A TIME-SHARED AUTOMATIC DATA RETRIEVAL SYSTEM FOR MANAGING THE NAVAL ELECTRONIC EQUIPMENT FIELD CHANGE IDENTIFICATION GUIDE

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ABSTRACT

The advent of ADP-controlled production of technical publications has provided all kinds of benefits in the form of cost-effectiveness, efficiency, and accuracy. However, the chief problem encountered in such techniques historically has been the keypunch operation. It requires the use of vendors, with the concomitant problems of cost, transportation, and the conspicuous absence of highly touted accuracies. Also, the increasing usage of Government computer facilities has begun to present problems when a publication with a frequent revision cycle is involved. Taking stock of the foregoing problems, this Section sought some way to solve them. It needed desperately to improve the data acquisition and management system used to publish the electronic equipment Field Change Identification Guide (FCIG) program. Working in conjunction with the NPPS, a new data retrieval system has been adopted to provide a fast-response capability by means of an on-line, time-shared computer in which FCIG data are accessed by an operator terminal located right in the Section office. The flow of input and output data associated with the field change program has become manageable and adapted to a streamlined operation through use of the new system.
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INTRODUCTION

The Electronic Equipment Field Change Identification Guide, referred to as the FCIG, is the single source of identification data for electronic equipment field changes. It consists of six lists of equipment entries, with each list corresponding to a category of electronic equipment (i.e., communications, radar, sonar, test equipment, radic, and countermeasures). Within each list, equipment entries are arranged alphanumerically by field change number and JAN nomenclature. Figure 1 shows a page from the radar FCIG. Note that the following data are given in a rather succinct format:

- Equipment name
- Field change number
- Title of field change
- Associated publications correction material
- Field change type, funding, estimated hours required to implement it, and the publication number and federal stock number of the field change bulletin
- Serial numbers of equipments affected by the field change
- Identification data
The individual lists are published as separate sections of the equipment-oriented handbooks of the Electronics Installation and Maintenance Book (EIMB) series. These handbooks are revised each quarter, with two handbook revisions being published each month. The FCIG comprises the bulk of each revision package. Thus two of the six FCIG master lists are revised and republished each month.

Coupled with the necessity of frequent, periodic revisions is the requirement that the data be as current as is practicable. These two conditions historically have been difficult to meet because of our total commitment to the sequential-card composition system. This system has a 50 to 60-day production cycle, which means that the published data are around 2 months old when they are received by the Fleet. The solution to this problem clearly lay in developing new procedures for managing the FCIG data program.

DEVELOPMENT CRITERIA

We began an investigation into the problem of developing new procedures with the premise that the best solution lay in some form of automatic data processing (ADP). The Technical Support Branch already had three operational ADP-controlled publications program. These were:

- MIL-HDBK-140 (Security classifications of electronic equipment)
- Weights and Vertical Centers-of-Gravity Reports
- Handbook of Manufacturers Designating Symbols
Branch personnel were well indoctrinated in the use and capabilities of ADP devices to control and maintain publications which require frequent updating. However, even with the improvements realized by changing from conventional data handling techniques to ADP techniques, two problems developed which soon became the limiting factors in producing publications that are revised frequently. The problems are associated with keypunching-keyverification and the "turn-around" time. The FCIG data must be updated frequently, and the data for a given revision must be the latest information that can be obtained prior to the revision "freeze date." Consider first the impact on these requirements by the keypunching-keyverification problem. The data must be transcribed onto 80-column keypunch transmittal forms. The forms are forwarded to the NAVMAT ADP support activity, which in turn sends the data to a vendor for keypunching and keyverification. After any errors detected during verification are corrected, the ADP support activity prepares a paper printout and sends it to the originator for a brief review of the material. Any errors discovered at this stage necessitate going through the entire cycle again. A typical cycle is approximately 1-1/2 weeks in duration. Although this period of time doesn't sound excessively long, it represents only a 2-week decrease in the time required in the sequential-card composition technique.

