FAULT LOCATING TESTS UTILITY PROGRAM

USER'S GUIDE AND DESIGN MANUAL

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This document supplies information for operating and maintaining the FLT Utility Program.

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PREFACE

The Fault Locating Tests (FLT) Utility Program, originally prepared by International Business Machines Corporation, was submitted to the Federal Aviation Administration (FAA) in accordance with the requirements of Contract FA74NA-1012.

This document contains the information required for using and maintaining the FLT Utility Program.

CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE OF PROGRAM

The purpose of the Fault Locating Tests (FLT) Utility Program is to provide service functions required to maintain the Fault Locating Tests. This program, which is loaded by cards, is used to maintain the FLT tapes. It has the ability to add, delete, modify, duplicate, list, and print records in the FLT tapes.

1.2 EQUIPMENT REQUIREMENTS

The FLT Utility Program is a stand alone program requiring no control program to operate. It must be loaded by IPL Card Deck Loader, D0000, or an equivalent.

Equipment requirements on the 9020 System are a Simplex system having one CE, one IOCE, and any SE.

The following I/O devices are required or desirable:

One 1052 Printer Keyboard is required

One to Eight 9-track tape drives (one required)

One 1403 High Speed Printer (optional)

One 2540 Card Reader (required for adds and modifies)

2.0 OPERATING PROCEDURES

2.1 PROGRAM INITIALIZATION

The FLT Utility Program should be placed in the card reader following the IPL Card Deck Loader (D0000). The card reader address should be dialed in on the UNIT LOAD rotary switches for the IPL.

When loading ends, the REQUEST pushbutton should be depressed on the 1052. The following message is printed on the 1052:

START FLT UTILITY - VERSION n

The same message will be printed on the 1403 High Speed Printer, if available.

If no 1403 or 2540 is found by the Utility Program, an information printout will be made to the 1052 informing the operator. (TABLE 2-1)

2.2 EQUIPMENT ASSIGNMENT

During initialization, the presentation of the first attention from any of four 1052 addresses (02, 3C, 8D, DD) will cause the presenting address to be assigned as the primary operator interface. Using the channel address presented with the attention interrupt, the program will attempt to assign a 1403 printer and 2540 Card Reader. If this procedure is unsuccessful, an information message will be printed on the 1052. (Example 2-1)

2.2.1 I/O SET ASSIGNMENT

If a card reader and high speed printer are desired, but were not available during initialization, the following message may be used:

HSPCUU/

HSPCUU,K/

HSP is the message identifier and CUU represents the Channel and Unit address of the available 1403 printer of a card reader/printer pair. The card reader, if available will be assigned along with the printer.

The K is an optional identifier which is entered if the printing of input cards is to be suppressed. The K may be entered alone, without the HSP message.

If the K option is not selected, all card inputs will be printed on the high speed printer.

2.2.2 TAPE ASSIGNMENT

The master FLT tape is assigned by the following message:

OLDCUU/

OLD is the message identifier and CUU represents the Channel and Unit address of the tape drive used as the master tape.

The output tapes are assigned by the following message:

NEWCUU,...,CUU/

NEW is the message identifier and CUU represents the Channel and Unit address of the tape drive used by the output tape. Up to eight output tapes may be specified with a comma separating each CUU.

2.2.3 INPUT DEVICE REASSIGNMENT

The card reader or a tape drive may be assigned as the input device by the following message:

RDCCUU/

RDC is the message identifier and CUU represents the Channel and Unit address of the tape drive to be assigned as input device.

If no CUU is included in the message, the card reader will

be assigned as input device. Input cards must be in the reader or the input tape must be mounted when this message is given. Table 2-2 outlines input deck construction.

When a TERM card is encountered the I/O typewriter is again assigned as input device.

2.3 FUNCTION USE AND OPERATION

2.3.1 ADD FUNCTION

The add function will insert an entiredly new FLT record on all output tapes after each tape record specified in the add operator message. The message format is:

ADDXXX,...,XXX/

Add is the message identifier and XXX is the record number on the FLT tape after which the new record will be inserted. A total of five records may be specified for the new record to be inserted after.

The record numbers may be from one to three characters and do not have to be entered sequentially. If, however, the ADD message is preceded by another function message the lowest numbered record of the ADD message must be higher than the highest record number of the preceding function.

The add function must be requested by using a card input (using RDC with card reader or input tape), with the new record data on cards following the add message card. The data input is ended by a DEND card. (Table 2-2)

2.3.2 DELETE FUNCTION

The delete function will skip the tape record numbers specified in the delete message while writing all records from the master FLT tape on to the output tapes. The message format is:

DELXXX,...,XXX/

DEL is the message identifier and XXX is the record number to be omitted from the output tape. A total of five records may be specified for deletion. The record numbers may be from one to three characters and do not have to be entered sequentially. If however, the DEL message is preceded by another function message the lowest numbered record of the DEL message must be higher than the highest record number of the preceding function.

2.3.3 DUPLICATE FUNCTION

The duplicate function will copy the old FLT master tape on to all specified new output tapes. The message format is:

DUP/

DUP is the message identifier. Up to seven output tapes can be created using the duplicate function.

