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19. SUPPLEMENTARY NOTES

Accompanied by:
- Divisional Electronic Warfare Combat (DEWCOM) Model -
  Executive Summary-CAA Doc No. D-80-4
  System Manual-CAA Doc No. D-80-6

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DEWCOM Model
Communications-Electronics
Electronic Warfare
Simulation

Electronic Countermeasures
Intelligence
Command-Control
Communications Intelligence
Radar Interception
Comm/EM Systems Analysis
Computer Simulation
Tactical (COMM) EW Analysis
War Games

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document is a manual designed to provide detailed internal information about the Divisional Electronic Warfare Combat (DEWCOM) computer simulation model, enabling an experienced programmer/analyst to maintain the model and to implement future extensions to it. The manual was prepared by C.A.C.I., Inc.-Federal under contract to the US Army Concepts Analysis Agency. The DEWCOM Model is a two-sided stochastic combat simulation model which focuses upon tactical communications and electromagnetic intelligence/threat acquisition...
systems and the electronic warfare (EW) directed against those systems. To accomplish this, the model is driven by conventional tactical engagement between a blue maneuver force against a red maneuver force. Each side consists of realistically deployed ground and close air support forces that include maneuver units, EW units, artillery units, and support units. The tactical war is driven by a set of radars that may direct units to attack, defend, move, delay or withdraw. As units begin to take tactical actions, messages are triggered which are transmitted over explicitly modeled communication links. The successful completion of these message transmissions is necessary for units to respond in the desired manner. Intelligence is gathered through direct observation of units in contact, radars, and from messages that flow between units. Increases in intelligence can in turn cause messages to be generated which may be sensed or acted upon. As messages are being transmitted over the communications facilities of one side, they are subject to being sensed by the opposing side. Several possible actions may be taken by a side upon becoming aware of the messages of the other side. The messages may be jammed, intercepted, the originator may be located, or no action at all may be taken. Intercepting a message or locating a transmitter allows an increase in the knowledge or intelligence. The model is run as a pure simulation for about 8 to 12 simulated combat hours.
# DIVISIONAL ELECTRONIC WARFARE COMBAT (DEWCOM) MODEL
## PROGRAMMER MANUAL
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1.0 INTRODUCTION

1.1 Purpose of Manual

This Divisional Electronic Warfare Combat (DEWCOM) Model Programmer Manual is designed to provide detailed internal information about the DEWCOM Model Structure and programs, to enable an experienced programmer/analyst to maintain the model and to implement future extensions to it. It assumes a thorough knowledge of the computer system on which the model is to be operated, as well as experience and proficiency in using the SIMSCRIPT II.5 programming language in which the model is written. In addition to this Programmer Manual, documentation of the DEWCOM Model includes the following:

- A DEWCOM Executive Summary, designed to provide managers with an overview of the features and capabilities of the DEWCOM Model.
- A DEWCOM User Manual, designed to provide military and civilian analysts with the information necessary to efficiently use the model. It contains extensive detail on the preparation of input data for the model as well as instructions concerning analysis of output products.
- A DEWCOM System Manual, designed to provide a Systems Analyst with the information necessary to operate the model on the computer.

1.2 Purpose of Model

The DEWCOM Model is a two-sided stochastic combat simulation model which focuses upon tactical communications and electromagnetic intelligence/threat acquisition systems and the electronic warfare (EW) directed against those systems. To accomplish this, the model is driven by conventional tactical engagement between a blue maneuver force against a red maneuver force. Each side consists of realistically deployed ground and close air support forces that include maneuver units, EW units, artillery units, and support units. The tactical war is driven by a set of orders that may direct units to attack, defend, move, delay, or withdraw. As units
begin to take tactical actions, messages are triggered which are transmitted over explicitly modeled communication links. The successful completion of these message transmissions is necessary for units to respond in the desired manner. Intelligence is gathered through direct observation of units in contact, radars, and from messages that flow between units. Increases in intelligence can in turn cause messages to be generated which may be sensed or acted upon. As messages are being transmitted over the communication facilities of one side, they are subject to being sensed by the opposing side. Several possible actions may be taken by a side upon becoming aware of the messages of the other side. The messages may be jammed, intercepted, the originator may be located, or no action at all may be taken. Intercepting messages or locating enemy transmitters increases a unit's level of intelligence of the opposing force.

The model is run as a pure simulation for about 8 to 12 simulated combat hours.

The DEWCOM Model provides for user entry of data describing a number of factors affecting the outcome of combat, including such things as:

- Combat organization
- Communications Organization
- Equipment
- Terrain
- Orders

The model can produce two sets of reports, individually selectable by the user at run time. The first set consists of formatted listings of input data as submitted by the user, one report for each major category of data. The second set consists of results of the simulation based on the input data and the internal logic of the model. In addition, the model generates an output file from which the user can prepare ad-hoc reports as required.
2.0 THE DEWCOM MODEL

2.1 Description

2.1.1 Design Characteristics

The DEWCOM Model is designed to simulate the concepts used in tactical combat, including communications-electronics and electronic warfare (EW). The model permits the analysis of communications, radars, and EW systems. The following features are incorporated in the model:

- Provision for two-sided tactical warfare with flexibility in force structure, organization, and doctrine. Through changes in model input, essentially any mix of echelons of combat forces can be simulated (e.g., Battalion to individual items of equipment, or Corps to Company, or Echelons above Corps to Brigade/Battalion). Limiting factors to what can be represented are computer size and/or model running time; such limitations may potentially be offset by simulation of a slice of the echelons to be studied.

- Realistic message processing, with the ability to depict non-degradable and degradable communications independently for either side.

- Two terrain models, one of which is the basis for line-of-sight (LOS) calculations and the other for mobility and combat attrition routines.

- Flexible artillery algorithms which allow indirect fire artillery missions as well as direct fire missions.

- Description of wear destructive effects and attrition as a function of target class, range, posture,
and other variables.

- The ability to represent command and control capabilities.
- Provision for units to change posture during the course of the battle.
- Provision for units to have a succession of tactical objectives.
- Unit movement and provision for interruption or changes in unit movement based on intelligence and force ratios.
- Provision for two-sided electronic warfare functions of jamming, intercepting, and direction finding.
- Display of radar and communications transmitters as tactical signal emitters.
- The capability to reflect ground-to-air and air-to-ground data links and jammers.
- The capability to utilize communications intelligence.
- Direction finding (DF), including the capability to discriminate between long and short range DF for both intelligence implications as well as artillery targeting.
- Close air support, including rotary wing and fixed wing aircraft. Sortie attrition and failure rates are included.
2.1.2 General DEWCOM Model Structure

The overall DEWCOM methodology is reflected on the diagram on page 6 and consists of the following elements:

- The input data introduced by the user, containing all the variable data concerning such factors as organization, equipment, communications, terrain, etc. to be modelled.

- The data processor and its user-specified controls, which build the data set that drives the DEWCOM Model itself. The data processor performs certain input data verification functions by subjecting the data to reasonableness checks, builds the internal data structure from the user input, and produces reports based on the contents of the input data. The elements of the Data Processor appear on the diagram on page 7. Each READ module is a self-contained element which inputs a logical grouping of user-provided data. These modules are constructed in such a manner as to be easily substitutable to provide adaptability to alternate data input media. The current read modules include ones for Terrain, Units, Combat Organization, Communications Organization, Equipment Capabilities, Orders, and Model Controls, i.e., one for each of the major input data categories. There is a one-to-one correspondence between READ and WRITE modules.

- The DEWCOM Model itself, consisting of a large number of computer routines organized into several modules which simulate the passage of time and the multitude of interrelated processes occurring during the combat
DEWCOM METHODOLOGY

INPUT DATA

INPUT DATA

DATA PROCESSOR

REPORTS

DEWCOM MODEL

REPORTS

CONTROLS

CONTROLS

QWICK QWERY FILE
DEWCOM
DATA PROCESSOR STRUCTURE

DATA PROCESSOR

INPUT/OUTPUT CONTROLS

INPUT/OUTPUT TERRAIN

INPUT/OUTPUT EQUIPMENT

INPUT/OUTPUT TYPE UNITS

INPUT/OUTPUT COMBAT ORGANIZATION

INPUT/OUTPUT COMMUNICATIONS ORGANIZATION

INPUT/OUTPUT ORDERS
period. The model produces user-specified standard output reports and an output file from which the user can generate desired ad hoc reports.

2.2 Methodology

2.2.1 Modules and Their General Functions

The DEWCOM model consists of several interrelated modules, as depicted on the diagram on page 9. The major functions of each module are as follow:

2.2.1.1 The Tactical Module

- Maneuvers units on the battleground;
- Processes orders for each unit;
- Fires weapons at opposing units and causes losses of personnel and equipment;
- Causes explicit messages to be transmitted;
- Maintains command structure;
- Collects intelligence from sources other than radar.

2.2.1.2 The Communications Module

- Processes and routes messages;
- Maintains status of communications facilities;
- Maintains communications structures.

2.2.1.3 The Electronic Warfare Module

- Intercepts enemy messages and radar transmissions;
- Performs direction finding;
- Jams enemy communications;
- Performs communications intelligence;
- Performs electronic intelligence.

2.2.1.4 The Background Traffic Module

- Reflects message traffic implicitly;
- Responds to tactical situations in volume of traffic.

2.2.2 How the Model Works

A main program provides central control for execution of the DEWCOM Model. The four modules mentioned above include many complex computer programs which represent specific activities or conditions occurring in the combat situation, as described below:

- **Unit Movement** is controlled by tactical orders. Three types of orders (attack, move, withdraw) cause a unit to move. The unit moves until the desired distance is covered, and then it executes a new tactical order. Movement is by a distance rather than time increment. An input value controls the frequency with which a unit's position is updated.

- **Direct fire attrition** is an aggregated "force on force" approach. As units are moved, they may come into contact with opposing units, causing attrition upon each other. Reduction in strength is a function of terrain, range, force ratio, and weapons. The loss of strength by a unit can cause a change in tactical orders. For example, a unit may change posture from "defend" to "withdraw". Such a change could separate the opposing forces and cause direct fire attrition to stop.

- **Indirect fire attrition** is only applied when messages requesting such fire are received by the firing units. The
routing of the message is determined by input data. Units generate requests for fire; the requests are communicated to firing units; and the missions are fired.

- **Close air support** may be requested by message sent by units to the headquarters controlling air resources. If the message succeeds, an air mission is ordered. If the communications fail because of jamming, the close air support mission is not initiated. For missions requiring ground coordination (user input) a subsequent message must succeed between a ground station and the aircraft before attrition can be applied.

- **Command and Control** is simulated in terms of orders and messages. As actions occur, messages are generated (based on input data) to direct units to take actions.

- **Message processing** is one of the most complex tasks performed by the model. This task takes the messages that are generated and routes them to the destination via links and nets defined by the input data. Message processing includes the delays that may occur for encrypting and decrypting, as well as those encountered when all available links are busy.

- **Electronic Warfare (EW)** actions (direction finding, jamming, and interception) are all directed by a set of EW orders described by input data. Direction finding and intercepting result in an increase in intelligence about the opposing side. Jamming results in the enemy being denied use of communications resources.

- **Intelligence collection** becomes the basis for many decisions in the model. Intelligence is gathered directly by units in contact with one another, direction finding, message intercepting, and radar. It is gathered indirectly
from messages that flow between units. Artillery fire can be ordered as a result of increased intelligence, and attrition on one side changes in accordance with the amount of knowledge about that side by the opposing side.

- **Implicit message functions** are modelled since it is virtually impossible (and in most cases, not desirable) to model every individual message that is transmitted among the units in the simulation. The delay time encountered by messages in the communications system may be increased as the amount of tactical activity increases to model implicit messages.

- **Radar** of two kinds is simulated in the model: counterbattery and detection. Counterbattery radar reacts to artillery fire and can gain intelligence about the firing unit. The detection radar gathers intelligence about the opposing units within range and line of sight.

- **Terrain** is taken into account by the use of two terrain models. The first describes each grid square of the terrain with parameters affecting movement rates. The second (STAR terrain model) determines the presence of optical line of sight between any two points on the battlefield. This routine is employed for direct fire combat to determine if units can engage opposing units. The routine is also employed to determine radio line of sight. The signal loss for electronic transmission is based on the existence (or absence) of visual line of sight.

### 2.2.3 Model Operating Features

The model can be stopped, have data changed, and be restarted at the point it stopped. This allows the flexibility of changing tactics in the middle of a battle. It also allows the data that describes weapon performance to be changed. The change of tac-
tics might be employed to model a commander declaring radio silence at some time. The change of the weapons data could be used to model a change in the environment such as the employment of smoke.

2.3 Processing Environment

2.3.1 Hardware

The DEWCOM Model is designed to be relatively machine-independent, able to be operated on any large scale computer system with the required software. A typical simulation run is expected to require between 300K and 500K characters of memory, or an equivalent amount on a word-oriented system. Memory (and time) requirements are highly dependent on the specific simulation being run. Data may be input using a terminal, card reader, or equivalent device. Most output is designed to be printed using a standard high speed printer. Otherwise, no special input or output equipment is required.

2.3.2 Software

The principal software requirements are a current SIMSCRIPT II.5 compiler and the QWICK QWERY retrieval and report generation package. SIMSCRIPT II.5 compilers and QWICK QWERY are currently available for the following systems:

- IBM 360/370
- UNIVAC 1100
- CDC 6000/7000
- HONEYWELL 600/6000
- DEC PDP 11

2.3.3 Data Base

The DEWCOM data base consists of the specific input data generated and input by the user. Special forms have been designed to
simplify the coding of the data for input to the model. These are described and discussed in the next section. While it is possible for the user to generated new input data for each run of the model, for practical reasons it is anticipated that the user will establish one basic data base, and make changes and refinements to it for each different simulation to be run. The data may be stored on an external medium such as cards or tape, but in most instances it is expected that it will be maintained on a direct access device such as a removable disk pack.
3.0 DESCRIPTION OF INPUT

3.1 General Description

The DEWCOM Model is driven by data supplied by the user, describing the characteristics and conditions of the forces involved in the simulated combat. The input data use English-like keywords, making them more meaningful and manageable when being prepared, modified, and verified. The data are structured for minimal repetition. For example, it is necessary to enter the characteristics of a radio only once rather than for every unit that has one. Built into the model are verification checks which look for "reasonableness" of the data. For example, probability values should be in the range of zero to one. The model does not stop when an "out of bounds" value occurs, but issues a warning notice to the user and continues.

3.2 User Control

The control available to the user of the DEWCOM Model is detailed, since the data to run the model is input rather than imbedded in the code. This control ranges from the selection of the data to run the model to the selection of reports to be generated from the model. User ability to direct the forces for either side through input is extremely flexible. The following sections provide a description of the data to operate the model.

3.3 Input Data Organization

Input data are organized into the following major categories:

- Controls
- Terrain
- Equipment
- Type Units
- Combat Organization
The first category (Controls) is concerned with the general overall operation of the model. Through it, the user identifies reports to be produced from the simulation, lists variables which do not apply exclusively to one side or the other, and otherwise establishes the general parameters for a particular "run" of the model.

The remaining six categories describe specific characteristics, capabilities, and conditions of the opposing forces being modelled, such as units, weapons, organization, combat posture, tactics, etc. and the terrain on which the simulated combat takes place. The basic building block for the forces in the model is the unit. Each unit is given a data structure so that any unit found in military organizations can be described. In this manner, it is possible to describe forces to the resolution of platoons, companies, or battalions. Units are organized in a "tree" structure to allow complete freedom in describing the command structure.

3.4 Input Data Conventions

Unless otherwise specified, all seven categories of data are required for operation of the model, and they must be input in the sequence shown in the preceding paragraph (i.e., Controls, Terrain, Equipment, Type Units, Combat Organizations, Communications Organization, and Orders). The following rules or conventions govern the input data:

- Major categories and subcategories of data are preceded by an appropriate identifying keyword and are terminated by the keyword "HALT". All keywords shown in these instructions (and the terminating keyword "HALT") must be included in the input stream, even if no data for a particular category or subcategory is being input for a given run.

- Although the SIMSCRIPT free-form "read" statement is used in this model, allowing considerable latitude in the for-
matting of input data, the specific formats and spacing shown in the instructions in the User Manual are strongly recommended in order to more clearly illustrate the data structure and relationships.

- When a zero value for a variable or field is intended, the zero (0) must be explicitly input (as opposed to leaving the field blank).

- Unless otherwise stated, numeric data should be right-justified in a field (with leading blanks, if appropriate) and alphabetic data should be left-justified (with trailing blanks).

- Since input may be through punch cards as well as other media, each line (may also be referred to as a record) is limited to 80 characters of data (including blanks).

3.5 Input Data Preparation Forms

Special forms have been designed to simplify the coding of data for input to the DEWCOM Model. Roman numerals are used to identify the order of major data categories (Controls, Terrain, Equipment, etc.) while Arabic numerals reflect the sequence of forms within a major category. Subcategories of data contained on a given form are listed adjacent to the sequence number. The numbering of forms by and within major data category permit them to be readily maintained in the proper entry sequence. Where necessary, multiple copies of a specific form can be used by lining out inapplicable key words and data fields. Details are contained in the instructions relating to each specific form in the User Manual.

The DEWCOM Model input data preparation forms are listed below. Each item identifies one specific form with its major data category (shown in all capital letters following a Roman numeral), its sequence within major category (Arabic numeral under major category), and data subcategories for which it is used (following Arabic numeral).
I. CONTROLS
   1. Global Variables Data
      Reports
   2. Side Attribute Data

II. TERRAIN
   1. Mobility Data
   2. Obstacle Data
   3. Base Height Data
   4. Hills Data
   5. Hill List Data
   6. Covers Data

III. EQUIPMENT
   1. Damage Class Data
      Communications Equipment Data
   2. EW Equipment Data
   3. Weapons Data
III. EQUIPMENT
   4. Type Sortie Data

IV. TYPE UNITS
   1. Unit Attribute Data
      Communications Equipment Owned Data
   2. EW Equipment Owned Data
      Weapons Owned Data
   3. Attrition Data
      Desirability of Firing Data
      Sector Width Data
      Performance Degradation Factor Data

V. COMBAT ORGANIZATION
   1. Units Data
   2. Air Sortie Data

VI. COMMUNICATIONS ORGANIZATION
   1. Nets and Links
   2. Compound Links

VII. ORDERS
    1. Communications Orders
    2. EW Orders
    3. Tactical Orders
VII. ORDERS

4. Posture

3.6 Input Data Preparation Instructions

Detailed instructions for completion of each of the input data preparation forms are contained in the DEWCOM User Manual and will not be repeated here. A foldout of a completed sample of each form is contained in that document following each subparagraph containing instructions governing its data fields.

All required key words are preprinted in bold block letters in the appropriate columns of each form. Key words are shown in their proper relationship to other key words and data fields. These relationships must be maintained in the input data stream.

In some instances, brief instructions for entries in the fields are contained on the form itself, adjacent to the space for the data. Areas of each form which are not to be used for data are shaded.

Where deemed necessary, a reference number or "key" is used to relate data fields on the form to the specific associated instructions. Key numbers are encircled and shown over or adjacent to a specific field, or preceding a line on the form.

The general format for detailed instructions is as follows:

Key: (When applicable; an Arabic numeral.)
Name: (The internal DEWCOM Model name for the data field or variable; all capital letters separated by dots, if appropriate; no embedded blank spaces.)
Spaces: (The maximum number of characters of data which may be entered.)
Columns: (The horizontally numbered spaces on the form in which the data are entered.)
Entries: (When applicable; a listing of the entries of type(s) of entries permitted or required in the field.)

Description: (When necessary; an explanation of the data field or variable, significance of entries, restrictions, etc.)
### 4.0 DESCRIPTION OF OUTPUT

The output products available from the DEWCOM Model are divided into three major categories:

- Input Data Reports
- Model Reports
- Ad Hoc Reports

The generation of any or all of the available reports is at the option and under control of the user.

