectiveness (ASROC, torpedo). In addition, it also can develop optimum localization tactics for two helicopters (Phase 1), two destroyers (Phase 2), or LAMPS and VP (Phase 3).

**GENERAL DESCRIPTION:** LOTRAK is a two-sided, stochastic model involving air and sea forces. It can consider either one or two vehicles. Outcomes are freely assessed. Simulated time is treated on an event store basis. Approximately three hours of real-time simulation are simulated in six seconds of computer time. The primary solution technique is kinematic, with probabilistic event assessment.

**INPUT:** ASW scenario.

**OUTPUT:**

- Event-by-event history
- Statistical analysis summary
- Trial summary

**MODEL LIMITATIONS:**

- 2 helicopters and 1 submarine (Phase 1)
- 2 destroyers and 1 submarine (Phase 2)
- 2 destroyers with LAMPS and 1 submarine (Phase 3)
- 1 VP and 1 submarine (Phase 3)

**HARDWARE:**

- Computer: IBM 360/91
- Operating System: OS-360
- Minimum Storage Required: 350K

**SOFTWARE:**

- Programming Language: PL/1
- Documentation: (1) "ASW Localization Model - LOTRAK II (Phase II), Operations Manual", PAG 41-71, OM 3360.
  (2) "ASW Localization Model - LOTRAK II (Phase I), Operations Manual", PAG Nos. 36-70, OM 3360.

(3) "ASW Localization Model - LOTRAK II (Phase III), Operations Manual", PAG 49-72, OM 3360 and PAG 51-73, OM 3360.

- Both user's and technical documentation are complete for Phase 1, Phase 2, and Phase 3.

TIME REQUIREMENTS:

- 3 weeks to prepare input.
- Approximately 4 seconds CPU time per model cycle (approximately 8 minutes run time per 100 replications).
- 2 weeks to analyze and evaluate results.

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Once

USERS: Strategic Analysis Support Group, OP-96

POINT OF CONTACT: Mr. Thomas Modelski
Planning Analysis Group
Johns Hopkins Applied Physics Laboratory
8621 Georgia Avenue
Silver Spring, Maryland 20910
Telephone: 589-7700

MISCELLANEOUS: LOTRAK II supersedes LOTRAK I.

KEYWORD LISTING: Analytical; Limited War; Air Forces; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store.

TITLE: LULEJIAN-I

PROPONENT: Weapons Systems Evaluation Group

DEVELOPER: Lulejian & Associates, Incorporated

PURPOSE: LULEJIAN-I is a computerized analytical, general, nonnuclear, warfare model developed for use in making relative assessments of forces, performing force deployment studies and generating information for use in tradeoffs among weapon systems. The outcome of force interactions is determined in terms of FEBA movement and the attritions of weapon systems and personnel.

GENERAL DESCRIPTION: The LULEJIAN-I model is a two-sided, deterministic simulation of integrated land and air combat. Ground force interactions are aggregated at the sector (corps) level, but individual battalions are accounted for. It is a theater-level model, but may be applied without modification to corps-level engagements. To determine attrition and movement of the FEBA, the model uses individual weapons performance potentials and a concept of trading space for survivability; it does not use aggregated measures of effectiveness such as firepower scores. A significant feature of the model is its use of game-theoretic techniques to determine approximately optimal allocations of some of the resources in the theater. The optimization may be two-sided, or the allocations may be fixed by the user. Six national participants may be played for each side, with three types of maneuver battalion per participant. Thirteen weapon types may be represented within each battalion. The model also represents for each side five types of tactical aircraft, which can be assigned to any of six mission areas; six types of artillery; two types of attack helicopters; and two types of ADA weapon systems.

INPUT:

- o Initial force and logistics inventory data, and a schedule of arrivals
- o Geographic and terrain data
- o Logistics systems capabilities and supply consumption data
- o Weapons performance data

OUTPUT: Tape of the values of all important variables used or generated by the model. Report Generator manipulates the information on the tape to provide printed results desired by the user. A wide variety of data can be obtained in available tables which may be selected for printing, e.g., detailed summary and cumulative results.

MODEL LIMITATIONS: The model is limited to specific maximum numbers of unit types, weapon system types and geographic sectors. Memory sizes and running times of the computers expected to be used were considered in establishing the limitations.

HARDWARE: The model has been successfully exercised on CDC 6400, CDC 6500, CDC 6600 and Honeywell Multics computers. The minimum storage requirement is approximately 50K. Peripheral equipment requirements include disc packs and tape.

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: WSEG Report 259, "The Lulejian-I Theater-Level Model"
- o The above document constitutes complete user's and technical documentation

TIME REQUIREMENTS: Acquire base data and structure it in model input format--4 man-months. This time reduced considerably for other than initial utilization of the model, since much of the data will not change for subsequent studies. Also, a data preprocessor is being developed to provide an interface with the OSD data files described in NATO Task Force Action Memorandum 3 (NTFAM-3). The model requires approximately 1.5 seconds CPU time per combat day, if allocations are fixed. Running times can increase substantially when approximately optimum allocations are being generated. Although the times required are dependent on the nature of the game and the optimization desired, some typical games have required from 20 to 40 minutes CPU time. The time required to analyze and evaluate results is dependent upon the range and depth of the analysis.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Newly developed, has not yet been used operationally.

USERS: Anticipated users include SAGA, OASD(PA&E), and WSEG.

POINT OF CONTACT: Weapons Systems Evaluation Group
400 Army Navy Drive
Arlington, Virginia 22202

KEYWORD LISTING: Analytic Model; General War; Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time Step.

TITLE: MABS - Mixed Air Battle Simulation

PROPONENT: Systems Analysis Office
U.S. Army Missile Command
Redstone Arsenal, AL 35809

DEVELOPER: Stanford Research Institute

PURPOSE: MABS is a computerized, analytical model that provides estimates of the effectiveness of alternative mixes of air defense forces (SAM, gun, and manned interceptors) against a mixed force of hostile aircraft and tactical ballistic missiles. It is primarily designed to provide a capability to simulate battles in which ground-based air defenses and manned interceptors on one side oppose coordinated air and missile attacks by the other side. In addition, it is concerned with the evaluation of alternative tactics, threat responses, rules of engagement, ECM levels, and the effects of defense in various types of terrain foliage.

GENERAL DESCRIPTION: MABS is a two-sided, stochastic model involving land and air forces. It is designed to consider SAM sites, manned interceptors, anti-aircraft guns and threat vehicles on an individual basis if desired and will aggregate up to a maximum of 255 ground sites, 100 manned interceptors, and 800 threat vehicles. Simulated time is treated on an event store basis. Probability theory and numerical analysis are the primary solution techniques employed.

INPUT:

- o Weapon system performance parameters, delay times, rates of fire, etc.
- o Geographical locations of defense entities.
- o Flight paths of enemy aircraft, damage parameters, flight tactics, and engagement doctrine

OUTPUT: Computer printouts of complete battle history, of results, or statistics of several replications. Selective debug information may also be printed.

MODEL LIMITATIONS:

- o 255 ground sites
- o 100 manned interceptors
- o 800 threat vehicles
- o ECM not explicitly simulated but reduced radar performance for ECM environment is an input
- o All threat flight paths are two-dimensional (however, see "Miscellaneous," below).

HARDWARE:

- o Computer: CDC 6400/6600
- o Operating System: SCOPE 3.3
- o Minimum Storage Required: 53,300 words for 6400 version
- o Peripheral Equipment: Card reader, line printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Documentation is available for MABS VIII-A and B.

TIME REQUIREMENTS:

- 1 month to acquire base data
- 2 man-weeks to structure data in model input format
- CPU time per model cycle can range from 10 seconds for an average iteration to 20 minutes for large problems

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Variable

USERS:

- Principal: ODDR&E (Land Warfare)
- Other: SRI, U.S. Army

POINT OF CONTACT: Mr. Harold R. Bright
U.S. Army Missile Command
Redstone Arsenal, AL 35809
Telephone: (205) 876-3798

MISCELLANEOUS:

- MABS uses data from the Terrain Simulation and Intervisibility Model (TIP) and the Air-to-Ground Intervisibility Assessment Program (AGIAP) in the form of three-dimensional effects resulting from terrain following flight profiles and line-of-sight.
- MABS currently includes fire coordination and IFF.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: MACE - Military Airlift Capability Estimator

PROPONENT: OJCS (J-4)

DEVELOPER: Military Airlift Command (MAC)

PURPOSE: MACE is a computerized, analytical logistics model that assists the transportation planner by providing rapid estimates of force closure times, utilizing airlift means. MACE is primarily designed for users who have a requirement to obtain estimates of large-scale troop and cargo movement closure times using military airlift force structure and general planning data.

GENERAL DESCRIPTION: MACE is a one-sided, deterministic model designed to consider single aircraft, individual requirements, and individual APOE-APOD. Aircraft can be grouped by aircraft type. The model works by successive increments and its aggregative ability is consequently limited only by the capacity of the computer. Numerical analysis is the primary solution technique used.

INPUT:

- o Force definitions
- o Aircraft ground time
- o Requirements (including APOE-APOD and distances)

OUTPUT:

- o Schedule of the daily movement capability of the aircraft employed
- o Closure time at the destination of the force being moved
- o Individual requirement traces
- o Aircraft mission traces
- o Aircraft utilization summaries
- o Requirement closure summaries

MODEL LIMITATIONS:

- o Air is the only mode of transportation considered.
- o Aircraft can be prepositioned for the first acquirement only. Thereafter they automatically appear where needed.
- o No time-phased processing of requirements

HARDWARE:

- o Computer: IBM 360/65; HIS 6080
- o Operating System: OS/MVT (IBM); GCOS (HIS)
- o Minimum Storage Required: 300K bytes (IBM); 36K words (HIS)
- o Peripheral Equipment: Magnetic tape and disks

SOFTWARE:

- o Programming Language: PL/1
- o Documentation: User's Manual - CSM-UM 112-70
- o User's documentation is complete. Technical documentation is not.

TIME REQUIREMENTS:

- 1 man month to acquire base data
- 1-1/2 man weeks to structure data in model input format
- 30 minutes CPU time per model cycle
- 2 man weeks learning time for users
- 1-1/2 man weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 75 times per year

USERS: OJCS (J-4)

POINT OF CONTACT: Office of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, D. C. 20301
Telephone: OX 7-5464

MISCELLANEOUS:

- MACE passes data to MASS (MACE Special Summaries Program) for summarization.
- MACE generates data for MORMAC (MORSA/MACE Interface Program) to reformat MORSA requirements data.

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Computerized; One-Sided; Deterministic

TITLE: MAWLOGS - Models of the Army Worldwide Logistics System

PROPONENT: U. S. Army Logistics Center

DEVELOPER: Research Analysis Corporation

PURPOSE: MAWLOGS is a computerized, simulation logistics modeling system, by means of which a particular model is generated to simulate the activities and measure the behavior of a particular logistics system structure with particular policy and procedure content at a level of detail chosen by the user. Its primary focus of concern is to simulate any of a wide range of alternative logistics system structures, policies and procedures involving maintenance supply, transportation, and communications and their interactions, and to measure characteristic workloads, performance and costs.

GENERAL DESCRIPTION: The keystone of the MAWLOGS system is the model assembler, a program which constructs a simulation model of a system represented as a network of functional nodes whose policy and procedural content are specified in terms of modules (i.e., blocks of computer program logic representing a logistics activity or policy). The model assembly technique potentially reaches well beyond the field of logistics modeling. The level of aggregation may be varied widely, from much to little detail, from troop unit to wholesale activities. Simulated time is treated on an event store basis. The primary solution technique of MAWLOGS is stochastic discrete event simulation. Except for a shortest chain algorithm in the route selection logic of transportation, no optimizing algorithms are in the present module library; but they can be added.

INPUT:

- To model assembler: description of system for which a model is to be generated--in terms of nodes and modules; a module library (on tape or cards).
- To a model: policy parameter settings, resource levels, demand characteristics of supported population, performance characteristics, such as capacities, delay times, and constraints of system elements.

OUTPUT: Output is in the form of computer printouts of summary statistics showing totals, averages, maxima, minima, and variances, and histograms. Optionally, a tape file of detailed transaction data susceptible of a variety of post analyses may be obtained. Post processors are available for analyzing the time behavior and the autocovariance, spectral density function, sample size, and statistical confidence of a variety of variables and for developing a variety of costs of the logistics system. A routine to plot graphs on a printer is available

MODEL LIMITATIONS: The modeling system is open-ended in that the user is free to add any module of interest to the module library. Thus, there is no limitation to the scope of the model. However, modules to be used together must have compatible data structures, which limits the number of feasible combinations that may be formed. There is a small loss in efficiency (i.e., a greater running time) caused by the logic linkage generated by the assembler to make possible the flexibility of model definition described above.

HARDWARE:

- Computer: CDC 6400 or CDC 6500
- Operating System: SCOPE 3.4
- Minimum Storage Required: Variable, from about 20,000 words upward
- Peripheral Equipment: Card reader, printer, two tape files plus one to five tape or disk files

SOFTWARE:

- Programming Language(s): FORTRAN
- Documentation: USASI Standard FORTRAN (CDC Run Version). May contain an occasional Control Data Corporation 6000 series FORTRAN pecularity.
- User's documentation and technical documentation is complete.

TIME REQUIREMENTS:

- CPU time varies from 1 minute to hours, but one hour is roughly typical.
- Approximately 3 months to analyze and evaluate results, varying with the problem.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: General Research Corporation and U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate
Fort Lee, Virginia 23801
AUTOVON: 687-1117

KEYWORD LISTING: Analytical Model; Logistics; Computerized; Stochastic; Event Store

TITLE: MESM - Multiechelon Supply Model

PROPONENT: U.S. Army Logistics Center

DEVELOPER: Research Analysis Corporation

PURPOSE: MESM is a computerized, analytical, logistics model designed to simulate the supply transactions in multiechelon systems of supply points, inventory control points, and shipment consolidation points; and to report the resulting supply performance, supply and transportation workloads and costs. Its primary concern is to perform comparative analyses of alternative supply systems and to determine their relative merits.

GENERAL DESCRIPTION: MESM involves land, air, and sea forces, and its level of aggregation is designed to be widely variable within a model run: the model can consider groups of units anywhere from battalion to worldwide in scope.

Years of time may be simulated in a time period ranging from a few seconds to many minutes per item. Simulated time is treated on an event store basis. The model uses stochastic discrete event simulation as its primary solution technique.

INPUT:

Major input requirements are a description of the system to be simulated in terms of nodes and links and their associated characteristics, and a specification of the demand patterns for each item to be considered.

OUTPUT:

- The model produces a detailed system description, reports of transportation workloads by link, and reports of summary performance and workload statistics by node and echelon for each item and for the aggregated items.
- Reports by item are optional. Four Output Data Postprocessors are available to produce reports of inventory and transportation costs, summary workload and performance reports for arbitrary sets of items, histograms and graphs, and statistical estimates of the mean, covariance and spectrum of time series statistics.

MODEL LIMITATIONS: Limited to analysis of supply systems with related transportation and communications. In multi-item runs, the items are simulated independently, one item per pass through simulated time.

HARDWARE:

- Computer: CDC 6500 or IBM 7094
- Operating System: SCOPE 3.4 on CDC 6500; IBSYS on IBM 7094
- Minimum Storage Required: $(151K)_8$ on the CDC 6500; 32K on IBM 7094 (with some reduction in modeling capabilities)
- Peripheral Equipment: 7 external files (tapes or disks)

SOFTWARE:

- o Programming Language(s): FORTRAN and COBOL
- o Documentation: H. A. Markham et al, "A Flexible Simulation Model of Multiechelon Supply, Vol. I: Description and Operating Instructions; Vol. II: Program Descriptions, Flow Charts, and Listings," RAC-TP-442, January 1972 (AD number not yet assigned).
- o Both user's documentation and technical documentation are complete.

TIME REQUIREMENTS:

- o Up to three months to acquire base data
- o Up to 1 man-month to structure data in model input format (An Automated Input Data System is available to screen and structure input data.)
- o CPU time varies from a few minutes to a few hours depending on the application.
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: One major study - 100 runs

USERS:

- o Principal: U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate
Fort Lee, Virginia 23801
AUTOVON 687-1117

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; Stochastic; Event Store

TITLE: Mine Hunting Model

PROPONENT: CNO (OP-96)

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: The Mine Hunting Model is a computerized, analytical model that evaluates the effectiveness of a mine field against mine hunting countermeasures. The model evaluates proposed minefields, with the purpose of helping the minefield planner to determine the number and type of mines, ship counts, arming delays, replenishments, mine settings, location of fields, etc., necessary to obtain the desired results against an expected mine hunting effort.

GENERAL DESCRIPTION: The Mine Hunting Model is a two-sided, stochastic model involving sea forces only. It is capable of considering mines and ships on an individual basis if desired, and can aggregate up to a maximum of 300 minelike objects of 60 types, 50 countermeasure ships, and 5 types of traffic ships. This upper limit may be indefinitely extended, however, depending on available computer capacity. Simulated time is treated on an event store basis. Monte Carlo simulation and probability are the primary solution techniques used.

INPUT:

- o Mines and their characteristics
- o Characteristics of mine hunting ships
- o Characteristics of traffic ships
- o Configuration of minefield and channel
- o Type of bottom and amount of clutter
- o Expected schedule of countermeasures and traffic

OUTPUT:

- o Computer printout giving mines detected and neutralized, mines fired, damage to ships, and threat of the minefield as a function of time.
- o The interval at which output is given is variable. Printout of status of entire minefield with other output is optional.

MODEL LIMITATIONS:

- o Computer storage
- o Cost of storage and running time

HARDWARE:

- o Computer: CDC 6700
- o Operating System: SCOPE
- o Minimum Storage Required: 50K words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a command manual, programmers manual, and input guide.

TIME REQUIREMENTS:

- o 2 days-week to acquire base data
- o 1 day to structure data in model input format
- o CPU time depends on the length of time simulated and the number of mines involved, e.g., a mine simulation over 30 days with heavy traffic took 500 seconds of CPU time
- o 2 days to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Twice per year

USERS: NSWC/DL for COMINWARFOR

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: (703) 663-7406 or 663-8645

MISCELLANEOUS:

- o The Mine Hunting Model has the option of using the output of the Mine Delivery Model and the Minefield Planning Model.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: MIPES - Mixed Platform Encounter Simulation

PROPONENT: Chief of Naval Operations (ASW Systems Project Office)

DEVELOPER: Naval Surface Weapons Center, Dahlgren, VA

PURPOSE: MIPES is a computerized simulation of an ASW engagement with the capability to play air, surface and submarine platforms in a coordinated engagement with enemy submarines.

GENERAL DESCRIPTION: The model is two-sided, stochastic, time-step using monte-carlo simulations. Mixed platform ASW/with a total of 16 enemy and friendly platforms can be simulated. Coordinated and complementary operations with appropriate command and control are addressed.

INPUT: Sensor, weapon, fire control, platform, environment tactics, scenario characteristics

OUTPUT: Computer printout and plot of statistically derived quantities. Either a summary or time-step by time-step output can be selected.

MODEL LIMITATIONS: The attack phase is still under development.

HARDWARE:

- o Computer CDC 6400, 6600, 6700, IBM 360, UNIVAC 1108
- o Minimum Storage Required 100K

SOFTWARE:

- o FORTRAN IV
- o Documentation NWLTR 2992 Mixed Platform Model Abstract (Uncl) (AD 912 648L)
- o Mixed Platform Encounter Simulation Model (U)
- o Vol. I: Technical Description (Uncl)
- o Vol. II: Programmer's Manual (Uncl)

TIME REQUIREMENTS:

- o Structure data base 1 man month
- o CPU Time: 30 Sec per replication

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Under development

USERS: NSWC Dahlgren

POINT OF CONTACT: Manager ASW Systems Project
Navy Department
Washington, D.C. 20360

KEYWORD LISTING: Computerized, stochastic, time-step, ASW

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TITLE: NEMO III - Nuclear Exchange Model, Mod III

PROPONENT: CNO (OP-96)

DEVELOPER: NAVCOSSACT

PURPOSE: NEMO III is a computerized, analytical model designed for use in evaluating the SIOP when gamed against the RISOP. The model addresses the problem of simulating the interaction of strategic nuclear offensive forces contained in the SIOP and RISOP and the opposing defensive forces.

GENERAL DESCRIPTION: NEMO III is a detailed two-sided event store simulation model. It plays individual missiles, RVs, bombers, ASMs, and decoys as programmed in the SIOP and RISOP. The model has both stochastic and deterministic elements, using a combination of Monte Carlo probability theory as its solution techniques. Both sides are played against their respective defense concurrently. Model can simulate the performance of one weapon or several thousand.

INPUT:

- o RISOP and SIOP
- o SAM and ABM sites: location and vulnerability
- o Aircraft interceptor bases: location and vulnerability
- o Offensive and defensive system performance parameters.

OUTPUT:

- o AGZ tapes for successful weapons
- o Computer listings summarizing results in terms of number of vehicles, weapons, yield of weapons, etc.
- o Detailed information on the performance of each weapon and vehicle.

MODEL LIMITATIONS: The model does not allocate weapons to targets. Running time is extensive which limits the number of possible runs. Building and maintaining the data base is a major effort.

HARDWARE:

- o Computer: UNIVAC 1108/1110
- o Operating System: EXEC VIII
- o Minimum Storate Required 64K
- o Peripheral Equipment: Drum, Tape, Disc, Printer, Card punch/reader

SOFTWARE:

- o Programming Languages: COBOL, FORTRAN
- o Documentation: Under preparation

TIME REQUIREMENTS:

- o 2 months to acquire base data
- o 2 man-months to structure data in model input format
- o 6 hours CPU time per model cycle for simulation only. 8 hours for input, 2 hours for output
- o 3 months to analyze and evaluate results from a gaming cycle

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 50-60 cycles per year

USERS: CNO (OP-96C4), SAGA (OJCS)

POINT OF CONTACT: Chief of Naval Operations (OP-96C4)
The Pentagon
Phone: 695-5051

NAVCOSSACT
Code 30
Washington Navy Yard
Washington, D. C.

MISCELLANEOUS:

- The QUICK Model generates the RISOP battle plan for input to NEMO III. The SIOP is provided by JSTPS
- AGZ output used as input to SIDAC Model operated by NMCSSC
- Supersedes NEMO II
- Model operation, support and maintenance requires the full time effort of about 15 skilled personnel

KEYWORD LISTING: Computerized, analytic, two-sided, strategic, nuclear, missiles, bombers

TITLE: NDAM - Nuclear Damage Assessment Model

PROPONENT: Defense Intelligence Agency (DI-7)

DEVELOPER: Defense Intelligence Agency (DI-7)

PURPOSE: NDAM is a computerized, analytic, damage assessment model, which given a specific laydown of nuclear weapons, assess probable damage to a given array of installations and personnel targets resulting from "prompt" effects.

GENERAL DESCRIPTION: NDAM is a one-sided deterministic model which will assess one to six possible targeting options in one run of the model.

INPUT:

- Target latitude, longitude, radius, VNTK, population.
- Weapon DGZ, CEP, HOB, reliability

OUTPUT:

- Detailed data on each target affected.
- Summary of expected damage by category for each weapon.
- Summary of expected damage by category for each laydown option.

MODEL LIMITATIONS:

- Laydown of 100 weapons.
- When using weapons in excess of 1 MT some affected targets are not included in printout.

HARDWARE:

- Computer: GE 635
- Operating System: GEC 053
- Minimum Storage Required: 80K words

SOFTWARE:

- COBOL and FORTRAN
- Documentation under preparation
- DI-550-27-74 "Mathematical Background and Programming Aids for Physical Vulnerability System for Nuclear Weapons."

TIME REQUIREMENTS:

- CPU - 10 minutes

SECURITY CLASSIFICATION: Secret Restricted Data.

FREQUENCY OF USE: 20 times per year

USERS: DIA

POINT OF CONTACT: Defense Intelligence Agency
Washington, D. C. 20301
Attn: DI-7D and SO-4A3, Tel. 692-5148

KEYWORD LISTING: Analytic, Deterministic, Damage Assessment, Nuclear, Computerized.

PROPONENT: Hq. US Army (DCSOPS)

DEVELOPER: Stanford Research Institute

PURPOSE: NEWCON is a computerized, analytical model designed to allocate strategic nuclear weapons so as to produce maximum damage against a set of targets that may be defended with overlapping area and local defenses. The model is used to assess various offensive and defensive force concepts under different conditions of attack. It also permits analysis of parametric variations of strategy or variations in offensive and defensive forces.

GENERAL DESCRIPTION: NEWCON is a two-sided, deterministic model involving land, air, sea forces, as well as civilian populations. It is capable of simulating anything from one missile against one target up to thousands of offensive and defensive missiles against a maximum of 400 target areas. LaGrange multipliers are the primary solution technique used. Simulated time is treated on an event store basis.

INPUT:

- o Numbers of offensive and defensive weapons and their characteristics.
- o Target data base.
- o Attack parameters.

OUTPUT:

- o Detailed data are printed out, giving damage by each weapon type to each target, various data summarizations, and input listings.

MODEL LIMITATIONS:

- o Performs analysis on aggregated bases.
- o Requires human interface at several steps which gives flexibility but can lead to inconsistencies.

HARDWARE:

- o Computer: CDC 6400, IBM 7090.
- o Operating System: SCOPE 3.3 (CDC); IBSYS (IBM).
- o Minimum Storage Required: 110K (CDC); 30K (IBM).
- o Peripheral Equipment: Tapes, card reader, line printer.

SOFTWARE:

- o Programming Languages: FORTRAN and ALGOL
- o Documentation:
  - (1) SSC-TN-8974-13, "NEWCON Reference Manual and Model Description."
  - (2) SSC-TN-8974-06, "Computer Assisted Strategic Analysis, with a Computational Example."
  - (3) SSC-TN-8974-14, "NEWCON Programmers Guide."
- o Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- o 1 month to acquire base data.
- o 1 man-week to structure data in model input format.
- o 10 minutes CPU time per model cycle.
- o 1 month learning time for users.
- o Less than 1 day to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Monthly

USERS: SRI and USACAA

POINT OF CONTACT:

Mr. Benjamin Suta
Stanford Research Institute
Menlo Park, California 94025
Telephone: (415) 326-6200

MISCELLANEOUS:

- o NEWCON is composed of the following computer models: XFORCE, HARDAT, STRATAS, MOD-5, and MOD-4. The output of each is used as input for the following.
- o NEWCON supersedes CONDAP.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Sea Forces; Civilians; Computerized; Two-Sided; Deterministic; Event Store.

TITLE: NEWS - Navy Electronic Warfare Simulator

PROPONENT: CNO (OP-96)

DEVELOPER: U.S. Naval War College

PURPOSE: The NEWS is an analog-computer-assisted, human-participation war gaming system. It is designed to provide decision-making practice, and limited decision-making information, to the participants in the play of war games. The NEWS is employed for games conducted to support the curriculum of the Naval War College, for games sponsored by Fleet and Operational Commanders to examine operational plans, examine strategic and tactical options, and rehearse at-sea exercises over the full spectum of naval warfare, and for the Tactical Development and Evaluation (TD&E) communities.

GENERAL DESCRIPTION: The NEWS was completed in 1958. It is a large three-story human-participation analog war gaming system containing an umpire area with a 15-foot by 15-foot master display screen, 20 player rooms, equipment areas, and a communications system. The NEWS can be used as either a one-sided or a two-sided system. It has both deterministic and stochastic features. Land, air and sea forces are involved. Games range in scope from the ship commander's level to the Fleet and National levels. Players may be located in the NEWS-player room or at remotely located operational control centers and flag plots. In a number of the games, manual techniques are employed to supplement the capabilities of the NEWS. The system may use several different ratios of game time to real time: 1:1, 2:1, 4:1, 10:1, 20:1, and 40:1. The game proceeds on the basis of real-time decisions by the tactical and/or strategic commanders. Automatic display is provided for 48 forces. Each force may be used to represent a single unit such as a submarine, ship or aircraft, or an aggregation of units. Paste-on symbols may also be used. Initial digital capabilities (Warfare and Analysis System) are now being implemented (see "Miscellaneous" entry below). To determine the capabilities in effect at any particular time, communicate with the point of contact.

INPUT: Types, numbers and performance characteristics of the forces, sensors, and weapons employed.

OUTPUT: In the current NEWS, there is no automatic recording feature. Outputs consist of photographs of the large screen in the umpire area, and game histories, detections, damage assessments, etc., maintained by the umpires and the players. The WARS (see "Miscellaneous" entry below) will have an automated record capability.

MODEL LIMITATIONS:

- 48 maneuverable forces
- Game areas of 40, 400, 1,000 and 4,000 miles on a side; by means of scaling, however, game areas of other sizes can be used
- Maximum force speeds of 5,000 knots; which, however, are reduced when ratios of game time to real time of 10, 20, and 40 to 1 are employed
- No electronic warfare or logistics capability
- No record or replay capability
- No automated data bank

HARDWARE:

- Computer: analog computer for NEWS; 2 USQ-20B for WARS version
- Minimum Storage Required: 544K words for current stage of WARS
- Peripheral Equipment: Teletype, high speed printer, magnetic tape unit and three slaves, card reader, punched card equipment, 3 General Automation 18/30 W/32K memory, 8 A/N Terminals, 9 medium speed printers, 1 high speed printer, 2 disk storage units, 1 bulk core memory, Eidophor large screen display with RAMTEK generator

SOFTWARE:

- Programming Languages: CMS-2, FORTRAN (WARS)
- Documentation: OPNAVINST 3000.7 Series and 1541.2 Series
- Documentation is not complete

TIME REQUIREMENTS:

- Base data for NEWS consists of documents and publications. The WARS data base is under construction and is as yet incomplete.
- 2-10 days playing time
- 1/2 day learning time for NEWS
- Up to 2 months to analyze and evaluate results

SECURITY CLASSIFICATION: Depends upon the specific game being played

FREQUENCY OF USE: 50 times per year

USERS: Students of the Naval War College
Fleet and operational commanders and their staffs (National and NATO)
Chief of Naval Material
Inter-American Naval War Colleges
OPNAV sponsors through CNA as agent

POINT OF CONTACT: Director
Center for War Gaming
Naval War College
Newport, Rhode Island 02840
Telephone: (401) 841-2102

MISCELLANEOUS: The present analog computer-based system is being replaced incrementally with a digital computer-based system. Digital computer programs will eliminate the supplementary manual techniques and will assist both umpires and players in a human-participation gaming facility emphasizing decision-making practice. The resultant physical facility will be known as the Warfare Analysis and Research System (WARS). Among the features of the WARS system are umpire alphanumeric I/O terminal sets, two additional computers, bulk core memory, and disk file.

KEYWORD LISTING: Training Model; Limited War; Politico-Military; Naval Air Forces; Sea Forces; Computer-Assisted; One-Sided; Two-Sided; Mixed Deterministic/Stochastic

TITLE: NUCROM - Nuclear Rainout Model

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Stanford Research Institute

PURPOSE: NUCROM was designed for damage assessment studies of the hazard from rainout from nuclear clouds over a wide range of input conditions. It was designed so that the user could choose from a number of assumptions concerning the initial conditions and the physical rainout mechanics.

GENERAL DESCRIPTION: NUCROM is a single burst rainout model that provides radiation exposure rate and exposure dose patterns for a wide range of input conditions.