The long "turn-around" time is increased further by heavy workloads and manpower shortages in the NAVMAT ADP support activity.
Even the advent of higher-speed computing machinery has not substantially alleviated the problem. Thus we have a situation such as this: we continually obtain new and faster data processing machinery, but we are constantly constrained by the limitations of peripheral equipment, manpower shortages, involved procedures, and such. The situation is similar to the air transportation riddle: "Why is it that we can fly from coast to coast at increasingly higher speeds, yet it takes longer and longer to drive across town just to get to the airport?"

Thus the problem here was defined in terms of finding a way to avoid the keypunch operation, if possible, and to reduce the turnaround time. Working on this problem with the Navy Publication and Printing Service, we have found a system which offers a solution.

THE ADMINISTRATIVE TERMINAL SYSTEM

The Administrative Terminal System (ATS) was developed by IBM and consists of a 1440 computer and a number of time-sharing terminals for inputting and outputting data. Figure 2 shows the configuration of the system. Data are entered into disk storage in the IBM 1440 computer via a dataphone line. The keyboard is a conventional IBM Selectric typewriter with an additional key to signal the computer. The ATS terminal and dataphone are located in the Main Navy Building, and the computer is located on the downtown premises of the contractor, the VIP Systems Corporation.
The terminal operator, a Government clerk-typist, can enter data into the computer; access the data; make corrections, additions, or deletions; and reformat the data. The data when retrieved are printed out in upper and lower-case letters and, at the operator's option, can be right-justified text. The operator proofreads the data from the copy made at the terminal while the data were being inputted. Any errors are spotted quickly and corrected immediately. Thus keypunching and keyverification have been eliminated. The data are always accessible for retrieving and, using the ATS as an output device, the operator can rapidly (150 words per minute) prepare high-quality, photolithographic reproducibles.

THE FCIG WORKFLOW

Figure 3 shows the sequence of events associated with the flow of data in the FCIG program. The first data product is normally a manuscript of the field change instructions — either a field change bulletin or a "paper" field change for publication in the Electronics Information Bulletin or other media. The manuscript is forwarded by the engineering activity to the Technical Support Branch where the printout of the FCIG master file is maintained. (Actually there are six master files — one for each equipment category.) The latest field change number is determined from the printout and affixed to the field change manuscript. If any question or confusion exists, the computer can be interrogated by means of the ATS terminal. If the field change publication is to be a field change bulletin, then
a NAVSHIPS publication number is requested and entered on the manuscript. The photolithographic reproducibles are now prepared. If the end product is a field change bulletin, the reproducibles are distributed and stocked via the supply system. If the end product is an EIB-propagated field change, the information is composed for publication in the EIB. After the field change appears in the EIB, it is extracted, assigned a NAVSHIPS publications number and stocked in the supply system.

The field change information is then placed in the FCIG format and transferred to the proper place in computer storage via the ATS terminal. By entering these data on an "as-arrived" basis, the FCIG master files are kept up to date. As new field change numbers are assigned, the new numbers are annotated on the master file printouts. At some time interval, new printouts will be requested at which time the old ones will be discarded.

PREPARING AN FCIG REVISION

The current production plan for the FCIG utilizes the ATS terminal as an input device only. Preparation of an FCIG revision begins with accessing the document number for the proper master subfile and print instructions (Figure 4). The contractor then prepares a magnetic tape of the proper FCIG master file (the internal 1440 storage is magnetic-disk). Then it is necessary to prepare a paper tape for the Photon equipment. This equipment, a photocomposition device, decodes the punched paper tape and records the decoded data onto photographic paper. The finished product is a multiple-type-font galley of high photolithographic
quality. Figure 5 shows a page from the Test Equipment FCIG. Note the bold type for the equipment nomenclature. The galley has been "pasted up" to obtain a 2-column format. Figure 6 shows a portion of the input data for the same page. The degree symbols superimposed on the "A" of the nomenclature line and on the colon are codes for the Photon to indicate a change in type font. The reproducible mechanicals, in 2-column format, are sent to the printer and distributed via the supply system.