#### 4.1 Input Data Reports

This group of reports provides the user with formatted listings reflecting actual data which was input to the model for the current run. The full simulation need not be run in order to produce these reports. In fact, one of their major uses is to permit a review of the input data for errors or omissions before a lengthy and costly simulation run is actually made.

The production of the Input Data Reports is controlled by the user at input time through entries in the REPORTS DATA section of DEWCOM Input Data Preparation Form I.1 (CONTROLS; Global Variables Data, Reports Data). Each Input Data Report number (1 through 7) entered in the appropriate blank spaces on Form I.1 results in the printing of a formatted report of the input data in the corresponding major category. The Input Data Reports are as follow:

<table>
<thead>
<tr>
<th>Report</th>
<th>Major Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>CONTROLS</td>
</tr>
<tr>
<td>D2</td>
<td>TERRAIN</td>
</tr>
<tr>
<td>D3</td>
<td>EQUIPMENT</td>
</tr>
<tr>
<td>D4</td>
<td>TYPE UNITS</td>
</tr>
<tr>
<td>D5</td>
<td>COMBAT ORGANIZATION</td>
</tr>
</tbody>
</table>
Because of the amount of data in various major input categories, some reports are printed in several parts, with related portions of the input data on each part. When a major category report is requested, all parts of that particular report are produced. The individual reports and their content are explained in the following subsections and a sample of each report format is included in Appendix D. The entire report is not printed in all cases due to the volume of data.

4.1.1 Report D1 reflects CONTROLS data input on Forms I.1 and I.2, including the following:
- Whether or not the simulation is to be started
- Identification numbers of the Data and Model reports which are to be printed
- Attributes of Blue and Red sides
- Global Variables.

4.1.2 Report D2 reflects TERRAIN data and is divided into 7 parts as follows:

4.1.2.1 Report D2A reflects mobility data input on Form II.1, including the following:
- X and Y coordinates of origin
- Size of each grid square
- Number of grid squares in the simulation
- Mobility indices of all grid squares in the simulation identified in terms of their X and Y offsets from the origin.

4.1.2.2 Report D2B reflects obstacle data input on Form II.2, including:
- X and Y grid coordinates of origin
4.1.2.3 Report D2C reflects base altitude data input on Form II.3, including:
- X and Y grid coordinates of origin
- Size of each grid square
- Number of grid squares in the simulation
- Base altitude of each grid square

4.1.2.4 Report D2D reflects hill data input on Form II.4, including:
- X and Y grid coordinates of origin
- Size of each grid square
- Number of grid squares in the simulation
- For each hill,
  - Hill ID
  - X and Y grid coordinates of the center
  - Peak height in meters
  - Orientation angle in degrees from east
  - Eccentricity of the hill mass
  - Spread of the hill mass
  - Height of normal curve describing this hill
  - Cut

4.1.2.5 Report D2E contains hill summary data, input on Form II.5, including:
- X and Y grid coordinates of origin
- Size of each grid square
- Number of grid squares in the simulation
- ID numbers of all hills appearing in each grid square
4.1.2.6 Report D2F contains covers data input on Form II.6, including:

- X and Y grid coordinates of origin
- Size of each grid square
- Number of grid squares in the simulation
- For each cover,
  - Cover ID
  - X and Y grid coordinates of the center
  - Height in meters
  - Orientation angle in degrees from east of an ellipse representing the cover
  - Length of the major axis of the ellipse in meters
  - Length of the minor axis of the ellipse

4.1.2.7 Report D2G contains covers summary data from Form II.6, including:

- X and Y grid coordinates of origin
- Size of each grid square
- Number of grid squares in the simulation
- ID number of all covers appearing in each grid square
4.1.3 Report D3 reflects EQUIPMENT data and is divided into 5 parts as follows:

4.1.3.1 Report D3A reflects Equipment Damage Class data input on Form III.1. It includes the damage class value input for each class.

4.1.3.2 Report D3B has a separate portion for each side (Blue and Red) and reflects Communications Equipment data input on Form III.1. For each item of communications equipment, the following information is included:

- Name
- Class
- Damage class
- Mean time between failures
- Mean time to repair
- Range
- Jamming awareness.

4.1.3.3 Report D3C has a separate portion for each side and reflects Electronic Warfare (EW) equipment input on Form III.2. For each named item of EW equipment, the following information is included:

- Name
- Class
- Damage class
- Mean time between failures (hours)
- Mean time to repair (hours)
- Range in meters
- DF time in seconds
- Intelligence rate
- High limit of frequency range at which effective
4.1.3.4 Report D3D has a separate portion for each side and reflects Weapons data input on Form III.3. For each weapon listed, the following information is included:

- Name
- Combat value
- Damage class
- Range
- Attrition class
- Terrain effect

4.1.3.5 Report D3E has a separate portion for each side and reflects air sortie data input on Form III.4. For each type air sortie, the following information is included:

- Name
- Class
- Ground coordination requirement
- Transit time
- Loiter time
- Effectiveness
- Transit attrition rate
- Loiter attrition rate
- Renewal time
4.1.4 Report D4 reflects TYPE UNITS data and is divided into 5 parts and follows:

4.1.4.1 Report D4A reflects type units separately by side, along with their attributes, as input on Form IV.1. For each type unit, the following information is included:
- Name
- Class
- Alternate CP existence
- Move Rate
- Radius
- Intelligence fade rate
- Maximum encryption capability
- Encryption factor
- Suppression factor
- Duration of suppression
- Artillery duration
- Artillery interval
- Communications setup time
- Communications teardown time
- EW equipment setup time
- EW equipment teardown time
- Tactical setup time
- Tactical teardown time
- EW priority
- IF priority

4.1.4.2 Report D4B is an equipment listing for each type unit, and contains a separate portion for each side. It reflects data input on Forms IV.1 and IV.2 and includes, for each type unit:
- Type unit name
- Name and quantity of each item of communications equipment
- Name and quantity of each item of EW equipment
0 Name and quantity of each type weapon

4.1.4.3 Report D4C lists attrition rates for each type of unit separately by side as input on Form IV.3. It includes type unit, attrition class, and percent attrition rates per combat day under a variety of force ratio ranges as well as for a non-combat situation.

4.1.4.4 Report D4D reflects the desirability of firing each type weapon of the opposing side at each type unit class. A separate portion is produced for each side, and the information corresponds to that input on Form IV.3.

4.1.4.5 Report D4E reflects performance degradation and sector width information separately for each side, as input of Form IV.3. A performance degradation factor is shown for each type unit class for each combat posture for various levels of cumulative attrition.

4.1.5 Report D5 reflects unit COMBAT ORGANIZATION data for each side, and contains information input on Forms V.1, V.2, and VI.1. Within each side, it provides the following for each unit:

- Unit ID
- Unit name
- Type unit
- X and Y grid coordinates of location
- Superior unit ID
- Unit IDs of subordinate units
- Communications link IDs
- Air sorties by type and number.
4.1.6 Report D6 reflects COMMUNICATIONS ORGANIZATION data and is divided into 2 parts as follows:

4.1.6.1 Report D6A reflects communications nets and links separately for each side, as input on Form VI.1. For each communications net, the following information is included:
- Type
- Model
- Security
- Usage
- Continuous carrier indication
- Primary and secondary frequencies
- Each link in the net, including
  - Link ID
  - Unit IDs of each end
  - Type equipment at each end
  - Whether one or two way
  - Desirability of use
  - Conversion time
  - Number of channels
  - Convertability
  - Switchability
  - Jamnability
  - Compound link indicator

4.1.6.2 Report D6B reflects data for compound links, separately by side, as input on Form VI.2. It includes the Net ID, the identity of each compound link in the net, and the ID of every unit in the compound link.
4.1.7 Reflect D7 reflects ORDERS data and is divided into 4 parts as follows:

4.1.7.1 Report D7A reflects communications orders for each originating unit separately by side, as input on Form VII.1. It identifies the type unit of the origin, and for each, the following information for each order:

- Destination
- Stimulus for transmission of the order
- Mode
- Precedence
- Threshold for transmission
- Length
- Intelligence value
- Action to be taken based on message
- Usage
- Security
- Deadline action
- Frequency of transmission
- Processing time
- Deadline time

4.1.7.2 Report D7-B lists EW order information separately by side, as input on Form VII.2. For each type of opposing net against which the EW order is to be executed, the following are included:

- Minimum range for execution
- Maximum range for execution
- Duration
- The preferable EW function to be performed
- The function to be carried out in the event the preferable one cannot be carried out

4.1.7.3 Report D7-C lists tactical orders separately by side, as input on Form VII.3. For each unit on the side, the following are reflected:
o Unit ID and name
o Active order
o For each combat posture order,
  - Range
  - Azimuth (direction)
  - Duration
  - Strength threshold for failure order
  - Attack force ratio
  - Failure force ratio
  - Failure order
  - Success order

4.1.7.4 Report D7-D lists the combat postures for both sides and, for each posture, the following:

  o Effectiveness
  o Strength threshold for order change
  o A multiplier to modify time duration

4.2 Model Reports

This group of reports provides the user with the status of various model factors reflecting the effects of the simulation. The reports reflect the model status at the beginning of the simulation, at intervals specified by the user at input time and at normal termination of the simulation.

Production of the Model Reports is controlled by the user at input time through entries in the REPORTS DATA section of DEMCOM Input Data Preparation Form I.1 (CONTROLS; Global Variables Data, Reports Data). Each Model Report number (1 through 7) entered in the appropriate blank spaces on Form I.1 results in the printing of a corresponding report, as follows:
The desired reports are produced at the interval specified by the user in the "REPORT.FREQUENCY" entry (Key #14) on Form I.1, and the simulated time is reflected on each. The Model Reports are explained in the following subsections, and a sample of each report format is included in Appendix E.

4.2.1 Report M1 (Unit Status) reflects status of all units on a side with a separate part produced for each side. For each unit, the following information is listed:

- Unit ID and name
- Type unit
- X and Y grid coordinates of location
- Strength
- Force ratio
- Artillery status
- Active tactical orders
- Number of units in contact list
- Number of units in indirect fire target list
- Number of messages in message list

4.2.2 Report M2 (Link Status) is produced separately for each side, and reflects the status of all communications links. The report includes the following information for each net on a side:

- Net ID
- Communications frequency (megahertz) in use
- ID of each link in the net, along with the following:
- Unit ID of each end of the link
- Link status
- Number of channels available and in use

4.2.3 Report M3 (Message Status) is produced separately for each side and reflects the status of all messages. The report includes the delay time affecting all messages due to the volume of message traffic, as well as the following:

- ID of communications order
- Originating Unit ID
- Transmitting Unit ID
- Destination ID
- Status
- Usage
- Mode
- Message length
- Minutes to deadline time

4.2.4 Report M4 (Attrition Summary) is produced separately for each side. It reflects the following information concerning each item of equipment within equipment type:

- Equipment name
- Original quantity
- Quantity destroyed
- Quantity remaining
- % remaining
- Killed by direct fire
- Killed by indirect fire
- Killed by close air support

4.2.5 Report M5 (EW Status) consists of two parts, Actions in Progress and Awaiting Action. Each part is produced separately for each side, and contains the following information:
4.2.5.1 EW Status - Actions in Progress.
- Unit ID
- Action
- Opposing side target Unit IDs

4.2.5.2 EW Status - Awaiting Action.
- IDs of opposing side units awaiting EW action
- Message ID
- Priority

4.2.6 Report M6 (Equipment Status) consists of three parts, Communications Equipment, EW Equipment, and Weapons. Each part is produced separately for each side, and contain the following information for each unit:
- Unit ID and Unit Name
- For each equipment name within type, the original quantity and the quantity currently remaining.

4.2.7 Report M7 (Intelligence Log) is produced separately for each side. It reflects the ID of each unit on a side which has intelligence information relating to opposing side units. Entries include the ID of the opposing side units about whom intelligence information is possessed, and the value of the information.

4.3 Ad Hoc Reports

Recognizing that all report requirements cannot be foreseen in advance of development of a system, provision is made for special or one-time reports to be produced from the DEWCOM Model through the use of the QWICK QWERY system.

The QWICK QWERY data analysis and report generation system was created to allow managers and programmers to selectively access and display information from existing data files. It reduces the costs and
delays associated with problem definition, system analysis, and the
coding, testing, modification, and debugging of special purpose pro-
gams. QWICK QWERY provides the means for timely retrieval and dis-
play of existing but frequently inaccessible information, satisfying
the following requirements:

- It allows the rapid generation of ad hoc reports without
  much of the usual programming delays.

- It is a powerful report design tool. Difference report
  formats, sorting sequences, attribute selections, and sub-
totals can be conveniently tried until the desired report
  is produced.

- It allows report requests to be made directly by the end
  user, avoiding the frequent miscommunications concerning
  what exactly is needed or desired.

The QWICK QWERY system provides the DEWCOM military analyst with a
very powerful and convenient analysis and report generation cap-
ability. User convenience is attained through three simple report
and request forms. Form 1 provides for the selection of specific data
items from a record and specific records from a file. It also pro-
vides for sorting and subtotal calculation. Form 2 is used when new
data items are to be computed as a function of existing data items.
It also provides the capability to do selective counting and indexing.
Form 3 provides the option of conveniently laying out the
generated report in the desired format. A blank copy of each of the
forms is contained in the Divisional Electronic Warfare Combat (DEWCOM)

The DEWCOM model writes the transaction file which must be accessed by
the QWICK QWERY System to produce the necessary reports.
5.0 PROGRAMMING DETAIL

5.1 Programming Conventions

The following programming conventions and standards are to be used to ensure consistent structured code in all modules.

5.1.1 General Structure and Indentation

To improve readability, source code should be indented to show the logical structure of the code. Names and labels should be chosen in a way that is descriptive of what is occurring. Whenever possible, code only one statement per line.

- Start statements in columns 1, 10, 15, 20, 25, 30, 35, 40, 45, and 50. Begin headings "PREAMBLE" and all "ROUTINE" declarations in column 1. Code terminator for these sections in column 1 also. Code GIVEN and YIELDING arguments each on a separate line, starting in column 10.

- To help associate a terminator with its section, include the section name in its terminator. For example:
  
PREAMBLE ROUTINE RADIO.VISIBILITY
ENDPREAMBLE ENDROUTINE

- Statement labels should occupy a separate line. To make them stand out, always begin labels in column 1.

- If a statement cannot be contained on one line, indent additional lines 5 spaces.

- Do not break a line within a keyword or name.

- Do not extend code beyond column 72.
In the preamble, begin subsection headers "PERMANENT ENTITIES", "TEMPORARY ENTITIES", and "EVENT NOTICES" in column 10. Within each, start the major definition statement in column 15 and the definition of attributes of entities (or parameters of events) in column 20.

Begin attribute definition statements in column 15.

Begin definitions of sets, routines, simple variables, "define to mean" statements, and data collection directives in column 10.

Begin the first statement in a routine or event (other than the routine specification itself) in column 10.

Code "FOR" loops in such a way that the statements controlled by the "FOR" are indented one level. Complex "FOR" statements requiring more than one line should be indented if control clauses are present.

Code "FOR" loops which search for the first case as follows:

```
10  15
FOR EACH UNIT
    WITH MI.AWAY(I)  0,
    FIND THE FIRST CASE
    IF FOUND
    ELSE
    ALWAYS
```

In this example, the clauses "FIND THE FIRST CASE" and "IF FOUND" are on the same level as the "FOR". The contents of the "FOR" are indented, and the "ELSE" and "ALWAYS" statements are placed at the same level as the "FOR".
o Indent nested "FOR" loops for each new nesting level.

o Code "IF" statements with the logic treated as one statement, indenting as specified earlier. If the statement is too long for one line, indent the "true" and "false" portions of the "IF" each one level.

o Precede blocks of code that perform a unified function with comments. To help the comments stand out, leave a blank line before and after the comments. The first word of the comment should line up with the block of code it relates to.

o It is often desirable to comment on a specific statement to expand or explain its meaning. Where possible, begin such comments in column 45.

5.1.2 The Preamble

Definitions within a Preamble should be in the following order:

PERMANENT ENTITIES
TEMPORARY ENTITIES
SYSTEM VARIABLES
PROCESSES
EVENT NOTICES
REAL GLOBAL VARIABLES
INTEGER GLOBAL VARIABLES
ALPHA GLOBAL VARIABLES
ARRAYS
SETS
DATA COLLECTION DIRECTIVES
DECLARATION OF ALL releASABLE SIMSCRIPT ROUTINES
DECLARATION OF ALL MonitoreD SIMSCRIPT ROUTINES
DEFINE TO MEAN DECLARATIVE
The following additional guidelines apply to the Preamble

Define mode of attributes of entities after their specification.

Declare the background mode as INTEGER, variable type as RECURSIVE, and DIMENSION as ZERO.

Pack variables if it is efficient to do so. Use field packing instead of bit packing whenever possible since less code is generated.

Use "DEFINE TO MEAN" statements to add more meaning to the body of the program. For example,

```
DEFINE ON TO MEAN 1
DEFINE OFF TO MEAN 2
```

5.1.3 Format of Routines, Processes, and Events

Each routine, process, and event should be coded in the following format:

```
ROUTINE NAME
   GIVEN arguments
   YIELDING arguments
   (Follow with comments beginning in column 10 for each of the headings listed below, indenting 5 columns thereafter)
      'PURPOSE
      ' (text of purpose)
      'FUNCTION
      ' (text of function of the routine)
      'COMMUNICATIONS
      'FILES
      ' (list names of additional files needed for program execution, e.g., system libraries and miscellaneous data files.
      ' All files must be defined.)
```
ARGUMENTS
GIVEN
YIELDING
ERRORS
(List error numbers associated with the names
of the routines that set the errors)
ASSOCIATED PROGRAMS
CALLED BY
(names of routines calling this routine)
CALLS
(names of routines called by this routine)
(follow with code)

An example of a routine in the above format follows:

ROUTINE TO RANGE
GIVEN

.FIRST.UNIT,
.SECOND.UNIT

PURPOSE
THE PURPOSE OF THIS ROUTINE IS TO ACT AS A RIGHT
FUNCTION TO COMPUTE THE RANGE BETWEEN TWO UNITS

FUNCTION
1. COMPUTE THE RANGE AS THE SQUARE ROOT OF THE
SUM OF THE SQUARES OF THE DIFFERENCES IN THE
X AND Y COORDINATES.
2. INTEGERIZE THE RESULTS.
3. AS THE UNIT COORDINATES ARE INTEGERS TO THE
NEAREST 10 METERS, THE RANGE IS ALSO TO THE
NEAREST 10 METERS.

FILES
NONE
```
''ERRORS
'' NONE
'' ASSOCIATED PROGRAMS
'' CALLED BY
'' COUNTER.BATTERY.RADAR
'' FIRE.DIRECTION
'' JAMMER
'' MESSAGE.ACTION.AT.DEADLINE
'' MOVE.UNIT
'' NEXT.EW.ORDER
'' RADAR
'' CALLS
'' NONE
NORMALLY MODE IS INTEGER
DEFINE .DELTA.X, .DELTA.Y, .R AS REAL VARIABLES
LET .DELTA.X = REAL.F(UN.X.COORDINATE(.FIRST.UNIT)-
    UN.X.COORDINATE(.SECOND.UNIT))
LET .DELTA.Y = REAL.F(UN.Y.COORDINATE(.FIRST.UNIT)-
    UN.Y.COORDINATE(.SECOND.UNIT))
LET .R = SQRT.F(.DELTA.X**2 + .DELTA.Y**2)
RETURN WITH INT.F(.R)
ENDROUTINE
```

5.1.4 General Programming Guidelines

0 Structured programming techniques should be used in
designing and coding the model and changes thereto.
Use of "sequence", "if then else", and "while do" con-
structs should form the basis for all programs.

