

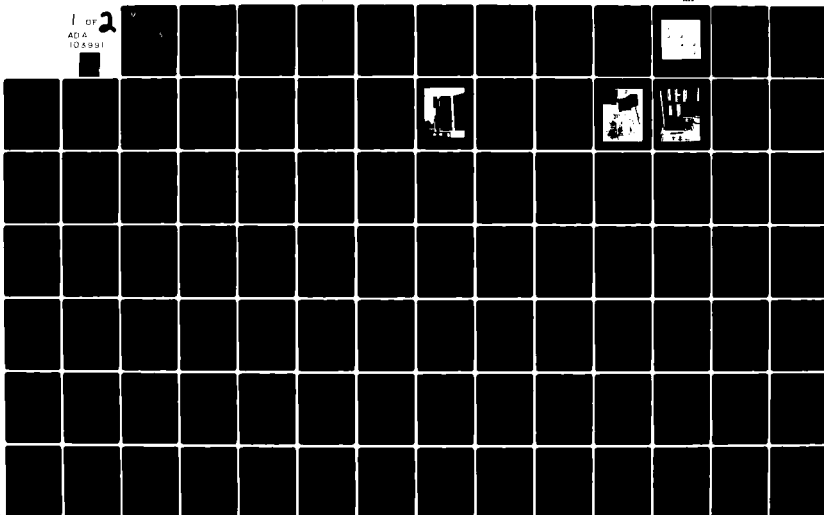
AD-A103 991

ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND FO--ETC F/G 9/2  
TACTICAL SITUATION SIMULATOR ALGORITHM FOR USE WITH A THERMAL L--ETC(U)  
AUG 81 J A KARAKOWSKI, R J MARTINO, A SLUTSKY  
DELCS-TR-81-1

UNCLASSIFIED

1 OF 2  
ADA  
105991

833





**LEVEL II**

4

RESEARCH AND DEVELOPMENT TECHNICAL REPORT

DELCS-TR-81-1

TACTICAL SITUATION SIMULATOR ALGORITHM FOR USE  
WITH A THERMAL LINE PRINTER IN A SENSOR MONITORING  
SET

J. KARAKOWSKI  
R. MARTINO  
A. SLUTSKY

COMBAT SURVEILLANCE & TARGET ACQUISITION LABORATORY

AUGUST 1981

DISTRIBUTION STATEMENT

Approved for public release;  
distribution unlimited.

DTIC  
ELECTE  
SEP 9 1981  
H

**ERADCOM**

US ARMY ELECTRONICS RESEARCH & DEVELOPMENT COMMAND  
FORT MONMOUTH, NEW JERSEY 07703

81 9 08 001

AD A103991

DTIC FILE COPY

## NOTICES

### Disclaimers

The citation of trade names and names of manufacturers in this report is not to be construed as official Government indorsement or approval of commercial products or services referenced herein.

### Disposition

Destroy this report when it is no longer needed. Do not return it to the originator.

## **DISCLAIMER NOTICE**

**THIS DOCUMENT IS BEST QUALITY  
PRACTICABLE. THE COPY FURNISHED  
TO DTIC CONTAINED A SIGNIFICANT  
NUMBER OF PAGES WHICH DO NOT  
REPRODUCE LEGIBLY.**

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                      | READ INSTRUCTIONS<br>BEFORE COMPLETING FORM                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------|
| 1. REPORT NUMBER<br>14<br>6<br>DELCS-TR-81-1                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2. GOVT ACCESSION NO.<br>AD-A203 992 | 3. RECIPIENT'S CATALOG NUMBER                                               |
| 4. TITLE (and Subtitle)<br>Tactical Situation Simulator Algorithm for use with a Thermal Line Printer in a Sensor Monitoring Set.                                                                                                                                                                                                                                                                                                                                                             |                                      | 5. TYPE OF REPORT & PERIOD COVERED<br>(9) Final Rpt.                        |
| 7. AUTHOR(s)<br>(10) J.A./Karakowski<br>R.J./Martino<br>A./Slutsky                                                                                                                                                                                                                                                                                                                                                                                                                            |                                      | 6. PERFORMING ORG. REPORT NUMBER                                            |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>USA ERADCOM<br>DELCS-I<br>Ft. Monmouth, NJ 07703                                                                                                                                                                                                                                                                                                                                                                                               |                                      | 8. CONTRACT OR GRANT NUMBER(s)                                              |
| 11. CONTROLLING OFFICE NAME AND ADDRESS<br>Combat Surveillance and Target Acquisition<br>ATTN: DELCS-I<br>Ft. Monmouth, NJ 07703                                                                                                                                                                                                                                                                                                                                                              |                                      | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS<br>N/A (12) 112 |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)                                                                                                                                                                                                                                                                                                                                                                                                                   |                                      | 12. REPORT DATE<br>(11) August 1981                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                      | 13. NUMBER OF PAGES<br>116                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                      | 15. SECURITY CLASS. (of this report)<br>Unclassified                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                      | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE                                  |
| 16. DISTRIBUTION STATEMENT (of this Report)<br>Approval for Public Release; Distribution Unlimited                                                                                                                                                                                                                                                                                                                                                                                            |                                      |                                                                             |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)                                                                                                                                                                                                                                                                                                                                                                                                    |                                      |                                                                             |
| 18. SUPPLEMENTARY NOTES                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                      |                                                                             |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number)<br>Tactical Simulator, Unattended Sensors, Computer Programs, Thermal Recorder, Displays, Real Time Simulator, Human Factors.                                                                                                                                                                                                                                                                              |                                      |                                                                             |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>A simulator which generated unattended ground sensor activations and target classification was developed and used in conjunction with a Thermal Recorder Display for a limited Human Factor Test to determine the usefulness of classification symbols in operator processing of sensor data.<br><br>The resulting data indicates that these symbols do aid in classification and object discrimination. |                                      |                                                                             |

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

387 387  
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)



SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

## TABLE OF CONTENTS

|                                               | <u>Page</u> |
|-----------------------------------------------|-------------|
| INTRODUCTION                                  | 1           |
| GENERAL DESCRIPTION                           | 1           |
| TACTICAL SITUATION SIMULATOR ALGORITHM (TSSA) | 2           |
| Models                                        | 2           |
| Data Structure                                | 4           |
| TSSA Operation Details                        | 5           |
| OPERATOR TEST DESCRIPTION                     | 6           |
| Operator Calculations                         | 14          |
| Test Tactical Situations                      | 18          |
| Test Data Definitions                         | 19          |
| OPERATOR RESULTS                              | 24          |
| Operator's Comments                           | 24          |
| Operator Problem Areas                        | 25          |
| Recorder Observations and Recommendations     | 25          |

## APPENDICES

|                                            |    |
|--------------------------------------------|----|
| A. System Overview                         | 27 |
| B. Detailed Software Description           | 31 |
| C. System Software Listings:               |    |
| Task 1 - Thermal Recorder Task             | 51 |
| Task 2 - Line Printer Task                 | 58 |
| Task 3 - Input Processing Task             | 65 |
| Task 4 - Operator Command Task             | 82 |
| Task 5 - Commands Directory Task           | 83 |
| Task 6 - Tactical Situation Simulator Task | 89 |

|                                                                         |                                                            |                         |
|-------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|
| Accession For<br>DTIC GRA&I<br>DTIC TAB<br>Unannounced<br>Justification | By<br>Distribution/<br>Availability Codes<br>Distribution/ | Special<br>Distribution |
|-------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|

A-1

## FIGURES

|                                                            | <u>Page</u> |
|------------------------------------------------------------|-------------|
| 1. Real Time CRT Target Track                              | 3           |
| 2. Trail Layout with Segment Definitions                   | 7           |
| 3. String Definitions                                      | 8           |
| 4. Tactical Situation Object Tape No. 42                   | 9           |
| 5. Sensor Deployment Chart                                 | 10          |
| 6. Sensor Deployment Map                                   | 11          |
| 7. Tactical Situation Object Tape No. 49                   | 12          |
| 8. Texas Instruments Thermal Recorder                      | 13          |
| 9. Observer-Operator Test Layout                           | 15          |
| 10. Thermal Recorder and CRT                               | 16          |
| 11. SMS Simulation Facility                                | 17          |
| 12. Charter/Symbol Representation                          | 23          |
| 13. RTOS Software System Configuration                     | 28          |
| 14. Hardware System Configuration                          | 29          |
| 15. Line Printer Activation Outputs                        | 34          |
| 16. Thermal Recorder Data Processing Flow Diagram          | 37          |
| 17. Symbol Generation for Detection-only Sensors           | 39          |
| 18. Character/Symbol Generation for Classification Sensors | 41          |
| 19. Recorder Output Buffer Data Structure                  | 42          |
| 20. Typical Administrative File CRT Output                 | 45          |
| 21. Typical Administrative File Line Printer Output        | 46          |
| 22. Task 6 Simulation Program Flow Diagram                 | 48          |

## TABLES

|                               |    |
|-------------------------------|----|
| 1. Operator Results - Group 1 | 20 |
| 2. Operator Results - Group 2 | 21 |

# **DEVELOPMENT OF TACTICAL SITUATION SIMULATOR ALGORITHM AND INVESTIGATION OF THERMAL LINE PRINTER FOR A SENSOR MONITORING SET**

## **INTRODUCTION**

A Sensor Monitoring Set (SMS) is being developed to monitor unattended group sensors. This device displays sensor alarms on an X-T recorder which presents an operator with a time history of sensor activations and target classification data. This data and the resulting activation patterns generated can be used to calculate and determine target parameters such as direction, velocity, length to column, number of objects in a target, et cetera.

Efficient processing of this data by an operator is partly dependent on the manner in which the data is presented. This area is presently under investigation. Included in this investigation is a limited human factors test which was conducted using Army and Marine personnel at Ft. Monmouth, NJ. However, owing to constraints imposed by funding and time limitations, it was recognized that the scope of the effort would be limited to a modest investigation that, at best, would produce only indicators on formats for displaying sensor data and on the performance of operators with visual display formats.

In order to display actual sensor activations and target classification for these tests, a data base containing these activations was required. A tactical situation simulator was designed to approximate operational situations and generate the resulting activations to be displayed.

The system and tests this report discusses were designed to aid in this investigation.

## **GENERAL DESCRIPTION**

The system utilized an Interdata Model 70 minicomputer with peripheral devices, a tactical situation simulator, character generator, and associated recorder programs. Generated sensor activations are processed to determine sensor type and target classification, if applicable. This processed data is displayed on the recorder for operator processing. Additional displays are used by the personnel conducting the tests to monitor the simulator outputs.

Human factors tests were conducted using trained operators who were asked to extract as much target parameter information as they could from the X-T plots. These plots represented a time history of the sensor activations and target classifications which could be expected from various operational tactical situations. Each tactical situation consisted of various types and quantities of vehicles and personnel moving along a number of different trails. Target classifications received from the "sensors" were printed on the plots using symbols and alphabetic characters.

### **TACTICAL SITUATION SIMULATOR ALGORITHM (TSSA)**

The TSSA reproduces the real time response of an unattended ground sensor or group of sensors for any set of objects following a defined set of tracks. Each item - sensors, objects, and road - can be defined by the user and are limited in number only by computer memory size and system cycle speeds. For example, situations which contain upwards of 50 objects and 45 sensors have been used to date, with still larger situations possible. An example will be given later.

The objects are output to an alphanumeric-type CRT in a quasi-graphical mode, that is, individual symbolic object data is mapped in the discrete position on the CRT which is nearest the exact object position. The activations data is output to the thermal recorder, line printer, and CRT. An example of a complete CRT mapping of both object and sensor data is shown in Figure 1. Here, the sensor ID numbers and activation count are given for each sensor and the real time track of the object(s) is displayed.

### **Models**

The geometry, object and sensor functions are described by models of their respective operations. Each of these models was chosen to provide algorithm flexibility as well as a realistic representation of actual system operation. Within the object and sensor models there are also submodels to give further system flexibility.

#### **1. Track Geometry Model**

The tracks or trails which an object follows may be a straight line or an approximate curve. The only restriction is that they all lie in the same geometrical plane. Thus, hills or valleys are not accounted for in this model, although they can be implemented with some object restrictions or additional software.

The tracks are defined as piecewise linear approximation in a two-step process. First, a number of discrete straight line segments are defined. Then, these segments are joined together in strings to form the desired tracks.

Each segment is defined in absolute terms by its beginning and end coordinates. When segments are joined, the end coordinates of one must

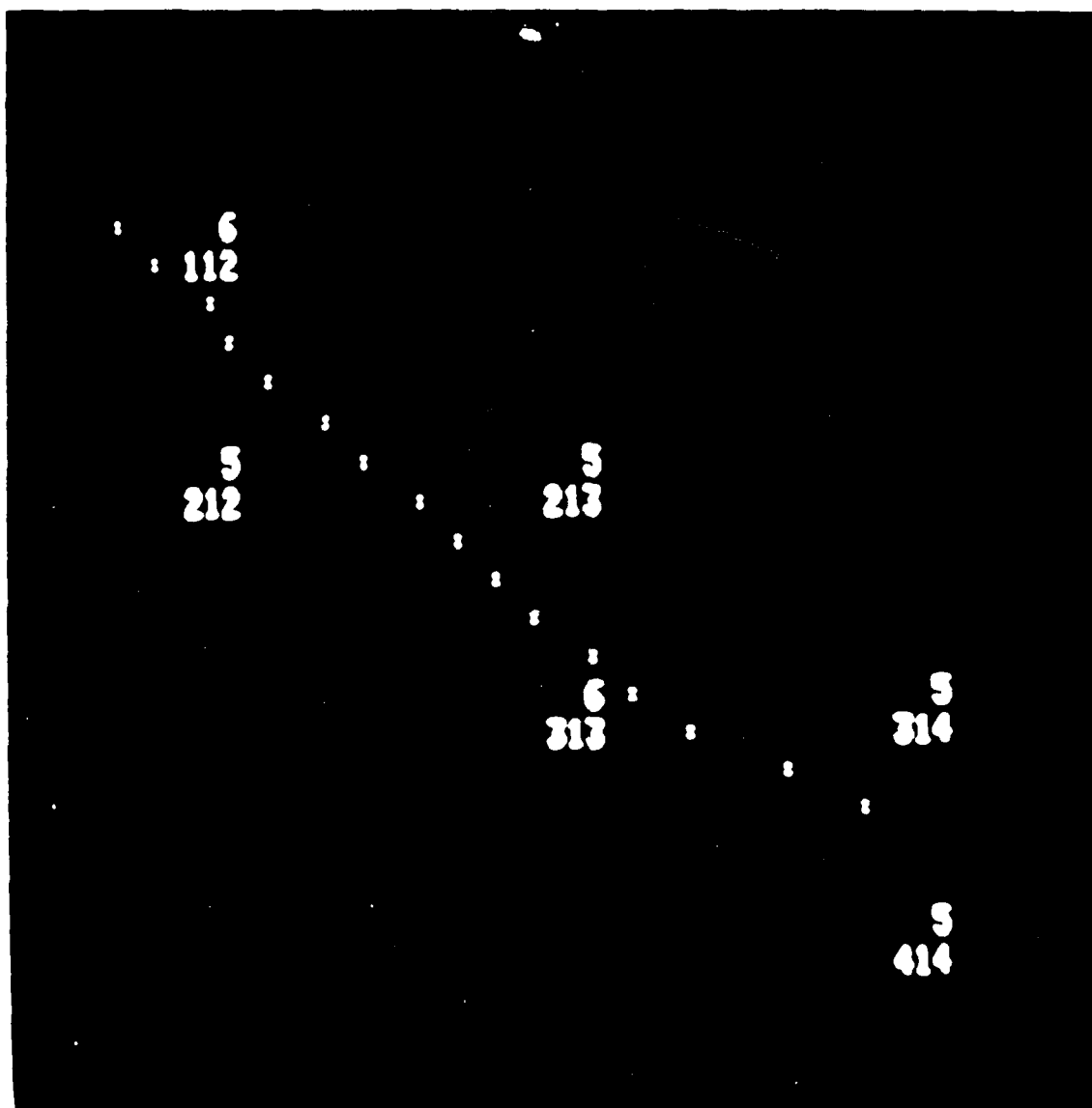


FIGURE 1. REAL TIME CRT TARGET TRACK

equal the start of the next and so on, for useful results to occur. The strings thus formed are numbered to allow assignment to a specific object.

## 2. Object Model

The objects which are presently recognized by the algorithm are personnel, wheel and track, but this can be expanded up to 255. Each object has several parameters which define its operational characteristics: (1) type, (2) string (track), (3) speed, (4) direction, (5) start time, and (6) location.

## 3. Sensor Model

There are two types of sensor models used in the algorithm at present; detection-only and classifiers. The detection-only type provides an alarm indication whereas the classification type provides a classification of the target as determined by the classifier model. Other types can be added, if desired, by simple software modifications.

Modeling of all the sensors operation is done by making the following assumptions and parameterization of sensor operation: (1) each sensor exhibits a probability of detection vs. object distance (usually a circular radius of detection is used); (2) the object type has an effect on the sensor detection radius or detection characteristic; (3) an inhibit time of operation is associated with each sensor.

The classification process also has certain operational characteristics which are incorporated into its model: (1) the sensors classify correctly on a gross probability basis, that is, the overall percentage of correct classifications is given; (2) the heaviest target within the area of influence of a classification sensor is always taken as the dominant target; (3) each classification sensor outputs an alert activation when the target is just outside the sensor's detection zone.

The actual classification is performed on a set partitioning scheme. A random number generator develops a random number between 1 and 32767. This set is partitioned at  $K \cdot 32767$  where  $K$  is the gross probability of correct classification. Thus, any random number which occurs between 1 and  $K \cdot 32767$  will correspond to the dominant target and all others will be considered a false alarm. Note that the random number generator produces the same sequence of random numbers for a certain starting value. The starting value for the random number generator can be any number between 1 and 32767. This number initializes the random sequence and produces an entirely different sequence for each different value. Thus, the classification sequences can be kept constant or varied, if desired, by manipulation of the starting value.

## Data Structure

The data structure of the algorithm is important because of the flexibility it allows in programming many tactical situations. It consists of three inputs: sensor parameters, track geometry parameters, and object parameters. Each is independent of the others and can thus be modified individually.

## TSSA Operation Details

The actual execution of the algorithm must first be preceded by a preliminary analysis and specification of the desired tactical situation. Note that once a tactical situation has been defined, it does not have to be defined again. The situation layout may be obtained from actual military maps or can be composed in any arbitrary manner, depending on the desired geometry one wishes to use. It is best to fix one or more of the data groups, track geometry, objects, or sensors to minimize confusion and to simplify operation. The two most useful groupings to keep fixed are: (1) geometry or (2) geometry and sensors. With a proper choice of track definitions in planning tactical situations a group of objects can be used with any tactical situation desired.

A complete list of the data for definitions of each parameter is presented below. Each of these data groups is translated to tape for a hard copy of the data. Thus, only a few numbered tapes, which contain all the defining data, can be used over and over again to produce a large variety of tactical situations.

Group parameters:

### (1) Track Geometry

(A) Segment definition: inputs numbered in order

1. Initial (X, Y) coordinates in meters
2. Final (X, Y) coordinates in meters

(B) String Definition

1. String Number (ID)
2. List of Consecutive Segment Numbers

### (2) Sensors - Data required for each sensor:

- (A) Type - detection-only, classifier
- (B) (X, Y) Location in meters
- (C) Inhibit time in seconds
- (D) Detection radius in meters
- (E) Probability Table number
- (F) ID number - RID

(3) Objects - Data required for each object

- (A) Type - personnel, track, wheel
- (B) Speed in meters per second
- (C) String number
- (D) Direction along string
- (E) Start time of object

A example of one tactical situation used during the thermal printer test is given in Figures 2 through 6. As can be seen, a large variety of track options were available for different objects to follow. The segmentation of the field is shown in Figure 2, and the actual track (string) definitions are shown in Figure 3. The objects (Tape Nos. 42 and 49, Figures 4 and 7) consist of six columns of varying mixtures of wheel and track vehicles with different start times for a total of 35 objects in all. This particular tactical situation took approximately 40 minutes to run. Figures 5 and 6 define the sensor IDs and deployment which was used for the test.

#### OPERATOR TEST DESCRIPTION

Two groups of trained operators (total of eight) were used during the test. Each individual received as much personal training and demonstration of the equipment as needed. This involved a description of system operation, both of the tactical situation simulator and thermal recorder, as well as detailed data concerning the sensor field such as detection radius, map of sensor placement along trails, and classification characters. Each operator was given a simple test tactical situation, if desired, for practice and additional instruction.

There were several facts and instructions given prior to beginning the testing. The physical layout and characteristics of the sensors and the target trails were explained. The information was presented on a scaled map of the sensor field and the target trails upon which the distances between sensors and strings were given. The map was posted near the operator, to his right, for immediate visual reference. Since there were no reference marks on the Thermal Line Printer (TLP) paper, the operators were given a simple procedure to calculate time on the TLP output. They were told that every inch of chart paper represented 2 minutes of time passage. This was based on the relationship between chart distance and elapsed time for a chart speed of 30 inches/hour. For example, 1.5 inches of chart movement represents a time passage of 3 minutes. In addition, the operators were told that they could also calculate time by using the 10 second inhibit time between sensor activations. For example, a string of five consecutive sensor activations represented a total time of 50 seconds.

For each sensor, the sensor pen patching information was placed above its respective pen. Also, the detection radius for the sensors was fixed on the recorder face. See Figure 8 for the actual arrangement.

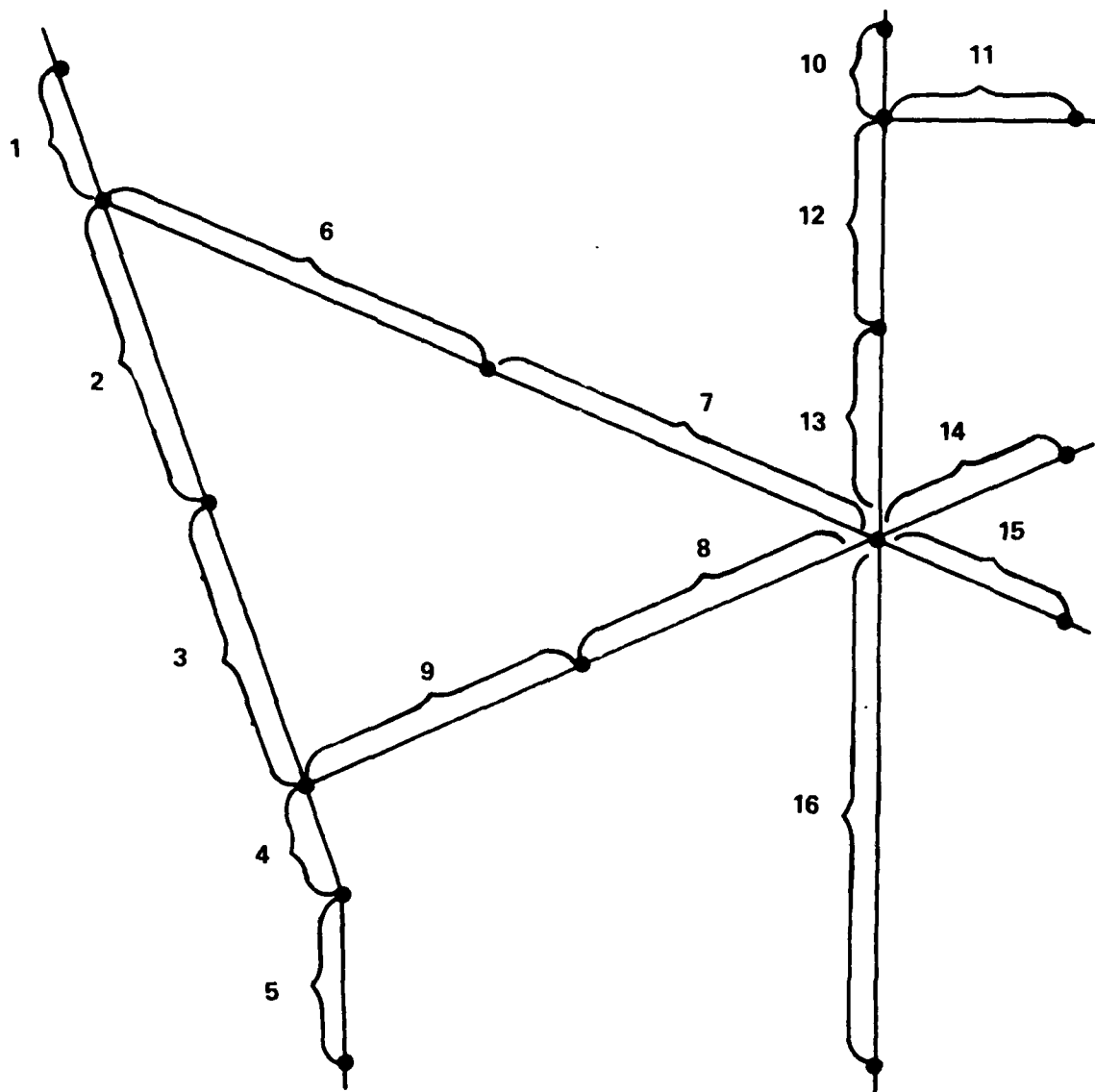


FIGURE 2. TRAIL LAYOUT WITH SEGMENT DEFINITIONS

| <u>String #</u> | <u>Segments</u>        |
|-----------------|------------------------|
| 1               | 1, 2, 3, 4, 5          |
| 2               | 3, 4, 5                |
| 3               | 9, 4, 5                |
| 4               | 1, 6, 7, 16            |
| 5               | 7, 16                  |
| 6               | 10, 12, 13, 16         |
| 7               | 11, 12, 13, 16         |
| 8               | 13, 16                 |
| 9               | 14, 8, 9, 4, 5         |
| 10              | 15, 8, 9, 4, 5         |
| 11              | 10, 12, 13, 8, 9, 4, 5 |
| 12              | 11, 12, 13, 8, 9, 4, 5 |
| 13              | 14, 16                 |
| 14              | 15, 16                 |
| 15              | 5, 4, 3, 2, 1          |
| 16              | 16, 13, 12, 10         |
| 17              | 8, 14                  |
| 18              | 1, 2                   |

**FIGURE 3. STRING DEFINITIONS**

| <u>Object(s)</u> | <u>Type</u> | <u>String</u> | <u>Velocity</u> | <u>Start Time</u> |
|------------------|-------------|---------------|-----------------|-------------------|
| 1                | Track       | 9             | 10              | 0:00              |
| 2                | Track       | 9             | 10              | 0:10              |
| 3                | Track       | 9             | 10              | 0:20              |
| 4                | Wheel       | 9             | 10              | 0:30              |
| 5                | Wheel       | 9             | 10              | 0:40              |
| 6                | Wheel       | 9             | 10              | 0:50              |
| 7-9              | Track       | 6             | 10              | 1:55              |
| 10               | Track       | 1             | 10              | 3:22              |
| 11               | Track       | 1             | 10              | 3:32              |
| 12               | Track       | 1             | 10              | 3:42              |
| 13               | Track       | 1             | 10              | 3:52              |
| 14               | Wheel       | 1             | 10              | 4:02              |
| 15               | Wheel       | 1             | 10              | 4:12              |
| 16               | Wheel       | 1             | 10              | 4:22              |
| 17               | Track       | 13            | 10              | 12:50             |
| 18               | Track       | 13            | 10              | 13:00             |
| 19               | Track       | 13            | 10              | 13:10             |
| 20               | Track       | 13            | 10              | 13:20             |
| 21               | Track       | 13            | 10              | 13:30             |
| 22               | Wheel       | 13            | 10              | 13:40             |
| 23               | Wheel       | 13            | 10              | 13:50             |
| 24               | Wheel       | 13            | 10              | 14:00             |
| 25               | Wheel       | 13            | 10              | 14:10             |
| 26               | Wheel       | 13            | 10              | 14:20             |
| 27               | Wheel       | 13            | 10              | 14:30             |
| 28-32            | Wheel       | 1             | 12              | 13:13             |
| 33-35            | Track       | 18            | 7               | 17:13             |

FIGURE 4. TACTICAL SITUATION OBJECT TAPE NO. 42

| RID<br>NO. | RECORDER<br>PEN<br>NO. | SENSOR<br>NO. | UTM COORDINATES<br>IN METERS |          | DISTANCE<br>IN<br>METERS | COMMENT             |
|------------|------------------------|---------------|------------------------------|----------|--------------------------|---------------------|
|            |                        |               | EAST                         | NORTH    |                          |                     |
| 101        | 101                    | 1             | 4,389.3                      | 28,832   | 1,231.1                  |                     |
| 102        | 102                    | * 2           | 4,500                        | 28,500   | 350                      |                     |
| 103        | 103                    | 3             | 4,657.6                      | 28,132.3 | * 400                    | (S [2-7] = 23.20°)  |
| 104        | 104                    | 4             | 4,893.9                      | 27,580.9 | * 1,000                  | " "                 |
| 105        | 105                    | 5             | 5,065.6                      | 28,200.6 | * 640                    | (S [2-20] = 62.10°) |
| 206        | 110                    | 6             | 7,322.7                      | 21,913.6 | 6,165.8                  | (from S#4)          |
| 207        | 111                    | * 7           | 7,500                        | 21,500   | 450                      | (S [2-7] = 23.20°)  |
| 208        | 112                    | 8             | 7,708.8                      | 21,012.9 | * 530                    |                     |
| 209        | 113                    | 9             | 7,953.0                      | 20,443.0 | * 1,250                  |                     |
| 211        | 114                    | 10            | 8,000.7                      | 21,727.6 | * 550                    | (S [7-20] = 24.44°) |
| 311        | 117                    | 11            | 9,000                        | 16,500   | 4,157.4                  | (S#9)               |
| 312        | 118                    | 12            | 9,000                        | 16,100   | 400                      |                     |
| 313        | 119                    | 13            | 9,000                        | 15,750   | 350                      |                     |
| 414        | 122                    | 14            | 13,000                       | 28,400   | 1,600                    |                     |
| 415        | 123                    | * 15          | 13,000                       | 28,000   | 400                      |                     |
| 416        | 124                    | 16            | 13,000                       | 27,500   | * 500                    |                     |
| 417        | 125                    | 17            | 13,000                       | 26,900   | * 1,100                  |                     |
| 418        | 126                    | 18            | 13,600                       | 28,000   | * 600                    |                     |
| 519        | 145                    | 19            | 13,000                       | 24,600   | 2,300                    | (S#17)              |
| 112        | 146                    | * 20          | 13,000                       | 24,000   | 600                      |                     |
| 521        | 147                    | 21            | 13,000                       | 23,400   | * 600                    |                     |
| 522        | 148                    | 22            | 13,000                       | 22,860   | * 1,140                  |                     |
| 523        | 149                    | 23            | 13,409.7                     | 24,186.2 | * 450                    | (S [7-20] = 24.44°) |
| 524        | 150                    | 24            | 12,499.3                     | 23,772.4 | * 550                    | " "                 |
| 525        | 151                    | 25            | 11,971.3                     | 23,532.4 | * 1,130                  | " "                 |
| 526        | 152                    | 26            | 12,558.1                     | 24,233.9 | * 500                    |                     |
| 527        | 153                    | 27            | 13,530.3                     | 23,719.3 | * 600                    |                     |
| 628        | 155                    | 28            | 13,000                       | 18,000   | 4,860                    | (S#22)              |
| 629        | 156                    | 29            | 13,000                       | 17,500   | 500                      |                     |
| 113        | 157                    | 30            | 13,000                       | 17,050   | 450                      |                     |

FIGURE 5. SENSOR DEPLOYMENT CHART



| <u>Object(s)</u> | <u>Type</u> | <u>String</u> | <u>Velocity</u> | <u>Start Time</u> |
|------------------|-------------|---------------|-----------------|-------------------|
| 1-4              | Track       | 3             | 10              | 0:00              |
| 5                | Track       | 5             | 10              | 0:00              |
| 6                | Track       | 5             | 10              | 0:10              |
| 7                | Track       | 5             | 10              | 0:20              |
| 8                | Wheel       | 5             | 10              | 0:30              |
| 9                | Wheel       | 5             | 10              | 0:40              |
| 10               | Track       | 1             | 10              | 2:00              |
| 11               | Track       | 1             | 10              | 2:10              |
| 12               | Track       | 1             | 10              | 2:20              |
| 13               | Track       | 1             | 10              | 2:30              |
| 14               | Track       | 1             | 10              | 2:40              |
| 15               | Track       | 1             | 10              | 2:50              |
| 16               | Track       | 1             | 10              | 3:00              |
| 17               | Wheel       | 1             | 10              | 3:10              |
| 18-26            | Personnel   | 2             | 1               | 4:00              |
| 27               | Track       | 6             | 10              | 4:00              |
| 28               | Wheel       | 6             | 10              | 4:10              |
| 29               | Wheel       | 6             | 10              | 4:20              |
| 30               | Track       | 6             | 10              | 4:30              |
| 31               | Wheel       | 6             | 10              | 4:40              |
| 32               | Wheel       | 6             | 10              | 4:50              |
| 33               | Track       | 7             | 10              | 9:00              |
| 34               | Wheel       | 7             | 10              | 9:10              |
| 35               | Wheel       | 7             | 10              | 9:20              |
| 36               | Wheel       | 7             | 10              | 9:30              |
| 37               | Wheel       | 7             | 10              | 9:40              |
| 38               | Wheel       | 7             | 10              | 9:50              |

FIGURE 7. TACTICAL SITUATION OBJECT TAPE NO. 49

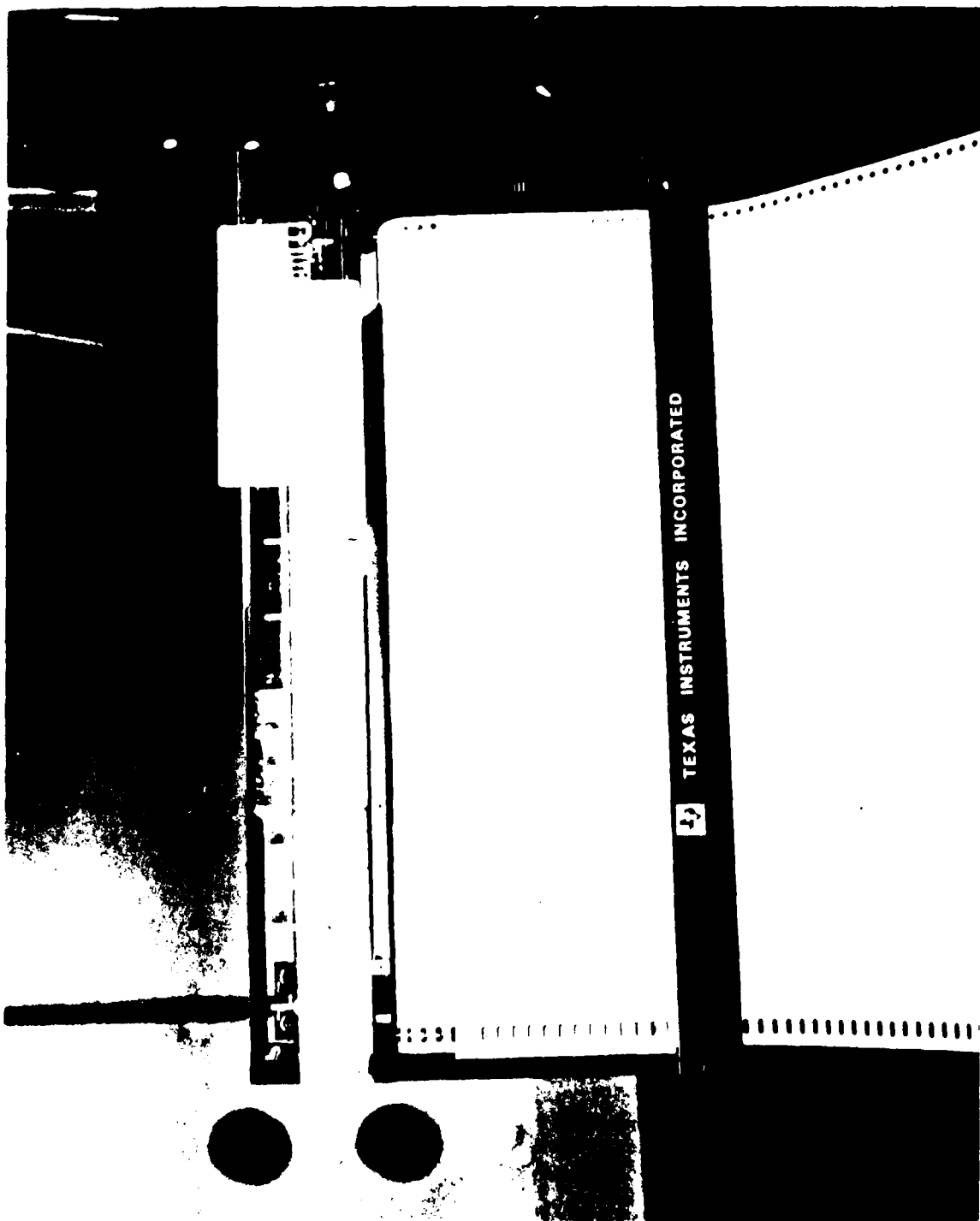


FIGURE 8. TEXAS INSTRUMENTS THERMAL RECORDER

In addition, the operators were:

- a. informed that the sensors would classify correctly 80% of the time; that is, 80% of the character symbols displayed on the recorder represented a correct target classification;
- b. given a copy and an explanation of the character/symbol set that was to be used for classification sensors;
- c. told that they could make use of the classifications to calculate dominant object type and to individually count and classify mixed objects in a target if they desired. They could use any method of analysis available in determining velocity, number of objects in a column, their individual classifications, and direction. Thus, it was left to each operator's discretion to use or ignore the classification data reported on the TLP;
- d. told to make all calculations on scratch paper and provide only their results on the actual TLP output.