Other options (not illustrated) are available. The magnetic tape can be processed in other computerized photocomposition devices such as the Stromberg-Carlson 4020 and the Morgenthaler Linotron. If desired, the ATS terminal can also be used as an output device. The data printout would be of photolithographic quality and would be used to prepare reproducible mechanicals.

CONCLUSIONS

The Administrative Terminal System is a truly flexible system. It provides close technical control over the data inputting, maintenance, and retrieval. It precludes the red tape involved with many conventional inhouse ADP procedures. It precludes the entire keypunching operation. Finally, it assures that the data are "purified" prior to storage and subsequent retrieval. The over-all FCIG is already in computer storage and we are applying our efforts toward further "purification" of the data each time we go to press. The ATS has proved itself a valuable
data management tool which in one compact, economical package offers some solutions to the problems that all of us in the data management business experience.
<table>
<thead>
<tr>
<th>RADAR NAVSHIPS</th>
<th>FCIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-AM/TPS-1B - MX-854/TPS-1B reactor drive kit</td>
<td>900,000.2</td>
</tr>
<tr>
<td>Correction material:</td>
<td>Cancelled</td>
</tr>
<tr>
<td>TM-9-508/TPS-1B, NS 91500</td>
<td></td>
</tr>
<tr>
<td>1-A FA-5</td>
<td></td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>2-AM/UPA-24 - Add wiring required for AN/UPA-24 used with AN/SPA-51 and AN/SPS-32</td>
</tr>
<tr>
<td>IDENTITY: PPI Connector in place above PPI Repri</td>
<td>Correction material:</td>
</tr>
<tr>
<td>syncro nameplate.</td>
<td>2-A FA-5/2</td>
</tr>
<tr>
<td>12-AM/TPS-1B - MX-856/TPS-1B elect motor drive for PU-1/TPS-1B</td>
<td></td>
</tr>
<tr>
<td>Correction material:</td>
<td>All AN/UPA-24 is used with AN/SPA-51 and AN/SPS-32</td>
</tr>
<tr>
<td>TM-9-508/TPS-1B, NS 91677</td>
<td>IDENTITY: Energizing of relay K1201 is Electron Check Top-360/GP (part of AN/SPA-51) when the challenge switch (S81) on Set Control C-100K/UPA-24 is in either the &quot;ON&quot; or &quot;LOCK ON&quot; position.</td>
</tr>
<tr>
<td>1-A FA-5</td>
<td></td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>4-AM/UPA-24 - Replace square mixer 100C series sub-assembly</td>
</tr>
<tr>
<td>IDENTITY: Electric motor drive generator of power unit PU-51/TPS-1B</td>
<td>Correction material:</td>
</tr>
<tr>
<td>2-AM/UPA-24</td>
<td>1-A FA-15</td>
</tr>
<tr>
<td>4-AM/TPX-18A - Same as 1-AM/TPX-18</td>
<td>F9630-318-7021</td>
</tr>
<tr>
<td>1-AM/UPA-1B - Non eq for 120 and 51 dummy loads</td>
<td>SERIAL: All</td>
</tr>
<tr>
<td>Correction material: None</td>
<td>IDENTITY: Presence of new nameplate on video-cam.</td>
</tr>
<tr>
<td>1-A FA-4</td>
<td></td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>2-AM/UPA-22 - Drive motor, repl carbon brg (O-290) with ball brg</td>
</tr>
<tr>
<td>IDENTIFY: Nameplates for dummy loads will be DA-15/U and DA-129/U</td>
<td></td>
</tr>
<tr>
<td>1-A FA-5</td>
<td>Correction material: T-1 to NS 91516(A)</td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>Repair of Safety Condns. (Cleaner Stop for KY-136/UPA-38)</td>
</tr>
<tr>
<td>IDENTIFY: Replacement of carbon bearing with ball bearing and addition of upper and lower retaining rings in motor shaft.</td>
<td>Correction material: None</td>
</tr>
<tr>
<td>2-AM/UPA-23 - Cancelled</td>
<td>2-A FA-1</td>
</tr>
<tr>
<td>3-AM/UPA-22 - Rear rect cntk, rewire</td>
<td>SERIAL: All</td>
</tr>
<tr>
<td>Correction material: None</td>
<td>IDENTIFY: Presence of a drawer stop consisting of a 2-1/2-inch steel pin inserted into a hole drilled at the end of the drawer rail about 1/4 inch from the rollers of the KY-136/UPA-38</td>
</tr>
<tr>
<td>1-A FA-10</td>
<td></td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>3-AM/UPA-22 - Same as 1-AM/UPA-22</td>
</tr>
<tr>
<td>IDENTIFY: Jumpers are removed from tube sockets XV-404 and XV-405</td>
<td>Correction material: T-1 to NS 91516(A)</td>
</tr>
<tr>
<td>1-A FA-10</td>
<td>Replacement of Relays.</td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>Correction material:</td>
</tr>
<tr>
<td>IDENTIFY: Mounting of H-428.</td>
<td>2-A FA-1</td>
</tr>
<tr>
<td>3-AM/UPA-23 - Cancelled</td>
<td>SERIAL: All</td>
</tr>
<tr>
<td>1-AM/UPA-21 - Hi-V reset sw and end, add</td>
<td>IDENTIFY: Presence of a relay between TK6004 and TK6002.</td>
</tr>
<tr>
<td>Correction material: T-1 to NS 91516(A)</td>
<td>1-AM/UPA-70 - Reaction of Shock Hazard</td>
</tr>
<tr>
<td>A FA-1</td>
<td>Correction material: None</td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>IDENTIFY: Mounting of H-428.</td>
</tr>
<tr>
<td>IDENTIFY: Press to reset H.V. overload button added to front panel of radar set control unit C-100K/UPA-24 directly below and centered between selector switches.</td>
<td>2-AM/UPA-70 - Multimeter meter insert for test. R429</td>
</tr>
<tr>
<td>Correction material: T-1 to NS 91516(A)</td>
<td>Correction material:</td>
</tr>
<tr>
<td>2-A FA-1</td>
<td>2-A FA-1</td>
</tr>
<tr>
<td>SERIAL: All</td>
<td>IDENTIFY: Drive motor, repl carbon brg (O-290) with ball brg</td>
</tr>
<tr>
<td>IDENTIFY: Add new nameplate on video-cam.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Sample Page from Radar FCIG.
PREPARE MS5 OF FIELD CHANGE