0 Overall software development should be approached as a
tool-building process. Where possible, individual
routines should be written as if they are to be placed
on a computer system support library for the project.
Routines that do too much or are difficult to communicate with because of a dependency on a particular data environment (e.g., heavy reliance on global variables instead of parameter lists) have little value as off-the-shelf packages.

A functions should be used only for its returned value and nothing more, i.e., it should behave the same as in a purely mathematical environment. Functions are sometimes misused because of a failure to consider the impact on the program environment. Thus, if \( F(x) + F(x) \) does not always equal \( 2F(x) \) because \( x \) (or a global variable) is altered, then an unwanted, difficult-to-detect side effect has been introduced.

Subroutines differ from functions in that they can alter formal parameters or global variables. However, subroutines are not immune to side effects if heavy reliance is made on hidden globals, as opposed to the more visible parameter lists for data communication. For example, a routine that redefines a global which serves as an input global for a subsequent call, may produce unexpected results.

Where possible, total communications with a routine should be confined to the call line only. This is in keeping with the tool building concept of program development. A routine becomes much more attractive to another user if he can pass his environment entirely through a call line. Exceptions will arise, especially at the executive level where large numbers of input variables must be made available to sub-executive routines.

If a routine needs so much information that it makes parameter passing impractical (or impossible), it
could be that the routine is doing too much. Additional breakdown into smaller modules may be necessary. On the other hand, the routine could be so highly specialized that its usability as a general tool is very remote. Thus, a mix of globals and formal parameters can be tolerated.

- Global variable labels should be used to isolate true global variables, i.e., those variables needed by more than one routine that cannot be passed as formal parameters.

### 5.1.5 Other Coding Constraints

The following additional coding standards and constraints are applicable for the DEWCOM Model:

- Use the new structured "IF" statement.
- Do not use numerical statement labels.
- Use WRITE instead of PRINT statements.
- Use free-form input whenever possible.
- Release logical recursive arrays before leaving a routine.
- If the limits of a "FOR" phrase are invariant for the life of the loop, evaluate those limits prior to execution of the loop.
- Do not use the "JUMP BACK" and "JUMP AHEAD" constructs.
- Identify global variable names by an embedded or trailing period.
0 Identify local variable names by a preceding period.

0 Identify words which have been defined in a "DEFINE WORD TO MEAN..." statement by two preceding periods.

0 To assist in debugging, do not give a value of zero (0) to indicators set by a "DEFINE WORD TO MEAN VALUE" statement. (The SIMSCRIPT compiler initialized all variable to zero. Thus, if a word has been defined to mean zero, and the variable has been set equal to word, a programmer would be unable to tell from a listing whether the value was due to the compiler, or if the variable had taken on other values and then been reset to zero by the word.)

0 Do not use implied subscripts.
### 5.2 Variable and Program Dictionary

The following is a dictionary of variables, routines, events, and processes used in the DEWCOM Model.

<table>
<thead>
<tr>
<th>NAME</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR.SORTIE</td>
<td>A temporary entity for storing data for air sorties for each side. It may belong to an AS.LIST. The attribute names for this entity are prefixed with &quot;AS.&quot;</td>
</tr>
<tr>
<td>ALPHA.SETUP</td>
<td>A routine which establishes the values of the elements in arrays used for alpha output.</td>
</tr>
<tr>
<td>AMAJ.E</td>
<td>An attribute of the permanent entity CVR.ELLIPSE, identifying the length in meters of the semi-major axis of an ellipse describing cover.</td>
</tr>
<tr>
<td>AMIN.E</td>
<td>An attribute of the permanent entity CVR.ELLIPSE, identifying the length in meters of the semi-minor axis of an ellipse describing cover.</td>
</tr>
<tr>
<td>ANG.E</td>
<td>An attribute of the permanent entity CVR.ELLIPSE, identifying the orientation angle in degrees measured counter-clockwise from East to the major axis of an ellipse describing cover.</td>
</tr>
<tr>
<td>ANG.H</td>
<td>An attribute of the permanent entity HILL, identifying the orientation angle in degrees measured counter-clockwise from East to the major axis of an ellipse representing a horizontal cross-section of a hill.</td>
</tr>
</tbody>
</table>
AR.COMBAT.ATTRITION
An attribute of the temporary entity ATTRITION.RATE representing the percent attrition per combat day for a given force ratio range.

AR.SET
A set of ATTRITION.RATE entities owned by the compound entity SIDE, ATTRITION.CLASS, TYPE.UNIT.CLASS.

AR.UPPER.FORCE.RATIO
An attribute of the temporary entity ATTRITION.RATE indicating the upper limit of a force ratio range for which an attrition rate (AR.COMBAT.ATTRITION) applies.

AS.FS.QUANTITY
An attribute of the temporary entity AIR.SORTIE indicating the quantity of an AS.TYPE originally assigned.

AS.LIST
A set of AIR.SORTIE entities owned by a unit.

AS.QUANTITY
An attribute of the temporary entity AIR.SORTIE indicating the quantity of an AS.TYPE currently assigned.

AS.TYPE
An attribute of the temporary entity AIR.SORTIE reflecting the name for a type of air sortie.

ATTRITION
A routine which updates unit attrition caused by direct contact with opposing units.

ATTRITION.CLASS
A permanent entity used as an index to find a particular AR.SET.
ATTRITION.RATE
A temporary entity belonging to an AR.SET, whose attributes provide data to compute attrition. Attribute names of this entity are prefixed with "AR."

BACKGROUND.TRAFFIC
An event modifying delay times for messages.

BACKGROUND.TRAFFIC.UPDATE.TIME.
A real variable representing the interval in minutes at which message processing delays are computed.

BASE
An attribute of the permanent compound entity X.GRID, Y.GRID which indicates the base height or elevation of a particular grid square.

CALL.SPECIFIC.UNIT
A routine which sends a message to a specific recipient.

CAS.OwNING.UNIT
An attribute of the process CLOSE.AIR.SUPPORT which identifies the unit owning air sorties.

CAS.REQUESTING.UNIT
An attribute of the process CLOSE.AIR.SUPPORT which identifies the unit requesting close air support.

CAS.STATUS
An attribute of the process CLOSE.AIR.SUPPORT indicating the current status of a sortie (in transit, loitering, completed, or cancelled).

CAS.TALK
A routine which attempts to find a link between a ground controller and an air sortie if TAS.GROUND.COORDINATION has been set to "YES".
CAS.TARGET.UNIT
An attribute of the process CLOSE.AIR SUPPORT; a pointer to the opposing unit which is the target of an air sortie.

CBR.ARTILLERY.UNIT
An attribute of the process COUNTER.BATTERY.RADAR; a pointer to the opposing artillery unit which the counterbattery radar is attempting to locate.

CBR.EQUIPMENT.TYPE
An attribute of the process COUNTER.BATTERY.RADAR; a pointer to the entity EWE.TYPE reflecting the characteristics of the counterbattery radar.

CBR.TARGET.UNIT
An attribute of the process COUNTER.BATTERY.RADAR; a pointer to the unit which is the target of the opposing CBR.ARTILLERY.UNIT.

CBR.TERMINATOR
An attribute of the process COUNTER.BATTERY.RADAR indicating whether or not the process was terminated before its successful completion.

CBR.TIME.UNTIL.ATTRITION
An attribute of the process COUNTER.BATTERY.RADAR reflecting the time period before attrition of the CBR.TARGET.UNIT.

CBR.UNIT
An attribute of the process COUNTER.BATTERY.RADAR; a pointer to the unit owning the CBR.EQUIPMENT.TYPE used in the process.

CE.ATTRITION
A routine which identifies communications equipment destroyed through routine ATTRITION or processes CLOSE.AIR.SUPPORT or FIRE.MISSION.
CE.DOWN.QUANTITY
An attribute of the temporary entity COMMUNICATIONS.EQUIPMENT representing the quantity of equipment that is currently being repaired.

CE.FS.QUANTITY
An attribute of the temporary entity COMMUNICATIONS.EQUIPMENT indicating the quantity of a CE type originally assigned.

CE.IN.USE
An attribute of the temporary entity COMMUNICATIONS.EQUIPMENT indicating the quantity of a type of communications equipment in actual use.

CE.LIST
A set of COMMUNICATIONS.EQUIPMENT owned by a unit.

CE.POINTER
A temporary entity belonging to a CEP.LIST and owned by a TYPE. UNIT. Its attribute names are prefixed with "CEP."

CE.REPAIR
A process simulating the failure and repair of communications equipment. Its attribute names are prefixed with "CER."

CE.TYPE
A permanent entity giving the attributes of the type communications equipment. Its attribute names are prefixed with "CET."

CE.TYPE.POINTER
An attribute of the temporary entity COMMUNICATIONS.EQUIPMENT pointing to its CE.TYPE.

CE.UP.QUANTITY
An attribute of the temporary entity COMMUNICATIONS.EQUIPMENT indicating the quantity of a type of communications equipment in operational condition but not in use.
CEP.ID
An attribute of the temporary entity CE.POINTER pointing to its CE.TYPE.

CEP.LIST
A set of CE.POINTER entities owned by a TYPE.UNIT.

CEP.QUANTITY
An attribute of the temporary entity CE.POINTER giving the quantity of equipment.

CER.EQUIPMENT.TYPE
An attribute of the process CE.REPAIR providing a pointer to the type COMMUNICATIONS.EQUIPMENT under repair.

CER.STATUS
An attribute of the process CE.REPAIR indicating the status of the COMMUNICATIONS.EQUIPMENT in the CE.REPAIR process (awaiting failure, being repaired, destroyed).

CER.UNIT
An attribute of the process CE.REPAIR providing a pointer to the unit owning the equipment being repaired.

CET.CAS.KILLS
An attribute of the permanent entity CE.TYPE indicating the quantity of a type of equipment destroyed by close air support.

CET.CLASS
An attribute of the permanent entity CE.TYPE identifying the general classification for a type of communications equipment.

CET.COLOR
An attribute of the permanent entity CE.TYPE. Its possible values are blue (1) and red (2).
CET.DAMAGE.CLASS
An attribute of the permanent entity CE.TYPE providing a pointer to the damage class relating to a type of equipment.

CET.DF.KILLS
An attribute of the permanent entity CE.TYPE indicating the quantity of a type equipment destroyed by direct fire.

CET.IF.KILLS
An attribute of the permanent entity CE.TYPE indicating the quantity of a type equipment destroyed by indirect fire.

CET.JAMMING.AWARENESS
An attribute of the permanent entity CE.TYPE. Its possible values are YES (1) or NO (2) indicating whether the user of this type equipment can be aware of being jammed.

CET.MTBF
An attribute of the permanent entity CE.TYPE; a value in hours expressing the mean time between failures for this type of equipment.

CET.MTTR
An attribute of the permanent entity CE.TYPE; a value in hours giving the mean time to repair this type of equipment.

CET.NAME
An attribute of the permanent entity CE.TYPE giving the name for a type of communications equipment.

CET.QUANTITY.ASSIGNED
An attribute of the permanent entity CE.TYPE expressing the quantity of a type of communications equipment assigned.

CET.RANGE
An attribute of the permanent entity CE.TYPE expressing the range in meters for a type of communication equipment.
CHAR.PER.WORD
   A global variable giving the number of characters which can be stored in one word of the computer system on which the model is to be operated.

CHECK.FEBA.DISTANCE
   A routine which determines the distance to the FEBA from a specific unit.

CIRCUIT
   A set of NODE entities.

CL.ID
   An attribute of the temporary entity COMPOUND.LINK containing the LK.ID of a link that is compound.

CL.LIST
   A set of COMPOUND.LINK entities owned by a temporary entity LINK.

CL.POINTER
   An attribute of the temporary entity COMPOUND.LINK containing a pointer to a unit in a COMPOUND.LINK.

CLOSE.AIR.SUPPORT
   A process simulating air sorties. Its attribute names are prefixed with "CAS."

CO.ACTION
   An attribute of the temporary entity COMM.ORDER specifying the action to be taken as a result of the message (ATTACK, DEFEND, MOVE, WITHDRAW, DELAY, JAM, NONE, or the CO.ID of another message to be transmitted).
CO.DEADLINE.ACTION
An attribute of the temporary entity COMM.ORDER specifying the action to be taken when the deadline time (CO.DEADLINE.TIME) is reached before the message is transmitted (delete or send by messenger).

CO.DEADLINE.TIME
An attribute of the temporary entity COMM.ORDER specifying a period of time in minutes after which the action specified in the attribute CO.DEADLINE.ACTION is taken.

CO.DESTINATION
An attribute of the temporary entity COMM.ORDER specifying the value of the TU.CLASS of the units to which a message is to be sent.

CO.ID
An attribute of the temporary entity COMM.ORDER providing a unique identifier for a communications order.

CO.INTELLIGENCE.VALUE
An attribute of the temporary entity COMM.ORDER providing the relative intelligence value (in the range 0 to 100) to the opposing side of the contents of the message (for purposes of interception only).

CO.LENGTH
An attribute of the temporary entity COMM.ORDER reflecting the transmission time (in seconds) of a message.

CO.LIST
A set of COMM.ORDER entities owned by a side.

CO.MEAN.TIME
An attribute of the temporary entity COMM.ORDER representing the frequency of transmission of messages with a time duration stimulus.
CO.MODE
An attribute of the temporary entity COMM.ORDER indicating the method of transmission of a message (VOICE, TT, CW, DATA, MESSAGE).

CO.PRECEDENCE
An attribute of the temporary entity COMM.ORDER indicating the relative order in which a message is to be handled within the system among other messages (DEFERRED, ROUTINE, PRIORITY, IMMEDIATE, FLASH).

CO.PROCESSING.TIME
An attribute of the temporary entity COMM.ORDER representing the interval (in minutes) between the time a decision is made to send a message and when it is transmitted. It is also the interval between receipt of a message and the time it is acted upon.

CO.SECURITY
An attribute of the temporary entity COMM.ORDER indicating the type of security afforded the message (CLEAR; ON.LINE, signifying on-line encryption; or OFF.LINE, signifying off-line encryption).

CO.STIMULUS
An attribute of the temporary entity COMM.ORDER specifying the reason for sending a message (MSG.RECEIPT, INFORMATION, ATTACK, TIME, STRENGTH, FAILURE.FR, CHANGE.MISSION, COORDINATION).

CO.THRESHOLD
An attribute of the temporary entity COMM.ORDER containing a value representing a quantity of information or a strength level, above which a message is transmitted.

CO.USAGE
An attribute of the temporary entity COMM.ORDER identifying the principal usage of a message (COMMAND, INTELLIGENCE, OPERATIONS,
ADMIN.LOGIS, FIRE.DIRECT, SURVEILLANCE, AIR.REQUEST, CAS.
COORD, CMMN).

COMBAT.ORGANIZATION.SETUP
A routine which initially processes data input to the model in
the major category entitled COMBAT.ORGANIZATION (category V).

COMBAT.POSTURE
A permanent entity for storing data relative to each posture
that a unit can assume. Its attribute names are prefixed with "CP."

COMM.ORDER
A temporary entity belonging to a set CO.LIST and containing
information pertaining to each communications order. Its attri-
bute names are prefixed with "CO."

COMM.ORGANIZATION.SETUP
A routine which initially processes data input to the model in
the major category entitled COMMUNICATIONS ORGANIZATION (cate-
gory VI).

COMMUNICATIONS.EQUIPMENT
A temporary entity belonging to a set CE.LIST and containing
data concerning the communications equipment that a unit pos-
sesses. Its attribute names are prefixed with "CE."

COMPOUND.LINK
A temporary entity belonging to a set CL.LIST and used to point
to a unit in a compound link. Its attribute names are prefixed with "CL."

CONCATENATE
A routine called by the process TRANSMIT.MESSAGE which concat-
enates links to form a circuit from the message originator to the
destination.
CONTACT.LIST
A set of DIRECT.FIRE.TARGET entities owned by a unit.

CONDITION.V
A global integer subprogram variable; a pointer to the routine which determines whether predefined thresholds have been reached and causes stipulated actions to be taken.

CONTROLS.INPUT
A routine which initially processes data input to the model in the major category entitled CONTROLS (category I).

COORDINATE.INTelliGENCE
A routine which updates the intelligence log of the receiver.

COUNTER.BATTERY.RADAR
A process which simulates the actions of a counter-battery radar unit. Its attribute names are prefixed with "CBR."

COURIER.POUCH
A set of messages being transported by a specific messenger.

COVER.LIST
A set owned by the permanent compound entity X.GRID, Y.GRID.

COVER.NUMBER.
An attribute of the temporary entity CVR.MEMO.

CP.EFFECTIVENESS
An attribute of the permanent compound entity SIDE., COMBAT. POSTURE. It is a value in the range 0 to 100 representing percentage effectiveness, which is used to modify a unit's strength.

CP.MEAN.TIME.MULTIPLIER
An attribute of the permanent compound entity SIDE., COMBAT. POSTURE. It is a multiplier in the range 0 to 100 used to modify time duration specified in CO.MEAN.TIME.
CRIT.H
An attribute of the permanent entity HILL which is a function of input HILL attributes and is used in the STAR Terrain Model.

CS1.LS
A global variable used in the STAR Terrain Model.

CS2.LS
A global variable used in the STAR Terrain Model.

CUT.H.
An attribute of the permanent entity HILL. It is the vertical distance measured down from the peak of the hill, beyond which the hill mass is no longer considered in the computations of the model.

CVR.ELLIPSE
A permanent entity containing descriptive data relating to shape, location, and height of terrain cover.

CVR.MEMO
A temporary entity belonging to the set COVER.LIST identifying each grid square affected by a CVR.ELLIPSE.

D1.REPORT
A routine which generates Input Data Report D1 (CONTROLS), reflecting if the simulation is to be started, reports to be produced, side attributes, and global variables.

D2.REPORT
A routine which generates Input Data Reports D2A (Mobility Index Data), D2B (Obstacles Index Data) and D2C (Base Altitudes) relating to terrain.
D2D.REPORT  
A routine which generates Input Data reports D2D (Hill Data) and D2E (Hill Summary Data) relating to terrain.

D2F.REPORT  
A routine which generates Input Data Reports D2F (Covers Data) and D2G (Covers Summary Data) relating to terrain.

D3.REPORT  
A routine which generates Input Data Reports D3A (Equipment Damage Class Data) and D3B (Communications Equipment Data).

D3C.REPORT  
A routine which generates Input Data Report D3C (Electronic Warfare Equipment Data).

D3D.REPORT  
A routine which generates Input Data Report D3D (Weapons Data).

D3E.REPORT  
A routine which generates Input Data Report D3E (Air Sortie Data).

D4.REPORT  
A routine which generates Input Data Report D4A, reflecting type units by side, along with their attributes.

D4B.REPORT  
A routine which generates Input Data Report D4B, containing an equipment listing for each type unit.

D4C.REPORT  
A routine which generates Input Data Report D4C, reflecting attrition rates for each type of unit.

D4D.REPORT  
A routine which generates Input Data Report D4D, reflecting the desirability of firing each type weapon of the opposing side at each type unit class.
D4E.REPORT
A routine which generates Input Data Report D4E, reflecting performance degradation and sector width information.

D5.REPORT
A routine which generates Input Data Report D5 reflecting unit combat organization data.

D6.REPORT
A routine which generates Input Data Reports D6A, reflecting communications nets and links, and D6B, reflecting data for compound links.

D7.REPORT
A routine which generates Input Data Reports D7A, reflecting communications orders for each originating unit, and D7D, listing combat postures.

D7B.REPORT
A routine which generates Input Data Report D7B, listing EW order information.

D7C.REPORT
A routine which generates Input Data Report D7C, listing tactical orders.

DAMAGE.CLASS
A permanent entity containing a value relating to the class to which a piece of equipment belongs.

DATA.PROCESSOR
A routine which controls the various data input and report routines.
DC.VALUE
An attribute of the permanent entity DAMAGE.CLASS; an integer value in the range 0 to 100 inclusive, which is the percent of the AR.COMBAT.ATTRITION to be used for a type of equipment.

