ELECTROMAGNETIC ENVIRONMENTAL EFFECTS ENGINEERING SUPPORT SYSTEM

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ABSTRACT

The need for a centralized database of Electromagnetic Environmental Effects (E3) information along with an easy method of access has resulted in the development of the E3 Engineering Support System (ESS). The ESS is a centralized database of E3 information compiled from existing documentation. The ESS is also a management information system (MIS) for E3 conference scheduling and action item (AI) tracking. User friendly programs are used to search the database and generate reports. These programs provide the necessary link between the managers and E3 engineers and the ESS database. The ESS is made accessible to remote users through local area network or telephone line communications. The purpose of the ESS is to assist managers and E3 engineers in assuring Electromagnetic Compatibility (EMC) of present and future naval air systems and equipment.

INTRODUCTION

The Naval Air Development Center (NAVAIRDEVCCEN) in Warminster, PA has developed for the Naval Air Systems Command (NAVAIRSYSCOM) a user friendly ESS database of E3 information to assist managers and E3 engineers in achieving and maintaining EMC among naval air systems and equipment. The ESS provides a centralized E3 information database on naval air systems and equipment and a MIS in eight data files. This paper describes the unique ESS user friendly structure and specific contents of each data file.

BACKGROUND

The ESS replaces the older E3 Requirements & Control System (R&CS), which was initiated in 1980. The R&CS required that the users have a high level of computer skills and a greater knowledge of the structure and data within each data file.

The ESS was developed with ease-of-use being a primary requirement. The ESS employs user friendly search programs developed using Fortran 5 and System 2000 Plex programming languages to interact with the database. The ESS provides menus to clearly display all options to the user. Figure 1 shows the NAVAIRDEVCCEN ESS Main Menu.

***** WELCOME TO THE NADC E3 ENGINEERING SUPPORT SYSTEM! *****

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0 0 ----- QUESTIONS? PLEASE CONTACT: -----
> STEVE LY - NADC (CODE 7021) 215-441-2499 - E3 ENGINEER
[ ] BOB FERRARO - ZEGGER-ABRAMS INC. 215-576-5566 - DATABASE MGR.
*****
HOST COMPUTER                                ENGINEERING DATA FILES
1. ELECTRONIC MAIL SYSTEM                    5. MICROFICHE FILE SEARCH
2. LOGOFF                                    6. MISSION ESSENTIAL EQUIPMENT &
                                           SAFETY OF FLIGHT LISTS **NEW**
-----
MANAGEMENT INFORMATION SYSTEM                7. PROBLEM TRACKING
3. MEETING CALENDAR **NEW**                 8. DOCUMENT TRACKING
4. ACTION ITEM TRACKING                     9. ECP TRACKING
                                           10. D/W TRACKING
                                           H ON-LINE HELP
*****
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Figure 1
NAVAIRDEVCCEN ESS Main Menu

An on-line Help system is included in the ESS to eliminate dependence on a user's manual. The ESS also contains a Usage History Tracking System, which runs in the background, to monitor the use of the ESS. The Usage History Tracking helps to determine the needs of the users to guide future developments.

DATABASE DESCRIPTION

The ESS includes six data files of E3 information for naval air systems and equipment and Naval ships.

- o The Documentation data file -- includes titles, authors, dates and locations of over 2,000 E3 test procedures, control and test plans, and test reports.
- o The Engineering Change Proposal (ECP) data file -- includes the description of each proposed change, the need for the change, the cost of the change, and the location of the original ECP for over 300 E3 ECPs.
- o The Deviation/Waiver (D/W) data file-- includes descriptions of specification to be deviated from or waived, reasons for the D/W, and the location of the original D/W for over 180 E3 D/Ws.
- o The Problems data file -- contains information on over 3,700 E3 problems

extracted from test reports, ECPs and D/Ws. This information includes victim and source equipment, a summary of the problem, and information about the original document describing the problem.

