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APPENDIX 21

DATA RECORDING WITH STE

FINAL SOFTWARE REPORT

DATA ITEM NO. A005

INTEGRATED ELECTRONIC WARFARE SYSTEM ADVANCED DEVELOPMENT MODEL (ADM)

PREPARED FOR:

NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PENNSYLVANIA

CONTRACT N62269-75-C-0070

RAYTHEON
ELECTROMAGNETIC SYSTEMS DIVISION

1 OCTOBER 1977

APPENDIX 21

DATA RECORDING

FINAL SOFTWARE REPORT

DATA ITEM A005

INTEGRATED ELECTRONIC WARFARE SYSTEM (IEWS) ADVANCED DEVELOPMENT MODEL (ADM)

Contract No. N62269-75-C-0070

Prepared for:

Naval Air Development Center
Warminister, Pennsylvania

Prepared by:

RAYTHEON COMPANY
Electromagnetic Systems Division
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1 OCTOBER 1977

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Data Recording

FUNCTION	APPROVED	DATE	FUNCTION	APPROVED	DATE
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TABLE OF CONTENTS

I. INTRODUCTION

THE DATA RECORDING PROGRAM IS DESIGNED TO PERFORM THE FOLLOWING TASKS:

A) STORE SYSTEM CONTROLLER DATA MESSAGES

B) SELECTIVELY OUTPUT RECEIVED DATA

C) SEND COMMANDS TO THE SYSTEM CONTROLLER

D) SIMULATE THE INS

II. PROGRAM DESCRIPTION

THE DATA EXTRACTION PROGRAM CONSISTS OF FOUR SETS OF ROUTINES:

A) PROCESSOR 1 ROUTINES

B) PROCESSOR 2 ROUTINES

C) COMMON UTILITY ROUTINES

D) DATA BASE

PROCESSOR 1 PROVIDES THE COMMUNICATIONS WITH THE OPERATOR AND I/O DEVICES. IT ALSO DOES THE CONVERSION OF INFORMATION FROM BINARY TO ASC II AND THE FORMATTING OF THIS DATA.

PROCESSOR 2 PROVIDES THE COMMUNICATIONS WITH THE SYSTEM CONTROLLER.

COMMON UTILITY ROUTINES ARE SHARED BY BOTH PROCESSORS AND PROVIDE THE DATA MANAGEMENT FUNCTION.

DATA BASE CONTAINS THE FLAGS, MESSAGES, POINTERS, BUFFERS AND TABLES FOR THE PROGRAM. THE FLAGS ENABLE THE CONTROL ROUTINES USED FOR DATA STORAGE. THE MESSAGES ARE THE ERROR MESSAGES AND OPERATOR ALERTS. THE POINTERS PROVIDE THE SHORT AND LONG BLOCK FREE QUEUES AND THE FIVE QUEUES USED FOR INTERPROCESSOR COMMUNICATIONS:

A) RAW DATA QUEUE
B) DISPLAY DATA QUEUE
C) LIST DATA QUEUE
D) RECORD DATA QUEUE
E) COMMAND QUEUE

THE BUFFERS PROVIDE THE DATA STORAGE FOR COMMUNICATIONS WITH THE OPERATING SYSTEM, SYSTEM CONTROLLER, AND THE UTILITY ROUTINES. THE TABLES PROVIDE THE INS DATA STORAGE, OPERATOR COMMANDS, OUTPUT FORMAT FOR EACH OP CODE, SPECIAL OPERATIONS, AND OP CODE MESSAGE CONTROL QUEUE POINTERS.

III. PROGRAM OPERATION (SEE FIGURE 1)

A. THE SYSTEM CONTROLLER GENERATES A DATA EXTRACTION MESSAGE WHICH INCLUDES AN OP CODE, A TRACK FILE NUMBER, TIME, AND DATA. THIS MESSAGE IS SENT TO THE SYSTEM TEST EQUIPMENT DATA EXTRACTION PROGRAM VIA A CYCLIC BUFFER IN PROCESSOR 2. HOW PROCESSOR 2 HANDLES THESE MESSAGES IS BASED UPON THE OPERATOR EITHER ENABLING THE CONTROL ROUTINES OR PLACING AN ENTRY INTO THE CONTROL QUEUE TABLE. THE OPERATOR HAS THE OPTION OF SELECTING 1) ALL MESSAGES, 2) MESSAGES BY OP CODE, 3) MESSAGES BY OP CODE AND TRACK FILE NUMBER, 4) MESSAGES BY OP CODE, TRACK FILE NUMBER, AND COUNT. THE OPERATOR ALSO MUST SELECT THE OUTPUT DEVICE FOR EACH MESSAGE, 1) OPERATOR CONSOLE, 2) LST 1, OR