DEBUG
A global variable used to specify if model execution is to be in debug mode. If so, attributes of processes and events are written out before their execution.

DEGRADATION.LIST
A set of PERFORMANCE entities owned by the compound entity SIDE., COMBAT.PUSTURE, TYPE.UNIT.CLASS.

DELAY.FROM.TRAFFIC
A global variable containing a time period added to reflect delays in message processing.

DFT.FIRE.DISTRIBUTION
An attribute of the temporary entity DIRECT.FIRE.TARGET used to compute DFT.STRENGTH.OPPOSING.

DFT.POINTER
An attribute of the temporary entity DIRECT.FIRE.TARGET which points to the unit on the direct fire CONTACT.LIST.

DFT.STRENGTH.OPPOSING
An attribute of the temporary entity DIRECT.FIRE.TARGET indicating quantity of fire from the owner of the direct fire CONTACT.LIST being received by the unit pointed to by the DFT.POINTER.

DIRECT.FIRE.TARGET
A temporary entity belonging to a CONTACT.LIST and giving information on a unit which is a direct fire target. Its attributes are prefixed with "DFT."
DISTANCE.FROM.FEBA
A function routine which calculates the distance of a unit from the FEBA.

ECC.H
An attribute of the permanent entity HILL, describing the eccentricity of an ellipse representing the hill, defined as the ratio of major axis length to minor axis length.

ELEV
A routine used in the STAR Terrain Model.

ELVI
A routine used in the STAR Terrain Model.

ELIMINATE.UNIT
A routine which eliminates a unit whose strength has fallen below a specified threshold. If it is a command post with an alternate, it activates the alternate.

END.CAS.TRANSMISSION
A routine which releases the link established by CAS.TALK when communication between a ground controller and the air sortie is completed.

END.TRANSMISSION
A routine which releases links used for communications (other than CAS.TALK) when the communication is complete.

END.OF.SIMULATION
An event which causes final status reports to be written and the model to be terminated.

EQUIPMENT.SETUP
A routine which initially processes data input to the model in the major category entitled EQUIPMENT (category III).
ERASE.CIRCUIT
A routine which releases NODE entities for use when the message using the circuit has been transmitted.

ERROR.COUNT
An global variable maintaining a count of errors detected during the execution of the model.

ERROR.MESSAGE
A routine which centralizes error handling for the model. Based on the value of a code, selects and prints the appropriate error message. For fatal errors, calls a routine to write out the current status.

ETU.LOWER.FREQ
An attribute of the temporary entity EW.TARGET.UNIT reflecting the lower limit of the frequency range of an EW.TARGET.UNIT transmitter.

ETU.ORDER
An attribute of the temporary entity EW.TARGET.UNIT identifying the EW.ORDER to be executed.

ETU.POINTER
An attribute of the temporary entity EW.TARGET.UNIT which points to the unit which is the target.

ETU.PRIORITY
An attribute of the temporary entity EW.TARGET.UNIT indicating its relative priority on the EWT.LIST.

ETU.PROCESS.POINTER
An attribute of the temporary entity EW.TARGET.UNIT which points to the process against which EW action is being taken (COUNTER, BATTERY.RADAR, JAMMER, RADAR, TRANSMIT.MESSAGE).
ETU.UPPER.FREQ
An attribute of the temporary entity EW.TARGET.UNIT reflecting the upper limit of the frequency range of an EW.TARGET.UNIT transmitter.

EW.EQUIPMENT
A temporary entity belonging to an EWE.LIST and containing information relating to each piece of EW equipment that a unit possesses. Its attribute names are prefixed with "EWE."

EW.ORDER
A temporary entity belonging to an EWO.LIST and containing data telling a unit when to take an EW action and which action to take.

EW.POINTER
A temporary entity belonging to an EWP.LIST and giving the type and quantity of EW equipment owned by a type unit. Its attribute names are prefixed with "EWP."

EW.TARGET.UNIT
A temporary entity belonging to an EWT.LIST and containing data on an EW target. Its attribute names are prefixed with "ETU." and their values are set by the model.

EW.UNIT.SEARCH
A routine activated by routine NEXT.EW.ORDER to determine if an EW unit exists within range to perform a required EW function.

EWE.ATTRITION
A routine which identifies EW equipment destroyed through routine ATTRITION or processes CLOSE.AIR.SUPPORT or FIRE.MISSION.

EWE.DOWN.QUANTITY
An attribute of the temporary entity EW.EQUIPMENT giving the positive integer quantity of equipment that is currently being repaired.
EWE.FS.QUANTITY

An attribute of the temporary entity EW.EQUIPMENT indicating the quantity of a type of EW equipment originally assigned.

EWE.IN.USE

An attribute of the temporary entity EW.EQUIPMENT indicating the quantity of a type of EW equipment in actual use.

EWE.LIST

A set of EW.EQUIPMENT entities owned by a unit.

EWE.REPAIR

A process simulating the failure and repair of EW equipment. Its attribute names are prefixed with "EWR."

EWE.TYPE

A permanent entity giving the characteristics of a type of EW equipment. Its attribute names are prefixed with "EWE."

EWE.TYPE.POINTER

An attribute of the temporary entity EW.EQUIPMENT indicating the EWE.TYPE.

EWE.UP.QUANTITY

An attribute of the temporary entity EW.EQUIPMENT giving the positive integer quantity of EW equipment that is currently operational.

EWO.DURATION.TIME

An attribute of the temporary entity EW.ORDER indicating a period of time in minutes for which a specified EW action is to be taken.

EWO.FIRST.OPTION

An attribute of the temporary entity EW.ORDER indicating the preferable EW function to be performed, if possible within
available time constraints (INTERCEPT, LOCATE, BARRAGE.JAM, SPOT.JAM).

EWO.LIST
A set of EW.ORDER entities owned by a side.

EWO.MAX.RANGE
An attribute of the temporary entity EW.ORDER indicating the maximum distance in kilometers between the FEBA and the opposing transmitter at which a specified EW order can be carried out.

EWO.MIN.RANGE
An attribute of the temporary entity EW.ORDER identifying the minimum distance in kilometers between the FEBA and the opposing transmitter in order for the specified EW order to be carried out.

EWO.PRIORITY
An attribute of the temporary entity EW.ORDER indicating its relative priority on the EWO.LIST.

EWO.SECOND.OPTION
An attribute of the temporary entity EW.ORDER identifying the EW function to be performed if the first option cannot be carried out (INTERCEPT, LOCATE, BARRAGE.JAM, SPOT.JAM).

EWO.TARGET.NET
An attribute of the temporary entity EW.ORDER identifying the type of opposing net against which specified EW orders are to be carried out (COMMAND, INTELLIGENCE, OPERATIONS, ADMIN.LOGIS, FIRE.DIRECT, SURVEILLANCE, AIR.REQUEST, CAS.COORD, CMMN, UNKNOWN).

EWP.ID
An attribute of the temporary entity EW.POINTER reflecting the name of a type of EW equipment owned by a TYPE.UNIT.
EWP.LIST
A set of EW.POINTER entities owned by a TYPE.UNIT.

EWP.QUANTITY
An attribute of the temporary entity EW.POINTER indicating the quantity of a type of EW equipment (EWP.ID) owned by a TYPE.UNIT.

EWR.EQUIPMENT.TYPE
An attribute of the process EWE.REPAIR identifying the type of equipment undergoing repair.

EWR.STATUS
An attribute of the process EWE.REPAIR indicating the status of the EW.EQUIPMENT in the EWE.REPAIR process (awaiting failure, being repaired, destroyed).

EWR.UNIT
An attribute of the process EWE.REPAIR providing a pointer to the unit owning the equipment being repaired.

EWT.CAS.KILLS
An attribute of the permanent entity EWE.TYPE indicating the quantity of a type of equipment destroyed by close air support.

EWT.CLASS
An attribute of the permanent entity EWE.TYPE, identifying the class of EW equipment being described (LOCATOR, INTECEPTOR, LT. SPOT, NL.SPOT, LT.BARRAGE, CB.RADAR, RADAR, EX.SPOT, EX. BARRAGE).

EWT.COLOR
An attribute of the permanent entity EWE.TYPE, identifying the side to which the EW equipment belong (1 = BLUE; 2 = RED).

EWT.DAMAGE.CLASS
An attribute of the permanent entity EWE.TYPE, identifying the damage class relating to a type of equipment.
EWT.DF.KILLS
An attribute of the permanent entity EWE.TYPE indicating the quantity of a type of equipment destroyed by direct fire.

EWT.DF.TIME
An attribute of the permanent entity EWE.TYPE, identifying the time period (in seconds) required to perform a direction finding function.

EWT.HIGH.FREQ
An attribute of the permanent entity EWE.TYPE indicating the high limit of the frequency range (in megahertz) for which a type of equipment is effective.

EWT.IF.KILLS
An attribute of the permanent entity EWE.TYPE indicating the quantity of a type of equipment destroyed by indirect fire.

EWT.INTELLIGENCE.RATE
An attribute of the permanent entity EWE.TYPE reflecting the rate of gain (per second) of intelligence information by an intercept function.

EWT.LIST
A set of EW.TARGET.UNIT entities owned by a unit.

EWT.LOW.FREQ
An attribute of the permanent entity EWE.TYPE indicating the low limit of the frequency range (in megahertz) for which a type of equipment is effective.

EWT.MTBF
An attribute of the permanent entity EWE.TYPE expressing the mean time between failures (in hours) for a type of equipment.
EWT.MTTR
An attribute of the permanent entity EWE.TYPE expressing mean
time (in hours) to repair a type of equipment.

EWT.NAME
An attribute of the permanent entity EWE.TYPE; the name for a
type of equipment being described.

EWT.QUANTITY.ASSIGNED
An attribute of the permanent entity EWE.TYPE expressing the
quantity of a type of EW equipment originally assigned.

EWT.RADAR.DURATION
An attribute of the permanent entity EWE.TYPE expressing (for
other than counter-battery radar) the time period (in minutes)
during which the unit normally transmits pulses and receives the
return.

EWT.RADAR.INTERVAL
An attribute of the permanent entity EWE.TYPE expressing (for
other than counter-battery radar) the time interval (in minutes)
between the intermittent transmission and return periods of
pulses.

EWT.RANGE
An attribute of the permanent entity EWE.TYPE reflecting the
range (in meters) for a type of equipment.

EXPENDABLE.JAMMER
An external event which initiates a JAMMER process using equip-
ment with EWT.CLASS of EX.SPOT or EX.BARRAGE.

FEBA.POINT
An attribute of the permanent entity Y.GRID indicating the X
grid coordinate which is the midpoint between the closest oppos-
ing side units for a given Y.GRID.
FIRE.DIRECTION
A routine which tasks artillery units by activating the process FIRE.MISSION.

FIRE.EFFECTIVENESS
A function routine which determines the effectiveness of a unit from the DEGRADATION.LIST based on its accumulated attrition.

FIRE.MISSION
A process which simulates artillery firing. Its attribute names are prefixed with "FM."

FIRST.BLUE
An attribute of the permanent entity Y.GRID indicating the X grid coordinate of the BLUE side unit closest to a RED side unit for a given Y.GRID.

FIRST.PAGE
A routine which generates the cover sheet for DEWCOM reports.

FIRST.RED
An attribute of the permanent entity Y.GRID indicating the X grid coordinate of the RED side unit closest to a BLUE side unit for a given Y.GRID.

FM.ARTY.UNIT
An attribute of the process FIRE.MISSION pointing to the firing unit in the FIRE.MISSION process.

FM.TARGET
An attribute of the process FIRE.MISSION pointing to the target unit in the FIRE.MISSION process.

FM.TERMINATOR
An attribute of the process FIRE.MISSION which indicates whether or not the process was terminated before its successful completion.
GRID.SIZE
A global variable reflecting the distance (expressed in meters) represented by the length of a side of one grid square of the map of the terrain described to the model.

HILL
A permanent entity.

HILL.LIST
A set of HILL entities owned by the compound entity X.GRID, Y.GRID and by temporary entity HILL.MEMO.

HILL.MEMO
A temporary entity belonging to the set HILL.LIST identifying each grid square affected by a HILL.

HILL.NUMBER
An attribute of the temporary entity HILL.MEMO.

HT.E
An attribute of the permanent entity CVR.ELLIPSE representing the height in meters of the trees or other cover above the terrain elevation.

HT.H
An attribute of the permanent entity HILL specifying the maximum height (in meters) of a "normal" curve describing a hill rass.

IE.LOG
A set of INTELLIGENCE.ENTRY entities owned by a UNIT.

IE.OPPOSING.UNIT
An attribute of the temporary entity INTELLIGENCE.ENTRY pointing to an opposing unit about which intelligence information is possessed.
IE.VALUE
An attribute of the temporary entity INTELLIGENCE.ENTRY indicating the quantity of intelligence information possessed concerning an IE.OPPOSING.UNIT.

IEL.LS
A global variable used in the STAR Terrain Model.

IFT.LIST
A set of INDIRECT.FIRE.TARGET entities owned by a UNIT.

IFT.POINTER
An attribute of the temporary entity INDIRECT.FIRE.TARGET pointing to a unit awaiting artillery fire.

IFT.PRIORITY
An attribute of the temporary entity INDIRECT.FIRE.TARGET indicating its relative priority on the IFT.LIST.

IGX.LS
A global variable used in the STAR Terrain Model.

IGY.LS
A global variable used in the STAR Terrain Model.

INDIRECT.FIRE.TARGET
A temporary entity belonging to the set IFT.LIST and pointing to a unit which is an indirect fire target. Its attribute names are prefixed with "IFT."

INITIALIZE
A routine which schedules initial processes and events and initializes subprogram variables CONDITION.V and INTEGRATOR.V.

INT.EQUIPMENT.TYPE
An attribute of the process INTERCEPTOR pointing to EW equipment type performing the interception of opposing side messages.
INT.MESSAGE.POINTER
An attribute of the process INTERCEPTOR which points to the
TRANSMIT.MESAGE process being intercepted.

INT.TARGET
An attribute of the process INTERCEPTOR pointing to the trans-
mitting unit of a TRANSMIT.MESSAGE message being intercepted.

INT.TERMINATOR
An attribute of the process INTERCEPTOR indicating whether or
not the process was terminated before its successful completion.

INT.UNIT
An attribute of the process INTERCEPTOR pointing to the unit
performing the interception.

INTEGRATOR.V
A subprogram variable which points to the routine determi-
ning attrition from direct fire.

INTELLIGENCE.ENTRY
A temporary entity which may belong to the set IE.LOG. Its
attribute names are prefixed with "IE."

INTERCEPTOR
A process which simulates the interception of opposing side mes-
sages. Its attribute names are prefixed with "INT."

JAMMED.UNIT
A temporary entity belonging to the set JU.LIST; the opposing
unit against which the JAMMER process is directed.
JAMMER
A process simulating spot and barrage jamming. It may belong to the set JM.LIST and its attribute names are prefixed with "JM."

JM.DURATION
An attribute of the process JAMMER indicating the period of time in seconds for which a process is carried out.

JM.EQUIPMENT.TYPE
An attribute of the process JAMMER pointing to the equipment type performing the JAMMER process.

JM.LOWER.FREQ
An attribute of the process JAMMER reflecting the lower limit of the frequency range at which the jammer is operating.

JM.PROCESS.POINTER
An attribute of the process JAMMER pointing to the process against which the jamming function is directed (RADAR, COUNTER, BATTERY.RADAR, TRANSMIT.MESSAGE).

JM.TERMINATOR
An attribute of the process JAMMER indicating whether or not the process was terminated before its successful completion.

JM_UNIT
An attribute of the process JAMMER pointing to the unit performing the jamming.

JM_UPPER.FREQ.
An attribute of the process JAMMER reflecting the upper limit of the frequency range at which the jammer is operating.

JU.LIST
A set of JAMMED.UNIT entities.
JU.POINTER
An attribute of the temporary entity JAMMED.UNIT pointing to a unit being jammed.

KCREP
An attribute of the permanent entity CVR.ELLIPSE determined from input data and used in the STAR Terrain Model.

KHREP
An attribute of the permanent entity HILL determined from input data and used in the STAR Terrain Model.

KOVER
A routine used in the STAR Terrain Model.

KTREP
A global variable used in the STAR Terrain Model.

LAGA.LS
A global variable used in the STAR Terrain Model.

LAGB.LS
A global variable used in the STAR Terrain Model.

LAST.FEBA.UPDATE
A computed global variable reflecting the simulated time at which the FEBA was last updated.

LATOB.LS
A global variable used in the STAR Terrain Model.

LBTOA.LS
A global variable used in the STAR Terrain Model.

LINE.OF.SIGHT
A routine used in the STAR Terrain Model.
LINK
A temporary entity which may belong to a LK.LIST, giving the characteristics of a link. Its attribute names are prefixed with "LK."

LINK.AVAILABILITY
A routine called by TRANSMIT.MESSAGE to determine if a link is available for a specific message and, if so, transmits the message.

LINK.CHECK
A routine called by CONCATENATE to determine if a particular link can be used and, if so, returns the cost of using the link.

LINK.INPUT
A routine which reads in the link input data in the major input data category entitled COMMUNICATIONS ORGANIZATION.

LK.A.END
An attribute of the temporary entity LINK; an integer pointer to the unit at one end of a link. It is input as the UNIT.ID of the unit.

LK.A.EQUIP.POINTER
An attribute of the temporary entity LINK identifying the communications equipment type name used by the LK.A.END of a communications link.

LK.B.END
An attribute of the temporary entity LINK; an integer pointer to the unit at one end of a link. It is input as the UNIT.ID of the unit.

LK.B.EQUIP.POINTER
An attribute of the temporary entity LINK identifying the communications equipment type name used by the LK.B.END of a communications link.
LK.CHANNELS
An attribute of the temporary entity LINK specifying the maximum number of usable channels in a link.

LK.CHANNELS.IN.USE
An attribute of the temporary entity LINK identifying the number of channels actually in use in a link.

LK.CONVERTABILITY
An attribute of the temporary entity LINK indicating whether or not a link converts from radio to wire after the unit has been in one location for a period equivalent to LK.TIME.TO.CONVERT.

LK.DESIRABILITY.OF.USING
An attribute of the temporary entity LINK containing a value in the range 0-100 which reflects the desirability of using a link over an alternate link.

LK.DIRECTION
A attribute of the temporary entity LINK indicating whether a link is a one-way or two-way channel.

LK.ID
An attribute of the temporary entity LINK uniquely identifying a link in a net.

LK.JAMMABILITY.CODE
An attribute of the temporary entity LINK indicating whether a link is affected by jamming.

LK.LIST
A set of LINK entities owned by a NET.

LK.NET.POINTER
An attribute of the temporary entity LINK pointing the the NET to which a LINK belongs.
LK.POINTER
A temporary entity for storing data concerning link membership of a unit.

LK.STATUS
An attribute of the temporary entity LINK indicating its current status (IDLE, BUSY, JAMMED.A.TO.B, JAMMED.B.TO.A, JAMMED.TWO.WAY, DOWN).

LK.SWITCHABILITY.CODE
An attribute of the temporary entity LINK indicating whether a link can be concatenated with another link to transmit a message.

LK.TIME.TO.CONVERT
An attribute of the temporary entity LINK indicating the time (in minutes) required to convert a link from radio to wire.

LOC.ELEMENTS
An attribute of the process LOCATOR indicating the number of DF sites in the LOCATOR process.

LOC.EQUIPMENT.TYPE
An attribute of the process LOCATOR pointing to the type of DF equipment used by the process.

LOC.PROCESS.POINTER
An attribute of the process LOCATOR pointing to the process against which the LOCATOR process is directed (RADAR, TRANSMIT.MESSAGE, COUNTER.BATTERY.RADAR, JAMMER)

LOC.TARGET
An attribute of the process LOCATOR pointing to the opposing unit against which the LOCATOR process is directed.