The layout for each test was as shown in Figure 9. A silent observer was present to note operator comments and performance during the test, as well as to monitor the CRT map as a guide for the tactical situations' progress. The operator received no help from the observer during the progress of each test, except for clarification of sensor data (detection, radius, layout, etc.). There was an audio indication available to each operator, if desired, for each sensor activation. This was provided by the line printer carriage movement as it printed the activation data. Figures 10 and 11 are additional photographs of the operator test area, except for the position of the CRT.

When each test was complete (in the actual output of activations), the operator was notified of the fact by the observer and given time to complete his analysis of the activation data.

The data obtained from each operator consisted of the actual thermal recorder output with the operator's results printed next to each alarm pattern. Also, through personal discussion with the operators, various operational and display techniques which might aid the operator were brought out.

There were several characters/symbols used for display of this test. Each was used with one or more operators. They may be seen in Figure 12 and are cross referenced to the operator test data.

This test was not meant to be a full blown human factors evaluation of the equipment, it should rather be considered a probe.

### **Operator Calculations**

The operators were directed to make calculations of target velocity, target direction, number of objects with a given target, and their classification using any means at their disposal to reach such conclusions. The

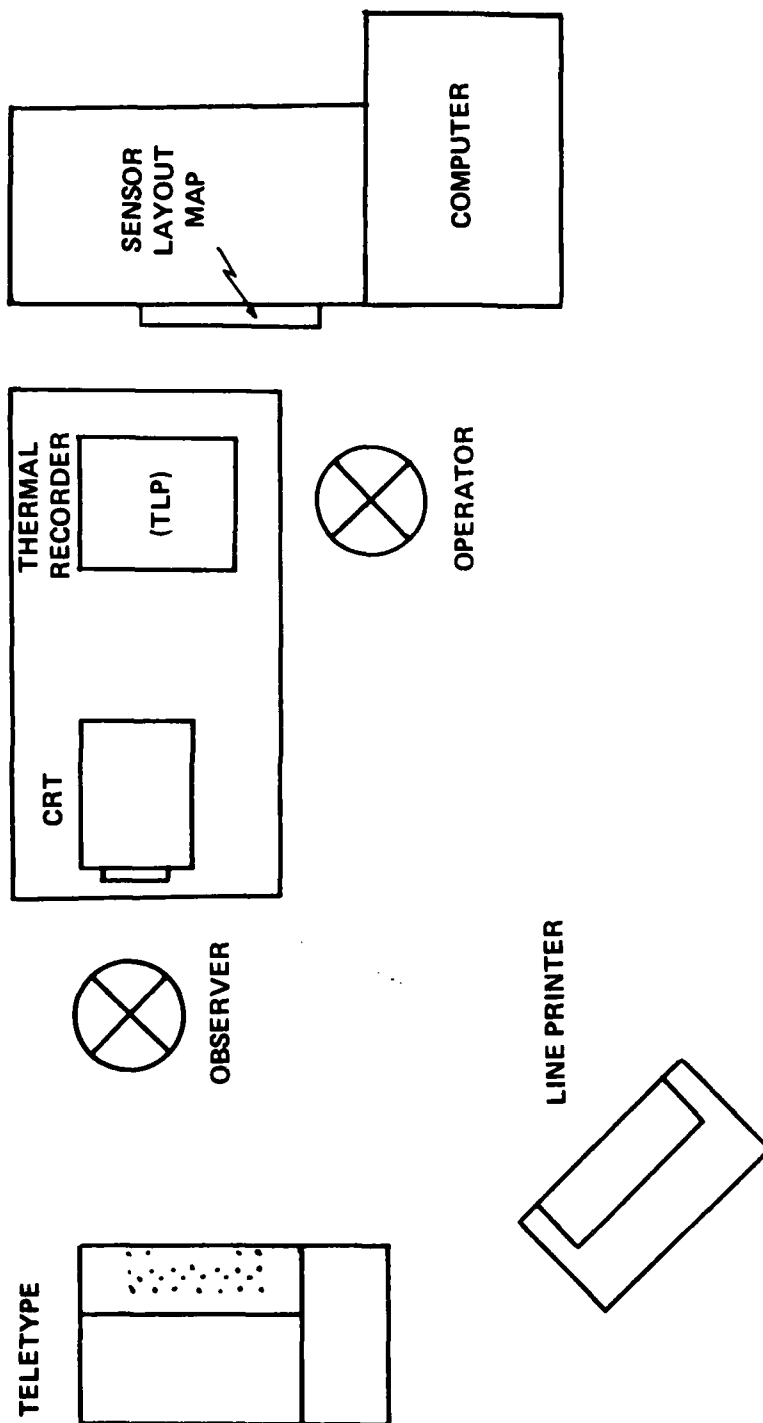


FIGURE 9. OBSERVER-OPERATOR TEST LAYOUT

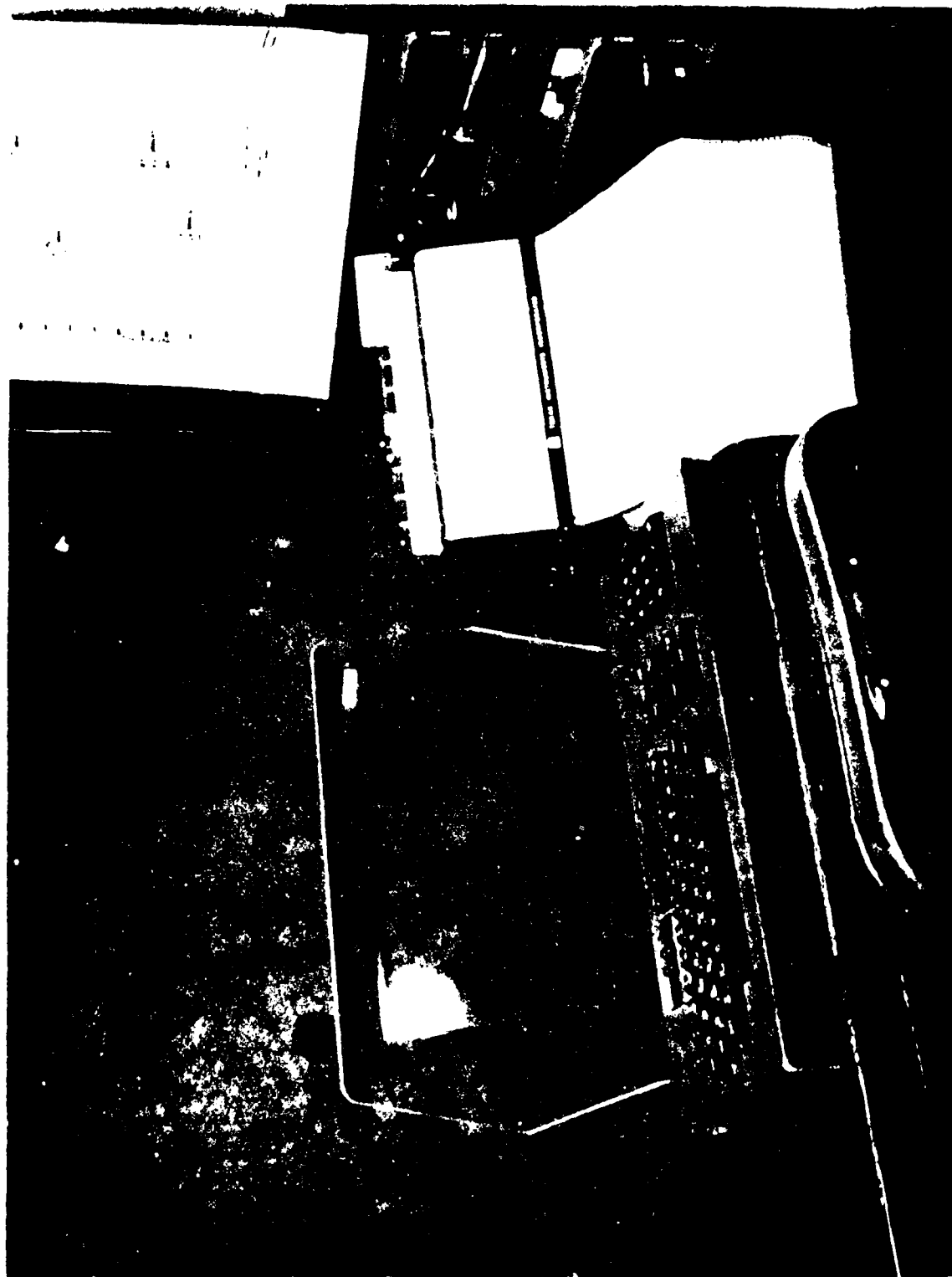


FIGURE 10. THERMAL RECORDER AND CRT



FIGURE 11. SMS SIMULATION FACILITY

operators selected the method prescribed by the Sensor Intelligence School in arriving at their results. Calculations made by the operators were based on the following equation.

$$LC = \frac{D}{M} \times TTI - CDR$$

where: LC = Length of column

D = Distance between two sensors

TM = Meantime between the two sensor patterns

TTI = Total time of the first sensor pattern

CDR = Combined detection radius of the two sensors.

Distances between vehicles was assumed (and actually was) to be 100 meters. Operators would calculate the number of objects in a column by the equation:

$$\text{Number of objects} = \frac{\text{Length of Column}}{\text{Assumed distance between objects}}$$

The operators obtained direction of the objects from observing which sensors activated in a string and from using the sensor deployment map (Figure 6).

### Test Tactical Situations

The tactical situations used for operator testing were composed mainly of columns of track and wheel objects. The actual columns and their object mixes are shown in Figures 4 and 7. Here, the object number, type, string, velocity, and start time are defined for each object. Also, groups (columns) of objects are obtained by placing individual objects on the same string separated by a fixed distance. The target tracks and sensor field are the same as in Figures 2 and 6.

Several features of the objects used for the tactical situations should be noted. First, most objects used in the test were travelling at 600 meters/minute and separated by 100 meters in columns. The speed variations from these figures are noted in the results. Secondly, both mixed and unmixed columns were used; that is, columns with either more than one type object or columns with only one type. Third, mixtures were made of varying proportions of track or wheel targets in individual columns.

In general, the tactical situations involved a large number (35 - 40) of objects converging and spearheading towards the forward edge of the battle area. As can be seen in Figure 2, which shows the trail layout, the objects had many paths on which to travel and be detected by the various strings of sensors.

### Test Data Definitions

The data from each individual operator trial was tabulated and further reduced to several measures. The following is a list and definitions of each test data item displayed in Tables 1 and 2:

1. Percentage correct object count: The overall accuracy of the calculated total number of objects in a tactical situation is described by a parameter. It is defined as:

$$1.0 - \frac{\sum | \text{count error} |}{\sum \text{number of all objects}}$$

The numerator of the second term is the sum of the absolute differences between the actual number of objects in a tactical situation and the calculated count. The denominator is the sum of all actual target objects.

2. Percentage ROS accuracy: The calculated rate of speed (ROS) in meters per minute was measured for accuracy by the following, for each operator:

$$\frac{\text{calculated ROS}}{\text{actual ROS}}$$

Note that the actual ROS is constant for each data grouping and hence the accuracy is simply the average of the calculated rate of speed divided by the constant actual ROS.

3. Percentage direction accuracy: The directs of the columns as noted by the operators were compared to the actual directions and measured for each trial by the following parameters:

$$\frac{\text{number correct directions}}{\text{total of direction attempts}}$$

The numerator is the total number of correct directions chosen by the operator while the denominator is the total number of attempts by the operator to determine object(s) direction. Note that not all changes in the target's direction were observed and hence were not included in this percentage.

4. Percentage correct mixed target determination: This quantity measures the performance of an operator to correctly separate a mixed column of objects into the correct object mix:

$$\frac{\text{number of correct mixed target determinations}}{\text{total mixed target determination opportunities}}$$

| INDIVIDUAL OPERATOR (TRIAL) | CORRECT OBJECT COUNT % | ROS ACCURACY % | DIRECTION ACCURACY % | CORRECT MIXED TARGET DETERMINED % | ALARM CLUSTERS PROCESSED % | CORRECT TRACK OBJECT COUNT % | CORRECT WHEEL OBJECT COUNT % | CORRECT TRACK OBJECT COUNT (MIXED) % | CORRECT WHEEL OBJECT COUNT (MIXED) % | ACTUAL OBJECT ROS MTRS/MIN | SENSOR DETECTION RADIUS METERS | DISPLAY FORMAT | OBJECT TAPE USED |
|-----------------------------|------------------------|----------------|----------------------|-----------------------------------|----------------------------|------------------------------|------------------------------|--------------------------------------|--------------------------------------|----------------------------|--------------------------------|----------------|------------------|
| A                           | 40.0                   | 89.3           | 50.0                 | N/A                               | 25.0                       | N/A                          | 40.0                         | N/A                                  | N/A                                  | 420                        | 500                            | 1              | 42               |
| B                           | 40.0                   | 56.4           | N/R                  | N/A                               | 33.3                       | N/A                          | 40.0                         | N/A                                  | N/A                                  | 420                        | 500                            | 2              | 42               |
| C                           | 80.0                   | 64.3           | N/R                  | N/A                               | 33.3                       | N/A                          | 80.0                         | N/A                                  | N/A                                  | 420                        | 500                            | 1              | 42               |
| D                           | 0.0                    | 71.9           | N/R                  | N/A                               | 33.3                       | N/A                          | 0.0                          | N/A                                  | N/A                                  | 420                        | 500                            | 2              | 42               |
|                             |                        |                |                      |                                   |                            |                              |                              |                                      |                                      |                            |                                |                |                  |
|                             |                        |                |                      |                                   |                            |                              |                              |                                      |                                      |                            |                                |                |                  |
| A                           | 66.7                   | 48.7           | 100.0                | N/A                               | 25.0                       | 66.7                         | N/A                          | N/A                                  | N/A                                  | 720                        | 500                            | 1              | 42               |
| B                           | 33.3                   | 20.3           | N/R                  | N/A                               | 25.0                       | 33.3                         | N/A                          | N/A                                  | N/A                                  | 720                        | 500                            | 2              | 42               |
| C                           | 100.0                  | 24.3           | 0.0                  | N/A                               | 25.0                       | 100.0                        | N/A                          | N/A                                  | N/A                                  | 720                        | 500                            | 1              | 42               |
| D                           | 0.0                    | 23.1           | N/R                  | N/A                               | 25.0                       | 0.0                          | N/A                          | N/A                                  | N/A                                  | 720                        | 500                            | 2              | 42               |
|                             |                        |                |                      |                                   |                            |                              |                              |                                      |                                      |                            |                                |                |                  |
|                             |                        |                |                      |                                   |                            |                              |                              |                                      |                                      |                            |                                |                |                  |
| A                           | 79.2                   | 51.9           | 100.0                | 0.0                               | 19.4                       | 89.0                         | N/R                          | -26.0                                | N/R                                  | 600                        | 500                            | 1              | 42               |
| B                           | 39.2                   | 49.9           | 100.0                | 0.0                               | 30.5                       | 78.0                         | N/R                          | 25.0                                 | N/R                                  | 600                        | 500                            | 2              | 42               |
| C                           | 58.3                   | 47.4           | 100.0                | 0.0                               | 33.3                       | 66.7                         | N/R                          | 39.0                                 | N/R                                  | 600                        | 500                            | 1              | 42               |
| D                           | 0.0                    | 43.9           | 40.0                 | 0.0                               | 24.3                       | 0.0                          | N/R                          | 0.0                                  | N/R                                  | 600                        | 500                            | 2              | 42               |

N/A Not applicable  
N/R No response

TABLE 1. OPERATOR RESULTS – GROUP 1

| INDIVIDUAL<br>OPERATOR<br>(TRIAL) | CORRECT<br>OBJECT<br>COUNT<br>% | RDS<br>ACCURACY<br>% | DIRECTION<br>ACCURACY<br>% | CORRECT<br>MIXED<br>TARGET<br>DETERMINED<br>% | CORRECT<br>ALARM<br>CLUSTERS<br>PROCESSED<br>% | CORRECT<br>TRACK<br>OBJECT<br>COUNT<br>% | CORRECT<br>WHEEL<br>OBJECT<br>COUNT<br>% | CORRECT<br>TRACK<br>OBJECT<br>(MIXED)<br>% | CORRECT<br>WHEEL<br>OBJECT<br>(MIXED)<br>% | ACTUAL<br>OBJECT<br>RDS<br>MTRS/MIN | SENSOR<br>DETECTION<br>RADIUS<br>METERS | DISPLAY<br>FORMAT | OBJECT<br>TAPE<br>USED |
|-----------------------------------|---------------------------------|----------------------|----------------------------|-----------------------------------------------|------------------------------------------------|------------------------------------------|------------------------------------------|--------------------------------------------|--------------------------------------------|-------------------------------------|-----------------------------------------|-------------------|------------------------|
| E                                 | 50.0                            | 86.9                 | 100.0                      | N/A                                           | 66.7                                           | N/R                                      | N/A                                      | N/A                                        | N/A                                        | 420                                 | 200                                     | 1                 | 42                     |
| F                                 | 66.7                            | 83.3                 | 100.0                      | N/A                                           | 50.0                                           | 66.7                                     | N/A                                      | N/A                                        | N/A                                        | 420                                 | 200                                     | 1                 | 42                     |
| G                                 | 66.7                            | 83.3                 | 100.0                      | N/A                                           | 50.0                                           | 33.3                                     | N/A                                      | N/A                                        | N/A                                        | 420                                 | 200                                     | 1                 | 42                     |
|                                   |                                 |                      |                            |                                               |                                                |                                          |                                          |                                            |                                            |                                     |                                         |                   |                        |
| E                                 | 76.0                            | 95.8                 | 100.0                      | N/A                                           | 67.5                                           | N/A                                      | N/R                                      | N/A                                        | N/A                                        | 720                                 | 200                                     | 1                 | 42                     |
| F                                 | N/R                             | 97.2                 | 100.0                      | N/A                                           | 33.3                                           | N/A                                      | N/R                                      | N/A                                        | N/A                                        | 720                                 | 200                                     | 1                 | 42                     |
| G                                 | 60.0                            | 53.2                 | 100.0                      | N/A                                           | 33.3                                           | N/A                                      | 60.0                                     | N/A                                        | N/A                                        | 720                                 | 200                                     | 1                 |                        |
|                                   |                                 |                      |                            |                                               |                                                |                                          |                                          |                                            |                                            |                                     |                                         |                   |                        |
| E                                 | 54.0                            | 88.7                 | 94.4                       | 100.0                                         | 56.3                                           | N/R                                      | N/R                                      | 33.3                                       | 33.3                                       | 600                                 | 200                                     | 1                 | 42                     |
| F                                 | 48.3                            | 81.7                 | 100.0                      | 83.0                                          | 41.7                                           | 75.0                                     | N/R                                      | 27.0                                       | 39.7                                       | 600                                 | 200                                     | 1                 | 42                     |
| G                                 | 70.3                            | 74.2                 | 90.9                       | 60.0                                          | 40.7                                           | 44.3                                     | N/R                                      | 67.4                                       | 38.2                                       | 600                                 | 200                                     | 1                 | 42                     |
| L(G)                              | 58.6                            | 84.1                 | 90.9                       | 55.6                                          | 37.9                                           | 50.0                                     | N/R                                      | 41.4                                       | 40.8                                       | 600                                 | 200                                     | 5                 | 49                     |
| M                                 | 54.7                            | 87.5                 | 100.0                      | 80.0                                          | 35.3                                           | 75.0                                     | N/R                                      | 17.0                                       | 48.4                                       | 600                                 | 200                                     | 3                 | 49                     |
| H(I)                              | 50.0                            | 82.9                 | 100.0                      | 50.0                                          | 50.0                                           | 50.0                                     | N/R                                      | -15.5                                      | 20.0                                       | 600                                 | 200                                     | 4                 | 49                     |

N/A Not applicable  
N/R No result

TABLE 2. OPERATOR RESULTS - GROUP 2

The numerator is the total number of times a single operator correctly separated a mixed column into its individual object types while the denominator indicates the total number of opportunities an operator had to determine mixed targets which he processed when they were presented.

5. Percentage alarm clusters processed: For all cases during the tactical situations, a number of adjacent alarm clusters were generated by the objects while passing the sensor strings. Many times a direction change occurred at one portion or another in the object track. The variable which is measured here attempts to give an indication of the usage of available data which was presented to each operator. It is defined as:

$$\frac{X + 1}{Y - 1}$$

where X = number of overall operator calculations made on the target alarm clusters produced by a sensor string.

Y = total number of alarm clusters produced by a target in a sensor string.

6. Percentage correct object type count: A measure of the count accuracies was made on both single and mixed object columns. It was calculated for each object type classification attempt made by an operator:

$$1.0 - \frac{\sum \text{percent count error}}{\text{total count attempt}}$$

The numerator is the percent count error for each count attempt made on a single object type. The denominator is the total number of count attempts made on the same object type. For example, suppose an operator calculated there were three track and one wheel targets when, in reality, there were four track and four wheel targets. His percentage correct object type count for track and wheel would be 75% and 25%.

Note that this parameter is calculated separately for mixed and single object columns in the data. A separate data column for both single and mixed target types is given.

7. Actual Target ROS: The actual rate of speed (ROS) of the targets is given in meters per minute. Note that all targets (columns) are composed of multiple objects.

8. Sensor detection radius: The sensor detection radius for a track vehicle is given in meters.

9. Character/Symbol displayed: The type of classification displayed characters/symbols during the testing is shown in Figure 12. Each format which was used for an individual operator trial is given by the corresponding set number in the data.

| <u>SET</u> | <u>PERSONNEL</u>                                                                      | <u>WHEEL</u>                                                                          | <u>TRACK</u>                                                                        | <u>COMMENT</u>             |
|------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------|
|            |    |    |    | SPECIFIC<br>5x7 DOT MATRIX |
| 1          |    |    |    | SPECIFIC<br>5x4 DOT MATRIX |
| 2          |    |    |    | ARBITRARY                  |
| 3          |   |   |   | SYMBOLIC                   |
| 4          |  |  |  | SYMBOLIC                   |
| 5          |  |  |  | ARBITRARY                  |

FIGURE 12. CHARACTER/SYMBOL REPRESENTATION

10. Object used: There were two sets of objects used during the testing. They are shown in Figures 4 and 7. The individual targets are partitioned in the data by their ROS. Note that the majority of all targets is moving at 600 meters/minute.

## OPERATOR RESULTS

The operator results are presented in Tables 1 and 2. They consist of results from two operator groups: one and two. Group one operators had a 500-meter sensor detection radius whereas group two had a 200-meter radius. There are also differences among both groups in the target ROS. This data, although small, is separated from the majority (600/minute).

Several features can be noted from the presented data: (1) all the operators of group one had difficulty in calculating time on the thermal printout and hence there are errors in their ROS calculations. They used twice the actual value of time, although they received detailed instructions on the procedure to calculate time; (2) the large detection radius used by group one results in 0% correct mixed target determination in all cases, whereas the lower detection radius of group two produces over 50% correct mixed target determination in all cases; (3) all the operators were consistent in their calculations of correct object count, direction accuracy, and ROS (if (1) above is taken into account); (4) the operators consistently did not use all the recorder data available to them as shown in the percentage of alarm-clusters-processed column.

### Operator's Comments

This section discusses useful comments made by the operators and the observations of the operators by testing personnel. They relate mainly to the printing of the classification symbols from the recorder:

1. As long as the character types or symbols were (a) completely distinguishable from each other, and (b) had no overlap, there was no classification confusion.
2. Characters or symbols should be distinguishable not only as in 1, above, but also when embedded in groups of other characters or symbols.
3. With an 80% correct classification response, the operators had no problem in choosing the correct majority classification. This resulted in a saving of analysis time on the part of the operators, since they did not need to estimate the type object, and it eliminated the corresponding problem of choosing the type object in a column of mixed objects by velocity discrimination.
4. Shortened or squatted 5 x 4 character formats were legible.
5. Common characters or symbols which cause automatic associations with object types are the best. Otherwise, the operators had to learn and constantly refer to the symbol drawings for their meaning. Once they were thoroughly learned, however, there seemed to be no difference among the characters or symbols.

## **Operator Problem Areas**

Several problem areas were exposed during the testing of the operators. They are mentioned in summary form to indicate possible areas in which improvements can be made in operator performance:

1. Different sensor detection radii, other than the assumed values which the operators use, cause large errors in their calculations.
2. Large inconsistencies in the results of several operators were found. For example, when one operator, M, calculated the object count for the same target, he obtained values of 2, 8 and 11 objects. Note that this is from alarm clusters which are identical in length, with identical sensor characteristics.
3. Targets were not tracked. There was no observed written grouping together of identical targets on the printout. Thus, there was no accumulation of knowledge about the individual targets and hence updates of their characteristics, as would have been helpful in 2 above, during their passage through the monitored area.
4. Many changes in target direction were not observed by the operators. For example, if there were several alarm clusters and the last two indicated a turn in the target direction, most operators ignored this fact. They only processed, as a rule, the first two alarm clusters.
5. Operators' performance was, in general, inflexible; they could not compensate for changing conditions which could be encountered in real tactical situations.

## **Recorder Observations and Recommendations**

The thermal recorder print heads consisted of 80 individual fixed heads made up of five in-line dots each. The use of individual heads created problems in maintaining equal contact pressure between the heads and the chart paper. This caused non-uniformity in the shading of the characters so that some characters would be light and difficult to read while others would be dark and easy to read. Though this created no problems during the test because pens which printed dark characters were selected, it may be an inherent problem associated with fixed head printers and should be considered before selecting a recorder for the SMS.

The recorder required the use of a non-standard size chart paper. The paper Texas Instruments used during the development of the recorder was not inscribed with columns or rows; however, this paper was used because a small number of rolls were required and the cost to manufacture paper of the correct size and markings was too high. Separating the groups of pens representing the individual sensor strings and marking the pen positions in the recorder near the print heads enabled the operators to match the activation to the corresponding sensor.

One problem was calculating time because there were no row markings to act as a reference. The operators were given a formula which required measuring distances and multiplying by a conversion factor. This method

worked well with one group of operators; however, the other group consistently calculated speeds of approximately one half the actual target speed.

It is recommended that the SMS chart paper have some form of timing reference such as a row indicator, a timing tick mark, or the actual time printed by the processor.

## APPENDIX A

### SYSTEM OVERVIEW

**Software System Description** — The software system is structured using a real time operating system (RTOS). Some of the more important features which this allows are:

- a. Multiple programs operating concurrently with interleaving.
- b. Program priorities determine execution sequence and distribution of processing time.
- c. Accurate time of day (clock) available.
- d. Programs can communicate and pass data among themselves.
- e. Programs can be segmented and overlaid from disc.

A simplified diagram of the system is given in Figure 13. The center of the system is the executive. All system interrupts, device interrupts, and system service requests are handled here. The executive always goes to the scheduler once it is done. The scheduler determines which user program: Task 1, Task 2, etc., is to be activated. This depends on both the current state of the tasks as well as their priority. Once the scheduler starts a program it continues in operation until the next interrupt to the executive occurs.

The drivers indicated at the bottom of the figure are software routines which interface the device controllers to the executive. The system uses them for all I/O operations performed through their respective devices.

**System Hardware Description** — The Sensor Monitor Set (SMS) simulation used an Interdata Model 70 minicomputer as the processor with standard peripheral equipment and a Texas Instrument Thermal Recorder. The Hardware-System Configuration (Figure 14) depicts all the hardware used in the SMS Test. Note, the thermal recorder is not a standard peripheral item and required the development of special interface circuitry.

The processor controls all activities and performs all arithmetic and logical functions. It executes instructions in an ordered sequence to complete a specified task or program. The processor has 16 hardware registers for data manipulation, hardware divide/multiply and floating point instructions. The main memory is core memory with a capacity of 64 k bytes of which 48 k bytes are presently installed. The selector channel is a standard direct memory access device that allows connection of high speed peripheral devices directly to main memory. The maximum data transfer rate is 2 mega bytes per second. All medium to low speed devices are connected to the Multiplexer Input/Output bus. This is a request/response bus consisting of 30 lines: 16 bi-directional data lines, 8 control lines, 5 test lines, and a system initialize line.