INPUT:

- Weapon yield
- Fission fraction
- Height of burst
- Wind direction and speed at various altitudes
- Precipitation cloud geometry, location, type and duration
- Activity distribution in debris cloud
- Scavenging rates

OUTPUT:

- Rainout arrival times
- Exposure dose rate pattern
- Exposure dose pattern

MODEL LIMITATIONS:

- Single burst model
- Airbursts only

HARDWARE:

- Computer: CDC 6400
- Operating System: Batch
- Storage Required: 40K
- Peripheral Equipment: none

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: "NUCROM: A Model of Rainout From Nuclear Clouds," DNA 3389F, August 1974
- Documentation Availability: Limited to U.S. Government Agencies, DDC No. 921975L

TIME REQUIREMENTS:

- o Prepare Inputs: Nominal
- o CPU Time per Cycle: 4 to 10 seconds
- o Data Output Analysis: Immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Very limited, i.e., only when rainout effects are being studied.

PRINCIPAL USER: Stanford Research Institute

POINT OF CONTACT: Mr. Sanford Baum
Engineering Systems Division
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
Telephone: (415) 326-6200

KEYWORD LISTING : Rainout; Washout; Tactical Nuclear Weapon Effects; Damage Assessment

TITLE: NUCWAL - Weapons Allocation and Optimization Model

PROPONENT: Studies, Analysis, and Gaming Agency (SAGA)

DEVELOPER: NMCSSC

PURPOSE: NUCWAL is a computerized analytical model designed for use in nuclear weapons allocation, nuclear forces requirement studies, and blast damage assessment. The chief focus of concern is the optimal, i.e., most destructive, allocation of a nuclear stockpile in a general war situation. Additionally, the model is concerned with determining the size of the nuclear stockpile needed to inflict a required level of damage to a specified target base.

GENERAL DESCRIPTION: NUCWAL is a one-sided deterministic model involving land, sea and air forces. It is designed to consider a wide range of units, ranging from a single warhead to the total national nuclear weapon inventory. The primary solution technique used is a non-linear, iterative optimization process. A combination of fixed and free weapons can be processed. Weapons without a fixed DGZ assignment will be optimally placed by the program and blast damage will be assessed for those weapons with a fixed DGZ assignment. Weapons system reliability and terminal defense penetration factors are considered. Installations can be considered as primary or collateral. HOB can be fixed or optimized.

INPUT:

- o Target base, with the following minimum information per target: Latitude, longitude, radius, VNTK, and point value.
- o Weapon inventory, with the following minimum information per weapon type: Number available, CEP and yield.

OUTPUT:

- o Computer printouts giving target blast damage data and a list of DGZs with associated payoffs.
- o Magnetic tape or disk file containing DGZs for use as input into fallout models such as SIDAC.
- o Weapon buy (payoff) list for plotting a damage response curve.

MODEL LIMITATIONS:

- o Mixed weapon inventory is processed sequentially.
- o Weapon range limitation is not considered.

HARDWARE:

- o Computer: Honeywell 6000, IBM 360
- o Operating System: Standard
- o Minimum Storage Required: 28K words
- o Peripheral Equipment: Card reader, printer, 2 magnetic or a disk

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Nuclear Weapons Allocation Program, CSM UM 145-74, NMCSSC 28 June 74

TIME REQUIREMENTS:

- o Time to acquire base data varies widely, from as little as one day to several weeks, depending upon the options chosen.
- o 1 day to structure data in model input format.
- o 5 minutes to 1 hour CPU time per model cycle, depending on scope of the exercise.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 300 times per year.

USER:

- o Principal: OASD
- o Other: J-5 and SAGA

POINT OF CONTACT: NMCSSC/B205
Pentagon, Washington, D.C. 20301
Telephone: OX 5-2277

MISCELLANEOUS: Weapon output from NUCWAL may be used as input to SIDAC.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Sea Forces; Computerized; One-sided; Deterministic.

TITLE: NUFAM-Nuclear Fire Planning and Assessment Model

PROPONENT: U.S. Army Concepts and Analysis Agency

DEVELOPER: U.S. Army Concepts and Analysis Agency

PURPOSE: NUFAM is a computerized, analytical, general war model designed to simulate a nuclear exchange, allow human intervention, and perform damage assessment. The model performs the fire planning needed in a nuclear engagement, simulates the nuclear exchange and then determines prompt and delayed casualties and material damage to a target bank resulting from the timed sequence nuclear strikes.

GENERAL DESCRIPTION: NUFAM is a two-sided, mixed model involving land force only. It is primarily designed to consider groupings ranging in size from a battery or battalion up to theater-level forces. The lower limit of this range, however, may be manipulated to consider units anywhere between a platoon and a brigade, while the upper limit may be adjusted to consider groupings ranging from a division to a theater. Simulated time is treated on an event store basis, using the GASP IV language. The nuclear exchange is simulated by automating, based on input criteria, the selection of nuclear targets and the allocation of firing assets against these targets. The human intervention is accomplished by placing a man in the loop with the on-going simulation. A Cathode ray tube is the input/output medium and allows the user to retrieve information and subsequently influence decisions made by the simulation. The damage assessment is accomplished through circle/rectangle overlap calculations.

INPUT:

- 23 types of input data are required to define commanders firing guidance (2), fire planning (2), weapon characteristics (4), graphic info (4), assessment parameters (6), GASP IV (4), preplanned info (1).

- SEPARATE INPUTS INCLUDE:
  Target Info
  Firing Units
  Yield
  Battlefield Unit Info

OUTPUT:

- Timed sequenced list of all events, flee-fire
- Fire event results
- End of Period status of all units
- Histograms and CALCOMP plots (optional)
- Hard copy of graphic displays (optional)

MODEL LIMITATIONS: No cumulative radiation from multiple burst, or distribution of delayed casualties in time.

HARDWARE:

- Computer UNIVAC 1108
- 1557/58 Graphic display subsystem (optional)
- Operating System: EXEC VIII
- Minimum Storage Required: 56K
- Peripheral Equipment: Two tape drives, FASTRAND Format mass storage

SOFTWARE:

- Programming Language: FORTRAN and ASSEMBLER
- Library Routines: UNIGRASP (optional) and GASP IV

TIME REQUIREMENTS:

- 1 month to acquire base data
- 2 man-day to structure data in model input format
- 30 minutes CPU time for 6000 targets and 500 fires
- 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 1 major study early 1975 lasting 3 months

USERS: USCAA

POINT OF CONTACT: United States Army Concepts and Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1639

MISCELLANEOUS:

- NUFAM shares a common data base with Target Acquisition Routine (TAR)
- NUFAM encompasses NAR III B
- NUFAM may be run with or without the human intervention. In the later case, the UNIGRASP system and the 1557/58 graphic subsystem will not be needed.

KEYWORD LISTING: Analytic model, computerized, General War, nuclear exchange, two-sided, land forces

TITLE: NUREX - Nuclear Requirements Extrapolator

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: NUREX is a computerized model that, as a part of the Nuclear Requirements Methodology (NUREM), is designed to extrapolate, from Combat Sample Results, the nuclear weapons expenditures and resulting losses associated with a specific scenario.

GENERAL DESCRIPTION: NUREX is a two-sided, deterministic model oriented primarily to a Theater Land Battle force. It is designed to consider units ranging in size from Blue Brigades to Red Divisions up to the theater level. Simulated time is treated on a time step basis. The model is an interactive simulation based on a model hiearchy assessment of losses and expenditures.

INPUT: From the Theater Nuclear Scenario-opposing force (by various nationality and Warsaw Pact types played) strengths, Blue and Red replacement policies, Red Division Replacement Criteria, Blue and Red personnel/equipment daily replacements, nuclear delivery systems to be played (by type, total number and associated delivery yields), delayed casualty decay factors, and Combat Sample Results, nuclear warheads expended and factors representing personnel and equipment losses and units broken.

OUTPUT: NUREX produces both hard copy tabulations and magnetic tape records in the form of a Historical Audit Trail of a Theater Level Conventional/Nuclear War.

MODEL LIMITATIONS:

- The length of time simulated is based on 24-hour iterations.
- Nuclear delivery systems cannot exceed six for Red and Blue, with five varying yields per system.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 32K
- Peripheral Equipment: 1558 Display Console, 1557 Display Controller, printer

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: Tactical Nuclear Weapons Requirements Methodology (TANREM) Phase II: Methodology Development Vol. IV, Appendix G: Nuclear Requirements Extrapolator (NUREX) Model CAA-SR-7421.
- The above represents users documentation and technical documentation.

TIME REQUIREMENTS:

- 3 months to acquire base data
- 3 man-days to structure data in model input format
- 1 CPU second per 24-hour day of simulated conflict
- 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 20 times per year

USERS: Player Group, War Gaming Directorate, US Army Concepts Analysis Agency

POINT OF CONTACT: United States Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1630

MISCELLANEOUS: NUREX is a spinoff of ATWAR is envisioned as being the basis of a family of special-purpose models each using the hierarchical approach but differing in detail and emphasis to meet specific requirements.

KEYWORD LISTING: Man-Machine Integration; two-sided Computerized; Extrapolator; Theater Nuclear Requirements; Deterministic; Historical Audit Trail

**TITLE:** OASIS - Operational Analysis Strategic Interactions Simulation

**PROPONENT:** Strategic Air Command (SAC)

**DEVELOPER:** Science Applications, Incorporated (SAI)

**PURPOSE:** A computerized, analytical model designed to simulate the interaction of reentry vehicles (RV), anti-ballistic missiles (ABM), and intercontinental ballistic missiles (ICBM). Endoatmospheric simulations are limited to wing size engagements; exoatmospheric events are simulated continent-wide. The model primarily analyzes a small scale strategic engagement in a nuclear environment. It considers nuclear effects such as blast, thermal, radiation, dust and debris (fallout) and rainout (including ice crystals).

**GENERAL DESCRIPTION:** A one-sided model involving the simulation of strategic missile operation and weapon interaction in a nuclear environment. Both persistent and nonpersistent nuclear effects are tested. The model has both deterministic and stochastic features, using physics, probability, and numerical analysis as solution techniques.

**INPUT:**

- Descriptive system characteristics for both attacking RVs and defending ABM and ICBMs (including geographic location).
- Nuclear vulnerability threshold levels for each nuclear effect considered. Attack and launch doctrine and timing.

**OUTPUT:** A history tape of all game events and a printed output containing detailed game interactions for each time step where significant events occur. The NMCSSC/SAGA version outputs a summary table of the results of the scenario.

**MODEL LIMITATIONS:** Capability of simulating only persistent effects as shock fronts, thermal pulse, and nuclear dust clouds in a local target complex (missile wing). The number of RVs/ABMs/ICBMs within this local complex is limited to 100 each in the SAI and SAC versions, and 300 RVs, 150 ICBMs, and 100 ABMs in the NMCSSC/SAGA version.

**HARDWARE:**

- Computer: IBM 360/65, UNIVAC 1108, or GE 635, HIS 6080.
- Operating System: OS/MVT (IBM), GCOS (HIS).
- Minimum Storage Required: 350K, IBM 360; 72K, HIS 6080.
- Peripheral Equipment: disk pack, tape drive, printer, card reader.

**SOFTWARE:**

- Programming Language: FORTRAN IV.
- Documentation: Six volumes.

TIME REQUIREMENTS:

- Average of six weeks to accumulate input data.
- One man-month to structure data in model input format.
- 5-60 minutes CPU time, dependent on the amount of defense in the scenario, and on the amount of nuclear cloud detail desired by the user.
- Average of one week to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified.

FREQUENCY OF USE: 100 times per year.

USERS: Headquarters SAC/JSTPS, OJCS/SAGA, DNA, AFSC/FTD, NMCSSC, AFWL, LASL.

POINT OF CONTACT: Headquarters, Strategic Air Command
XOXM
Offutt AFB, Nebraska 68113
Telephone: AUTOVON 271-2332

MISCELLANEOUS: OASIS-74 supersedes other versions of OASIS. In OASIS-74, the nuclear cloud geometries and loading are described by VORDUM (dust) and WAIVOR (water and ice) routines. The erosion of specific heatshield materials is determined using the Erosion/Ablation Systems Analysis Program (EASAP), which handles both atmospheric and cloud entrainment erosion.

KEYWORD LISTING: Analytical model; General War; Computerized; Nuclear Exchange; Nuclear Effects; Fratricide; Damage Assessment/Weapons Effectiveness; Deterministic; Event Store.

TITLE: OSAGE - One Strike Allocation Generator

PROPONENT: Foreign Technology Division, USAF Systems Command

DEVELOPER: Science Applications, Inc., Analytical Technology Division

PURPOSE: OSAGE is a one strike allocator which optimally allocates, by linear programming techniques, a mixed strategic arsenal (bombers, ICBMs and SLBMs) against a large number of individual targets which are known by their vulnerability, geographic location, value and terminal defense level. Additionally, there can be a complex situation of limited-range ABM defense (interceptors and radars) which protect certain subsets of the targets.

GENERAL DESCRIPTION: OSAGE provides a weapon allocation which maximizes the total expected damage against a designated target set, subject to a large number of allocation controls. MIRV weapon allocations and the associated footprint-feasibility problems may be considered. There is no target aggregation in the model and range limitations on both offensive and defensive weapons are fully treated. Damage functions, either computed internally or program inputs, are computed as a function of weapon yield, CEP, reliability, and target vulnerability and area. The program contains a retargeting model which allows uncertainties about firing rates or prelaunch survivability to be explicitly considered in the allocation. The model has the capability to determine the optimum SLBM deployment to a specific set of launch areas.

INPUT:

- o Weapon and target description
- o Allocation control parameters
- o Target defense descriptors
- o Submarine deployment variables

OUTPUT:

- o Specific allocation of weapons by weapon type and launch point to target sets
- o Damage assessment data by weapon type and target vulnerability class
- o Target/defense summary
- o MIRV weapon allocation by booster
- o Linear programming summary
- o Weapon range summary

MODEL LIMITATIONS:

- o 350 different classes of targets
- o 75 launch point sites
- o 50 different types of weapons of which up to 10 may be MIRV-type weapons
- o 140 ABM defense complexes

HARDWARE:

- o IBM 370/145, GE 635, CDC 6600 and UNIVAC 1108
- o Storage Requirement: 300K
- o Peripheral Equipment: Printer

SOFTWARE:

- o Programming Language: FORTRAN IV, NAMELIST OPTIONS
- o Documentation: "OSAGE BASIC USER'S MANUAL", SAI-73-005-DEN, Science Applications, Inc., Denver, Colorado, December 1973.

TIME REQUIREMENTS:

- o Prepare Data Base: 1-8 hours
- o CPU time per analysis: 1-10 minutes
- o Data output analysis: Few minutes

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Monthly

POINT OF CONTACT: John Battilega
Science Applications, Inc.
7400 S. Alton Way
Englewood, Colorado 80110
Telephone: (303) 770-5240

KEYWORD LISTING: Strategic allocator; optimization; one-strike war game; resource allocator; limited war; linear programming; Benders' Decomposition; MIRV footprints.

TITLE: PFD-SAM-Preliminary Force Designer-Simulation Allocation Model

PROPONENT: U.S. Army Concepts Analysis Agency (CAA)

DEVELOPER: Research Analysis Corporation

PURPOSE: PFD-SAM is a computerized, analytical, logistics model whose purpose is to determine the arrival time of U.S. Forces in overseas theaters of operations. The model determines deployment schedules with specified lift assets, or designs a lift system to meet the required deployment schedule. In addition, it is also concerned with designing force structures to meet objective requirements.

GENERAL DESCRIPTION: PFD-SAM is a one-sided, deterministic model. It is designed to consider units ranging in size from a division to a design group of multiple theater operations. Simulated time is treated on a time step basis.

INPUT:

- o Force characteristics: troop strengths, location, readiness state, resupply, consumption, etc.
- o Lift vehicle characteristics: speed, load and unload times, capacity for each cargo type, etc.
- o General characteristics: port restrictions, distances between ports, attrition factors, etc.

OUTPUT: Detailed and summary printouts showing deployment schedules and/or lift and force structure.

MODEL LIMITATIONS: Resolution of model inputs

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII
- o Minimum Storage Required: 30K

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: "FORTRAN Force Planning System - Annex D1, Volume 1."
- o Both user's documentation and technical documentation are complete.

TIME REQUIREMENTS:

- o 1/4 month to acquire base data
- o 1/2 man-month to structure data in model input format
- o 1/4 hour CPU time per model cycle
- o 1/4 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS:

- Principal: CAA for ODCSOPS
- Other: Engineer Strategic Studies Group

POINT OF CONTACT: USA CAA
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1630

MISCELLANEOUS: PFD provides unit closures to the ATLAS model. It may also receive unit requirements from ATLAS.

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Computerized; One-Sided; Deterministic; Time Step

TITLE: PLOM - Prescribed Load Optimization Model

PROPONENT: U.S. Army Logistics Center

DEVELOPER: Research Analysis Corporation

PURPOSE: PLOM is a computerized, analytical, optimization model designed for the development of "optimal" prescribed loads. The model is primarily concerned with the development of a repair parts list - both the types of parts and the quantity of each - that ought to be included in the prescribed load of a military unit to best satisfy a unit's requirements without sacrificing its mobility. Corollary to this concern is that of reducing the number of different items stocked and of reducing inventory investment.

GENERAL DESCRIPTION: PLOM involves land, air and sea forces. It is primarily designed to consider units of battalion or independent company size, but it may be manipulated to consider any organization having a constrained ability to hold inventory and using a "use one/order one" replenishment policy.

The model is stochastic. Marginal utility, probability, and search theory are the primary solution techniques used.

INPUT:

- o Tape file containing a list of eligible items and their demand rates
- o Units of issue, unit prices, unit weights, unit cubes and military essentiality (optional)
- o A punched card containing the constraint and miscellaneous control information

OUTPUT:

- o A list of the prescribed load in terms of the items and quantities that make up the prescribed load, the total dollar value, weight, and cube, and the expected number of unsatisfied requirements
- o Additional options are detailed listings of items and quantities in order of priority for stockage, listing of final prescribed load, summary characteristics of prescribed load, summary characteristics of list of items eligible for stockage (produced by Automated Input Data System), numerous special reports available from Data Postprocessor.

MODEL LIMITATIONS: The model is applicable only if a "use one/order one" resupply policy is followed.

HARDWARE:

- o Computer: CDC 6400 or 6500 and IBM 7094
- o Operating System: SCOPE on CDC 6400 and 6500<br>IBSYS on IBM 7094
- o Minimum Storage Required: 32K words (IBM 7094)<br>151K words (CDC 6500)<br>(Word counts are decimal.)
- o Peripheral Equipment: 4 tape (or disk) files

SOFTWARE:

- Programming Language(s): FORTRAN
- Documentation: H.A. Markham et al, "A Model for Optimizing Prescribed Loads," RAC-TP-424, June 1971 (AD 886313L)
- Both user's documentation and technical documentation are complete. Conversion documentation for operation on the IBM 7094 has been provided the sponsor.

TIME REQUIREMENTS:

- Time to acquire and structure the base data varies widely depending on the problem. Division Logistic System (DLOGS) data are available at sponsor and an Automated Input Data System is provided with a model to screen and structure this data for input.
- CPU time per model cycle averages about 2 minutes on CDC 6400; not known for the IBM 7094 due to the fact that the model has not been given a full run as yet on this machine.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Semi-annually

USERS:

- Principal: U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate
Fort Lee, Virginia 23801
AUTOVON: 687-1117

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; Stochastic

TITLE: Politico-Military Simulation

PROPONENT: Studies, Analysis, and Gaming Agency (SAGA)

DEVELOPER: Studies, Analysis, and Gaming Agency (SAGA)

PURPOSE: The Politico-Military Simulation is a manual simulation which analyzes critical issues, problems, and questions in the sphere of national security policy. It generates new approaches to possible future trends in this area and provides increased awareness of crisis management situations for manager-level and senior government officials. The simulation is chiefly concerned with the politico-military aspects of mid-range national security interests of the United States; specifically, U. S. regional relationships with its allies, uncommitted nations, and potential enemies.

GENERAL DESCRIPTION: The Politico-Military Simulation may involve from one to six teams, but usually two are used. These teams play the roles of countries, international organizations, or blocs. Simulated time is treated on a time step basis. The ratio of game time to real time can vary from years to hours through days to hours, depending on the intensity and pace of the crisis being simulated.

INPUT:

- Politico-military scenario
- Order-of-battle: weapons and force levels (data for future timeframes is approximated)
- Country descriptions including detailed demographic and economic information

OUTPUT:

- Narrative Final Report containing brief summary, commentary, and conclusions
- Documentation report containing scenario projections, team messages, and edited transcript
- Film report when appropriate to subject classification

MODEL LIMITATIONS:

- Extensive research required for each simulation
- Conclusions are subjective in nature, depending in varying degrees upon value judgments and participants' experience level
- Non-repetitive

HARDWARE: Word processing equipment

SOFTWARE: Documentation consists of representative collections of National Security Policy papers, intelligence estimates, etc. New documentation is required for each repetition.

TIME REQUIREMENTS:

- Average of 4 man-months to acquire base data
- Average of 12 man-months to structure data in model format, but this varies depending on nature of subject and level of player experience and seniority.
- 3 days to 2 weeks playing time
- 4-6 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED; substance of the exercise is SECRET-NOFORN through TOP SECRET-NOFORN.

FREQUENCY OF USE: 3-4 simulations per year

USERS:

- Principal: Department of Defense
- Other: Component departments of the Executive Branch;
  Senior Service Colleges;
  Defense Intelligence School;
  Foreign Service Institute

POINT OF CONTACT: Chief, Politico-Military Division
Studies, Analysis, and Gaming Agency (SAGA)
Organization of the Joint Chiefs of Staff (OJCS)
Pentagon, Washington, D. C. 20301
Telephone: OX 5-7683

MISCELLANEOUS: It is currently planned to add to the model computerized reference data retrieval on a shared basis.

KEYWORD LISTING: Analytical Model; Politico-Military; Manual; Multisided; Time Step

TITLE: POSTURE System

PROPONENT: OJCS (J-4)

DEVELOPER: Research Analysis Corporation (RAC)

PURPOSE: POSTURE is a computerized, analytical logistics model designed to assist in defining the strategic mobility resources required for contingency situations and to assist in assessing the delivery capability of a given set of resources. The primary problem addressed is that of determining the optimal least-cost strategic mobility resource system required to meet time-phased strategic deployment requirements or, conversely, the maximum deployment capability of the given mobility resources. The model is concerned with both commercial and military mobility resources, DOD transportation requirements to meet concurrent non-war and peacetime obligations, time-phased readiness of movement requirements and availability of lift resources, intermediate transfer points, mixed commodity loads, peacetime economic value of military resources, mobility support constraints, and multiple contingencies.

GENERAL DESCRIPTION: The POSTURE System is actually three computer programs or phases. The first phase, the matrix generation, is run on the CDC 6400 computer; the other two phases, the LP and the Report Writer, are run on a CDC 6400, and IBM 360/65, or HIS 6080. POSTURE involves land, air, and sea forces. It is designed to consider troops, vehicle groups, and cargo categories at the infantry level. The model is deterministic. Simulated time is treated on a time step basis. Linear programming is the primary solution technique employed.

INPUT:

- o Origin/destination sets for force transfers
- o Lift resources
- o Cost parameters for the resources
- o Time-phased requirements by contingency and unit type
- o Vehicle characteristics, speed, payload
- o Allowable routes and route distances
- o Operational delay assumptions
- o Attrition factors (if used)
- o Convoy limits by theater and time period
- o Resource availability
- o Cargo characteristics: containerized or outsize

OUTPUT:

o Computer printout of optimal solution, giving ten-year system cost, fleet sizes, level of deployment activities, and basing and readiness levels of resources. Report writer tables are also available aggregating, manipulating, and interpreting solution results.

MODEL LIMITATIONS:

- 5 theaters
- 5 world areas
- 20 time periods (variable length)
- 12 commodity types
- 9 origins
- vehicles are fractionalized
- all events are deterministic
- cargo requirement integrity is not maintained

HARDWARE:

- Computer: For Matrix Generator: CDC 6400
  For LP and Report Writer: IBM 360/65, CDC 6400, or HIS 6080
- Operating System: For CDC: SCOPE, For IBM: OS/MVT, For HIS: 6080 GCOS
- Minimum Storage Required: For CDC: 30K words; For IBM: 250K bytes; For HIS: 92K words
- Peripheral Equipment: Tapes and Disk

SOFTWARE:

- Programming Language(s): FORTRAN IV, MPS/360 and CDC 6400 ALC
- Documentation: 1. RAC-P-42, "DOD Stragegic Deployment Problems: Formulation and Techniques 1967-68," October 1968, Part II (AD 691276).
  2. Unpublished draft: "Description of POSTURE matrix structure and mnemonics," RAC, 1970.
- There is no user's documentation. Technical documentation is not up to date.

TIME REQUIREMENTS:

- 2 weeks to acquire base data
- 1 week to 2 man-months to structure data in model input format
- 40 minutes to 1 hour CPU time per model cycle
- 4 hours to 2 man-days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS: OJCS (J-4) and OASD (SA)

POINT OF CONTACT: OJCS, Logistics Directorate (J-4)
Technical Adviser Office
The Pentagon, Washington, D. C. 20301
Telephone: OX 7-3686

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; Deterministic; Time Step

TITLE: PROFORMA - Pre-voyage Performance Analysis

PROPONENT: Military Sealift Command

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: PROFORMA is a computerized model that provides Headquarters, Military Sealift Command with comparative ship voyage, income, and expense data to assist management decision making in the acquisition and economical utilization of shipping. The model addresses the problem of how to economically transport cargo by sea.

GENERAL DESCRIPTION: PROFORMA is a one-sided model and is based on a deterministic algorithm. The model determines the cost incurred, revenue gained and length of time involved in the movement of cargo by a specified ship. The model's results give costs and revenue of potential voyages from which decisions can be made concerning future ship voyages and expected shipping requirements for the future. The mode considers events in a time step fashion and uses heuristic logic.

INPUT: The model contains a data base with the following information:

- Characteristics of all MSC controlled dry cargo ships
- Cargo handling capability of all world-wide water ports
- Distance between ports
- Billing rates for transporting cargo to various ports from a given port

Therefore, a user need only to select a ship, ports of call, and the cargo to be moved for a simulation.

OUTPUT:

- Income by cargo type
- Ship costs incurred
- Ship schedule (arrivals, departures, cargo by type lifted and unloaded)
- Optimal ship usage after a planned voyage has been terminated

MODEL LIMITATIONS

- 2 year period
- 40 ports
- 30 commodities

HARDWARE:

- Computer: CDC 6700
- Operating System: SCOPE 3.3 or 3.4
- Minimum Storage Required: 54K octal 64 bit words
- Peripheral Equipment: none

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: (1) NWL Technical Report TR-2976, The PROFORMA Model (MOD 1), (Command-Users Manual)

**TIME REQUIREMENTS:**

- A few minutes to structure input
- 90 seconds CPU time per model cycle
- A few minutes to analyze and evaluate results

**SECURITY CLASSIFICATION:** UNCLASSIFIED

**FREQUENCY OF USE:** Weekly

**USERS:**

- Principal: Military Sealift Command

**POINT OF CONTACT:** Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 663-7406 or 663-8645

**MISCELLANEOUS:**

- The version of PROFORMA supersedes the original version of PROFORMA.
- Some modifications may be forthcoming to increase flexibility and efficiency

**KEYWORD LISTING:** Analytical Model; Logistics; Costing; Scheduling; Sea Transportation

TITLE: PTMOS - Port and Mode Selection Model

PROPONENT: CNO (OP-96), CINCLANT

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: PTMOS is a computerized model that provides a logistician the means to select the proper port of embarkation and proper transportation mode to move each force unit involved in a deployment. The model addresses the problem of how to move military forces from their origins to their destinations in an optimal matter.

GENERAL DESCRIPTION: PTMOS is a one-sided model. The model creates a transportation network which represents the deployment by land, sea, and air transportation systems. The criteria for port and mode selection is to move each force unit to its required destination at the earliest possible time, but in a designed priority order. The model considers throughput capacity of deployment ports, travel time between deployment points, and force unit availability data at origin, and earliest arrival time at destination to make its selections. The technique used in this selection process employs a dynamic expansion in time of the deployment transportation network and uses the shortest chain algorithm of Ford and Fulkerson to make deployment port and transportation mode selections for each force unit. The model can make selections for a thousand force units in approximately fifteen minutes of computer time.

INPUT:

- Description of the deployment transportation network: number of deployment points, distance between these points, and daily throughput constraints.
- Description of each movement requirement (force units): size of force unit in short and measurement tons, required destination, earliest possible delivery date, earliest availability date, and required transportation mode, if any.

OUTPUT:

- The outputs consist of the selected port of embarkation and mode of transportation to move each force unit along with the closure date of each force unit.

MODEL LIMITATIONS:

- 40 sea ports of embarkation
- 40 sea ports of debarkation
- 50 air ports of embarkation
- 50 air ports of debarkation

HARDWARE:

- Computer: CDC 6700 and Honeywell 6050
- Operating System: SCOPE 3.3/GECOS 6000
- Minimum Storage Required: 36K words
- Peripheral Equipment: card reader, printer, scratch disk

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: (1) NAVCOSSACT Document 20A002W PM-07, Port/Mode Optimizer Module - T25 (JIS-TFE), Project Manual
- Both user's documentation and technical documentation will be complete by July 1975

TIME REQUIREMENTS:

- Several hours to structure data in model input format.
- CPU time is dependent on problem size and ranges from a few minutes to several hours.
- Several hours to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Annually

USERS:

- Principal: CINCLANT
- Possible Users: CINCPAC, CINCEUR and REDCOM

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: (703) 663-7406 or 663-8645

MISCELLANEOUS:

- PTMOS uses four of the input processing programs of CINCLANT's Transportation Feasibility Estimation Modules (TFE) to gain all input necessary to run the model.
- No plans exist for modifying PTMOS.

KEYWORD LISTING: Analytical Model, Logistics; Contingency Plans; Sea Transportation; Air Transportation Scheduling; Deployment; Network Theory; Shortest Route; Transportation Network.

**TITLE:** PWM - Patient Workload Model

**PROPONENT:** The Academy of Health Sciences, U.S. Army

**DEVELOPER:** U.S. Army Logistics Center

**PURPOSE:** PWM is a computerized, analytic, logistics model designed to assess the resource requirements for health care delivery to the Army-In-The-Field. It determines the number and types of patients expected from specific combat situations and resources required to process this workload.

**GENERAL DESCRIPTION:** PWM is one-sided, stochastic, dealing with land forces only. It can assess the requirements of up to 20 battalions (12 committed, 8 reserve). It is primarily designed to determine the medical facilities at Corps level for a single Corps.

**INPUT:**

- Scenario-unit, area, type operations, terrain, climate, troop strength, length of engagement
- Medical system structure
- Medical doctrine

**OUTPUT:**

- Number of admissions by class
- Number of outpatients by class
- Statistics on patient flow, treater utilization, ambulance utilization

**MODEL LIMITATIONS:**

- Does not play nuclear warfare
- Applies to Army-in-the-field personnel only

**HARDWARE:**

- Computer CDC 6500
- Operating System SCOPE 3.4.205
- Minimum storage required 140K

**SOFTWARE:**

- FORTRAN IV and SIMSCRIPT
- Documentation complete in one manual

**TIME REQUIREMENTS:**

- Structure Data Base - 2 man days
- CPU 18 minutes

**SECURITY CLASSIFICATION:** UNCLASSIFIED

**FREQUENCY OF USE:** 20 times per year

**USERS:** U.S. Army Medical Planners

**POINT OF CONTACT:** Assistant Superintendent
Combat Developments and Health Care Studies
Academy of Health Sciences (HSA-CSD)
Ft. Sam Houston, TX 78234

**KEYWORD LISTING:** Analytic, Medical, Computerized, Land Forces, one-sided, stochastic, event store

TITLE: RADOBS SYSTEM - Radar Observations System

PROPONENT: HQ NORAD/ADC (XPQY)

DEVELOPER: RCA-NORAD/ADC

PURPOSE: The RADOBS System is a computerized analysis model comprising several programs which will generate a series of vacuum-ballistic (rotating earth) trajectories for a given set of launch and impact points and radar look angles for each generated trajectory. Subsequent programs are designed to process the generated data. Missile trajectories may be generated (via table lookup) to match intelligence estimates of apogee altitude versus range. The model is designed for the analysis of the coverage capabilities of single or multiple radar systems and to analyze the timeliness of generated look angles.