- o The Documentation Microfiche data file-- includes descriptions and microfiche reference numbers for approximately 18,000 E3 documents. The documents include test procedures, control and test plans, test reports, ECPs, D/Ws, technical manuals, specifications, review comments, meeting minutes, memos and other E3 documents. This library serves as a comprehensive source of E3 documentation.
- o The Mission Essential Equipment and Safety of Flight Equipment data file -- includes lists of equipment essential to the success and safety of a Naval air mission.

SOURCES OF INFORMATION

Sources of information for these data files are provided from contractor test results, government test results, and other E3 documentation. The ESS data files form a comprehensive database which is being utilized to assist engineers in testing, evaluating, and solving Electromagnetic Interference problems in naval air systems and equipment. The ESS database also serves as a historical repository to guide future designs to assure EMC and provide guidance for future development.

SEARCHING THE DATABASE

The data files are organized by naval platform type (e.g. Fighter), aircraft model (e.g. F-14) and series (e.g. F-14A). Each data file also contains other search fields which are related to the information in the data file. The search fields are displayed to the user in a menu form along with the total number of items located at each stage of the search. Figure 2 shows a sample main search menu for the Problems data file search before a search is performed.

```

*****
NADC E3 DATA FILE SEARCH - PROBLEMS      FILE ITEMS LOCATED = 2057
-----MAIN SEARCH MENU-----
SELECT BY CATEGORY:      SELECTIONS MADE:
1. AIR PLATFORM/SYSTEM      1.
2. AIRCRAFT MODEL           2.
3. AIRCRAFT SERIES          3.
4. VICTIM SYSTEM NAME       4.
5. VICTIM EQUIPMENT NAME    5.
6. VICTIM EQUIPMENT NOMENCLATURE 6.
7. SOURCE SYSTEM NAME       7.
8. SOURCE EQUIPMENT NAME    8.
9. SOURCE EQUIPMENT NOMENCLATURE 9.

P. PRINT REPORT OF LOCATED FILE ITEMS
L. LIST/DELETE SELECTIONS MADE

N=NEW SEARCH  C=COUNT ON/OFF  E=EXIT SEARCH  H=HELP

```

Figure 2
ESS Problems Main Search Menu

The user chooses a field to be searched from the main search menu. A list of valid selections from the data file are then displayed to the user. Figure 3 shows a list of valid selections for the Aircraft Platform/System field from the Problem data file.

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*****
NADC E3 DATA FILE SEARCH - PROBLEMS      FILE ITEMS LOCATED = 2057
-----SELECTION MENU-----
AIR PLATFORM/SYSTEM SELECTIONS
1. ADVANCED COMPOSITE      11. FIGHTER
2. AIR-TO-AIR MISSILE      12. GENERAL AVIONICS
3. AIR-TO-SURFACE MISSILE  13. HELICOPTERS
4. ANTI-RADIATION MISSILE  14. MISSILES
5. ANTI-SUB                15. NAVAL SHIPS
6. ATTACK                  16. PATROL
7. BOMBER                  17. SPECIAL ELECTRONIC
8. BOMBS                   18. TRAINER
9. CARGO/TRANSPORT
10. FAANTAEI

M=MAIN SEARCH MENU  H=HELP  E=EXIT  S=SEARCH BY CHARACTER STRING

```

Figure 3
ESS Problem Tracking Selection Menu

From this list, the user makes his or her desired selection(s) and control shifts back to the Main Search Menu. The selections are displayed to the user along with a new count of the located file items. By process of eliminating unwanted data, the user locates desired information. Figure 4 shows the Main Search Menu after a search was performed.

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*****
NADC E3 DATA FILE SEARCH - PROBLEMS      FILE ITEMS LOCATED = 14
-----MAIN SEARCH MENU-----
SELECT BY CATEGORY:      SELECTIONS MADE:
1. AIR PLATFORM/SYSTEM      1. FIGHTER
2. AIRCRAFT MODEL           2. F/A-18
3. AIRCRAFT SERIES          3. F/A-18A
4. VICTIM SYSTEM NAME       4. ELECTRONIC WARFARE
5. VICTIM EQUIPMENT NAME    5.
6. VICTIM EQUIPMENT NOMENCLATURE 6.
7. SOURCE SYSTEM NAME       7.
8. SOURCE EQUIPMENT NAME    8.
9. SOURCE EQUIPMENT NOMENCLATURE 9.

P. PRINT REPORT OF LOCATED FILE ITEMS
L. LIST/DELETE SELECTIONS MADE

N=NEW SEARCH  C=COUNT ON/OFF  E=EXIT SEARCH  H=HELP