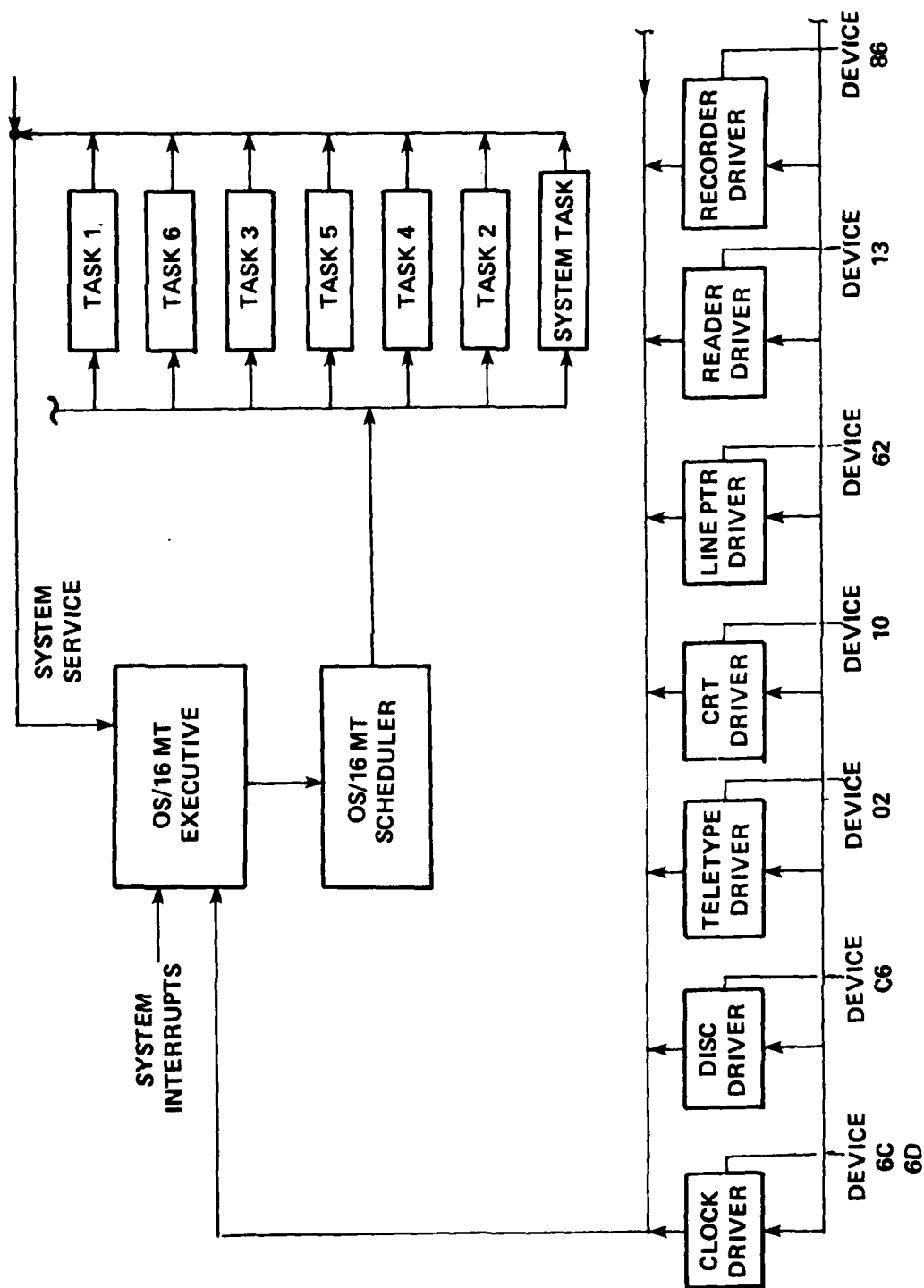


FIGURE 13. RTOS SOFTWARE SYSTEM DIAGRAM

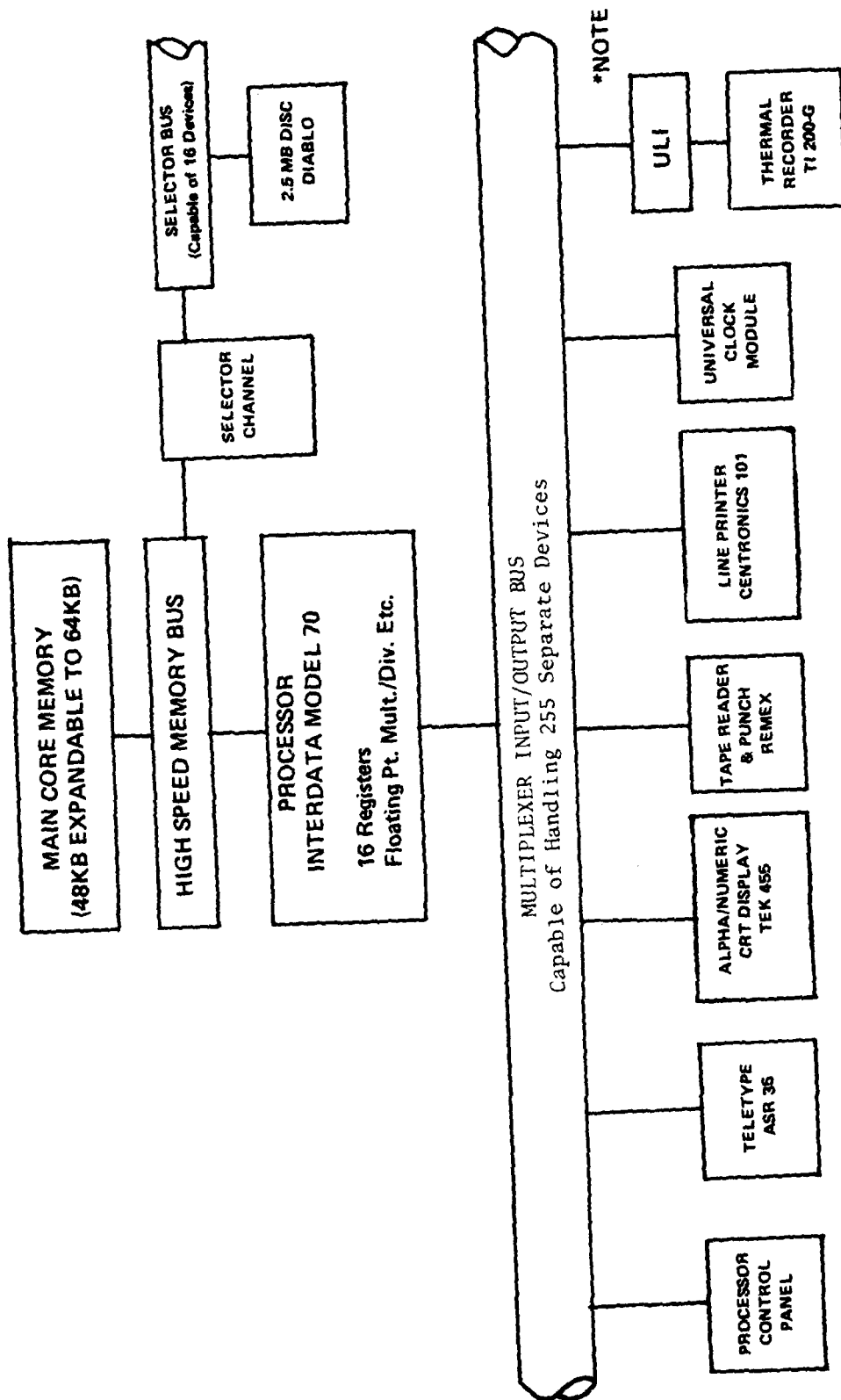


FIGURE 14. HARDWARE SYSTEM CONFIGURATION

Interrupt detection and hardware vectoring can be accomplished for all of a possible 255 devices which can be interfaced to the multiplexer bus. The peripherals used are standard devices offered through Interdata with the exception of the thermal recorder (TI Graphic 200) which was obtained through Texas Instruments. The recorder was integrated into the system using a Universal Logic Interface Board and Associated Hardware to obtain the specified input and output characteristics required by the multiplexer bus.

## APPENDIX B

### DETAILED SOFTWARE DESCRIPTION

#### Operating System

The real time operating system used is OS/16 - MT (multi-tasking operational system). It is divided into system programs and user program units called tasks. System programs include the executive, scheduler, initialization route, I/O drivers, and interrupt handlers.

#### Tasks

A task can be a single program or a group of programs, whose execution is controlled by the operating system. Each task exists in one of eight states; they are:

- |                  |                                                                                                             |
|------------------|-------------------------------------------------------------------------------------------------------------|
| (1) Dormant      | - The task has not been started or has gone to completion.                                                  |
| (2) Active       | - The task which is currently executing instructions. Only one task can be in this state at any given time. |
| (3) Ready        | - The task which will start or resume execution when it becomes the highest priority ready task.            |
| (4) Task Wait    | - A task has called another task into execution and is waiting for the called task to go to completion.     |
| (5) Console Wait | - The task is waiting for an operator reply.                                                                |
| (6) I/O          | - The task is waiting for a specific time interval to elapse.                                               |
| (8) Overlay Wait | - The task is waiting for an overlay to be loaded.                                                          |

Each task is assigned a priority level based upon which task has operating privileges over the other tasks. The priority numbers are selected with the highest priority task, always being the command processor task, having the lowest number, and the lowest priority user task having the highest number (task to be run last). The following are the Sensor Monitor Set Systems tasks in order of their priority of execution:

| <u>Priority</u> | <u>Name of Task</u>                        |
|-----------------|--------------------------------------------|
| 0               | Command Processor (within OS-16-MT)        |
| 1               | Thermal Recorder Task (Task 1)             |
| 2               | Tactical Situation Simulator Task (Task 6) |
| 3               | Input Processing Task (Task 3)             |
| 4               | Operator Processing Task (Task 4)          |
| 5               | Command Directory Task (Task 5)            |
| 6               | Line Printer Task (Task 2)                 |

### **Executive**

The OS/16-MT executive is a collection of routines that are entered as a result of internal interrupts. These interrupts include supervisor calls, illegal instructions, arithmetic faults, I/O termination, I/O queue overflow, and console interrupts. The executive always exits through the task scheduler. Normally, the status of a least one task is changed by the executive in servicing the interrupt. This means that the task that was active at the time of the interrupt may no longer be the highest priority ready task when the executive exits. When it exits, the scheduler decides which task is to be activated.

### **Real Time Clock (Universal Clock Module)**

The OS/16-MT system maintains two clocks, a time of day clock and an interval timer. The time of day counter is a full word count kept in seconds since midnight. It is driven by a presetable 120 Hz interrupt from the Universal Clock Module. This counter is initialized to zero on system start up and may be set through the operator command to set time. From this counter, a task may request the current time of day or that it be placed in a time wait until a specified time of day is reached. A task may also request that it be placed in a time wait for a specified time interval.

### **TASK 1**

The recorder input buffer is eight 5-bit characters long and must be filled with either activation data or zeros when there are no activations. When the recorder is ready to receive new data, it sends a recorder Not Busy signal to the computer. This signal interrupts the processor. The interrupt routine conditions the state of the operating system so that the scheduler starts Task 1.

Task 1 controls the interface between the computer and the recorder. It designates the input buffers to be filled with new activations data, the buffer from which data is to be put out and it controls the actual output of the data.

Thermal Recorder. The thermal recorder is capable of printing an 80 character line. The print head is a row of eight 5-bit stationary thermal heads with a space between each group of 5 bits. A 5 by 7 dot matrix character is printed by building the characters one row at a time. The applicable dots of the bottom are printed by driving the corresponding bits of the print head. The chart is moved slightly, and the applicable bits of the same 5 bits are driven to print the second row and so on until all seven rows have been printed.

The row of print heads is divided into four sets of twenty 5-bit subsets each. This permits using a smaller power supply for the printing drivers. Each set is driven at different times. One set is driven, and the chart is moved a small step in order to move the burned portion from under the head, then another set is driven and another step taken. This procedure continues until all four sets have been driven and four steps have been taken. At this time one row has been printed.

The recorder logic contains a character generator which requires as an input the 8-bit ASCII code for the desired character; however, this was inadequate for the recorder's intended use. Other characters or symbols in addition to those available in the character generator were required. It was also required that on-the-spot character and symbol configurations be changed so that any configuration capable of being generated by a 5 by 7 dot matrix would be available.

Modifications were made in the recorder and an option board built which, in essence, removed the character generator from the recorder. This function was designed into the software in the Model 70. The computer outputs to the recorder one row of a character at a time. Changes in software requiring only a few minutes can enable the generation of symbols in any 5 by N dot matrix.

Chart speed is controlled by the recorder; however, switches enable various speeds to be set into the recorder. Additional speeds can be acquired by using an external oscillator. The switches and the external oscillator enables speeds being considered for the SMS to be obtained.

## **TASK 2 - The Line Printer Task**

The function of the line printer task is to output the sensor activations to the line printer correctly formatted with a heading printed approximately every thirty sensor activations (Figure 15). The following data is recorded for each activation:

|      |   |                                           |
|------|---|-------------------------------------------|
| RID  | - | Receiver and Sensor Identification Number |
| TYPE | - | Sensor Type: Examples                     |
|      |   | SFE - Seismic Feature Extractor           |
|      |   | VFP - Variance Frequency Processor        |

| RID | TYPE | EAST   | NORTH  | TIME   | TBR |
|-----|------|--------|--------|--------|-----|
| 101 | SFE  | 004389 | 028832 | 000217 | TRK |
| 101 | SFE  | 004389 | 028832 | 000227 | TRK |
| 101 | SFE  | 004389 | 028832 | 000237 | TRK |
| 102 | SFE  | 004500 | 028500 | 000240 | WHL |
| 101 | SFE  | 004389 | 028832 | 000247 | TRK |
| 102 | SFE  | 004500 | 028500 | 000250 | TRK |
| 101 | SFE  | 004389 | 028832 | 000302 | TRK |
| 102 | SFE  | 004500 | 028500 | 000302 | WHL |
| 103 | SFE  | 004657 | 028132 | 000306 | TRK |
| 101 | SFE  | 004389 | 028832 | 000312 | WHL |
| 102 | SFE  | 004500 | 028500 | 000312 | TRK |
| 103 | SFE  | 004657 | 028132 | 000316 | TRK |
| 101 | SFE  | 004389 | 028832 | 000322 | TRK |
| 102 | SFE  | 004500 | 028500 | 000322 | TRK |
| 103 | SFE  | 004657 | 028132 | 000326 | TRK |
| 105 | SFE  | 005066 | 028201 | 000326 | WHL |
| 102 | SFE  | 004500 | 028500 | 000332 | TRK |
| 113 | SFE  | 013000 | 017050 | 000332 | WHL |
| 103 | SFE  | 004657 | 028132 | 000336 | TRK |
| 105 | SFE  | 005066 | 028201 | 000336 | TRK |
| 102 | SFE  | 004500 | 028500 | 000342 | TRK |
| 113 | SFE  | 013000 | 017050 | 000342 | TRK |
| 103 | SFE  | 004657 | 028132 | 000346 | TRK |
| 104 | SFE  | 004094 | 027581 | 000346 | TRK |
| 105 | SFE  | 005066 | 028201 | 000346 | TRK |
| 113 | SFE  | 013000 | 017050 | 000352 | TRK |
| 103 | SFE  | 004657 | 028132 | 000356 | TRK |
| 104 | SFE  | 004094 | 027581 | 000356 | WHL |
| 105 | SFE  | 005066 | 028201 | 000356 | TRK |
| 629 | SFE  | 013000 | 017500 | 000402 | TRK |
| 113 | SFE  | 013000 | 017050 | 000402 | TRK |
| RID | TYPE | EAST   | NORTH  | TIME   | TBR |
| 103 | SFE  | 004657 | 028132 | 000406 | TRK |
| 104 | SFE  | 004094 | 027581 | 000406 | TRK |
| 629 | SFE  | 013000 | 017500 | 000412 | TRK |
| 113 | SFE  | 013000 | 017050 | 000412 | TRK |

FIGURE 15. LINE PRINTER ACTIVATION OUTPUTS

EAST        -     East UTM Coordinates

NORTH      -     North UTM Coordinates

TIME       -     System Time the Activation was processed

TBF        -     Sensor Data Processed

            Class I Detection Only   - (Blank) - No Data

            Class II Classification   - TRK - Track  
                                           WHL - Wheel  
                                           MAN - Personnel  
                                           UNK - Unknown

The line printer works in conjunction with the line printer driver, which outputs each individual character to the line printer.

### **TASK 3 - Input Processing Task**

The function of the Input Processing Task is to process the activations and associated data from the tactical situation simulator task (Task 6). When activation data is passed to Task 3, the following programmed sequence occurs:

1. Validation and checking of sensor identification codes and sensor data for a particular class of sensor

Type I    -   Detect Only Sensors        -   No Data

Type II   -   Classification Sensors   -   Classification Data.

If the data obtained from a classification sensor is not within proper parameters, the activation is tagged with a corresponding symbol for bad data.

2. Decoding and proper formatting of the activation and associated data for transfer to the peripheral equipment used by the computer.

3. Setting up of the data into specific buffer location to be used by Task 1 to output this data to the Texas Instruments Thermal Recorder. This data can be displayed in any format by the character generator routine.

4. Outputting of the activation to the following devices:

- a. Disc, on which a history record is kept for all activations.
- b. Cathode Ray Tube, for display in simulated map format.

Upon completion of these functions, the task terminates itself and becomes dormant until another activation is passed to it.

### **Input Data Processing Routine for Texas Instruments Thermal Recorder**

The data processing routine for the Texas Instruments thermal recorder tests and validates sensor input data received through the Input Processing Task (Task 3). This routine formats and stores data to be outputted to the recorder by the Thermal Recorder Task (Task 1). The sensor activations are generated by the Tactical Situation Simulator Task (Task 6) which simulated sensor activations, sensor data and sensor time of activations. These simulated activations and associated data are then stored into the Data Processing Queue Facility (Input Queue) which is a circular list processing storage area (first-in-first-out) located within Task 3. When sensor activations and data enter the queue, the input processing task and data processing routine for the thermal recorder begin execution of their programs. When the data processing routine for the thermal recorder is executed (Figure 16), the following programmed functions occur:

1. Determine the corresponding sensor type from the activation's sensor identification and channel number (RID#). Two types of sensors generated activations:
  - a. Type I - Detection-Only Sensors  
Channel No. + Sensor ID No. + Time of Activation
  - b. Type II - Classification Sensors  
Channel No. + Sensor ID No. + Time of Activation +  
Classification Data
2. Decode and store the data into an output storage area which will be accessed by the thermal recorder task. This data can be translated into the form of single data bytes (detection-only activations) or full characters or symbols (classification activations).

The routine begins by determining the type of sensor activation which is being processed. When the data enters, it consists of a channel and sensor identification number (RID). The RID is checked against a list of known active sensors with RID numbers stored in a common data base located in the core memory. Each RID number in the data base has a corresponding sensor type, either detection-only (Type I) or classification (Type II). When the sensor type has been determined, the appropriate data handling routine is executed under program control.

#### **Detection-Only Activation - Type I Sensor Routine**

Data from a detection-only type sensor is passed to the Type I Sensor Routine. This routine loads the last time of activation for that particular sensor identification number (RID#). The last time of activation of each of the active sensors is stored in the common data base of the input processing routine. The routine loads the current time of activation from the input queue where the current activation is stored temporarily until servicing of the activation is completed. A time comparison routine is used to determine if the difference between the last activation time and the present activation time for the specific RID number is less than, or greater than, a fixed differential in time which can be specified. The time differential used in the SMS software was 1 minute between successive activations. This was done so that activations

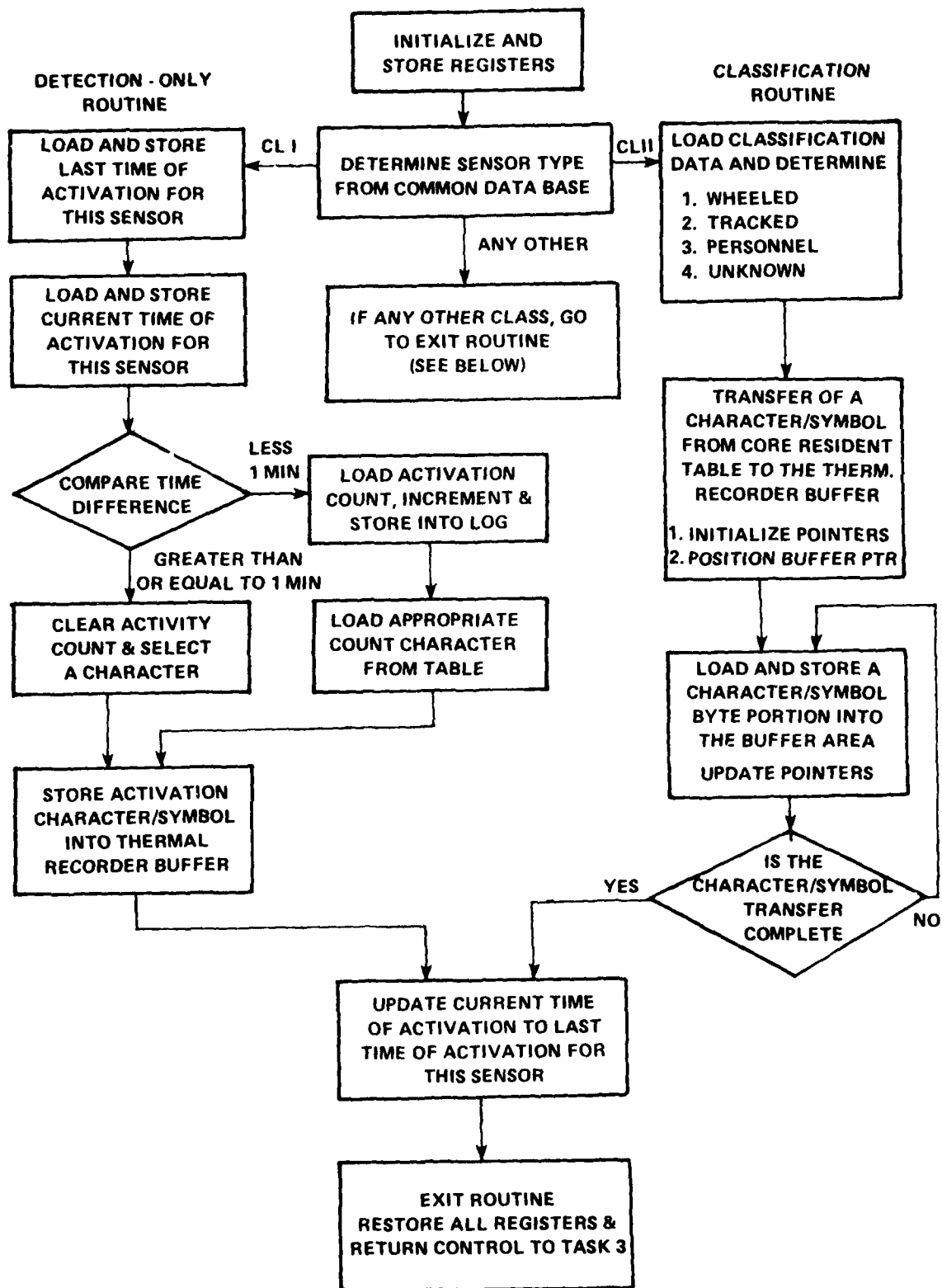


FIG. 16 THERMAL RECORDER DATA PROCESSING FLOW DIAGRAM

arriving within this time limit, successively, would be given different symbol representations to be displayed to the recorder, thereby isolating single activations and multiple activations at the recorder output so that possible false activations could be recognized at a glance (see Figure 17). The technique for displaying the data follows:

a. If the differential in activation times is less than one minute, the activation log counter for the sensor identification number is loaded, updated and restored in the activation log. A symbol is taken from the character/symbol table corresponding to the updated activation count and stored in the appropriate recorder pen number location in the recorder output buffer.

b. If the differential is greater or equal to one minute, the activation log count for this RID number is initialized to Zero, stored into the activation log, and a symbol is taken from the character/symbol table corresponding to an initial activation. This symbol is a single dot, which is stored into the recorder pen number location, in the recorder output buffer for this RID number.

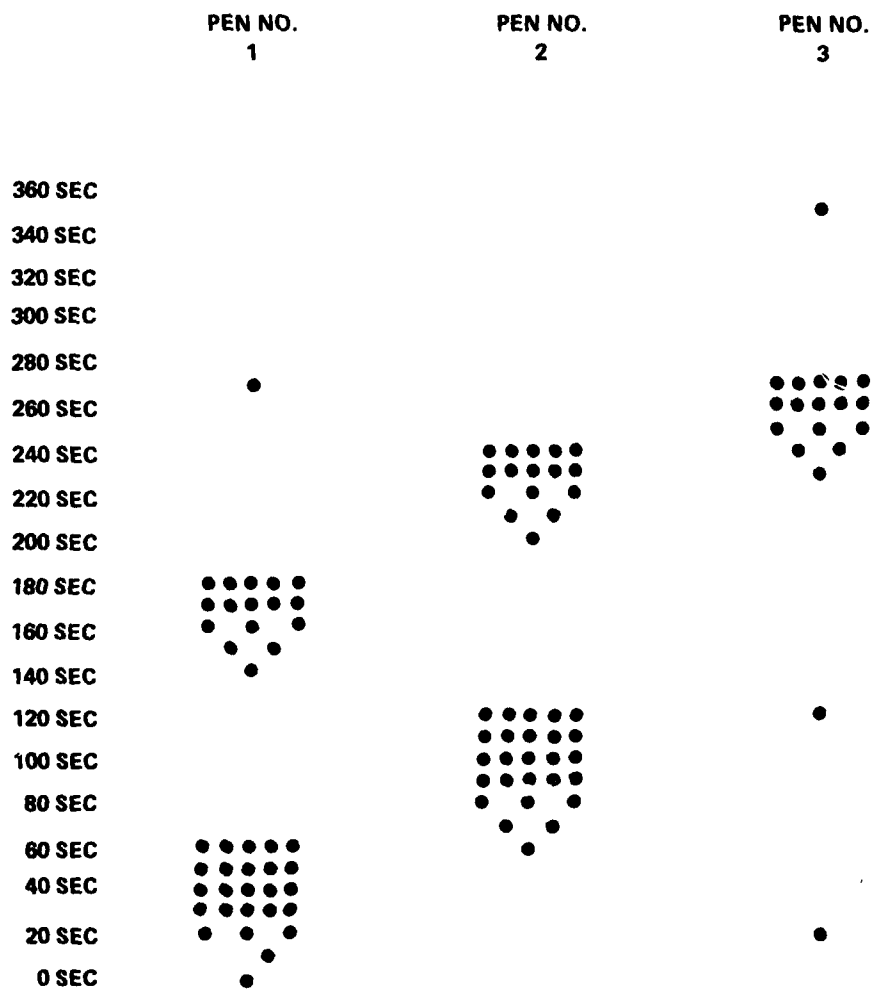
When this has been completed, the current time of activation is stored where the last time of activation was in the common data base, thereby making the current time the last time of activation for this sensor identification number. Following this, all the registers of the operating system are restored and the processing of the input data is continued on the input processing task, where software control is returned.

#### **Classification Sensor - Type II Sensor Routine**

When a classification sensor activation is determined, the data portion of the activation is loaded from the input queue where the current activation is temporarily stored. The data is decoded and checked for its classification. In the simulation tests, three different types of valid classification data were generated and processed through the operating system. The valid classifications were:

- a. Tracked Vehicle
- b. Wheeled Vehicle
- c. Personnel

If data received for an activation does not coincide with any of the valid data codes, the activation is tagged with a symbol signifying that the data is unknown (i.e., insufficient data to correctly classify the target). After the activation and decoded data have been verified for type of classification, the program goes to a reference table in the core memory and determines which character/symbol is to be stored into the recorder buffer to be displayed. For example, if the data for an activation was found to be that of a tracked vehicle, the routine would go to the reference table and select a "T" for tracked vehicle. Then the character/symbol would be transferred into the recorder output buffer.



NOTE: Symbol initialization after  
60 sec. of no activity

FIG. 17 SYMBOL GENERATION FOR DETECTION-ONLY SENSORS

specified by the recorder pen number for this particular sensor identification code. Similarly, if the activation data was that of a wheeled vehicle, a "W" would be selected from the table. Having the character generation under software control expands the possibility of outputting any 5 by 7 character or symbol rather than the standard ASCII Code, or, for that matter, any 5 x N character or symbol. (See Figure 18.) This technique is used to shrink the characters to a 5 x 4 dot matrix thereby enabling slower recorder chart speeds.

When the character/symbol has been completely transferred to the recorder output buffer, the current time of activation is stored into the common data base for this sensor identification number; all registers are restored to initial entry values, and program control is transferred back to the main input processing routine.

#### **Recorder Output Buffer Data Structure**

The data base structure for the Texas Instruments thermal recorder is a core resident storage area made up of seven 80 8-bit data strings. (See Figure 19.) The first three most significant bits of each data byte (8 bits) are not required by the recorder and are only used to simplify the software data base and programming of the data transfer.

The seven data strings, or data blocks, represent the seven character/symbol lines as discussed in the character/symbol generation of classification sensors (Figure 18). The seven data blocks are configured in a circular list, data is transferred sequentially into all seven data blocks, continuing into the first block after the last has been filled. The starting data block is determined by the relationship between the recorder output state and the time an activation is being processed.

The data block structure uses seven data blocks to generate 5 by 7 dot matrix characters/symbols. By extending or shortening the circular data structure, any 5 by N character/symbol can be generated. This technique was used in changing the size of the characters for slower chart speeds used by the thermal recorder.

#### **TASK 4 - Operator Command Processing Task**

The purpose of the operator command processing task is to enable the operator to execute disc overlay programs. The task consists of a four kilobyte overlay area (storage area) and some controlling software. There are many programs at the operator's disposal (Edit, Admin, etc.), and storing all of them into the core is impossible owing to restraints on the core size. Also, additions and modifications to software available to the operator would require a regeneration of the entire system. Therefore, all of the interactive programs were stored on a disk file non-resident to the system. When a program is requested by the operator, the non-resident disc file is searched (Task 5), the program is loaded into the overlay area (Task 4), and program control is passed to the non-resident routine which is in the overlay area by starting Task 4. Upon completion of the non-resident routine 4 terminates itself and becomes dormant.

|   |                        |                        |        |        |
|---|------------------------|------------------------|--------|--------|
| 1 | .                      | ..                     | . .    | ... .. |
| 2 | :                      | ...                    | ....   | .. ..  |
| 3 | :                      | ...                    | ....   | .. ..  |
| 4 | :                      | ...                    | ....   | .. ..  |
| 5 | :                      | ...                    | ....   | .. ..  |
| 6 | :                      | ...                    | ....   | .. ..  |
| 7 | T                      | U                      | A      | A      |
|   | CHARACTER<br>FOR TRACK | CHARACTER<br>FOR WHEEL | SYMBOL | SYMBOL |

FIG. 18 CHARACTER/SYMBOL GENERATION FOR CLASSIFICATION SENSORS

ALL DATA BLOCKS ARE OF  
EQUAL MEMORY LENGTH

|                                              |
|----------------------------------------------|
| DATA BLOCK 1<br>80 8-BIT BYTES<br>(640 BITS) |
| DATA BLOCK 2                                 |
| DATA BLOCK 3                                 |
| DATA BLOCK 4                                 |
| DATA BLOCK 5                                 |
| DATA BLOCK 6                                 |
| DATA BLOCK 7                                 |

OVERALL DATA BASE STRUCTURE

| DATA BIT POSITIONS |   |   |   |   |   |   |   |                 |    |    |    |    |    |    |  |
|--------------------|---|---|---|---|---|---|---|-----------------|----|----|----|----|----|----|--|
| 1                  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9               | 10 | 11 | 12 | 13 | 14 | 15 |  |
| DATA FOR PEN 0     |   |   |   |   |   |   |   | DATA FOR PEN 1  |    |    |    |    |    |    |  |
| DATA FOR PEN 2     |   |   |   |   |   |   |   | DATA FOR PEN 3  |    |    |    |    |    |    |  |
| DATA FOR PEN 4     |   |   |   |   |   |   |   | DATA FOR PEN 5  |    |    |    |    |    |    |  |
| DATA FOR PEN 6     |   |   |   |   |   |   |   | DATA FOR PEN 7  |    |    |    |    |    |    |  |
| ⋮                  |   |   |   |   |   |   |   | ⋮               |    |    |    |    |    |    |  |
| ⋮                  |   |   |   |   |   |   |   | ⋮               |    |    |    |    |    |    |  |
| ⋮                  |   |   |   |   |   |   |   | ⋮               |    |    |    |    |    |    |  |
| DATA FOR PEN 74    |   |   |   |   |   |   |   | DATA FOR PEN 75 |    |    |    |    |    |    |  |
| DATA FOR PEN 76    |   |   |   |   |   |   |   | DATA FOR PEN 77 |    |    |    |    |    |    |  |
| DATA FOR PEN 78    |   |   |   |   |   |   |   | DATA FOR PEN 79 |    |    |    |    |    |    |  |

TYPICAL DATA BLOCK STRUCTURE

FIG. 19 RECORDER OUTPUT BUFFER DATA STRUCTURE

The execution and operation of the non-resident programs or, for that matter, any other task, in no way interferes with the processing of incoming data from the tactical situation simulator or outputting to the recorder. This aspect is covered under the discussion of operation of the real time operating system.