3) BIN 2. LST 1 AND BIN 1 ARE ASSIGNED TO AN I/O DEVICE VIA THE FLOPPY DISK OPERATING SYSTEM WHICH INCLUDES:

1) CONSOLE (TYP)
2) FLOPPY DISK A (FDA)
3) FLOPPY DISK B (FDB)
4) PAPER TAPE PUNCH (PTP)
5) SERIAL LINE (SLO)
6) SERIAL LINE 1 (SLO1)
7) NOTHING (NOP)

THE OPERATOR ALSO HAS THE OPTION OF SENDING ALL RAW DATA TO BIN 2 WHICH MUST BE ASSIGNED TO ONE OF THE I/O DEVICES ABOVE.

B. WHEN PROCESSOR 2 RECEIVES A MESSAGE FROM THE SYSTEM CONTROLLER, THE PROGRAM ATTEMPTS TO PLACE THE MESSAGE ON THE DISPLAY, LIST, OR RECORD QUEUE WHICH IS USED BY PROCESSOR 1. PROCESSOR 2 CHECKS THE CONTROL ROUTINES, SPECIAL OPERATION TABLE, AND THE OP CODE CONTROL QUEUE TABLE. THE CONTROL ROUTINES, ENABLED BY THE "SF" COMMAND, PLACES ALL MESSAGES ON THE APPROPRIATE QUEUE. IF AN OPERATOR ENTRY IS MADE IN THE OP CODE CONTROL QUEUE TABLE, THE CONTROL ROUTINES ARE DISABLED AND THE CONTROL TABLE IS USED. THIS TABLE, LOADED BY THE "DS," "PR," OR "RD" COMMANDS, CONTAINS DATA WHICH SELECTS WHICH QUEUE, WHICH OP CODE, WHICH TRACK FILE NUMBER, AND THE MESSAGE COUNT REQUIRED FOR AN OUTPUT. THE "AF" COMMAND DISABLES THAT PORTION OF THE TABLE WHICH CHECKS THE TRACK FILE NUMBER AND COUNT. IF A MATCH BETWEEN THE MESSAGE AND THE CONTROL TABLE DOES NOT EXIST, THE DATA IS EITHER PLACED ON THE RAW DATA QUEUE, IF IT IS ENABLED, OR DISCARDED. THE SPECIAL OPERATIONS TABLE, WHICH IS ALWAYS CHECKED BY THE PROGRAM, PROVIDES THE CAPABILITY TO

CALL A SPECIAL ROUTINE DEFINED BY THE OPERATOR WHENEVER A SPECIFIC OP CODE IS RECEIVED.

C. PROCESSOR 1 MONITORS THE RAW DATA RECORD, DISPLAY, AND LIST QUEUES FROM PROCESSOR 2 IN THAT ORDER. WHEN A BLOCK IS PRESENT THE REQUIRED ACTION IS TAKEN. RAW DATA IS SENT DIRECTLY TO BIN 2. DISPLAY, LIST, AND RECORD DATA IS FIRST SENT TO A FORMAT ROUTINE BASED UPON THE OPCODE AND THE FORMAT TABLE. EACH FORMAT ROUTINE SEPARATES THE DATA FIELDS AND CONVERTS THE DATA FROM BINARY TO ASCII OR THE DECIMAL EQUIVALENT AND GENERATES AN OUTPUT TO THE OPERATOR, LST 1, OR BIN 2.