```

Figure 4
ESS Problem Data File Main Search Menu after Search

After the information is located, the user has the option to display (or print) a summary or detailed output report to a terminal (or printer). Figure 5 shows a sample output report from the Problem data file search.

```

AIRCRAFT SERIES: F/A-18A      PROBLEM NO. 68      PROBLEM CATEGORY: EMC
VICTIM SYSTEM NAME      VICTIM EQUIP NOMEN      VICTIM EQUIP NAME
ELECTRONIC WARFARE      COUNTERMEASURES SET

PROBLEM DESCRIPTION:
UNCOMMANDED STANDBY OPERATION OF ELECTRONIC WARFARE JAMMER DUE TO
CYCLING OF LEFT GENERATOR. THE AN/ALQ-126 IS DESIGNED TO RECYCLE
THROUGH WARM-UP AFTER ANY POWER INTERRUPTION.

SOURCE SYSTEM NAME      SOURCE EQUIP NOMEN      SOURCE EQUIP NAME
UTILITIES               LEFT GENERATOR

PROBLEM STATUS: OPEN
SYSTEM IMPACT:
THE LEFT GENERATOR COULD CYCLE WHILE THE F/A-18A IS FLYING THROUGH A
HOSTILE THREAT ENVIRONMENT. THE RESULTANT UNCOMMANDED STANDBY OF THE
ECM WOULD SUBJECT THE AIRCRAFT TO 3 MIN. OF THE THREAT ENVIRONMENT
WHICH WOULD NOT BE RECEIVED OR JAMMED BY THE ECM SET.

CORRECTIVE ACTION:
GOVERNMENT INVESTIGATE AND TAKE CORRECTIVE ACTION AS SOON AS PRACTICAL.

LOCATION WHERE PROBLEM OCCURRED:  NAVY GROUND TEST AT NATC
DOCUMENT: NATC SY-C13R-84      DOCUMENT DATE: 06/11/82

```

Figure 5
ESS Problem Data File Search Output Report

RECENT DEVELOPMENTS

Recent developments to the ESS have been in the MIS area. The new E3 Meeting/Conference Calendar contains dates, times, topics, and participants of EMC Advisory Board (EMCAB) meetings, E3 Working Group (E3WOG) meetings, Technical Interchange meetings and other E3 meetings. Figure 6 shows a sample ESS Meeting Calendar Main Search Screen.

```

                AUGUST 1990
MON  TUE  WED  THU  FRI
-----
6    7    8    9    10
-----
13   14   15   16   17
-----
20   21   22   23   24
      IEEE IEEE IEEE
      SYMPOSYMPOSYMPO
      SIUMSIUMSIUM
      ON EMC ON EMC ON EMC
-----
27   28   29   30   31
-----
H=HELP : S=SEARCH : C=CONFLICTS : M=MEETING INFO : E=EXIT : L=LOCAL
F=FWD FF=FAST FWD B=BWD BB=FAST BWD >>

```

Figure 6
ESS Meeting Calendar Main Search Screen

The Meeting Calendar data file is used to organize the scheduling of meetings, disperse the meeting information and to help avoid and resolve schedule conflicts. Figure 7 shows a sample ESS meeting information output report.

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NADC E3 MEETING CALENDAR
AUGUST 21, 1990
TIME: 0800 - 1600

MEETING TITLE: 1990 IEEE INTERNATIONAL SYMPOSIUM ON EMC
MEETING DATES: 21 AUG 90 - 23 AUG 90
LOCATION:      WASHINGTON HILTON HOTEL
              WASHINGTON, D.C.