### **EDIT Routine (EDIT)**

The EDIT Routine is a disc overlay program that enables the operator to create and modify the sensor administration file. Through the teletype, the operator can activate, deactivate, or modify existing sensor records in the file and also activate or deactivate entire receiver channels. Data entered for each sensor in the Administrative File is as follows:

- |                                             |            |
|---------------------------------------------|------------|
| a. Activate (A) or Deactivate (D) status    | ST         |
| b. Sensor Channel and Identification Number | RID        |
| c. Recorder Number and Pen Position         | RPP        |
| d. Type of Sensor                           | TYP        |
| e. East and North UTM coordinates           | EAST-NORTH |
| f. Array Number                             | AR         |
| g. Date Sensor was Deployed                 | DDPD       |

When the EDIT Routine is run to completion, a new active sensor file is created in core (located in the common data base) and the entire sensor file is transferred to a disc. This file contains all active and deactivated sensors. (A deactivated sensor is one which is invisible to the system for processing.) The channel indicator will be set to indicate the status of the receiver channels, which will be set by the input processing task (Task 3). The EDIT Routine also calculates the coordinate scale from the UTM coordinates of all the active sensors and scales of the CRT display appropriately for the mapping of the sensor field.

### **The Administrative Routine (ADMIN)**

The ADMINISTRATIVE Routine is a disc overlay program that allows the operator to list on a peripheral device either the entire or any portion of the sensor administrative file on disc. This allows the operator to display the data for any sensor or groups of sensors to any of the peripheral devices (CRT, line printer or teletype). The operator has the following display modes of operations for listing sensors:

1. All sensors in the Administrative File
2. All active sensors in the Administrative File
3. Any particular sensor or group of sensors

4. All sensors within specified UTM coordinates
5. All active sensors within specified UTM coordinates

When the CRT is selected as the output device, (Figure 20), the sensors are listed on two sides of the screen, split screen fashion. This permits a maximum of 43 sensors to be displayed at any time. If there are more than 43, the routine will queue the operator if the rest are to be displayed. When the line printer is selected as the output device (Figure 21), a heading is printed and the list outputted. When sensor activations enter the system during this mode, they are processed to completion immediately, and the activations are listed to the line printer upon completion of outputting the Administrative List.

### ACTIVation Routine

The sensor ACTIVation simulation routine is a disc overlay program which generates sensor activations and enters them into the system. This input is the same as if an actual activation occurred at the receiver inputs. Thus, the simulation of any sensor report can be easily accomplished for software testing, demonstrations, et cetera.

The program can produce either classification or detection-only reports. To enter the data one needs only the RID (Receiver - ID) number and the desired classification (if a classifier).

For multiple activations, one has to enter the data separated by commas. This will time-tag all entered data at the identical time of entry. An example of program operation is as follows:

| <u>Command</u>       | <u>Explanation</u>                     |
|----------------------|----------------------------------------|
| ACTIV                | Call Program                           |
| **                   | Program Ready                          |
| 121                  | Output Activation on Sensor 121        |
| **                   | Program Ready                          |
| 131-2                | Output Activation and Classification 2 |
| 121, 131-2, 121, 141 | Output many Activations                |
| **                   | Program Ready                          |
| END                  | END Program                            |
| END ACTIV            | Normal Program End.                    |

| RID | TYP | EAST  | NORTH | RPP | AR | ST | DDPD | RID | TYP | EAST  | NORTH | RPP | AR | ST | DDPD |
|-----|-----|-------|-------|-----|----|----|------|-----|-----|-------|-------|-----|----|----|------|
| 101 | SFE | 04000 | 50000 | 111 | 00 | A  | 1019 | 233 | SFE | 21000 | 32500 | 160 | 00 | A  | 1019 |
| 102 | SFE | 04000 | 49500 | 112 | 00 | A  | 1019 | 234 | SFE | 21000 | 32000 | 161 | 00 | A  | 1019 |
| 103 | SFE | 04000 | 49000 | 113 | 00 | A  | 1019 | 235 | SFE | 21000 | 31500 | 162 | 00 | A  | 1019 |
| 104 | SFE | 04000 | 44000 | 116 | 00 | A  | 1019 | 236 | SFE | 21000 | 31000 | 163 | 00 | A  | 1019 |
| 105 | SFE | 04000 | 43500 | 117 | 00 | A  | 1019 | 264 | SFE | 21000 | 36500 | 156 | 00 | A  | 1019 |
| 106 | SFE | 04000 | 43000 | 118 | 00 | A  | 1019 | 537 | SFE | 12250 | 33750 | 166 | 00 | A  | 1019 |
| 107 | SFE | 04565 | 42935 | 119 | 00 | A  | 1019 | 538 | SFE | 13000 | 33750 | 167 | 00 | A  | 1019 |
| 108 | SFE | 04920 | 42581 | 120 | 00 | A  | 1019 | 539 | SFE | 13750 | 33750 | 168 | 00 | A  | 1019 |
| 109 | SFE | 04000 | 38000 | 123 | 00 | A  | 1019 | 541 | SFE | 13000 | 33000 | 170 | 00 | A  | 1019 |
| 111 | SFE | 04000 | 36700 | 125 | 00 | A  | 1019 | 542 | SFE | 13750 | 33000 | 171 | 00 | A  | 1019 |
| 112 | SFE | 04000 | 32000 | 130 | 00 | A  | 1019 | 543 | SFE | 12250 | 32250 | 172 | 00 | A  | 1019 |
| 113 | SFE | 04000 | 31500 | 131 | 00 | A  | 1019 | 544 | SFE | 13000 | 32250 | 173 | 00 | A  | 1019 |
| 114 | SFE | 04000 | 31000 | 132 | 00 | A  | 1019 | 545 | SFE | 13750 | 32250 | 174 | 00 | A  | 1019 |
| 115 | SFE | 04000 | 30500 | 133 | 00 | A  | 1019 | 564 | SFE | 12250 | 33000 | 169 | 00 | A  | 1019 |
| 164 | SFE | 04000 | 37350 | 124 | 00 | A  | 1019 | 616 | SFE | 19500 | 57000 | 140 | 00 | A  | 1019 |
| 225 | SFE | 21000 | 48000 | 150 | 00 | A  | 1019 | 617 | SFE | 20250 | 57000 | 141 | 00 | A  | 1019 |
| 226 | SFE | 21000 | 47350 | 151 | 00 | A  | 1019 | 618 | SFE | 21000 | 57000 | 142 | 00 | A  | 1019 |
| 227 | SFE | 21000 | 46700 | 152 | 00 | A  | 1019 | 619 | SFE | 19500 | 56250 | 143 | 00 | A  | 1019 |
| 228 | SFE | 21000 | 37500 | 154 | 00 | A  | 1019 | 621 | SFE | 21000 | 56250 | 145 | 00 | A  | 1019 |
| 229 | SFE | 21000 | 37000 | 155 | 00 | A  | 1019 | 622 | SFE | 19500 | 55000 | 146 | 00 | A  | 1019 |
| 231 | SFE | 20500 | 37000 | 157 | 00 | A  | 1019 | 623 | SFE | 20250 | 55000 | 147 | 00 | A  | 1019 |
| 232 | SFE | 20000 | 37000 | 158 | 00 | A  | 1019 |     |     |       |       |     |    |    |      |

PAGE COMPLETED

FIGURE 20. TYPICAL ADMINISTRATIVE FILE CRT OUTPUT

```

*          ADMINISTRATIVE FILE          *
RID TYP EAST  NORTH RPP  AR ST DDPD
101 SFE 04000 50000 111  00 A 1019
102 SFE 04000 49500 112  00 A 1019
103 SFE 04000 49000 113  00 A 1019
104 SFE 04000 44000 116  00 A 1019
105 SFE 04000 43500 117  00 A 1019
106 SFE 04000 43000 118  00 A 1019
107 SFE 04565 42935 119  00 A 1019
108 SFE 04920 42581 120  00 A 1019
109 SFE 04000 38000 123  00 A 1019
111 SFE 04000 36700 125  00 A 1019
112 SFE 04000 32000 130  00 A 1019
113 SFE 04000 31500 131  00 A 1019
114 SFE 04000 31000 132  00 A 1019
115 SFE 04000 30500 133  00 A 1019
164 SFE 04000 37350 124  00 A 1019
225 SFE 21000 48000 150  00 A 1019
226 SFE 21000 47350 151  00 A 1019
227 SFE 21000 46700 152  00 A 1019
228 SFE 21000 37500 154  00 A 1019
229 SFE 21000 37000 155  00 A 1019
231 SFE 20500 37000 157  00 A 1019
232 SFE 20000 37000 158  00 A 1019
RID TYP EAST  NORTH RPP  AR ST DDPD
233 SFE 21000 32500 160  00 A 1019
234 SFE 21000 32000 161  00 A 1019
235 SFE 21000 31500 162  00 A 1019
236 SFE 21000 31000 163  00 A 1019
264 SFE 21000 36500 156  00 A 1019
537 SFE 12250 33750 166  00 A 1019
538 SFE 13000 33750 167  00 A 1019
539 SFE 13750 33750 168  00 A 1019
541 SFE 13000 33000 170  00 A 1019
542 SFE 13750 33000 171  00 A 1019
543 SFE 12250 32250 172  00 A 1019
544 SFE 13000 32250 173  00 A 1019
545 SFE 13750 32250 174  00 A 1019
564 SFE 12250 33000 169  00 A 1019
616 SFE 19500 57000 140  00 A 1019
617 SFE 20250 57000 141  00 A 1019
618 SFE 21000 57000 142  00 A 1019
619 SFE 19500 56250 143  00 A 1019
621 SFE 21000 56250 145  00 A 1019
622 SFE 19500 55000 146  00 A 1019
623 SFE 20250 55000 147  00 A 1019
624 SFE 21000 55000 148  00 A 1019
RID TYP EAST  NORTH RPP  AR ST DDPD
664 SFE 20250 56250 144  00 A 1019
*          ADMIN FILE COMPLETE          *

```

FIGURE 21. TYPICAL ADMINISTRATIVE FILE LINE PRINTER OUTPUT

### Scenario EDIT Routine

The SCenario EDITor performs three functions:

- a. Read, check and pass geometry, object, or sensor data to Task 6.
- b. Check for current valid data files in Task 6 and output the values to the operator.
- c. Execute the Task 6 Tactical Situation Simulator algorithm.
  1. Enter Data. Data entry to the algorithm is done by means of prepunched paper tapes which have the desired geometry, object, or sensor data to be used. The program uses a specially written driver on high speed paper tape reader/punch to read in the data tapes. When entering data, all initialization required for the specific data files is performed as well as format, sync, and data record checks.
  2. Check Data. The previously entered tape numbers for geometry, object, and sensor data are checked and outputted to the operator.
  3. Execute. All pertinent system and Task 6 data are initialized. The proper flags are then set and the program is exited to allow the real time operating system (RTOS) to start the Task 6 tactical situation simulator algorithm.

### TASK 5 - Command Directory Task

The function of Task 5 is to read from disc, a directory file of valid names used to call the non-resident programs. Once the list is read into memory, the operator may select one of the non-resident programs to be implemented. This is accomplished by the operator entering the program's name (Example: EDIT). Task 5 searches the directory for the program, EDIT, and its corresponding location on the non-resident disc file. Once the program and location have been found, Task 5 loads the appropriate program, in this example, EDIT, into the operator processing task (Task 4) overlay area. After the program is loaded, Task 5 starts Task 4, thereby giving control to the operator who can now use the non-resident program. In the event an operator enters the name of a non-resident program which does not exist in the directory, an error message will be logged to the teletype by Task 5.

### TASK 6 - Tactical Situation Simulator Algorithm Operation

The Task 6 algorithm is started by a non-resident program (SCEDIT) which also edits and checks data (Figure 22). Once started, it initializes several parameters in the data and pointer files, sets CRT constants and several general operating register values. Then it proceeds to a time check routine. Here, the algorithm time is generated by comparison to the real time clock interrupt count. If the required count has not elapsed, the program waits and returns to the scheduler. Once the required count has elapsed (from the previous time, approximately 500 milliseconds), the current state of the system is updated.

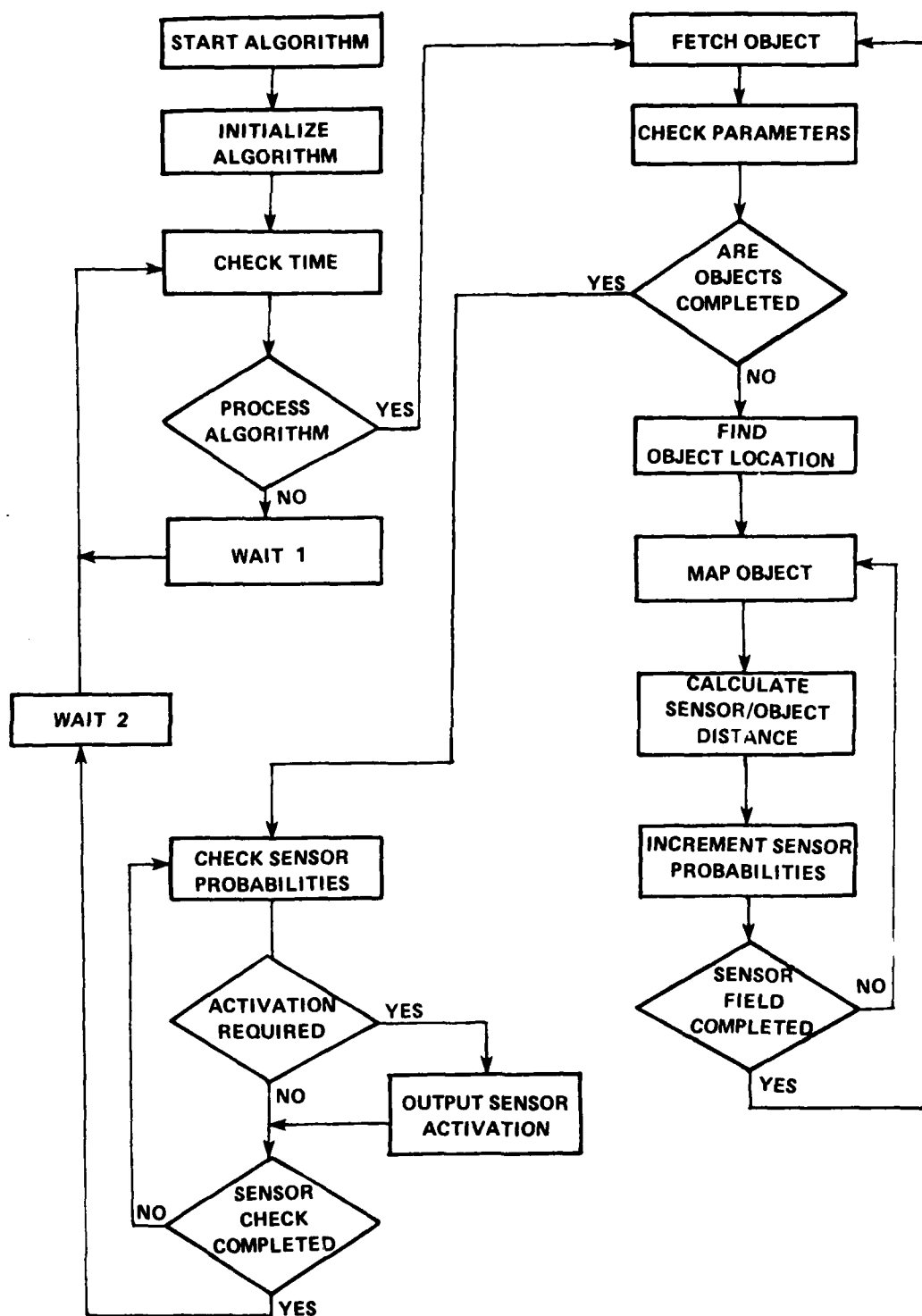


FIG. 22 TASK 6 SIMULATION PROGRAM FLOW DIAGRAM

The system update relocates each object to its new position based on the exact inhibit time value for the current algorithm period, the object speed, and the track which the object is following. The distance between each object and sensor is calculated, and the resulting probabilities and classifications for each sensor are modified, if required.

Once all the objects have been checked against each sensor, the program looks for activation threshold conditions of each sensor. An activation will result whenever the summed probability of detection for a given sensor exceeds a threshold value. Classification is determined from the dominant target which perturbed the given sensor for that period.

After all the sensors have been checked as to their activation condition, the algorithm passes the activation data to Task 3, starts it, and goes into the wait state. When it is finished waiting, it is reactivated and the entire process starts all over again.

The end of the program execution occurs when all the objects reach the end of their respective tracks. At the end, a message is printed to alert the operator to the fact.

### General Description

The algorithm basically functions as a discrete state system.<sup>1</sup> A general expression of the describing state equations is as follows:

$$O_i = f_1 (G, O_{i-1}) \quad (1) \quad (B1)$$

$$S_i = f_2 (S_{i-1}, O_i) \quad (2) \quad (B2)$$

where  $O$  is the object state matrix,  $S$  is the sensor matrix,  $G$  the geometry functions, and  $i$  the current state. The  $f_1$  and  $f_2$  are state transition functions.

The current object state  $O_i$  is functionally determined in (B1) by the geometry function  $G$  and the previous object state  $O_{i-1}$ . Then the current sensor state  $S_i$  is determined in (B2) from  $O_i$  and  $S_{i-1}$ , the previous sensor state.  $S_i$  is interpreted and the appropriate actions taken until the next operation (B1) is begun. Note that the operations of  $f_1$  and  $f_2$  are done in discrete time intervals, which can be varied depending on the computer speed.

The three state variables which define the system are described by (1) geometry (track) parameters, (2) object parameters, and (3) sensor parameters. The basic characteristics of each are defined before the execution of the program, although certain items may be changed during

---

<sup>1</sup> A discrete state system is a collection of state variables, the value of which at any instant of time, determines the state, or output, of the system.

execution. Thus, the operator merely initializes the state equations with data from (1), (2), and (3) above and starts the program. Once initialized with all three sets of data, the system does not need to be reinitialized unless it is desired to change one or more of the data groups.

# APPENDIX C

## TASK 1 - THERMAL RECORDER TASK

THERMAL RECORDER TASK

PAGE 1

```

*
* AUTHOR: AL SLUTSKY
*
*
* TMRDR TASK BLOCK
*
*
0000R      ENTRY RDRTB, RPTR, WPTR, TMFLG, TMRDR
0000R      ENTRY TASK1
0000R      EXTRN LASTBF, RDRBUF, TEXRUN
*
*
0000R      TASK1      EOU      *
0000R      RDRTB      DS        8          UNUSED
0008R 0000          DC        0          PARAMETER
000AR          DS        2          UNUSED
000CR 0000          DC        0          NO TELL. BUFFER
000ER 0000          DC        0          LU 0
0010R 0056          DC      X'56', 0, 0    LU 1-3
          0000
          0000
0016R 0000          DC      0, 0, 0, 0    LU 4-7
          0000
          0000
          0000
001ER 0000          DC      0, 0, 0, 0    LU 8-11
          0000
          0000
          0000
0026R 0000          DC      0, 0, 0, 0    LU 12-15
          0000
          0000
          0000
002ER          DS        32          REG SAVE AREA
*
*
0001      PTR      EOU      1
0001      R1      EOU      1
0002      R2      EOU      2
0003      R3      EOU      3
0004      R0      EOU      0
0006      R6      EOU      6
*
*
* THIS IS THE THERMAL RECORDER TASK (TMRDR).
* IT IS MADE READY BY THE TMRDR ISR
004ER      TMRDR    EOU      *
004ER 4810          LH      R1, TMFLG      FIRST TIME THRU TASK?
          011AR
0052R 4330          BZ      INITIAL      YES, BRANCH
          0090R
0056R 0711      TEXCH  XHR      R1, R1      WAIT FOR
0058R 4510          CLH      R1, TEXRUN    TASK 3 TO COMPLETE
          0000F

```

| THERMAL RECORDER TASK. |         |             |            | PAGE 2                            |
|------------------------|---------|-------------|------------|-----------------------------------|
| 0050R 4330             | BZ      | GO          |            | OUTPUTTING                        |
| 0060R 2120             | SVC     | 2, WAIT     |            | CHARACTER                         |
| 0060R 4300             | B       | TEXCHK      |            |                                   |
| 0060R 4810             | GO      | LH          | PTR, RPTR  | LOAD READ POINTER                 |
| 0060R 4010             | STH     | PTR, WPTR   |            | SET EQUAL TO WRITE POINTER        |
| 0070R 4010             | STH     | PTR, BUFST  |            | STORE INTO PARA BLOCK             |
| 0070R 0A10             | ARI     | PTR, 79     |            | INC TO END OF BUFFER              |
| 0070R 4010             | STH     | PTR, BUFEND |            | STORE ENDING BUFFER ADDRESS       |
| 0070R 2611             | ARI     | PTR, 1      |            | INCR TO NEXT BUFFER               |
| 0070R 4510             | CLH     | PTR, FINAL  |            | ARE WE PAST LAST BUFFER?          |
| 0080R 2133             | BNES    | STORE       |            | IF NOT, STORE IT                  |
| 0080R 0810             | LHI     | PTR, R0BUF  |            | ELSE, RE-INITIALIZE POINTER       |
| 0080R 4010             | STORE   | STH         | PTR, RPTR  | STORE POINTER FOR TASK 3          |
| 0080R 0110             | WRITE   | SVC         | 1, WRIBUF  | WRITE TO RECORDER                 |
| 0080R 4800             | LH      | R0, STAT    |            | GET STATUS IN R0                  |
| 0080R 4230             | BNZ     | ERROR       |            | IF NOT 0, BRANCH TO ERROR ROUTINE |
| 0080R 0000             | EQJ     | SVC         | 3, 0       |                                   |
| 0080R 0830             | INITIAL | LHI         | R3, LASTBF | LOAD LAST BUFFER ADDRESS          |
| 0080R 0000             |         | ARI         | R3, 80     | INCR TO BUFFER AREA END           |
| 0080R 4030             | STH     | R3, FINAL   |            | STORE FINAL BUFFER LOCATION       |
| 0080R 0810             | LHI     | R1, R0BUF   |            | SET RPTR TO START                 |
| 0080R 4010             | STH     | R1, BUFST   |            |                                   |
| 0080R 0110             | STH     | R1, RPTR    |            | OF BUFFER                         |
| 0080R 0A10             | ARI     | R1, 79      |            | INCR TO END OF BUFFER             |
| 0080R 4010             | STH     | R1, BUFEND  |            | STORE BUFFER ENDING ADDRESS       |
| 0080R 0110             | SVC     | 1, WRIBUF   |            |                                   |
| 0080R 4800             | LH      | R0, STAT    |            |                                   |
| 0080R 4230             | BNZ     | ERROR       |            |                                   |
| 0080R 0810             | LHI     | R1, R0BUF   |            | SET UP BUFFER                     |

| THERMAL RECORDER TASK |        |            |                              | PAGE 3               |
|-----------------------|--------|------------|------------------------------|----------------------|
| 000CR 4010            | STH    | R1, BUFST  |                              |                      |
| 0112R                 |        |            |                              |                      |
| 000OR 4010            | STH    | R1, RPTR   | ADDRESSES TO OUTPUT          |                      |
| 0116R                 |        |            |                              |                      |
| 0004R CA10            | AHI    | R1, 79     | BLANKS FOR RECORDER          |                      |
| 004F                  |        |            |                              |                      |
| 000SR 4010            | STH    | R1, BUFEND | GENERATED INTERRUPT          |                      |
| 0114R                 |        |            |                              |                      |
| 000LR E110            | SVC    | 1, WRIBUF  | GENERATE THE FIRST INTERRUPT |                      |
| 010ER                 |        |            |                              |                      |
| 000CR 4800            | LH     | R0, STAT   | FROM RECORDER                |                      |
| 0110R                 |        |            |                              |                      |
| 0004R 4230            | BNZ    | ERROR      |                              |                      |
| 000CR                 |        |            |                              |                      |
| 000SR 4300            | B      | EQJ        |                              |                      |
| 0076R                 |        |            |                              |                      |
|                       | *      |            |                              |                      |
|                       | *      |            |                              |                      |
| 000CR E120            | ERROR  | SVC        | 2, UNPACK                    | UNPACK ERROR MESSAGE |
| 010AR                 |        |            |                              |                      |
| 000CR E120            |        | SVC        | 2, ERRMSG                    |                      |
| 000SR                 |        |            |                              |                      |
| 0004R E130            |        | SVC        | 3, 0                         |                      |
| 0000                  |        |            |                              |                      |
|                       | *      |            |                              |                      |
|                       | *      |            |                              |                      |
|                       | *      |            |                              |                      |
| 000SR 0007            | ERRMSG | DC         | X'0007                       |                      |
| 000AR 000E            |        | DC         | 14                           |                      |
| 000CR 492F            |        | DC         | C I/O ERROR                  |                      |
| 4F20                  |        |            |                              |                      |
| 4552                  |        |            |                              |                      |
| 524F                  |        |            |                              |                      |
| 5230                  |        |            |                              |                      |
| 0106R                 | STATUS | DS         | 4                            |                      |
|                       | *      |            |                              |                      |
|                       | *      |            |                              |                      |
| 010AR 0006            | UNPACK | DC         | X'0006                       |                      |
| 010CR 0106R           |        | DC         | STATUS                       |                      |
|                       | *      |            |                              |                      |
| 010ER 3801            | WRIBUF | DC         | X'3801                       | WRITE ASCII          |
| 0110R                 | STAT   | DS         | 2                            |                      |
| 0112R 000AR           | BUFST  | DC         | RDRBUF                       |                      |
| 0114R 0000            | BUFEND | DC         | 0                            |                      |
| 0116R 0112R           | RPTR   | DC         | RDRBUF                       |                      |
| 0118R 0000            | WPTH   | DC         | 0                            |                      |
| 011AR 0000            | THMFLG | DC         | 0                            |                      |
| 011CR 0000            | FINAL  | DC         | 0                            |                      |
|                       | *      |            |                              |                      |
| 011ER 000B            | WAIT   | DC         | X'000B                       |                      |
| 0120R 0000            |        | DC         | X'0000                       |                      |
| 0122R 0001            |        | DC         | X'0001                       |                      |
| 0124R                 |        | END        |                              |                      |

\*  
\* AUTHOR: AL. SLUTSKY  
\*

0000R ENTRY RDINIT, THMOVR  
0000R EXTRN ISROVR, TCBROVR, LIOTRM, THMFLG, IOEXIT  
0000R EXTRN TCBTR

\*

\*

\*

\* THIS IS THE DRIVER INITIALIZATION ROUTINE

\*ISRINT IS ENTERED THROUGH A SINT. THIS ROUTINE ENABLES THE INT.  
\*AND SETS UP THE ISR ADDRESS.

\*

\*

\*

|       |        |        |               |                           |
|-------|--------|--------|---------------|---------------------------|
| 0000R | THMOVR | EDU    | *             |                           |
| 0000R | ISRINT | OC     | DEV, ENHWD    | ENABLE INT, HALFWORD MODE |
|       | 010AR  |        |               |                           |
| 0004R | 9DE9   | SSR    | DEV, STAT     | GET STATUS                |
| 0006R | C390   | THI    | STAT, DU      | IS DEVICE UNAVAILABLE?    |
|       | 0001   |        |               |                           |
| 000AR | 2337   | B7S    | DEVUAV        | YES, BRANCH               |
| 000CR | 07AA   | XHR    | RA, RA        | SET CLOCK                 |
| 000ER | 9A6A   | WDR    | RA, RA        | HIGH                      |
| 0010R | C8F0   | LHI    | RF, ISR       | SET ADDR TO ISR ROUTINE   |
|       | 0034R  |        |               |                           |
| 0014R | 4300   | B      | 16(OCB)       |                           |
|       | 0010   |        |               |                           |
| 0018R | C890   | DEVUAV | LHI           | STAT, X'A000'             |
|       | A000   |        |               | SET STATUS TO DU          |
| 001CR | 4090   | STH    | STAT, 38(OCB) | STORE IN OCB              |
|       | 0026   |        |               |                           |
| 0020R | DFE0   | OC     | DEV, DISARM   | DISARM INT                |
|       | 010BR  |        |               |                           |
| 0024R | C8FD   | LHI    | RF, 20(OCB)   | SET ADDR TO IGNORE INT    |
|       | 0014   |        |               |                           |
| 0028R | 24D1   | LIS    | OCB, 1        |                           |
| 002AR | 64D0   | ATL    | OCB, LIOTRM   |                           |
|       | 0000F  |        |               |                           |
| 002ER | 27D1   | SIS    | OCB, 1        |                           |
| 0030R | 4300   | B      | 16(OCB)       | RETURN AND SAVE REGS      |
|       | 0010   |        |               |                           |

\*

\*

\*

\* THIS ROUTINE MAKES THE RECORDER TASK (THMRDR) READY WHEN AN 'N'  
\* IS RECEIVED FROM THE RECORDER SIGNALING THAT IT IS READY TO REC  
\* NEW DATA

\*

\*

|       |       |     |              |                   |
|-------|-------|-----|--------------|-------------------|
| 0034R | ISR   | EDU | *            |                   |
| 0034R | DEFO  | OC  | DEV, DISARM  | DISARM INTERRUPTS |
|       | 010BR |     |              |                   |
| 0038R | 489C  | LH  | STAT, 6(OCB) | LOAD TASK STATUS  |

## THERMAL RECORDER DRIVER

PAGE 2

```

0006
0036R 0590          CLHI  STAT, X'8000      DORMANT
0040R 4280          BNF  16(DCB)          NO, RETURN
0010
0044R 4890          LH   STAT, 18(TCB)      SET
0012
0048R 4090          STH  STAT, 32(TCB)      CURRENT
0020
0046R 4890          LH   STAT, 20(TCB)      PSW TO
0014
0050R 4090          STH  STAT, 34(TCB)      INITIA PSW
0022
0054R 0B90          SHR  R9, R9            TASK STATUS
0056R 4090          STH  STAT, 6(TCB)       ZERO R9
0006
0058R DEE0          OC   DEV, ENHWD        ENABLE INTERRUPTS
0100
005ER 24D1          LIS  DCB, 1
0060R 64D0          ATL  DCB, LIOTAM
0020R
0064R 27D1          SIS  DCB, 1
0066R 430E          B    16(DCB)          RETURN
0010

```

\*  
\*  
\*

\*THIS IS THE DRIVER FOR THE THERMAL RECORDER. IT IS CALLED BY SV

\*  
\*

```

0000      R0      EQU 0
0001      R1      EQU 1
0002      R2      EQU 2
0003      R3      EQU 3
0004      R4      EQU 4
0005      R5      EQU 5
0006      R6      EQU 6
0007      R7      EQU 7
0008      R8      EQU 8
0009      STAT    EQU 9
0009      R9      EQU 9
000A      RA      EQU 10
000A      R10     EQU 10
000B      RB      EQU 11
0001      DU      EQU 1
000C      TCB     EQU 12
000D      DCB     EQU 13
000E      DEV     EQU 14
000F      RF      EQU 15
0038      WRITE   EQU X'38'

```

\*

```

0066R      R0INIT EQU *
0066R 4E90      LH   R9, TCBALG          IF NOT FIRST TIME BRANCH TO
0066R 0000
0066R 4E90      BNZ  R0EVR              R0EVR
0066R 00A0R

```

| THERMAL RECORDER DRIVER |        |                  | PAGE 1 3                  |                            |
|-------------------------|--------|------------------|---------------------------|----------------------------|
| 0072R 24A1              | LIS    | R10, 1           | SET THMFLG                |                            |
| 0074R 40A0              | STH    | R10, THMFLG      |                           |                            |
| 006ER                   |        |                  |                           |                            |
| 0076R 08C2              | LHR    | TCB, R2          | LOAD TCB, DCB, DEV        |                            |
| 007AR 90C8              | SRLS   | TCB, 8           |                           |                            |
| 007CR 48C0              | LH     | TCB, TCBTAB(TCB) | GET TCB ADDRESS           |                            |
| 0000F                   |        |                  |                           |                            |
| 0080R 08D1              | LHR    | DCB, R1          | ADDR FOR EVENTUAL STORAGE |                            |
| 0082R 08E4              | LHR    | DEV, R6          | IN DCB REGS AREA          |                            |
| 0084R 08F0              | LHI    | R6, ISRINT       | LOAD ADDR FOR ISRINT      |                            |
| 0000R                   |        |                  |                           |                            |
| 0086R 0880              | LHI    | R8, X'4000'      |                           |                            |
| 4000                    |        |                  |                           |                            |
| 008CR 9598              | EPBR   | R9, R8           | MASK INT. EXTERNAL        |                            |
| 008ER D020              | STH    | R2, 28(DCB)      | SAVE REGS FOR ISRINT      |                            |
| 001C                    |        |                  |                           |                            |
| 0092R E20E              | SINT   | 0(DEV)           | GO TO ISRINT ROUTINE      |                            |
| 0000                    |        |                  |                           |                            |
| 0096R 9589              | EPBR   | R8, R9           |                           |                            |
| 0098R 487D              | LH     | R7, 38(DCB)      | LOAD STATUS FROM DCB      |                            |
| 0026                    |        |                  |                           |                            |
| 009CR 4300              | B      | IDEXIT           | EXIT DRIVER INITIALIZE    |                            |
| 0000F                   |        |                  |                           |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
| 00A0R 08FA              | RDRDVR | LHR              | R8, R4                    | LOAD FUNCT AND LU          |
| 00A2R 9028              | SRLS   | R8, 8            | ISOLATE FUNCTION          |                            |
| 00A4R 0580              | CLHI   | R8, WRITE        | IS IT A WRITE             |                            |
| 0038                    |        |                  |                           |                            |
| 00A6R 4230              | BNE    | ILFUNC           | NO, BRANCH                |                            |
| 006ER                   |        |                  |                           |                            |
| 00ACR 9D69              | SSR    | R6, STAT         | GET STATUS                |                            |
| 00AER 0390              | THI    | STAT, 00         | IS DEVICE UNAVAILABLE     |                            |
| 0001                    |        |                  |                           |                            |
| 00B2R 4230              | BNZ    | DEVNAV           | YES BRANCH                |                            |
| 0000R                   |        |                  |                           |                            |
| 00B4R 2309              | BS     | OUTPUT           | BRANCH TO OUTPUT ROUTINE  |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
| 00B6R 0870              | ILFUNC | LHI              | R7, X'0000'               |                            |
| 0000                    |        |                  |                           |                            |
| 00B8R 4300              | B      | IDEXIT           |                           |                            |
| 009ER                   |        |                  |                           |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
| 00C0R 0870              | DEVNAV | LHI              | R7, X'A000'               | SET STATUS TO 00           |
| A000                    |        |                  |                           |                            |
| 00C4R 4300              | B      | IDEXIT           | BRANCH TO EXIT            |                            |
| 006ER                   |        |                  |                           |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
|                         | *      |                  |                           |                            |
| 00C6R 4053              | OUTPUT | LH               | R5, 4(63)                 | START ADDR OF WRITE BUFFER |