GENERAL DESCRIPTION: The RADOBS programs are two-sided models which have deterministic elements. Both land and sea-launched ballistic missiles may be used. It is capable of considering individual radar-trajectory pairs and, if desired, can aggregate up to a maximum of 98 radar sensors, 600 launch point coordinates, and 300 impact point coordinates. The two-sided nature of the programs allows the user to determine radar sensor coverage of either launch or impact areas, plus associated radar detection-to-impact times. Simulated time is treated on an event store basis. Network analysis and queuing theory are the primary solution techniques used.

INPUT:

a. RADOBS Driver:
   (1) Run mode card
   (2) Sensor parameters and location
   (3) Launch point coordinates and launch angles
   (4) Impact point coordinates
   (5) Table lookup (X-Y pairs of launch angle versus ground range)

b. Data Processing Programs:
   (1) Special processing card
   (2) Time frequency
   (3) Radar sub-systems

OUTPUT:

a. Computer printout of trajectory and radar look angles

b. Magnetic tape containing trajectory parameters and radar detection-to-impact times.

c. Computer printout summarizing coverage data by launch point, by impact point, and by detection-to-impact times.

MODEL LIMITATIONS:

a. Keplerian orbits - no perturbations
b. Vacuum trajectories
c. No powered flight
d. No atmospheric reentry
e. Fan-shaped sensors (two fans)
f. 98 sensors, 600 launch points, 300 impact points

HARDWARE:

a. Computer: Philco 2000, Model 212
b. Operation System: COSMOS (Colorado Springs Maintenance and Operating systems)
c. Minimum Storage Required: 8 to 32K per program
d. Perhipheral Equipment: 2 magnetic drums at 262,144 words each; 10 magnetic tape drives

SOFTWARE:

a. Programming Languages: FORTRAN IV and SIMSCRIPT I.5
b. Documentation:

(1) R. J. Winkelman, "The Philosophy, Mathematical Methods, and Computational Methods for the MEWSAC System and the MEWSAC Program," Radio Corporation of America, Moorestown, N.J., December 1961.

(2) Users documentation for RADOBS, SUMMARY, SUMMTRSP, SUMFAN and SUMSORT.

(3) FORTRAN programs are being converted for use on the H6060 computer; SIMSCRIPT I.5 programs are being converted to SIMSCRIPT II.5 for use on the H6060.

TIME REQUIREMENTS:

a. Dependent on input: 1 day to 1 week to acquire data base
b. One day to one week to structure data
c. CPU time processed at 470 launch-impact-radar combination per minute
d. Subsequent processing varies from 1-2 minutes per radar system
e. One day-three months to analyze and evaluate results

SECURITY CLASSIFICATION:

a. The model is unclassified.
b. The data base may be SECRET.

FREQUENCY OF USE: 100 times per year

USERS: NORAD/XPQY

POINT OF CONTACT: HQ NORAD(XPQY)
Ent AFB, CO, 80912
Telephone: AUTOVON 692-3535/3161; (303) 635-8911, x-3535/3161

MISCELLANEOUS: The program utilized several programs including the RADOBS driver (a version of the MEWSAC program), SUMMARY, SUMMTRSP, SUMFAN and SUMSORT. Several other programs not currently in normal use (e.g. for CONUS plots of iso warning times) are available for use within the system. Several updates of the model have been made since the original MEWSAC program was developed. These changes include a magnetic tape output capability, a table lookup feature, capability to process depressed/lofted trajectories, plus changes to improve the efficiency of the program. Follow-on data processing programs may be added as required.

KEYWORD LISTING: Analytical model, general war, limited war, damage assessment, land, sea, ICBM, SLBM, MRBM, IRBM, radar, radar systems, warning, detection-to-impact, computerized, two-sided, deterministic, event store, Keplerian, ballistic.

TITLE: RAM - Red Artillery Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: The purpose of this model is analysis.

GENERAL DESCRIPTION: The Red artillery model is a computerized deterministic model. It accepts an acquired target list from the Target Acquisition Model and assigns artillery batteries to targets in accordance with Red doctrine. Simulated time is treated on an event stored basis. The solution technique used is that of a computer simulation algorithm.

INPUT:

- Acquired target list which includes target location, type, size and environment.
- Location of Red artillery batteries

OUTPUT:

- Computer printout of a list of time sequenced fire mission against Blue targets
- A summary of rounds fired by round type casualties achieved by Red artillery and armor losses to artillery fire

MODEL LIMITATIONS: Limited to ten types of artillery, two environments, and 16 types of targets.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: Exec 8
- Minimum Storage Required: 33K
- Peripheral Equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Red Artillery Model, December 1974, USACC. Available in the Defense Documentation Center. This publication is a complete user's and technical documentation.

TIME REQUIREMENTS:

- Approximately one man month to acquire basic data
- 0.25 man months to structure data in model input form
- Two minutes CPU time

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Three times per year

USERS: USACAA

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency - WGT
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1696

MISCELLANEOUS: The Red artillery model provides support to the Theater Rates Model.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Artillery, Deterministic

TITLE: RAPIDSIM - Rapid Intertheater Deployment Simulator

PROPONENT: OJCS (J-4)

DEVELOPER: General Research Corporation (GRC)

PURPOSE: The Rapid Intertheater Development Simulator is a computerized, analytical logistics model designed to simulate the rapid deployment of combat units and their resupply required for a military contingency operation. The model is used to determine the minimum time required to deliver each portion of the unit to its destination using ships and/or aircraft. All units are assumed to have a priority for movement. All movements of units are scheduled according to priority.

GENERAL DESCRIPTION: The RAPIDSIM is a deterministic model involving both aircraft and ships. Cargo tonnage is made available at ports of embarkation (POEs) according to schedules that reflect the readiness for movement of the units, the order of priority of units to be moved, and the movement times to the POEs from origin points. Specified airlift and sealift resources are initially applied to the movement of the cargo on the basis of a schedule of the availability of the resources at the POEs. The unit delivery rate is determined primarily by vehicle speed, vehicle capacity, and the time for loading and offloading.

INPUT:

- o Available number of aircraft by class
- o Available number of ships by class
- o POEs
- o PODs
- o Convoy Routes
- o Transportation modes
- o Time periods for initial ship availability
- o Commodities and units
- o Attrition rate of vehicles

OUTPUT: In addition to a detailed log of movements, summary reports are available as follows:

- o Summary of Materiel Movements -- showing for each POD the amount of each commodity required, moved, closed, the amount of the requirement which was not satisfied, and the amount lost
- o Summary of Aircraft Idleness - showing the number of utilization hours remaining unused during each day
- o Summary of Unused Ship Resources at POE -- showing the ship periods of availability at each POE by time period and ship type
- o Summary of Unused Ship Resources at POD -- showing the ship periods of availability at each POD by time period and ship type
- o Summary of Aircraft Sorties from POEs -- showing the number of aircraft sorties to each POE by 5-day time period
- o Summary of Aircraft Sorties from PODs -- showing the number of aircraft sorties to each POD by 5-day time period
- o Summary of Ship Attrition -- showing each ship the number made available, the number entering deployment, the number surviving, the number lost, and the percentage of deployed ships lost
- o Summary of Ships Arriving at POD -- showing for each POD the scaled number of ships arriving by ship and time period along with an implication of which ships were convoyed.

- o Summary of Convoy Utilization -- showing for each convoy route the number of convoyed ships departing during each period; also shown are the numbers arriving in convoy and the convoy size limit for each period
- o Summary of Ships Departing from POE -- showing the number of ships by each type sailing from each POE by 5-day time period
- o Summary of Non-Convoy Ships Sailing to Each POD -- showing the number of ships leaving each POE and sailing to each POD by time period

MODEL LIMITATIONS:

PARAMETER RANGES

| Parameter | Maximum No. | Minimum No. |
|---|---|---|
| Time periods | 36 | 1 |
| Aircraft classes | 6 | 1 |
| Ship classes | 12 | 1 |
| POEs | 10 | 1 |
| PODs | 10 | 1 |
| Convoy Routes | 10 | 0 |
| Mode definitions | 3 | 1 |
| Time periods for initial ship availability | 30 | 1 |
| Commodities | 40 | 1 |
| Attrition rate changes at each POD | 6 | 0 |
| Movement requirements | Unlimited | 1 |
| Partially used vehicles (at each point in the run) | 400 | 0 |

HARDWARE:
- o Computer: Honeywell 6080 or Honeywell 6180 for MULTICS
- o Operating System: GCOS
- o Minimum Storage Required: 97K words
- o Peripheral Equipment: Magnetic tapes and disk

SOFTWARE:
- o Programming Languages: FORTRAN Y and PL1
- o Documentation: Users Manual by General Research Corporation, 1 June 1974. Technical documentation is not available

TIME REQUIREMENTS:
- o 2 weeks to acquire data base
- o 1 week to 2 man-months to structure data in model input format
- o 1 minute of CPU time permodel cycle
- o 4 hours to 2 man-days to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 60 times per year

USER: OJCS (J-4)

POINT OF CONTACT: OJCS, Logistics Directorate (J-4), Technical Advisor Office
The Pentagon, Washington, D.C. 20301
Telephone: OX 7-3686

KEYWORD LISTING: Analytical Model; Logistics; Transportation Airlift; Sealift; Closure Dates; Computerized; Deterministic

TITLE: REACT Model

PROPONENT: Office of Preparedness, GSA

DEVELOPER: Mathematics and Computation Laboratory, OP/GSA

PURPOSE: REACT is a computerized, on-line trans-attack damage prediction model, designed to provide quick estimates of losses or residual values for a select group of priority resources while a nuclear attack is in progress and thus provide the basis for policy decisions. The REACT Model predicts the extent of damage or casualty losses on selected resources by measuring the impact of nuclear detonations on the basis of parameters used in matching the weapon characteristics against those of the targets or resources in question--along with a consideration of environmental factors. The specifications for the parameters, the structure of the damage and casualty assessment procedures, and the output information afforded parallel those basic elements in the READY model. They are described in the discussion of that model. The REACT system is characterized by speed and flexibility and is user-oriented in that the computer, which constitutes the center of operations, can be queried in English language statements for the output, or have input data entered, by the user(s) from remote terminals. Answers will normally be provided in a matter of seconds, but may require minutes for extensive printouts. This model is intended for use in providing individualized up-to-the-minute status reports. Therefore, it is designed primarily for use in an interactive mode.

GENERAL DESCRIPTION: REACT is a one-sided, deterministic model capable of considering individual resource locations if desired, and capable of aggregating up to a maximum of 7,000 resource locations within CONUS. Probability theory is the primary solution technique used. Simulated time is treated on an event store basis. Damage predictions are computed against the data base as each weapon is inputted.

INPUT: Basic input parameters can be classed as weapons and resources. The point of detonation for each weapon is the actual ground zero (AGZ) or the best approximation to it. Weapon characteristics consist of the yield of warhead, the height of burst, and time of detonation. Resource locations are provided in the same coordinate system used for the weapon locations. The resource data also include vulnerability characterizations of structural type of identification capable of being interpreted into the vulnerability characterization. Provision is also made to carry the identifying information, the classification code by which the category is structured, and up to ten data fields of category value. Population data are carried for the major SMSAs and for each county above 50,000 in population count.

OUTPUT: Outputs are available primarily as visual displays on CRT terminals or as printouts from teletype compatible terminals. Certain selected displays can be coupled into closed circuit TV. On special request, printer listings of REACT weapons or resource files can be obtained. Estimates of damage, casualty and availability status are given either for points or in summary form for resource categories. Weapons summaries are also available.

Thus, the analyst may ask a wide range of questions interactively with the model in order to obtain an estimate of the most recent status of the attack pattern and its effects on selected critical resources. The precision of the model analysis is the same as READY because the line of analysis is the same. But, since the entire data base contains only about 7,000 points, in order to insure expeditious real-time response, much of the detailed coverage afforded by the application of READY to the data base carried in the emergency package has been sacrifieced.

MODEL LIMITATIONS: REACT uses the same weapon effects parameters used by READY in matching the weapon and resource data to make the damage and casualty assessment estimates. Their reliability is subject to the same limitations described for READY results. REACT casualty estimates are based on direct effects only; there is no consideration of radioactive fallout.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 65K
- Peripheral Equipment: Interactive teletype compatible terminals connected on-line, remote and local

SOFTWARE:

- Programming Language: VULCAN
- Documentation: (1) "REACT Trans-Attack Information Systems," REG-103, National Resource Analysis Center, Resource Evaluation Division, OEP, September 1969.
  (2) REACT Users's Guide GSA/OP/MCLTM 25 1 Feb 1975

TIME REQUIREMENTS:

- Data base presently exists: see "REACT User's Guide" Section V
- Typically 1 minute or less response time per query
- 10 seconds CPU time per model cycle
- 4-8 hours learning time for users, depending on complexity of results desired
- 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Participated in two large studies and several exercises. The system is also being used continually as a training device for a number of Federal civilian agencies.

USERS:

- Principal: OP
- Other: Federal non-defense departments and agencies with emergency responsibilities under Executive Order 11490, 28 October 1969

**POINT OF CONTACT:** OP - Dr. James C. Pettee
General War Preparedness Division
Office of Preparedness
General Services Administration
Washington, D. C. 20405
Telephone 343-4227

MCL - Mr. Irving E. Gaskill
Chief, Mathematics and Computation Laboratory
Office of Preparedness
General Services Administration
Washington, D. C. 20405
Telephone 343-6213

**MISCELLANEOUS:**

- It is currently planned to improve the operating capability of the REACT model by reducing core requirements, and improving real time response while expanding the operational data base.

**KEYWORD LISTING:** Analytical Model; Training Model; General War; Damage Assessment/Weapons Effectiveness; Computerized; One-Sided; Deterministic; Event Store; Vulnerability Analysis

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TITLE: READY Model

PROPONENT: Office of Preparedness, General Services Administration

DEVELOPER: Mathematics and Computation Laboratory, OP/GSA

PURPOSE: READY is a computerized, nuclear attack damage assessment model designed to provide an adequately realistic simulation of a hypothetical post-attack situation as a basis for preparedness exercises and planning. It is intended to simulate the effects of a nuclear exchange on the resources, including population, of one adversary. From explicit information on weapon detonations, winds and the location and availability of resources, READY assesses the direct (prompt) effects and fallout radiation levels for all points of concern and estimates the expected damage or casualty level. From these estimates, the expected surviving population and facilities are developed in summary form. For large data categories, stratified samples can be developed to provide rapid assessment of national resource totals.

GENERAL DESCRIPTION: READY is a one-sided, deterministic model capable of considering individual resource locations if desired and capable of aggregating up to a worldwide scale. Although designed primarily for use with the extensive OP data bank on the U.S. and Canada, the model can operate worldwide with appropriate input data.

Probability theory is the primary solution technique used. Simulated time is treated on an event store basis.

INPUT:

- Nuclear weapons data: yield of warhead, height of burst, time of detonation, fission ratio, actual ground zero or designated ground zero with the circular error probable, and weather
- Pre-attack status of resources data: available in OP files (three million records organized into 110 categories), maintained for the most part in the READY format. The essential ingredients for the resource data are geographic locations, physical vulnerabilities of each data item, and value quantifications indicating the significance of the items within their resource categories.

OUTPUT: The two basic types of output are point assessments and summary analyses. Generally, point assessments show preattack information together with estimates of postattack status. Summaries include time-phased population conditions and availability of facilities, special presentations of items requiring unique assumptions of vulnerability (e.g., livestock, crops, and manpower) and special comparisons of local time-phased supply requirements as the basis for deriving apparent deficits in housing and medical service. The levels of aggregation in these summaries may provide for geographical totals such as an OP region, in an individual state or individual standard metropolitan statistical areas.

MODEL LIMITATIONS: READY reflects only the direct effect of blast, fireball gamma and thermal radiation, and fallout radiation. The effects of prevailing cloud cover, fire or firespread in the areas affected by the blast, earth shock, electromagnetic pulse and induced radiation are not considered.

**HARDWARE:**

- Computer: CDC 3600; UNIVAC 1108
- Operating System: SCOPE (CDC); EXEC VIII (UNIVAC)
- Minimum Storage Required: 64K (CDC); 65K (UNIVAC)
- Peripheral Equipment: Stromberg Carlson 5000 printer and UNIVAC 9300 printer

**SOFTWARE:**

- Programming Languages: FORTRAN IV (CDC 3600); FORTRAN V (UNIVAC 1108)
- Documentation:
  CDC 3600 Technical Documentation:
  (1) READY I - NREC Technical Report No. 24, OEP, July 1963
  (2) READY I - (Ann..) TR 24, OEP, February 1964
  (3) READY I - Weapons Preparation Program, National Resource Evaluation Center, Technical Manual No. 188, OP, February 1967
  (4) READY I - Attack Conditions Program, NREC, TM No. 191, OEP, March 1967
  (5) READY I - Selector Program, NREC, TM No. 161, Rev. 2, OEP, December 197.
  (6) READY I - Weapon Effects Program Asst. Director for Resource Analysis, OEP, TM-162, Rev. 2, November 1971
  (7) READY I - Summary Analysis Program, Asst. Director for Resource Analysis OEP TM No. 164, Rev. 2, June 1973
  (8) READY I - Point Analysis Program, Asst. Director for Resource Analysis OEP TM-163, Rev. 3, May 1972
- UNIVAC 1108 Technical Documentation:
  (1) READY I - Weapons Preparation Program GSA/OP/MCL TM-234, Rev. 1, Nov 1974
  (2) READY I - Attack Conditions Program, GSA/OP/MCL TM-234, Rev. 1, November 1974
  (3) READY I - Weapons Effects Program GSA/OP/MCL TM 231, Rev. 1, November 1974
  (4) READY I - Point Analysis Program GSA/OP/MCL TM 232, December 1974
  (5) READY I - Summary Analysis Programs GSA/OP/MCL, TM 233 currently being published.
  (6) READY I - Selector Program GSA/OP/MCL TM 247 December 1974

TIME REQUIREMENTS:

- The existing data base is described in "Resource Data Catalog," ISG-101, Assistant Director for Resource Analysis, OEP, January 1973
- Time to structure data in model input format varies with the requirements of the study in hand
- CPU time per model cycle is highly variable, ranging from minutes to many hours, depending on the problem under consideration
- Days to weeks to analyze and evaluate results, depending on the scope of the exercise or study

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 15 to 25 times a year

USERS:

- Principal: OP
- Other: DCPA, and other federal non-defense department and agencies with emergency responsibilities under Executive Order 11490, 28 October 1969

POINT OF CONTACT: Dr. James C. Pettee (OP)
Office of Preparedness
General Services Administration
Washington, D.C. 20405
Telephone: 343-4227

Mr. Irving E. Gaskill (MCL)
Chief, Mathematics and Computation Laboratory
Office of Preparedness
General Services Administration
Washington, D.C. 20405
Telephone: 343-6213

MISCELLANEOUS:

- READY can use weapon assignments from the Attack Generator Model.
- READY provides attack residuals for the INFERS Model.
- READY supersedes JUMBO III and STREAK IV.
- It is currently planned to add more local supply/requirement comparisons, programmed assignment of local viability dates, and network analyses to the model.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Nuclear Forces; Computerized; One-Sided; Deterministic; Event Store; Vulnerability Analysis

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TITLE: RISK II

PROPONENT: Office of Preparedness, GSA

DEVELOPER: Mathematics and Computation Laboratory, OP/GSA

PURPOSE: RISK II is a computerized, nuclear attack assessment model designed to facilitate the production of "hazard" studies which provide emergency planners with comprehensive characterizations of the impact of contingencies created by nuclear attacks. Hazard studies establish best-to-worst characterizations of the spectrum of estimated effects of nuclear attack or post-attack survival conditions pertinent to planning contingencies. In each case, the spectrum presumes to cover the range of plausible effects/conditions considering enemy offensive and friendly defense capabilities used in the study. Alternative nuclear attacks, i.e., options, are devised to represent varying possibilities with respect to the initiation of a nuclear war. For each option, a series of outcomes (trials) is gamed through the Monte Carlo program of RISK II. The heart of the model is the "Point Experience Computation" wherein for each trial, nuclear effects are computed for geographic reference points and their associated resource categories. These effects include blast overpressure, fallout radiation intensity, time of first fallout arrival and equivalent residual dose. The results for all trials and reference points make up the "Point Experience Library" and provide the basic profile of the possible range of nuclear effects which may be anticipated. Physical vulnerability and shelter protection factors are applied to the spectrum of nuclear effects resulting in point analysis and summary analyses probability ranges which are essential for nuclear contingency planning.

GENERAL DESCRIPTION: RISK II is a one-sided, stochastic model capable of considering resource points on an individual basis if desired, and of aggregating up to a worldwide level. Although designed primarily for use with the extensive OP data bank on the US and Canada, the model can operate in the Northern Hemisphere with appropriate input data. Monte Carlo and probability theory are the primary solution techniques used.

INPUT: Weapon application lists for each option with nuclear detonation data, trial structure specifications and resource data.

OUTPUT:

- For various geographic reference points, selected probable results of basic nuclear effects are recorded in various formats. The most extensive application of this type provides probable effects for several thousand representative reference points organized geographically by cities within states.
- Summary analyses provide the planner with a prospective best-to-worst range of resources available after a nuclear attack. A routine is also available to develop a probable range of local, time-phased, supply requirement comparisons which indicate prospects for a surplus or deficit in such items as medical service and housing.

MODEL LIMITATIONS: The weapon application list is limited to 3,000 weapons per option. Since the relative numbers of trials determine the relative weighting of the options, each option is given sufficient trials to provide representation of the principal variables (circular error probable, probability of arrival and wind season). In past studies, trials per option have ranged from eight to twenty. A discussion of the statistical reliability of RISK II is in National Resource Evaluation Center (NREC) Technical Report No. 22, "An Analysis of the Reliability of the RISK II Computer Statistical Model: NAHICUS-63 Application," February 1963. Tables of confidence levels are given in the documentation.

HARDWARE:

- Computer: CDC 3600. The "Point Experience" and Monte Carlo programs have been reprogrammed for the UNIVAC 1108.
- Operating System: SCOPE (CDC); EXEC VIII (UNIVAC).
- Minimum Storage Required: 64K
- Peripheral Equipment: Stromberg Carlson-5000 and UNIVAC 9300 printers.

SOFTWARE:

- Programming Languages: FORTRAN IV (CDC 3600); FORTRAN V (UNIVAC 1108).
- Documentation: NREC Technical Report #11, RISK II NREC Vulnerability Analysis Computation System, June 1965.
- Documentation of the RISK II computer routines for the Control Data 3600 exists. It is currently being prepared for the two programs which have been converted to the UNIVAC 1108.
- Control Data 3600, NREC Technical Manual No. 169, RISK II System for CDC 3600, July 1966.

TIME REQUIREMENTS:

- Approximately 1 month to acquire and structure base.
- CPU time per model cycle is a matter of hours.
- Days to weeks to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED.

FREQUENCY OF USE: 4 times per year.

USERS:

- Principal: OP
- Federal non-defense departments and agencies with emergency responsibilities under Executive Order 11490, 28 October 1969.

POINT OF CONTACT:

OP - Dr. James C. Pettee
Office of Preparedness
General Services Administration
Washington, D.C. 20405
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MCL - Mr. Irving E. Gaskill
Chief, Mathematics & Computation Laboratory
Office of Preparedness, GSA
Washington, D.C. 20405
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MISCELLANEOUS: RISK II takes weapon assignments from the Attack Generator Model. RISK II supersedes RISK I.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Nuclear Forces; Computerized; Stochastic; Vulnerability Analysis.

TITLE: ROA - Rank-Order Model

PROPONENT: Hq. US Army (DCSOPS)

DEVELOPER: Stanford Research Institute

PURPOSE: ROA is a computerized, analytical model designed to conduct a rank-order attack using strategic offensive and defensive nuclear weapons. The primary problem addressed is that of allocating offensive and defensive weapons in a rank-order attack so as to evaluate different force postures and force posture relationships. In addition, the model permits parametric analysis of input factors.

GENERAL DESCRIPTION: ROA is a two-sided, deterministic model involving land, air and sea forces as well as civilian populations. It is capable of considering situations involving one weapon and one target and can aggregate up to thousands of offensive and defensive missiles and over 400 target areas. Sequential allocation is the primary solution technique used. Simulated time is treated on an event store basis.

INPUT:

- o Number and characteristics of offensive and defensive weapons.
- o Target data base.
- o Attack parameters.

OUTPUT:

- o Normal detailed summary of allocation of weapons by numbers and types, and damage on a city-by-city basis.

MODEL LIMITATIONS:

- o Only does rank order attacks with a sequential application of weapons.
- o Does analysis on aggregated bases

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE 3.3
- o Minimum Storage Required: 100K
- o Peripheral Equipment: Tape decks, card reader, line printer.

SOFTWARE:

- o Programming Language: FORTRAN
- o No documentation is available.

TIME REQUIREMENTS:

- o 1 month to acquire base data.
- o 1 man-week to structure data in model input format.
- o 2 minutes CPU time per model cycle.
- o 2 weeks learning time for users.
- o 1 day or less to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 40 times per year.

USERS: Stanford Research Institute

POINT OF CONTACT:

Mr. Benjamin Suta
Stanford Research Institute
Menlo Park, California 94025
Telephone: (415) 326-6200

MISCELLANEOUS:

- o The Counterforce (XFORCE or HARDAT) Models of the NEWCON system supply input to ROA in the form of the human interface of the output.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Sea Forces; Civilians; Computerized; Two-Sided; Deterministic; Event Store.

TITLE: Runway Finder

PROPONENT: USAF (AF/SA)

DEVELOPER: AF/SAA

PURPOSE: The Runway Finder Model is a computerized, analytical model designed to determine the coverage that an aircraft with a certain "radius of action" can give to a geographical region by calculating the proportion of the region that lies within that radius from any suitable runway. The program generates uniform random points within some geographical region, country, or countries, under consideration, and determines the proportion of random points which fall within various distances from runways of desired characteristics.

GENERAL DESCRIPTION: The Runway Finder Model involves air forces only. It is designed to consider 1 runway versus 1 geographic point if desired, and is capable of aggregating up to a maximum of 3000 runways versus 100 geographic points. Probability is the primary solution technique employed.

INPUT:

- o Control variables.
- o Output options.
- o Characteristics of suitable runways.
- o Latitude and longitude of points describing outline of geographic region under consideration.

OUTPUT: The output is a cumulative probability distribution (and plot if desired) of miles versus the probability of finding a suitable airfield within that number of miles, for each characteristic of airfield considered.

MODEL LIMITATIONS:

- o 6 types of runways.
- o 3000 suitable runways in the region under construction.
- o The geographic region can be described by a maximum of 100 points of latitude and longitude.

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Volume III - Saber Lift Bravo, 15 February 1970, AF/SA
- o The above constitutes both complete user's documentation and complete technical documentation.

TIME REQUIREMENTS:

- o Up to three months to acquire base data, depending on data availability.
- o 3 man-days to structure data in model input format.
- o 15 minutes CPU time per model cycle.
- o 20 minutes to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS: AF/SA

POINT OF CONTACT: HQ USAF
Assistant Chief of Staff, Studies and Analysis
AF/SAA
417 Lynn Building
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8036

MISCELLANEOUS:

- It is planned to make the Runway Finder Model operational on the GE 635.

KEYWORD LISTING: Analytical Model; Limited War; General War; Logistics; Air Forces; Computerized; One-Sided

**TITLE:** SADDLE - Strategic Assured Destruction and Damage Limiting Evaluation

**PROPONENT:** USAF (AF/SA)

**DEVELOPER:** AF/SAS

**PURPOSE:** SADDLE is a computerized, analytical model that was developed for annual strategic force structure analysis over a variety of general war scenarios. It has also been used to provide quick evaluation of alternate force structures or specific scenarios. SADDLE can be used to determine U.S. strategic force structures to accomplish assured destruction (AD) and/or damage limiting (DL) tasks, while minimizing total cost, or to evaluate the effectiveness of alternative force structures in accomplishing these tasks.

**GENERAL DESCRIPTION:** SADDLE is a two-sided, deterministic model involving all strategic forces. It is capable of considering an individual vehicle, if desired, and of aggregating up to the total of all strategic offense and defensive systems. Simple arithmetic and expected values are the primary solution techniques used.

**INPUT:**

- Descriptions of the offensive systems, including bomb and ASM loads, R/Vs per missile booster, weapon yields in megatons, CEP in feet, alert rates reprogrammable and non-programmable reliability factors, number of bases and silo hardness.
- Estimates of systems costs to reflect investment and O&M. Offensive systems costs are input in millions of dollars per weapon. Defensive systems cost are input as millions of dollars per reliable intercept.
- Defensive systems capabilities are generally the result of other simulation models and war game analyses. These inputs, for both sides, include chaff discrimination (in percent) for ABM systems, percent of SLBMs which cannot be engaged for whatever reason, alert rates, launch and inflight reliabilities, number of inventory ABM required per successful intercept and the probability of survival of bombers by types through defenses.

**OUTPUT:** A summary for each specified budget level lists the preferred force, the candidate systems employed, costs and degree of accomplishment of the assigned tasks. Runs at successive budget increments and varying tasks also show the sequence in which candidate systems are selected on a cost-effectiveness basis, and for what tasks they are best suited.

**MODEL LIMITATIONS:**

- 15 types of bomber systems.
- 30 types of missile systems.
- 9 types of defense systems.
- 4 target types: defended cities, undefended cities, time urgent counterforce, and non-time urgent counterforce.
- Maximum budgets are $50 billion for defense and $999 billion total. Cost sharing between systems, where appropriate, is considered.

**HARDWARE:**

- Computer: GE 635
- Operating System: GECOS.
- Minimum Storage Required: 35K.

**SOFTWARE:**

- Programming Language: FORTRAN IV.
- No formal documentation exists at present. Source listings and rough programmer's notes are available. Running of the model should probably not be attempted without AF/SA assistance.

**TIME REQUIREMENTS:**

- Adequate data base is available in AF/SA.
- 2 man-days to structure data in model input format.
- .6 seconds CPU time per case.
- 3 days to one month to analyze and evaluate results, depending on the purpose of the run.

**SECURITY CLASSIFICATION:** UNCLASSIFIED.

**FREQUENCY OF USE:** 15 times per year.

**USERS:** USAF, ACS/Studies and Analysis

**POINT OF CONTACT:** HQ USAF
Assistant Chief of Staff, Studies and Analysis
AF/SASF
The Pentagon, Washington, D.C. 20330
Telephone: OX 5-0752

**KEYWORD LISTING:** Analytical Model; General War; Air Forces; Computerized; Two-Sided; Deterministic.

**TITLE:** SADS I - Real Time SADS I Missile Program

**PROPONENT:** USAF Armament Development and Test Center (USAF ADTC)

**DEVELOPER:** USAF ADTC (Computer Sciences Laboratory)

**PURPOSE:** SADS I is a computer-assisted, analytical model that provides real time evaluation of ECM against the SADS I and missile system.