D. REVIEW MODE, ENABLED BY THE "RV" COMMAND, ALLOWS THE RAW DATA STORED ON BIN 2 TO BE REVIEWED. THE COMMAND REWINDS BIN 2 AND SENDS THE DATA TO A CYCLIC BUFFER IN PROCESSOR 2 IDENTIFICAL TO THE BUFFER BETWEEN THE SC AND PROCESSOR 2. THIS ENABLES THE OPERATOR TO GENERATE A SELECTIVE OUTPUT OF THE RECEIVED DATA IN NON-REAL TIME IN THE SAME MANNER AS THE REAL TIME OPERATION.

E. SC EXECUTIVE MESSAGES CAN BE GENERATED BY THE STE OPERATOR VIA THE "DM," MO," OR "EM" COMMANDS. "DM" SENDS A DUMP MEMORY REQUEST VIA THE COMMAND QUEUE TO PROCESSOR 2, WHICH LOADS THE SC EXEC MESSAGE BUFFER. THIS MESSAGE CREATES AN SC DATA EXTRACTION MESSAGE OF 15 CONTIGUOUS MEMORY LOCATIONS WITHIN IEWS. "MO" SENDS A MODIFIED MEMORY REQUEST WITH THE NECESSARY DATA VIA THE SAME PATH AS DM AND EM. "EM" ALLOWS THE OPERATOR TO CREATE ANY SC EXEC MESSAGE BY THE ENTERED DATA ARGUMENTS.

F. INS SIMULATION IS CONTROLLED BY THE OPERATOR, WHO ENTERS THE LIMITS AND RATES FOR HEADING, ALTITUDE, PITCH, AND ROLL INTO THE INS TABLE. THIS TABLE IS USED BY PROCESSOR 2, UPON INITIALIZATION, TO LOAD THE INS OUTPUT BUFFER. WHEN THE SC INTERROGATES THE INS BUFFER, PROCESSOR 2 UPDATES THE BUFFER AT THE SPECIFIED RATE, UNLESS THE LIMIT HAS BEEN REACHED FOR EACH PARAMETER.

IV. DATA RECORDING LOAD

A. LOAD THE FLOPPY DISK OPERATING SYSTEM

B. LOAD THE LINKING LOADER

C. START THE OPERATING SYSTEM AND MODIFY THE LINKING LOADER

```
OPERATING SYSTEM    4/1/77
?UB6000
OPERATING SYSTEM    4/1/77
?ST  1,3D32,0
OPERATING SYSTEM    4/1/77
?ST 1,3D4C,FEE6
OPERATING SYSTEM    4/1/77
? ST 1,3BE0,C700
OPERATING SYSTEM    4/1/77
?ST 1,3BE1,8044
OPERATING SYSTEM    4/1/77
```

D. LOAD THE LATEST VERSION OF SYSTEST.BR

AS BIN 1, FDB, 0
?LO

OPERATING SYSTEM 4/1/77

E. ASSIGN THE NEEDED I/O DEVICES

AS BIN 2, FDA	RAW DATA OUTPUT
?AS BIN 1, FDB, 1	ASCII RECORD OUTPUT
?AS LST 1, SLO	ASCII PRINT OUTPUT

F. START DATA EXTRACTION

?G0 1000

IEWS DATA EXTRACTION PROGRAM 5/1/77

??

V. DATA RECORDING COMMANDS

A. PRIMARY COMMANDS

GO INITIALIZES AND STARTS PROCESSOR 2
IN INITIALIZES PROCESSOR 1
QU STOPS PROCESSOR 2 AND RETURNS CONTROL TO OPERATING SYSTEM

B. REVIEW MODE

RV REWINDS BIN 2 AND LOADS INPUT CYCLIC BUFFER

C. MESSAGE CONTROL

*** DEFAULT ALL MESSAGES SENT TO DISPLAY ***

SF <SW1>, <SW2>, <SW3> if SW1=1 RAW DATA TO BIN2
if SW2=1 ASCII DATA TO I. LST1
if SW3=1 ASC II DATA TO I. BIN 1

DS <OP CODE>, <FILE>, <COUNT> DISPLAY (I,OPLS)
PR <OP CODE>, <FILE>, <COUNT> PRINT (I, LST1)
RD <OP CODE>, <FILE>, <COUNT> RECORD (I, BIN 1)
AF <OP CODE>, <SWITCH> ALL FILES ON =1, OFF =0

EXAMPLES:

DS 80, 1, 1	DISPLAY DATA EXTRACTION POINT MSG 80 FOR TRACK FILE 1 EVERY TIME
PR 81, 2, 10	PRINT MSG 81 FOR FILE 2 EVERY 10TH TIME
RD 81, 3, 100	RECORD MSG 81 FOR FILE 3 EVERY 100TH TIME
AF 81, 1	PRINT AND RECORD EVERY MSG 81

D. SC MESSAGES

DM <PROC #>, <ADDRESS> DUMP 15 CONTIGOUS MEMORY LOCATIONS

MO <PROC#>, <ADDRESS>, <ARG 1>, , , , , <ARG8> MODIFY UP TO 8 MEMORY LOCATIONS

EM <ARG>, <ARG>, , , , , , <ARG> CREATE ANY SC MESSAGE

(PROCESSOR NUMBERS: 3=RMP, 4=AP, 5=TG, 6=CP, 7=SS)

E. INS CONTROL

HEAD ALT PITCH ROLL

IL FROM, TO, INC, FROM, TO, INC, FROM, TO, INC, FROM, TO, INC. (IN (LSB = .1°/SEC OR 10 FT/SEC)

APPENDIX A

OPERATION NOTES

1) WHEN A KEY IS HIT DATA EXTRACTION ENTERS A KEYBOARD ROUTINE WHICH WAITS FOR ANOTHER CHARACTER AND "LOCKS UP" PROCESSOR 1. ONLY A "RETURN" WILL ALLOW AN ESCAPE "DELETE" OR "RUB OUT" WILL NOT!

2) DATA EXTRACTION WILL STORE 450 MESSAGES IN REAL MEMORY.

3) RAW DATA CANNOT BE STORED IN REVIEW MODE.

4) WHEN PRINTING A LIST OR RECORD FILE, USE THE SLO OR SLO DEVICE RATHER THAN TYP. SLO AND SLO1 SIMULATES THE PGC WHICH THE FILES WERE DESIGNED FOR.

5) WHEN DATA HAS BEEN STORED ON A FLOPPY DISK FILE, THE FILE MUST BE CLOSED VIA THE EF COMMAND IN THE OPERATING SYSTEM.

6) WHEN ASCII DATA HAS BEEN STORED ON A DISK, THE COPY "CP" COMMAND IN THE OPERATING SYSTEM MAY BE USED TO OUTPUT THE DATA TO THE PRINTER.

7) THE DEFAULT CONDITION FOR OPERATOR INPUTS IS A Ø EXCEPT FOR COUNT WHICH IS A 1.

APPENDIX B

OPERATION EXAMPLES

1) DISPLAY ALL DATA

```
GO                          (START PROCESSOR 2)
      (DATA DISPLAYED)
QU                          (QUIT)
```

2) DISPLAY, LIST, AND RECORD ALL DATA

```
GO
SF Ø, 1, 1                  (ENABLE: LIST QUEUE COMMAND
                             ROUTINES)
      (DATA OUTPUT)         (RECORD QUEUE COMMAND ROUTINES)
QU
```

*** IF DATA IS STORED ON FLOPPY DISK, THE FILE MUST BE CLOSED ***

```
EF  LST 1                   (CLOSE LIST FILE)
EF  BIN 2                   (CLOSE RECORD FILE)
AS  BINL, SL01              (ASSIGN FILE TO OPERATOR CONSOLE)
CP  LST1, BIN1              (COPY LIST FILE TO OPERATOR CONSOLE)
```

3) SAVE RAW DATA AND DISPLAY

```
GO
SF1                         (ENABLE RAW DATA COMMAND ROUTINE)
      (DATA DISPLAYED AND SENT TO BIN 2)
QU
```

*** IF BIN 2 ASSIGNED TO FLOPPY DISK ***

```
EF  BIN 2                   (CLOSE RAW DATA FILE)
```

4) DISPLAY OP CODE 80 MESSAGES

```
GO
DS 80,0                    (DISPLAY 8Ø MSGS. FOR TRK Ø)
AF 80,1                    (ENABLE ALL TRACKS)
        (OP CODE BØ MESSAGES DISPLAYED)
QU
```