## THERMAL RECORDER DRIVER

PAGE 4

```

0004
000CR 0700      XHR  R0, R0
000CR 08A0      LHI  R10, 128      CLOCK IS 7TH BIT OF HALFWORD
0080
00D2R 48B0      LH   RB, X'2EA'    TO SYNC CLOCK
02EA
00D6R 45B0      SYNC  CLH  RB, X'2EA'  SO THAT OUTPUTTINY STARTS
02EA
00DAR 43B0      BE   SYNC          AFTER REAL TIME CLK INTERRUPT
00D6R
00D1R 0E60      DC   R6, DISARM
010DR
00E1R 2302      BS   OUT
00E1R 2651      OUT1  AIB  R5, 1
00E6R 0B95      OUT  LB   R9, 0(R5)   LOAD BYTE
0000
00E9R 0790      XHI  R9, X'1F'     COMPENENT FOR OUTPUT
001F
00E9R 9A69      WDR  R6, R9        OUTPUT CHAR
00F0R 0690      QHR  R9, R10       AND CLOCK TO CHAR
00F1R 9A69      WDR  R6, R9        OUTPUT BYTE PLUS CLOCK
00F4R 0205      STB  R0, 0(R5)     ZERO BUF LOC FROM WHICH CHAR WAS O
0000
00FER 4553      CLH  R5, 6(R3)     IF 80 CHAR HAVE NOT BEEN OUTPUT
0006
00FER 42B0      BNE  OUT1          BRANCH TO OUT1
00E4R
0100R 0777      XHR  R7, R7
0102R 0E60      DC   R6, ENHWD
010AR
0106R 4300      B    IOEXIT        RETURN TO USER
00D6R
010AR 6000      ENHWD  DC   X'6000'
0106R  DISARM  EQU  ENHWD+1
010CR  END

```

# TASK 2

## LINE PRINTER TASK

- LINE PRINTER TASK FOR THE SENSOR MONITOR SET

PAGE 1

\*

\*

### \* LINE PRINTER TASK

\*

\* REWRITTEN AND DEBUGGED BY

\* RICH MARTINO & JOE KARAKOWSKI

\*

\*

\*

```
0000R      EXTRN LPFLAG, ININUM
0000R      EXTRN CURSEC, CURNUM, INISEC, DBUFF1, DBUFF2
0000R      EXTRN @AHLOX, @AHL DY, @AHEN, @AHSZE
0000R      EXTRN @AHTER, @AHTIM, @AHTYP
0000R      ENTRY LNP, LNPTB
```

\*

### \* LINE PRINTER TASK CONTROL BLOCK

\*

```
0000R      LNPTB    DS      8              UNUSED
0000R 0000      DC      0              PARAMETER
0000R      DS      2              UNUSED
0000R 0000      DC      0              NO TELL BUFFER
0000R 0000      DC      0, X'62', X'406', 0 LU 0-3
0000R      0062
0000R      0406
0000R      0000
0010R 0000      DC      0, 0, 0, 0      LU 4-7
0000R      0000
0000R      0000
0000R      0000
0010R 0000      DC      0, 0, 0, 0      LU 8-11
0000R      0000
0000R      0000
0000R      0000
0020R 0000      DC      0, 0, 0, 0      LU 12-15
0000R      0000
0000R      0000
0000R      0000
0020R      DS      32              REGISTER SAVE AREA
```

\*

```
0000      AHRN      EQU      0
0004      AHTYP      EQU      4
0008      AHLOX      EQU      9
0010      AHL DY      EQU      16
0017      AHTIM      EQU      23
001E      AHTER      EQU      30
```

\*

```
0007      NOPGE      EQU      7
0001      CSEC      EQU      1
0002      CNUM      EQU      2
0003      CBUF      EQU      3
0004      BUFA      EQU      4
000A      R10      EQU      10
000B      R11      EQU      11
000C      R12      EQU      12
000D      R13      EQU      13
000E      R14      EQU      14
```

- LINE PRINTER TASK FOR THE SENSOR MONITOR SET

PAGE 2

```

000F      R15      EQU      15
0009      WORK     EQU      9
0005      RS       EQU      5
*
0000      ZERO     EQU      0
001F      PGEMAX   EQU      30
0008      CMAX     EQU      8
9006      EDF      EQU      X'9006'
*
*
* LINE PRINTER TASK MAIN PROGRAM
*
*
004ER      LNF      EQU      *
004ER 0E00      SHR      ZERO, ZERO      SET REG
0050R 4000      STH      ZERO, IOFLG      SET FLAG TO NO ERROR
01F8R
0051R 4810      LH       CSEC, INISEC      LOAD INITIAL SECTOR OF THE PROGRAM
0000F
0058R 4820      LH       CNUM, ININUM
0000F
005CR 0520      CLHI     CNUM, CMAX
0008
0060R 4280      BL       LDBUF
0066R
0064R 0E22      REINIT  SHR      CNUM, CNUM      0 CURRENT NUMBER
0066R 0830      LDBUF   LHI      CBUF, DBUFF1      LOAD CURRENT BUFFER ADDRESS
0000F
006AR 0310      THI      CSEC, 1
0001
006FR 2338      BZS      DONE
0070R 0830      LHI      CBUF, DBUFF2
0000F
0074R      DONE     EQU      *
0074R 4890      CHSECC  LH       WORK, LPFLAG      LOAD L. P. FLAG INTO REG
0000F
0075R 4210      BM       CHFLG
0088R
007CR 0870      LHI      NOPGE, PGEMAX      LOAD REG WITH NO. ON PAGE
001E
0080R 0890      LHI      WORK, -1      LOAD LINE PRINTER FLAG WITH -1
FFFF
0084R 4090      STH      WORK, LPFLAG
0076R
0088R 2129      CHFLG   BPS      WAIT      BRANCH IF POSITIVE
008AR 4510      CLH      CSEC, CURSEC      SECTORS EQUAL ?
0000F
008ER 4230      BNE      PAGE2
0146R
0092R 4520      CLH      CNUM, CURNUM      RECORD NUMBERS EQUAL
0000F
0096R 4230      BNE      GETNXT
00A3R
0090R      WAIT     EQU      *
009AR E120      SVC      2, INTERR

```

```

0200R
009ER 4800      B      CHKSEC
0074R
00A7R 0843      GETNXT  LHR   BUFA,CBUF      ADD TO NUMBER SINCE LAST PAGE
00A4R 2871      NEXTRC  AIS   NOPGE,1
00A5R 0570      CLHI   NOPGE,PGE MAX      IF LESS NO HEADING
001E
00A4R 4320      BNF    SKPHD
00C0R
00AER 0877      HDRVDC  SHR   NOPGE,NOPGE
00B0R          EDU    *
00B0R E110      SVC    1,HDRBLK      WRITE ASCII AND WAIT ON LU 1
0212R
00B4R 4850      LH     RS,HDRBLK+2      LOAD STATUS
0214R
00B5R 4230      BNZ    IOERR1      IF ERROR BRANCH
0180R
00D0R 4000      STH    ZERO,IOFLG      RESET FLAG
01F8R
00C0R 0862      SKPHD  LHR   R11,CNUM
00C2R 08A0      LHI    R10,@ARSIZE
0000F

*
* LINE PRINTER BUFFER FORMATING
*
00C6R 0CAA      MHR    R10,R10      COMPUTE DISP INTO BUFFER
00C8R 0A4B      AHR    BUFA,R11      GET ADRS OF DISC RECORD
* FORMAT RID ( RID )
00CAR 2403      LIS    R12,3      LENGTH
00C7R 08D4      LHI    R13,@AHEN(BUFA) ORGIN
0000F
00D0R 08E0      LHI    R14,LFBUF+AHRI
0230R
00D4R 41F0      BAL    R15,MVC
0266R

* FORMAT TYPE ( TTT )
00D8R 2403      LIS    R12,3
00DAR 08D4      LHI    R13,@AHTYP(BUFA)
0000F
00DER 08E0      LHI    R14,AHTYP+LFBUF
0240R
00E2R 41F0      BAL    R15,MVC
0266R

* FORMAT EAST ( XXXXXX )
00E6R 2406      LIS    R12,6
00E8R 08D4      LHI    R13,@AHLOX(BUFA)
0000F
00E0R 08E0      LHI    R14,LFBUF+AHLOX
0245R
00F0R 41F0      BAL    R15,MVC
0266R

* FORMAT NORTH ( YYYYYY )
00F4R 2406      LIS    R12,6
00F6R 08D4      LHI    R13,@AHLOY(BUFA)
0000F
00FAR 08E0      LHI    R14,LFBUF+AHLOY

```

```

0240R
00FER 41F0          BAL    R15,MVC
0266R
      * FORMAT TIME ( HHMMSS )
0102R 2406          LIS    R12,6
0104R 08D4          LHI    R13,@AHTIM(BUFA)
      0000F
0108R 08E0          LHI    R14,LPBUF+AHTIM
      0253R
010CR 41F0          BAL    R15,MVC
0266R
      * FORMAT TBR ( **** )
0110R 2404          LIS    R12,4
0112R 08D4          LHI    R13,@AHTBR(BUFA)
      0000F
0114R 08E0          LHI    R14,LPBUF+AHTBR
      025AR
011AR 41F0          BAL    R15,MVC
0266R
011FR              LPSVC   EQU    *
011ER E110          SVC    1,LPBLK      WRITE ASCII AND WAIT ON LU 2
      025ER
012FR 4850          LH     RS,LPBLK+2
      0260R
0126R 4230          BNZ    IOERR2
      0188R
012AR 4000          STH    ZERO,IOFLG    SET FLAG TO NO ERROR
      01F8R
012ER 2621          AIS    CNUM,1
0130R 4020          STH    CNUM,ININUM
      005AR
0134R 0520          CLHI   CNUM,CMAX
      0008
0138R 4280          BL     CHUSED
      0074R
013CR 2611          AIS    CSEC,1
013ER 4010          STH    CSEC,INISEC
      0056R
0142R 4300          B      REINIT      BRANCH TO REINITIALIZE
      0064R
0146R 08F1          PAGE2  LHI    R15,1(CSEC)
      0001
014AR 42F0          CLH    R15,CURSEC
      008CR
014ER 4330          BE     GETNXT
      00A2R
0152R 0840          LHI    BUFA,DSOBUF
      027AR
0156R 4510          CLH    CSEC,DPBLK+8
      0382R
015AR 4330          BE     NEXTRO
      00A4R
015ER 4010          DOSVC   STH    CSEC,DPBLK+8
      0382R
016CR              DSOVC   EQU    *
0167R E110          SVC    1,DPBLK      WRITE RANDOM AND WAIT ON LU 2

```

- LINE PRINTER TASK FOR THE SENSOR MONITOR SET

PAGE 5

```

037AR
01A6R 4850          LH      RS, DPBLK+2      LOAD STATUS
037CR
01A8R 4880          BZ      NEXTRO
00A4R
01A5R 0550          CLHI   RS, EOF
9006
0171R 4230          BNE     IOERR3
0190R
0176R 4000          STH     ZERO, IOFLG
01F8R
0171R 0B11          SHR     CSEC, CSEC
017CR 4300          B       DCSVC
015ER
018CR 41F0          IOERR1 BAL     R15, IOERR
0198R
0184R 4300          B       HDSVC          BRANCH TO PRINT HEADING AGAIN
00B0R
0188R 41F0          IOERR2 BAL     R15, IOERR
0198R
018CR 4300          B       LPSVC          BRANCH TO PRINT LNPTR BUFFER AGAIN
011ER
019CR 41F0          IOERR3 BAL     R15, IOERR
0198R
0194R 4300          B       DCSVC          BRANCH TO DISC WRITE AGAIN
0162R
0198R 4890          IOERR  LH      WORD, IOFLG
01F8R
019CR 4230          BNZ     WAIT2
01B4R
01A0R 40F0          STH     R15, IOFLG
01F8R
01A4R 4050          STH     RS, ERSTAT
0203R
01A8R 41F0          BAL     R15, UNPK          BRANCH TO HEX/ASCII UNPACK ROUTINE
01BER
01ACR 0203R          DC      ERSTAT, STATUS
0203R
01B0R E120          SVC     2, ERROR
01FAR
01B4R E120          WAIT2  SVC     2, INTFBL
020CR
01B8R 48F0          LH      R15, IOFLG
01F8R
01BCR 030F          BR      R15

*
* UNPACK ROUTINE TO CONVERT HEX TO ASCII
*
01BER 48EF          UNPK    LH      R14, 0(R15)
0000
01C2R 48DF          LH      R13, 2(R15)
0002
01C6R 2400          LIS     R12, 12
01C8P 48DE          LH      R11, 0(R14)
0000
01CCR 08AB          UNPK1   LHR     R10, R11

```

- LINE PRINTER TASK FOR THE SENSOR MONITOR SET

PAGE 6

```

010CR 00AC          SRHL  R10,0(R12)
      0000
010CR 04A0          NHI   R10,15
      000F
010CR 03AA          LB    R10,UTAB(R10)
      01E8R
010CR 02AD          STB   R10,0(R13)
      0000
010CR 26D1          AIS   R13,1
010CR 2704          SIS   R12,4
010CR 271B          BNMS  UNPK1
010CR 430F          B     4(R15)
      0004

      *
      * PARAMETER BLOCKS
      *
01E8R 3031          UTAB   DC    C'0123456789ABCDEF'
      3233
      3435
      3637
      3839
      4142
      4344
      4546

01F8R              IOFLG   DS      2              I/O ERROR FLAG
01F8R 0007          ERROR  DC      7,14,C'I/O ERROR'
      000E
      492F
      4F20
      4552
      524F
      5220

0208R              STATUS  DS      4
0208R              ERSTAT  EQU     STATUS
020CR 000B          INTRK   DC      11,0,1000      ONE SECOND WAIT
      0000
      03F8
0212R 2801          HDRBLK  DC      X'2801',0,BEGHDR,ENDHDR
      0000
      0218R
      0258R
0218R 5747          BEGHDR  DC      C'RID TYPE  EAST  NORTH  TIME  TBR
      4420
      5459
      5045
      2020
      4541
      5354
      2020
      4E4F
      5254
      4820
      2020
      5449
      4D45
      2020

```

```

5442
5220
023BR      ENDDHR EQU *-1
023CR 5249 LPBUF DC  C'RID TTT XXXXXX YYYYYY HHMMSS TBR '
4420
5454
5420
2058
5858
5858
5820
5959
5959
5959
2048
484D
4D53
5820
5442
5220
025DR      LPBUFE EQU *-1
025CR 2801 LPBLK DC  X'2801', 0, LPBUF, LPBUFE
0000
023CR
025DR
*
* BYTE HANDLING ROUTINE FOR EACH FORMAT
*
0266R      MVC EQU *
0266R D39D NXTB LB  WORK, 0(R13)
0000
026AR D29E      STB  WORK, 0(R14)
0000
026ER 26D1      AIS  R13, 1
0270R 26E1      AIS  R14, 1
0272R 27C1      SIS  R12, 1
0274R 4270      BP   NXTB          BRANCH ON PLUS TO NEXT BYTE
0266R
0278R 030F      BR   R15          RETURN
027AR      DSCBUF DS   256
037AR 4C02      DFBLK DC  X'4C02', 0, DSCBUF, DSCBUF+255, -1
0000
027AR
0379R
FFFF
0384R      END

```

# TASK 3

## INPUT PROCESSING TASK

- INPUT PROCESSING ROUTINE FOR THE SENSOR MONITOR SET PAGE 1

```

*
*
*   INPUT PROCESSING TASK
*
*
*   REWRITTEN AND DEBUGGED BY
*   RICH MARTINO & JOE KARAKOWSKI
*
*
* TO INITIALIZE THE INPUT PROCESSING ROUTINE, THE BITS
* OF NCHSTA MUST FIRST BE SET FOR EACH RECVR CHANNEL
* TO BE ACTIVATED (NUMBERED FROM RIGHT TO LEFT).
* THEN A CALL TASK MESSAGE (CHMESS) OF "0" MUST BE
* PLACED IN THE INPUT QUEUE (INPD).
*
* THE RECEIVER LOGICAL UNIT NUMBER IS THE SAME AS THE RECEIVER
* CHANNEL NUMBER
*
*   DEFINED CONSTANTS
*
0000      R0      EDU      0
0001      R1      EDU      1
0002      R2      EDU      2
0003      R3      EDU      3
0004      R4      EDU      4
0005      R5      EDU      5
0006      R6      EDU      6
0007      R7      EDU      7
0008      R8      EDU      8
0009      R9      EDU      9
000A      R10     EDU     10
000B      R11     EDU     11
000C      R12     EDU     12
000D      R13     EDU     13
000E      R14     EDU     14
000F      R15     EDU     15
0020      RST     EDU     X'20'
0040      SET     EDU     X'40'
000E      LINK1   EDU     14
000D      LINK2   EDU     13
0022      ABSIZE  EDU     34
*
0001      RCV1     EDU      1      RECVR LOGICAL UNITS
0002      RCV2     EDU      2
0003      RCV3     EDU      3
0004      RCV4     EDU      4
0005      RCV5     EDU      5
0006      RCV6     EDU      6
*
0006      NOCHAN  EDU      6      NO. OF RECVR CHANNELS
*
0000R      ENTRY  INPD, INPDR, TASK3, NUMRCH, CHMESS
0000R      ENTRY  RCV1, INTBUF
*
0000R      EXTRN  ACTADM, ADMTAG, CHSTA, NCHSTA

```

- INPUT PROCESSING ROUTINE FOR THE SENSOR MONITOR SET PAGE 2

```

0000R      EXTRN CONASC, CRTOUT, TYPE
0000R      EXTRN INCTSE, WDOCTSE, ADOCTSE
0000R      EXTRN INCTSI, WDOCTSI, ADOCTSI
0000R      EXTRN @ADMSZ, @LTMAZ
0000R      EXTRN @LTMA2
0000R      EXTRN @NOACT, @SNSBP, @LCBR
0000R      EXTRN TEXAS, @RECNO

```

```

*
*
* INPUT PROCESSING TASK CONTROL BLOCK
*
*

```

```

0000R      TASK3      DS      8      UNUSED
0000R      DS      2      ADRS INPUT SLOT
0000R      DS      2      UNUSED
0000R      DS      2      UNUSED TELL BUFFER
0000R 0000      DC      0      LU00-UNUSED
0010R 0080      DC      X'80'    LU01-RCVR1
0011R 0081      DC      X'81'    LU02-RCVR2
0012R 0082      DC      X'82'    LU03-RCVR3
0013R 0083      DC      X'83'    LU04-RCVR4
0014R 0084      DC      X'84'    LU05-RCVR5
0015R 0085      DC      X'85'    LU06-RCVR6
0016R 0000      DC      0,0
0000
0020R 0010      DC      X'10'    LU09-SITUATION DISPLAY
0021R 0014      DC      X'14'    LU10-AREA DISPLAY
0024R 0000      DC      0
0026R 0000      DC      0,0,0,0    UNUSED LUTS
0000
0000
0000

```

```

0026R      DS      32      REGISTER SAVE AREA

```

```

*
004ER FC00      INFO      DB      252,0,0,0
0000
0052R      DS      504      INPUT QUEUE STORAGE

```

```

*
*
* INPUT PROCESSING MAIN PROGRAM
*
*

```

```

024AR 0700      INPRD      XHR      R0,R0      LOAD R0 WITH 0
024CR 2411      LIS      R1,1      LOAD R1 WITH 1

```

```

*
*
* INPUT DATA, VALIDATE, AND CHECK RECEIVER STATUS
*

```

```

024ER 6630      DATAIN      RTL      R3, INFO      INPUT CHANNEL NUMBER
004ER
0253R 4340      BFL      4, CADATA      IF LST ENTRY, GO TO CADATA
0284R
0256R 0727      XHR      R2,R2      RESET ENTRY FLAG
0258R E120      LISTERR      EVL      2,ERRRST      PRINT "NO LIST ENTRY"
0204R

```

- INPUT PROCESSING ROUTINE FOR THE SENSOR MONITOR SET      PAGE    3  
0250R 4300                    B        ROSTCK                    BRANCH TO ROSTCK  
0322R

\*  
\* THE FOLLOWING IS THE DEFINITION OF A RECEIVER PARAMETER  
\* BLOCK.  
\*  
\* THE PARAMETER BLOCK CONTAINS:  
\*     FCT CODE (BYTE 1)  
\*     LOGICAL UNIT NO. (BYTE 2)  
\*     STATUS (BYTE 3)  
\*     DEVICE NUMBER (BYTE 4)  
\*     INPUT QUEUE NAME (BYTE 5 & 6)  
\*  
\* THE RECEIVER LOGICAL UNIT NUMBER IS THE SAME AS THE  
\* RECEIVER CHANNEL NUMBER  
\*  
\*         RECEIVER PARAMETER BLOCKS  
\*

0260R 4001     RCVR1     DC     X'4000'+RCV1  
0262R                    DS     2  
0264R 004ER                    DC     INFO

\*  
0266R 4002     RCVR2     DC     X'4000'+RCV2  
0268R                    DS     2  
026AR 004ER                    DC     INFO

\*  
026CR 4003     RCVR3     DC     X'4000'+RCV3  
026ER                    DS     2  
0270R 004ER                    DC     INFO

\*  
0272R 4004     RCVR4     DC     X'4000'+RCV4  
0274R                    DS     2  
0276R 004ER                    DC     INFO

\*  
0278R 4005     RCVR5     DC     X'4000'+RCV5  
027AR                    DS     2  
027CR 004ER                    DC     INFO

\*  
027ER 4006     RCVR6     DC     X'4000'+RCV6  
0280R                    DS     2  
0282R 004ER                    DC     INFO

\*  
\*  
0284R 2421     CKDATA    LIS    R2,1                    SET ENTRY FLAG  
0286R 0843                    LHR    R4,R3                    LOAD R4 WITH DATA  
0288R 4310                    BNM    CKMESS                    IF NOT MINUS, GO TO CKMESS  
02E6R

\*  
028CR 0430     CKSTAT    NHI    R3,X'7FFF'                    REMOVE SIGN BIT  
7FFF  
0290R 0930                    CHR    R3,R0                    COMPARE CH NO. WITH 0  
0292R 4330                    BE     INVDTA                    IF 0, GO TO INVDTA  
0300R  
0296R 0930                    CHI    R3,NOCHAN                    COMPARE WITH NO CH  
0006  
029AR 4270                    BE     INVDTA                    IF PLUS, GO TO INVDTA

- INPUT PROCESSING ROUTINE FOR THE SENSOR MONITOR SET PAGE 4

```

0300R
029ER C883      LHI   R8,X'30'(R3)    LOAD R8 WITH CH NO. IN ASCII
0030
02A2R D780      STB   R8,UNAVAIL+13   STORE CH NO. IN MESSAGE
0315R
02A6R E120      SVC   2,UNAVAIL       PRINT "RECVR NO. X NOT AVAIL "
0308R
02A9R C840      LHI   R4,X'FFFF'      LOAD R4 WITH X'FFFF'
FFFF
02AER C850      LHI   R5,X'FFFE'      LOAD R5 WITH X'FFFE'
FFFE
02B2R EB43      RLL   R4,-1(R3)        SHIFT LEFT NO. CH - 1
FFFF
02B6R 4450      NH    R5,CHSTA        RESET CHAN STATUS BIT
0000F
02BAR 4050      STH   R5,CHSTA        STORE CHSTA WITH BIT RESET
02B8R 02B8R
02BER E130      SVC   3,0            EQU
0000

*
02C2R 0000      CHMESS DC    0          CALL TASK MESSAGE
*
02C4R 0007      ERRLIST DC    7
02C6R 000E      DC    14
02C8R 4E4F      DC    C'NO LIST ENTRY'
204C
4953
5420
454E
5452
5920

*
02D6R 0007      ERRDAT DC    7
02D8R 0014      DC    20
02DAR 494E      DC    C'INVALID CHANNEL NO.'
5641
4C49
4420
4348
414E
4E45
4C20
4E4F
2F20

*
02EFR 2135      CKMESS BNZS CKOK        IF NOT 0, GO TO CKOK
02FOR 4800      LH    R12,CHSTA        LOAD R12 WITH CHAN STATUS
02FOR
02F4R 4300      B      STACKR        GO TO STACKR
032ER

*
02F8R C930      CKOK   CHI   R3,NOCHAN   COMP CHAN NO WITH NO CHAN
0004
02FCR 4320      BNF    ROSTCK        IF NOT PLUS, GO TO ROSTCK
0322R
0300R E120      INVDTA SVC   2,ERRDAT    PRINT "INVALID DATA"

```

```

0206R
0304R E130      SVC      3,0      EDJ
      0000
      *
      *
0308R 0007      UNAVAI  DC      7
030AR 0016      DC      22
030CR 5243      DC      C'RCVR NO.  UNAVAILABLE
      5652
      204E
      4F2E
      2020
      2055
      4E41
      5641
      494C
      4142
      4C45

```

```

*
*      RECEIVER STATUS ROUTINE
*

```

```

0327R 4800      RSTCH  LH      R12,CHSTA      LOAD R12 WITH CHAN STATUS
      02F2R
0326R 4900      CH      R12,NCHSTA      COMP CHSTA WITH NCHSTA
      0000F
032AR 4330      BE      CHENT      IF 0, SKIP UPDATE
      0436R
      *
032ER 4800      STACH  LH      R13,NCHSTA      LOAD R13 WITH NXT CHAN STATUS
      0328R
0332R 0841      LHI      R4,NCHAN(R1)      LOAD R4 WITH NO. CH + 1
      0006
0336R 0851      LHR      R5,R1      LOAD R5 WITH 1
0338R 0D54      SLHL     R5,-1(R4)      SHFT R5 LFT BY NO. CH
      FFFF
033CR 9051      NATCH  SRLS     R5,1      SHFT R5 RGT BY 1 BIT POSITION
033ER 0B41      SHR      R4,R1      SUBTRACT 1 FROM CH NO.
0340R 4330      BZ      PRMES      IF 0, GO TO PRIMES
      0426R
0344R 0894      LHI      R9,-1(R4)      LOAD R9 WITH NO. CH - 1
      FFFF
0348R 4050      MH      R8,SIX      MULT R9 BY 6
      0360R
034CR 0875      LHR      R7,R5      LOAD R7 WITH SET BIT
034ER 0470      NHR      R7,R13      ISOLATE STATUS BIT
0350R 2336      BZS     RSTCHA      IF 0, GO TO RSTCHA
0352R 01E0      LM      R14,ON      LOAD RCVR STATUS IN ASCII
      0416R
0356R 08B0      LHI      R11,SET      LOAD R11 WITH FCT CODE
      0040
035AR 2305      BS      SETRST      GO TO SETRST
035LR 01E0      RSTCHA  LM      R14,OFF      LOAD RCVR STATUS IN ASCII
      0416R
0360R 08B0      LHI      R11,RST      LOAD R11 WITH FCT CODE
      0020
0364R 0289      SETRST  STD      R11,RCVR1(R9)      STORE FCT CODE IN PPS LCL

```

- INPUT PROCESSING ROUTINE FOR THE SENSOR MONITOR SET PAGE 6

```

0260R
0368R E119          SVC  1,RCVR1(R9)      SET OR RESET RCVR
0260R
036CR 4889          LH   R8,RCVR1+2(R9)    CHECK STATUS
0262R
0370R 2136          BNZS COMPBT             IF NOT 0, GO TO COMPBT
0372R D0E9          STM  R14,RCVSTA+2(R9)   STORE RCVR STATUS IN MFSS.
03F4R
0376R 08A7          LHR  R10,R7            LOAD R10 WITH STATUS BIT
0378R 4300          B     SETBIT            GO TO SETBIT
03A0R
037CR C480          COMPBT NHI  R8,X'FF00'   DELETE RIGHT BYTE FROM R8
FF00
0380R C980          CHI  R8,X'A000'         COMPARE STATUS WITH X'A000'
A000
0384R 2136          BNZS ILEG              IF NOT 0, GO TO ILEG
0386R D1E0          LM   R14,DU            LOAD RCVR STATUS IN ASCII
041ER
038AR D0E9          STM  R14,RCVSTA+2(R9)   STORE RCVR STATUS IN MFSS
03F4R
038ER 2305          BS   CONTCK            BRANCH TO CONTCK
0390R D1E0          ILEG LM   R14,ILL       LOAD RCVR STATUS IN ASCII
0429R
0394R D0E9          STM  R14,RCVSTA+2(R9)   STORE RCVR STATUS IN MFSS
03F4R
0398R C8A0          CONTCK LHI  R10,X'FFFF'  LOAD R10 WITH ALL 1'S
FFFF
039CR 08A7          SHR  R10,R7            COMPLEMENT BIT
039ER 04A5          NHR  R10,R5            AND WITH SET BIT
03A0R C890          SETBIT LHI  R9,X'FFFF'   LOAD R9 WITH ALL 1'S
FFFF
03A4R 0B95          SHR  R9,R5            COMPLEMENT SET BIT
03A6R 04C9          NHR  R12,R9            REMOVE BIT FROM CHSTA
03ABR 06CA          OHR  R12,R10           ADD BIT TO CHSTA
03AAR 4300          B     NXTCH            GO TO NXTCH
038ER
*
03AER 0006          * NUMBCH DC  NOCHAN      NUMBER OF CHANNELS
03B0R 0006          SIX  DC   6
*
03B2R 0007          * RCVSTM DC  7
03B4R 002F          DC   46
03B6R 4348          DC   0 CHANNEL -
414E
4E45
4C20
2020
03C0R 2020          DC   0 1 2 3
2031
2020
2020
2032
2020
2020
2033
2020

```

PAGE 7

71

```

*
043AR 6620 CONTIN RTL R7, INFO INPUT ID AND DATA
      004ER
043ER 6640 RTL R4, INFO INPUT TIME(HRS & MIN)
      004ER
0442R 6650 RTL R5, INFO INPUT TIME(SEC & 120TH'S)
      004ER
0446R 4340 BFC 4, LDDATA IF LIST ENTRY, GO TO LDDATA
      0452R
044AR E120 SVC 2, ERRLIST PRINT "NO LIST ENTRY"
      0204R
044ER E130 SVC 3, 0 EQU
      0000

*
0452R 0862 LDDATA LHR R6, R2 LOAD R6 WITH ID & DATA
0454R 0873 LHI R7, -1(R3) LOAD R7 WITH CH NO. -1
      FFFF
0458R EB60 RIL R6, 6 COMBINE CH & ID IN R7
      0006
045CR D3B7 LB R11, ADMTAR(R7) LOAD R11 WITH SENSOR NUMBER
      0000F
0460R 08BB LHR R11, R11 SET FLAGS
0462R 4230 BNZ LCTNLG IF NOT 0, GO TO LCTNLG
      0494R
0466R 6110 ERRCHA AHM R1, INCTSE INCR CTR
      0000F
046AR 6110 AHM R1, INCTSI INCR CTR
      0000F
046ER E130 SVC 3, 0 EQU
      0000
0472R INTBUF DS ABSIZE
*
*
* FIND ADDRESS IN ADMIN LOG
*
0494R 0800 LCTNLG LHI R12, @ADMSZ LOAD R12 WITH RECORD SIZE
      0000F
0498R 27B1 SIS R11, 1 SUBTRACT 1 FROM SENSOR NUMBER
049AR 00AC MHR R10, R12 MULT SENSOR NO. BY SIZE
049CR CAB0 AHI R11, ACTADM ADD ADDR OF ADMIN LOG
      0000F

*
* ROUTINE TO DETERMINE IF DATA IS TO BE OUTPUT
* TO THE TEXAS INSTRUMENTS THERMAL RECORDER
*
04A0R D39B RDROUT LB R9, @RFCND(R11) LOAD RECORDER NUMBER
      0000F
04A4R 0990 CHI R9, 1 IS DATA TO BE OUTPUT TO RECORDER 1
      0001
04A8R 2133 BNFS UPDATE IF NOT, CONTINUE ON THRU INF
04AAR 41E0 BAL LINK1, TEXAS IF SO, GO TO THERMAL RECORDER ROUT
      0000F

*
*
*
*