LOC.UNIT
An attribute of the process LOCATOR pointing to the unit performing the LOCATOR process.
LOCATOR
A process which performs direction finding and identifies the location of an opposing unit. Its attribute names are prefixed with "LOC."

LP.ID
An attribute of the temporary entity LK.POINTER pointing to the link to which a unit belongs.

LP.LIST
A set of LINK.POINTER entities belonging to a UNIT.

MI.REPORT
A routine which generates Model Report M1 (Unit Status).

M2.REPORT
A routine which generates Model Report M2 (Link Status), reflecting the status of all communications links.

M3.REPORT
A routine which generates Model Report M3 (Message Status), reflecting the status of all messages.

M4.REPORT
A routine which generates Model Report M4 (Attrition Summary), reflecting equipment attrition by type.

M5.REPORT
A routine which generates Model Report M5 (EW Status), consisting of two parts, Actions in Progress and Awaiting Actions.

M6.EW.REPORT
A routine which generates the portion of Model Report M6 (Equipment Status) reflecting status of EW Equipment.
M6.REPORT
A routine which generates the portion of Model Report M6 (Equipment Status) reflecting status of Communications Equipment.

M6.WEAPONS.REPORT
A routine which generates the portion of Model Report M6 (Equipment Status) reflecting status of Weapons.

M7.REPORT
A routine which generates Model Report M7 (Intelligence Log), reflecting units which have intelligence information relating to opposing side units.

MAIN
The routine which provides the central control for execution of the DEWCOM model.

MAX.DELAY
A global variable reflecting the maximum time period added to reflect delays in message processing.

MAX.LINKS.IN.CIRCUIT
A global variable reflecting the maximum number of links which may be concatenated to connect two units in a circuit.

MAX.PERMITTED.ERRORS
A global variable reflecting the maximum number of errors detected before the model terminates.

MAX STEP
A global variable specifying the maximum time interval in minutes between computations of attrition.

MESSAGE.STATUS
A two-dimensional computed global variable which stores alphabetical MESSAGE.STATUS definitions.
MESSENGER
A process which handles sending a messenger if a message does not reach its destination by its deadline time (CO.DEADLINE.TIME) or if NET.TYPE is specified as MESSENGER. Its attribute names are prefixed with "MGR."

MESSENGER.RATE
A global variable reflecting the rate at which a messenger travels, expressed in meters per minute.

MGR.DESTINATION
An attribute of the process MESSENGER identifying the destination unit of a message.

MGR.ORIGIN
An attribute of the process MESSENGER identifying the originating unit of a message.

MGR.TERMINATOR
An attribute of the process MESSENGER indicating whether or not a messenger arrived safely at the destination.

MIN.DELAY
A global variable reflecting the minimum time period added to reflect delays in message processing.

MIN STEP
A global variable specifying the minimum time interval in minutes between computations of attrition.

MOBILITY.INDEX
An attribute of the compound entity X.GRID, Y.GRID identifying the mobility characteristics of a terrain grid square.

MODE
A two-dimensional computed global variable (alpha array) which stores alphabetical MODE definitions.
MOVE_STEP_SIZE
A global variable reflecting the distance (in meters) that a unit travels before the location coordinates are updated.

MOVE_UNIT
An event which maneuvers units on the battlefield, updating unit position, checking proximity and line of sight to enemy units, and scheduling the next move.

MREPORTS
A global variable (1-dimensional integer array) storing the report numbers of the model reports to be produced by a run of the simulation.

MSG_LIST
A set of TRANSMIT_MESSAGE processes.

MU_UNIT
An attribute of the event MOVE_UNIT pointing to a unit being moved.

NAS_TYPE
An attribute of the event NEW_AIR_SORTIE pointing to the type of sortie being generated.

NAS_UNIT
An attribute of the event NEW_AIR_SORTIE pointing to the unit to which the NEW_AIR_SORTIE belongs.

NET
A temporary entity belonging to a NET_LIST and used to describe a communications net in the model. Its attribute names are prefixed with "NET."

NET_CONTINUOUS_CARRIER
An attribute of the temporary entity NET, indicating whether a net utilizes a continuous (as opposed to intermittent) signal carrier.
NET.FREQ.IN.USE
An attribute of the temporary entity NET identifying the frequency (in megahertz) currently in use by a net.

NET.ID
An attribute of the temporary entity NET uniquely identifying a communications net for a side.

NET.LAST.FREQ.CHANGE
An attribute of the temporary entity NET reflecting the simulated time at which the frequency in use by a NET was last changed.

NET.LIST
A set of NET entities owned by a side.

NET.MODE
An attribute of the temporary entity NET describing the mode or medium for a net (VOICE, TT, CW, DATA, MESSAGE).

NET.PRIMARY.FREQ
An attribute of the temporary entity NET identifying a net's primary frequency (in megahertz).

NET.SECONDARY.FREQ
An attribute of the temporary entity NET identifying a net's secondary frequency (in megahertz).

NET.SECURITY
An attribute of the temporary entity NET indicating the type of security available on a net (CLEAR; ON.LINE, denoting on-line encryption; OFF.LINE, denoting off-line encryption).
NET.TYPE
An attribute of the temporary entity NET indicating the type of communications net being described (RADIO, WIRE, MESSENGER).

NET.USAGE
An attribute of the temporary entity NET indicating the principal usage of a net (COMMAND, SURVEILLANCE, INTELLIGENCE, AIR. REQUEST, OPERATIONS, CAS.COORD, ADMIN.LOGIS, CMMN, FIRE. DIRECT).

NEW.AIR.SORTIE
An event which replaces air sorties that have been expended.

NEWTON
A routine used in the STAR Terrain Model.

NEXT.COMM.ORDER
A routine which finds a net on which a given order can be sent and activates TRANSMIT.MESSAGE.

NEXT.EW.ORDER
A routine which causes units to perform EW orders, activating process JAMMER, LOCATOR, or INTERCEPTOR, as appropriate.

NEXT.INTEGRATE.TIME
A computed global variable specifying the next simulated time at which subprogram variables CONDITION.V and INTEGRATOR.V are to be called.

NEXT.TACTICAL.ORDER
An event which is invoked whenever a unit changes its UN.ACTIVE.TACTICAL.ORDER to update that attribute and to schedule a new NEXT.TACTICAL.ORDER.

NEW.COMBAT.VALUES
A routine which reads in a new WT.COMBAT.VALUE for each WPN. TYPE.
NEW.MOVE.RATES
A routine which reads in new values of TU.MOVE.RATE for all TYPE.UNITS.

NEW.ORDERS
A routine which reads in new orders.

NODE
A temporary entity for storing information concerning a potential link used in computing the next LINK in a circuit.

NODE.COST
An attribute of the temporary entity NODE reflecting the relative cost of using a link (100 minus LK.DESIRABILITY.OF. USING).

NODE.LINK
An attribute of the temporary entity NODE pointing to the identity of a link.

NODE.SENDER
An attribute of the temporary entity NODE pointing to the transmitting unit in a LINK.

NON.COMBAT.ATTRITION
An attribute of the compound entity SIDE., ATTRITION.CLASS, TYPE.UNIT.CLASS reflecting a percentage of attrition other than from combat per combat day.

NTO.CAUSE
An attribute of the event NEXT.TACTICAL.ORDER identifying the stimulus for order change (STRENGTH.THRESHOLD, ATTACK_FORCE.RATIO, FAILURE_FORCE.RATIO, ELAPSED.TIME, MOVED_DISTANCE, DIRECT_ORDER).
NTO.ORDER
An attribute of the event NEXT.TACTICAL.ORDER identifying the action specified by a direct order (ATTACK, DEFEND, MOVE, WITHDRAW, DELAY).

NTO.UNIT
An attribute of the event NEXT.TACTICAL.ORDER pointing to the unit whose order is being changed.

OBSTACLES.INDEX
An attribute of the compound entity X.GRID, Y.GRID describing the obstacle characteristics of a terrain grid square.

ORDERS.SETUP
A routine which initially processes data input to the model in the major category entitled ORDERS (category VII).

PEAK.H
An attribute of the permanent entity HILL, indicating the elevation of the hilltop in meters, measured from zero = sea level.

PERCEIVED.FORCE.RATIO
A function routine which calculates the ratio of opposing forces based on several factors.

PERFORMANCE
A temporary entity belonging to a DEGRADATION.LIST and giving the decreased performance of a unit due to attrition in specified combat postures and for different levels of accumulated attrition. Its attribute names are prefixed with "PF."

PF.DEGRADATION.FACTOR
An attribute of the temporary entity PERFORMANCE giving the percentage effectiveness of a unit for a specified combat posture and level of accumulated attrition.
PF.UPPER.ATTRITION
An attribute of the temporary entity PERFORMANCE giving the upper limit of an attrition range for which a PF.DEGRADATION.FACTOR applies.

POSTURE
A two-dimensional computed global variable (alpha array) used to store alphabetical posture descriptions for output reports.

PXX.E
An attribute of the permanent entity CVR.ELLIPSE determined from input data and used in the STAR Terrain Model.

PXX.H
An attribute of the permanent entity HILL determined from input data and used in the STAR Terrain Model.

PXY.E
An attribute of the permanent entity CVR.ELLIPSE determined from input data and used in the STAR Terrain Model.

PXY.H
An attribute of the permanent entity HILL determined from input data and used in the STAR Terrain Model.

PYY.E
An attribute of the permanent entity CVR.ELLIPSE determined from input data and used in the STAR Terrain Model.

PYY.H
An attribute of the permanent entity HILL determined from input data and used in the STAR Terrain Model.

QQ.OUTPUT
A routine which writes transactions into the CWIC: QWRY file.
RADAR
A process simulating the data gathering of radar equipment. Its attribute names are prefixed with "RD."

RADIO. VISIBILITY
A function routine which determines if the ends of a link have radio line of sight.

RANGE
A function routine which computes the range between two units.

RATE.OF.CONTACT
A global variable expressing the rate (in units per minute) at which a unit in contact gathers intelligence about the opposing unit.

RD.EQUIPMENT.TYPE
An attribute of the process RADAR pointing to the equipment type being used.

RD.OWNER
An attribute of the process RADAR identifying the unit owning the RD.EQUIPMENT.TYPE

RD.TERMINATOR
An attribute of the process RADAR indicating whether or not the process was terminated before its successful completion.

READ.THE.NAME
A routine used to read in alphabetical input data.

RECEIPT.OF.MESSAGE
A routine which models the effects of receiving a message.

RELATIVE.DESIRABILITY.OF.FIRING
An attribute of the compound entity TYPE.UNIT.CLASS, WPN.TYPE expressing the relative desirability of firing a weapon of the opposing side at a type unit class.
REMOVE.COMM.LINKAGES
A routine which eliminates communications linkages relating to any unit eliminated by ELIMINATE.UNIT.

REPORT.FREQUENCY
A global variable expressing the frequency in minutes of simulated time at which requested reports are to be produced by the model.

RN.STREAM
A global variable identifying which of 10 available random number streams is to be used by the model.

SP.READY.RESET.TIME
An attribute of the permanent entity SIDE expressing the minimum time interval after firing (in minutes) required for an artillery unit to accept a new target.

SD.COLOR
An attribute of the permanent entity SIDE giving the alpha value of BLUE or RED.

SD.COORDINATION INTERVAL
An attribute of the permanent entity SIDE indicating the minimum time interval (in minutes) separating messages between any two units on a side.

SD.DF.RATE.1.UNIT.OUT
An attribute of the permanent entity SIDE expressing the decreased intelligence gathering capability of a DF unit when one of its sites becomes inoperable, expressed as a percentage of its capability when all sites are operational.

SD.DF.RATE.2.UNIT.OUT
An attribute of the permanent entity SIDE expressing the decreased intelligence gathering capability of a DF unit when two of its sites become inoperable, expressed as a percentage of its capability when all sites are operational.
SD. ENCRYPTION. INTELLIGENCE
An attribute of the permanent entity SIDE denoting a multiplier which modifies the intelligence value of an intercepted encrypted message.

SD. EW. INTEL. THRESHOLD.
An attribute of the permanent entity SIDE identifying a threshold above which the opposing force net type changes from UNKNOWN to a known type.

SD. FIRE. SUPPORT. THRESHOLD
An attribute of the permanent entity SIDE indicating the target strength threshold, above which a unit from which artillery support has been requested, asks for additional artillery support from another fire direction center.

SD. MAX. ARTY. DISTANCE
An attribute of the permanent entity SIDE identifying the threshold distance in meters between an artillery unit and the FEBA, above which the artillery unit moves toward the FEBA.

SD. MAX. EW. DISTANCE
An attribute of the permanent entity SIDE indicating the threshold distance in meters between an EW unit and the FEBA, above which the EW unit moves toward the FEBA.

SD. MIN. ARTY. DISTANCE
An attribute of the permanent entity SIDE indicating the threshold distance in meters between an artillery unit and the FEBA, below which the artillery unit moves away from the FEBA.

SD. MIN. EW. DISTANCE
An attribute of the permanent entity SIDE indicating the threshold distance in meters between an EW unit and the FEBA, below which the EW unit moves away from the FEBA.
SD.MIN.UNIT.STRENGTH
An attribute of the permanent entity SIDE identifying the percentage of its normal unit strength below which a unit ceases to be a factor in the simulation.

SD.PCT.OVER.TRUE.STRENGTH.
An attribute of the permanent entity SIDE; a modifier reflecting the maximum percentage over its normal strength that an opposing unit's strength will be perceived by a unit on this side.

SD.PCT.UNDER.TRUE.STRENGTH
An attribute of the permanent entity SIDE; a modifier reflecting the maximum percentage under its normal strength that an opposing unit's strength will be perceived by a unit on this side.

SD.SUPPORT.THRESHOLD
An attribute of the permanent entity SIDE identifying the target strength threshold above which an artillery unit which cannot provide requested artillery support requests such support from another fire direction center.

SD.WIRE.FAILURE.RATE
An attribute of the permanent entity SIDE indicating the mean time between failure (in hours) of a wire link.

SD.WIRE.MTTR
An attribute of the permanent entity SIDE indicating the mean time to repair a wire link (in hours).

SECTOR.WIDTH
An attribute of the compound entity SIDE., COMBAT.POSTURE, TYPE.UNIT.CLASS giving the sector width (in meters) for a given type unit class for a specified combat posture.

SET
A function routine which is used to verify the validity of alphabetical input terms.
SET.FEBA.POINT
A routine which updates the location of the FEBA for each Y.GRID value.

SIDE
A permanent entity separating data by side (BLUE or RED). Its attribute names are prefixed with "SD."

SIGHT
A function routine; the control program for the STAR Terrain Model to determine whether line of sight exists.

SIGNAL.STRENGTH
A function routine which determines the signal strength in a link.

SIZEA.LS
A global variable used in the STAR Terrain Model.

SIZEB.LS
A global variable used in the STAR Terrain Model.

SNAP.R
A routine called by TIM1.R to write out status information (reports and attributes) at model termination if a SIMSCRIPT execution error occurs.

SNAP.SIDES
A routine called by a SNAP.R to write out attributes of sides and units at model termination if a SIMSCRIPT execution error occurs.

SPRD.H
An attribute of the permanent entity HILL providing a measure of a hill size defined as the distance in meters measured along the major axis from hill center to a contour line which is 50 meters below the peak.
STATUS.REPORTS
An event which causes specified model reports to be generated.

STOP.RESTART
An external event triggered by the user to stop the model, change data, and restart the model.

STOP.THE.MODEL
The routine which is called to stop the model. It prints a message indicating the reason for stopping and writes final reports, if reports have been requested.

TACTICAL.ORDER
A temporary entity belonging to a TO.LIST and giving data on each tactical order. Its attribute names are prefixed with "TO."

TACTICAL.ORDERS.SETUP
A routine which initially processes data input to the model in the subcategory Tactical Orders of the major category entitled ORDERS (category VII).

TAS.CLASS
An attribute of the permanent entity TYPE.AIR.SORTIE identifying the class name (ROTARY or FIXED) for a type air sortie.

TAS.COLOR
An attribute of the permanent entity TYPE.AIR.SORTIE identifying the side to which a sortie belongs (BLUE or RED).

TAS.CURRENT.QUANTITY
An attribute of the permanent entity TYPE.AIR.SORTIE which maintains a count of the number of sorties of a type available at a given time.

TAS.EFFECTIVENESS
An attribute of the permanent entity TYPE.AIR.SORTIE denoting the relative effectiveness of a type air sortie (on a scale of 0 to 100).
TAS.GROUNDCOORDINATION
An attribute of the permanent entity TYPE.AIR.SORTIE indicating whether or not contact with a ground controller is required after arrival on target. If "YES" and contact does not occur within the loiter time specified in TAS.LOITER.TIME, the mission is aborted.

TAS_LOITER.ATTRITION
An attribute of the permanent entity TYPE.AIR.SORTIE indicating the probability of a sortie being attritted during loiter time in the vicinity of the target.

TAS.LOITER.TIME
An attribute of the permanent entity TYPE.AIR.SORTIE indicating the time period (in minutes) after arrival in the vicinity of the target, after which the mission is aborted if a message has not been received from a ground controller.

TAS.NAME
An attribute of the permanent entity TYPE.AIR.SORTIE giving the name for a type air sortie being described.

TAS.QUANTITY.ASSIGNED
An attribute of the permanent entity TYPE.AIR.SORTIE indicating the sortie quantity originally assigned.

TAS.RENEWAL.TIME
An attribute of the permanent entity TYPE.AIR.SORTIE indicating the time interval (in minutes) before an expended sortie is again available for use.

TAS.TRANSIT.ATTRITION
An attribute of the permanent entity TYPE.AIR.SORTIE indicating the probability of a sortie being attritted during transit time to the target.
TAS.TRANSIT.TIME
An attribute of the permanent entity TYPE.AIR.SORTIE giving the time period (in minutes) from sortie dispatch until its arrival in the vicinity of the target.

TERRAIN.SETUP
A routine which initially processes data input to the model in the major category entitled TERRAIN (category II).

THRESHOLD.CHECK
A function routine which compares updated strength and intelligence values to determine whether specified thresholds have been achieved and takes appropriate actions.

TIM1.R
The routine which determines the event or process to occur next, allowing the simulation of continuous variables. Its use is fully described in reference 28.

TIME.EOS
A global variable specifying the length of time the simulation is to run, expressed in hours.

TM.CURRENT.SENDER
An attribute of the process TRANSMIT.MESSAGE pointing to the transmitting unit in the current link.

TM.DEADLINE
An attribute of the process TRANSMIT.MESSAGE reflecting the simulated time at which a message being transmitted is to be cancelled or sent by messenger if it has not reached its destination.

TM.DESTINATION
An attribute of the process TRANSMIT.MESSAGE pointing to the ultimate destination unit of the message being transmitted.
TM.LINK
An attribute of the process TRANSMIT.MESSAGE pointing to the current link in the net over which a message is being transmitted.

TM.NET
An attribute of the process TRANSMIT.MESSAGE pointing to the net over which a message is being transmitted.

TM.ORDER
An attribute of the process TRANSMIT.MESSAGE pointing to the COMM.ORDER which was the stimulus for the process.

TM.ORIGINATOR
An attribute of the process TRANSMIT.MESSAGE pointing to the originating unit of a message being transmitted.

TM.PRECEDENCE
An attribute of the process TRANSMIT.MESSAGE reflecting the precedence of a message being transmitted (DEFERRED, ROUTINE, PRIORITY, IMMEDIATE, FLASH)

TM.STATUS
An attribute of the process TRANSMIT.MESSAGE identifying the current status of a message in the process (WAITING.PROCESSING, BEING.PROCESSED, WAITING_LINK, BEING.TRANSMITTED, JAMMED, BY.MESSENGER, WAITING.ENCRYPTION, BEING.ENCRYPTED, A.EQUIPMENT.FAILURE, B.EQUIPMENT.FAILURE, FINAL.PROCESSING).

TM.TARGET
An attribute of the process TRANSMIT.MESSAGE which points to the opposing unit which is the target of a requested CLOSE.AIR.SUPPORT or FIRE.MISSION process.