2.3.4 LIST HEADER RECORD FUNCTION

The list header record function will list, on the 1403 printer, all FLT header records on the old FLT master tape. Tape record numbers

will be assigned to each header record in the printout for reference when requesting other Utility functions. The message format is:

LST/

LST is the message identifier. The tape, whose header records are to be listed, has to be mounted on the OLD tape drive.

2.3.5 MODIFY FUNCTION

The modify function will change an existing records, in part, or completely. The message format is:

MODYYYY,ZZZ,...,ZZZ/

MOD is the message identifier. YYYY is the word number of the FLT record where the modification will start.

ZZZ is the tape record number to be modified. A maximum of five records may be specified for modification by the input data following the modify message. The record numbers may be from one to three characters and do not have to be entered sequentially. If however, the MOD message is preceded by another function message the lowest numbered record of the MOD message must be higher than the highest record number of the preceding function.

The modify function must be requested by a card input (using RDC with card reader or input tape), with the modification data following the modify message card. The data input is ended by a DEND card. (Table 2-2)

If the end of the modification data will also be the end of the modified record a REND card should be used in place of a DEND card. (Table 2-2)

2.3.6 PRINT FUNCTION

The print function will print part or all of the specified FLT tape records. The message format is:

PRTXXX.XXX,YYYY,ZZZZ/

PRT is the message identifier. XXX is the tape record number where printing will start. If only one tape record number is specified only one will be printed. If a second XXX is entered after the period, all tape records will be printed starting with the first tape record specified and ending with the second tape record specified. The period is not used if only one tape record is specified.

YYYY specifies the word number of the requested record where printing will start. This is an optional field.

ZZZZ specifies the length, in bytes, of the data to be printed. This is optional and is used in conjunction with the word start option.

2.3.7 END FUNCTION

The end function will properly complete one pass through the master FLT tape. The message format is:

END/

END is the message identifier. It may be entered after any function and, depending upon the previously entered function, will take appropriate action to complete the pass through the master FLT tape.

2.3.8 CARD TO TAPE FUNCTION

The card to tape function is used to build an input tape to be used in place of the card reader. The message format is:

CIT/

CIT is the message identifier. The card to tape function must be run as a stand alone function. Cards are read from the card reader in the same order as if the reader were to be used as an input device. The cards are written on all new tapes assigned. The last card input must be a TERM card. (Table 2-2)

2.4 GENERAL OPERATION

This section is dedicated to explaining how, and in what sequence, the functions of the FLT Utility program should be used.

2.4.1 FIRST STEP

The first step which must be taken before any FLT tape can be modified is to obtain a listing of all the header records on the FLT tape and their assigned tape record number. This is accomplished by the "List" function. All further references made in Utility functions must reference the proper tape record number or numbers.

2.4.2 SECOND STEP

Once the correct tape record number has been established, a printed hexidecimal representation of the tape record can be obtained by use of the "Print" function.

The printed representation is necessary for analysis of existing FLT test patterns.

2.4.3 THIRD STEP

The third step is the actual alteration of the FLT tape. The Modify, Add, or Delete, may be selected. If the master tape has been used for any function prior to this point, an End should be entered to bring the master tape back to load point. A summary printout is provided on the high speed printer after a complete run through the master tape. (Table 2-3)

When an FLT tape is going to be reconstructed with Adds, Modifies, and Deletes, each record requested by the function message must be in ascending order to keep the tapes properly positioned. Tape records requested out of sequence in relation to the last function requested will be rejected.

When the last alteration has been made, and End should be entered to cause duplication of the remaining records from the master tape to the new tape.

If it is not possible to sequence tape record requests to completely generate a new FLT tape on one pass through the master tape, several passes may be necessary with the new tape created during the run becoming the master tape for the next run.