```

- INPUT PROCESSING ROUTINE FOR THE SENSOR MONITOR SET      PAGE    9  
 \* UPDATE ADMIN LOG EXTENSION & INCR ACTIV CTR

```

*
04AER 404B      UPDATE  STH   R4,@LTMAC(R11)  STORE TIME (HR & MIN)
      0000F
04B2R 405B      STH     R5,@LTMA2(R11)  STORE TIME (SEC & 120TH'S)
      0000F
04B6R 611B      AHM     R1,@NOACT(R11)  INCR ACTIV CTR(SINCE ERASE)
      0000F
04BAR 9466      EXBR    R6,R6           SHIFT DATA TO RIGHT BYTE
04BCR C460      NHI     R6,Z55         REMOVE 1ST BYTE OF R6
      00FF
04C0R D39B      LB      R9,@SNSTP(R11)  LOAD R9 WITH SLU
      0000F
04C4R 9197      SLLS    R9,2           MULT BY 4
04C6R D389      LB      R8,TYPE(R9)    LOAD R8 WITH CLASS
      0000F
04CAR 0981      CHR     R8,R1          IF CLASS IS NOT 1, SKIP
04CCR 4230      BNZ     NOCHGE
      04D2R
04D0R 0260      LHR     R6,R0
04D2R C488      NOCHGE  AHI     R8,-2(R8)  LOAD R8 WITH 2 X CLASS -2
      FFFE
04D6R 4888      LH      R8,TELADR(R8)  LOAD R8 WITH SW ADDR
      0516R
04DAR 0308      BR      R8            GO TO SW ADDRESS
      *
04DCR C960      LDCLS   CHI     R6,63     COMPARE DATA WITH 63
      003F
04E0R 2339      BZS     STACT
04E2R C960      CHI     R6,57     COMPARE DATA WITH 57
      0039
04E6R 4270      BP      BADDAT      IF GTR 57, GO TO BADDAT
      0502R
04EAR C960      CHI     R6,52     COMP DATA WITH 52
      0034
04EER 4210      BM      BADDAT      IF LT 52, GO TO BADDAT
      0502R
04F2R D26B      STACT   STB     R6,@LCBR(R11)  STORE DATA
      0000F
04F6R 6110      CNTACT  AHM     R1,ACCTSE    INCR CTR
      0000F
04FAR 6110      AHM     R1,ACCTSI    INCR CTR
      0000F
04FER 4300      B       CALCAS
      051AR
      *
      *
0502R C880      BADDAT  LHI     R8,X'80'    LOAD R8 WITH DATA BIT
      0080
0506R D28B      STB     R8,@LCBR(R11)  STORE IN DATA AREA
      04F4R
050AR 6110      AHM     R1,WDCETSE    INCR CTR
      0000F
050ER 6110      AHM     R1,WDCETSI    INCR CTR
      0000F
0512R 4300      B       CNTACT      GO TO CNTACT
  
```

- INPUT PROCESSING ROUTINE FOR THE SENSOR MONITOR SET  
04F6R

PAGE 10

```

*
0516R 04F6R  TBLADR  DC  CNTACT
0518R 04DCR  DC  LDCL'S
*
* CALL SUBROUTINE TO CONVERT SENSOR DATA TO ASCII
* AND PLACE IN AN INTERIM BUFFER
*
051AR 40B0  CALCAS  STH  R11,SNSAD1  STORE ADDR OF SENSOR DATA
0527R 0527R
*
051ER 41E0  BAL  LINK1,CONASC  CALL CONV TO ASCII ROUTINE
0000F
0527R  SNSAD1  DS  2  ADDR OF SENSOR DATA
0524R 0472R  DC  INTBUF  ADDR OF INTERIM BUFFER
*
0526R 4300  B  CRTOUT  BRANCH TO CRTOUT
0000F
*
052AR  END

```

```

*
*
*****
*
*
*      *      *      *      *      *
*      *      *      *      *      *
*      *      *      *      *      *
*      *      *      *      *      *
*      *      *      *      *      *
*      *      *      *      *      *
*      *      *      *      *      *
*      *      *      *      *      *
*
*****
*
*
ENTRY TEXAS, RDRBUF, LASTBF
ENTRY TEXRUN
EXTRN TYPE, @LTMAC, @LTMAT
EXTRN @ENSTF, @PENND
EXTRN RPTA, TSELPR, PLIN

*
*
* WRITTEN AND DEBugged BY RICH MARTINO
*
*
* THIS ROUTINE LOADS SEQUENTIAL BUFFERS WITH DATA
* WHICH WILL BE OUTPUT TO A THERMAL RECORDER BY ANOTHER
* TASK A SPECIFIED TIME AFTER A DEVICE AVAILABLE SIGNAL
* IS RECEIVED FROM THE TI THERMAL RECORDER
*
* IN THIS VERSION, THE COMPUTER IS THE CHARACTER GENERATOR
*
0000R      TEXAS      EDU      *
0000R 0000      STM      R0, TAB-112
0004R 4040      STH      R4, TAB-36
0008R 0502R      STH      R5, TAB-34
0008R 4050      STH      R5, TAB-34
0008R 0504R      LB       R10, @PENND(R11)
0008R 03AB      LB       R10, @PENND(R11)
0008R 0000F
0010R 40A0      STH      R10, TAB-32
0010R 0506R
0014R 40B0      STH      R11, TAB-30
0014R 0508R
0018R 080A      LHR      R12, R10
001AR 0200      NOFR
0018R 039E      LB       R9, @ENSTF(R11)
0018R 0000F
0020R 9192      SUI 5     R9, 2
0020R 0389      LB       R5, TYPE(R9)
0020R 0000F
0024R 4 30      CH       R8, TAB-10
0510R

```

- ROUTINE FOR TEXAS INSTRUMENTS THERMAL RECORDER PAGE 2  
 002AR 4330 BFC 3, DETECT  
 003AR  
 003ER 4980 CH R8, TAB-8  
 051ER  
 0032R 4330 BFC 3, CLASFY  
 012ER  
 0036R 4300 BFC 0, EXIT1  
 0106R

\* PROCESSING OF A DETECTION SENSOR

\*

003AR 088B DETECT LHI R8, @LTMA0(R11)  
 0000F  
 003ER 4898 LH R9, 0(R8)  
 0000  
 0042R 4090 STH R9, TAB-48  
 04F6R  
 0046R 4898 LH R9, 2(R8)  
 0002  
 004AR 4090 STH R9, TAB-46  
 04F6R  
 004ER 4840 LH R4, TAB-36  
 0502R  
 0052R 4850 LH R5, TAB-34  
 0504R  
 0056R 4048 STH R4, @LTMA0(R11)  
 0030R  
 005AR 4058 STH R5, @LTMA2(R11)  
 0000F  
 005ER 088B LHI R8, @LTMA0(R11)  
 0058R  
 0062R 4898 LH R9, 0(R8)  
 0000  
 0066R 4090 STH R9, TAB-42  
 04F6R  
 006AR 4898 LH R9, 2(R8)  
 0002  
 006ER 4090 STH R9, TAB-40  
 04F6R

\* ONE MINUTE ACTIVATION COMPARE ROUTINE

\*

0071R 0711 XHR R1, R1  
 0074R 0081 LB R8, TAB-48(R1)  
 04F6R  
 0077R 0081 L R9, TAB-42(R1)  
 04F6R  
 007AR 0081 SHR R9, R8  
 0074R 0081 CH R9, TAB-12  
 0077R 0081 BFC 3, CKMINS  
 007AR 0081 CH R9, TAB-10  
 0074R 0081 DEFS 3, 4  
 0077R 0081 SKUS R9, 4  
 007AR 0081 BFC 0, ZRUL0G

| - ROUTINE FOR TEXAS INSTRUMENTS THERMAL RECORDER |       |            |                    | PAGE 3 |
|--------------------------------------------------|-------|------------|--------------------|--------|
| 0092R                                            | 2611  | AIS        | R1, 1              |        |
| 0094R                                            | D381  | LB         | R8, TAB-48(R1)     |        |
|                                                  | 04F6R |            |                    |        |
| 0098R                                            | D391  | LB         | R9, TAB-42(R1)     |        |
|                                                  | 04F0R |            |                    |        |
| 0090R                                            | 4980  | CH         | R8, TAB-14         |        |
|                                                  | 0518R |            |                    |        |
| 00A0R                                            | 2333  | BFFS       | 3, 3               |        |
| 00A7R                                            | 4300  | BFC        | 0, ZROLOG          |        |
|                                                  | 00E0R |            |                    |        |
| 00A6R                                            | 4990  | CH         | R9, TAB-12         |        |
|                                                  | 051AR |            |                    |        |
| 00AAR                                            | 4330  | BFC        | 3, CKSECS          |        |
|                                                  | 00D0R |            |                    |        |
| 00AER                                            | 4300  | BFC        | 0, ZROLOG          |        |
|                                                  | 00E0R |            |                    |        |
| * CHECK ON MINUTES ROUTINE                       |       |            |                    |        |
| *                                                |       |            |                    |        |
| 00B2R                                            | 2611  | CKMINS AIS | R1, 1              |        |
| 00B4R                                            | D381  | LB         | R8, TAB-48(R1)     |        |
|                                                  | 04F6R |            |                    |        |
| 00B8R                                            | D391  | LB         | R9, TAB-42(R1)     |        |
|                                                  | 04F0R |            |                    |        |
| 00B0R                                            | 0E98  | SHR        | R9, R8             |        |
| 00BER                                            | 4990  | CH         | R9, TAB-12         |        |
|                                                  | 051AR |            |                    |        |
| 00C2R                                            | 4330  | BFC        | 3, INCL03          |        |
|                                                  | 00E6R |            |                    |        |
| 00C6R                                            | 4990  | CH         | R9, TAB-10         |        |
|                                                  | 0510R |            |                    |        |
| 00CAR                                            | 2333  | BFFS       | 3, 3               |        |
| 00CCR                                            | 230A  | BFFS       | 0, 10              |        |
| 00CER                                            | 2409  | LIS        | R0, R9             |        |
| * CHECK ON SECONDS ROUTINE                       |       |            |                    |        |
| *                                                |       |            |                    |        |
| 00D0R                                            | 2611  | CKSECS AIS | R1, 1              |        |
| 00D2R                                            | D381  | LB         | R8, TAB-48(R1)     |        |
|                                                  | 04F6R |            |                    |        |
| 00D6R                                            | D391  | LB         | R9, TAB-42(R1)     |        |
|                                                  | 04F0R |            |                    |        |
| 00DAR                                            | 0989  | CHR        | R8, R9             |        |
| 00DCR                                            | 2125  | BTFS       | 2, 5               |        |
| 00DER                                            | 2301  | BFFS       | 0, 1               |        |
| * ACTIVATION LOG UPDATE ROUTINE                  |       |            |                    |        |
| *                                                |       |            |                    |        |
| 00E0R                                            | 0711  | ZROLOG XHR | R1, R1             |        |
| 00E7R                                            | D21A  | STB        | R1, TABLE+650(R10) |        |
|                                                  | 0466R |            |                    |        |
| 00E6R                                            | D31A  | INCL03 LB  | R1, TABLE+650(R10) |        |
|                                                  | 0466R |            |                    |        |
| 00EAR                                            | 4910  | CH         | R1, TAB-2          |        |
|                                                  | 0524R |            |                    |        |
| 00EFR                                            | 2122  | BTFS       | 2, 2               |        |
| 00FOR                                            | 2611  | AIS        | R1, 1              |        |
| 00F2R                                            | D21A  | STB        | R1, TABLE+650(R10) |        |
|                                                  | 0466R |            |                    |        |

PAGE 4

```

- ROUTINE FOR TEXAS INSTRUMENTS THERMAL RECORDER
00F6R 4910      CH      R1, TAB-10
      0510R
00FAR 2135      BTFS    3, 5
00FCR 0380      LB      R8, TABLE+71
      0223R
0100R 4300      BFC     0, STORE
      0120R
0104R 4910      CH      R1, TAB-8
      0510R
0108R 2134      BTFS    3, 4
010AR 0380      LB      R8, TABLE+73
      0225R
010ER 2307      BFFS    0, 9
0110R 4910      CH      R1, TAB-6
      0520R
0114R 2134      BTFS    3, 4
0116R 0380      LB      R8, TABLE+75
      0227R
011AR 2303      BFFS    0, 3
011CR 0380      LB      R8, TABLE+77
      0229R
0120R 4890      STORE   LH      R9, RPTR
      0000F
0124R 0A9C      AHR     R9, R12
0126R 0289      STB     R8, 0(R9)
      0000
012AR 4300      BFC     0, EXIT1
      0106R

```

\* PROCESSING OF A CLASSIFICATION SENSOR  
\*

```

012ER 9466      CLASFY  EXBR   R6, R6
0130R 0460      NHI     R6, 255
      00FF
0134R 4960      CH      R6, TAB-26
      0500R
0138R 2135      BTFS    3, 5
013AR 0380      LHI     R8, TABLE+14
      01E4R
013ER 2307      BFFS    0, 7
0140R 2036      BTBS    3, 6
0142R 4960      CH      R6, TAB-24
      050ER
0146R 2135      BTFS    3, 5
0148R 0380      LHI     R8, TABLE+42
      0206R
014CR 2307      BFFS    0, 7
014ER 2254      BFFS    5, 4
0150R 4960      CH      R6, TAB-22
      0510R
0154R 2135      BTFS    3, 5
0156R 0380      LHI     R8, TABLE+0
      010CR
015AR 2307      BFFS    0, 7
015CR 2037      BTBS    3, 7
017ER 4960      CH      R6, TAB-20
      0512R

```

|   |                                                |      |   |
|---|------------------------------------------------|------|---|
| - | ROUTINE FOR TEXAS INSTRUMENTS THERMAL RECORDER | PAGE | 5 |
|---|------------------------------------------------|------|---|

|       |       |      |              |
|-------|-------|------|--------------|
| 0162R | 2134  | BTFB | 3, 4         |
| 0164R | 0880  | LHI  | R8, TABLE+28 |
|       | 01F8R |      |              |
| 0168R | 2309  | BFFB | 0, 9         |
| 016AR | 4960  | CH   | R6, TAB-18   |
|       | 0514R |      |              |
| 016ER | 2134  | BTFB | 3, 4         |
| 0170R | 0880  | LHI  | R8, TABLE+28 |
|       | 01F8R |      |              |
| 0174R | 2303  | BFFB | 0, 3         |
| 0176R | 0880  | LHI  | R8, TABLE+56 |
|       | 0214R |      |              |

|       |                                            |     |             |
|-------|--------------------------------------------|-----|-------------|
|       | * CHARACTER / BUFFER TRANSPOSITION ROUTINE |     |             |
|       | *                                          |     |             |
| 017AR | 2405                                       | LIS | R13, 5      |
| 017CR | 4000                                       | STH | R13, TSK6PR |
|       | 0000F                                      |     |             |
| 0180R | 4000                                       | STH | R13, TAB-28 |
|       | 050AR                                      |     |             |
| 0184R | 0000                                       | STM | R0, TAB-80  |
|       | 04D6R                                      |     |             |
| 0188R | 4110                                       | BAI | R1, PLINK   |
|       | 0000F                                      |     |             |
| 018CR | 0100                                       | LM  | R0, TAB-80  |
|       | 04D6R                                      |     |             |
| 0190R | 48E0                                       | LH  | R14, RPTR   |
|       | 0122R                                      |     |             |
| 0194R | 2407                                       | LIS | R13, 7      |
| 0196R | 2680                                       | AIS | R8, 13      |
| 0198R | 0AEC                                       | AHR | R14, R12    |

|       |                         |        |                |           |
|-------|-------------------------|--------|----------------|-----------|
|       | * DATA TRANSFER ROUTINE |        |                |           |
| 019AR | 0378                    | NXLINE | LB             | R7, 0(R8) |
|       | 0000                    |        |                |           |
| 019ER | 027E                    | STE    | R7, 0(R14)     |           |
|       | 0000                    |        |                |           |
| 01A2R | 09E0                    | CHI    | R14, TABLE+570 |           |
|       | 0416R                   |        |                |           |
| 01A6R | 2339                    | BFFB   | 3, 9           |           |
| 01A8R | 2128                    | BTFB   | 2, 8           |           |
| 01AAR | 0AEC                    | AHI    | R14, 80        |           |
|       | 0050                    |        |                |           |
| 01AER | 2782                    | SIS    | R8, 2          |           |
| 01BOR | 2701                    | SIS    | R13, 1         |           |
| 01B2R | 4230                    | BTC    | 3, NXLINE      |           |
|       | 019AR                   |        |                |           |
| 01B6R | 2308                    | BFFB   | 0, 8           |           |
| 01B8R | 08E0                    | LHI    | R14, TABLE+90  |           |
|       | 0236R                   |        |                |           |
| 01BCR | 0AEC                    | AHF    | R14, R12       |           |
| 01BER | 2782                    | SIS    | R8, 2          |           |
| 01COR | 2701                    | SIS    | R13, 1         |           |
| 01C2R | 4230                    | BTC    | 3, NXLINE      |           |
|       | 019AR                   |        |                |           |
| 01C6R | 0700                    | XHF    | R0, R0         |           |
| 01C8R | 4000                    | STH    | R0, TAB-28     |           |
|       | 050AR                   |        |                |           |

```

- ROUTINE FOR TEXAS INSTRUMENTS THERMAL RECORDER PAGE 6
010CR 2403 LIS R13,3
010CR 4000 STH R13,TSN6FR
017ER
0102R 4110 BAL R1,PLINK
018AR

* NORMAL EXIT ROUTINE
*
0106R D100 EXIT1 LM R0,TABLE+730
04B6R
010AR 030E BR LINK1

*
* TABULAR INDEX OF DEFINED
* CONSTANTS AND STORAGE AREA
*
010CR TABLE EQU *
010CR 001F DC 31,04,04,04,04,04,04,30,17
0004
0004
0004
0004
0004
0004
001E
0011
01EFR 0011 DC 17,30,16,16,16,04,10,17,17
001E
0010
0010
0010
0004
000A
0011
0011
0200R 001F DC 31,17,17,17,17,17,21,21,21
0011
0011
0011
0011
0011
0015
0015
0015
0212R 000A DC 10,04,21,14,04,14,21,04,04
0004
0015
000E
0004
000E
0015
0004
0004
0224R 000A DC 10,21,31,00,00,00,00,00,00
0015
001F
0000
0000

```

```

0000
0000
0000
0000
0236R          DS      726
0500R 0035      DC      53, 54, 55, 56, 57, 58, X'59'
0036
0037
0038
0039
003A
0059
051AR 0000      DC      00, 01, 02, 03, 04, 05, 06
0001
0002
0003
0004
0005
0006
0000          R0      EQU    0
0001          R1      EQU    1
0002          R2      EQU    2
0003          R3      EQU    3
0004          R4      EQU    4
0005          R5      EQU    5
0006          R6      EQU    6
0007          R7      EQU    7
0008          R8      EQU    8
0009          R9      EQU    9
000A          R10     EQU    10
000B          R11     EQU    11
000C          R12     EQU    12
000D          R13     EQU    13
000E          R14     EQU    14
000F          R15     EQU    15
000E          LINK1   EQU    14
050AR          TEXRUN EQU    TABLE+814
0416R          LASTBF EQU    TABLE+570
0236R          RDRBUF EQU    TABLE+90
0526R          TAB     EQU    *-2
0526R          END

```

TASK 4  
OPERATOR COMMAND TASK

- OPERATOR COMMAND PROGRAMS FOR THE SENSOR MONITOR SET      PAGE    1

```

*
* OPERATOR CONTROL COMMANDS OVERLAY AREA
*
* REWRITTEN AND DEBUGGED BY :
* RICH MARTINO & JOE KARAKOWSKI
*
*
* OPERATOR COMMANDS TASK CONTROL BLOCK
*
0000R          ENTRY OVERLY, OVERLE
0000R          ENTRY TASK4, CMD
0000R  TASK4   DS      8          *UNUSED
0000R  ADRS    DS      2          *ADDRESS INPUT SLOT
0000R          DS      2          *UNUSED
0000R          DS      2          *UNUSED TELL BFR
0000R 04C6     DC      X'04C6'    *LU 00--DISC HISTORY FILE
0010R 0010     DC      X'10'      *LU 01--ALERT CRT
0012R 0000     DC      0          LU 2--UNUSED
0014R 0062     DC      X'62'      *LU 03--LINE PRINTER
0016R 01C6     DC      X'1C6'     *LU 04--DISC ADMIN FILE
0018R 02C6     DC      X'2C6'     *LU 05--DISC OVERLAY FILE
001AR 0013     DC      X'13'      *LU 6 HSPTX
001CR 03C6     DC      X'3C6'     *LU 07--TFL HISTORY FILE
001ER 00C6     DC      X'C6'      *LU 08--RESIDENT SOFTWARE
0020R 0000     DC      0,0        *UNUSED LUS
0000
0024R 0000     DC      0,0,0,0,0
0000
0000
0000
0000
0000
002ER          DS      32          * GR SAVE
*
*
* TASK 4 PROGRAM
*
*
004ER  CMD     EQU      *
000E   R14     EQU      14
000F   R15     EQU      15
004ER 48E0     LH      R14, ADRS
0008R
0052R 48EE     LH      R14, 0(R14)   LOAD BUFF ADRS INTO R14
0000
* R14---TTY BUFFER
* R15---RETURN ADDRESS REGISTER
0056R 41F0     BAL      R15, OVERLY
0005R
005AR E130     SVC      3,0
0000
005ER  OVERLY  DS      X'1200'
1250R  OVERLE  EQU      *-1
125ER  END

```

TASK 5  
COMMANDS DIRECTORY TASK

- COMMANDS DIRECTORY FOR THE SENSOR MONITOR SET

PAGE 1

```

*
*
*   COMMANDS DIRECTORY ROUTINE
*
*   REWRITTEN AND DEBugged BY :
*   RICH MARTINO & JOE KARAKOWSKI
*
*
0000R      EXTRN ALGFLG
0000R      EXTRN OVERLY, OVERLE
0000R      EXTRN T4STAT
0000R      ENTRY TIMCOM
0000R      ENTRY SRU, SRUTB
*
*   COMMANDS DIRECTORY TASK CONTROL BLOCK
*
0000R      SRUTB   DS      8      UNUSED
0000R 0000      DC      0      PARAMETER
0000R      DS      2      UNUSED
0000R 03PER      DC      TTYBUF  TELL BUFFER
0000R 0000      DC      0      LU 0
0010R 0002      DC      2      LU 1--TTY
0012R 0000      DC      0
0014R 0062      DC      X'62'   LU 3--LINE PRINTER
0016R 0062      DC      X'62'   LU 4 = LINE PRINTER
0018R 0013      DC      X'13'   LU 5--TAPE
001AR 0206      DC      X'206'  LU 6--DISC OVERLAY FILE
001CR 0002      DC      2      LU 7--TTY
001ER 0000      DC      0,0,0,0  LU 8-11
      0000
      0000
      0000
0026R 0000      DC      0,0,0,0  LU 12-15
      0000
      0000
      0000
00ZER      DS      32      GEN REG SAVE

```

\*  
\*  
\*  
\*  
\* COMMANDS DIRECTORY MAIN PROGRAM  
\*  
\*  
\*

|       |       |        |      |                |                               |
|-------|-------|--------|------|----------------|-------------------------------|
| 004ER |       | SRU    | EDU  | *              |                               |
| 004ER | E110  |        | SVC  | 1, DIRRD       | READ DIRECTORY INTO BUFFER    |
|       | 0152R |        |      |                |                               |
| 0052R | 4800  |        | LH   | STAT, DIRRD+2  | TEST STATUS                   |
|       | 0154R |        |      |                |                               |
| 0056R | 4210  |        | BM   | DEVER1         |                               |
|       | 00F8R |        |      |                |                               |
| 005AR | 24E1  |        | LIS  | ONE, 1         |                               |
| 005CR | 0700  |        | XHR  | ZRO, ZRO       | ZERO REG 0                    |
| 005ER | 4000  |        | STH  | ZRO, ALGFLG    | ZERO ALGOR FLAG               |
|       | 0000F |        |      |                |                               |
| 0062R | 4000  |        | STH  | ZRO, TTYBUF    |                               |
|       | 03BER |        |      |                |                               |
| 0066R |       | TASK5  | EDU  | *              |                               |
| 0066R | 4820  |        | LH   | TS2, T4STAT    | REQUEST STATUS OF TN4         |
|       | 0000F |        |      |                |                               |
| 006AR | 0520  |        | CLHI | TS2, X18000    | TEST IF DORMANT               |
|       | 8000  |        |      |                |                               |
| 006ER | 4230  |        | BNE  | ALGOR          |                               |
|       | 00FCR |        |      |                |                               |
| 0072R | 4810  |        | LH   | TS1, TTYBUF    | IS THERE A COMMAND TO PROCESS |
|       | 03BER |        |      |                |                               |
| 0076R | 4330  |        | BZ   | ALGOR          | IF ZERO CHECK FOR ALGOR       |
|       | 00FCR |        |      |                |                               |
| 007AR | 41D0  | PRMSER | BAI  | RTN, SEARCH    |                               |
|       | 00CAR |        |      |                |                               |
| 007ER | 4000  |        | STH  | ZRO, TTYBUF    | ZERO TTY BUFFER               |
|       | 03BER |        |      |                |                               |
| 0082R | 4300  |        | B    | ALGOR          | GO TO CHECK ALGORITHM         |
|       | 00FCR |        |      |                |                               |
| 0086R | 4520  |        | CLH  | TS2, PROGRD+8  | ALREADY IN CORE ?             |
|       | 03B8R |        |      |                |                               |
| 008AR | 4330  |        | BE   | CALTN4         | YES, SKIP READ                |
|       | 00A2R |        |      |                |                               |
| 008ER | 4020  |        | STH  | TS2, PROGRD+8  | SET UP PARAMETER              |
|       | 03B8R |        |      |                |                               |
| 0092R | 4020  |        | STH  | TS2, TASK4+14  | BLOCKS                        |
|       | 037CR |        |      |                |                               |
| 0096R | E110  |        | SVC  | 1, PROGRD      | READ IN PROG                  |
|       | 03B0R |        |      |                |                               |
| 009AR | 4800  |        | LH   | STAT, PROGRD+2 | TEST STATUS                   |
|       | 03B2R |        |      |                |                               |
| 009ER | 4210  |        | BM   | DEVER2         |                               |
|       | 014AR |        |      |                |                               |
| 00A2R | E160  | CALTN4 | SVC  | 6, TASK4       |                               |
|       | 030FF |        |      |                |                               |
| 00A6R | 4330  |        | BZ   | TABLS          |                               |
|       | 0066R |        |      |                |                               |

- COMMANDS DIRECTORY FOR THE SENSOR MONITOR SET

PAGE 3

|       |       |        |       |                     |                                  |
|-------|-------|--------|-------|---------------------|----------------------------------|
| 00AAR | E120  | TKERR  | SVC   | 2, TASKER           |                                  |
|       | 00B2R |        |       |                     |                                  |
| 00AER | 4300  |        | B     | TASK5               |                                  |
|       | 0066R |        |       |                     |                                  |
| 00B2R | 0007  | TASKER | DC    | 7, 20, 01           | THERE IS A TASK ERR              |
|       | 0014  |        |       |                     |                                  |
|       | 2054  |        |       |                     |                                  |
|       | 4845  |        |       |                     |                                  |
|       | 5245  |        |       |                     |                                  |
|       | 2049  |        |       |                     |                                  |
|       | 5320  |        |       |                     |                                  |
|       | 4120  |        |       |                     |                                  |
|       | 5441  |        |       |                     |                                  |
|       | 534B  |        |       |                     |                                  |
|       | 2045  |        |       |                     |                                  |
|       | 5252  |        |       |                     |                                  |
| 00CAR |       | SEARCH | EDU   | *                   |                                  |
| 00CAR | 4840  |        | LH    | CT, DIRBUF+2        | LOAD NO. OF ENTR AS COUNT        |
|       | 015ER |        |       |                     |                                  |
| 00CER | 9142  |        | SLI S | CT, 2               | SL (MULTX2) TO MAKE COUNT AN ADR |
| 00DOR | 0733  |        | XHR   | DIFO, DIFO          | RESET DIR POINTER                |
| 00D2R | 4513  | NAMSER | CLH   | TS1, DIRBUF+4(DIFO) | CHECK NAME WITH DIRECTORY        |
|       | 0160R |        |       |                     |                                  |
| 00D6R | 4330  |        | BE    | FILPER              | IF NAME FOUND THEN BRANCH        |
|       | 00FOR |        |       |                     |                                  |
| 00DAR | 2634  |        | AIS   | DIFO, 4             | INCR DIR PNTR                    |
| 00DCR | 0534  |        | CLHR  | DIFO, CT            | TEST IF SEARCH IS FINISH         |
| 00DER | 4280  |        | BL    | NAMSER              | OTHERWISE CONT                   |
|       | 00D2R |        |       |                     |                                  |
| 00E2R | E120  |        | SVC   | 2, CMERR            | ERROR NAME NOT FOUND             |
|       | 038ER |        |       |                     |                                  |
| 00E6R | 4010  |        | STH   | TS1, JOE            | PUT BAD CMD IN BUFFER            |
|       | 03AER |        |       |                     |                                  |
| 00EAR | E120  |        | SVC   | 2, ERMS             | WRITE OUT CMD                    |
|       | 03AAR |        |       |                     |                                  |
| 00EER | 0300  |        | BR    | RTN                 | RETURN TO ROUTINE                |
| 00FOR |       | FILPER | EDU   | *                   |                                  |
| 00FOR | 4823  |        | LH    | TS2, DIRBUF+6(DIFO) | LOAD SECTOR ADR IN TS2           |
|       | 0162R |        |       |                     |                                  |
| 00F4R | 4300  |        | B     | 8(RTN)              | RETURN TO CALLER                 |
|       | 0008  |        |       |                     |                                  |
| 00F8R | 4300  | DEVER1 | B     | DEVER2              |                                  |
|       | 014AR |        |       |                     |                                  |
| 00FCR |       | ALGOR  | EDU   | *                   |                                  |
| 00FCR | 45E0  |        | CLH   | ONE, ALGFLG         |                                  |
|       | 0060R |        |       |                     |                                  |
| 0100R | 4230  |        | BNE   | TASK5               |                                  |
|       | 0066R |        |       |                     |                                  |
| 0104R | E160  |        | SVC   | 6, TASK6            |                                  |
|       | 037ER |        |       |                     |                                  |
| 0108R | 4230  |        | BNZ   | TKERR               |                                  |
|       | 00AAR |        |       |                     |                                  |
| 010CR | 40C0  |        | STH   | ZRD, ALGFLG         | ZERO ALGORITHM FLAG              |
|       | 00FER |        |       |                     |                                  |
| 0110R | 4300  |        | B     | TASK5               |                                  |
|       | 0066R |        |       |                     |                                  |

\*  
\*  
\*  
\* TIME COMPACT ROUTINE  
\* THIS ROUTINE CALLS THE TIME OF DAY HH:MM:SS  
\* AND COMPRESSES THE : I. E. HHMMSS  
\* ONE MUST LOAD GEN REG 1(TS1) WITH THE ADR WHERE THE RESULT IS  
\* STORED  
\*

|            |        |      |                |                   |
|------------|--------|------|----------------|-------------------|
| 0114R      | TIMCOM | EQU  | *              |                   |
| 0114R E120 |        | SVC  | 2, RDTIME      | READ CURRENT TIME |
| 0130R      |        |      |                |                   |
| 0118R 48A0 |        | LH   | R10, RDTIME+10 |                   |
| 0146R      |        |      |                |                   |
| 0110R 40A1 |        | STH  | R10, 4(TS1)    | STORE SS IN TN    |
| 0004       |        |      |                |                   |
| 0120R 48A0 |        | LH   | R10, RDTIME+4  |                   |
| 0140R      |        |      |                |                   |
| 0124R 40A1 |        | STH  | R10, 0(TS1)    | STORE HH IN TN+4  |
| 0000       |        |      |                |                   |
| 0128R 48A0 |        | LH   | R10, RDTIME+6  | /:M/              |
| 0142R      |        |      |                |                   |
| 0120R 91A8 |        | SLLS | R10, 8         | SHIFT SQ/MO/      |
| 012ER 48B0 |        | LH   | R11, RDTIME+8  | /M:/              |
| 0144R      |        |      |                |                   |
| 0132R 90B8 |        | SRLS | R11, 8         | SHIFT SQ /OM/     |
| 0134R 06AB |        | OHR  | R10, R11       | OR /MO/+ /OM/     |
| 0136R 40A1 |        | STH  | R10, 2(TS1)    | STORE MM IN TN+2  |
| 0002       |        |      |                |                   |
| 013AR 030D |        | BR   | RTN            | RETURN            |

\*  
\*  
\*  
\*  
\*  
\* D C CONSTANTS  
\*

|            |        |     |                               |
|------------|--------|-----|-------------------------------|
| 0130R 0008 | RDTIME | DC  | 8, *+2, 0, 0, 0, 0            |
| 0140R      |        |     |                               |
| 0000       |        |     |                               |
| 0000       |        |     |                               |
| 0000       |        |     |                               |
| 0000       |        |     |                               |
| 0148R 0000 | LSTMIN | DC  | 0                             |
| 014AR      | DEVER2 | EQU | *                             |
| 014AR E120 |        | SVC | 2, ERMESS                     |
| 035ER      |        |     |                               |
| 014ER 4300 |        | B   | TASKS                         |
| 0066R      |        |     |                               |
| 0152R 5006 | DIRRD  | DC  | X'5006', 0, DIRBUF, DIREND, 0 |
| 0000       |        |     |                               |
| 0150R      |        |     |                               |
| 035ER      |        |     |                               |