**GENERAL DESCRIPTION:** SADS I is a two-sided, deterministic model involving land and air forces. It is designed to consider one aircraft against one site, with one active missile. Simulated time is treated on a time step basis. The primary solution techniques are mathematical missile modeling of guidance, autopilot and aerodynamics, and least-squares polynomial fit of aircraft true position.

**INPUT:**

- Real time aircraft true position from FPS-16 radar
- Real time aircraft trajectory from SADS I radar
- Radar boresight correction data
- Local daily weather

**OUTPUT:**

- Real time updated missile position - CRT
- Real time miss-distance, updated and final - CRT
- Real time aircraft and missile trajectories - CRT
- Real time performance graphs
- Real time post-mission data: Computer data listed above.
- CRT controls over missile mode, graphic grid scalings, and data presentations

**MODEL LIMITATIONS:** Three missiles active at any one time.

**HARDWARE:**

- Computer: CDC 6600
- Operating System: SCOPE 3.4
- Minimum Storage Required: 110K Octal Words
- Peripheral Equipment: CRT, 1 tape drive, real time interface from two radars

**SOFTWARE:**

- Programming Language: FORTRAN IV
- Documentation is complete.
- Program was validated by other Air Force (Air Force Systems Command) agencies.

**TIME REQUIREMENTS:**

- 1 day to acquire base data
- 1 day to structure data in model input format
- Utilizes 60% of CPU real time when multiple missiles are fired
- 1 week to analyze and evaluate results

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: 3 times per week

USER: USAF ADTC ECM Testing

POINT OF CONTACT: Mr. William P. Webster, ADTC/TSXDA
Eglin Air Force Base, FL 32542
Telephone: (904) 882-5818

MISCELLANEOUS: It is currently planned to expand the model to include multiple radar sites with multiple missiles from each site firing at multiple targets.

KEYWORD LISTING: Computer-Assisted; Analytic; Two-sided; Land and Air Forces, Missile, Time Step, ECM

TITLE: SALUM - Ship and Aircraft Loading and Unloading Model

PROPONENT: CNO (OP-96), CINCLANT

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory Warfare Analysis Department

PURPOSE: SALUM is a computerized analysis model that provides a staff officer with the capability for rapidly determining the logistic feasibility of existing or proposed contingency plans and evaluating the impact of modifications to these plans. The model simulates the point-to-point transfer of passengers and cargo by sea and air transportation means to create an acceptable deployment plan.

GENERAL DESCRIPTION: SALUM is a one-sided model having both deterministic and stochastic features. The model simulates the movement of cargo and personnel by air and sea for any size deployment from the evacuation of U. S. citizens from some hot spot in the world up to a general war. The simulation considers events in a time step fashion and users heuristics as its primary solution technique. The model can simulate, in approximately one hour of computer time, the deployment by sea or air of all forces involved in a contingency plan extending for 270 days.

INPUT:

- Detailed description of each movement requirement: size of force units in troops, cargo, and vehicle square
- Transportation assets: characteristics of ships, landing craft, and aircraft
- Ports: distances, operating characteristics, facilities (piers, beaches, airfields), and daily throughput constraints

OUTPUT:

- Movement requirement summary: how transported, departure and arrival dates, comparison between required delivery date and simulated delivery date
- Utilization of transportation assets: each movement transported, load and unload times, and arrival and departure times
- Port usage summary: daily throughput in terms of personnel, tons of cargo, and square feet of cargo

MODEL LIMITATIONS:

- 40 sea ports of embarkation
- 40 sea ports of debarkation
- 50 air ports of embarkation
- 50 air ports of debarkation
- 150 ship types
- 750 ships
- 24 aircraft types
- 750 aircraft
- 365 days simulated

HARDWARE:

- o Computer: CDC 6700 and Honeywell 6050
- o Operating System: SCOPE 3.3/GECOS 6000
- o Minimum Storage Required: 36K (decimal) words with overlay
- o Peripheral Equipment: card reader, printer, scratch disk

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: (1) NWL Technical Report, Ship and Aircraft Loading and Unloading Model - Air Simulator, Maintenance Manual
  (2) NWL Technical Report, Ship and Aircraft Loading and Unloading Model - Sea Simulator, Maintenance Manual
  (3) NAVCOSSACT Document 20A002W UM-01, Transportation Scheduling and Support Modules (JIS-TFE), Users Manual
- o Both user's documentation and technical documentation will be complete by July 1975

TIME REQUIREMENTS:

- o Several hours to structure data in model input format
- o CPU time is dependent on problem size and ranges from a few minutes to several hours
- o Several hours to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice monthly

USERS:

- o Principal: SALUM has become part of the Joint Operational Planning System (JOPS) Interim Software which is used by OJCS, CINCLANT, CINCPAC, CINCEUR, and REDCOM
- o Other: Naval Surface Weapons Center/Dahlgren Laboratory

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: (703) 663-7406 or 663-8465

MISCELLANEOUS:

- o The version of SALUM in JOPS Interim Software has six input processing programs creating input for SALUM and four output reporting programs plus SALUM are known as the Transportation Feasibility Estimation Modules (TFE).
- o It is currently planned to add various capabilities to SALUM to increase performance and efficiency.

KEYWORD LISTING: Analytical Model; Logistics; Contingency Plans; Simulation; Sea Transportation; Air Transportation; Scheduling; Deployment

TITLE: SAMEM Sustained Attrition

PROPONENT: CNO (OP-96)

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: SAMEM is a computerized, analytical model that evaluates the effectiveness of a mine plan that includes mine choice and field design. The primary problem addressed is that of demonstrating the capability of a minefield of causing casualties and of identifying that which would need to be done to the minefield if it did not perform as advertised. It can also be used to test mine countermeasure (MCM) tactics.

GENERAL DESCRIPTION: SAMEM is a two-sided, stochastic model involving mining and influence minesweeping. It is designed to consider individual mines, individual ships and specific mine settings, and can aggregate up to any level for the nomral minefield. Simulated time is treated on an event store basis. Monte Carlo simulation is the primary solution technique used.

INPUT: All data relative to the mines countermeasures and traffic ships, e.g., mine sensitivity, charge weight, ship speed, displacement, number of mines, placement, countermeasure data, etc.

OUTPUT:

- o Number of casualties
- o Number of mines fired
- o Level of damage to each casualty

MODEL LIMITATIONS: Relative to its use, the model has no limitations

HARDWARE:

- o Computer: CDC 6700
- o Operating System: SCOPE
- o Minimum Storage Required: 33K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a Command Manual and an Input Guide, but neither user's documentation nor technical documentation is complete.

TIME REQUIREMENTS:

- o 2 days to acquire base data
- o 1 man-day to structure data in model input format
- o Average of 5 seconds CPU time per model cycle
- o 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Twice per year

USERS: NSWC for COMINWARFOR

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: (703) 663-7406 or 663-8645

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: SATAN III - Simulation for the Assessment of Tactical Nuclear Weapons

PROPONENT: OJCS (SAGA/GPFD)

DEVELOPER: Anagram Corporation

PURPOSE: SATAN III is a computerized, analytical model designed as a tool for two-sided operational war gaming in the context of a large tactical nuclear war. It can also be used for parametric studies to tactical nuclear weapons systems operations. SATAN III will automatically deploy forces, acquire targets, assign nuclear weapons of fire on those targets, and assess the effects of those fires on personnel and troop equipment. The capabilities of the weapons and the status of the targets are updated whenever delivery systems are committed to firing missions, weapons are expended, and damage is inflicted.

GENERAL DESCRIPTION: SATAN III is a two-sided, stochastic model involving land forces and air forces, the latter in a secondary role as deliverer of air-delivered weapon systems. The smallest grouping that the model was primarily designed to consider is artillery units at the section level (one launcher/unit), and combat units at the company level (this could also be a platoon). Combat and support units may be aggregated to the battalion level but this magnifies error in the assessment of damage. The model is chiefly designed to consider groupings as large as divisions, corps and armies, all of which are described by one or more stylized target complexes (combination of units). Alteration of these levels of forces may influence the interpretation of the conflict environment size. Simulated time is treated on the basis of a timed event-sequence. Random numbers provide the primary solution technique.

INPUT:

- Weapon system characteristics, target characteristics and the groupings of associated targets into stylized target complexes.

- For the game scenario: theater force strength and deployment, described by stylized targets, complexes, personnel postures within target areas, weapon employment doctrine, probabilities of target acquisition, probabilities of acquisition of launchers which have just fired, error factors in intelligence functions. and a decision table which triggers a structured set of actions for a given set of conditions.

OUTPUT:

- Computer printouts of summary reports (format may be controlled by user):
  - Actual ground zeros
  - Damaged targets
  - Status of every target in game and a summary of division, corps and army
  - Weapon allocation
  - Target acquisition
- There is also a plot capability for sector summary bargraphs, geographic plots of theater, division, corps or army overlay with an area enlargement feature.
- Selective data retrieval and basic mathematical operations (+,−,x,÷) permit automated analysis of results of the conflict

MODEL LIMITATIONS:

- 10 Sectors
- 400 Units
- 100 Complex Types
- 200 Target Types
- 2000 Total Complexes
- 200 Target Priorities
- 50 Weapon Types
- 100 Launcher Types
- 5 Acquisition Zones
- 15 Deployment Areas

HARDWARE:

- Computer: Honeywell Information System 6000 Series Computer
- Operating System: GCOS
- Minimum Storage Required: 90K
- Peripheral Equipment: CalComp Plotting System 780/718

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: Users Manual; Computer Operations Manual; Program Maintenance Manual
- All documents will be completed by October 1975

TIME REQUIREMENTS: For a Corps size simulation

- Assemble data base - 1 man month
- CPU time per run - 1 hour
- Analyze results - 1 man month

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Weekly

USERS: SAGA

POINT OF CONTACT: General Purpose Forces Division (GPFD)
Studies, Analysis, and Gaming Agency (SAGA)
Office of Joint Chiefs of Staff (OJCS)
The Pentagon, Washington, D.C. 20301
Telephone: OX 5-9003

MISCELLANEOUS:

- SATAN III will supersede SATAN II, which is presently programmed in the IBM system for use on the IBM 360/50 and IBM 360/65.
- The SATAN III output deck of AGZs, fed to the NMCSSC conversion programs, produce deck inputs for the Single Integrated Damage Analysis Capability model or the Tactical Damage Evaluation Model which damage assess civilian population in the area of conflict.

KEYWORD LISTING: Analytical Model; Limited War; Damage Assessment/Weapons Effectiveness; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Mixed Time Step/Event Store

TITLE: SDPS - Space Defense Planning Simulator

PROPONENT: HQ NORAD, Aerospace Defense Command (ADC/XPQYA)

DEVELOPER: HQ NORAD, Aerospace Defense Command (ADC/XPQYA)

PURPOSE: SDPS is a computerized, analytical model that will be used to determine the capabilities of proposed satellite sensor systems to provide data sufficient to maintain the orbital elements of possible satellite populations to a specific level(s) of accuracy. SDPS is a computer program in the advanced stages of development. It models certain aspects of a satellite population and a system of satellite sensors. The aspects simulated are those that directly affect the quality of the primary output of the system which is a catalog of satellite elements representing the space population. The primary use of this model is to determine how the dynamic interplay of various combinations of events occurring in the system affects the overall quality of the system product. Information with respect to communication utilization and task frequency distribution is also available. The overall simulator will be capable of processing any credible satellite population which has been predicted for the foreseeable future through the existing and/or proposed satellite missile sensor networks. In addition, communications and data processing workload volume may be deduced from the model's output.

GENERAL DESCRIPTION: SDPS is a one-sided model having both deterministic and stochastic elements. Only air forces are currently considered. It is capable of considering individual sensor-satellite pairs if desired, and can aggregate up to a maximum of 4000 satellites and 63 sensors. Simulated time is treated on an event store basis. Probability theory, network analysis, and queuing theory are the primary solution techniques used.

INPUT:

- o Sensor parameters: Location and operational characteristics.
- o Satellite parameters: Orbital elements, physical characteristics, and element quality control data.
- o Exogenous events: New satellite launches, satellite break-up while in orbit, satellite decay, periods of interest, and systems alert.

OUTPUT:

- o Computer printout of system activity, raw data for immediate analysis, and data for reduction by report generation program.
- o Optional outputs from the report generation program for individual or group and/or summary reports of Tracker Workload, Observation History, Space Object Identification (SOI), Satellite Trace, SOI Trace, Catalogue Quality.

MODEL LIMITATIONS:

- o 4000 satellites
- o 63 sensors
- o No detailed analysis of subsystems; purely aggregated approach
- o No special perturbative effects simulated
- o Communications systems not modeled - implicit only
- o No missile capability

HARDWARE:

- o Computer: Philco 2000, Model 212
- o Operating System: COSMOS (Colorado Springs Maintenance and Operating Systems)
- o Minimum Storage Required: 213K characters
- o Peripheral Equipment: 2 magnetic drums at 262,144 words each; 10 magnetic tape drives

SOFTWARE:

- o Programming Language: SIMSCRIPT I.5, modified to utilize magnetic drums as program and data storage media
- o Documentation: User's documentation and technical documentation are complete

TIME REQUIREMENTS:

- o 1 week to acquire base data
- o 2 man-weeks to structure data in model input format
- o CPU time varies
- o 1-2 months to analyze and evaluate results

SECURITY CLASSIFICATION: The model is Unclassified
The data base is Secret

FREQUENCY OF USE: Model became operational on 1 January 1972

USERS: ADC/XPY

POINT OF CONTACT: HQ NORAD, Aerospace Defense Command (XPQYS)
Ent Air Force Base, Colorado 80912
Telephone: Autovon 692-2795/6061
AC (303) 635-8911, Ext 2795/6061

MISCELLANEOUS: SDPS supersedes the Space Defense System Simulator and the SPACE-TRACK Analysis Model.

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; One-sided; Deterministic/Stochastic; Event Store.

TITLE: SEALIFT

PROPONENT: Chief of Naval Operations (OP-96)

DEVELOPER: Center for Naval Analyses

PURPOSE: SEALIFT is a computerized, analytic model of limited war which measures the battle between a convoy system with protective ASW forces against a submarine force opposing it. Deliveries and losses of various types are calculated.

GENERAL DESCRIPTION: This two-sided stochastic model deals with land and sea forces (primarily one convoy and one submarine). Time is treated in the event store mode. It's primary role is to measure the effectiveness of an ASW force assigned to protect a convoy system resupplying a country under attack.

INPUT:

- o Forces
- o Weapon effectiveness
- o Engagement probability

Exchange ratios

OUTPUT:

Printout of mean results with standard deviations. Printed quantities include deliveries, losses and losses of combatants. Output can be by day or cumulative.

MODEL LIMITATIONS:

Model is basically a bookkeeping device with no physical calculations.

HARDWARE:

- o Computer: CDC3400/IBM709C

SOFTWARE:

- o FORTRAN IV
- o Documentation: CNA NWG Study 47, App.F

TIME REQUIREMENTS:

- o Structure Data Base: 1/2 man month
- o CPU Time: minutes

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Annually

USERS: Chief of Naval Operations (OP-96)

POINT OF CONTACT:

Center for Naval Analyses
1401 Wilson Boulevard
Arlington, Virginia, 22209

Telephone: 701-524-9400

KEYWORD LISTING: Analytic, Limited War, ASW, Computerized, Two-sided, Event Store

TITLE: SEER III - Simplified Estimation of Exposure to Radiation (second modification)

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Stanford Research Institute

PURPOSE: SEER III is a computerized single nuclear burst fallout model that was designed for fallout damage assessment purposes. The design requirements were that it require a short computer execution time and that its output fallout exposure patterns simulate those of the DELFIC fallout model for the same inputs.

GENERAL DESCRIPTION: SEER III is a computerized single nuclear burst fallout model that will produce fallout dose and dose rate patterns for weapon yields in the range from 0.01kt to 100mt, for various burst altitudes, and various winds aloft. SEER III only requires a few seconds of CDC 6400 computer execution time per run.

INPUT:

- Total weapon yield
- Fission fraction
- Height of burst
- Wind speeds and directions at various altitudes

OUTPUT:

- Exposure dose rate patterns
- Exposure dose patterns from time of fallout arrival to any user specified time

MODEL LIMITATIONS:

- Weapon yields from 0.01kt to 100mt
- Surface and above surface bursts only

HARDWARE:

- Computer: CDC 6400
- Operating System: Batch
- Minimum Storage Required: 120K
- Peripheral Equipment: none

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation Identification: "SEER II: A New Damage Assessment Fallout Model," DNA 3008F, May 1972. Supplemental Users Instructions for SEER III not formally documented, but are available with program.
- Documentation Availability: Distribution unlimited, DDC No. AD 754144

TIME REQUIREMENTS:

- Prepare Inputs: Nominal
- CPU Time per Cycle: 2 to 10 seconds
- Data Output Analysis: Immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used from time to time for various studies at SRI where fallout is part of the research problem. Also being used by other defense oriented organizations.

PRINCIPAL USER: Stanford Research Institute

POINT OF CONTACT: For information - Mr. Paul W. Wong
Engineering Systems Division
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
Telephone: (415) 326-6200

For Computer Program - Mr. Joseph Maloney
U.S. Army Ballistic Research Laboratories
Aberdeen Proving Ground, Maryland 21005

MISCELLANEOUS:

- SEER III has been incorporated into DACOMP, "Damage Assessment Computer Program," to efficiently assess fallout damage from very large numbers of nuclear detonations

KEYWORD LISTING: Fallout; Nuclear War; Damage Assessment; Radiation; DELFIC

TITLE: SIDAC - Single Integrated Damage Analysis Capability

PROPONENT: SAGA

DEVELOPER: NMCSSC

PURPOSE: SIDAC is a computerized analytical model designed to provide nuclear damage analysis information for both the Red and Blue resource monitoring subsystems of the General War System at the ANMCC. SIDAC is a modularly designed system with expandable capabilities that will fulfill user requirements for nuclear damage assessment in the operational environments and vulnerability analysis in planning support studies. SIDAC's modularity feature provides for rapid incorporation of state-of-the-art advances and adaption for unique user needs.

GENERAL DESCRIPTION: SIDAC is a one-sided model that simulates land, air and sea forces, as well as civilians and paramilitary. It can consider weapons or weapons systems individually and the modularity of its design allows the user to aggregate up to any level he wishes, depending upon his specific requirements. Simulated time is treated on an event store basis. The model uses a mixture of deterministic and stochastic elements. Probability is used as the primary solution technique for prompt damage by means of the methodology developed by the Physical Vulnerability (PV) Division of the United States Air Force Intelligence. Delayed radiation effects are estimated by means of the methodology developed by the Weapons Systems Evaluation Group (WSEG).

INPUT: Input is required for three files designated as target, weapon and wind, respectively, as follows:

- The basic NMCSSC source of target information for damage assessment vulnerability analysis studies is the 336 character Joint Resource Assessment Data File (JAD). The JAD format is not the only format the SIDAC system will accept since the user can format his own input file. A complete description of the JAD can be found in Joint Chiefs of Staff, JCS Pub 6.

- Input into the weapons file consists of two standard type reports; strike (used to describe a weapon that has arrived and detonated or a weapon that was launched successfully) and error (used to delete the effects of a previously reported strike).

- Input into the wind file originates from the Global Weather Central (GWC), Offutt AFB, Nebraska, and consists of wind speed and direction at five different pressure surfaces.

OUTPUT:

- Hardcopy output is prepared from a SIDAC created file by use of the output features of compilers (e.g. COBOL, FORTRAN). Basic procedures are provided to help the user in translating the basic effects information into more meaningful terms.

MODEL LIMITATIONS:

- o Target base contains only static targets. Moving targets are not taken into account.
- o Targets must be assigned a VN number to calculate prompt damage.
- o Fire ignition and spread, as well as communications blackout modules, are not available.

HARDWARE:

- o Type Computer - HIS/6000
- o Operating System - GCOS
- o Minimum Storage Required - 36K words of core storage
- o Peripheral Equipment - Card reader, printer, magnetic tape handler 9 channels (optional) and at least one disc storage unit

SOFTWARE:

- o Programming Language - FORTRAN
- o Documentation: Available from the Defense Documentation Center using the AD numbers listed with each title.
  Functional Description (UNCLASSIFIED), SPM FD 7-73, (AD 910 614L).
  Test and Implementation Plan (UNCLASSIFIED), SPM PT 7-73, (AD 912 420)
  Users Manual (UNCLASSIFIED), CSM UM 67-74, (AD 922 212L)
  Description of Mathematics for the Single Integrated Damage Analysis Capability (SIDAC) (UNCLASSIFIED), TM 15-73, (AD 913 164L)
  Advanced Single Integrated Damage Analysis Capability (SIDAC) Concepts, (UNCLASSIFIED), TM 91-74, (AD 921 242)

TIME REQUIREMENTS:

- o Prepare Data Base - variable
- o CPU Time per Cycle - variable
- o Data Output Analysis - variable

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Over 600 times per year

USERS: Studies, Analysis and Gaming Agency, Survivability Office of the Defense Communications Agency, Deputy Director for Strategic Programs, Defense Intelligence Agency, Defense Program Analysis and Evaluation, USREDCOM, CINCLANT, CINCPAC and US ARMY

POINT OF CONTACT: Defense Communications Agency
National Military Command System Support Center (B205)
The Pentagon, Washington, D.C. 20301
Telephone: OX 52277

MISCELLANEOUS: Use as the nuclear damage analysis portion of the GENERAL WAR SYSTEM

KEYWORD LISTING: Nuclear, fallout, radiation, assessment, fatalities, casualties, weapon effects, prompt effects, residual effects, mathematical model, computer simulation

TITLE: SIGMALOG I - Simulation and Gaming Methods for Analysis of Logistics, Part I: Requirements Analysis System

PROPONENT: U.S. Army Deputy Chief of Staff for Logistics (DCSLOG)

DEVELOPER: General Research Corporation

PURPOSE: SIGMALOG I is a set of computer-assisted, analytical logistics models used to test the logistic feasibility of contingency plans, including the adequacy of stock levels specified, transportation capacities and capabilities, maintenance capabilities, and construction of facilities. The primary focus of concern is on time-phased logistic requirements to support the forces involved in an operation/contingency plan or study, including combat service support units, materiel, maintenance, transportation, and construction. In addition, the model may be used to determine time-phasing and adequacy of combat service support units on a troop list, hospital bed requirements, and personnel replacements.

GENERAL DESCRIPTION: SIGMALOG I models are deterministic. The types of forces involved may be land, air, paramilitary, and/or civilian. It is capable of considering one US Army platoon or team or equivalent USMC/USAF units, if desired, and of aggregating up to the level of theater level or worldwide forces. Simulated time is treated on a time step basis.

INPUT: Time-phased force deployment list data, Allied Forces data, local labor data, scenario, tactical matrix, PW policy, hospital policy, evacuation policy, supply stockage policy, supply network, maintenance policy, transportation policy, transportation network, construction policy, refugee policy, personnel replacements policy.

OUTPUT: Computer printouts reduced to summary format, e.g., tables, matrices, and two-dimensional graphic displays, or variations as desired such as detailed reports or selective retrievals.

MODEL LIMITATIONS: 30 groupings of personnel, 30 categories of personnel using materiel or requiring support, 20 categories of materiel, 20 time periods, 20 regions, 5 modes of transportation.

HARDWARE:

- Computer: CDC 6400/IBM 7094/UNIVAC 1108
- Minimum Storage Required: 32,000 words
- Peripheral Equipment: Printer, 12 tape drives, and disk storage

SOFTWARE:

- Programming languages: FORTRAN, COBOL
- Documentation: Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- Presimulation Phase - 2 months
- Simulation Phase - 1 month
- 13 hours CPU time per cycle
- Post Simulation Phase - 2 months

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 4 times per year

USERS: US Army Logistics Evaluation Agency

POINT OF CONTACT: US Army Logistics Evaluation Agency
Planning and Operations Research Division
New Cumberland Army Depot
New Cumberland, PA 17070
Telephone: AUTOVON 977-6742

MISCELLANEOUS:

- SIGMALOG I can be linked by automated interface to US Army Engineer Study Group Model Computer-Assisted System for Theater-Level Engineering (CASTLE) and the US Army Concept Analysis Agency theater round out model FASTALS.

- Improvements and modifications are made as requirements dictate.

KEYWORD LISTING: Logistics; Deterministic; Time Step; Computer-Assisted

TITLE: SIGMALOG II - Simulation and Gaming Methods for Analysis of Logistics, Part II: Capability Analysis System

PROPONENT: U.S. Army Deputy Chief of Staff for Logistics (DCSLOG)

DEVELOPER: General Research Corporation

PURPOSE: SIGMALOG II is a computer-assisted, logistics capabilities analysis system that compares time-phased Army logistic resources with time-phased deployment and resupply requirements determined by SIGMALOG I for combat service support units, major end items, intertheater transportation, and ammunition for the support of one to three contingency plans.

GENERAL DESCRIPTION: SIGMALOG II accepts logistic requirements for up to three theaters, and together with analyst inputs, compares these with the logistic resources recorded in Army data files in order to identify the Army's logistic capability in the four resource areas listed above. The term "time-phased" refers to the requirements in each of the (up to 20) distinct time periods into which a contingency plan is divided in SIGMALOG I. Since SIGMALOG II can accommodate up to three theaters, time periods overlap and a maximum of 36 time periods may be used.

INPUT: Time-phasing requirements of the three theaters, current assets, and future availability of assets. All major inputs are tape files produced by SIGMALOG I and drawn from Army resource files.

OUTPUT: Computer printouts stating by combat service support unit (standard requirements code), major end item (line item number), ammunition by round (DOD ammunition code), and transportation carrier, the number required, available, and the differences by time period.

MODEL LIMITATIONS:

- 12 commodities
- 12 carriers
- 36 time periods
- 3 theaters
- There are no restrictions on the number of CSS units, major end items, or types of ammunition rounds.

HARDWARE:

- Computer: CDC 6400, three modules on IBM 7094, UNIVAC 1108
- Minimum Storage Required: Three modules - 32,000 words<br>One module - 65,000 words
- Peripheral Equipment: Printer and four tape drives

SOFTWARE:

- Programming Language(s): FORTRAN and COBOL
- Documentation: CDC related manuals--The paper, "Simulation and Gaming Methods for Analysis of Logistics, Part II (SIGMALOG II): Capability Analysis System," RAC-TP-432, dated August 1971, (AD 888044L), by Richard C. Robinson et al, is the complete documentation.
- The above represents both complete user's documentation and complete technical documentation.

TIME REQUIREMENTS:

- Provided that SIGMALOG I generated requirements are available, one month to analyze and evaluate results.
- 5 hour CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Once per year

USERS: U.S. Army Logistics Evaluation Agency

POINT OF CONTACT: U.S. Army Logistics Evaluation Agency
Planning and Operations Research Division
New Cumberland Army Depot
New Cumberland, PA 17070
Telephone: AUTOVON 977-6742

MISCELLANEOUS:

- SIGMALOG II uses the following four SIGMALOG I models: Force Employment, Major Item Resupply, Ammunition Resupply, and Transportation. Data is transmitted via magnetic tape.

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Computer Assisted; Deterministic; Time Step; Linear Programming

TITLE: SIMCE - Simulation-Communications-Electronics

PROPONENT: USA Signal School, Fort Gordon, Georgia 30905

DEVELOPER: Booz Allen Applied Research, Inc.

PURPOSE: SIMCE is a computerized, analytical model designed to size and analyze a multichannel communications system, given a statement of user requirements (telephone and teletype), in the field or theater army systems. The model is used to size army communication as to unrouted and routed requirements for each mode (telephone or teletype). In addition, it is also concerned with communications requirements as a function of user location and user density.

GENERAL DESCRIPTION: SIMCE is a one-sided model having both deterministic and stochastic elements. Only land forces are involved. It is designed to consider groupings ranging in size from an army to a theater. Linear equations are the primary solution techniques used.

INPUT:

- o User communications requirements
- o Unit locations
- o Node locations
- o Node-to-node connectivity
- o Busy hour to busy 8-hour ratio
- o Holding time (each mode of communication for a maximum of eight modes)
- o Network routing

OUTPUT:

- o Unrouted and routed communications requirements for each mode
- o Local and long distance distribution
- o Security requirements
- o Regression curves for traffic volume as function of number of units at a node
- o Output can be selective retrievals at each stage of processing, such as unrouted, routed communication requirements
- o Communication requirements as a function of user location of user density

MODEL LIMITATIONS: User communications requirements are needed for each force model in use; this can lead to much data-gathering.

HARDWARE:

- o Computer: IBM 360/65 or CDC 3300
- o Operating System: OS/MVT (IBM); MASTER (CDC)
- o Minimum Storage Required: 200K bytes
- o Peripheral Equipment: Printer, tape drive, disk, card reader, plotter

SOFTWARE:

- Programming Language: FORTRAN IV/USA FORTRAN
- Documentation: SIMCE User's Manual, Volumes I (AD 880-335), II (AD 880-336), III (AD 880-421), and IV (AD 880-422)
- Both user's documentation and technical documentation are complete. Technical documentation is part of the user's manual.

TIME REQUIREMENTS:

- 6 months to acquire base data
- 2 man-months to structure data in model input format
- 212 minutes CPU time per model cycle
- 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS: Concepts & Studies Division, CTD, USASIGS, Ft Gordon, Georgia

POINT OF CONTACT: LT R.R. Sedlacek
Concepts & Studies Division (ATSN-CTD-CS-S)
CTD/USASIGS
Fort Gordon, Georgia
(Autovon 780-6643)

MISCELLANEOUS:

- The model is being rewritten to accept the COMSR data base (USASIGS) as a base input. This will lead to more efficient data gathering as well as more accurate results.
- Current plans call for the model to be available for use on the CDC 6500 computer by 1 July 1975.

KEYWORD LISTING: Analytical Model; General War; Land Forces; Computerized; One-Sided; Mixed Deterministic/Stochastic

TITLE: SIMETTE - Simulation Exchange Model

PROPONENT: Weapons Systems Evaluation Group

DEVELOPER: Weapons Systems Evaluation Group (WESG) and Planning Research Corporation (PRC)

PURPOSE: SIMETTE is a computerized, analytical general war model designed to study in detail the interactions between various strategic components in a nuclear exchange by modeling in detail the movement of individual entities (Missiles, aircraft, command-and-control sites, etc.) through a nuclear environment.

GENERAL DESCRIPTION: The SIMETTE model is a deterministic, event-stepped simulation of a two-sided nuclear exchange. N-country participation can also be played. The model involves land, air, and submarine forces. Forces are not aggregated; the model is designed specifically to consider only individual missiles, aircraft, and command sites.

INPUT:

- Deployment and inventory of offensive and defensive forces
- Weapon system performance characteristics and nuclear vulnerabilities
- Attack scenario, to include target assignment and launch schedule for offensive missiles, and detailed bomber flight path and target assignments
- Defensive doctrine

OUTPUT: Output is a history tape of all game events and a printed trace report containing the details of any selected game interactions. The user has the option of selecting the interactions to be reported by the trace routine and of specifying the periods of game time at which such reports will be made. Using the history tape, the postprocessor produces summary reports of the offensive forces for each side, including aborts, fratricides, detonations, etc.

MODEL LIMITATIONS: The only limitation on the number of objects and sites in the game is the memory size of the computer.