TM.TERMINATOR
An attribute of the process TRANSMIT.MESSAGE indicating whether or not the process was terminated before its successful completion.
TMCA.LS
A global variable used in the STAR Terrain Model.

TMCA.BL
A global variable used in the STAR Terrain Model.

TMCA.CLS
A global variable used in the STAR Terrain Model.

TMICB.CLS
A global variable used in the STAR Terrain Model.

TO.ATTACK.FORCE.RATIO
An attribute of the temporary entity TACTICAL.ORDER indicating the strength threshold ratio between friendly and opposing forces below which any order being executed is immediately changed to ATTACK.

TO.AZIMUTH
An attribute of the temporary entity TACTICAL.ORDER indicating the direction (in degrees clockwise from grid north) in which the tactical order is to be executed.

TO.FAILURE.FORCE.RATIO
An attribute of the temporary entity TACTICAL.ORDER indicating the strength threshold ratio between friendly and opposing forces above which the FAILURE order specified in TO.FAILURE.NEXT.ORDER is immediately executed.

TO.FAILURE.NEXT.ORDER
An attribute of the temporary entity TACTICAL.ORDER indicating the order (ATTACK, DEFEND, MOVE, WITHDRAW, DELAY) to be executed when the previous order results in failure.

TO.LIST
A set of TACTICAL.ORDER entities owned by a unit.
TO.RANGE
An attribute of the temporary entity TACTICAL.ORDER indicating the distance in meters for which a tactical order is to be carried out by a unit in a moving posture.

TO.STRENGTH.THRESHOLD
An attribute of the temporary entity TACTICAL.ORDER giving the strength threshold percentage below which the FAILURE order specified in TO.FAILURE.NEXT.ORDER is immediately executed.

TO.SUCCESS.NEXT.ORDER
An attribute of the temporary entity TACTICAL.ORDER specifying the order (ATTACK, DEFEND, MOVE, WITHDRAW, DELAY) to be executed when the previous order succeeds.

TO.TIME.DURATION
An attribute of the temporary entity TACTICAL.ORDER specifying a time interval in minutes before a unit selects the next order.

TO.TYPE
An attribute of the temporary entity TACTICAL.ORDER indicating the type of action to be taken (ATTACK, DEFEND, MOVE, WITHDRAW, DELAY, FOLLOW) as a result of the order.

TRACE
A routine, activated if DEBUG has been set to "YES", which writes out the attributes of each process and event before their activation.

TRANSMIT.MESSAGE
A process simulating the sending and receiving of messages. It may belong to a MSG.LIST and its attribute names are prefixed with "TM."

TREE.CHECK
A routine used in the STAR Terrain Model.
TU.ALTGATE.CP
An attribute of the permanent entity TYPE.UNIT indicating whether an alternate command post exists for this type unit.

TU.ARTY.DURATION
An attribute of the permanent entity TYPE.UNIT giving the duration of fire (in minutes) of an opposing artillery unit against this type unit.

TU.ARTY.INTERVAL
An attribute of the permanent entity TYPE.UNIT giving the interval (in minutes) between periods of fire by an opposing artillery unit against this type unit.

TU.CLASS
An attribute of the permanent entity TYPE.UNIT identifying the class of a unit (HQ, CORPS.HQ, DIV.HQ, BDE.HQ, REGT.HQ, BN.HQ, CO.HQ, ALT.CP, FDC, ARTILLERY, MANEUVER, SUPPORT, EW.UNIT, COMM.UNIT, OTHER)

TU.COLOR
An attribute of the permanent entity TYPE.UNIT identifying the side to which a unit belongs (RED or BLUE).

TU.COMM.SETUP.TIME
An attribute of the permanent entity TYPE.UNIT giving the time period (in minutes) required for a type unit to establish wire communications after change from a moving posture (ATTACK, MOVE, WITHDRAW) to a static posture (DEFEND, DELAY).

TU.COMM.TEARDOWN.TIME
An attribute of the permanent entity TYPE.UNIT indicating the time period (in minutes) required for this type unit to discontinue wire communications before changing from a static posture (DEFEND, DELAY) to moving posture (ATTACK, MOVE, WITHDRAW).
TU.DURATION.OF.SUPPRESSION
   An attribute of the permanent entity TYPE.UNIT indicating the time period (in minutes) for which a unit's effectiveness is decreased because of opposing artillery fire.

TU.ENCRYPTION.FACTOR
   An attribute of the permanent entity TYPE.UNIT; a multiplier used with message length to determine the time in minutes required to encrypt a message.

TU.EW.PRIORITY
   An attribute of the permanent entity TYPE.UNIT giving the relative priority of this type unit for EW actions by an opposing unit.

TU.EW.SETUP.TIME
   An attribute of the permanent entity TYPE.UNIT giving the time period (in minutes) before this type unit can initiate EW functions after changing from a moving posture to a static posture.

TU.EW.TEARDOWN.TIME
   An attribute of the permanent entity TYPE.UNIT giving the time period (in minutes) required for this type unit to discontinue EW functions in preparation for change from a static posture to a moving posture.

TU.FULL.STRENGTH
   An attribute of the permanent entity TYPE.UNIT indicating its strength at the beginning of the simulation.

TU.IF.PRIORITY
   An attribute of the permanent entity TYPE.UNIT giving the relative priority of this type unit for indirect fire by an opposing unit.

TU.INTELLIGENCE.FADE.RATE
   An attribute of the permanent entity TYPE.UNIT giving the percentage rate per minute at which intelligence information relating to this type unit decreases in value.
TU.MAX. ENCRYPTION.CAPABILITY
An attribute of the permanent entity TYPE.UNIT giving the maximum number of messages which can be encrypted simultaneously by this type unit.

TU.MOVE.RATE
An attribute of the permanent entity TYPE.UNIT giving the rate (in meters per minute) at which this type unit can move.

TU.NAME
An attribute of the permanent entity TYPE.UNIT giving the name of the type unit being described.

TU.RADIUS
An attribute of the permanent entity TYPE.UNIT giving the distance in meters from the location of the center of the unit to its periphery (to determine when opposing units come into contact with each other).

TU.SUPPRESSION.FACTOR
An attribute of the permanent entity TYPE.UNIT indicating the percentage decrease in a unit’s effectiveness resulting from it being subjected to opposing artillery fire.

TU.TACTICAL.SETUP.TIME
An attribute of the permanent entity TYPE.UNIT giving the time period (in minutes) required before an artillery unit can be prepared to function after change from a moving to a static posture.

TU.TACTICAL.TEARDOWN.TIME
An attribute of the permanent entity TYPE.UNIT giving the time period (in minutes) required before an artillery unit can change from a static to a moving posture.
TU.CLASS
A computed global variable (two-dimensional alpha array) used to store alphabetical descriptions of TU.CLASS

TYPE.AIR.SORTIE
A permanent entity used to describe air sorties. Its attribute names are prefixed with "TAS."

TYPE.UNIT
A permanent entity used to describe characteristics of units. Its attribute names are prefixed with "TU."

TYPE.UNIT.CLASS
A permanent entity used as an index for compound entities.

TYPE.UNIT.SETUP
A routine which initially processes data input to the model in the major category entitled TYPE UNITS (category IV).

UNIT
A temporary entity describing a collection of personnel and equipment located at a point on a battlefield. It belongs to a UN.LIST and its attribute names are prefixed with "UN."

UN.ACTIVE.TACTICAL.ORDER
An attribute of the temporary entity UNIT pointing to the TACTICAL.ORDER that a unit is executing.

UN.ALTARENATE.CP
An attribute of the temporary entity UNIT indicating whether or not this unit has an alternate command post.

UN.ARTY.STATUS
An attribute of the temporary entity UNIT relating to artillery units only and indicating status of artillery (BUSY, IDLE, or DOWN).
UN.AZIMUTH

An attribute of the temporary entity UNIT indicating the direction in which the unit is moving.

UN.COMM.TIME.TO.RESUME

An attribute of the temporary entity UNIT reflecting the simulated time at which the unit can resume wire communications (stop time + TU.COMM.SETUP.TIME).

UN.ENEMY.INTEL

An attribute of the temporary entity UNIT indicating the quantity of intelligence about a unit possessed by the opposing side.

UN.EW.TIME.TO.RESUME

An attribute of the temporary entity UNIT reflecting the simulated time at which a unit can resume EW functions (stop time + TU.EW.SETUP.TIME).

UN.FORCE.RATIO

An attribute of the temporary entity UNIT reflecting the ratio of the strength of the units with which it is in contact to its strength.

UN.ID

An attribute of the temporary entity UNIT; an identification number which is unique for each unit on a side.

UN.INTEL.LAST.COORDINATION.TIME

An attribute of the temporary entity UNIT reflecting the last simulated time at which the unit received an intelligence update.

UN.LAST.COMBAT.COORDINATION

An attribute of the temporary entity UNIT reflecting the last simulated time at which it received a combat coordination message.
UN.LAST.MOVE.TIME
An attribute of the temporary entity UNIT giving the time that
the unit's position was last updated.

UN.LIST
A set of UNIT entities owned by a side.

UN.NAME
An attribute of the temporary entity UNIT giving its name.

UN.REMAINING.DISTANCE
An attribute of the temporary entity UNIT reflecting, for a
moving unit, the distance it must move to complete its UN.
ACTIVE.TACTICAL.ORDER.

UN. STRENGTH
An attribute of the temporary entity UNIT providing the strength
of the unit. It is a positive integer value computed by the
model.

UN.SUPERIOR.UNIT
An attribute of the temporary entity UNIT containing a pointer
of a unit's superior unit in the chain of command.

UN.SUPPRESSION.FACTOR
An attribute of the temporary entity UNIT used in determining
its effectiveness after receiving artillery fire.

UN.TACTICAL.TIME.TO.RESUME
An attribute of the temporary entity UNIT relating to an artil-
ler y unit and reflecting the simulated time at which it can
resume artillery functions (stop time + TU.TACTICAL.SETUP.TIME).
UN.TIME.OF.LAST.ARTY
An attribute of the temporary entity UNIT reflecting the simulated time at which it was last subjected to artillery fire.

UN.TYPE
An attribute of the temporary entity UNIT giving its type.

UN.X.COORDINATE
An attribute of the temporary entity UNIT giving the six digit X UTM grid coordinate of the unit's location.

UN.Y.COORDINATE
An attribute of the temporary entity UNIT giving the six digit Y UTM grid coordinate of the unit's location.

UPDATE.FEBA
A computed global variable reflecting the period of time it would take for the fastest unit to move across one grid square.

UPDATE.INTELLIGENCE
A routine called by ATTRITION to update intelligence values as a result of contact and time decay.

USAGE
A computed global variable (two-dimensional alpha array) used for storing alphabetical descriptions of CO.USAGE, EWO.TARGET. NET, and NET.USAGE values for output reports.

VISFRA.LS
A global variable used in the STAR Terrain Model.

VISFRB.LS
A global variable used in the STAR Terrain Model.

WEAPON
A temporary entity belonging to a WPN.LIST and containing data on the weapons owned by a unit. Its attribute names are prefixed with "WPN." and their values are set by the model.
WEAPONS.ATTRITION

A routine which identifies weapons destroyed as a result of routine ATTRITION.

WP.ID

An attribute of the temporary entity WPN.POINTER reflecting the name of a WPN.TYPE owned by a TYPE.UNIT.

WP.LIST

A set of WPN.POINTER entities owned by a TYPE.UNIT.

WP.QUANTITY

An attribute of the temporary entity WPN.POINTER reflecting the number of a type of weapon (WP.ID) owned by a TYPE.UNIT.

WPN.CURRENT.QUANTITY

An attribute of the temporary entity WEAPON containing a value reflecting its current quantity.

WPN.FS.QUANTITY

An attribute of the temporary entity WEAPON reflecting the originally assigned quantity of the equipment.

WPN.LIST

A set of WEAPON entities owned by a unit.

WPN.POINTER

A temporary entity belonging to a WP.LIST and giving the ID and quantity of a type weapon. Its attribute names are prefixed with "WP."

WPN.TYPE

A permanent entity containing all non-variable data concerning the weapons in the simulation. Its attributes are prefixed with "WT."
WFN.TYPE.POINTER
An attribute of the temporary entity WEAPON pointing to the
weapon type.

WT.ATTRITION.CLASS
An attribute of the permanent entity WPN.TYPE reflecting the
rate at which attrition of this type weapon is incurred (LIGHT or
HEAVY).

WT.CAS.KILLS
An attribute of the permanent entity WPN.TYPE indicating the
quantity of a type of weapon destroyed by close air support.

WT.COLOR
An attribute of the permanent entity WPN.TYPE indicating the
side to which a weapon belongs (BLUE or RED).

WT.COMBAT.VALUE
An attribute of the permanent entity WPN.TYPE reflecting its
combat value (a positive integer in the range 0 to 100).

WT.DAMAGE.CLASS
An attribute of the permanent entity WPN.TYPE indicating the
damage class number relating to this type of equipment.

WT.DF.KILLS
An attribute of the permanent entity WPN.TYPE indicating the
quantity of a type of weapon destroyed by direct fire.

WT.IF.KILLS
An attribute of the permanent entity WPN.TYPE indicating the
quantity of a type of weapon destroyed by indirect fire.

WT.NAME
An attribute of the permanent entity WPN.TYPE reflecting its
name.
WT.QUANTITY.ASSIGNED
An attribute of the permanent entity WPN.TYPE expressing the quantity of a type of weapon originally assigned.

WT.RANGE
An attribute of the permanent entity WPN.TYPE indicating the maximum effective range of the weapon (in meters).

WT.TERRAIN.EFFECT
An attribute of the permanent entity WPN.TYPE indicating whether or not terrain is a factor which affects the attrition rate of a type of weapon.

X.GRID
A permanent entity (UTM grid coordinate), which, together with a Y.GRID, identifies the location of a grid square on a map.

X.ORIGIN
A global variable (UTM grid coordinate), identifying the X coordinate of the lower left corner of the map used for the simulation.

XA.LS
A global variable used in the STAR Terrain Model.

XB.LS
A global variable used in the STAR Terrain Model.

XC.E
An attribute of the permanent entity CVR.ELLIPSE; the six-digit X coordinate of the center of an ellipse representing an area of cover.

XC.H
An attribute of the permanent entity HILL; the six-digit X coordinate of the center location of a hill.
Y.GRID
A permanent entity (UTM grid coordinate), which, together with an X.GRID identifies the location of a grid square on a map.

Y.ORIGIN
A global variable (UTM grid coordinate), identifying the Y coordinate of the lower left corner of the map used for the simulation.

YA.LS
A global variable used in the STAR Terrain Model.

YB.LS
A global variable used in the STAR Terrain Model.

YC.E
An attribute of the permanent entity CVR.ELLIPSE; the six-digit Y coordinate of the center of an ellipse representing an area of cover.

YC.H
An attribute of the permanent entity HILL; the six-digit Y coordinate of the center location of a hill.
5.3 Program Descriptions and Listings

This subsection contains a brief statement about the preamble and each routine, event, and process in the DEWCOM Model. Routines are listed after the preamble and main program and are followed by events and processes (alphabetically within each category).

Copies of the DEWCOM Model source code listing are available upon request from:

Commander
US Army Concepts Analysis Agency
Rt 2, Woodmont Avenue
Bethesda, MD 20014
ATTN: CSCA-SM (Director)

5.3.1 The Preamble

The preamble defines all elements in the model including background conditions, permanent and temporary entities and their attributes, processes and their attributes, event notices, external events, computed global variables, input global variables, redefinition of variable names to ensure uniqueness, attribute definitions, set definitions, routine and function declarations, "define to mean" statements, and the possible values for those variables which can assume limited values.

5.3.2 The MAIN Program

The MAIN program is a routine which provides the central control for execution of the DEWCOM Model.

5.3.3 Routines

5.3.3.1 ALPHA.SETUP Routine
This routine establishes the values of the elements in arrays used for alpha output.

5.3.3.2 ATTRITION Routine
This routine updates unit attrition caused by direct contact with opposing units.

5.3.3.3 CALL.SPECIFIC.UNIT Routine
This routine sends a message to one of the units identified as a recipient in the routine which activates the NEXT.COMM.ORDER routine.
5.3.3.4. CAS.TALK. Routine
This routine attempts to find a link between a ground controller and an air sortie if TAS.GROUND.COORDINATION has been set to "YES".

5.3.3.5 CE.ATTRITION Routine
This routine identifies communications equipment destroyed through routine ATTRITION or processes CLOSE.AIR.SUPPORT or FIRE.MISSION.

5.3.3.6 CHECK.FEBA.DISTANCE Routine
This routine determines the distance to the FEBA from a specific unit.

5.3.3.7 COMBAT.ORGANIZATION.SETUP Routine
This routine initially processes data input to the model in the major category entitled COMBAT ORGANIZATION (Category V).

5.3.3.8 COMM.ORGANIZATION.SETUP Routine
This routine initially processes data input to the model in the major category entitled COMMUNICATIONS ORGANIZATION (Category VI).

5.3.3.9 CONCATENATE Routine
This routine is called by the process TRANSMIT.MESSAGE and concatenates links to form a circuit from a message originator to the destination.

5.3.3.10 CONTROLS.INPUT Routine
This routine initially processes data input to the model in the major category entitled CONTROLS (Category I).

5.3.3.11 COORDINATE.INTELLIGENCE Routine
This routine updates the intelligence log of the receiver.

5.3.3.12 DI.REPORT Routine
This routine generates Input Data Report DI (CONTROLS), reflecting if the simulation is to be started, reports to be produced, side attributes, and global variables.
5.3.3.13 D2.REPORT Routine
This routine generates Input Data Reports D2A (Mobility Index Data), D2B (Obstacles Index Data), and D2C (Base Altitudes), relating to terrain.

5.3.3.14 D2D.REPORT Routine
This routine generates Input Data Reports D2D (Hill Data) and D2E (Hill Summary Data) relating to terrain.

5.3.3.15 D2F.REPORT Routine
This routine generates Input Data Reports D2F (Covers Data) and D2G (Covers Summary Data) relating to terrain.

5.3.3.16 D3.REPORT Routine
This routine generates Input Data Reports D3A (Equipment Damage Class Data) and D3B (Communications Equipment Data). A separate portion of Report D3B is produced for each side.

5.3.3.17 D3C.REPORT Routine
This routine generates Input Data Report D3C (Electronic Warfare Equipment Data) with a separate portion produced for each side.

5.3.3.18 D3D.REPORT Routine
This routine generates Input Data Report D3D (Weapons Data) with a separate portion produced for each side.

5.3.3.19 D3E.REPORT Routine
This routine generates Input Data Report D3E (Air Sortie Data) with a separate portion produced for each side.

5.3.3.20 D4.REPORT Routine
This routine generates Input Data Report D4A, which reflects type units separately by side along with their attributes.

5.3.3.21 D4B.REPORT Routine
This routine generates Input Data Report D4B, containing an equipment listing for each type unit with a separate portion produced for each side.
5.3.3.22 D4C.REPORT Routine

This routine generates Input Data Report D4C, which reflects attrition rates for each type of unit separately by side.

5.3.3.23 D4D.REPORT Routine

This routine generates Input Data Report D4D, which reflects the desirability of firing each type weapon of the opposing side at each type unit class. A separate portion is produced for each side.

5.3.3.24 D4E.REPORT Routine

This routine generates Input Data Report D4E, which reflects performance degradation and sector width information separately for each side.

5.3.3.25 D5.REPORT Routine

This routine generates Input Data Report D5, which reflects unit combat organization data for each side.

5.3.3.26 D6.REPORT Routine

This routine generates Input Data Reports D6A, reflecting communications nets and links separately for each side, and D6B, reflecting data for compound links, separately by side.

5.3.3.27 D7.REPORT Routine

This routine generates Input Data Reports D7A, reflecting
communications orders for each originating unit separately by side, and D7D, listing combat postures for both sides.