FORWARD TO SEC 6181C

SEARCH MASTER FCIG BOOK (PRINT-OUT)

ENTER F.C. NUMBER ON MSS

INTERROGATE COMPUTER VIA ATS (OPTIONAL)

NAVSEC OPERATOR

REQUEST MS NUMBER (FCB'S ONLY)

ENTER MS NUMBER ON MS5 (FCB'S ONLY)

PREPARE REPRODUCIBLE MS5

PUBLISH IN EIB OR AS FC BULLETIN

TRANSMIT FCIG DATA TO COMPUTER VIA ATS

UPDATE MASTER FILE

PRINT-OUT (OPTIONAL)

SEC 6181

SEC 6181

SEC 6181

SEC 6181

HPPS

SEC 6181

SEC 6181

SEC 6181

SEC 6181

Figure 3. FCIG Data Flow Diagram.
Figure 4. FCIG Revision Procedure.
1. AN/UPM-1B: Power fuse change.
   -- FA-1: NS98799, F9040-895-0049
   IDENTIFY: The 5 amp fuses are replaced with 3 amp fuses.

2. AN/UPM-1B: Antenna assy, incorrect
   -- IDENTIFY: Disconnect any cable going to the antenna.
   -- SERIAL (CH): 1201-1242
   -- IDENTIFY: Check continuity between the two quarter-wave elements
     by touching one lead to the outer shell of the coaxial
     connector in the base of the antenna. There should be
     no continuity. If continuity exists, field change
     has not been performed. Recheck as before.