HARDWARE:

- Computer: IBM 360/65
- Operating System: 365/60J
- Minimum Storage Required: 240K for program, 500K minimum for average game
- Peripheral Equipment: disk pack, tape

SOFTWARE:

- Programming Language: SIMSCRIPT I.5
- Documentation: 1. WSEG Report 155; subject: SIMEX Prototype Development (U)
  2. WSEG Report 149; subject: Scope of the Multi-System Interaction Problem in Nuclear War
- The above documents constitute complete user's and technical documentation.

TIME REQUIREMENTS:

- Average of 1 month to acquire base data
- 1 man-month to structure data in model input format
- Average of 1 to 3 hours CPU time per model cycle
- 2 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: TOP SECRET

FREQUENCY OF USE: 9 times since 1969

USERS: WSEG and JSIPS

POINT OF CONTACT: Weapons Systems Evaluation Group
400 Army Navy Drive
Arlington, VA 22202

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic; Event Store

**TITLE:** SIRNEM - Strategic International Relations Nuclear Exchange Model

**PROPONENT:** United States Arms Control and Disarmament Agency

**DEVELOPER:** Academy for Interscience Methodology

**PURPOSE:** SIRNEM is a computerized, analytical model designed to study strategic force exchanges and interactives. The model simulates various missiles and bombers as well as tactical aircraft and satellites.

**GENERAL DESCRIPTION:** The model is two-sided, event store and considers land, air and sea forces. Individual weapons and targets are considered. The model's chief focus is on strategic force effectiveness against counter value and counterforce target systems. Primary solution techniques are LaGrange multipliers, probability and geographic relationships.

**INPUT:**

- Target coordinates, hardness level, value and identifier
- Weapon coordinates, number, yield, accuracy, reliability and identifier

**OUTPUT:**

- Computer printout of percent target base destroyed, weapons allocated and collateral effects

**MODEL LIMITATIONS:**

- Command and control not explicitly simulated

**HARDWARE:**

- Computer CDC 6600
- Minimum Storage Required 220K

**SOFTWARE:**

- Fortran IV
- Documentation available from USACDA

**TIME REQUIREMENTS:**

- Structure data base 2 man months
- CPU time problem dependent

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 12 times per year

USERS: USACDA, Lawrence Livermore Laboratory

**POINT OF CONTACT:** Operations Analysis Division
U.S. Arms Control & Disarmament Agency
State Department
320 21st Street NW
Washington, D.C. 20451

**MISCELLANEOUS:** A subroutine called AIRPEN to simulate manned bomber penetration and interactions with complex defensive systems is currently under development

KEYWORD LISTING: Computerized, strategic, missile, bomber, nuclear, event store

TITLE: (SITAP) Simulator for Transportation Analysis and Planning

PROPONENT: OJCS (J-4)

DEVELOPER: Computer Sciences Corporation (CSC)

PURPOSE: The SITAP is a computerized, analytical, transportation model designed to give the analyst a broad spectrum of transportation systems. A transportation system, for this purpose, is any system that can be viewed as a network through which vehicles move in order to satisfy movement demands arising at nodes in the network. The movement demands, vehicles, and defined network are controlled by the analyst. SITAP produces cargo and vehicle throughput, depot holdings, and utilization of facilities and manpower.

GENERAL DESCRIPTION: The SITAP is a deterministic model involving airlift and sealift vehicles, transportation networks, and requirements for cargo movement. Requirements may be considered individually or they may be grouped. Numerical analysis is the primary solution technique used.

INPUT: The input source is card images and/or MACE generation of events. Inputs are: (1) the network, (2) parameters, (3) vehicle characteristics and movements, (4) cargo description and quantities, and (5) facilities. Each of these areas may have as many input cards as necessary to complete the problem scenario.

OUTPUT:

- Traffic generated over each link of the network and simulated flow of cargo through the network
- Mean response times between cargo ordering and delivery
- Cargo throughput
- Vehicle throughput
- Depot holdings
- Resource, manpower, and facility utilization
- Vehicle waiting times, service times, and idle times for each vehicle type and node

MODEL LIMITATIONS Limitations are directly related to computer core size. The HIS 6080 can accept the following:

- 20 nodes
- 10 cargo types
- 20 vehicle types
- 15 resources
- 500 individual vehicles
- 1000 individual cargo movement requirements

HARDWARE REQUIREMENTS:

- Computer IBM 360/65 or HIS 6080
- Operating System OS/MVT for IBM and GCOS for HIS
- Minimum Storage Required: 350K bytes for IBM 360/65 and 110K words for HIS 6080
- Peripheral Equipment: tapes and disk

SOFTWARE:

- Programming Languages: FORTRAN IV, IBM 360/65; FORTRAN Y, HIS 6080
- Documentation: Users Manual, NMCSSC, 18 January 1971, and Technical Manuals in draft only, MNCSSC

TIME REQUIREMENTS:

- 1 to 2 weeks to acquire base data
- 1 man-week to structure data in model input format
- 10 minutes to 1 hour CPU time per model cycle
- 1 hour to 2 days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 per year

USER: OJCS (J-4)

POINT OF CONTACT: OJCS, Logistics Directorate (J-4)
Technical Adviser Office
The Pentagon, Washington, D. C. 20301
Telephone: OX 7-3686

KEYWORD LISTING: Analytical Model; Transportation; Logistics; Airlift; Sealift, Nodes; Throughput; Computerized; Deterministic

TITLE: SLATEM - Submarine Launch Assignment, Targeting, and Effectiveness Model

PROPONENT: U.S. Army Ballistic Missile Defense Program Office

DEVELOPER: Stanford Research Institute - Huntsville

PURPOSE: SLATEM is a computerized, analytical, damage assessment/weapons effectiveness model used to design and evaluate a nearly optimum attack by an SLBM force against a time-varying value structure. In the development of this program, emphasis has been given to modeling an attack against the Strategic Air Command (SAC) alert aircraft forces while defended by a BMD system. Determine for some given SLBM threat against a given SAC Aircraft Base deployment the number of alert aircraft that would escape.

GENERAL DESCRIPTION: SLATEM is a two sided, deterministic, air/sea force model that was primarily designed to simulate the attack of 1 SAC base by 1 submarine. The model may be manipulated to simulate a typical SLBM force versus any SAC aircraft deployment. The level for which the model was primarily designed is 350 launch points, 72 SAC bases, 4 types of Aircraft, 16 SLBM's per Sub, 40 Subs. Range of possible manipulation is any combination of above. Sides uses a time step in mechanizing the closed-form probabilistic equation.

INPUT: (1) Number of SAC bases, (2) Location of each base, (3) Number of each type of aircraft on alert at each base, (4) Total alert aircraft, (5) Warning time, (6) Decision and communication time, (7) Reaction time, (8) Time to safety, (9) Average time between departures, (10) Departure Lag, (11) Number of submarine on station, (12) Number of available SLBM's on each submarine, (13) The SLBM's non-reprogrammable reliability, (14) SLBM launch delay, (15) Number of launch points, (16) Location of each launch point, (17) Minimum SLBM range, (18) Maximum SLBM range, (19) SLBM Trajectory time-of-flight coefficients.

OUTPUT: For each submarine in the attacking force, the expected number as well as type of aircraft destroyed.

MODEL LIMITATIONS: In addition to the input limitations as shown above there are two additional: (1) The launch points and target lists are selected sequentially for each submarine rather than simultaneously for all submarines. The difference between sequential and simultaneous selection for the cases considered has been less than 3% of the total SAC alert force, (2) The effects of exhaustion of the defense's interceptor stockpile is not considered.

HARDWARE:

- Type of Computer - CDC 6400
- Operating System - SCOPE 3.4
- Minimum storage required - 30,000 words of core

SOFTWARE:

- Programming language: Fortran IV
- Documentation: SRI memorandum by J.O. Carroll, H.A. Lewis, and W. H. Winter, "Methodology for Evaluating SAFEGUARD SAC Defense Effectiveness" (U), SRD-EG53 (March 1971), SECRET

TIME REQUIREMENTS:

- Acquire base data - Unknown
- CPU time per model cycle - Unknown
- Analyze and evaluate results - Unknown

SECURITY CLASSIFICATION: Unclassified

USERS: Principal BMDSCOM and SRI

POINT OF CONTACT: J. O. Carroll (principal contact), W. H. Winter, H. A. Lewis, W. J. Meaal, Stanford Research Institute - Huntsville, Ala.
Tel: 205-837-3050

MISCELLANEOUS: Model(s) to which linked - Analysis of SAFEGUARD Repertoire (ANSR). ANSR is capable of generating a list of SAC bases that can be attacked by avoiding the defense from each SLBM launch point; this list is then input into SLATEM as possible launch points for use against SAC. SLATEM is not a replacement for an existing model. The following modifications are planned for SLATEM: (1) Mix aircraft types on a runway, (2) Mix threat elements, and (3) Add a more efficient means of handling bases which have dual runways.

KEYWORD LISTING: Analytic Model; Damage Assessment/Weapons Effectiveness; Computerized; Two-sided; Deterministic; Time Step.

TITLE: SMOBSMOD - Strategic Mobility Simulation Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: OSD/USAF; USA STAG; USA CAA

PURPOSE: SMOBSMOD is a computerized, analytical, logistics model designed to serve as a strategic mobility (inter-theater) movement capability estimator. The model is primarily concerned with determining the routing and vehicle utilization (any number of vehicle types) that can close a unit most quickly into an overseas theater. In addition, the model is also concerned with node throughput capacities. A pre-processor is provided which can be used to generate movement requirements for resupply and theater supply buildup, and to integrate these into the movement requirements deck at appropriate dates. The impact of attrition of ships and of aircraft due to enemy action is also examined.

GENERAL DESCRIPTION: SMOBSMOD is a one-sided, stochastic model involving air and sea forces. Tonnages and manpower strengths may be aggregated to any level the user desires, from single units to hundreds of units. The model is designed to consider from one to ten simultaneous multiple-theater networks. Simulated time is treated on an event store basis. Simulation-type algorithms are the primary solution technique used.

INPUT:

- Number, type and description of aircraft and ships
- Tonnages, troop strengths, and location of units to be moved
- Distance tables
- Theater supply consumption factors and stockage objectives

OUTPUT:

- Closure profiles, by unit, by theater, and by percentage of total requirements
- Vehicle and node utilization
- Detailed output of the processing of each unit movement
- Vehicle status reports

MODEL LIMITATIONS: Convoying cannot be played discretely.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 45K words

SOFTWARE:

- Programming Language; SIMSCRIPT I.5
- Documentation: "Strategic Mobility Simulation Model (SMOBSMOD) - Users Manual." US Army Concepts Analysis Agency, Bethesda, Maryland (June 1974)
- Both user's documentation and technical documentation are complete, except for attrition algorithm. Documentation was prepared for use with the UNIVAC 1108, as of February 1972, and is available only at USA STAG. A SIMSCRIPT I.5 compiler is required.

TIME REQUIREMENTS:

- 1 month to acquire base data
- 5 man-months to structure data in model input format
- Approximately 2 minutes CPU time per 10-unit movement requirements
- 1 month learning time for users
- 1 day to several weeks to analyze and evaluate results, depending on the size of the problem

SECURITY CLASSIFICATION: Input-dependent

FREQUENCY OF USE: 10 times per year

USERS: USA CAA

POINT OF CONTACT: US Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1683

MISCELLANEOUS: It is currently planned to add the capability of convoy play to the model. This is currently being refined and converted to the SIMSCRIPT II-5 language.

KEYWORD LISTING: Analytical Model, Logistics; Air Forces; Sea Forces; Computerized; One-Sided; Stochastic; Event Store

TITLE: SNAP - Strategic Nuclear Attack Planning System (SNAP)

PROPONENT: National Military Command System Support Center

DEVELOPER: NMCSSC

PURPOSE: SNAP is a computerized analytical system designed for use in nuclear weapons allocation, nuclear forces requirement studies and blast damage assessment. The chief focus of concern is the achievement of a nuclear stockpile allocation minimizing overkill, maximizing the number of targets killed while minimizing weapon expenditures. This allocation is achievable with or without restraints; using or not using launch areas for weapon systems; and obeying or ignoring restraints/optional with-holds.

GENERAL DESCRIPTION: SNAP is a one-sided deterministic system comprised of five programs, one of which is the allocator, and is designed to consider a wide variety of nuclear weapon arsenals in allocations resulting from the exercising of the more than twenty operational variables available for user control. Depending on the usage, one allocation run or a number of them may be required to achieve a solution acceptable to the user. If more than one is required, the printed output from a given run will permit an improvement of the achieved solution in the next run. The number of runs required will depend on the nature of the request and the familiarity of the user with SNAPS. The SNAP system will allocate up to thirty weapon systems from up to forty launch areas to JAD type target data bases. The target data bases can be coded or uncoded (minor changes would be required on up to two of the auxiliary preprocessing programs of the system to adapt to any properly prepared target data base). An uncoded data base permits the user to generate attack instructions on the targets in the data base according to their category or subcategory. A coded data base permits the generation of attack instructions according to the resulting pseudo-categories and/or tide codes. The primary solution technique used for the determination of the DGZ is a complex multivariable dependent process exercised on a geometric plane resulting from a transformation from a probabilistic one.

INPUT:

- Target base with the information requirements depending upon the task at hand. Minimum requirements per target are: Latitude, Longitude, Radius, VNTK, Point Value, and or Capacity. For P-95's the capacity is required.
- Weapon system inventory with the information requirements depending upon task at hand. Minimum information per weapon system: Number available, CE, Yield, Height of Burst and Probability of Arrival.

OUTPUT:

- Computer printouts giving a statistical synthesis of the results of the laydown with highly detailed information for further analytical studies of various options.

- Magnetic tape file containing DGZ listing with pertinent information per DGZ. This tape can be used to generate input for SIDAC, DASH, DARCOL, FOZ or others as needed. This listing is also part of the printed output.

MODEL LIMITATIONS:

- Targets - Only point targets and circular area targets, the latter can be uniform or normally distributed.
- Weapon Systems - 30
- Launch Areas - 40
- Systems within each launch area - 10

HARDWARE:

- Computer HIS 6080
- GCOS
- Storage Required 71K
- Peripheral Equipment - Card Reader, Disk Drives, Printer, Tape Drives

SOFTWARE:

- Programming Language: FORTRAN
- Documentation (Due March 1975) - Strategic Nuclear Attack Planning System (SNAP) - Users Manual NMCSSC - 1975
- This document encompasses the system capabilities up to time of print.

TIME REQUIREMENTS:

- Given a data base in JAD format the time from receipt to conversion to SNAP would be less than 3 days. From this converted base any subset will be generated as part of the run to be made by the allocator preprocessor.
- For first run input time can vary from 20 minutes to 2 days depending on task at hand.
- Run time range is from 5 minutes to 50 minutes.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 200 times per year

USERS:

- Principal: SAGA
- Other: None

POINT OF CONTACT: NMCSSC/B205
Pentagon, Washington, D.C. 20301
Telephone: OX 5-2277

KEYWORD LISTING: Analytical Model; General War, Damage Assessment, System-Launch Areas Allocator, Deterministic, Acceptable Solution, Minimal Weapon Expenditure, Minimal Target Overkill, Maximum Target Destruction per DGZ

TITLE: SOURCE - Simulation of Utilization, Resources, Cost and Efficiency

PROPONENT: USAF (AF/SA)

DEVELOPER: Northrop Corporation, Aircraft Division

PURPOSE: SOURCE is a computerized, analytical logistics model designed to assist in the evaluation of the impact of maintenance upon sortie rate capabilities of tactical aircraft in various operational environments.

GENERAL DESCRIPTION: SOURCE is a one-sided, stochastic model involving air forces only. It can consider only one aircraft type at a time. The time period of consideration can be varied from one to thirty-six months. A given aircraft can be evaluated under varying operational conditions and maintenance conditions. Simulated time is treated on a time step basis. The Monte Carlo approach is used to simulate those activities and determinations which occur as random in an actual operation.

INPUT:

- Aircraft characteristics: probability of ground abort, probability of air abort, probability that post-flight maintenance will be required, maintenance regeneration times by aircraft system, frequency of major scheduled inspections, elapsed time required for scheduled inspections, field maintenance, probability that a functional check flight will be required and pre-mission, post-mission and turnaround time.

- Operational conditions: number of flying days per month, operational hours per day, sortie cycles per day, commitment per sortie cycle, available maintenance time between sorties, mission duration, number of flight hours required for a functional check flight and probability of bad-weather day.

- Maintenance conditions: elapsed hours for a "not operationally ready supply" (NORS) condition, probability of a NORS condition, number of maintenance crews available for each aircraft system, number of productive maintenance manhours available for each aircraft system, number of productive maintenance manhours available per crew per day, and length of the maintenance day.

OUTPUT:

- Detailed description of the sortie rate capability achieved by the aircraft considered under the given conditions, specifically:

  - Operational Daily Display, presenting the number of sorties scheduled and the number flown for each day of the month.

  - Daily Sorties and Utilization, presenting for each day total sorties scheduled and flown, sorties per aircraft, cumulative sorties, flight hours scheduled and flown, and flight hours per aircraft.

  - Operational Effectiveness Display, presenting by day the percentage of assigned aircraft in each of the following five classes of aircraft operational statues: operationally ready, unscheduled maintenance, scheduled maintenance, NORS, and functional check flight.

- Monthly Output of percentage of scheduled sorties completed, sorties per aircraft per day (monthly average), flight hours per aircraft per day (monthly average), utilization-flight hours per aircraft per month.

MODEL LIMITATIONS:

- Only one aircraft type can be considered at a time.
- The need to input aircraft characteristics data necessitates an in-depth analysis of maintenance requirements of each aircraft type and the availability of existing operational and maintenance data on those aircraft which are operational.

HARDWARE:

- Computer: GE 635
- Operating System: GECOS
- Minimum Storage Required: 24K words
- Peripheral Equipment: Tape Drive

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Volume I -SOURCE Program User's Manual, Northrop Corporation, (September 1969; AD 869468).
  Volume II -Programmers Manual (SOURCE), Northrop Corporation (September 1969; AD 869469)
  Volume III -Operator's Manual (SOURCE), Northrop Corporation, (September 1969; AD 869470).
- Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- 3 days to 5 months to acquire base data, depending on size of problem and data availability.
- Average of 6 man-days to structure data in model input format.
- 5 minutes CPU time per model cycle.
- 3 days to one month to analyze and evaluate results, depending on size of problem.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 times per year

USERS: HQ USAF AF/SA

POINT OF CONTACT: HQ USAF
Assistant Chief of Staff, Studies and Analysis
AF/SAA
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8036

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; computerized; One-Sided; Stochastic; Time Step.

TITLE: SPSM - Supply Point Simulation Model

PROPONENT: U.S. Army Logistics Center

DEVELOPER: Research Analysis Corporation

PURPOSE: SPSM is a computerized, analytical logistics model designed to simulate the supply transactions of a supply point (i.e., any organization that receives demands, places orders for supplies, and receives shipments) operating in accordance with prescribed supply policies, and to report the resulting supply performance, workloads, and costs. The primary problem addressed is that of performing comparative analyses of alternative supply policies applied at a single point and of determining their relative merits.

GENERAL DESCRIPTION: The model involves land, air and sea forces. It is primarily designed to consider groups of division size, but may be manipulated to consider groups ranging from company to theater size. The ratio of game time to real time is seconds to years. Simulated time is treated on an event store basis. The model uses stochastic discrete event simulation as its primary solution technique.

INPUT:

- Supply policy parameters.
- Demand forecasting parameters.
- Item characteristics and probability distributions for number of demands, quantity demanded, and resupply delay time.

OUTPUT:

- Detailed input report.
- Reports of summary performance, workloads and costs for each item and the aggregated items.
- An Output Postprocessor is available to produce histograms, time series and graphs.

MODEL LIMITATIONS:

- Limited to the analysis of the effects of supply policies at a single point.

HARDWARE REQUIREMENTS:

- Computer: CDC 6500 and IBM 7094.
- Operating System: SCOPE 3.4 on CDC 6500<br>IBSYS on IBM 7094.
- Minimum Storage Required: 17K Decimal words on CDC 6500<br>32K on the IBM 7094.
- Peripheral Equipment: One external file.

SOFTWARE:

- Programming Language(s): FORTRAN
- Documentation: H.A. Markham et al, "Supply Point Simulation Model," RAC-TP-437, November 1971 (not yet distributed so no AD number has been assigned).
- The above document represents both complete user's documentation and technical documentation.

TIME REQUIREMENTS:

- 0-3 months to acquire base data.
- 0-1 man-months to structure data in model input format. (An Automated Input Data System is available to screen and structure input data).
- Some seconds of CPU time per model cycle.
- 1-3 weeks to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS:

Principal: U.S. Army Logistics Center

POINT OF CONTACT: U.S. Army Logistics Center
Operations Analysis Directorate
Fort Lee, Virginia 23801
Telephone: AUTOVON 687-1117

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; Stochastic; Event Store.

TITLE: STAB II - Anti-Air Warfare Battle Model

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Development Center

PURPOSE: STAB II is a computerized, analytical general war model used to analyze the effectiveness of airborne weapon systems, including the aircraft, weapons control system, and weapons, against one or many airborne targets attacking ships or a task force. The primary focus of concern is the combat effectiveness of the system in fleet air defense environments. In addition, the model may be used to study the effects of command and control systems functions, ECM, aircraft performance, maintainability and reliability, threat variations, and reaction time on fleet air defense.

GENERAL DESCRIPTION: STAB II is a two-sided model having both deterministic and stochastic elements. It is capable of considering one interceptor or one target, if desired, and of aggregating up to the level of 10 groups of 6 resolvable targets per group or 10 groups of 64 unresolvable targets per group. Simulated time is treated on an event store basis. The Game Time: Real Time ratio is variable, dependent upon the number of interceptors and targets being considered. Probability is the primary solution technique used.

INPUT:

- Threat description
- Aircraft performance: acceleration, fuel usage, etc.
- Weapon system performance
- Command and control logic.

OUTPUT:

- Computer printout stating times of initiation and completion of combat and interceptors against targets and the expected number of kills achieved.

MODEL LIMITATIONS:

- Two types of target groups, two types of interceptors.
- 10 target groups: 6 resolvable targets per group and/or 64 unresolvable targets per group.
- 30 interceptors (Combat Air Patrol plus deck-launched interceptors).

HARDWARE:

- Computer: CDC 6600.
- Minimum Storage Required: 40,000.
- Peripheral Equipment: Mass storage (disk).

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: FORTRAN extended reference manual.

TIME REQUIREMENTS:

- 0.5 months to prepare input.
- 5 minutes CPU time average per game.
- Less than one day to evaluate results of one game; varies with number of parametric variations in total evaluation of systems.

SECURITY CLASSIFICATION: Unclassified.

FREQUENCY OF USE: 25 times per year.

USERS:

- Principal: NAVAIR (AIR-503), CNO (OP-96)
- Other: OSD, Systems Analysis; NADC is support of other projects.

POINT OF CONTACT: Systems Analysis and Engineering Department
Naval Air Development Center
Warminster, Pennsylvania 18974
Telephone: AUTOVON 441-2595

MISCELLANEOUS: STAB II can be linked with the Weapon System Engagement (WSE) model where an analog simulation determines launch opportunities versus a threat and the Launch Acceptability Region (LAR) provides missile launch zones against selected targets. This data is punched on cards for input into STAB II.

KEYWORD LISTING: Analytical Model, Computerized, Two-sided, General War, Aircraft, Deterministic.

TITLE: Static Sector Analysis Model

PROPONENT: Office of the Assistant Secretary of Defense
Program Analysis & Evaluation (PA&E)

DEVELOPER: Office of the Assistant Secretary of Defense
Program Analysis & Evaluation (PA&E)

PURPOSE: This is a computer assisted model for calculating force requirements directly by comparing measures of the combat effectiveness of opposing forces at various points in time after mobilization. The model does not consider movement of units within a theater or FEBA movement, and therefore, it is classified as static, although it does consider the buildup of forces in theater with time.

GENERAL DESCRIPTION: The combat effectiveness of defending forces is calculated for each sector and for the theater reserve. Effectiveness is expressed in terms of Weighted Unit Value (WUV), which is the total worth of all effective weapons in a force; however, any set of force effectiveness indicators could be used. The total WUV of the attacker is determined and an attack axis(es) selected. The amount of defender WUV deployed in sectors off the main attack is determined, and enough attacker WUV is allocated opposite those sectors to fix the defending force in place. That is, the attacker allocates enough force in those sectors to keep the defender from exceeding the stalemate force ratio. This ratio can be varied. The remaining attacker WUV is then assumed to be applied on the main attack sectors and compared with the defender's WUV in those sectors plus in his entire reserve. If the defender does not have enoughWUV to keep the attacker from exceeding the stalemate force ratio, a requirement is generated. If the defender has too much WUV, an excess is calculated. The WUV output is translated into a more convenient measure, such as the equivalent WUV in armor divisions (ADEs), to make comparisons easier. This process is repeated at each point in time after M-Day for which results are dhsired, updating the force deployments to reflect the availability of any additional units in the theater of operations. This model has been used by OASD(PA&E) to estimate US force requirements for Europe and Northeast Asia.

INPUT:

- A battlefield description which includes FEBA location, sector subdivisions within the theater, initial deployment of friendly forces to sectors and theater reserve, and identification of likely attack sectors for enemy forces;
- A set of combat value scores describing the relative contribution of each unit to overall force effectiveness;
- A time-phased deployment/availability schedule for friendly and enemy forces; and
- A value for the maximum attacker/defender effectiveness ratio that still allows the defender to hold the attacker on a defensive line (called "stalemate force ratio").

OUTPUT: The output measure of the model is the incremental amount of force effectiveness (+ or -) that a defender would require to stalemate an attacker at a given point in time. Force effectiveness is usually measured in terms of armor division equivalents (ADEs), which is the combat effectiveness score for a standard US armor division.

MODEL LIMITATIONS:

- o Geography is not explicitly considered.
- o Considers only ground forces.
- o Does not consider logistics or combat attrition.
- o Is limited to static comparisons.

HARDWARE:

- o Computer: IBM 360/50, IBM 360/65, CDC 6400, GE 635, UNIVAC 1108/1110, Honeywell 6000, IBM 370.
- o Operating System: OS Release 20 (IBM); SCOPE (CDC).
- o Minimum Storage Required: 100K bytes.
- o Peripheral Equipment: Standard scratch disk plus permanent disk for war file.

SOFTWARE:

- o Programming Languages: FORTRAN IV.
- o Documentation is available.

TIME REQUIREMENTS:

- o 1 day to acquire and structure base data in model input format.
- o 10-30 seconds CPU time per model.
- o 1 hour or less to analyze and evaluate results.

SECURITY CLASSIFICATION: The model is UNCLASSIFIED.
Data is up to TOP SECRET.

FREQUENCY OF USE: Several times per year.

USER: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Europe Division
The Pentagon
Washington, D. C. 20301
Telephone: OX 5-4347

KEYWORD LISTING: Analytical Model; Conventional War; Land Forces; Computerized; Two-Sided; Deterministic.

TITLE: STEAM - Search Tactic Effectiveness Analysis Model

PROPONENT: Office of Naval Research (Code 462)

DEVELOPER: Systems Sciences Company, Planning Research Corporation (PRC)

PURPOSE: STEAM is a computerized, analytical, general war model that provides a means for assessing effectiveness of ASW search around datum. ASW force may consist of multiple platforms/sensors. It is primarily concerned with assessing the effectiveness of search and regain contact tactics in an ASW operation such that more effective tactics can be derived. In addition, it may be used to provide a tracking aid for the development of ASW tactics.

GENERAL DESCRIPTION: STEAM is a two sided model having both deterministic and stochastic elements, involving only sea forces. The fields of considerations may vary from an individual acoustic sensor (i.e., surface ship sonar or sonobuoy) to the current maximum of 25 individual ships/sonobuoys. Simulated time is treated on a time-step basis. The Game Time: Real Time ratio is 100:1. The primary solution techniques used are those of probability and game theory.

INPUT:

- Acoustic sensor performance values.
- Proposed destroyer tracks/sonobuoy, sonar placement.
- Probability curves describing submarine speed, direction, and time.

OUTPUT:

- Cumulative probability of detecting submarine as a function of time.

MODEL LIMITATIONS:

- User definite range to describe sensor performance.
- Submarine probable locations do not diffuse as a function of distance to ASW force.

HARDWARE:

- Computer: Digital
- Minimum storage required: 20K

SOFTWARE:

- Programming Language: FORTRAN II
- Documentation: PRC Report R-1377, July 1970, Confidential
- Documentation is complete

TIME REQUIREMENTS:

- 0.1 man-month to prepare input
- 1-15 minutes run time
- 0.1 man-month to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified.

FREQUENCY OF USE: Annually

POINT OF CONTACT: Roy Newton
c/o PRC Systems Sciences Company
COMDESDEVGRU
Newport, RI 02840

MISCELLANEOUS:

- Planned improvements to STEAM will remove the limitations mentioned above.

KEYWORD LISTING: Analytical, Computerized, Two-sided, General War, Anti-Submarine, Time-step, Naval

TITLE: STRATEGEM - Strategic Relative Advantage Model

PROPONENT: HQ SAC (XPS)

DEVELOPER: XPSF, HQ, SAC

PURPOSE: STRATEGEM is a computerized, analytical model that determines the relative position of advantage after each of a possible series of limited nuclear exchanges. The model provides an analytical tool for investigating the implications of a less-than-all-out nuclear exchange. The relative strategic position of both sides after each limited exchange and the remaining options for a subsequent exchange are assessed.

GENERAL DESCRIPTION: STRATEGEM is a two-sided, deterministic model involving land, air and sea forces. It is capable of considering an individual weapon against an individual target, if desired, and can aggregate both weapons and targets up to any level the user wishes. Expected values are the primary solution technique used.

INPUT:

- o Fixed inputs: weapon yield, CEP, height of burst, target vulnerability, type of overpressure and adjustment factor for each target category and the minimum and maximum vulnerability (VNs) bounds for applications of each weapon type.
- o Scenario inputs: option to change yields, CEPs, and mini/max weapon VNs in fixed inputs, weapon system reliabilities and penetration rates, the number of targets per DGZ category, number of weapons by type, number of weapon carriers (limited to four bomber types, 12 land-launched missile types, and 4 sea-launched missile types), and the maximum number of weapons each target may receive.
- o Exchange inputs: identification of the side attacking and type of attack (suppression or objective), minimum acceptable damage expectancy for initial weapon consideration, minimum acceptable compounding DE for more than one weapon per targer, maximum DE (i.e., upper bound cut-off for weapon allocation), determination of weapon allocation and target types (i.e., percent of weapons and percent of targets), target eligibility (i.e., a numerical value assigned each targer category to predetermine the type of weapon: bomber, ICBM, or SLBM, which is to be used in the initial attack), target value, (i.e., subjective order in which targets are to be attacked), and attack timing sequence which may be bypassed, but could be used for sensitivity study on bomber regeneration after an attack.

OUTPUT: The output of numerical results, tabulated for each exchange, includes a current inventory or weapons and targets showing those remaining, used and destroyed. A final summary provides an inventory of weapon types remaining after each exchange and at the end of all exchanges.

MODEL LIMITATIONS:
- o Targets currently handled as point targets.
- o Maximum of 14 bomber weapon types.
- o Maximum of 16 missile types (ICBMs: 12 for Blue, 12 for Red.
  SLBMs: 4 for Blue, 4 for Red.)
- o Range is not simulated.
- o FOOTPRINT is not simulated.
- o No geographical constraints are simulated.

HARDWARE:

- Computer: IBM 360-85
- Operating System: 360 OS
- Minimum Storage Required: 28,600 words.

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation consists of a brief description of subroutines and their purpose. User's documentation is complete, in the form of a computer printout listing. Technical documentation is not complete.