5.3.3.28 D7B.REPORT Routine

This routine generates Input Data Report D7B, which lists LW order information separately by side.

5.3.3.29 D7C.REPORT Routine

This routine generates Input Data Report D7C, which lists tactical orders separately by side.

5.3.3.30 DATA.PROCESSOR Routine

This routine controls the various data input to the model and the report routines.

5.3.3.31 DISTANCE.FROM.FEBA Routine

This function routine calculates the distance of a unit from the FEBA.

5.3.3.32 ELEV Routine

This routine is used in the STAR Terrain Model.

5.3.3.33 ELIMINATE.UNIT Routine

This routine eliminates a unit whose strength has fallen below a specified threshold. If it is a command post with an alternate, it activates the alternate (which has been assumed to have undergone no attrition).
5.3.3.34 ELVI Routine

This routine is used in the STAR Terrain Model.

5.3.3.35 END.CAS.TRANSMISSION Routine

This routine releases the link established by CAS.TALK when communication between a ground controller and the air sortie is completed.

5.3.3.36 END.TRANSMISSION Routine

This routine releases links used for communications (other than CAS.TALK) when the communication is completed.

5.3.3.37 EQUIPMENT.SETUP Routine

This routine initially processes data input to the model in the major category entitled EQUIPMENT (Category III).

5.3.3.38 ERASE.CIRCUIT Routine

This routine releases NOTE entities for use when the message using the circuit has been transmitted.

5.3.3.39 ERROR.MESSAGE Routine

This routine centralizes error handling for the model. Based on the value of a code, it selects and prints the appropriate error message. For fatal errors, it calls a routine to write out the current status.
5.3.3.40 EW.UNIT.SEARCH Routine

This routine is activated by routine NEXT.COMM.ORDER to determine if an EW unit exists within range to perform a required EW function.

5.3.3.41 EWE.ATTRITION Routine

This routine identifies EW equipment destroyed through routine ATTRITION or processes CLOSE.AIR.SUPPORT or FIRE.MISSION.

5.3.3.42 FIRE.DIRECTION Routine

This routine tasks artillery units by activating the process FIRE.MISSION.

5.3.3.43 FIRE.EFFECTIVENESS Routine

This function routine determines the effectiveness of a unit from the DEGRADATION.LIST based on its accumulated attrition.

5.3.3.44 FIRST.PAGE Routine

This routine generates the cover sheet for DEWCOM reports.

5.3.3.45 INITIALIZE Routine

This routine schedules initial processes and events, and initializes subprogram variables CONDITION.V and INTEGRATOR.V.
5.3.3.46 INPUT.LOS.TERRAIN Routine

This routine reads in the data for the line-of-sight model (base altitudes, hill data, and cover ellipse data).

5.3.3.47 KOVER Routine

This routine is used in the STAR Terrain Model.

5.3.3.48 LINE.OF.SIGHT Routine

This routine is used in the STAR Terrain Model.

5.3.3.49 LINK.AVAILABILITY Routine

This routine is called by TRANSMIT.MESSAGE to determine if a link is available for a specific message and, if so, transmits the message.

5.3.3.50 LINK.CHECK Routine

This routine is called by CONCATENATE to determine if a particular link can be used and, if so, returns the LK.DESIRABILITY.OF.USING value.

5.3.3.51 LINK.INPUT Routine

This routine reads in the link input data in the major input data category entitled COMMUNICATIONS ORGANIZATION.

5.3.3.52 MI.REPORT Routine
This routine generates Model Report M1 (Unit Status), with a separate part produced for each side.

5.3.3.53 M2.REPORT Routine

This routine generates Model Report M2 (Link Status), reflecting the status of all communications links, with a separate part produced for each side.

5.3.3.54 M3.REPORT Routine

This routine generates Model Report M3 (Message Status), reflecting the status of all messages, with a separate part produced for each side.

5.3.3.55 M4.REPORT Routine

This routine generates Model Report M4 (Attrition Summary), reflecting equipment attrition by type, with a separate part produced for each side.

5.3.3.56 M5.REPORT Routine

This routine generates Model Report M5 (EW Status), which consists of two parts, Actions in Progress and Awaiting Actions. Each part is produced separately for each side.

5.3.3.57 M6.EW.REPORT Routine

This routine generates the portion of Model Report M6 (Equipment Status) reflecting status of EW equipment. It is produced separately for each side. The other two portions are produced by routines M6.REPORT and M6.WEAPONS.REPORT.
5.3.3.58 M6.REPORT Routine

This routine generates the portion of Model Report M6 (Equipment Status) reflecting status of Communications Equipment. It is produced separately for each side. The other two portions are produced by routines M6.EW.REPORT and M6.WEAPONS.REPORT.

5.3.3.59 M6.WEAPONS.REPORT Routine

This routine generates the portion of Model Report M6 (Equipment Status) reflecting status of weapons. It is produced separately for each side. The other two portions are produced by routines M6.REPORT and M6.EW.REPORT.

5.3.3.60 M7.REPORT Routine

This routine generates Model Report M7 (Intelligence Log), which reflects units which have intelligence information relating to opposing side units. It is produced separately for each side.

5.3.3.61 NEWTON Routine

This routine is used in the STAR Terrain Model.

5.3.3.62 NEXT.COMM.ORDER Routine

This routine finds a net on which a given order can be sent and activates TRANSMIT.MESSAGE.

5.3.3.63 NEXT.EW.ORDER Routine

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This routine causes units to perform EW orders, activating process JAMMER, LOCATOR, or INTERCEPTOR, as appropriate.

5.3.3.64 NEW.COMBAT.VALUES Routine

This routine reads in a new WT.COMBAT.VALUE for each WPN.TYPE.

5.3.3.65 NEW.MOVE.RATES Routine

This routine reads in new values of TU.MOVE.RATE for all TYPE.UNITS.

5.3.3.66 NEW.ORDERS Routine

This routine reads in new orders.

5.3.3.67 ORDERS.SETUP Routine

This routine initially processes data input to the model in the major category entitled ORDERS (Category VII).

5.3.3.68 PERCEIVED.FORCE.RATIO Routine

This function routine calculates the ratio of opposing forces based on several factors.

5.3.3.69 QQ.OUTPUT Routine

This routine writes transactions into the QWICK QWERY file.

5.3.3.70 RADIO.VISIBILITY Routine
This function routine determines if the ends of a link have radio line-of-sight.

5.3.3.71 RANGE Routine

This function routine computes the range between two units.

5.3.3.72 READ.THE.NAME Routine

This routine reads in alphabetical input data.

5.3.3.73 RECEIPT.OF.MESSAGE Routine

This routine models the effects of receiving a message.

5.3.3.74 REMOVE.COMM.LINKAGES Routine

This routine eliminates communications linkages relating to any unit eliminated by ELIMINATE.UNIT.

5.3.3.75 SET Routine

This function routine is used to verify the validity of alphabetical input terms.

5.3.3.76 SET.FEBA.POINT

This routine updates the location of the FEBA for each Y.GRID value.

5.3.3.77 SIGHT Routine
This function routine is the control program for the STAR Terrain Model to determine whether line-of-sight exists.

5.3.3.78 SIGNAL.STRENGTH Routine

This function routine determines the signal strength in a link.

5.3.3.79 SNAP.R Routine

This routine is called by the TIM1.R routine to write out status information (reports and attributes) at model termination if a SIMSCRIPT execution error occurs.

5.3.3.80 SNAP.SIOES Routine

This routine is called by the TIM1.R routine to write out attributes of sides and units at model termination if a SIMSCRIPT execution error occurs.

5.3.3.81 STOP.THE.MODEL Routine

This routine is called to stop the model. It prints a message indicating the reason for stopping and writes final reports, if reports have been requested.

5.3.3.82 TACTICAL.ORDERS.SETUP Routine

This routine initially processes data input to the model in the subcategory Tactical Orders of the major category entitled ORDERS (Category VII).
5.3.3.83 TERRAIN.SETUP Routine

This routine initially processes data input to the model in the major category entitled TERRAIN (Category II).

5.3.3.84 THRESHOLD.CHECK Routine

This function routine compares updated strength and intelligence values to determine whether specified thresholds have been achieved and takes appropriate actions.

5.3.3.85 TIM1.R Routine

This routine determines the event or process to occur next, allowing the simulation of continuous variables.

5.3.3.86 TRACE Routine

This routine is activated if DEBUG has been set to "YES" and writes out the attributes of each process and event before their activation.

5.3.3.87 TREE.CHECK Routine

This routine is used in the STAR Terrain Model.

5.3.3.88 TYPE.UNIT.SETUP Routine

This routine initially processes data input to the model in the major category entitled TYPE.UNITS (Category IV).

5.3.3.89 UPDATE.INTELLIGENCE Routine
This routine is called by ATTRITION to update intelligence values as a result of attrition and time decay.

5.3.3.90 WEAPONS.ATTRITION Routine
This routine identifies weapons destroyed as a result of routine ATTRITION.

5.3.4 Events

5.3.4.1 BACKGROUND.TRAFFIC Event
This event modifies delay times for messages.

5.3.4.2 END.OF.SIMULATION Event
This event causes final status reports to be written and the model to be terminated.

5.3.4.3 EXPENDABLE.JAMMER Event
This event initiates a JAMMER process using equipment with EWT.CLASS of EX.SPOT or EX.BARRAGE.

5.3.4.4 MOVE.UNIT Event
This event maneuvers units on the battlefield, updating unit position, checking proximity and line-of-sight to enemy units, and scheduling the next move.

5.3.4.5 NEW.AIR.SORTIE Event
This event replaces air sorties that have been expended.

5.3.4.6 NEXT.TACTICAL.ORDER Event
This event is invoked whenever a unit changes its UN.ACTIVE.TACTICAL.ORDER, updating that attribute and scheduling a new NEXT.TACTICAL.ORDER.

5.3.4.7 STATUS.REPORTS Event
This event causes specified model reports to be generated.

5.3.4.8 STOP.RESTART Event
This external event is triggered by the user to stop the model, change data, and restart the model.

5.3.5 Processes

5.3.5.1 CE.REPAIR Process

This process simulates the failure and repair of communications equipment. Its attribute names are prefixed with "CER".

5.3.5.2 CLOSE.AIR.SUPPORT Process

This process simulates air sorties. Its attribute names are prefixed with "CAS".

5.3.5.3 COUNTER.BATTERY.RADAR Process

This process simulates the actions of a counterbattery radar unit. Its attribute names are prefixed with "CBR".

5.3.5.4 EWE.REPAIR Process

This process simulates the failure and repair of EW equipment. Its attribute names are prefixed with "EWR".

5.3.5.5 FIRE.MISSION Process

This process simulates artillery firing. Its attribute names are prefixed with "FM".

5.3.5.6 INTERCEPTOR Process

This process simulates the interception of opposing side messages. Its attribute names are prefixed with "INT".

5.3.5.7 JAMMER Process

This process simulates spot and barrage jamming. It may belong to the set JM.LIST and its attribute names are prefixed with "JM".

5.3.5.8 LOCATOR Process

This process performs direction finding and identifies the location of an opposing unit. Its attribute names are prefixed with "LOC".
5.3.5.9 MESSENGER Process

This process handles sending a messenger if a message does not reach its destination by its deadline time (CO.DEADLINE.TIME) or if NET.TYPE is specified as MESSENGER. Its attribute names are prefixed with "MGR".

5.3.5.10 RADAR Process

This process simulates the data gathering of radar equipment. Its attribute names are prefixed with "RD".

5.3.5.11 TRANSMIT.MESSAGE Process

This process simulates the sending and receiving of messages. It may belong to a MSG.LIST and its attribute names are prefixed with "TM".
5.4 Job Control Language

The following sections give the EXEC 8 control statements required to compile, collect, and run the DEWCOM model. For the purpose of these examples, the file containing the source code, relocatables, and the absolute will be called G3DEWCOM.

5.4.1 Compilation

The following commands will compile the source code. If there is already an up-to-date compilation of the PREAMBLE, run time may be reduced by the statement VERY OLD PREAMBLE. This will suppress the compilation and listing of the PREAMBLE.

@ASG,A G3DEWCOM.
@ASG,T $$$$7,F///800 . OBJECT CODE
@ASG,T $$$$8,F///800 . STARS
@ASG,T $$$$11,F///800 . XREF
@ASG,T $$$$12,F///800 . SCRIPTS
@SIM25,SF ,G3DEWCOM.REL
PREAMBLE
.
.
ENDPREAMBLE
.
.
Source code to be compiled
.
.

5.4.2 Collection

The following commands will collect the relocatables and form the absolute. The overlay structures is required to reduce the amount of core needed for running the model.
@PACK G3DEWCOM
@PREP G3DEWCOM
@USE D,G3DEWCOM
@MAP,L,D.ABS
LIB D.
SEG MAIN
IN D.MAIN
SEG IN*,(MAIN)
IN D.RDATA$PROCES
IN D.RSTOP$RESTAR
SEG ALP*, (IN)
IN D.RALPHA$SETUP
SEG INA*, (IN)
IN D.RCONTROLS$IN
SEG OUTA*, (IN)
IN D.RD1$REPORT
SEG INB*, (IN)
IN D.RTERRAIN$SET
SEG OUTB*, (IN)
IN D.RD2$REPORT
SEG OUTB1*, (OUTB)
IN D.RD2D$REPORT
SEG OUTB2*, (OUTB)
IN D.RD2F$REPORT
SEG INC*, (IN)
IN D.REQUIPMENT$S
SEG OUTC*, (IN)
IN D.RD3$REPORT
SEG OUTC1*, (OUTC)
IN D.RD3C$REPORT
SEG OUTC2*, (OUTC)
IN D.RD3D$REPORT
SEG OUTC3*, (OUTC)
IN D.RD3E$REPORT
SEG IND*, (IN)
IN D.RTYPES$UNIT$S

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SEG OUTD*, (IN)
  IN D.RD4$REPORT
    SEG OUTD1*, (OUTD)
      IN D.RD4B$REPORT
    SEG OUTD2*, (OUTD)
      IN D.RD4C$REPORT
    SEG OUTD3*, (OUTD)
      IN D.RD4D$REPORT
    SEG OUTD4*, (OUTD)
      IN D.RD4E$REPORT
    SEG INE*, (IN)
      IN DE.RCOMBATSORGAN
    SEG OUTE*, (IN)
      IN D.RD5$REPORT
    SEG INF*, (IN)
      IN D.RCOMS$ORGAN
    SEG OUTF*, (IN)
      IN D.RD6$REPORT
    SEG ING*, (IN)
      IN D.ORDERS$SETUP
    SEG OUTG*, (IN)
      IN D.RD7$REPORT
        SEG OUTG1*, (OUTG)
          IN D.RD7B$REPORT
        SEG OUTG2*, (OUTG)
          IN D.RD7C$REPORT

SEG A*, (MAIN)
  IN D.REC$REPAIR
SEG B*, (MAIN)
  IN D.RECLOSE$AIR$S
SEG C*, (MAIN)
  IN D.RCOUNTER$BAT
SEG D*, (MAIN)
Running the model requires three input files and three output files, in addition to the file containing the absolute. They must be assigned to the SIMSCRIPT units as shown below:
- G3DEWCOM contains the data inputs described in section 3.
- G3EXJ contains the external event cards used to schedule the event EXPENDABLE.JAMMER.
- G3SRS contains the external event cards used to schedule the event STOP.RESTART.
- G3PRINT will receive the data and model reports and all data written on unit 6.
- G3OUT will receive the error message and any other data written on Unit 8.
- G3QQOUT will receive the QWICK QWERY transactions and will be used by the QWICK QWERY Post-processor to construct reports.

@ASG,A G3DEWCOM.
@ASG,A G3DEWCOMDATA.
@ASG,A G3OUT.
@ASG,A G3QQOUT.
@ASG,A G3PRINT.
@ASG,A G3EXJ.
@ASG,A G3SRS.
@ERS G3OUT.
@USE SIMUB.,G3OUT.
@USE SIMU9., G3EXJ.
@USE SIMU10., G3SRS.
@USE SIMU12., G3QQOUT.
@XQT G3DEWCOM.ABS
APPENDIX A

GLOSSARY OF TERMS

ACKNOWLEDGEMENT
A message from the addressee informing the originator that his communication has been received and understood. (FM 24-1)

ADDRESSEE
The activity or individual to whom a message is directed by the originator. Addressees are indicated as either "ACTION" or "INFORMATION". (FM 24-1)

ADDRESS INDICATING GROUP
An address group which represent a specific set of action or information addresses. (FM 24-1)

AREA SIGNAL CENTER
This signal center provides communications to units within its assigned geographical area of responsibility. This ties the units into the area communications system and supplements their organic means for communications with higher, subordinate, or adjacent headquarters. (FM 24-1)

ATTENUATION
Decrease in strength of a signal, beam, or wave as a result of absorption of energy and of scattering out of the path of a receiver. (FM 24-1).

AUTOMATIC CENTRAL OFFICE
A switch at which communications between subscribers is effected without the intervention of an operator. The electronic switches are controlled by the operation of a keysender on the instrument of the originating subscriber. (FM 24-1)
<p>| AUTOMATIC DATA PROCESSING SYSTEM | Automatic Data Processing Equipment linked together by communication and data transmission equipment to form an integrated system for the processing and conveyance of data. (FM 24-1) |
| BARRAGE JAMMING | The jamming of several channels or frequencies simultaneously. (FM 24-1) |
| CHAFF | Radar confusion reflectors, which consist of thin, narrow metallic strips of various lengths and frequency responses, used to reflect echoes for confusion purposes. (FM 24-1) |
| CHANNEL | A facility for telecommunications on a system or circuit. The number of independent channels on a system or circuit is measured by the number of separate communications facilities that can be provided by it. (FM 24-1) |
| CIPHER, OFF-LINE | A method of encryption which is not associated with a particular transmission system and in which the resulting cryptogram can be transmitted by any means. (FM 24-1) |
| CIPHER, ON-LINE | An automatic method of encryption associated with a particular transmission system, whereby signals are encrypted and passed directly through the line to operate the reciprocal equipment at the distant station. (FM 24-1) |
| CIRCUIT | An electronic path between two or more points capable of providing a number of channels. (FM 24-1) |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMAND POST</td>
<td>A headquarters for a unit from which command and control is centrally exercised. (FM 24-1)</td>
</tr>
<tr>
<td>COMMAND SIGNAL CENTER</td>
<td>This signal center provides communications for command and control at division and corps headquarters and to units located in the immediate area as facilities permit. (FM 24-1)</td>
</tr>
<tr>
<td>COMMAND SYSTEM</td>
<td>A communications network which connects an echelon of command with some or all of its subordinate echelons for the purpose of command and control. (FM 24-1)</td>
</tr>
<tr>
<td>COMMON-USER CIRCUIT</td>
<td>A circuit allocated to furnish communications paths between switching centers to provide communications service on a common basis to all connected stations or subscribers. (FM 24-1)</td>
</tr>
<tr>
<td>COMMUNICATIONS-ELECTRONICS</td>
<td>A series of orders issued for the technical control and coordination of the signal communications activities of a command. (FM 24-1)</td>
</tr>
<tr>
<td>COMMUNICATIONS NODAL OPERATION INSTRUCTIONS</td>
<td>A dual function facility that incorporates both facilities control and technical control requirements. The technical control element contains patching, testing, conditioning, and monitoring equipment and provides technical control or circuits in and through the facility. The management element provides management and control of C-E functions within the node. (FM 24-1)</td>
</tr>
<tr>
<td>COMMUNICATIONS SYSTEM</td>
<td>Provides actual focal point for dynamic control, acts as operations center for command</td>
</tr>
</tbody>
</table>
system, and directs organic and subordinate C-E systems. Maintains the data base. Replaces the term SYSCON. (FM 24-1)

**CONTINUOUS WAVE**

Morse Code transmissions achieved by on and off keying of an unmodulated carrier wave, or by the keying of a modulating subcarrier wave with the carrier suppressed. (FM 24-1)