- COMMANDS DIRECTORY FOR THE SENSOR MONITOR SET

PAGE 5

```

0000
015CR      DIRBUF  DS      512
035BR      DIREND  EQU     *-1
0000      STAT    EQU     0
0001      TS1      EQU     1
0002      TS2      EQU     2
0003      R3        EQU     3
0003      DIFO      EQU     3
0004      CT        EQU     4
0005      R5        EQU     5
0006      R6        EQU     6
0007      R7        EQU     7
0008      R8        EQU     8
0009      AI CT     EQU     9
000A      R10       EQU     10
000B      CMD       EQU     11
000B      R11       EQU     11
000C      ZR0       EQU     12
000D      RTN       EQU     13
000E      ONE       EQU     14
000F      R15       EQU     15
035CR 2020    BLANK   DC      X'2020'
035ER 0007    ERMESS  DC      7, 10, C'I/O ERROR'
      000A
      492F
      4F20
      4552
      524F
      5220
036CR 0001    PAUSE   DC      1
036ER 434D    TASK4   DC      C'CMD' , X'0202' , 0, **2, TTYBUF, 0
      4420
      2020
      0202
      0000
037AR
03BER
0000
037ER 5441    TASK6   DC      C'TASK6' , X'0202' , 0, 0, 0, 0
      534B
      3620
      0202
      0000
      0000
      0000
      0000
038FR 0007    CMERR   DC      7, 24, C'CMD-ERR , INVALID CMD IS'
      0018
      2043
      4D44
      2D45
      5252
      2020
      494E
      5641
      4C49

```

- COMMANDS DIRECTORY FOR THE SENSOR MONITOR SET

PAGE 6

```

4420
4340
4420
4953
03AAR 0007      ERMS      DC      7,2
      0002
03AER 0000      JOE       DC      0
03BOR 5006      PROGRD    DC      X'5006',0,OVERLY,OVERLE,0
      0000
      0000F
      0000F
      0000
      *      TTYBUF IS FROM TASK1
      * THE FOLLOWING CARD MUST BE IMMEDIATELY BEFORE THE TTYBUF
      *
      ****
      ***
      **
      *
03BAR 0007      DC      7,80
      0050
03BER      TTYBUF      DS      80      TELL BUFFER
040ER      RFLDRG      EQU      *
0001      CRT1LU      EQU      X'0001'
0002      CRTLU2      EQU      X'0002'
0002      CRT2LU      EQU      X'0002'
0005      QVLFIL      EQU      X'0005'
2000      WRITE      EQU      X'2000'
0800      WAIT      EQU      X'0800'
0004      LNFLU      EQU      X'0004'
0400      RANDOM      EQU      X'0400'
0000      ASCII      EQU      X'0000'
040ER 0007      ABSERR    DC      7,27,0'PROGRAM IS NOT IN DIRECTORY'
      0018
      5052
      4F47
      5241
      4D20
      4953
      204E
      4F54
      2049
      4E20
      4449
      5245
      4354
      4F52
      5920
042ER      END      SRU

```

TASK 6  
TACTICAL SITUATION SIMULATOR TASK

TACTICAL SITUATION SIMULATION PROGRAM

PAGE 1

\* AUTHOR J. KARAKOWSKI

\*

```

0000R      ENTRY @SEGN0
0000R      ENTRY @OBJCL, @SENF, @SENW, @SENK, @SENUK
0000R      ENTRY TASK6, TSK6TB, CNVTAB, SENSNO, ACTSEN
0000R      ENTRY CURGED, CURSEN, CURDU, @SEGLT
0000R      ENTRY @SENEG, @BULST, @STRNG, STRTBL
0000R      ENTRY SEGLST, SEGNUM, @SENW
0000R      ENTRY STRNO, @SEG1X, @SEG1Y, @SEG2X, @SEG2Y
0000R      ENTRY @SEGL, @SEGM, STRLST, @BUNUM
0000R      ENTRY @LSTL, @OBUND, @OBJST, @OBJD, @OBJVE, @OBJRS, @OBJEN
0000R      ENTRY @SEGF0, @OBJFG, @SENI0, @SENF0, @SENRT, @SENTP
0000R      ENTRY @SENTB, @SENEX, @SENSY, @SENF0, @SENDR
0000R      EXTRN .U, SORT, W
0000R      EXTRN INFO, ALGFLG
0000R      EXTRN CRTIDA, TSKBOP
0000R 0398R      TSK6TB DC      TASK6, TASK6
0000R 0398R
0004R 006ER      DC      UTOP
0006R 0000R      DC      TSK6TB
0008R 0000      DC      0          PARAMETER
000AR      DS      2          UNUSED
000CR      DS      2          TELL BUFF
000ER 0000      DC      0          LU 1
0010R 0000      DC      0          LU 1
0012R 0062      DC      X'62'      LU 2
0014R 0406      DC      X'406'     LU 3
0016R 0010      DC      X'10'     LU 4
0018R 0002      LUS      DC      2          LU 5
001AR      DC      10
001AR 0000      DC      0
001CR 0000      DC      0
001ER 0000      DC      0
0020R 0000      DC      0
0022R 0000      DC      0
0024R 0000      DC      0
0026R 0000      DC      0
0028R 0000      DC      0
002AR 0000      DC      0
002CR 0000      DC      0
002ER      DS      64          GEN+FLT PT REFSAV
003ER      UTOP      DS      700
0000      R0      EQU      0
0001      R1      EQU      1
0002      R2      EQU      2
0003      R3      EQU      3
0004      R4      EQU      4
0005      R5      EQU      5
0006      R6      EQU      6
0007      R7      EQU      7
0008      R8      EQU      8
0009      R9      EQU      9
000A      R10     EQU      10
000B      R11     EQU      11
000C      R12     EQU      12
000D      R13     EQU      13

```

AD-A103 991

ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND FO--ETC F/6 9/2  
TACTICAL SITUATION SIMULATOR ALGORITHM FOR USE WITH A THERMAL L--ETC(U)  
AUG 81 J A KARAKOWSKI, R J MARTINO, A SLUTSKY  
DELCS-TR-81-1

UNCLASSIFIED

2 OF 2

ADA  
08591



ALL

END

DATE

FILMED

10-81

DTIC

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 2

|       |        |        |    |                  |
|-------|--------|--------|----|------------------|
| 000E  | R14    | EQU    | 14 |                  |
| 000F  | R15    | EQU    | 15 |                  |
| 0004  | ALRTL  | EQU    | 4  |                  |
| 0000  | SCX    | EQU    | 0  |                  |
| 0004  | RX     | EQU    | 4  |                  |
| 0006  | INCX   | EQU    | 6  |                  |
| 0008  | XR     | EQU    | 8  |                  |
| 000A  | SCY    | EQU    | 10 |                  |
| 000E  | RY     | EQU    | 14 |                  |
| 0010  | INCY   | EQU    | 16 |                  |
| 0012  | YR     | EQU    | 18 |                  |
| 032AR | SCXF   | DS     | 4  |                  |
| 032ER | RXF    | DS     | 4  |                  |
| 0332R | INXF   | DS     | 4  |                  |
| 0336R | XRF    | DS     | 4  |                  |
| 033AR | SCYF   | DS     | 4  |                  |
| 033ER | RYF    | DS     | 4  |                  |
| 0342R | INCYF  | DS     | 4  |                  |
| 0346R | YRF    | DS     | 4  |                  |
| 034AR | XLDC   | DS     | 2  |                  |
| 034CR | YLDC   | DS     | 2  |                  |
| 034ER | MAFFLG | DS     | 2  |                  |
| 0350R | MAFWT  | DS     | 2  |                  |
| 0352R | 2004   | DBJLDC | DC | X'2000'+ALRTL    |
| 0354R |        |        | DS | 2                |
| 0356R | 035CR  |        | DC | MAPBUF, MAPBUF+3 |
|       | 035FR  |        |    |                  |
| 035AR |        | DS     | 2  | UNUSED           |
| 035CR | 6000   | MAPBUF | DC | X'6000'          |
| 035ER | 002A   |        | DC | X'2A'            |
| 0360R |        | DS     | 4  | UNUSED           |
| 0364R | 4232   | MAXM   | DC | X'4232', 0       |
|       | 0000   |        |    |                  |
| 0368R | 0232   | MINM   | DC | X'0232', 0       |
|       | 0000   |        |    |                  |
| 036CR |        | OLDX   | DS | 2                |
| 036ER |        | OLDY   | DS | 2                |
| 0370R | 0008   | C8     | DC | 8                |
| 0372R | 4048   | COP5   | DC | X'4048', 0       |
|       | 0000   |        |    |                  |
| 0376R | 4099   | COP6   | DC | X'4099', X'999A' |
|       | 999A   |        |    |                  |
| 037AR | 4000   | CLASSG | DC | X'4000', X'0000' |
|       | 0000   |        |    |                  |
| 037ER | 4040   | TOFFST | DC | X'4040', 0       |
|       | 0000   |        |    |                  |
| 0382R |        | II     | DS | 2                |
| 0384R |        | CLASFG | DS | 2                |
| 0386R | 6666   | GATE   | DC | X'6666'          |
| 0388R | 0383   | C899   | DC | X'383'           |
| 038AR | 4232   | C50    | DC | X'4232', 0       |
|       | 0000   |        |    |                  |
| 038ER | 4110   | C1     | DC | X'4110'          |
| 0390R | 0000   | ZERO   | DC | 0, 0             |
|       | 0000   |        |    |                  |
| 0394R | 4000   | FRGATE | DC | X'4000', X'0000' |

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 3

```

0000
02EA      CLKCNT EQU X'2EA'
02DE      SEC    EQU X'2DE'
003C      CLKINT EQU 60
0398R     TASK6 EQU *
0398R     C8B0    LHI R11,UTOP
           006ER
039CR     40B0    STH R11,TSK6TB+4
           0004R
03A0R     C8B0    LHI R11,TSK6TB
           0000R
03A4R     40B0    STH R11,TSK6TB+6
           0006R
03A8R     41F0    BAL 15,U
           0000F
03ACR     D0C0    STM R12,FORSAY
           161CR

* ZERO ALGORITHM FLAG
03B0R     0700    XHR R0,R0
03B2R     2411    LIS R1,1
03B4R     4000    STH R0,ALGFLG
           0000F
03B8R     4000    STH R0,MAPFLG
           034ER
03BCR     2B00    SER R0,R0
03BER     6000    STE R0,SCETM
           251ER
03C2R     4000    STH R0,SCETIM
           24FCR
03C6R     C820    LHI R2,X'4080'
           4080
03CAR     4020    STH R2,DELTm
           251AR
03CER     4000    STH R0,DELTm+2
           251CR

* ZERO MAP WAIT FLAG
03D2R     07AA    XHR R10,R10
03D4R     24BA    LIS R11,10
03D6R     40B0    STH R11,MAPWT
           0350R
03DAR     C8B0    LHI R11,CRT1DA
           0000F
03DER     C8AB    LHI R10,2(R11)
           0002
03E2R     40A0    STH R10,OUT1
           03ECR

* SET UP CRT PARAMETERS
03E6R     41E0    BAL R14,CNVFP
           2716R
03EAR     03DCR   DC CRT1DA
03ECR     OUT1    DS 2
03EER     6080    STE R8,SOXF
           032AR
03F2R     C8AB    LHI R10,10(R11)
           000A
03F6R     40A0    STH R10,OUT5

```

MINIMUM SCEN INTERVAL = 0.5 SEC

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 4

```

0404R
03FAR 26A2      AIS  R10, 2
03FCR 40A0      STH  R10, OUT5+2
0406R
* SET UP CRT PARAMETERS
0400R 41E0      BAL  R14, CNVFP
0404R 2216R
0404R OUT5      DS    4
0408R 6080      STE  R8, SCYF
033AR
040CR 4000      STH  R0, OLDY
036CR
0410R 4000      STH  R0, OLDY
036ER
0414R C8B0      LHI  R11, X'435'
0435
0418R 07AA      XHR  R10, R10
041AR 4CA0      MH   R10, C899
0388R
041ER C4B0      NHI  R11, X'7FFF'
7FFF
0422R 40B0      STH  R11, II
0382R
* SYSTEM TIMER LOOP
0426R 4820      WAITCK LH  R2, CLKCNT
02EA
042AR 2338      BFBS  3, 8
042CR 4200      NOP
0000
* WAIT FOR SCENARIO INTERVAL
0430R E120      SVC  2, WAITI
0534R
0434R 2207      BFBS  0, 7
0436R 4200      NOP
0000
043AR CLKSET    EDU  *
043AR 4020      STH  R2, CLK1
1E84R
043ER 4020      STH  R2, DELTIM
24FAR
0442R 41D0      BAL  R13, CNVSEC
050ER
0446R 4060      STH  R6, SEC1
1E86R
044AR 4000      NXTIME STH  R0, RESULT      ZERO RESULT ACCUM
0532R
044ER 4850      LH   R5, CLKCNT      LOAD CURR INTERRUPT COUNT
02EA
0452R 41D0      BAL  R13, CNVSEC
050ER
0456R 4560      CLH  R6, SEC1      COMPARE CURR WITH PREV TIME
1E86R
045AR 2333      BFBS  3, 3
045CR 41D0      BAL  R13, SECADJ
049CR
0460R 4550      CLFCHL CLH  R5, CLK1

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 5

```

1E84R
0464R 2323      BFFS  2, 3
0466R C850      SHI   R5, 120
0078
046AR 4870      LH    R7, CLK1
1E84R
046ER 0B75      SHR   R7, R5
0470R 4A70      AH    R7, RESULT
0532R

* CHECK CLOCK INTERVAL
0474R C570      CLHI  R7, CLKINT
0030
0478R 4380      BFC   8, STTSK6
04C0R
047CR C850      LHI   R5, CLKINT
0030
0480R C857      SHI   R5, 1(R7)
0001
0484R 4380      BFC   3, NXTIME
044AR
0488R 0722      XHR   R2, R2
048AR 0835      LHR   R3, R5
048CR 4C20      MH    R2, C8
0370R
0490R 4030      STH   R3, CLKWT
052ER

* WAIT X MILI ISECONDS
0494R E120      SVC   2, WAITM
052AR
0498R 4300      BFC   0, NXTIME
044AR
049CR SECADJ EQU *
049CR 2385      BFFS  8, 5
049ER 4200      NOP
0000
04AZR CA60      AHI   R6, 60
0030
04A6R 4B60      SH    R6, SEC1
1E86R

* IF DIFFERENCE=1?
04AAR C560      CLHI  R6, 1
0001
04AER 0330      BFCR  3, R13
04B0R C876      LHI   R7, -1(R6)
FFFF
04B4R 0766      XHR   R6, R6
04B6R 4C60      MH    R6, ONE20
0576R

* ADJUST SECOND COUNT
04BAR 4070      STH   R7, RESULT
0532R
04BER 0300      BFCR  0, R13
04C0R STTSK6 EQU *
04C0R 6170      AHI   R7, SCETIM
24FCR
04C4R 4070      STH   R7, DELTIM

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 6

```

04C8R 0100          LM   R12, FORSAV
      1610R
04C0R 4880          LH   11, DELTIM
      24FAR
04D0R 6880          LE   8, %C2
      2556R
04D4R 08EB          LHR  R14, R11
04D6R 41F0          BAL  15, W
      0000F
04D8R 2800          LER  0, 0
04DCR 2D08          DER  0, 8
04DER 6000          STE  0, DELTM
      251AR
04E2R 0000          STM  R12, FORSAV
      1610R
04E6R 0700          XHR  R0, R0
04E8R 2411          LIS  R1, 1
04EAR 6800          LE   R0, SCETM
      251ER
04EER 6A00          AF   R0, DELTM
      251AR
      * SAVE SCENARIO TIME
04F2R 6000          STE  R0, SCETM
      251ER
      * CONVERT SECONDS
04F6R 41D0          BAL  R13, CNVSEC
      050ER
04FAR 4060          STH  R6, SEC1
      1E84R
04FER 4850          LH   R5, CLKONT
      02FA
0502R 4050          STH  R5, CLK1
      1E84R
      * SET CURRENT TIME
0506R E120          SVC  2, R0TIME
      2478R
050AR 4300          BFC  0, STTASE
      0578R
050ER              CNVSEC EQU *
      * USES R6-R9
      * CONVERTS ASCII SECONDS TO BINARY
050ER 0788          XHR  R8, R8
0510R 4860          LH   R6, SEC
      02DE
0514R 0896          LHR  R9, R6
0516R 0460          NHI  R6, X'F'
      000F
051AR 0490          NHI  R9, X'F00'
      0F00
051ER 9499          EXGR R9, R9
0520R 4080          MH   R8, TEN
      0530R
      * CONVERT SECONDS
0524R 0A69          AHR  R6, R9
052AR 030D          BFCR 0, R13

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 7

```

0528R      SYNC      DS      2
052AR 000B      WAITM  DC      11, 0
0000
052ER 0000      CLKWT  DC      0
0530R 000A      TEN    DC      10
0532R      RESULT   DS      2
0534R 000B      WAITI  DC      11, 0, 1
0000
0001
053AR 000B      WAITIX DC      11, 0, 9
0000
0009
0540R 000B      WAITC  DC      11, 0, 100
0000
0064
0546R 000C      XII    DC      12
0548R 494E      STASK3  DC      0, INF      , X'202'
5020
2020
0202
0550R 0000      STSTAT  DC      0, 0, 0, 0
0000
0000
0000
0558R 0007      TASKER  DC      7, 20
0014
055CR 5441      DC      0, TASK3 START ERROR
534B
3320
5354
4152
5420
4552
524F
5220
056ER      ERRND    DS      2
0570R 0019      XXV    DC      25
0572R 0003      THREE  DC      3
0574R 0000      ACTFLG  DC      0
0576R 0078      ONE20  DC      120
0578R      STASK    EQU      *
0578R 4100      BAL     R13, SCENAR      START SCENARIO
1E80R

* OUTPUT ACTIVATIONS FOR PREVIOUS PERIOD
057CR 4000      STH     R0, ACTFLG
0574R

* SET UP LOOP
0580R 0830      LHI     R3, ACTSEN
1634R
0584R 0744      XHR     R4, R4
0586R 4850      LH      R5, SENSND
1E8AR
058AR 2751      SIS     R5, 1
058CR 0860      LHI     R6, X'22'
0022
0590R 0C45      MHR     R4, R6

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 8

```

0592R 0846      LHR   R4, R6
0594R 0A53      AHR   R5, R3
                * R4= ZERO
0596R 6840      LE    R4, ZERO
                * NEXT ACTIVATION
059AR          NXTACT EQU  *
059AR 6863      LE    R6, 8(R3)
                0008
059ER 4320      BFC   2, ZR01
                0500R
05A2R 6860      SE    R6, DELTM
                251AR
05A6R 4320      BFC   2, ZR01
                0500R
05AAR 6960      CE    R6, COPS
                0372R
05AER 2125      BTFS  2, 5
05BOR 4200      NOP
                0000
                * ZERO ANTICIPATE FLAG
05B4R D203      STB   R0, 2(R3)
                0002
05B8R 6063      STE   R6, 8(R3)
                0008
05BCR 4300      BFC   0, INCR1
                050ER
05C0R          ZR01 EQU  *
05C0R 6043      STE   R4, 8(R3)
                0008
                * ZERO SENFLG
05C4R D203      STB   R0, 2(R3)
                0002
05C8R 6803      LE    R0, X'14'(R3)
                0014
05CCR 6900      CE    R0, PRGATE      CHECK FOR PROB THRESHOLD
                0394R
05D0R 2187      BTFS  8, 7
05D2R 4200      NOP
                0000
05D6R 4100      BAL   R13, ADDLST
                23AAR
05DAR 4010      STH   R1, ACTFLG
                0574R
                * ZERO PROBABILITY ACCUMULATOR
05DER          INCR1 EQU  *
05DER 6043      STE   R4, X'14'(R3)
                0014
05E2R D203      STB   R0, X'10'(R3)
                001C
05E6R D203      STB   R0, X'10'(R3)
                001D
05EAR D203      STB   R0, X'1E'(R3)
                001E
                * RESTORE CLASSIFICATION TO ZERO
05EER D203      STB   R0, X'1F'(R3)

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 9

```

001F
05F2R 0130      BXLE  R3,NXTACT
05F4R 4880      LH    R8,MAFFLG
05F6R 034ER
05F8R 4580      CLH   R8,MAFWT
05F0R 0350R
05FER 2186      BTFS  8,6
0600R 4200      NOP
0600R 0000
0604R 4000      STH   R0,MAFFLG
0606R 034ER
0608R 2303      BFFS  0,3
* MAP CHECK
060AR 6110      AHM   R1,MAFFLG
0606R 034ER
0608R 4890      LH    R9,ACTFLG
0606R 0574R
0612R 4330      BFC   3,WAIT1
0606R 0630R
0616R 4000      STH   R0,ACTFLG
0606R 0574R
061AR 0890      LHI   R9,X'8000'
0600R 8000
* SYSTEM TASK 3 SYNC
061ER 4090      STH   R9,TSK3OP
0600R 0000F
0622R E160      SVC   6,STACK3
0606R 0548R
0626R 4890      LH    R9,STSTAT
0606R 0550R
062AR 2339      BFFS  3,9
062CR 4200      NOP
0600R 0000
0630R 0690      OHI   R9,X'3030'
0600R 3030
0634R 4090      STH   R9,ERRNO
0606R 056ER
0638R E120      SVC   2,TASKER
0606R 0558R
063CR E120      WAIT1 SVC   2,WAITC
0606R 0540R
0640R 4300      BFC   0,NXTIME
0606R 044AR
0644R          SETUP EQU   *
0644R D060      STM   R6,RSAV1
0606R 0708R
* LOAD CURR OBJECT STRING
0648R D375      LB    R7,1(R5)
0600R 0001
064CR 0766      XHR   R6,R6
064ER 2771      SIS   R7,1
0650R 0880      LHI   R8,STR1GT
0600R 0011
0654R 0C68      MHR   R6,R8
0656R 0A70      AHI   R7,STR1EL
DEVELOP STRING TABLE INDEX

```

```

* LOAD CURR SEG POSITION
065AR 4895      LH      R9,6(R5)
      0006
065ER 2691      AIS     R9,1
066OR 0387      LB      R11,1(R7)
      0001
0664R 0598      CLHR    R9,R11      COMP CURR NO WITH TOTAL NO
0666R 2329      BFFS    2,9
0668R 4200      NOP
      0000
066CR          KILLS    EQU     *
* SET END OF OBJ FLAG
066CR 0215      STB      R1,2(R5)
      0002
067OR 0160      LM       R6,RSBV1
      0708R
0674R 4300      BFC      0,NXT1
      1E82R
* STORE NEW POSITION
0678R 4095      STH      R9,6(R5)
      0006
067CR CA79      AHI      R7,1(R9)      INDEX NEW POSITION BY SEG POSIT ON
      0001
068OR 0397      LB       R9,0(R7)
      0000
0684R 4590      CLH      R9,SEGNUM
      15FAR
0688R 4220      BTC      2,KILLS
      066CR
068CR 0899      LHR      R9,R9
068ER 4330      BFC      3,KILLS
      066CR
* STORE NEW NUMBER
0692R 4095      STH      R9,X'24'(R5)
      0024
0696R 2791      SIS      R9,1
0698R 0788      XHR      R8,R8
069AR 08A0      LHI      R10,X'18'
      0018
069ER 0C8A      MHR      R8,R10
06AOR CA90      AHI      R9,SEGLST      GENERATE SEGMENT INDEX
      114AR
06A4R 6809      LE       R0,0(R9)
      0000
06A6R 4005      STH      R0,X'2F'(R5)
      002E
06A8R 6809      LE       R0,4(R9)
      0004
06BOR 6005      STE      R0,X'10'(R5)
      0010
* SET REMAINING SEG DIST=SEG LEN
* X AND Y COOR INITIALIZATION
06B4R 6809      LE       R0,8(R9)
      0008
06B8R 6829      LF       R2,12(R9)

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 11

```

0000
06BCR 6849      LE      R4, X'10' (R9)
0010
06C0R 6869      LE      R6, X'14' (R9)
0014
06C4R 03A5      LB      R10, 4(R5)
0004
06C8R 08AA      LHR     R10, R10
06CAR 4330      BFC     3, NRVERS
06EAR 0645      STE     R4, 8(R5)
0008
06D2R 6045      STE     R4, X'10' (R5)
0010
06D6R 6065      STE     R6, 12(R5)
000C
06DAR 6065      STE     R6, X'14' (R5)
0014
06DER 6005      STE     R0, X'26' (R5)
0026
06E2R 6025      STE     R2, X'2A' (R5)
002A
06E6R 4300      BFC     0, RET
0702R
06EAR          NRVERS EQU *
06EAR 6005      STE     R0, 8(R5)
0008
06EER 6005      STE     R0, X'10' (R5)
0010
06F2R 6025      STE     R2, 12(R5)
000C
06F6R 6025      STE     R2, X'14' (R5)
0014
06FAR 6045      STE     R4, X'26' (R5)
0026
06FER 6065      STE     R6, X'2A' (R5)
002A
0702R          RET     EQU *
0702R 0160      LM      R6, R5AV1
0708R
0706R 030E      BFCR   0, R14
0708R          R5AV1   DS    24
0720R          OBULST  DS    2600
1148R          OBUNUM  DS    2
114AR          SEGLST  DS    1200
15FAR          SEGNUM  DS    2
15FCR          REGSAV  DS    32
161CR          FORSAV  DS    14
162AR 0000      OBURD   DC    0, 0
0000
162ER 0000      CURGED  DC    0
1630R 0000      CURSEN  DC    0
1632R 0000      CURDJ   DC    0
1634R          ACTSEN  DS    1700
1C08R          STRTEL  DS    2
1C0AR          DS      15

```

STRING IDS + NUMBER OF SEGS  
15 SEGMENTS PER STRING

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 12

```

1CEAR          DS      408      25 STRINGS MAX
0011          STRLGT EQU      17
1E82R          STRND  DS       2
              * TASK CLOCK COUNT
1E84R 0000     CLK1   DC       0
              * TASK SECONDS COUNT
1E86R 0000     SEC1   DC       0
1E88R          SCNFLG DS       2
1E8AR          SENSND DS       2
0022          @SENEH EQU     X'22'
0000          @SEGM  EQU      0
0018          @SEGLT EQU     X'18'
0000          @SENID EQU      0
0032          @OBJMX EQU     X'32'
0000          @OBJND EQU      0
0005          @OBJFG EQU      5
0001          @STRNG EQU      1
0002          @SENGS EQU      2
0004          @SEGL  EQU      4
0003          @SENTF EQU      3
0002          @OBJEN EQU      2
0003          @OBJCL EQU      3
0004          @SENFW EQU      4
001E          @SENTH EQU     X'1E'
0033          @OBJMY EQU     X'33'
0014          @OBJIY EQU     X'14'
0026          @OBJEX EQU     X'26'
0004          @OBJD  EQU      4
0008          @SENRT EQU      8
001F          @SENUK EQU     X'1F'
0008          @SEG1X EQU      8
000C          @SENEX EQU     12
0020          @SENTE EQU     X'20'
0034          @LSTL  EQU     X'34'
001C          @OBJRS EQU     X'1C'
002E          @SEGEL EQU     X'2E'
0008          @OBJCX EQU      8
000C          @SEG1Y EQU     12
0010          @SENSY EQU     X'10'
001D          @SENW  EQU     X'1D'
0006          @SEGFD EQU      6
0024          @SEGND EQU     X'24'
0010          @SEGZX EQU     X'10'
0014          @SENFB EQU     X'14'
0014          @SEGZY EQU     X'14'
0018          @SENRD EQU     X'18'
000C          @OBJCY EQU     12
0010          @OBJIX EQU     X'10'
001C          @SENF  EQU     X'1C'
0018          @OBJVE EQU     X'18'
0020          @OBJST EQU     X'20'
002A          @OBJEY EQU     X'2A'
1E8CR          SCENAR EQU      *
1E8CR 0733     XHR    R3,R3      ZERO OBJECT NUMBER
1E8ER 4000     STH    R0,CLASFG
              0384R

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 13

```

1E92R 4840      LH      R4, OBUNUM
      1148R
1E96R          PROCES EQU      *
1E96R 4000      STH      R0, SCNFLG
      1E88R
1E9AR 2421      LIS      R2, 1
1E9CR 2431      LIS      R3, 1
1E9ER 0850      LHI      R5, OBULST-QLSTL
      06E0R
1EA3R          NXTOBJ EQU      *
1EA3R 0A50      AHI      R5, X'34'
      0034
      * CHECK FOR END OF OBJECT
1EA6R 0385      LB       R8, 2(R5)
      000E
1EAAE 0888      LHR      R8, R8
1EACR 233C      BFFS     3, 12
1EAEH 4200      NOP
      0000
1EB2R          NXT1 EQU      *
1EB2R 0120      BXLE     R2, NXTOBJ
      1EA3R
1EB6R 4820      LH       R3, SCNFLG
      1E88R
1EBAR 4330      BFC      3, ENDSON
      24EEH
1EBER 4000      STH      R0, SCNFLG
      1E88R
1EC2R 0300      BFCR     0, R13
1EC4R 4010      CONT1    STH      R1, SCNFLG
      1E88R
1EC8R 6800      LE       R0, SCETM          LOAD CURR SCEN TIME
      251EH
1ECCR 6905      CE       R0, X'20'(R5)
      0020
1ED0R 4280      BTC      8, NXT1
      1EB2R
1ED4R 0385      LB       R8, 5(R5)
      0005
1ED8R 0888      LHR      R8, R8
1EDAR 2339      BFFS     3, 9
1EDCR 4200      NOP
      0000
      * INITIALIZE CURR SEG POSITION
1EE0R 4005      STH      R0, 6(R5)
      0006
1EE4R 41E0      BAL      R14, SETUP          SET UP WHEN OBJECT STARTS FOR F R5
      0644R
1EE8R 0205      STB      R0, 5(R5)
      0005
1EECR          CONT31 EQU      *
1EECR 6805      LE       R0, X'18'(R5)
      0018
1EF0R 6C00      ME       R0, DELTM
      251AH
1EF4R 6000      STE      R0, CURRD

```

```

252AR
1EF8R 6000      STE  R0, OBJRD
162AR
1EF0R          NXT2 EQU  *
1EF0R 6820      LF   R2, OBJRD
162AR
1F00R 6805      LE   R0, X'10' (R5)
0010
1F04R 2920      CER  R2, R0      COMP OBJ DIST WITH R0 SEG 1ST
1F06R 4220      BTC  Z, NXTSEG
2006R
1F0AR 2802      SER  R0, R2
1F0CR 6005      STE  R0, X'10' (R5)
0010
1F10R 6825      LE   R2, X'2E' (R5)
002E
1F14R 2022      MER  R3, R2
1F16R 6A70      AE   R2, C1
038ER
1F1AR 6020      STE  R2, A      A=1+M**2
252ER
1F1ER 0000      STM  R12, REGSAV
15F0R
1F22R 0100      LM   R12, FORSAV
1610R
1F26R 41F0      BAL  15, SORT
0000F
1F2AR 0004      DC   X'0004'
1F2CR 252ER      DC   A
1F2ER 6000      STE  O, B
2532R

* CONTINUE PROGRAM
1F32R 0000      STM  R12, FORSAV
1610R
1F36R 0100      LM   R12, REGSAV
15F0R
1F3AR 6820      LE   R2, CURRD
252AR
1F3ER 6020      DE   R2, B      R2=CURRD/B
2532R
1F42R 6865      LE   R6, X'2E' (R5)
002E
1F46R 6960      CE   R6, MAXM
0364R
1F4AR 4320      BFC  Z, NOVERT
1F80R
1F4ER 6960      CE   R6, MINM
0368R
1F52R 4280      BTC  8, NOVERT
1F80R
1F56R 6820      LE   R2, CURRD
252AR
1F5AR 6805      LE   R0, X'2A' (R5)
002A
1F5ER 6805      SE   R0, X'14' (R5)
0014

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 15

## \* CHECK FOR MINUS CONDITION

1F62R 2319 BFFS 1, 9  
 1F64R 4200 NOP  
       0000  
 1F68R 48B0 LH R11, 4  
       0004  
 1F6CR C6B0 OHI R11, X'8000'  
       8000  
 1F70R 40B0 STH R11, 4  
       0004

## \* NOT MINUS CONDITION

1F74R 6A25 AF R2, 12(R5)  
       0000  
 1F78R 6025 STE R2, 12(R5)  
       0000  
 1F7CR 4300 BFC 0, OBJMAP  
       1FC6R