TIME REQUIREMENTS:

- 1/3 month to acquire base data.
- 3 man-days to structure data in model input format.
- 1 minute CPU time per model cycle.
- 2 days to 2 weeks learning time for users.
- A few hours to analyze and evaluate results.

SECURITY CLASSIFICATION: FOR OFFICIAL USE ONLY

FREQUENCY OF USE: 50 times per year

USER: XPSF,SAC HQ

POINT OF CONTACT: HQ Strategic Air Command
Directorate, Future Force Structure Studies and Evaluation (XPS)
Offutt Air Force Base, Nebraska 68113
Telephone: Autovon 271-4316

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic.

TITLE: STRAT SCALES - Strategic Cyclic Analysis and Evaluation System

PROPONENT: HQ SAC (XPS)

DEVELOPER: XPSF, HQ, SAC

PURPOSE: STRAT SCALES is a computerized, analytical model designed to simulate the conduct of strategic force exchanges against urban/industrial and/or military targets. The model serves as a tool in the analysis of the numbers and types of weapons required and the expected damage from an urban/industrial or counter force attack. In addition, it assesses ICBM survivability.

GENERAL DESCRIPTION: STRAT SCALES is a one-sided, deterministic model involving land, air and sea forces. It is capable of considering an individual weapon against an individual target, and can aggregate both weapons and targets up to any level the user desires. Probability is the primary solution technique used.

INPUT:

- The amount of input preparation involved varies according to the number of cases and the number of years the user wishes to examine in one computer run.

- Part I inputs: weapon name, yield, CEP, number of weapons by type for the alert and non-alert force, number of weapons by type to be subtracted from the alert and/or non-alert force for other purposes, weapon system reliabilities, system survivability and penetration probabilities.

- Part II inputs: number of urban/industrial centers eligible for attack and percent user wishes to attack, option to achieve a specified percent of damage to data base by bombers and missiles, option to select rank or non-rank order of attack, and the option to use alert force only or total force.

- Part III inputs: minimum DE (i.e., initial acceptable damage expectancy prior to weapon allocation; also permits target damage level the user may wish to obtain on a category before continuing to a new category), minimum acceptable compounding DE for more than one weapon per target, maximum DE (i.e. upper bound cut-off for weapon allocation), option to use alert force only or total force, capability to present a target category's previous DE due to a prior attack such as a suppression attack, and number of targets in each category, target value and vulnerability numbers (VNTK).

OUTPUT:

- Part I output: numerical table of weapons, yields, CEPs, available weapons (alert and non-alert), withheld weapons, and associated characteristics.
- Part II output: initial weapon array with characteristics; urban/industrial allocation array; summary of weapons available, used and remaining; summary of attack results; and description of urban/industrial data base.

- Part III output: probability of damage tabulated for each weapon versus each target, damage expectancy table for weapon versus target, initial weapon array with characteristics; military target allocation array, summary of target categories attacked with damage expectancy, and summary of weapons remaining.

MODEL LIMITATIONS:

- 50 weapon types (25 bomber and 25 missile).
- No FOOTPRINT constraints.
- No geographical constraints.
- No range constraints in military attack.

HARDWARE:

- Computer: IBM 360-85
- Operating System: 360 OS
- Minimum Storage Required: 43K Words
- Peripheral Equipment: Disk storage.

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation consists of brief descriptions of subroutines and their purpose. User's documentation is complete, in the form of a computer printout listing. Technical documentation is not complete.

TIME REQUIREMENTS:

- Two weeks to acquire base data.
- One man-week to structure data in model input format.
- About 1 minute CPU time for 1 case (8 years).
- One week learning time for users.
- Two hours to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 60 times per year

USERS: SAC

POINT OF CONTACT: Hq., Strategic Air Command
Directorate, Future Force Structure Studies and Evaluation (XPS)
Offutt Air Force Base, Nebrasks 68113
Telephone: Autovon 271-4316

MISCELLANEOUS: Strat Scales has been updated for use with the latest SIOP data base.

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Sea Forces; Computerized; One-Sided; Deterministic.

TITLE: STRAT SENTRY

PROPONENT: USAF (AF/SA)

DEVELOPER: AF/SAS

PURPOSE: STRAT SENTRY is a computerized, analytical general war model developed to evaluate the probability of survival of a point target under attack. In addition, the target may be undefended or defended by terminal and/or area defense. STRAT SENTRY can be used to determine the number of land-based missiles remaining on alert after a counterforce first strike.

GENERAL DESCRIPTION: STRAT SENTRY is a two-sided, deterministic model involving air forces only. It is capable of considering one target and one attacking weapon if desired, and can aggregate up to a force-wide counterforce attack. Game theory, based on expected values, is the primary solution technique used.

INPUT:

- Descriptions of the attacking force, including the number of different types of weapons, the number of weapons in each type, and the probability of damage ($P_d$) of each weapon type against each target type.
- Descriptions of the target system, including the number of different types of targets, the number of aim points within each target and the value of each aim point within each target type.
- Descriptions of the defensive weapons, including the probability of intercept, the number of interceptors, and the number of target types defended.

OUTPUT: Output consists of a summary of attacking and defensive weapon allocation and the number of targets by type expected to be remaining on alert.

MODEL LIMITATIONS: The product of the number of weapon types and the number of target types must be less than or equal to twelve.

HARDWARE:

- Computer: GE 635
- Operating System: GECOS
- Minimum Storage Required: 30K

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: The theory of the model is contained in Analytical Services, Incorporation, reports number AR66-2 and AR67-1.
- Neither user's documentation nor technical documentation is complete.

TIME REQUIREMENTS:

- SA has adequate data base for its needs. Up to 2 weeks would be required to acquire a different base.
- 1 man-day to structure data in model input format.
- 10 seconds CPU time per model cycle.
- 2 weeks learning time for users.
- 3 days to 2 weeks to analyze and evaluate results (based on AF/SA experience. This experience, however, may not relate to other potential users.)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 300 per year

USERS: AF/SASM

POINT OF CONTACT: HQ USAF
Assistant Chief of Staff, Studies and Analysis
AF/SASM
The Pentagon
Washington, D. C. 20301
Telephone: OX 5-7724

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; Two-Sided; Deterministic.

TITLE: STS - Ship-To-Shore Model

PROPONENT: CNO (OP-96)

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: STS is a computerized, logistics model that provides a detailed simulation of the landing of virtually any conceivable amphibious force by either surface means or helicopters. The primary areas of concern are build-up ashore, craft requirements, standoff distances and attrition effects. In addition, the model is concerned with force composition, with beach handling rates, and with configurations and characteristics of proposed landing craft and helicopters.

GENERAL DESCRIPTION: STS is a one-sided model having both deterministic and stochastic features. It is designed to consider units ranging in size from a Marine Amphibious Unit up to a Marine Amphibious Force. Simulated time is treated on an event store basis. Eight minutes of real time are simulated in one minute of computer time. Heuristics is the primary solution technique used.

INPUT:

- Annex I (Ship-to-Shore Movement) of an operations plan, and the corresponding Administrative Plan and Embarkation Plan.
- User operational data such as troop activity levels, attrition probabilities, etc.

OUTPUT: Tables and graphs indicating the time required to complete landing, numbers of trips made by landing craft and helicopters, build-up ashore records, etc.

MODEL LIMITATIONS:

- 500 x 500 mile area
- 26 ship types
- 9 types of landing craft, helicopters, and landing zones
- 99 amphibious ships
- 99 LPHs

HARDWARE:

- Computer: CDC 6700 (Helicopter Simulation Only)
- Operating System: SCOPE 3.3
- Minimum Storage Required: 38K words with overlay
- Peripheral Equipment: card reader, printer

Note: Only the helicopter portion has been recorded for the CDC 6700. The surface simulation must be run on an IBM 7030.

SOFTWARE:

- Programming Language: FORTRAN IV for the helicopter simulation and STRAP II for the surface simulation
- Documentation: (1) NWL Technical Memo K-26/65, The Ship-to-Shore Model (STS-2), User's Guide
  (2) NWL Technical Memo K-31/65, Control Events for Increased Flexibility of the Ship-to-Shore Model (STS-2)
  (3) NWL Report No. 1904, The Ship-to-Shore Model
- A new document is in preparation for the potential user, describing the helicopter simulation which has been recoded for the CDC 6700.

TIME REQUIREMENTS:

- 1 week to acquire base data
- 1 man-week to structure data in model input format
- 45-75 minutes CPU time per model cycle
- Several hours to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Twice per year

USERS:

- Principal: Navy/Marine Corps Planning Staffs
- Other: Private contractors

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: (703) 663-7406 or 663-8645

MISCELLANEOUS:

- STS provides input to the SPOL (Shore Party Operations and Logistics) Submodel
- This version of STS supersedes the Ship-to-Shore Model, Mod 1 (STS-1)
- It is currently planned to add various capabilities to the STS Model to increase flexibility, performance and efficiency

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces; Sea Forces; Computerized; One-Sided; Mixed Deterministic/Stochastic; Event Store

TITLE: SUAS - Small Unit Action Simulation

PROPONENT: USAF (AF/SA)

DEVELOPER: USAF/OA

PURPOSE: SUAS is a computerized, analytical model that investigates the effect of fire support reaction times on the outcome of small unit engagements. The model's chief concern is to determine the number of friendly casualties saved by the timely introduction of fire support. Different fire support systems are compared in both an ambush and a skirmish scenario.

GENERAL DESCRIPTION: SUAS is a two-sided, stochastic model involving land and air forces. The smallest unit considered is the individual combatant, and the model is capable of considering unit sizes as large as 48 combatants. Simulated time is treated on a time step basis. Monte Carlo simulation and stochastic processes are the primary solution techniques used.

INPUT:

- Troop strengths
- Troop aimed and area fire capabilities
- Troop vulnerable area
- Fire support effectiveness
- Ambush or skirmish scenario

OUTPUT: Output consists of the average battle duration, number of friendly and enemy casualties and withdrawals, and the fraction of the battles the friendly force won. Also available is a description of each battle simulated.

MODEL LIMITATIONS:

- No maneuver of combat elements is considered.
- Each force is assumed to desire to fight.

HARDWARE:

- Computer: GE 635
- Operating System: GECOS
- Minimum Storage Required: Approximately 40K

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: "Effect of Fire Support on Small Unit Actions," AF/OA Memorandum 69-7.
- The above represents complete technical documentation. User's documentation is not complete.

TIME REQUIREMENTS:

- o 4 months to acquire base data.
- o 1 man-month to structure data in model input format.
- o Less than 1 second CPU time per battle.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 6 times per year

USERS:

- o Principal: USAF/Operations Analysis Office
- o Other: JCS

POINT OF CONTACT: HQ USAF
Assistant Chief of Staff, Studies and Analysis
AF/SAA
The Lynn Building
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8036

KEYWORD LISTING: Analytical Model; Limited Wars; Land Forces: Air Forces; Computerized; Two-Sided; Stochastic; Time Step.

TITLE: SUBDUEL - Series of Submarine Tactical Simulation Models

PROPONENT: Center for Naval Analyses

DEVELOPER: Center for Naval Analyses

PURPOSE: SUBDUEL is a computerized, undersea warfare model, designed primarily to study submarine vs. submarine encounters in detail (from detection through approach, attack, and kill), but having also the capability to study submarine vs. surface ship tactical encounters and submarine trailing.

GENERAL DESCRIPTION: SUBDUEL is a two-sided, Monte Carlo model. Only sea forces are involved. It was designed to consider one submarine (in a fixed or moving barrier) vs. one to three transitors -- or one submarine vs. one surface ship. The model is a variable-timestep, digital simulation.

INPUT:

- Acoustic data (ambient noise, self-noise, radiated noise, propagation loss, etc., required for the passive sonar equation), and kinematic data.

OUTPUT:

- Computer printout stating probabilities of detection, counterdetection, attack, counterattack, kill, and counterkill. There are three output options: (1) Summary Output -- which lists total probability outcomes only; (2) Detailed Output -- which can be selected to show position, course, and speed of all units, status of weapons, tactic employed, ranges and bearings (actual and estimated), and time required; (3) Diagnostic Output -- same as the Detailed Output, but includes printouts of those items and variable values specifically ordered for diagnostic purposes.

MODEL LIMITATIONS:

- Detailed modeling of weapons is not included.

HARDWARE:

- Computer: CDC 3400 or 3800
- Minimum storage required: 151,000 words

SOFTWARE:

- Programming language used: FORTRAN
- Documentation: OEG Study 747, Dec 1971, Vols. I-V
- Is documentation complete? Yes, both user's documentation and technical documentation.

TIME REQUIREMENTS:

- Months required to acquire base data: One
- Man-months to structure data in model input format: 1/4
- Playing time: NA
- CPU time per model cycle: 5 to 30 seconds per replication, depending upon the specifics of the simulation being run.

SECURITY CLASSIFICATION: Unclassified tape. Documentation CONFIDENTIAL.

FREQUENCY OF USE: Monthly

USERS: Principal: Center for Naval Analyses
Other: Ketron, Inc.; WSEG

POINT OF CONTACT: Center for Naval Analyses
1401 Wilson Boulevard
Arlington, Virginia 22209
Telephone: (703) 524-9400

MISCELLANEOUS:

- This model is not linked to any other models, nor does it supersede any other model. There are no present plans for modifying SUBDUEL or devising another model to supersede it.

KEYWORD LISTING: Limited War; Sea Forces; Computerized; Two-Sided; Stochastic; Time Step.

**TITLE:** Super-Ace

**PROPONENT:** Office of the Deputy Assistant Secretary of Defense Program Analysis & Evaluation (PA&E)

**DEVELOPER:** Science Applications, Incorporated (SAI)

**PURPOSE:** To provide a capability to evaluate alternative strategic forces in terms of their effectiveness against specified target sets or their contribution to the strategic nuclear balance.

**GENERAL DESCRIPTION:** Super-Ace is a computerized, analytical deterministic model that provides a capability to compare various strategic forces either by measuring their effectiveness against specified target sets, through the use of a single strike optimum weapon allocator, or by measuring static characteristics such as throwweight, number of warheads, megatonnage, etc. The model is highly user oriented, thereby enabling the user to exercise control over the degree of output fidelity desired.

The capability exists to input either pre-stored arsenals and/or target sets or to create new ones. Additionally, weapon arsenals/target sets may be temporarily modified prior to production to facilitate sensitivity analysis or minimize set up time. The primary solution techniques used in weapon allocations are LaGrange multipliers, linear programming and probability.

**INPUT:**

- Weapon variables.
- Target variables.
- Scenario variables.
- Allocation constraints.
- Statis measures desired.
- Degree of output summarization desired.

**OUTPUT:**

- Static measure summaries.
- Throwweight drawdown.
- Summaries in terms of weapon allocation and value destroyed.
- Output options allow extremely detailed output or highly aggregated summaries.

**MODEL LIMITATIONS:**

- Geography is not explicitly considered.
- Aggregated target data base.
- Co-location not considered.

**HARDWARE:**

- Computer: Honeywell
- Operating System: Multics
- Minimum Storage Required: N/A
- Peripheral Equipment: Interactive I/O device.

SOFTWARE:

- Programming Languages: FORTRAN IV.
- Documentation is available. The model is dynamic and under constant revision.

TIME REQUIREMENTS:

- 10-60 seconds CPU time for one strike allocation.
- 1 hour or less to analyze and evaluate results.

SECURITY CLASSIFICATION: The model is Unclassified.
Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year.

USERS: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: OX5-5587

KEYWORD LISTING: Analytical Model; Strategic Forces; Computerized; Deterministic; Linear Programming

TITLE: SURVIVOR - The Aggregated Survivability of Aircraft Forces as a Result of an Attack by Submarine Launched Ballistic Missiles

PROPONENT: USAF (AF/SA)

DEVELOPER: AF/SAA

PURPOSE: SURVIVOR is a computerized, analytical simulation model designed to aid in studies of the survivability of all types of ground alert aircraft (bombers, interceptors, AWACs, tankers, etc.) which are subject to pattern attack by multiple warhead SLBMs. SURVIVOR uses simplified descriptions of aircraft performance and hardness, SLBM capability, and a relatively comprehensive kill algorithm based upon equations in the DIA Physical Vulnerability Handbook to determine the expected number of aircraft killed by each salvo from every submarine firing at every base. The potential kills are summed and weighted to form an aggregated value matrix, and the optimal allocation of missiles is selected by use of a linear programming scheme. The model will allocate multiple missiles to a target when feasible and profitable, and can reflect downstream expectations for convergence on the universal optimum allocation. For a given submarine threat, the model will also determine the optimum bed-down of aircraft with respect to the damage expected from the initial launch of SLBMs.

GENERAL DESCRIPTION: SURVIVOR is a two-sided model with both deterministic and stochastic elements. Air and sea forces are simulated. The model is capable of considering aircraft on an individual basis if desired and can aggregate up to a total of 5000 aircraft. Simulated time is treated on a time step basis. Linear programming, probability, and random draws are the primary solution techniques used.

INPUT:

- Base and launch point coordinates.
- Length and number of runways.
- Aircraft hardness and flyout characteristics.
- Aircraft bed-down.
- SLBM yield, CEP, reliabilities, launch rates, number of salvos, range limitations, and trajectory characteristics.
- Nuclear curve-fitting constants, and scaled height of burst selector.
- Game control parameters.

OUTPUT:

- Raw game data.
- Value matrix resulting from data.
- Complete detailed history of weapon allocation.
- Number of each type of aircraft surviving from each base.
- Output of matrices preliminary to the problem solution.
- Case summary.

MODEL LIMITATIONS:

- 100 bases played in game.
- 50 aircraft at each base.
- 20 aircraft types.
- 50 submarine launch points.
- 32 salvos per launch point.
- 20 submarine types.

HARDWARE:

- Computer: GE 635
- Operating System: GECOS
- Minimum Storage Required: 37K words.
- Peripheral Equipment: Tape, disk.

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: "Calculation of SSPK Against a Target via the Circular Coverage Function and the Physical Vulnerability (PV) System" (in draft).

- The above, when complete, will constitute complete technical documentation. User's documentation is not complete.

TIME REQUIREMENTS:

- Base data is already available.
- A few hours to structure data in model input format.
- 30 minutes CPU time per model cycle.
- 2 days to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified.

FREQUENCY OF USE: 6 times per year.

USERS: HQ USAF AF/SA

POINT OF CONTACT: HQ USAF, Assistant Chief of Staff, Studies and Analysis, AF/SAA, 417 Lynn Building, 1111 19th Street, Arlington, Va. 22209, Tel: X 4-8036

MISCELLANEOUS: It is currently planned to expand the SURVIVOR model to play up to 75 submarine launch points, 150 bases, and 75 aircraft at each base; to include attrition of SLBMs; and to incorporate a more realistic representation of nuclear effects.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Air Forces; Sea Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Time Step.

TITLE: TAC AVENGER - Tactical Air Capabilities, Avionics, Energy Maneuverability, Evaluation and Research

PROPONENT: USAF (AF/SA)

DEVELOPER: AF/SAG

PURPOSE: TAC AVENGER is a computerized, analytical model designed to evaluate the effectiveness of one aircraft versus another in a close-in air duel. The chief focus of concern is to evaluate the capabilities of two aircraft, opposing each other in a close-in air duel. During the duel, each aircraft can maneuver in three dimensions and launch weapons at the other aircraft. The kill probabilities of each firing pass are cumulative for the entire time of the air duel. Aircraft motion is computed by utilizing the standard aerodynamic equations of flight. As a result, an aircraft's actual aerodynamic maneuvering capability is simulated. Aerodynamic parametric variation may be exercised to determine the sensitivity of variables.

GENERAL DESCRIPTION: TAC AVENGER is a two-sided model having both deterministic and stochastic elements. It involves air forces only. It is primarily designed to consider two aircraft in an air duel, and is capable of aggregating up to thirty air duels lasting five minutes each. Aerodynamic equations of flight and probability theory are the primary solution techniques used.

INPUT:

- The aircraft description requires basic engineering data. Aerodynamic and structural capabilities defined by lift and drag curves, "G" limitations, visibility limitations, engine thrust and fuel flow curves are necessary. The systems described include on-board sensors. Descriptions for missiles require complete definition of launch parameters, missile control, guidance and aerodynamic capabilities and kill radius of warhead. Gun systems require complete ballistic information for the type of projectile under consideration, and gun and sight characteristics.

OUTPUT:

- Second-by-second summary of aircraft's position, maneuvers, gun and missile firings.

- Gun summary.

- Missile summary.

MODEL LIMITATIONS:

- The model simulates the air duel of two opposing aircraft, each of which may employ as many as 12 tactical maneuvers with variations in each.

- Since the maneuver selection is stochastic, numerous duels are required to produce a usable data point.

HARDWARE:

- Computer: IBM 7094, GE 635.
- Operating System: IBSYS 13 (IBM); GECOS III (GE).
- Minimum Storage Required: 37K (IBM); 39K (GE).
- Peripheral Equipment: 1401 unit, 16 files.

SOFTWARE:

- Programming Language: FORTRAN IV
- There is no documentation.

TIME REQUIREMENTS:

- 1 month to structure data in model input format.
- 5 minutes CPU time per model cycle.
- 2 years learning time for users.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 20,000 per year

USERS: AF/SAGF, HQ USAF

POINT OF CONTACT:

HQ USAF
Assistant Chief of Staff, Studies & Analysis
AF/SAA
The Lynn Building
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8036

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Air Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Time Step.

TITLE: TAC CONTENDER - Evaluation of the Effectiveness of Tactical Fighter Forces

PROPONENT: USAF (AF/SA)

DEVELOPER: USAF (AF/SA)

PURPOSE: TAC CONTENDER is a computerized, analytical model that measures the capabilities of two opposing tactical air forces to provide support to the ground commander. The chief focus of concern is to evaluate the effectiveness of tactical fighter forces employed in a conventional conflict. The effectiveness is measured in terms of their capability of providing support to the ground commander. The tactical roles to which both sides can allocate aircraft are: (1) airfield attack, (2) airfield defense, (3) defense of the airspace over the battlefield, and (4) combat air support. The principal measure of merit employed is the difference (Blue minus Red) in the amount of ordnance delivered by each side's tactical air forces in support of his ground troops. The model contains an algorithm which selects a Blue strategy (i.e., an allocation of Blue's tactical aircraft to the four different roles) which maximizes the measure of merit against Red's best strategy for minimizing it.

GENERAL DESCRIPTION: TAC CONTENDER is a two-sided, deterministic model involving air forces only. It is designed to consider theater level simulations but can group aircraft in any way the user desires, down to the individual aircraft. Simulated time is treated on a time step basis. Game theory and interaction equations are the primary solution techniques used.

INPUT:

- Program variables: convergence criteria for the game solutions.
- Scenario dependent variables (the choice of which determines the character of the interactions): descriptions of aircraft beddowns, resupply rates, bombloads to airfields, bombloads for combat air support, air-to-air kill probabilities, bombing accuracy probabilities, ground-to-air attrition factors, sortie rates, mission lengths, combat day length, numbers of aircraft shelters, and length of war.

OUTPUT:

- Detailed and summary daily output.

MODEL LIMITATIONS:

- Does not have ground interactions.

HARDWARE:

- o Computer: IBM 7094, GE-635, IBM 360.
- o Operating System: IBSYS (IBM 7094); GECOS (GE); OS FORTRAN G (IBM 360).
- o Minimum Storage Required: 32K (IBM 7094); 35K (GE and IBM 360).
- o Peripheral Equipment: Tape drive.

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is very limited. Neither user's documentation nor technical documentation is complete.

TIME REQUIREMENT:

- o A base data bank is currently being developed.
- o 1 man-week to structure data in model input format.
- o 15 minutes CPU time per model cycle.
- o 5 minutes to years to analyze and evaluate results.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE. 50 per year

USERS:

- o Principal: AF/SA
- o Other: USAFE

POINT OF CONTACT:

Assistant Chief of Staff - Studies and Analysis
Computer Applications Group
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8420

KEYWORD LISTING: Analytical Model; Limited War; Air Forces; Computerized; Two-Sided; Deterministic; Time Step.

TITLE: TACOS II (USACDC version)
TACOS II/AF1 (Air Force version)

PROPONENT: U.S. Army Air Defense School, Directorate of Combat Development (USACDC version)
USAF/SAGR and ADTC/XR (Air Force version)

DEVELOPER: Braddock, Dunn & McDonald, Inc.

PURPOSE: The TACOS II and the TACOS II/AF1 versions of this model are computerized, analytical models designed to consider the effectiveness of ground/air defense and penetrating air forces accounting for air and ground damage, ordnance and missile stockage, command and control, ECM, etc. Both deal primarily with operational employment doctrine and concepts, and technical characteristics of the following: (1) force development, (2) deployments, (3) effectiveness, (4) weapons requirements, (5) command and control requirements, (6) doctrine development, (7) system parameters, and (8) ECM. In addition, the model considers organizational requirements, systems performance, and interface requirements for both ground and air forces.

GENERAL DESCRIPTION: Both TACOS II and TACOS II/AF1 are two-sided, stochastic models that simulate ground and air forces, using a digitized terrain model. Both versions are primarily designed to consider from 1 to 255 ground sites versus a large number of aircraft or ballistic missiles, but can consider a single ground site versus a single aircraft or ballistic missile. Ground sites may range in size from a single gun to a missile launch complex, while aircraft may be aggregated up to the level of a penetrator wave. The simulation covers a 24-hour period and a 1600 km2 area. Simulated time is treated on an event store basis. The primary solution techniques used are game theory, queuing theory, probability, Newton-Raphson, Monte Carlo, and radar theory equations.

INPUT: For TACOS II:

- Ground system characteristics: e.g., reaction times, missile guidance parameters, radar power, damage criteria
- Penetrator type characteristics: e.g., radar cross-section as a function of azimuth, elevation, radar frequency, jammer types, maneuver capability
- Ground element characteristics: e.g., location, altitude, sector limits, ammunition (missile) stockage
- Air element characteristics: e.g., flight profile, number in sortie, decoys, ARMS, ordnance

FOR TACOS II/AF1:

- See "TACOS II, Input Variable Descriptions and Format, Fourth Edition," 1 November 1971, and BDM Memorandum, subject: Modifications to FRAG 3 (TACOS 2.4/AF1), 14 January 1972

OUTPUT: For TACOS II:

- Complete time history of each engagement
- Resources expended summaries by fire unit
- Number of penetrators reaching objectives with summaries
- Targets damaged by target type
- Numbers of penetrators lost with summaries

FOR TACOS II/AF 1:

- o Same as TACOS II plus detailed missile flyout parameters and probabilities of survival

MODEL LIMITATIONS:

- o Terrain limited to Germany, Korea, and Okinawa
- o 15AD system types
- o Cannot presently simulate aircraft interceptors, ground sites moving during battle, or moving support ECM aircraft
- o Maximum of 255 ground sites
- o Maximum of 2040 aircraft
- o Maximum of 255 threat paths

HARDWARE:

- o Computer: TACOS II - IBM 360/50, CDC 6500/6600
  TACOS II/AF1 - IBM S/360
- o Operating System: Both versions - OS/PCP/MFT/MVT; SCOPE
- o Minimum Storage Required: TACOS II - 300K bytes, IBM/256K Octal, CDC
  TACOS II/AF1 - 330K bytes
- o Peripheral Equipment: Both versions - one to two 2314 disk packs and/or one to two tape units, plus card reader and line printer or remote terminal to computer facility

SOFTWARE:

- o Programming Languages: Both versions - FORTRAN IV (H) and ALC
- o Documentation: TACOS II is fully documented.

TIME REQUIREMENTS: Time requirements for TACOS II are based on a full scale run (I.E., 255 sites, 15 AD systems, 100+ threat paths, etc.); TACOS II/AF1 requirements involve, at most, 50 sites (usually 2 or 3) against few threat paths. CPU requirements for TACOS II are based on IBM 360/50 CPU rates.

- o To acquire base data: TACOS II - 1-10 months
  TACOS II/AF1 - 1/2 man-day to 1 month
- o To structure data in model input format: TACOS II - 1-4 man-months
  TACOS II/AF1 - 1 man-week
- o CPU time per model cycle: TACOS II - 1-20 hours
  TACOS II/AF1 - 30 seconds to 1 hour
- o To analyze and evaluate results: TACOS II - 1 month minimum

SECURITY CLASSIFICATION: UNCLASSIFIED (both versions)

TIMES USED SINCE 1969: TACOS II (USACDC usage) - Run continually
TACOS II (Air Force version) - 25-50 times
AF1 version - 2 times (this version dates from December 1971)

USERS: TACOS II:

- o Principal: TRADOC, Directorate of Combat Developments, USAADS
- o Other: U.S. Army Missile Command, Naval Weapons Command

TACOS II/AF1:

- o Principal: USAF/ADTC(XR), USAF/SAGR

POINT OF CONTACT: TACOS II: U.S. Army Air Defense School (ATSA-CD-SP)
Fort Bliss, Texas 79916
Telephone: (915) 568-5712
AUTOVON 978-5712

TACOS II/AF1: Headquarters
Armament Developments & Test Center
(ADTC/XR)
Eglin Air Force Base, Florida 32542
Telephone: (904) 882-5845
AUTOVON 872-5845

MISCELLANEOUS:

- o TACOS II/AF1;
  - o TACOS supplies aircraft loss rates, ammunition, expenditure rates, etc., to TAC CONTENDER and DMEW.
  - o FAIRPASS provides gun aiming errors or $P_k$ tables for TACOS.
  - o TACOS II/AF1 (developed in December 1971) supersedes TACOS II.4.
  - o It is currently planned to add an Airborne Interceptor (AI) submodel and an escort jamming submodel to TACOS II/AF1.

KEYWORD LISTING: Analytical Model; Land Forces; Air Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: TAM - Target Acquisition Model

PROPONENT: U.S. Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: The Target Acquisition Model is a computerized model used for analysis. It provides a list of acquired targets for use by artillery simulation models.

GENERAL DESCRIPTION: The Target Acquisition Model is a one-sided, stochastic model involving sensor systems only. The model is designed to consider theater sensor systems, with no limit on the number of sensor systems employed. Simulated time is treated on an event store basis. Probability is the primary solution technique used combined with algorithms for computer simulation.

INPUT:

- o Target array
- o Sensor detection probabilities
- o Type and number of sensors

OUTPUT: Target lists and data appropriate to each target

MODEL LIMITATIONS: Model is limited to providing target lists as needed by ammunition rates methodology.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Exec 8
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader, printer, card punch, and disk storage

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Target Acquisition Model, December 1974, USACAA Available in Defense Documentation Center
- o The above represents complete user's documentation and technical documentation

TIME REQUIREMENTS:

- o Approximately 4 months to acquire base data
- o 1 man-month to structure data in model input format
- o 1 minute CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED when separated from code sheet

**FREQUENCY OF USE**: 3 times per year

**USERS**: U.S. Army Deputy Chief of Staff for Operations and Plans

**POINT OF CONTACT**: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone (202) 295-1696

**MISCELLANEOUS**:

- The Target Acquisition Model supplies input for the Blue and the Red Artillery Models of the Ammunition Rates Methodology.

**KEYWORD LISTING**: Analytical Model; General War (Nonnuclear); Computerized; One-Sided; Stochastic; Event Store

TITLE: Tank

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation

DEVELOPER: Science Applications, Incorporated (SAI)

PURPOSE: To provide the capability to evaluate the contribution of airborne tankers to strategic bomber force capability and to all strategic forces in general.

GENERAL DESCRIPTION: Tank is a computerized, analytical deterministic model that provides the capability to evaluate the contribution of tankers to strategic bomber force capability as measured by the percent of target value destroyed by the bomber force. Additionally, the model can be used to compare various force mixes of bombers, weapons and tankers on a force effectiveness basis.