**DATA LINK**

A communication link suitable for transmission of data. (FM 24-1)

**DIAL CENTRAL OFFICE**

A switch at which communications between subscribers is effected without the intervention of an operator, by means of relays set in motion by the operation of a dial on the instrument of the originating subscriber. (FM 24-1)

**DIVERSITY SYSTEM**

A system of communications in which a single received signal is derived from a combination of, or selections from, a plurality of transmission channels or paths. (FM 24-1)

**DUPLEX OPERATION**

Duplex (or "Full Duplex") operation refers to communications between two points in both directions simultaneously. (FM 24-1)

**ELECTROMAGNETIC COMPATIBILITY**

The ability of C-E equipments, subsystems, and systems to operate in their intended operational environments without suffering or causing unacceptable degradation because of unintentional electromagnetic radiation or response. (FM 24-1)
ELECTRONIC COUNTER-COUNTERMEASURES
That division of electronic warfare involving actions taken to insure friendly effective use of the electromagnetic spectrum. (FM 24-1)

ELECTRONIC COUNTERMEASURES
That major subdivision of electronic warfare involving actions taken to prevent or reduce the effectiveness of enemy equipment and tactics employing or affected by electromagnetic radiations, and to exploit the use by the enemy of such radiations. (FM 24-1)

ELECTRONIC DECEPTION
The deliberate radiation, re-radiation, alteration, absorption or reflection of electromagnetic energy in a manner intended to mislead in enemy in the interpretation or use of information received by his electronic systems. There are two categories of deception: MANIPULATIVE and IMITATIVE. (FM 24-1)

ELECTRONIC INTELLIGENCE
The intelligence information product of activities engaged in the collection and processing, for subsequent intelligence purposes, of foreign, noncommunications, electromagnetic raditions emanating from other than nuclear detonations and radioactive sources. (FM 24-1)

ELECTRONIC JAMMING
The deliberate radiation, re-radiation, or reflection of electromagnetic energy with the object of impairing the use of electronic devices, equipment or systems being used by an enemy. (FM 24-1)

ELECTRONIC WARFARE
That division of military use of electronics involving actions taken to prevent or reduce an effective use by an enemy of radiated elec-
tromagnetic energy, and actions taken to in-
sure our own effective use of radiated elec-
tromagnetic energy. Electronic warfare con-
ists of Electronic Countermeasures (ECM),
Electronic Counter-countermeasures (ECCM),
and Electronic Warfare Support Measures
(ESM). (FM 24-1)

**Electronic Warfare Support Measures**
That division of EW involving actions taken to
search for, intercept, locate, record, and
analyze radiated electromagnetic energy, for
the purpose of exploiting such radiations in
support of military operations. Thus, ESM
provides a source of EW information required
to conduct ECM, ECCM, Threat Detection, Warn-
ing, Avoidance, Target Acquisition and Hom-
ing. (FM 24-1)

**Facsimile**
A system of telecommunications for the trans-
mission of fixed images with a view to their
reception in a permanent form. (FM 24-1)

**Frequency Assignment**
The process of designating a radio frequency
for use at a specific station or by a specific
military unit under specified conditions of
operation. (FM 24-1)

**Ground Wave**
In propagation, that portion of the trans-
mitted radio wave that travels near the sur-
face of the earth. (FM 24-1)

**Half-Duplex**
The capability of operating in either direc-
tion, but not in both directions simulta-
neously. It is also called "Simplex". (FM
24-1)
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<tr>
<th>Term</th>
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<tr>
<td>IMITATIVE ELECTRONIC DECEPTION</td>
<td>The intrusion on the channels of the enemy and the introduction of matter in imitation of his own for the purpose of deceiving or confusing him. (FM 24-1)</td>
</tr>
<tr>
<td>INTERCEPTION</td>
<td>The act of searching for and listening to and/or recording communications and electronic transmissions for the purpose of obtaining intelligence. (FM 24-1)</td>
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<td>INTERFACE</td>
<td>A point common to two or more systems or other entities across which useful information flow takes place. (FM 24-1)</td>
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<tr>
<td>INTERFERENCE</td>
<td>Any electrical disturbance which causes undesirable responses in electronic equipment (FM 24-1)</td>
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<tr>
<td>LASER</td>
<td>A device that utilizes the natural oscillations of atoms for amplifying or generating electromagnetic waves in the region of the spectrum from the ultraviolet to the far-infrared, including the visible region. (FM 24-1)</td>
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<td>LIGHT ANTIARMOR WEAPON</td>
<td>The M72A2 is a close-in, lightweight, smooth-bore, percussion-fired antiarmor weapon which is designed to give the individual infantryman the capability of defeating armored vehicles. (FM 24-1)</td>
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<tr>
<td>LINK</td>
<td>The basic component of a circuit which assures a direct connection between two units. (See ROUTE)</td>
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<tr>
<td>LOCAL LOOP</td>
<td>A circuit connecting an end instrument to a switching facility or distribution point. (FM 24-1)</td>
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<tr>
<td>MANIPULATIVE ELECTRONIC DECEPTION</td>
<td>The use of friendly electromagnetic radiations so as to falsify the information which a foreign nation can obtain from their analysis. (FM 24-1)</td>
</tr>
<tr>
<td>MANUAL CENTRAL OFFICE</td>
<td>A switch in which the lines are connected to a switchboard and interconnections are controlled by an operator. (FM 24-1)</td>
</tr>
<tr>
<td>MESSAGE</td>
<td>A demand placed on the communications system which contains some information to be transmitted along a route from one unit to another.</td>
</tr>
<tr>
<td>MIJI REPORT</td>
<td>A report to a higher headquarters of an incident of interference in the reception of radio signals. (FM 24-1)</td>
</tr>
<tr>
<td>MINIMIZE</td>
<td>A condition wherein normal messages and telephone traffic are drastically reduced, in order that messages connected with an actual or simulated emergency will not be delayed. (FM 24-1)</td>
</tr>
<tr>
<td>MULTI-AXIS</td>
<td>More than one line along which communications takes place. (FM 24-1)</td>
</tr>
<tr>
<td>MULTI-MEANS</td>
<td>More than one method or system over which a message can be transmitted. (FM 24-1)</td>
</tr>
<tr>
<td>MULTIPLEX</td>
<td>The simultaneous use of a number of channels on a single circuit. (FM 24-1)</td>
</tr>
<tr>
<td><strong>NET</strong></td>
<td>An entire communications network consisting of one or more circuits.</td>
</tr>
<tr>
<td><strong>NET CONTROL STATION</strong></td>
<td>A station designated to control traffic and enforce circuit discipline within a given net. (FM 24-1)</td>
</tr>
<tr>
<td><strong>NETWORK</strong></td>
<td>An organization of stations capable of intercommunication but not necessarily on the same channel. (FM 24-1)</td>
</tr>
<tr>
<td><strong>NODE</strong></td>
<td>An end point of a link. It may also be a switching point for messages and is co-located with a unit.</td>
</tr>
<tr>
<td><strong>OPERATION ORDER</strong></td>
<td>A directive, usually formal, issued by the commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation. (FM 24-1)</td>
</tr>
<tr>
<td><strong>PRECEDENCE</strong></td>
<td>A designation, assigned to a message by the originator, to indicate to communications personnel the relative order of handling and to the addressee the order in which the message is to be noted. (FM 24-1)</td>
</tr>
<tr>
<td><strong>RADIO DIRECTION FINDING</strong></td>
<td>Radio locations in which only the direction of a station is determined by means of its emission. Since this technique can be used against all electronic emitters, it is sometimes simply referred to as direction finding. (FM 24-1)</td>
</tr>
<tr>
<td><strong>RADIO LISTENING SILENCE</strong></td>
<td>Designated radio stations are instructed to monitor their receivers for incoming traffic but not to transmit for a specified period or until further ordered. (FM 24-1)</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<td>------------------------------</td>
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</tr>
<tr>
<td>RADIO RELAY SYSTEM</td>
<td>A radio transmission system in which the signals are received and transmitted from point to point by intermediate radio stations. This system, normally used in conjunction with carrier equipment, provides channels for both voice and teletypewriter operations. (FM 24-1)</td>
</tr>
<tr>
<td>RADIO SILENCE</td>
<td>A period during which all or certain radio equipment capable of radiation is kept inoperative. (FM 24-1)</td>
</tr>
<tr>
<td>RADIO TELETYPewriter</td>
<td>The system of communication by teletypewriter over radio circuits. (FM 24-1)</td>
</tr>
<tr>
<td>RADIO WIRE INTEGRATION</td>
<td>The interconnection of wire circuits with radio facilities. (FM 24-1)</td>
</tr>
<tr>
<td>READABILITY</td>
<td>The ability to be understood, i.e., the readability of signals sent by any means of telecommunications. (FM 24-1)</td>
</tr>
<tr>
<td>RETRANSMISSION</td>
<td>Employment of a radio communication set for the purpose of rebroadcasting a message on a different frequency simultaneously with the original broadcast by means of an electrically operated linkage device between the receiver and transmitter of the set. (FM 24-1)</td>
</tr>
<tr>
<td>ROUTE</td>
<td>A sequence of links over which messages can be transmitted. It is dynamically selected as a function of the type of message to be transmitted and as a function of the characteristics of the links. (See LINK)</td>
</tr>
</tbody>
</table>
ROUTING The process of determining and prescribing the path or method to be used in forwarding messages. (FM 24-1)

SIGNAL INTELLIGENCE The final produce resulting from collection, evaluation, analysis, integration, and interpretation of information gathered from hostile electronic emitters. It includes Communications Intelligence and Electronic Intelligence and is used in determining enemy Order of Battle and planning of future operations.

SOLE-USER CIRCUIT A circuit from one subscriber to another subscriber on a fixed path. (FM 24-1)

SPOT JAMMING The jamming of a specific channel or frequency. (FM 24-1)

SWITCHBOARD An apparatus on which the various circuits from subscribers and other switchboards are terminated to enable communications either between two subscribers on the same switchboard or between subscribers on different switchboards. (FM 24-1)

TACTICAL COMMUNICATIONS Communications provided by, or under the operational control of, commanders of combat forces, combat troops, combat support troops, or forces assigned a combat service support mission. (FM 24-1)

TACTICAL OPERATIONS CENTER A facility from which selected special or general staff members assist in the direction, coordination, and control of current combat operations. (FM 24-1)
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TANDEM SWITCH</td>
<td>A switch used primarily as a switching point for traffic between other switches. (FM 24-1)</td>
</tr>
<tr>
<td>TAPE RELAY</td>
<td>A method of receiving and retransmitting messages in tape form. (FM 24-1)</td>
</tr>
<tr>
<td>TELECOMMUNICATIONS CENTER</td>
<td>An agency charged with the responsibility for acceptance, preparation for transmission, receipt, duplication and delivery of messages. (FM 24-1)</td>
</tr>
<tr>
<td>TEXT</td>
<td>That part of a message which contains the thought or idea which the originator desires to be communicated. (FM 24-1)</td>
</tr>
<tr>
<td>TRUNK CIRCUIT</td>
<td>A circuit directly connecting two distant central offices. (FM 24-1)</td>
</tr>
<tr>
<td>UNIT</td>
<td>A concentration of equipment and personnel on the battlefield. Units move on the battlefield, engage in combat, communicate with each other and apply Electronic Warfare Support Measures (ESM), Electronic Countermeasures (ECM), and Electronic Counter-countermeasures (ECCM) to enemy communications.</td>
</tr>
<tr>
<td>VOICE FREQUENCY</td>
<td>Any frequency within the part of the audio frequency range essential for the transmission of speech of commercial quality, i.e., 300-3000 Hz. (FM 24-1)</td>
</tr>
</tbody>
</table>
APPENDIX B

GLOSSARY OF ABBREVIATIONS

ADPS  Automatic Data Processing System
AIG   Address Indicating Group
AM    Amplitude Modulation
ARDF  Airborne Radio Direction Finding
ASA   Army Security Agency
ATSE  Army Security Agency Tactical Support Element
CAS   Close Air Support
C-E   Communications-Electronics
CEOI  Communications Electronics Operating Instructions
CFA   Covering Force Area
CNCE  Communications Nodal Control Element
COMINT Communication Intelligence
CP    Command Post
CSCE  Communications System Control Element
CW    Continuous Wave
C2    Command and Control
C3    Command, Control, and Communications
DEWCOM Divisional Electronic Warfare Combat
DF    Direction Findings
EAC   Echelons Above Corps
ECCM  Electronic Counter-Countermeasures
ECM   Electronics Countermeasures
EIM   Extended Interface Meeting
ELINT Electronic Intelligence
EMC   Electromagnetic Compatibility
EMCON Emission Control
ESM   Electronic Warfare Support Measures
EW    Electronic Warfare
EWCO  Electronic Warfare Cryptologic Officer
FAX   Facsimile
FEBA  Forward Edge of the Battle Area
FM    Frequency Modulation
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF</td>
<td>High Frequency</td>
</tr>
<tr>
<td>HQ</td>
<td>Headquarters</td>
</tr>
<tr>
<td>IAW</td>
<td>In Accordance With</td>
</tr>
<tr>
<td>ICD</td>
<td>Imitative Communication Deception</td>
</tr>
<tr>
<td>JTF</td>
<td>Joint Task Force</td>
</tr>
<tr>
<td>LAW</td>
<td>Light Antiarmor Weapon</td>
</tr>
<tr>
<td>LOS</td>
<td>Line of Sight</td>
</tr>
<tr>
<td>MED</td>
<td>Manipulative Electronic Deception</td>
</tr>
<tr>
<td>MIJI</td>
<td>Meaconing, Intrusion, Jamming, Interference</td>
</tr>
<tr>
<td>MRRD</td>
<td>Motorized Rifle Division</td>
</tr>
<tr>
<td>MRRR</td>
<td>Motorized Rifle Regiment</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time to Repair</td>
</tr>
<tr>
<td>NBC</td>
<td>Nuclear, Biological and Chemical</td>
</tr>
<tr>
<td>NCS</td>
<td>Net Control Station</td>
</tr>
<tr>
<td>OPSEC</td>
<td>Operations Security</td>
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<tr>
<td>RATT</td>
<td>Radio Teletypewriter</td>
</tr>
<tr>
<td>RDF</td>
<td>Radio Direction Finding</td>
</tr>
<tr>
<td>RWI</td>
<td>Radio Wire Integration</td>
</tr>
<tr>
<td>SAG</td>
<td>Study Advisory Group</td>
</tr>
<tr>
<td>SDD</td>
<td>Software Design Document</td>
</tr>
<tr>
<td>SDDL</td>
<td>Software Design and Documentation Language</td>
</tr>
<tr>
<td>SEAD</td>
<td>Suppression of Enemy Air Defense</td>
</tr>
<tr>
<td>SIGINT</td>
<td>Signal Intelligence</td>
</tr>
<tr>
<td>TOC</td>
<td>Tactical Operations Center</td>
</tr>
<tr>
<td>UHF</td>
<td>Ultra High Frequency</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
</tr>
<tr>
<td>VT</td>
<td>Variable Time</td>
</tr>
</tbody>
</table>
APPENDIX C
REFERENCES

1. Source listing of COMMEL II.5 simulator with a variable name dictionary and subroutine cross-reference list.

2. Source listing of Tactical Preprocessor for COMMEL II.5 with a variable name dictionary.

3. Source listing of Communications Preprocessor for COMMEL II.5 with a variable name dictionary.

4. Source listing of Subtactical Message Preprocessor for COMMEL II.5 with a variable name dictionary.

5. Input and output for benchmark run of COMMEL II.5 - Alpha Offense with force ratio = 1.6 (tactical only; perfect communications; no EW).

6. COMMEL II.5 Users Manual
   Volume I - Model Overview
   Volume II - Input Data Preparation
   Volume III - Appendices
   Volume IV - Blank Data Forms
   Volume V - Electronic Warfare Addendum (COMMEL II.5)

7. Conceptual logic of the functional processes for additions to the model.

8. USAICS Handbook on the Soviet Ground Forces (Revised), SUPR 69720, Aug 78.


14. The COMMEL Model
   Final Report
   Annex A - Description of the COMMEL Model
   Annex B - COMMEL Model Program Documentation (6 volumes)
   Annex C - COMMEL Model Users Guide
   Annex D - Sensitivity Analysis
   Annex E - Use of the COMMEL Model for Parametric Evaluation of Communications Problems
   Supplement to Annex C, Appendix 2 - Facsimilies of Tactical Data Input Forms.

15. The Signal Corps Ground Combat Simulator
   Final Report
   Annex I: The Signal Corps Ground Combat Simulator
   Volume I - Theory, Organization, and Structure of the Model (2 parts)
   Volume II - Flowcharts and the Data Set (3 parts)
   Volume III - Exercise Goldleaf
   Appendix A to Volume III, Section 1 - Maps
   Volume IV - Program and Data Listings.


20. PAM (Performance Analysis Model) - Descriptions.


22. AR 310-50, Authorized Abbreviations and Brevity Codes, 1975.

23. JCS PUB. 1, Dictionary of Military and Associated Terms, 1974.


25. FM 11-50, Combat Communications Within the Division, 1977.


BEGIN SIMULATION = NC

GLOBAL VARIABLES

CHARACTERS PER WORD 9
MAX PERMITTED ERRORS 5
MAX LINKS IN CIRCUIT 5
MOVE STEP SIZE 200 METERS
MAIL UP CONTACT 30
MINIMUM NUMBER STREAM 2
SIGN TIME 6.0 HOURS
TIME EDS 1.0 HOURS
DEBUG

BACKGROUND TRAFFIC UPDATE TIME 15.0 MIN
JOIN 5.0
MAX STEP 500.0
MIN STEP 100.0
MIN DELAY 20.0 MIN
MAX DELAY 60.0 MIN
REPORT FREQUENTLY 30.0 MIN
MESSENGER RATE 1500 METERS/MIN

REPORTS TO BE PRINTED

DATA PROCESSOR: 1 2 3 4 5 6 7
MODEL: MAIN

SIDE ATTRIBUTES

NAME BLUE RED
---------
ENCRYPTION INTELLIGENCE
WE INTEL THRESHOLD
SUPPORT THRESHOLD
FIRE SUPPORT THRESHOLD
COORDINATION INTERVAL
MIN UNIT STRENGTH
ARTY RESEI TIME
ARTY CONTACT RANGE
MIN ARTY DISTANCE
MAX ARTY DISTANCE
MIN EW DISTANCE
MAX EW DISTANCE
WIRE FAILURE RATE
WIRE ATTA
DF RATE - 1 UNIT OUT
DF RATE - 2 UNITS OUT
PCT OVER TRUE STRENGTH
PCT UNDER TRUE STRENGTH

5 5
40 40
30 30
45 45 MINUTES
20 20
55 55 MINUTES
20000 20000 METERS
1000 1000 METERS
2000 2000 METERS
10000 10000 METERS
15000 15000 METERS
4 4
3 3 HOURS
50 50
70 70
15 15
10 10
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<th>Y OFFSET</th>
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**Note:** The table above represents the coordinate grid for obstacles in a 40 grid square grid, with Y and X offsets. Each cell indicates whether an obstacle is present (1) or not (0) at the specified grid location.
### Terrain Obstacles Index

**GRID SQUARE = ORIGIN** + (OFFSET = GRID SIZE)

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**COORDINATE OF GRID SQUARE = ORIGIN** + (OFFSET = GRID SIZE)

- **REPORT 02-0**
- **PAGE 5**

**GRID SIZE:** 1000 Meters

**MAP IS:** 60 x 60 GRID SQUARES

---

The table and diagram provide the grid coordinates and offsets for various grid squares, facilitating the identification and mapping of terrain obstacles. The data is structured to allow for easy referencing and visualization of the obstacles within the specified area.
## OBSTACLES INDEX

**COORDINATES OF GRID SQUARE = ORIGIN + (OFFSET * GRID SIZE)**

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