## \* NO VERTICAL CALCULATION

1F80R NOVERT EQU \*  
 1F80R 6065 ME R6, X'10' (R5)  
       0010  
 1F84R 6845 LE R4, 12(R5)  
       0000  
 1F88R 6B45 SE R4, X'14' (R5)  
       0014  
 1F8CR 2A64 AER R6, R4  
 1F8ER 6065 ME R6, X'2E' (R5)  
       002E  
 1F92R 6A65 AE R6, 8(R5)  
       0008  
 1F96R 6D60 DE R6, A  
       252ER  
 1F9AR 6805 LE R0, X'26' (R5)  
       0026  
 1F9ER 6B05 SE R0, X'10' (R5)  
       0010  
 1FA2R 2317 BFFS 1, 7  
 1FA4R C8B0 LHI R11, 4  
       0004  
 1FA8R C6B0 OHI R11, X'8000'  
       8000  
 1FACR 40B0 STH R11, 4  
       0004  
 1FB0R 2A62 AER R6, R2  
 1FB2R 6065 STE R6, 8(R5)  
       0008  
 1FB6R 6B65 SE R6, X'10' (R5)  
       0010  
 1FBAR 6065 ME R6, X'2E' (R5)  
       002E  
 1FBER 6A65 AE R6, X'14' (R5)  
       0014  
 1FC2R 6065 STE R6, 12(R5)  
       0000

## \* OBJECT MAP CALCULATIONS

1FC6R OBJMAP EQU \*

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 16

|                     |     |               |
|---------------------|-----|---------------|
| 1FC6R 4880          | LH  | R8, MAPFLG    |
| 034ER               |     |               |
| 1FCAR 4580          | CLH | R8, MAPWT     |
| 0350R               |     |               |
| 1FCER 4280          | BTC | 8, SENCAL     |
| 20D4R               |     |               |
| 1FD2R 6805          | LE  | R0, 8(R5)     |
| 0008                |     |               |
| 1FD6R 6B00          | SE  | R0, SCXF      |
| 032AR               |     |               |
| 1FDAR 4210          | BTC | 1, SENCAL     |
| 20D4R               |     |               |
| * CONVERT TO BINARY |     |               |
| 1FDER 41E0          | BAL | R14, CNVBI    |
| 2290R               |     |               |
| 1FE2R 034AR         | DC  | XLDC          |
| 1FE4R 4890          | LH  | R9, XLDC      |
| 034AR               |     |               |
| 1FE8R 4210          | BTC | 1, SENCAL     |
| 20D4R               |     |               |
| * CRT 1 CONSTANTS   |     |               |
| 1FE0R 08B0          | LHI | R11, CRT1DA   |
| 03EAR               |     |               |
| 1FF0R 459B          | CLH | R9, RX(R11)   |
| 0004                |     |               |
| 1FF4R 4220          | BTC | 2, SENCAL     |
| 20D4R               |     |               |
| 1FF8R 4BFB          | SH  | R9, XR(R11)   |
| 0008                |     |               |
| 1FFLR 0788          | XHR | R8, R8        |
| 1FFER 4DEB          | DH  | R8, INCX(R11) |
| 0006                |     |               |
| 2002R 0790          | XHI | R9, X'7F'     |
| 007F                |     |               |
| 2006R 0490          | NHI | R9, X'7F'     |
| 007F                |     |               |
| 200AR 0290          | STB | R9, XLDC      |
| 034AR               |     |               |
| 200ER 6805          | LE  | R0, 12(R5)    |
| 000C                |     |               |
| 2012R 6B00          | SE  | R0, SCYF      |
| 033AR               |     |               |
| 2016R 4210          | BTC | 1, SENCAL     |
| 20D4R               |     |               |
| * CONVERT TO BINARY |     |               |
| 201AR 41E0          | BAL | R14, CNVBI    |
| 2290R               |     |               |
| 201ER 0340R         | DC  | YLDC          |
| 2020R 4890          | LH  | R9, YLDC      |
| 0340R               |     |               |
| 2024R 4210          | BTC | 1, SENCAL     |
| 20D4R               |     |               |
| 2028R 459B          | CLH | R9, RY(R11)   |
| 000F                |     |               |
| 202LR 4210          | BTC | 2, SENCAL     |
| 20D4R               |     |               |

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 17

## \* Y CALCULATIONS

|            |     |                 |
|------------|-----|-----------------|
| 2030R 4E9B | SH  | R9, YR(R11)     |
| 0012       |     |                 |
| 2034R 0788 | XHR | R8, R8          |
| 2036R 4D8B | DH  | R8, INCY(R11)   |
| 0010       |     |                 |
| 203AR 0880 | LHI | R8, 19          |
| 0013       |     |                 |
| 203ER 0B89 | SHR | R8, R9          |
| 2040R 0780 | XHI | R8, X*7F'       |
| 007F       |     |                 |
| 2044R 0480 | NHI | R8, X*7F'       |
| 007F       |     |                 |
| 2048R 0485 | CLB | R8, X*33' (R5)  |
| 0033       |     |                 |
| 2040R 4230 | BTC | 3, TRYX         |
| 206ER      |     |                 |
| 2050R 03A0 | LB  | R10, XLOC       |
| 034AR      |     |                 |
| 2054R 0305 | LB  | R12, X*32' (R5) |
| 0032       |     |                 |
| 2058R 0BAC | SHR | R10, R12        |
| 205AR 09A0 | CHI | R10, 3          |
| 0003       |     |                 |
| 205ER 4230 | BTC | 2, OUTLOC       |
| 209AR      |     |                 |
| 2062R 09A0 | CHI | R10, -3         |
| FFFF       |     |                 |
| 2066R 4280 | BTC | 8, OUTLOC       |
| 209AR      |     |                 |
| 206AR 4300 | BFC | 0, SENDAL       |
| 20D4R      |     |                 |

## \* TRY X CALCULATION

|            |      |                 |          |
|------------|------|-----------------|----------|
| 206ER 0390 | TRYX | LB              | R9, XLOC |
| 034AR      |      |                 |          |
| 2072R 0495 | CLB  | R9, X*32' (R5)  |          |
| 0032       |      |                 |          |
| 2076R 4230 | BTC  | 3, OUTLOC       |          |
| 209AR      |      |                 |          |
| 207AR 08A8 | LHR  | R10, R8         |          |
| 2070R 0305 | LB   | R12, X*33' (R5) |          |
| 0033       |      |                 |          |
| 2080R 0BAC | SHR  | R10, R12        |          |
| 2082R 09A0 | CHI  | R10, 1          |          |
| 0001       |      |                 |          |
| 2086R 212A | BTFS | 2, 10           |          |
| 2088R 4200 | NOP  |                 |          |
| 0000       |      |                 |          |
| 2080R 09A0 | CHI  | R10, -1         |          |
| FFFF       |      |                 |          |
| 2090R 2185 | BTFS | 8, 5            |          |
| 2092R 4200 | NOP  |                 |          |
| 0000       |      |                 |          |
| 2096R 4300 | BFC  | 0, SENDAL       |          |
| 20D4R      |      |                 |          |

## \* OUTPUT LOCATION

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 18

|       |       |        |      |                  |                                    |
|-------|-------|--------|------|------------------|------------------------------------|
| 209AR |       | OUTLOC | EOU  | *                |                                    |
| 209AR | D285  |        | STB  | R8, X'33' (R5)   |                                    |
|       | 0033  |        |      |                  |                                    |
| 209ER | D280  |        | STB  | R8, MAPBUF+2     |                                    |
|       | 035ER |        |      |                  |                                    |
| 20A2R | D380  |        | LB   | R8, XL0C         |                                    |
|       | 034AR |        |      |                  |                                    |
| 20A6R | D285  |        | STB  | R8, X'32' (R5)   |                                    |
|       | 0032  |        |      |                  |                                    |
| 20AAR | D280  |        | STB  | R8, MAPBUF+1     |                                    |
|       | 035DR |        |      |                  |                                    |
| 20AER | D385  |        | LB   | R8, 3(R5)        |                                    |
|       | 0003  |        |      |                  |                                    |
| 20B2R | D388  |        | LB   | R8, OBJTEL-1(R8) |                                    |
|       | 20C1R |        |      |                  |                                    |
| 20B6R | D280  |        | STB  | R8, MAPBUF+3     |                                    |
|       | 035FR |        |      |                  |                                    |
| 20BAR | E110  |        | SVC  | 1, OBJLOC        |                                    |
|       | 0352R |        |      |                  |                                    |
| 20BER | 4300  |        | BFC  | 0, SENDAL        |                                    |
|       | 20D4R |        |      |                  |                                    |
| 20C2R | 2E3A  | OBJTEL | DC   | X'2E3A', X'2200' |                                    |
|       | 2200  |        |      |                  |                                    |
| 20C6R | 2E20  | NXTSEG | SER  | R2, R0           |                                    |
| 20C8R | 6020  |        | STE  | R2, OBJRD        | SAVE REMAINING DISTANCE            |
|       | 162AR |        |      |                  |                                    |
| 20CCR | 41E0  |        | BAL  | R14, SETUP       | SET UP NEW OBJECT LIST FOR NEXT SE |
|       | 0644R |        |      |                  |                                    |
| 20DOR | 4300  |        | BFC  | 0, NXT2          |                                    |
|       | 1EF0R |        |      |                  |                                    |
| 20D4R |       | SENDAL | EOU  | *                |                                    |
| 20D4R | 0870  |        | LHI  | R7, ACTSEN       |                                    |
|       | 1634R |        |      |                  |                                    |
| 20D8R | 0788  |        | XHR  | R8, R8           |                                    |
| 20DAR | 4890  |        | LH   | R9, SENSNO       |                                    |
|       | 1E8AR |        |      |                  |                                    |
| 20DER | 2791  |        | SIS  | R9, 1            |                                    |
| 20EOR | 08A0  |        | LHI  | R10, X'22'       |                                    |
|       | 0022  |        |      |                  |                                    |
| 20E4R | 0C8A  |        | MHR  | R8, R10          |                                    |
| 20E6R | 088A  |        | LHR  | R8, R10          |                                    |
| 20E8R | 0A97  |        | AHR  | R9, R7           |                                    |
| 20EAR |       | NXTSEN | EOU  | *                |                                    |
| 20EAR | D3A7  |        | LB   | R10, 2(R7)       |                                    |
|       | 0002  |        |      |                  |                                    |
| 20EFR | 08AA  |        | LHR  | R10, R10         |                                    |
| 20FOR | 4230  |        | BTC  | 3, NXTVAL        |                                    |
|       | 2206R |        |      |                  |                                    |
| 20F4R |       | CONT7  | EOU  | *                |                                    |
| 20F4R | 6807  |        | LE   | R0, X'18' (R7)   |                                    |
|       | 0018  |        |      |                  |                                    |
| 20F8R | D3A5  |        | LB   | R10, 3(R5)       |                                    |
|       | 0003  |        |      |                  |                                    |
| 20FOR | 05A0  |        | CLHI | R10, 1           | IS OBJECT PERSONNEL?               |
|       | 0001  |        |      |                  |                                    |
| 2100R | 2134  |        | BTPS | 3, 4             |                                    |

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 19

```

2102R 6800      LE      R0, C50
      038AR
2106R 2306      BFFS    0, 6
2108R 05A0      CLHI    R10, 2      IS OBJECT WHEEL
      0002
210CR 2133      BTFS    3, 3
210ER 6C00      ME      R0, C0F6
      0376R
2112R 6885      LE      R8, 8(R5)
      0008
2116R 6B87      SE      R8, 12(R7)
      000C
211AR 48B0      LH      R11, X'10'
      0010
211ER 04B0      NHI     R11, X'7FFF'  ABSOLUTE VAL OF FP R8
      7FFF
2122R 40B0      STH     R11, X'10'
      0010
2126R 2980      CER     R8, R0
2128R 4220      BTC     2, NXTVAL
      2206R
212CR 68A5      LE      R10, 12(R5)
      000C
2130R 6BA7      SE      R10, 16(R7)
      0010
2134R 48B0      LH      R11, X'14'
      0014
2138R 04B0      NHI     R11, X'7FFF'
      7FFF
213CR 40B0      STH     R11, X'14'
      0014
2140R 29A0      CER     R10, R0
2142R 4220      BTC     2, NXTVAL
      2206R
      * SAVE DETECTION RADIUS
2146R 6000      STE     R0, DETRAD
      2546R
214AR 40A0      STH     R10, OBJTP
      220ER
214ER 2088      MER     R8, R8
2150R 20AA      MER     R10, R10
2152R 2A8A      AER     R8, R10
2154R 6080      STE     R8, W
      24FER
2158R 03A7      LB      R10, 3(R7)
      0003
215CR 08AA      LHR     R10, R10
215ER 2333      BFFS    3, 3
2160R 4010      STH     R1, CLASFG
      0384R
      * SET UP CALCULATION
2164R          CONT9   EQU    *
2164R 00C0      STG     R12, REGSAV
      15FCR
2168R 01C0      LM      R12, FURSAV
      161CR

```

# TACTICAL SITUATION SIMULATION PROGRAM

PAGE 20

|                                   |      |               |                            |
|-----------------------------------|------|---------------|----------------------------|
| 216CR 41FO                        | BAL  | 15, SORT      |                            |
| 1F28R                             |      |               |                            |
| 2170R 0004                        | DC   | X'0004'       |                            |
| 2172R 24FER                       | DC   | W             |                            |
| 2174R 6000                        | STE  | 0, SENOBD     |                            |
| 254AR                             |      |               |                            |
| 2178R D0C0                        | STM  | R12, FORSAV   |                            |
| 161CR                             |      |               |                            |
| 217CR D1C0                        | LM   | R12, REGSAV   |                            |
| 15FCR                             |      |               |                            |
| * CHECK SENSOR TO OBJECT DISTANCE |      |               |                            |
| 2180R 6860                        | LE   | R6, DETRAD    |                            |
| 2546R                             |      |               |                            |
| 2184R 6960                        | CE   | R6, SENOBD    |                            |
| 254AR                             |      |               |                            |
| 2188R 4280                        | BTC  | 8, NXTVAL     |                            |
| 2206R                             |      |               |                            |
| 218CR 6800                        | LF   | R0, C1        |                            |
| 038ER                             |      |               |                            |
| * CHECK PROBABILITY THRESHOLD     |      |               |                            |
| 2190R 6900                        | CE   | R0, PRGATE    |                            |
| 0394R                             |      |               |                            |
| 2194R 4280                        | BTC  | 8, NXTVAL     |                            |
| 2206R                             |      |               |                            |
| 2198R 6827                        | LE   | R3, X 14 (R7) |                            |
| 0014                              |      |               |                            |
| 219CR 2A20                        | AFR  | R3, R0        |                            |
| 219ER 6027                        | STE  | R3, X 14 (R7) |                            |
| 0014                              |      |               |                            |
| * CHECK TYPE                      |      |               |                            |
| 21A2R 48A0                        | LH   | R10, CLASFG   |                            |
| 0384R                             |      |               |                            |
| 21A6R 4880                        | BFC  | 8, NXTVAL     |                            |
| 2206R                             |      |               |                            |
| 21AA6 4000                        | STH  | R0, CLASFG    |                            |
| 0384R                             |      |               |                            |
| 21AER 07AA                        | XHR  | R10, R10      |                            |
| 21B0R 48B0                        | LH   | R11, II       |                            |
| 0382R                             |      |               |                            |
| 21B4R 4CA0                        | MH   | R10, 0899     |                            |
| 0388R                             |      |               |                            |
| 21B8R 04D0                        | NHI  | R11, X'7FFF'  |                            |
| 7FFF                              |      |               |                            |
| 21BCR 40D0                        | STH  | R11, II       |                            |
| 0382R                             |      |               |                            |
| 21C0R 45D0                        | CLH  | R11, GATE     |                            |
| 0386R                             |      |               |                            |
| 21C4R 212A                        | BTFB | 2, 10         |                            |
| 21C6R 4200                        | NDF  |               |                            |
| 0000                              |      |               |                            |
| 21CAR 08A0                        | LHI  | R10, X 1B'    |                            |
| 001B                              |      |               |                            |
| 21CER 4AA0                        | AR   | R10, DBJF     | SET CORRECT CLASSIFICATION |
| 2206R                             |      |               |                            |
| 21D2R 0AA7                        | ANR  | R10, R7       |                            |
| 21D4R 4300                        | BFC  | 0, STOREC     |                            |

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 21

```

21FCR
21D8R 48B0      FALSEC  LH      R11,OBJTP
220ER
21DCR 27B1      SIS      R11,1
21DER 07AA      XHR      R10,R10
21E0R 4CA0      MH       R10,L05
21E4R 48A0      LH       R10,II
21E8R 0382R
21E8R 04A0      NHI      R10,2
21ECR 90A1      SRLS     R10,1
21EER 0AAR      AHR      R10,R11
21FOR 03CA      LB       R12,FALTEL(R10)  FETCH FALSE CLASSIFICATION
2210R
21F4R 08A0      LHI      R10,X'1B'
21F8R 0AAC      AHR      R10,R12
21FAR 0AA7      AHR      R10,R7
21FCR 033A      STORED  LR      R3,0(R10)
2200R 2631      AIS      R3,1
2202R 023A      STB      R3,0(R10)      STORE NEW COUNT
2206R 0170      NXTVAL  BXLE   R7,NXTSEN
220AR 4300      BFC      0,NXT1
220ER 1EB2R
2210R 0203      OBJTP   DS      2      OBJECT TYPE
2210R 0103      FALTEL  DC      X'203',X'103',X'102'
2216R 0102
2216R 0060      CNVFP   EQU     *
2284R 2467      STM     R6,SUBSAV
221AR 2467      LIS     R6,7
221CR 488E      LH      R8,0(R14)
2220R 0000      LH      R8,0(R8)
2224R 489E      LH      R9,2(R14)
2228R 0002      LH      R9,0(R9)
2228R 4899      * SET UP
222CR 0480      NHI      R8,X'FF'
2230R 00FF
2230R 07AA      XHR      R10,R10
2232R 076B      XHR      R11,R11
2234R 0808      * NEXT TRY
2234R 0808      NXTTRY  LHR      R12,R8
2236R 2761      SIS      R6,1
2238R 4330      BFC      3,ERROR
2265R
223CR 90C4      SRLS     R12,4
223ER 080C      LHR      R12,R12

```

TACTICAL SITUATION SIMULATION PROGRAM

|            |     |           |
|------------|-----|-----------|
| 2240R 4230 | BTC | 3, OREXIT |
| 2240R      |     |           |
| 2244R E680 | RLL | R8, 4     |
| 0004       |     |           |
| 2248R 4300 | BFC | 0, NXTTRY |
| 2234R      |     |           |

PAGE 22

\* OR EXIT PATH

|            |        |            |   |
|------------|--------|------------|---|
| 2240R      | OREXIT | EDU        | * |
| 2240R 0660 | OHI    | R6, X'40'  |   |
| 0040       |        |            |   |
| 2250R 9466 | EXBR   | R6, R6     |   |
| 2252R 06A6 | OHR    | R10, R6    |   |
| 2254R 06A8 | OHR    | R10, R8    |   |
| 2256R 06B9 | OHR    | R11, R9    |   |
| 2258R 40A0 | STH    | R10, X'10' |   |
| 0010       |        |            |   |
| 2250R 40B0 | STH    | R11, X'12' |   |
| 0012       |        |            |   |
| 2260R 0160 | LM     | R6, SUBSAV |   |
| 2284R      |        |            |   |
| 2264R 430E | BFC    | 0, 4(R14)  |   |
| 0004       |        |            |   |

\* ERROR ROUTINE

|            |       |         |                            |
|------------|-------|---------|----------------------------|
| 2268R E120 | ERROR | SVC     | 2, CERR                    |
| 2270R      |       |         |                            |
| 2260R 4300 | BFC   | 0, EQU1 |                            |
| 24F2R      |       |         |                            |
| 2270R 0007 | CERR  | DC      | 7, 16, C'CONVERSION ERROR' |
| 0010       |       |         |                            |
| 434F       |       |         |                            |
| 4E56       |       |         |                            |
| 4552       |       |         |                            |
| 5349       |       |         |                            |
| 4F4E       |       |         |                            |
| 2045       |       |         |                            |
| 5252       |       |         |                            |
| 4F52       |       |         |                            |

|            |            |           |            |
|------------|------------|-----------|------------|
| 2284R      | SUBSAV     | DS        | 24         |
| 2290R      | CONVBI     | EQU       | *          |
| 2290R 0060 | STH        | R6, SUB2S |            |
| 2392R      |            |           |            |
| 22A0R 0700 | XHR        | R0, R0    |            |
| 22A2R 0700 | XHR        | R12, R12  |            |
| 22A4R 03A0 | LB         | R10, 0    |            |
| 0000       |            |           |            |
| 22A8R 2501 | LCS        | R13, 1    |            |
| 22AAR 04A0 | NHI        | R10, X'F' |            |
| 000F       |            |           |            |
| 22AER 40A0 | STH        | R10, EXP  |            |
| 2390R      |            |           |            |
| 22B2R 03B0 | LB         | R11, 1    |            |
| 0001       |            |           |            |
| 22B6R 90B4 | SRLS       | R11, 4    |            |
|            |            |           |            |
| 22B8R 41F0 | * FACTOR 1 | BAL       | R15, CALFA |
| 2350R      |            |           |            |

TACTICAL SITUATION SIMULATION PROGRAM

|            |       |             |
|------------|-------|-------------|
| 22BCR 07AA | XHR   | R10, R10    |
| 22BER 4CA0 | MH    | R10, FACTOR |
| 238ER      |       |             |
| 22C2R 0ACB | AHR   | R12, R11    |
| 22C4R 61D0 | AHM   | R13, EXP    |
| 239OR      |       |             |
| 22C8R 4330 | BFC   | 3, EXIT55   |
| 234CR      |       |             |
| 22C0R 03B0 | LB    | R11, 1      |
| 0001       |       |             |
| 22D0R 04B0 | NHI   | R11, X'F'   |
| 000F       |       |             |
| * FACTOR 2 |       |             |
| 22D4R 41F0 | BAL   | R15, CALFA  |
| 235CR      |       |             |
| 22D8R 07AA | XHR   | R10, R10    |
| 22DAR 4CA0 | MH    | R10, FACTOR |
| 238ER      |       |             |
| 22DER 0ACB | AHR   | R12, R11    |
| 22E0R 61D0 | AHM   | R13, EXP    |
| 239OR      |       |             |
| 22E4R 4330 | BFC   | 3, EXIT55   |
| 234CR      |       |             |
| 22E8R 03B0 | LB    | R11, 2      |
| 0002       |       |             |
| 22E0R 90B4 | SRI S | R11, 4      |
| * FACTOR 3 |       |             |
| 22EER 41F0 | BAL   | R15, CALFA  |
| 235CR      |       |             |
| 22F2R 07AA | XHR   | R10, R10    |
| 22F4R 4CA0 | MH    | R10, FACTOR |
| 238ER      |       |             |
| 22FER 0ACB | AHR   | R12, R11    |
| 22FAR 61D0 | AHM   | R13, EXP    |
| 239OR      |       |             |
| 22FER 4330 | BFC   | 3, EXIT55   |
| 234CR      |       |             |
| 2302R 03B0 | LB    | R11, 2      |
| 0002       |       |             |
| 2306R 04B0 | NHI   | R11, X'F'   |
| 000F       |       |             |
| * FACTOR 4 |       |             |
| 230AR 41F0 | BAL   | R15, CALFA  |
| 235CR      |       |             |
| 230ER 07AA | XHR   | R10, R10    |
| 2310R 4CA0 | MH    | R10, FACTOR |
| 238ER      |       |             |
| 2314R 0ACB | AHR   | R12, R11    |
| 2316R 61D0 | AHM   | R13, EXP    |
| 239OR      |       |             |
| 231AR 4330 | BFC   | 3, EXIT55   |
| 234CR      |       |             |
| 231ER 03B0 | LB    | R11, 3      |
| 0003       |       |             |
| 2322R 90B4 | SRI S | R11, 4      |
| * FACTOR 5 |       |             |

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 24

```

2324R 41F0      BAL      R15, CALFA
      235LR
2328R 07AA      XHR      R10, R10
232AR 4CA0      MH       R10, FACTOR
      238FR
232ER 0ACB      AHR      R12, R11
2330R 61D0      AHM      R13, EXP
      2390R
2334R 4330      BFC      3, EXIT55
      234CR
2338R D3B0      LR       R11, 3
      0003
233CR 04B0      NHI      R11, X'F'
      000F
2340R 41F0      BAL      R15, CALFA
      235CR
2344R 07AA      XHR      R10, R10
2346R 4CA0      MH       R10, FACTOR
      238ER
234AR 0ACB      AHR      R12, R11
      * EXIT SUBPROGRAM
234CR          EQU      *
EXIT55      LH       R11, 0(R14)
      43FE
      0000
2350R 40CB      STH      R12, 0(R11)
      0000
2354R D160      LM       R6, SUB25
      2392R
2358R 430E      BFC      0, 2(R14)
      0002
      * CALCULATE FACTOR
235CR          EQU      *
CALFA      LIS      R1, 1
      2411
      4010
      238ER
2362R 4880      LH       R8, EXP
      2390R
      2781
2364R          SIS      R8, 1
2368R 033F      BFCR     3, R15
236AR 0870      LHI      R7, 16
      0010
236ER 2781      SIS      R8, 1
2370R 233B      BFFS     3, 11
2372R 4200      NOP
      0000
      NEXT16 EQU      *
2376R          XHR      R6, R6
2376R 0766      MH       R6, SIXTNN
2378R 4060
      238CR
237CR 2781      SIS      R8, 1
237ER 233B      BFFS     3, 3
2380R 2205      BFFS     0, 5
2382R 4200      NOP
      0000
      NEXT17 EQU      *
2384R          STH      R7, FACTOR
2386R 4070

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 25

```

238ER
238AR 030F      BFCR  0, R15
238CR 0010      SIXTNN DC    16
238ER          FACTOR DS    2
2390R          EXP   DS    2
2392R          SUB2S DS    24
000B          WORK1 EQU    11
000C          WORK  EQU    12
23AAR          ADDLST EQU    *
23AAR 0000      STM    R0, REG5AV
          15FCR
23AER 0303      LB     WORK, 0(R3)
          0000
23B2R 40C0      STH    WORK, L0
          2484R
          * LOAD ID VALUE IN HEX
23B6R 0303      LB     WORK, 1(R3)
          0001
23BAR 41A0      BAL    R10, INDEX
          248AR
23BER 0383      LB     R8, 3(R3)
          0003
23C2R 0888      LHR    R8, R8
23C4R 2136      BTFS   3, 6
23C6R 4200      NOP
          0000
23CAR 0788      XHR    R8, R8
23CCR 4300      BFC    0, ADDRESS
          23FCR
          * CHECK FOR DATA TYPE
23D0R 0383      LB     R8, X'1E'(R3)
          001E
23D4R 0888      LHR    R8, R8
23D6R 2334      BFFS   3, 4
23D8R 2483      LIS    R8, 3
23DAR 4300      BFC    0, EEND
          23F8R
23DER 0383      LB     R8, X'1D'(R3)
          001D
23E2R 0888      LHR    R8, R8
23E4R 2333      BFFS   3, 3
23E6R 2482      LIS    R8, 2
23E8R 2308      BFFS   0, 8
23EAR 0383      LB     R8, X'1C'(R3)
          001C
23EER 0888      LHR    R8, R8
23FOR 2333      BFFS   3, 3
23F2R 2481      LIS    R8, 1
23F4R 2302      BFFS   0, 2
23F6R 0788      XHR    R8, R8
23F8R          EEND   EQU    *
23F8R 0A80      AHI    R8, 52          ADJUST DATA
          0034
23FCR 940C      ADDRESS EXBR  WORK, WORK          SHIFT DATA
23FER 0608      OHR    WORK, R8
2400R 9102      SLLS   WORK, 2

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 26

|            |      |             |                      |
|------------|------|-------------|----------------------|
| 2402R 4000 | STH  | WORK, DATA  | SAVE DATA            |
| 2406R 4890 | LH   | R9, TIME    |                      |
| 2408R 9389 | LBR  | R8, R9      |                      |
| 240CR 0490 | NHI  | R9, X'F00'  |                      |
| 2410R 9194 | SLLS | R9, 4       |                      |
| 2412R 0480 | NHI  | R8, X'F'    |                      |
| 2416R 9488 | EXBR | R8, R8      |                      |
| 2418R 0698 | QHR  | R9, R8      | 1ST BYTE R9 HAS HR   |
| 241AR D380 | LB   | R8, TIME+4  |                      |
| 241ER 0480 | NHI  | R8, X'F'    |                      |
| 2422R 0698 | QHR  | R9, R8      | LS BIT MIN SET       |
| 2424R D380 | LB   | R8, TIME+3  |                      |
| 2428R 0480 | NHI  | R8, X'F'    |                      |
| 242CR 9184 | SLLS | R8, 4       |                      |
| 242ER 0698 | QHR  | R9, R8      | MS BIT MIN SET       |
| 2430R 4090 | STH  | R9, TIME1   | SAVE MS BITS OF TIME |
| 2434R 4890 | LH   | R9, TIME+6  |                      |
| 2438R 9389 | LBR  | R8, R9      |                      |
| 243AR 0490 | NHI  | R9, X'F00'  |                      |
| 243ER 9194 | SLLS | R9, 4       |                      |
| 2440R 0480 | NHI  | R8, X'F'    |                      |
| 2444R 9488 | EXBR | R8, R8      |                      |
| 2446R 0698 | QHR  | R9, R8      |                      |
| 2448R 4870 | LH   | R7, LU      | GET LU               |
| 244CR 4880 | LH   | R8, DATA    | GET DATA             |
| 2450R 4800 | LH   | WORK, TIME1 | GET TIME1            |
| 2454R 6570 | ABL  | R7, INFO    |                      |
| 2458R 6580 | ABL  | R8, INFO    |                      |
| 245CR 6500 | ABL  | WORK, INFO  |                      |
| 2460R 6590 | ABL  | R9, INFO    | ADD SEC00            |
| 2464R 2411 | LIS  | R1, 1       |                      |
| 2466R D213 | STB  | R1, 2(R3)   |                      |
| 2468R D100 | LM   | R0, REG5AV  |                      |
| 246ER 6503 | LE   | R0, 4(R3)   |                      |

\* SET SENSOR FLAG

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 27

```

0004
2472R 6003          STE   R0,8(R3)
0008
2476R 030D          BFOR   0,R13
2478R 0008          ROTIME DC   8,TIME
247CR
247CR          TIME   DS    8
2484R          LU     DS    2
2486R          DATA  DS    2
2488R          TIME1  DS    2
248AR          INDEX  EQU    *
248AR 2701          SIS   WORK,1          ID-1
248CR 080C          LHI   WORK,CNVTAB(WORK)
2496R
2490R 030C          LB     WORK,0(WORK)    FETCH INDEX
0000
2494R 030A          BFOR   0,R10
2496R          CNVTAB EQU    *
2496R 1516          DC     X'1516'
2498R 1719          DC     X'1719'
249AR 1A1B          DC     X'1A1B'
249CR 101E          DC     X'101E'
249ER 1FFF          DC     X'1FFF'
24A0R 2526          DC     X'2526'
24A2R 2729          DC     X'2729'
24A4R 2A2B          DC     X'2A2B'
24A6R 202E          DC     X'202E'
24A8R 2FFF          DC     X'2FFF'
24AAR 3536          DC     X'3536'
24ACR 3739          DC     X'3739'
24AER 3A3B          DC     X'3A3B'
24BOR 303E          DC     X'303E'
24B2R 3FFF          DC     X'3FFF'
24B4R 0506          DC     X'506'
24B6R 0709          DC     X'709'
24B8R 0A0B          DC     X'A0B'
24BAR 0D0E          DC     X'D0E'
24BCR 0FFF          DC     X'FFF'
24BER 1112          DC     X'1112'
24BOR 1321          DC     X'1321'
24C2R 2223          DC     X'2223'
24C4R 3132          DC     X'3132'
24C6R 33FF          DC     X'33FF'
24C8R 1418          DC     X'1418'
24CAR 1C24          DC     X'1C24'
24CCR 282C          DC     X'282C'
24CER 3438          DC     X'3438'
24D0R 3CFF          DC     X'3CFF'
24D2R 0102          DC     X'102'
24D4R 0304          DC     X'304'
24D6R 080C          DC     X'80C'
24D8R 1020          DC     X'1020'
24DAR 30FF          DC     X'30FF'
24DCR 0000          DC     0
24DER 0007          ENSCEN DC   7,12,0,END SCENARIO
000C

```

## TACTICAL SITUATION SIMULATION PROGRAM

PAGE 28

```

454E
4420
5343
454E
4152
494F
24EER E120  ENDSOEN SVC 2, ENSOEN
240ER
24F2R EQU1 EQU *
24F2R D100 LM RO, FORSAV
1610R
24F6R EXTRN .V
24F6R 41F0 BAL 15, .V
0000F
24FAR DELTM DS 2
24FLR SCETIM DS 2
24FER W DS 4
2502R X DS 4
2506R Y DS 4
250AR INITSX DS 4
250ER INITSY DS 4
2512R CURRX DS 4
2516R CURRY DS 4
251AR DELTM DS 4
251ER SCETM DS 4
2522R ENDX DS 4
2526R ENDY DS 4
252AR CURRD DS 4
252ER A DS 4
2532R B DS 4
2536R C DS 4
253AR D DS 4
253ER SENSX DS 4
2542R SENSY DS 4
2546R DETRAD DS 4
254AR SENOB0 DS 4
254ER ACTPRB DS 4
2552R CURRM DS 4
2556R 4278 $CZ DC X'4278', X'0000'
0000
255AR END

```

U.S. GOVERNMENT PRINTING OFFICE: 1981 - 703-073/FM-C-48-81

**DATE**  
**FILME**