The model is highly user oriented, thereby enabling the user to exercise control over the degree of output fidelity desired. Temporary modifications to pre-stored data are easily accomplished facilitating rapid sensitivity analysis. The primary solution technique used in bomber/weapon allocation are LaGrange multipliers, linear programming and probability.

INPUT:

- Number and type of tankers.
- Number and type of bombers.
- Number of weapons for bombers.
- Percent of tankers/bombers available for allocation.
- Variables for specifying tanker/bomber flight profiles and performance characteristics.
- Probability of bomber penetration.
- Variables controlling degree of output desired.

OUTPUT:

- Summarization of variable selected.
- Listing of strategies used in weapon allocation.
- Summaries of weapon allocation and value destroyed by bomber type and entry point area.
- Numbers of bombers, weapons and tankers used, by type.
- Output options allow a detailed description of the weapon allocation or aggregated summaries.

MODEL LIMITATIONS:

- Aggregated target data base.
- Aggregated weapon type.

HARDWARE:

- Computer: Honeywell
- Operating System: Multics
- Minimum Storage Required: N/A
- Peripheral Equipment: Interactive I/O device.

SOFTWARE:

- Programming Languages: FORTRAN IV.
- Documentation is available. The model is dynamic and under constant revision.

TIME REQUIREMENTS:

- 10-60 seconds CPU time for one strike allocation.
- 1 hour or less to analyze and evaluate results.

SECURITY CLASSIFICATION: The model is Unclassified.
Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year.

USERS: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: 695-5587

KEYWORD LISTING: Analytical Model; Strategic Tanker/Bomber; Computerized; Deterministic; Linear Programming.

**TITLE:** TARTARUS IV N/COCO

**PROPONENT:** US Army Concepts Analysis Agency (CAA)

**DEVELOPER:** US Army Strategy and Tactics Analysis Group (STAG)

**PURPOSE:** TARTARUS IV N/COCO is a computerized, analytical model designed to simulate movement and attrition of ground forces in contact. Externally derived effects of close air support and nuclear weapons can be applied in the model, if desired.

**GENERAL DESCRIPTION:** TARTARUS IV N/COCO is a two-sided, deterministic model involving land forces only. It is primarily designed to consider units ranging in size from a battalion to a division theater (300 units). Simulated time is treated on a time step basis. The primary solution technique used is the numerical solution of a system of differential equations based on Lanchester's Linear Law.

**INPUT:**

- Terrain data
- Unit descriptions: mission, location, and strength in FPP (Firepower Potential)
- Factors for weapon class versus weapon class effectiveness, attrition, movement, suppression
- Air strike data
- Fuel and ammunition distribution and consumption factors
- Individual weapon FPPs

**OUTPUT:**

- Unit Status Report
- Detailed Strength and Loss Report
- Ammunition and Fuel Expenditure Reports
- CALCOMP plots of terrain, strikes, unit locations, objectives, and frontages
- All of the above are optional, except the Unit Status Report

**MODEL LIMITATIONS:** Limited number of targets per unit

**HARDWARE:**

- Computer: UNIVAC 1108
- Operating System: EXEC VIII
- Minimum Storage Required: 40K words
- Peripheral Equipment: 1 tape drive, FASTRAND format mass storage, CALCOMP plotter is optional

**SOFTWARE:**

- Programming Languages: FORTRAN V, 1108 Assembly Language
- Documentation: "TARTARUS IV N/COCO Players and Technical Manual." (AD 829525L)
- Technical documentation is complete; user's documentation is not. The model has been modified since the above documentation was published and corrections have not been published.

TIME REQUIREMENTS:

- 4 months to acquire base data
- 2 man-months to structure data in model input format
- Average of 1/2 hour's CPU time per model cycle (4 hours real time)
- 1 week learning time for users
- 2 months to analyze and evaluate results of one study

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 3 studies

USERS: USA STAG, USA CAA

POINT OF CONTACT: US Army Concepts Analysis Agency (CAA)
8120 Woodmont Avenue
Bethesda, Maryland 20014
Telephone: (301) 295-1630

MISCELLANEOUS:

- TARTARUS IV N/COCO supersedes all previous versions of TARTARUS.
- It is currently planned all expand units' target lists, and to restructure the model to reduce running time and permit more flexibility. After all modifications are complete, the documentation will be updated.

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Computerized; Two-Sided; Deterministic; Time-Step

TITLE: TATS - Tank/Antitank Simulation

PROPONENT: U.S. Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments were done in-house.

PURPOSE: The Tank/Antitank Simulation is a computerized model used for analysis. It simulates tank battles between battalion-sized units or smaller. It has the capability of incorporating all antitank weapons. The model is primarily concerned with the expenditure of ammunition, armor losses, and concurrent weapon losses for both Red and Blue sides. Many items can be extracted from the model, such as battle duration, loss rate, ammunition lost in combat, and so forth.

GENERAL DESCRIPTION: The Tank/Antitank Simulation is a two-sided, deterministic model involving land forces only. In theory, there are no logical limits to the model, but it is generally applied to units no smaller than a platoon. Simulated time is treated on a time step basis. The model is expected value, hence it uses probability theory as appropriate but is primarily a computer simulation algorithm.

INPUT:

- o Weapon kill probabilities
- o Specific number and kind of armor units
- o Detection limits
- o Target priorities
- o Firing rates

OUTPUT:

- o Ammunition expenditures and armor losses at up to six points during a battle
- o Printout of sub-results for up to six ranges between antagonists, and a summary

MODEL LIMITATIONS:

- o Limited to a linear battle which can be approximated by a single axis.
- o Can readily accept different weapons but cannot readily accept variations in target sensing devices

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Exec 8
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Disk storage and card punch, reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Tank/Antitank Model, December 1974, USACAA. Available in Defense Documentation Center
- The above represents complete users documentation. Technical documentation is complete.

TIME REQUIREMENTS:

- 2 months to acquire base data
- 2 man-weeks to structure data in model input format
- Approximately 1 minute CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED when separated from code sheet. Otherwise, SECRET.

FREQUENCY OF USE: 300 times per year

USERS: U.S. Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1696

MISCELLANEOUS:

- The Tank/Antitank Simulation provides input to the Theater Rates Model of the Ammunition Rates Methodology.
- The Tank/Antitank Simulation supersedes the FILTER Model.

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: TESE - Tactical Exercise Simulator and Evaluator

PROPONENT: US Marine Corps

DEVELOPER: USMC (Marine Corps Development and Education Center)/Naval Electronics Laboratory Center

PURPOSE: TESE is a computer assisted model for use in a limited war situation. It provides a real time simulation of combat to support Command Post Exercises and other map type exercises for training Commanders and Staffs in decision making and staff functioning as its chief focus of concern. It can be used to determine effects of specific weapons versus designated targets or to investigate other problems of similar limited scope.

GENERAL DESCRIPTION: TESE is a two-sided, mixed model involving land, air and sea forces. Designed resolution was the company level but can be manipulated from a squad level to a division level. Simulated time is treated on a time step basis, 1:1 is normal but can achieve a 4:1 ratio. Primary solution techniques are monte carlo and deterministic.

INPUT:

- Weapons characteristics
- Weapons effects
- Terrain data
- Unit descriptions
- Supply levels
- Vehicle landing craft, helo characteristics
- Wave/serial descriptions; Beach/LZ location

OUTPUT:

- Unit Status Reports; Location Reports
- Movement Reports; Control Status
- Detection Reports; Brief System Generated Reports
- Assessment Report; Response to Query

MODEL LIMITATIONS:

- Provides no final answers
- Cannot account for intangible factors such as morale, training, etc.

HARDWARE:

| | | |
|---|---|---|
| o | IBM 360/65 | AN/YUK-7 |
| o | OS | TOS |
| o | 150K | 96K |

SOFTWARE:

- PL/1 CMS2Y
- Flow Charts
- Model descriptions and users manual, documentation not complete.

TIME REQUIREMENTS:

- Time to acquire data base and to structure data in model input format not applicable
- Learning time for players 1 week
- 2 months to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Semi-annually

USERS: Education Center
Fleet Marine Force

POINT OF CONTACT: Major Leroy A. Bickley
$C^3$ Division, Development Center
MCDEC, MCB, Quantico, Virginia 22134
Telephone: (703) 640-3161

MISCELLANEOUS: TESE can be linked to a Marine Aerial Recon Model and Fire Support Model if desired. The linkage is manual. It is planned to develop a family of stand alone modules to support the general TESE program.

KEYWORD LISTING: Training; Limited War; Land, Air, and Sea Forces; Computer Assisted; Two-Sided; Mixed; Time Step

TITLE: TLS - Training Line Simulator

PROPONENT: AFHRL/ORS, Manpower & Personnel Systems Branch, Occupational and Manpower Research Division

DEVELOPER: Decision System Associates, Inc.

PURPOSE: The Training Line Simulator is a computerized, analytical model that games the interaction of policy decisions impacting on Basic Military Training and Entry-level Technical Training. The model assesses policy alternatives with respect to training school prerequisites, weekly requirements mix, wash-out, wash-ahead and wash-back rates, application of fill priorities and desirable prerequisites to selected assignments, etc. In addition, it investigates the effects of changing the quality of enlisted input with respect to fulfilling training objectives.

GENERAL DESCRIPTION: The Training Line Simulator is a one-sided model having both deterministic and stochastic elements. Only Air Force personnel are considered, consisting of the weekly input of non-prior service enlisted personnel into the Air Force. Simulated time is treated on a weekly time step basis. The primary solution technique is a modified Ford Fulkerson optimal assignment algorithm.

INPUT:

- o Mandatory and desirable prerequisites for each Technical Training course
- o Weekly quotas for each course
- o Wash-out, wash-ahead and wash-back policies, optimal classload, etc., for Basic Military Training and for each training course
- o Records of hypothetical Air Force enlisted input

OUTPUT:

- o Weekly summary of number of inductees, number in Basic Military Training and in Technical schools, graduates from BMT and Tech schools, wash-backs, wash-aheads, wash-outs, casual pools, etc.
- o Output tape of airman records with disposition codes, etc.

MODEL LIMITATIONS:

- o Maximum of 4000 inductees per week
- o 255 weeks
- o 250 individual training courses

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Standard
- o Minimum Storage Required: 44K words (36 bits/word) plus operating system
- o Peripheral Equipment: 2 tape drives, 6 mass storage files (approx 229K words depending on application), card reader, printer

SOFTWARE:

- Programming Language: FORTRAN V
- Documentation: Training Line Simulator (Enhanced Version)
  AFHRL-TR-73-50(I) User's Manual
  AFHRL-TR-73-50(II) Training Line Simulator
  (Enhanced Version)

TIME REQUIREMENTS:

- 1 week to 3 months to acquire and structure base data, depending upon the specific application
- 1-15 seconds CPU time per model cycle
- Less than 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Monthly

USERS:

- Principal: AFHRL/ORS, Manpower & Personnel Systems Branch
- Other: Personnel Processing Group, Lackland Air Force Base
  HQ Air Training Command
  DCS/P USAF

POINT OF CONTACT: AFHRL/ORS, Manpower & Personnel Systems Branch
Occupational & Manpower Research Division
Lackland Air Force Base, Texas 78236
Telephone: AUTOVON 473-4106

MISCELLANEOUS: N/A

KEYWORD LISTING: Analytical Model; Air Forces; Computerized; One-Sided; Mixed Deterministic/Stochastic; Time Step

TITLE: TOPOPS - Total Objective Plan for the Officer Procurement System

PROPONENT: AFHRL/ORS, Manpower & Personnel Systems Branch, Occupational and Manpower Research Division

DEVELOPER: System Automation Corporation

PURPOSE: TOPOPS is a computerized optimization model to allow the analysis of various officer procurement scenarios for planning purposes.

GENERAL DESCRIPTION: TOPOPS is an aggregate optimization model that uses a linear programming algorithm to program a scheme of officer procurement to either minimize cost or maximize quality. Constraints on optimization include production requirements by officer type (pilot, navigator, etc.), policy restrictions, specific characteristics of various commissioning sources and training programs (including attrition rates, type crossflows, and career turnover). The model works on a five-year procurement lead time to optimize a five-year schedule of accessions.

INPUT: Inputs into the model are flexibly arranged to allow different procurement scenarios to be examined by modifying both the objective function and the constraint set by choosing particular members of classes of available constraints and objective functions. Numerical data inputs include such things as procurement requirements by officer type for the next five years; turnover rates by type of officer and training agency; training agency crossflow rates; maximum production limits for training agencies; limitations on supply pools of officers; quality distributions of various supply pools; inflation rates; and training agency and commissioning source costs, capacities, and attrition rates.

OUTPUT: Model output includes a schedule of officer recruitment requirements to meet the accession requirements by type, supply pool, and commissioning source for the next five years. Also, the model gives a program cost analysis and officer quality profile, and a sensitivity and parametric analysis of the objective function and constraint set.

MODEL LIMITATIONS: The model is currently limited by the linear programming algorithm available to 2280 constraints and 775 structural variables. This allows only five officer types, ten commissioning sources, 20 supply pools, ten procuring years, and a five-year procurement scenario to be considered.

HARDWARE: The TOPOPS model was designed and programmed to run on the UNIVAC 1108.

SOFTWARE: The UNIVAC MPS linear programming package is called by the source program to perform the optimization routines. The model itself has three distinct modules: the Data Initializer Module, the Procurement Policy Generator Module, and the Report Processor Module. The first translates the user-specified problem definition into specifications for the linear programming algorithm. The second module inputs the matrix entries of the initial tableau until it locates an optimal solution, if one exists. The third module writes user-oriented reports.

TIME REQUIREMENTS: Approximately a week to prepare data for input; about five minutes of CPU time to run (depending on the size of the specified problem.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Under test

USERS: AFHRL for development; Hq USAF/DPPPO

POINT OF CONTACT: AFHRL/ORS, Manpower & Personnel Systems Branch
Occupational & Manpower Research Division
Lackland Air Force Base, Texas 78236
Telephone: AUTOVON 473-3895

MISCELLANEOUS: With the availability of the UNIVAC FMPS linear programming package, the TOPOPS model is being enhanced to handle larger and more complex procurement scenarios.

KEYWORD LISTING: Analysis and Planning; Personnel Procurement; Computerized; Optimization; Deterministic; Simultaneous Solution

**TITLE:** TOTEM - Theatre Operations Tactical Evaluation Model

**PROPONENT:** Headquarters, US Air Force (AF/SA)

**DEVELOPER:** Rand Corporation

**PURPOSE:** TOTEM is a computer-assisted model for the analysis of theatre air and ground combat, force capability and requirements and air-ground interaction in limited war. The chief focus of concern is the air contribution to theatre war with secondary emphasis on ground force capability.

**GENERAL DESCRIPTION:** TOTEM is a two-sided, deterministic model involving land and air forces. It is primarily designed to consider movement of divisions, however, it can consider aggregation from brigade to Army. The model considers the entire NATO and PACT force.

**INPUT:**

- Unit scores
- Major weapon counts
- Division move rates
- Initial scenario
- Air effectiveness by aircraft type and load
- War reserve stocks
- Maintenance capability by unit

**OUTPUT:**

- FEBA trace
- Status of all units
- Vehicle losses from air and ground
- Movement and strength history by unit

**MODEL LIMITATIONS:**

- No dynamically interacting air allocation
- Depends on unit scores and ratio calculations

**HARDWARE:**

- Computer: HIS 6180
- Operating system: MULTICS
- Minimum storage: 120K

**SOFTWARE:**

- Programming language: FORTRAN
- Documentation: Incomplete

**TIME REQUIREMENTS:**

- Structure data - 3 weeks
- CPU time - 10-15 minutes

SECURITY CLASSIFICATION:

- Model - Unclassified
- Data - Secret

FREQUENCY OF USE: Monthly

USERS: RAND, US Army CAA, USAF/SA

POINT OF CONTACT: Headquarters, US Air Force
Asst Chief of Staff Studies & Analysis
Washington, D.C. 20330

KEYWORD LISTING: Analytical model, computerized, computer assisted, two side, air-ground forces, time step

**TITLE:** TRACS - Transportation Requirements and Capabilities Simulation

**PROPONENT:** OJCS (J-4)

**DEVELOPER:** Bilateral U.S. Army and U.S. Air Force Intratheater Transportation Requirements Study Group

**PURPOSE:** TRACS is a computerized, analytical logistics model designed to simulate the capability of a specified transportation network to handle particular transportation requirements in a defined theater of operations. The model simulates the actions within a transportation network necessary to deploy a force with accompanying equipment and established consumption and resupply rates (either dynamic, based on unit strength, or simply as designated for the unit by the user). Additional problems addressed are: (1) "choke-point" analysis, (2) effects of degradation of routes, (3) change in combat status of units, and (4) interdiction of supply points.

**GENERAL DESCRIPTION:** TRACS is a one-sided, deterministic model involving land and air forces. It is designed to consider individual aircraft, trucks, or railcars, in the context of single theater troop deployment and resupply. It is highly parametric in all areas except for the limitations noted below under "Model Limitations." Queuing theory and network analysis are the primary solution techniques used. Simulated time is treated on a time step basis.

**INPUT:**

- Network characteristics
- Vehicles and their characteristics
- Unit locations and strength
- Facility constraints
- Costs involved in operations of networks and resources

**OUTPUT:**

- All outputs are computer printouts. Daily outputs show the effectiveness of the transportation system.
- Optionally, the user can select various combinations of forty different printed reports that include reports indicating the responsiveness of the system, stockage levels, and vehicle/route/terminal utilization, as well as various detailed reports that depict individual route/vehicle allocations to selected specific requirements.

**MODEL LIMITATIONS:**

- 6 transportation modes
- 6 supply classes
- 6 postures for units
- 4 plane types
- Model does not simulate repositioning of vehicles (all vehicles return to their home terminal before reassignment)
- Restricted to intra-theater environment
- Not successful on a large scale problem
- Outputs for daily reports; no summation

**HARDWARE:**

- Computers: IBM 360/65; HIS 6080
- Operating System: OS/MVT for IBM; GCOS for HIS
- Minimum Storage Required: 250K bytes for IBM; 90K words for HIS
- Peripheral Equipment: Disk and tape drives

**SOFTWARE:**

- Programming Languages: SIMSCRIPT 2.5 and IBM Assembly Language
- Documentation: User's Manual and Technical Documentation are being updated and will be published in 1975

**TIME REQUIREMENTS:**

- Time to acquire base data varies widely, depending on the problem under consideration
- 3 man-weeks to structure data in model input format
- 10 minutes CPU time per model cycle
- 1 man-month learning time for users
- 2 man-weeks to analyze and evaluate results

**SECURITY CLASSIFICATION:** UNCLASSIFIED

**FREQUENCY OF USE:** Rarely

**USERS:** OJCS (J-4)

**POINT OF CONTACT:** Organization of the Joint Chiefs of Staff
Logistics Directorate
Technical Adviser Office
The Pentagon, Washington, D.C. 20301
Telephone: OX 7-5464

**KEYWORD LISTING:** Analytical Model; Logistics; Land Forces; Air Forces; Computerized; One-Sided; Deterministic Time Step

TITLE: TRM - Theater Rates Model

PROPONENT: U.S. Army Concepts Analysis Agency

DEVELOPER: Model has evolved through several stages. The latest developments have been done in-house.

PURPOSE: The Theater Rates Model is a computerized model used for analysis. It simulates theater level combat over a predetermined span of time.

GENERAL DESCRIPTION: The Theater Rates Model is a two-sided deterministic model. It simulates theater level conflict on a day by day basis in order to determine ammunition expenditures of all Army weapons engaged in conflict. Its primary solution technique is that of a computer simulation algorithm.

INPUT:

- Personnel casualties and armor losses from all forms of combat
- Red and Blue force deployment schedule
- Scenario of combat activity

OUTPUT:

- Computer printout of day by day ammunition expenditures and
- The status of both Red and Blue forces in the theater

MODEL LIMITATIONS:

- Combat activity is dictated by a scenario
- Blue and Red deployed units are aggregated

HARDWARE:

- Computer: UNIVAC 1108
- Operating system: Exec 8
- Minimum storage required: 21K
- Peripheral equipment: Card reader and printer

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Theater Rates Model, December 1974, USACAA. Available in Defense Documentation Center
- Preceeding publication represents complete user's and technical documentation

TIME REQUIREMENTS:

- Approximately one month to acquire basic data
- One week to structure data in model input format
- One minute CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 times per year

USER: U.S. Army Deputy Chief of Staff for Operations and Plans

POINT OF CONTACT: Mr. C. E. Van Albert
USACAA-WGT
8120 Woodmont Avenue
Bethesda, MD 20014
Telephone: (301) 295-1696

KEYWORD LISTING: Analytical Model; General war (Nonnuclear); Theater Level conflict; Two-Sided; Deterministic

TITLE: UNICORN - Conventional/Nuclear Weapon Allocator Model

PROPONENT: Office of the Deputy Assistant Secretary of Defense Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Incorporated

PURPOSE: UNICORN is a conventional/nuclear weapon allocator that addresses those kinds of issues revolving around the employment capabilities of a conventional/nuclear arsenal against a snapshot target array, which may consist of fixed targets or operating areas of troop units. The target array can be of arbitrary size, ranging from division or less through thearer. Weapons can be any conventional or nuclear indirect fire weapons, ranging from tactical through strategic. The model optimally allocates weapons of varying characteristics against targets of various types. Each weapon and target location can be explicitly defined, and the weapon - target range considered in determining weapon impact error estimates. The model can allocate both nuclear and conventional weapons as a function of range, survivability estimates, weapon effectiveness, target acquisition capability, and various constraints. For nuclear attack, either a radiation or a blast criteria may be specified. The user has the option of specifying an upper limit for blast and radiation levels. In addition to the damage limitation consideration, the model can guarantee a least cost allocation which achieves user specified levels of firepower and mobility damage. User specified levels of target damage in a number of user-defined target categories can also be guaranteed. A weapon effectiveness drawdown can be readily determined, including optimal weapon deployment. The program also considers the effects of rate of fire limitations caused by weapons systems rates of fire, target acquisition, tactical and strategic $C^3$, and weapon survivability estimates.

GENERAL DESCRIPTION: The model uses generalized linear programming to efficiently enumerate all of the possible assignments of weapons to targets. The method of solution is an iterative process, with a small number of possible assignments considered at each step. The best subset of assignments at each step is chosen by a linear program. The process ends when no new assignments can be made or when the potential improvement in the objective function value falls below a specified level. The objective function is a sum of values from concave nonlinear functions, each reflecting the expected damage of the particular weapon - target combination.

INPUT:

- o Scenario variables
- o Weapon variables
- o Target variables
- o Collateral radiation and blast restriction variables
- o Weapon and target hedge variables
- o Force design constraint variables
- o Optimal deployment variables

OUTPUT:

- o Summaries in terms of the weapon allocation and targets and value destroyed
- o Extensive summary of input data
- o Output options allow detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- The model is basically one-sided, and considers estimates of opponent responses rather than dynamically calculating which might happen over time.
- Expected value calculations are generally performed.
- Targets defined in the target array structure are considered to be independent.
- A flat-earth calculator is used to compute weapon to target ranges.
- Direct fire attrition to troop units is not considered.

HARDWARE:

- Computer: GE/Honeywell 645, IBM 370/145, Honeywell 6080, IBM 360
- Operating System: MULTICS(MIT), CT67 (IBM)
- Minimum Storage Required: Honeywell-71K bytes, IBM-284K bytes
- Peripheral Equipment: Standard scratch disk plus permanent disk

SOFTWARE:

- Programming Languages: FORTRAN IV
- Documentation is available. The model is dynamic and under constant revision. Documentation is updated periodically.

TIME REQUIREMENTS:

- 1 day or less to acquire and structure base data in model input format
- 10-60 seconds CPU time
- 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION:

- The model is Unclassified
- Data is up to TOP SECRET

FREQUENCY OF USE: Several hundred times per year

USERS:

- Principal: OASD(PA&E)
- Other: CIA, NMCSSC

POINT OF CONTACT: OASD(PA&E), Strategic Programs
The Pentagon
Washington, D.C. 20301
Telephone OX 5-9180 (Area Code 202)

KEYWORD LISTING: Analytical Model, Theater War, Land Forces, Air Force, Sea Forces, Computerized, Linear Programming, Nuclear Weapons

TITLE: VALIMAR

PROPONENT: OJCS, J-5/SAGA

DEVELOPER: DCA, NMCSSC and The LAMBDA Corp.

PURPOSE: VALIMAR is a computerized, analytic model designed to assess the damage effected by the offensive forces of each of two opposing sides attacking, successively, the target base of the others. In so doing, the model addresses the problem of allocation of weapons to targets.

GENERAL DESCRIPTION: VALIMAR is a highly aggregated, expected value, nuclear exchange model designed to evaluate the destructive capability of two strategic forces. This is accomplished by selecting a subgrouping of the targets as "preferred" targets, then constructing an allocation to achieve a specified fraction of damage on this subgrouping. The allocation itself uses lagrange multipliers to achieve maximum real buy (difference between target value destroyed and weapon value expended).

INPUT: Target characteristics, weapon characteristics (yield, CEP, HOB, survival expectancy, vulnerability, and penetration expectancy) and attack strategies (optional).

OUTPUT: Consists primarily of computer printout, reporting on both input items and results of the scenario, specifically, data base input can be checked in two formats, one of which permits an easy comparison of different data bases. As to reporting scenario results, a target destruction summary is produced as well as target-by-target breadkowns and a brief allocation summary. In addition, customized reports may be generated, from input and results, according to user-designed formats.

MODEL LIMITATIONS:

- A maximum of 48 weapons and 150 target classes
- Individual target and weapon units are not identified (they are aggregated)
- Time, geography, and physical movement are not simulated

HARDWARE:

- Computer: HIS 6000
- Operating System: GCOS
- Minimum Storage Required: 50K
- Peripheral Equipment: 540 links of disc storage

SOFTWARE:

- Programming Language: FORTRAN and GMAP
- Documentation: Users Manual, TM94-75, available from Commander, NMCSSC, B-215, The Pentagon, Washington, DC

TIME REQUIREMENTS:

- Prepare Data Base: 5 hours
- CPU Time: 15 minutes
- Analyze Output: 10 hours

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 600 times per year

USERS: OJCS, J-5 and SAGA

POINT OF CONTACT: Commander
National Military Command Systems Support Center
B-215
The Pentagon, Washington, DC 20301
Phone: 695-0258

MISCELLANEOUS: Portions of VALIMAR's data base consist of data which is related to vulnerability of targets. These numbers can be calculated by the integrated response parameter system (IRS) currently being developed by the NMCSSC (B-215).

KEYWORD LISTING: Aggregated, Lagrange, VALIMAR, Allocator, Damage Assessment, Analytical Model; General War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic

TITLE: VECTOR-1, A Theater Battle Model

PROPONENT: Weapons Systems Evaluation Group (WSEG)

DEVELOPER: Vector Research, Incorporated

PURPOSE: VECTOR-1 is a computerized, analytical, midintensity, non-nuclear warfare model developed for use in estimating net assessments, performing force deployment studies and generating information for performing trade offs among weapon systems. The outcome of force interactions is determined in terms of FEBA movement and the attritions of personnel and individual weapon systems.

GENERAL DESCRIPTION: The VECTOR-1 model is a two-sided deterministic simulation of integrated land and air combat. The level of aggregation is the maneuver battalion or its equivalent. It is a theater-level model, but may be applied without modification to corps-level model, but may be applied without modification to corps-level engagements. Employing small time steps, modified differential equations of combat are used to compute dynamically the outcome of attacks involving maneuver battalions. Other model activities are performed using larger time steps, e.g., one day. Tactical decision rules supplied by the user provide for flexibility in controlling model decision processes. Ten different types of maneuver battalions or the equivalent may be played for each side. Each side may employ nine types of maneuver unit weapon systems and seven types of tactical aircraft, as well as artillery, mines, helicopters, air defense artillery systems and aircraft shelters.

INPUT:

- Initial forces and supply inventories, and a schedule of weapon, personnel and supply arrivals in the theaters.
- Basic weapons performance data (not aggregated into a form such as firepower scores).
- Geographic and terrain data
- Tactical decision rules

OUTPUT: Daily and cumulative casualties and weapon system losses, by type, are provided, and supply consumption data are given by type of supply. Current inventories of weapons, personnel and supplies are also listed. All of these data are given for individual battalions (if applicable), and are also presented as sector (corps) and theater totals. Reserve forces are explicitly accounted for. Numbers of sorties flown on each mission are given for each aircraft type. The daily activity of each battalion is shown, along with its daily FEBA position. Attributions of casualties and weapon system losses to the enemy system type which inflicted the attrition are presented.

MODEL LIMITATIONS: The model is limited to specific maximum numbers of unit types, weapon system types and geographic sectors. Memory sizes of the computers which were expected to be used were considered in establishing the limitations.

HARDWARE REQUIREMENTS: The model has been successfully exercised on IBM 370/168, UNIVAC 1108 and CDC 6400 computers. The minimum storage requirement is approximately 50K (decimal). Peripheral equipment requirements include disk pack and tape.

SOFTWARE:

- Programming Language: ANSI Fortran
- Documentation: WSEG Report 251, VECTOR-1
  WSEG Report 260, Preprocessor for VECTOR-1
- The above documents constitute complete user's and technical documentation.

TIME REQUIREMENTS: An estimated six man-months are required to acquire base data and structure it in model input format. This time can be reduced considerably for other than the initial utilization of the model, since few changes to much of the data (e.g., basic weapon system performance data) would be expected for subsequent studies. Also, a data preprocessor is available which provides an interface with the automated OSD data file described in Nato Task Force Action Memorandum 3 (NTFAM-3), allowing model users with access to this file to reduce substantially the required data preparation time. For typical games, the model requires approximately 11 seconds CPU time per combat day. The time required to analyze and evaluate results is dependent upon the range and depth of the analysis; however, the level of detail available in the output facilitates efficient analysis and evaluation.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Since the model is newly developed, it has not as yet been used operationally.

USERS: Anticipated users include SAGA, USACAA and WSEG.

POINT OF CONTACT: Weapons Systems Evaluation Group
400 Army Navy Drive
Arlington, Virginia 22202

KEYWORD LISTING: Analytical Model; General War; Land Forces; Air Forces; Computerized; Two-Sided, Deterministic; Time Step

TITLE: VONSIM-AUTOVON Simulation

PROPONENT: DNA

DEVELOPER: The BDM Corporation

PURPOSE: This model was developed to assess AUTOVON system performance as it relates to the support of critical command and control communications during periods of both benign and stressed operating environments. Transient/permanent component upset and functional impairment of network assets due to EMP illumination are addressed in detail.

GENERAL DESCRIPTION: The AUTOVON system simulation is a dynamic, event stepped digital computer model employing both deterministic and stochastic solution techniques. All message traffic is discretely modeled on a call-by-call basis. $C^2$ call interdependencies are permitted including message aggregation, alternate destinations and dependency chains. Network switching centers are modeled at a functional level whereby calls are processed through distinct operational classes where each class typically requires a unique type of switch resource. All logical processes performed by the switches are represented in detail which accommodates variations in hardware/software/procedures among the switches. Temporal/spacial variations in EMP illuminations are translated into functional impairments including call dropping and misrouting, switch and link outages, increased processing time and erroneous induced service requests.

INPUT:

- o Network configuration (number and type of switches, interconnectivity, multi-homed subscribers of interest)
- o Representative traffic sample of day-to-day operations
- o Attack scenario (time and location of bursts)
- o Casual message scenario ($C^2$ traffic)
- o Control parameters

OUTPUT: A file of all events processed by the simulation is generated to provide for complete flexibility in game outcome recapitulation and analysis.