TOPICS:  1. EM ENVIRONMENT, EMC MANAGEMENT, EMI CONTROL
          2. SOCIO-ECONOMIC IMPLICATIONS
          3. EM PRODUCT SAFETY
          4. EMC MEASUREMENTS
          5. NON-SINUSOIDAL SIGNAL
          6. SPECTRUM MANAGEMENT

COMMENTS: 1. POINT OF CONTACT DR. WILLIAM DUFF, ARC INC. 703-642-4090

PARTICIPANTS      ACTIVITY/COMPANY      PHONE #      COMMENTS
-----
1. DUFF W.        ARC INC.          703-642-4090
2. FERRARO R.     ZEGER-ABRAMS INC. 215-576-5566
3. LANE R.        NADC-7021         215-441-1881
4. LY S.          NADC-7021         215-441-2499
5. ZEGER A.       ZEGER-ABRAMS INC. 215-576-5566

```

Figure 7
ESS Meeting Information Report

The AI Tracking System is used to track and evaluate the status and disposition of AIs assigned at EMCAB meetings, E3WOG meetings, Technical Interchange meetings, and other E3 Meetings. Figure 8 shows a sample ESS AI tracking output report.

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                A-6 EMCAB ACTION ITEMS
ACTION  MEETING  MINUTES  ACTION  DUE
ITEM NO. DATE    PARA.    BY      DATE    FROM    STATUS
-----
11-1    09/14/89    11.5    NWC      03/07/90 EMCAB   OPEN
DESCRIPTION: PROVIDE INFORMATION ON INTERGRATION ASPECTS OF
              IDAP.
DISPOSITION: OPEN

11-2    09/14/89    11.6    NATC     03/07/90 EMCAB   OPEN
DESCRIPTION: PROVIDE INFORMATION ON INTERGRATION ASPECTS OF
              IDAP.
DISPOSITION: OPEN

11-3    09/14/89    11.8    NWC      03/07/90 NATC    OPEN
DESCRIPTION: PROVIDE SCHEDULE FOR SOFTWARE GROWTH AND DETERMINE
              WHAT ADDITIONAL CAPABILITY E/A-250 HAS IN
              COMPARISON TO BASELINE NATC WILL BE CONDUCTING.
DISPOSITION: OPEN

```

Figure 8
ESS Action Item Tracking Report

FUTURE DEVELOPMENTS

Considerations are being made towards the integration of a lessons-learned data file. This data file will take full advantage of the existing information available from the ESS database by allowing the user to search for a problem and ways to solve it based on prior experience of engineers.

ACCESS TO ESS

The ESS resides on the NAVAIRDEVCON Central Computer System (CCS) which consists of five computers all manufactured by Control Data Corporation (CDC). The CCS computers are as follows:

System A CDC Cyber 170 Model 875

System B CDC Cyber 170 Model 760

System C CDC Cyber 170 Model 175

System D CDC Cyber 170 Model 760

System E CDC Cyber 170 Model 730

The CDC CYBER computers are interconnected to perform as a front end processor (FEP) and four host computers. In the event of a hardware problem two of the host computers, system A or E, can act as the FEP. All five computers are connected to various peripheral devices to form a comprehensive computer network.

The CCS can be accessed via telephone modem or through NAVAIRDEVCON's local area network. A user account number is necessary to access the CCS. There are 26 Naval facilities which currently have access to the ESS.

SUMMARY AND CONCLUSION

The ESS is a centralized database consisting of eight data files which provides managers and E3 engineers with essential E3 information. The NAVAIRDEVCON CCS is the central node for storing and accessing the ESS database. The database is updated daily to provide the user with the most up-to-date information available. User friendly programs to search the data files provide the necessary link between the E3 information and the managers and E3 engineers who need the information. The ESS is continuously proving itself to be a useful tool. Further software programming, such as the development of the Lessons-Learned data file will make the ESS even more useful in efforts to achieve EMC among present and future naval air systems and equipments.