3. AN/UPM-1B: Same as 2. AN/UPM-1B except
   -- IDENTIFY: The 7 IN21 crystals are replaced with IN25
   -- SERIAL (CH): 1201-1245

4. AN/UPM-1B: Same as 3. AN/UPM-1B except
   -- IDENTIFY: Modifies equipment designation to AN/UPM-99.

5. AN/UPM-2: Crystal replacement.
   -- IDENTIFY: The 7 IN21 crystals are replaced with IN25
   -- SERIAL: None

6. AN/UPM-2A: Conversion to provide Mark 30 STF test
   capabilities.
   -- IDENTIFY: Modifies equipment designation to AN/UPM-99.

7. AN/UPM-3A: Electron tube contact, repl.
   -- IDENTIFY: Electron tube contact replaced with Hazeltine
   Part No: SP-102343B

8. AN/UPM-6A: Modd for use with KY-177/L PA-39
   -- IDENTIFY: Adds new "side-out, mod in" tack to the
   left of the attenuator dial.

9. AN/UPM-25D: Procedure for Grounding the AN/URM-25D
   through the Power Receptacle.
   -- IDENTIFY: Substitution of the two-conductor power cable
   with a three-conductor grounded type cable.

10. AN/URM-26: Procedure for Obtaining Pulse Modulation
    Correction material: NS98798
   2-A: FA-3

11. AN/URM-25: Protective Cover for Capacitors C168
    and C169.
    -- IDENTIFY: Presence of an extended cover over capacitor
    tips C168 and C169.

12. AN/URM-26: Improving External Modulation
    Correction material: T9040-895-0049
   2-A: FA-3

13. AN/URM-43: Securing Crystal Holders
    Correction material: None
   2-A: FA-1

14. AN/URM-43: Same as AN/URM-43
    -- IDENTIFY: Substitution of SPDT Switch with a DPDT Switch.

Figure 5 Sample Page of Test Equipment FC19 Produced by ATS-Photon System.
Incorporation of DC Firing Circuit in Missile Starting and Launching Console Model CA-663/PS'-4.

Correction material: T- to NS

1-4 TA-60 99572

IDENTITY: Field change nameplates installed on front of console.

1-A/TS'-5A! Replacement of Type 5696 Tubes with Type 5727/2D21V

Correction material: T-1 to NS 01327(A)

1-1 TA-3 998914 None

IDENTITY: Type 5696 tubes replaced with 5727/2D21V

1-A/TS'-1f: BFO, install.

Correction material: Change 1 to NS 01255

A TA-4 0908772 7665-662-5901

IDENTITY: BFO toggle switch on front panel.

1-A/PS'-1f! Conversion of ZV-13/PS'-1 and ZV-14/PS'-2 Insulation Test Sets from Vacuum Tube to Selenium Rectification.

Correction material: to NS 01530

2-A ZV-4 None

IDENTITY: ZV-13/PS'-1 and ZV-14/PS'-2 which are part of ZV/PS'-1, -2

IDENTITY: Selenium Rectifier in place of Vacuum Tube.

1-A/PS'-2f! Same as 1-A/PS'-1f

1-A/PS'-4f! Cancelled

1-A/PS'-6f! Cancelled

1-A/PS'-13f Electronic Plug-In Test Set - Incorporation of Factory Notification Bulletin No. 1 as a Field Change.

Correction material: To be furnished as a permanent change to

2-A 30

IDENTITY: Cancelled.

3-A/PS'-13f Assembling Jack 351

Correction material: None required

2-A 7-1

IDENTITY: Equipment built under Contract 1240999 (02 thru 17)

IDENTITY: Observing that the hill screening underneath the top panel for Jack 351 has been removed.

Figure 6: Portion of Data Given in Fig. 5, Shown in Input Format.