5) DISPLAY OP CODE 80 MESSAGES FOR TRACK 1.

```
GO
DS 80,1                    (DISPLAY OP CODE 8Ø, TRK 1)
        (OP CODE 8Ø MSGS FOR TRK 1 DISPLAYED)
QU
```

6) DISPLAY EVERY 10TH OP CODE 8Ø MESSAGES FOR TRK 2.

```
GO
DS 8Ø,2,10                 (DISPLAY OP CODE 8Ø, TRK 2, COUNT 1Ø)
        (EVERY 1ØTH 8Ø MSG FOR TRK 2)
```

7) DISPLAY EVERY 8Ø MSG, EVERY 1ØØTH 81 MSG FOR TRK 2, EVERY 1ØTH 81 MSG. FOR TRK 3.

RECORD EVERY 84 MSG.

LIST EVERY 85 MSG. FOR TRK 1, 2, AND 3

SAVE RAW DATA

```
GO
DS 8Ø,0                    (DISPLAY 8Ø MSG'S)
AF 8Ø,1                    (DISPLAY 8Ø MSG'S TRK 2 AND COUNT)
DS 81,2,100                (DISPLAY 81 MSG 'S TRK 2 AND COUNT 100)
DS 81,3,100
```

```
RD 84,0                    (RECORD 84 MSG'S)
AF 84,1
PR 85,1                    (PRINT 85 MSG'S TRK 1)
PR 85,2
PR 85,3
SF1                        (RECORD RAW DATA)
        (DATA PROCESSED)
QU
*** CLOSE DATA FILES ON FLOPPY***
EF BIN 2  (RAW DATA)
EF BIN 2  (RECORD DATA)
```

8) REVIEW RAW DATA FOR AØ MSG'S FOR TRK 1, THEN FOR TRK 2

```
GO
DS AØ,1                    (DISPLAY AØ MSG'S FOR TRK 1)
RV                         (REVIEW MODE)
          (DATA DISPLAYED)
IN                         (REINITIALIZE)
GO
DS AØ,2                    (DISPLAY AØ MSG'S FOR TRK 2)
RV
          (DATA DISPLAYED)
```

	SORTER	RMP	CP	AP
0	80 PTDW	AO	CO	EO
1	81 NEW EMITTER ALERT	A1 UNEXPECTED INTERUPT	C1 UNEXPECTED INTERUPT	E1 UNEXPECTED INTERUP
2	82 CAM FILE DUMP	A2 NON-EXIST DRIVER	C2 NON-EXIST DRIVER	E2 NON-EXIST DRIVER
3	83 AOA READOUT	A3	C3	E3
4	84 THROTTLE ALERT	A4 MEMORY DUMP	C4 MEMORY DUMP	E4 MEMORY DUMP
5	85 CONFIRM FILE CREATION	A5	C5	E5
6	86 ERROR ALERT	A6	C6	E6
7	87 INACTIVE FILE ALERT	A7	C7	E7
8	88 LONG PULSE PARAMETERS	A8	C8	E8
9	89 IB<1/4 FULL	A9	C9	E9
A	8A IB>3/4 FULL	AA	CA	EA
B	8B FILES FULL	AB	CB	EB
C	8C TROTTLE FILES FULL	AC	CC	EC
D	8D BUS HUNG	AD	CD	ED
E	8E WATCH DOG TIMER	AE	CE	EE
F	8F ALR-50	AF	CF	EF
70	90 NPDW MESSAGE	B0 WATCH DOG TIMER	D0	F0
71	91 MEMORY DUMP	B1 SYSTEM TEST DRIVER	D1	F1
72	92 MULTIFREQ FLAG	B2 PRIORITY DUMP	D2	F2
73	93 BIT STATUS	B3 ID DUMP	D3	F3
74 TG MEMORY DUMP	94	B4	D4	F4
75	95	B5	D5	F5
76	96	B6	D6	F6
77	97	B7	D7	F7
78	98	B8	D8	F8
79	99	B9	D9	F9
7A	9A	BA	DA	FA
7B	9B	BB	DB	FB
7C	9C	BC	DC	FC
7D	9D	BD	DD	FD
7E	9E	BE	DE	FE
7F	9F	BF	DF	FF

APPENDIX C. SC OP CODES