- o The main game itself provides aggregate statistics of performance for the $C^2$ and routine traffic classes such as blocking probabilities and speed of service
- o A summary of the processing of each distinct $C^2$ call is available
- o The set of $C^2$ calls can be sorted into various subclasses dependent on user needs
- o Specific point-to-point performance statistics can be generated

MODEL LIMITATIONS:

- o Addresses only EMP caused impairments although other types can be treated parametrically
- o Routing procedures are limited to those currently employed by AUTOVON. (All routing logic is contained in a replaceable submodel)

HARDWARE:

- Computer: CDC 6000-7000 systems
- Operating System: SCOPE
- Storage Required: 120-150K Octal
- Peripherals: Disk storage for five files and one tape drive

SOFTWARE: Programming language is CSC FORTRAN IV extended

TIME REQUIREMENTS:

- Data Base: The network configuration is provided by AT&T on magnetic tape from which the VONSIM data base is generated in one three-minute computer run. No experience is available for other networks
- Burst and message scenarios can require fron one to eight man-weeks of effort depending on size, complexity and starting point.
- The model executes at 2-2 1/2 times real time for busy hour traffic loads
- Run preparation including input of control parameters requires one half to one hour
- Rigorous run analysis is typically done in less than a day

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: On a continuing basis in support of DNA ongoing EMP testing and analysis.

USERS: The BDM Corporation for DNA

POINT OF CONTACT: Mr. J.P. Riceman
Mr. R.H. Schmidt
The BDM Corporation
1920 Aline Avenue
Vienna, Virginia 22180
Telephone: (703) 893-0750

KEYWORD LISTING: Digital Computer Simulation, Electromagnetic Pulse, Communications Analysis, Network Analysis, AUTOVON

TITLE: WARF - Wartime Replacement Factors

PROPONENT: HQ US Army, DCSOPS

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: WARF is a computer assisted family of analytical, mathematical and bookkeeping models used to computer loss rates for up to 500 major items of equipment (MIE) for a combat theater. Ten causes of loss are considered for five zones within a theater over four mission postures. A large number of the loss rates were developed by analysis of WWII and Korean War battles, however, simulations of tactical losses are used to the miximum to replace the historically developed loss rates. The Concepts Analysis model (CEM) is a theater level mode that simulates losses to purely tactical MIE (up to 41) within artillery range of the Forward Edge of the Battle Area (FEBA). A family of artillery models from the AMMORATES system (TAM, FPM and CAM) are used to compute artillery losses to blue MIE for all equipments with artillery range. An intermediate roll-up routine, the loss consolidator (LOSCON), prepares and combines the loss rates for entry into a bookkeeping routine called the WARF Generator (WARFGEN). Inter theater loss rates may be applied within the WARF system and calibration of loss rates in the theater model for key tactical items is accomplished by producing expected results from the discrete Tank-Antitank (TATS) simulation in AMMORATES. The computed WARF is the average monthly loss rates expressed as a percent.

GENERAL DESCRIPTION: WARF uses a family of computer models which are briefly described here. More detailed descriptions for each specific model are contained elsewhere in this catalog.

- o Concepts Evaluation Model (CEM): A theater-level model used for force design having 4 terrain types, tactical weapons, helicopters, artillery and air. It considers force mix, intelligence, decisions, casualty assessment and FEBA movement. Its decision process is unique for theater-level models. CEM is deterministic and maintains status files for equipment, units and logistics.
- o Target Acquisition Model (TAM)/AMMORATES: The TAM is a deterministic model which, given sensor probabilities for detection, detects units arrayed and passes the list of detected units to the FPM. Errors are made in both unit size and location.
- o Fire Planning Model (FPM)/AMMORATES: The FPM is a deterministic model receiving detected units from the RAM and produces a target list against which firing units are employed using appropriate firing doctrine.
- o Casualty Assessment Model (CAM)/AMMORATES: CAM is a mathematical model which determines the kill of MIE based upon accuracy, target size and lethal area. Casualties are assessed based upon fire missions from the FPM.
- o Loss Consolidator (LOSCON): LOSCON is a roll-up routine which combines loss rates from CEM, Artillery play and Historic rates into a 200 cell matrix for input to WARFGEN.
- o WARF Generator (WARFGEN): WARFGEN is a bookkeeping routine that uses the loss rate matrix from LOSCON, inter theater shipping loss rates, equipment profiles by zone and theater postures to compute a WARF.

INPUT: See individual models

OUTPUT: The principal output from WARFGEN is a detailed or abbreviated summary of the components used to derive the WARF. Intermediate outputs from the other supporting models are varied and voluminous.

MODEL LIMITATIONS:

- o 500 items for WARF computation
- o Single theater
- o Extensive resource requirements, both personnel and machine time

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII, level 31
- o Minimum Storage Required: 115K (CEM)
- o Peripheral Equipment: Tape drive, disc drive, printer and optional graphics output and mechanical plotter

SOFTWARE:

- o Algorithm Language: FORTRAN V
- o Documentation: Users guide to be available in June 1975

TIME REQUIREMENTS:

- o 6-24 person months for data acquisition
- o 30 hours of computer time for complete cycle
- o 6 team months for cycle time (4 person team)

SECURITY CLASSIFICATION: Unclassified (WARF product is Confidential)

FREQUENCY OF USE: Newly developed

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: US Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, Maryland 20014
ATTN: War Gaming Directorate
Telephone: (301) 295-1677

MISCELLANEOUS: WARF was a 3 phase methodology improvement study started in March 1973 at the request of ACSFOR (now DCSRDA). Phase I was feasibility, Phase II was system design and Phase III combined system implementation and a production cycle to be completed in June 1975.

KEYWORD LISTING: Analytic, Model, Computerized, General War, Two-Sided

**TITLE:** WEAPON - A Tactical Fighter Weapon Effectiveness Model

**PROPONENT:** USAF (AF/SA)

**DEVELOPER:** AF/OA

**PURPOSE:** WEAPON is a computerized, analytical computer program that evaluates the effectiveness of current, non-nuclear weapons as delivered by fighter aircraft against an array of various targets. The model is designed to aid in the determination of weapon mix requirements for the HQ USAF Nonnuclear Consumables Annual Analysis and to support other studies that require the determination of the number of weapons required to produce a prescribed level of damage on a target (weaponeering).

**GENERAL DESCRIPTION:** WEAPON is a one-sided, deterministic model involving air forces only. It is capable of considering combinations of 1 weapon/1 aircraft/ 1 target, and of aggregating up to combinations of 100 weapons/50 aircraft/ 100 targets. The methodology employed is based on the procedures of the "Joint Munitions Effectiveness Manual (JMEM), Air Delivered Nonnuclear Weapons (U), July 1966," classified CONFIDENTIAL. The operational factors and tactics represented are based on methods taught at the USAF Fighter Weapons Center, Nellis AFB.

**INPUT:**

- Weapon delivery parameters, aircraft operational factors, and descriptions of each target to be attacked. For each weapon, there is required a table of weapon effectiveness values against each type, or category, of targets, the weaponeering kill mechanism to consider, and the desired level of damage for each target.

**OUTPUT:**

- Basic output: table containing the number of weapons required to "defeat" each input target for each applicable weapon-target pair.

- Optional printouts: table of targets destroyed per sortie and the individual probabilities of kill per sortie; also, detailed listing of several of the intermediate computed values used in the weaponeering calculations.

**MODEL LIMITATIONS:**

- 100 targets

- 100 weapons (50 high and 50 low)

- 50 aircraft

**HARDWARE:**

- Computer: IBM 7094, GE 635

- Operating System: IBSYS (IBM); GECOS (GE).

- Minimum Storage Required: IBM - 32K words of core storage, plus "overlay feature."
  GE - 34K, no overlay.

- Peripheral Equipment: 3 magnetic tapes as intermediate storage during program execution for IBM and DISCS as intermediate storage for GE 635.

SOFTWARE:

- Programming Language: FORTRAN IV

- Documentation:
  HQ USAF, AF/OA Memorandum 69-11, "WEAPON, A Tactical Fighter Weapon Effectiveness Model," July 1970, in four volumes:
  - Vol. I - A General Description of the WEAPON Model (U)
  - Vol. II - Weaponeering Methodologies Used in the WEAPON Model (U)
  - Vol. III - The WEAPON Program Manual (U)
  - Vol. IV - Sample Input and Output of the WEAPON Model (U) (S)

- The above represents both complete user's documentation and complete technical documentation.

TIME REQUIREMENTS:

- 1 man-month to acquire base data.

- 2 man-weeks to structure data in model input format.

- 4 minutes CPU time per model cycle for an average number of inputs.

- 3 man-days to analyze and evaluate results.

SECURITY CLASSIFICATION:

- The program and that documentation limited to a description of the program are UNCLASSIFIED.

- Typical input data and the output are SECRET and documented "real" examples thereby become SECRET.

FREQUENCY OF USE: Monthly

USERS: USAF (AF/Studies and Analysis)

POINT OF CONTACT:

HQ USAF
Assistant Chief of Staff, Studies and Analysis
AF/SAA
Lynn Building
1111 19th Street
Arlington, Virginia 22209
Telephone: OX 4-8036

MISCELLANEOUS:

- WEAPON provides input to the TAC SELECTOR Model.

- It is currently planned to restructure the model to reduce core size and eliminate unnecessary subroutines (SABER Mix study use).

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Air Forces; Computerized; One-Sided; Deterministic.

## LIST OF MODELS BY PROPONENT

Office of the Assistant Secretary of Defense, Program Analysis & Evaluation

AEM HEDGE - Arsenal Exchange Model
HALL
SSA - Static Sector Analysis Model
SUPER-ACE
TANK
UNICORN - Conventional/Nuclear Weapon Allocator

Organization of the Joint Chiefs of Staff, Logistics Directorate

ALM - Aircraft Loader Model
BUILDUP
ETNAM - European Theater Network Analysis Model
GFE III - Gross Feasibility Estimator
MACE - Military Airlift Capability Estimator
POSTURE - Posture System
RAPIDSIM - Rapid Intertheater Deployment Simulator
SITAP - Simulator for Transportation Analysis and Planning
TRACS - Transportation Requirements and Capabilities Simulation

Organization of the Joint Chiefs of Staff, Plans and Policy Directorate

SIDAC - Single Integrated Damage Assessment Capability
VALIMAR

Organization of the Joint Chiefs of Staff, Studies, Analysis and Gaming Agency

COMPLEXER
FORDIM - Force Distribution Model
GACAM - Ground Air Campaign Model
IDAGAM I - IDA Ground Air Model
NUCWAL - Weapons Allocation and Optimization Model
Politico-Military Simulation
SATAN III - Simulation for Assessment of Tactical Nuclear Weapons

Headquarter, US Army, Office of the Comptroller

FCIS - Force Cost Information System

Headquarters, US Army, Deputy Chief of Staff for Logistics

SIGMALOG I - Simulation and Gaming Methods for Analysis fo Logistics
SIGMALOG II - Simulation and Gaming Methods for Analysis of Logistics

Headquarters, U.S. Army, Deputy Chief of Staff for Operations and Plans

AREA DOMINATION II
NEWCON
ROA - Rank Order Model
WARF - Wartime Replacement Factors

U.S. Army Missile Command

MABS - Mixed Air Battle Simulation

U.S. Army Ballistic Missile Defense Program Office

ANSR - Analysis of Safeguard Repertoire
SLATEM - Submarine Launch Assignment Targeting and Effectiveness

U.S. Army Logistics Center

AMPS - Air Movement Planning System
LDB - Logistics Data Base
MAWLOGS - Models of the Army Worldwide Logistics System
MESM - Multiechelon Supply Model
PLOM - Prescribed Load Optimization Model
SPSM - Supply Point Simulation Model

U.S. Army Combined Arms Combat Development Agency

DIVOPS - Division Operations Model
DIVWAG - Division War Game Model
DYNTACS - Dynamic Tactical Simulator
IUA - Individual Unit Action

U.S. Army Concepts Analysis Agency

AMMORATES - Ammunition Rates
ATLAS - A Tactical Logistical and Air Simulation
BAM - Blue Artillery Model
CAM - Artillery Casualty Assessment Model
CAMP - Computer Assisted Match Program
CARMONETTE VI - Computer Simulation of Small Unit Combat
CEM - Concepts Evaluation Model
COMMEL II - Integrated Tactical & Communications Simulation
CONTACA
FASTALS - Force Analysis of Theater Administration and Logistics Support

## LIST OF MODELS BY PROPONENT
(Cont'd)

U.S. Army Concepts Analysis Agency (cont'd)

FORECAST II
FOREWON - Automated Force Planning System
HOVARM - Anti-Armor Helicopter Combat Model
HOVER - Anti-Personnel Helicopter Combat Model
ICM - Infantry Combat Model
NUFAM - Nuclear Fire Planning and Assessment Model
NUREX - Nuclear Requirements Extrapolator
PFD-SAM - Preliminary Force Designer Simulation Allocation Model
RAM - Red Artillery Model
SMOBSMOD - Strategic Mobility Simulation Model
TAM - Target Acquisition Model
TARTARUS IV - TARTARUS IV N/COCO
TATS - Tank/Anti-tank Simulation
TRM - Theater Rates Model

U.S. Army Defense School

CADENS IV - CONUS Air Defense Engagement Simulator
TACOS II

U.S. Army Signal School

SIMCE - Simulation - Communication-Electronics

U.S. Army Academy of Health Sciences

Hospital
PWM - Patient Workload Model

Chief of Naval Operations, OP-95

APAIR - ASW Program Air Engagement Model
APSUB Mod 2 - ASW Program Submarine Engagement Model
APSURF - ASW Program Surface Ship Engagement Model
APSURV - ASW Program Surveillance Model
MIPES - Mixed Platform Encounter Simulation

Chief of Naval Operations, OP-96

ASGRAM - Anti-Submarine Graphical Resource Allocation Model
ASWAS - ASW Air Systems Model
CAM-SAAB - Counter Anti-Ship Missiles - Simulated Air-to-Air Battle
CAM/SAM - Countering Anti-Ship Missiles - Surface-to-Air Missile Submodel
CREST - Computer Routine for Evaluation of Simulated Tactics
DSL - Detailed Ship Loading Model
Fire Support Simulation

Chief of Naval Operations, OP-96 (Cont'd)

FOZ - Footprints by Oz
LOTRAK II - ASW Localization Model
Mine Hunting Model
NEMO III - Nuclear Exchange Model
NEWS - Navy Electronic Warfare Simulator
PTMOS - Port and Mode Selection Model
SALUM - Ship and Aircraft Loading and Unloading Model
SAMEM - Sustained Attrition
SEALIFT
STS - Ship to Shore Model

Office of Naval Research

STEAM - Search Tactic Effectiveness Analysis Model

Naval Air Systems Command

STAB II - Anti-Air Warfare Battle Model

Naval Electronics Laboratory

CAS/DAM - Casualty/Damage Assessment

Military Sealift Command

PROFORMA - Pre-voyage Performance Analysis

Center for Naval Analyses

SUBDUEL - Series of Submarine Tactical Simulation Models

Headquarters, United States Marine Corps

LFWG - Landing Force War Game
TESE - Tactical Exercise Simulator and Evaluator

Headquarters, United States Air Force, Assistant Chief of Staff, Studies and Analysis

ALM - Airlift Loading Model
COLLIDE - An Aggregated Conversion Model for Air Combat
FAIRPASS - Fighter Aircraft Penetration Assessment
GIANT - Geometric Interceptor Analysis Technique

Headquarters, United States Air Force, Assistant Chief of Staff, Studies and Analysis (Cont'd)

RUNWAY FINDER
SADDLE - Strategic Assured Destruction and Damage Limiting Evaluation
SOURCE - Simulation of Utilization, Resources, Cost and Efficiency
STRAT SENTRY
SUAS - Small Unit Action Simulator
SURVIVOR - Aggregated Survivability of Aircraft Forces as a result of an attack by Submarine Launched Ballistic Missiles
TAC AVENGER - Tactical Air Capabilities, Avionics, Energy Maneuverability Evaluation and Research
TAC CONTENDER - Evaluation of the Effectiveness of Tactical Fighter Forces
TOTEM - Theater Operations Tactical Evaluation Model
WEAPON - Tactical Fighter Weapon Effectiveness Model

Strategic Air Command

OASIS - Operational Analysis Strategic Interactions Simulation
STRATEGEM - Strategic Relative Advantage Model
STRAT SCALES - Strategic Cyclic Analysis and Evaluation System

United States Air Force Armament Development Test Center

SADS I - Real Time SADS I Missile Program

United States Air Force Human Resources Laboratory

CAROM - Career Rotation Model
TLS - Training Line Simulator
TOPOPS - Total Objective Plan for the Officer Procurement System

United States Air Force Systems Command, Foreign Technology Division

OSAGE - One Strike Allocation Generator

Aerospace Defense Command, NORAD

Interceptor - Interceptor War Game Model
RADPBS - Radar Observation System
SDPS - Space Defense Planning Simulator

Defense Communications Agency, National Military Command System Support Center

ABM-I - General War Antiballistic Missile System Model
SNAP - Strategic Nuclear Attack Planning System

## LIST OF MODELS BY PROPONENT
## (Cont'd)

Defense Intelligence Agency

NDAM - Nuclear Damage Assessment Model

Defense Nuclear Agency

ATR - Air Transportation of Radiation
COMBAT II
DACOMP - Damage Assessment Computer Program
DCAPS - Dual Criteria Aimpoint Selection Program
NUCROM - Nuclear Rainout Model
SEER III - Simplified Estimation of Exposure to Radiation
VONSIM - AUTOVON Simulation

Weapons Systems Evaluation Group

LULEJIAN I
SIMETTE - Simulation Exchange Model
VECTOR I - VECTOR - A Theater Battle Model

Defense Civil Preparedness Agency

DASH III - Computerized System for Performing Detailed Assessments of the Hazards of Nuclear Attack

United States Arms Control and Disarmament Agency

ACM - Air Campaign Model
SIRNEM - Strategic International Relations Nuclear Exchange Model

Office of Preparedness, General Services Administration

AGM - Attack Generator Model
INFERS - Interindustry National Feasible Economic Recovery System
REACT
READY
RISK II

Stanford Research Institute

DOSDIS - Prompt Effects and Dose Distribution Model

Science Applications, Inc.

FAST - Fratricide Avoidance Sequencer and Timer
FTPRINT - Footprint

Lawrence Livermore Laboratory

DWEEPS

# LIST OF MODELS BY DEVELOPER

Office of the Assistant Secretary of Defense, Program Analysis & Evaluation

SSA - Static Sector Analysis

Organization of the Joint Chiefs of Staff, Studies, Analysis and Gaming Agency

COMPLEXER
FORDIM - Force Distribution Model
PMS - Politico-Military Simulation

US Army Concepts Analysis Agency

AMMORATES - Ammunition Rates
BAM - Blue Artillery Model
CAM - Artillery Casualty Assessment Model
CAMP - Computer Assisted Match Program
COMMEL II - Integrated Tactical & Communication Simulation
CONTACA
FORECAST II
HOVARM - Anti-Armor Helicopter Combat Model
ICM - Infantry Combat Model
NUFAM - Nuclear Fire Planning and Assessment Model
NUREX - Nuclear Requirements Extrapolator
RAM - Red Artillery Model
SMOBSMOD - Strategic Mobility Simulation Model
TAM - Target Acquisition Model
TARTARUS IV - TARTARUS IV N/COCO
TATS - Tank/Anti-tank Simulation
TRM - Theater Rates Model
WARF - Wartime Replacement Factors

US Army Logistics Center

AMPS - Air Movement Planning System
PWM - Patient Workload Model

US Army Air Defense School

CADEMS IV - CONUS Air Defense Engagement Simulator
CADENS IV - CONUS Air Defense Engagement Simulator

US Army Academy of Health Sciences

Hospital

US Army Management Systems Support Agency

FCIS - Force Cost Information System

USA/USAF Intratheater Transportation Requirements Study Group

TRACS - Transportation Requirements and Capabilities Simulation

US Naval War College

NEWS - Navy Electronic Warfare Simulator

Center for Naval Analyses

CAM-SAAB - Counter Anti-Ship Missles - Simulated Air-to-Air Battle
CAM/SAM - Countering Anti-Ship Missles - Surface-to-Air Missle Submodel
SEALIFT
SUBDUEL - Series of Submarine Tactical Simulation Models

Naval Surface Weapons Center

DSL - Detailed Ship Loading Model
FSS - Fire Support SImulation
MHM - Mine Huntiing Model
MIPES - Mixed Platfoorm Encounter Simulation
PROFORMA - Pre-voyage Performance Nalaysis
PTMOS - Port and Mode Selection Model
SALUM - Ship and Aircraft Loading and Unloading Model
SAMEM - Sustained Attrition
STS - Ship to Shore Model

Naval Command Systems Support Activity

NEMO III - Nuclear Exchange Model

Naval Air Development Center

STAB II - Anti-Air Warfare Battle Model

Naval Weapons Laboratory

APSUB Mod 2 - ASW Program Submarine Engagement Model

Headquarters, United States Marine Corps

LFWG - Landing Force War Game
TESE - Tactical Exercise Simulator and Evaluator

## LIST OF MODELS BY DEVELOPER
## (Cont'd)

Headquarters, United States Air Force, Assistant Chief of Staff, Studies and Analysis

- ALM - Airlift Loading Model
- COLLIDE - An Aggregated Conversion Model for Air Combat
- FAIRPASS - Fighter Aircraft Penetration Assessment
- GIANT - Geometric Interceptor Analysis Technique
- RUNWAY FINDER
- SADDLE - Strategic Assured Destruction and Damage Limiting Evaluation
- STRAT SENTRY
- SUAS - Small Unit Action Simulator
- SURVIVOR - Aggregated Survivability of Aircraft Forces as a Result of an attack by Submarine Launched Ballistic Missiles
- TAC AVENGER - Tactical Air Capabilities, Avionics, Energy Maneuverability Evaluation and Research
- TAC CONTENDER - Evaluation of the Effectiveness of Tactical Fighter Forces
- WEAPON - Tactical Fighter Weapon Effectiveness Model

Strategic Air Command

- STRATEGEM - Strategic Relative Advantage Model
- STRAT SCALES - Strategic Cyclic Analysis and Evaluation System

Aerospace Defense Command, NORAD

- Interceptor - Interceptor War Game Model
- RADOBS - Radar Observation System
- SDPS - Space Defense Planning Simulator

United States Air Force Armament Development Test Center

- SADS I - Real Time SADS I Missile Program

Military Airlift Command

- MACE - Military Airlift Capability Estimator

Defense Communications Agency, National Military Command System Support Center

- GFE III - Gross Feasibility Estimator
- NUCWAL - Weapons Allocation and Optimization Model
- SIDAC - Single Integrated Damage Assessment Capability
- SNAP - Strategic Nuclear Attack Planning System

Defense Intelligence Agency

- NDAM - Nuclear Damage Assessment Model

## LIST OF MODELS BY DEVELOPER
## (Cont'd)

Office of Preparedness, General Services Administration

AGM - Attack Generator Model
INFERS - Interindustry National Feasible Economic Recovery System
REACT
READY
RISK II

Academy for Interscience Methodology

FOZ - Footprints by Oz
SIRNEM - Strategic International Relations Nuclear Exchange Model

Anagram Corporation

SATAN III - Simulation for Assessment of Tactical Nuclear Weapons

Applied Physics Laboratory, John Hopkins University

ASGRAM - Anti-Submarine Graphical Resource Allocation Model
ASWAS - ASW Air Systems Model
CREST - Computer Routine for Evaluation of Simulated Tactics
LOTRAK II - ASW Localization Model

The BDM Corporation

COMBAT II
DIVOPS
TACOS II
VONSIM - AUTOVON Simulation

Booz-Allen Applied Research, Inc.

IUA - Individual Unit Action
SIMCE - Simulation, Communication-Electronics

Computer Sciences Corporation

ABM-I - General War Antiballistic Missile System Model
CAS/DAM - Casualty/Damage Assessment
DIVWAG - Division War Game Model
LDB - Logistics Data Base
SITAP - Simulator for Transportation Analysis and Planning

General Research Corporation

BUILDUP
FASTRALS - Force Analysis of Theater Administration and Logistics Support

General Research Corporation (Cont'd)

RAPIDSIM - Rapid Intertheater Deployment Simulator
SIGMALOG I - Simulation and Gaming Methods for Analysis of Logistics
SIGMALOG II - Simulation and Gaming Methods for Analysis of Logistics

Decision System Associates, Inc.

CAROM - Career Rotation Model
TLS - Training Line Simulator

Institute for Defense Analyses

ALM - Aircraft Loader Model
GACAM - Ground Air Campaign Model
IDAGAM I - IDA Ground Air Model

J. D. Kettle Corporation

APAIR - ASW Program Air Engagement Model
APSURF - ASW Program Surface Ship Engagement Model

Ketron, Inc.

ACM - Air Campaign Model

Lambda Corporation

VALIMAR

Lawrence Livermore Laboratory

DWEEPS

Lulejian & Associates, Inc.

LULEJIAN I

Northrop Corporation

SOURCE - Simulation of Utilization, Resources, Cost and Efficiency

## LIST OF MODELS BY DEVELOPER
(Cont'd)

Planning Research Corporation

SIMETTE - Simulation Exchange Model
STEAM - Search Tactic Effectiveness Analysis Model
RAND CORPORATION
TOTEM - Theater Operations Tactical Evaluation Model

Research Analysis Corporation

AREA DOMINATION II
ATLAS - A Tactical Logistical and Air Simulation
CARMONETTE VI - Computer Simulation of Small Unit Combat
CEM - Concepts Evaluation Model
ETNAM - European Theater Network Analysis Model
FOREWCN - Automated Force Planning System
MAWLOGS - Models of the Army Worldwide Logistics System
MESM - Multiechelon Supply Model
PFD-SAM - Preliminary Force Designer Simulation Allocation Model
PLOM - Prescribed Load Optimization Model
POSTURE - Posture System
SPSM - Supply Point Simulation Model

Science Applications, Inc.

AEM HEDGE - Arsenal Exchange Model
ATR - Air Transportation of Radiation
DCAPS - Dual Criteria Aimpoint Selection Program
FAST - Fratricide Avoidance Sequencer and Timer
FTPRINT - Footprint
OASIS - Operational Analysis Strategic Interactions Simulation
OSAGE - One Strike Allocation Generator
SUPER-ACE
TANK
UNICORN - Conventional/Nuclear Weapon Allocator

Stanford Research Institute

ANSR - Analysis of Safeguard Repertoire
DACOMB - Damage Assessment Computer Program
DOSDIS - Prompt Effects and Dose Distribution Model
MABS - Mixed Air Battle Simulation
NEWCON
NUCROM - Nuclear Rainout Model
ROA - Rank Order Model
SEER III - Simplified Estimation of Exposure to Radiation
SLATEM - Submarine Launch Assignment Targeting and Effectiveness

System Automation Corporation

TOPOPS - Total Objective Plan for the Officer Procurement System

Systems Research Group, Ohio State University

DYNTACS - Dynamic Tactical Simulator

System Sciences, Inc.

DASH III - Computerized System for Performing Detailed Assessments of the Hazards of Nuclear Attack

Tetra-Tech, Inc.

APSURV - ASW Program Surveillance Model

Vector Research Inc.

VECTOR I - VECTOR-A Theater Battle Model

# INDEX OF MODELS BY TYPE

## STRATEGIC FORCES MODELS

## INDEX OF MODELS BY TYPE
(Cont'd)

### STRATEGIC FORCES MODELS
(Cont'd)

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### GENERAL PURPOSE LAND FORCES MODELS

## GENERAL PURPOSE LAND FORCES MODELS (Cont'd)

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## GENERAL PURPOSE AIR FORCES MODELS

## GENERAL PURPOSE AIR FORCES MODELS (Cont'd)

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## GENERAL PURPOSE NAVAL FORCES MODELS

## GENERAL PURPOSE NAVAL FORCES MODELS (Cont'd)

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## GENERAL PURPOSE COMBINED ARMS MODELS



## LOGISTICS MODELS

INDEX OF MODELS BY TYPE
(Cont'd)

LOGISTICS MODELS
(Cont'd)

Page

## PERSONNEL MODELS



## COMMUNICATIONS-ELECTRONICS MODELS



## POLITICO-MILITARY MODELS

CATALOG OF WARGAMES AND MILITARY SIMULATIONS - DATA COLLECTION SHEET

**TITLE**: (Acronym followed by full name)

**PROPONENT**: (Organization primarily responsible for maintaining model)

**DEVELOPER**: (Organization/Corporation which developed current version of the model)

**PURPOSE**: (Analysis/Training) (Manual/computerized/computer assisted) (general or limited war/politico-military/logistics/damage assessment)

(This section should contain a brief narrative covering the above, the role the model plays and the primary and secondary problem the model addresses.)

**GENERAL DESCRIPTION**: (One/two sided), (Deterministic/stochastic/mixed), (Time step/event store), (Land/Air/Sea/Paramilitary/Civilian/etc.)

(This section is a brief narrative covering the above, level of unit/personnel/equipment/target aggregation, level of exercise, ratio of game time to real time and primary solution techniques.)

**INPUT**: (For example, scenario, weapons characteristics, troop unit size, arrival dates)

**OUTPUT**: (Computer printout, plots, raw data, statistically analyzed data)

MODEL LIMITATIONS: (E.G. number of targets, no geography)

HARDWARE:

- o Type Computer -
- o Operating System -
- o Minimum Storage Required -
- o Peripheral Equipment -

SOFTWARE

- o Programming Language -
- o Documentation identification -
- o Documentation availability - (Include DDC accession numbers if assigned)

TIME REQUIREMENTS:

- o Prepare Data Base -
- o CPU Time per Cycle -
- o Data Output Analysis

SECURITY CLASSIFICATION: (Model less data)

FREQUENCY OF USE (e.g. 50 times per year/once a month)

USERS: (List primary organizations which have or are using the model)

POINT OF CONTACT:
(List organization, address, and telephone number from which additional information can be obtained. Office symbols where applicable should be included.)

MISCELLANEOUS:
(Supercessions, planned enhancements, linkage of this model to other models, etc.)

KEYWORD LISTING:
(String of single words appropriate for indexing the model in an automated system, e.g. computerized, analytical, nuclear, damage-assessment, missiles, strategic)

NOTES:
(1) The data on a single model should be capable of being typed on two pages of 55 lines per page, 80 spaces per line.
(2) Data contained in this summary must be UNCLASSIFIED.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

# REPORT DOCUMENTATION PAGE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number):

This catalog contains a brief description of 152 military simulations and models which are in general use throughout the Department of Defense. The models and simulations are categorized as to application. Thus, there are 46 Strategic Forces models, 22 General Purpose Land Forces Models, 14 General Purpose Air Forces Models, 19 General Purpose Naval Forces Models, 11 General Purpose Combined Arms Models, 32 logistics models, 3 personnel models, 3 Communications-Electronics models and 2 Politico-Military simulations.

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20 continued -

All models are listed alphabetically, and are indexed by short and long title and model type. The model descriptions were submitted by 38 proponents and reflect the efforts of 47 separate developers. The description for each model includes: proponent, developer, purpose, general description, input, output, limitations, hardware, software, time requirements, security classification, frequency of use, users, and point of contact for additional information. The inclusion of a specific model in the catalog was at the discretion of its proponent, and thus does not in any way constitute indorsement of the model by the Organization of the Joint Chiefs of Staff.