TABLE 2-1 OPERATOR MESSAGES

INITIALIZATION MESSAGE

START FLT UTILITY - VERSION 1

ENTER USER REQUEST FUNCTION, THEN PRESS ENTER

USER ENTRY MESSAGES

USER REQUEST COMPLETE, ENTER NEXT REQUEST

ENTER USER REQUEST FUNCTION, THEN PRESS ENTER

MOUNT MESSAGES

MOUNT OLD MASTER ON XXX

MOUNT SCRATCH TAPES ON XXX

PRESS ENTER WHEN TAPES ARE MOUNTED

UNAVAILABLE CARD READER PRINTER MESSAGE

NO PRINTER FOUND

READER ADDRESS NOT FOUND

ABNORMAL CONDITIONS/ERROR MESSAGES

UNEXPECTED SVC INTERRUPT, CORRECT PROBLEM AND RE-IPL

UNEXPECTED DAR INTERRUPT HAS OCCURRED

UNEXPECTED RD. OR WR. DIRECT EXTERNAL INTERRUPT HAS OCCURRED

UNEXPECTED PROGRAM INTERRUPT. CORRECT PROGRAM AND RE-IPL

UNEXPECTED SELECTOR CHANNEL UNIT EXCEPTION

UNEXPECTED I/O INTERRUPT

NO TERM CARD FOUND, TASK ABORTED

BAD TAPE ON TAPE DRIVE NUMBER XXX. MOUNT NEW TAPE

BAD INPUT TAPE RETRIED 100 TIMES AND COULD NOT READ
TRY TO DUPE TAPE AND RE-IPL

BAD MASTER TAPE RETRIED 100 TIMES AND COULD NOT READ
TRY TO DUPE TAPE AND RE-IPL

INVALID SELECTOR CHANNEL ADDRESS CAUSED THIS I/O INTERRUPT

INTERVENTION REQUIRED ON DEVICE XXX. READY DEVICE TO CONTINUE

NO TERM CARD FOUND ON TAPE, TASK ABORTED

TAPE UNIT XXX IS FILE PROTECTED

TAPE ASSIGNMENT MESSAGE IS ILLEGAL AT THIS TIME
END MUST BE ENTERED BEFORE TAPES CAN BE ASSIGNED

INVALID MASTER RECORD TYPE - XXXX XXXXXXXX XXXXXXXX

RECORD NO. XXXX HAS INVALID TYPE,
BUT WILL BE WRITTEN TO OUTPUT TAPE

NO OLD MASTER CUU ENTERED. RE-ENTER USER REQUEST

NO SCRATCH CUU ENTERED. RE-ENTER USER REQUEST

CURRENT REQUEST INVALID. CANNOT FOLLOW PREVIOUS REQUEST

CURRENT REQUEST IS - 00 - TERMINATING PROGRAM

INPUT REQUESTED RECORD NUMBER
IS OUT-OF-SEQUENCE, A DUPLICATE OR INVALID.
CORRECT INPUT AND START RUN AGAIN

UNIT XXX NOT AVAILABLE. RESTART JOB

FORMAT ERROR - NO SLASH

FORMAT ERROR - INVALID REQUEST

INVALID PRINTER ADDRESS ENTERED

MESSAGE DELIMITER - , - NOT FOUND

MESSAGE DEILIMTER - , OR / - NOT FOUND

INVALID TCU ENTERED

NO DATA INPUT DEVICE ASSIGNED

DATA INPUT HAS INVALID SYSTEM SPECIFIED IN FLT HEADER

NO OUTPUT TAPES HAVE BEEN ASSIGNED

TAPE DRIVE XXX IS AT END OF TAPE, INCOMPLETE FILE,
FUNCTION ABORTED

START WORD IS NOT POSSIBLE

EOF ENCOUNTERED ON MASTER TAPE BEFORE REQUESTED
RECORD FOUND
TASK ABORTED

SAME RECORD REQUESTED TWICE

INVALID TAPE UNIT ENTERED

THE INPUT TAPE MAY NEED TO BE REGENERATED

LOAD CARDS AGAIN STARTING WITH THE ONE THAT FAILED

TAPE ASSIGNMENTS CONFLICT
RE-ENTER ALL TAPES AND REQUESTED FUNCTION

TABLE 2-2 INPUT DECK CONSTRUCTION

First card must be a valid input message starting in column 1:

HSP, OLD, NEW, DUP, LST — Must be followed by either:

1. Valid input message
2. Term Card

PRT — Must be followed by either:

1. Another PRT or END
2. Term Card

DEL — Must be followed by either:

1. ADD, DEL, MOD, END
2. Term Card

ADD — Must be followed by either:

1. Data Cards followed by DEND card

Following the DEND card must be either:

1. ADD, DEL, MOD, END
2. Term Card

MOD Must be followed by either:

1. Data cards followed by either a DEND or REND card

Following the DEND or REND card must be either:

1. ADD, DEL, MOD, END

2. Term card

END Must be followed by a TERM card

The TERM card consists of the characters TERM starting in column one.

The DEND card and the REND card consist of characters DEND or REND starting in column ten.

EXAMPLE:

Card 1	OLD111/NEW 112, 113, 114, 115, 116, 117/
Card 2	ADD 5, 17, 19/
Cards 3 thru 10	(Data starting in any column, any length, but must be valid hexidecimal characters.)
Card 11	DEND
Card 12	DEL 23, 27/
Card 13	MOD 142, 59/
Cards 14 thru 20	(Data starting in any column, any length, but must be valid hexidecimal characters.)
Card 21	REND
Card 22	END/
Card 23	TERM

TABLE 2-3 SUMMARY PRINTOUT

Check totals are provided (in the format shown) for the following functions:

DUPLICATE

INPUT MASTER COUNT XXX

NEW MASTER COUNT XXX

LIST

MASTER TAPE RECORD COUNT XXX

ADD, DELETE, MODIFY

When any of these functions have been run, cross-footing totals are provided, following the entry of an END/

INPUT MASTER COUNT XXX

ADDS PROCESSED XXX

DELETES PROCESSED XXX

MODIFIES PROCESSED XXX

NEW MASTER COUNT XXX

3.0 PROGRAM DESIGN LOGIC

The functions provided by the FLT Utility Program consist of all utility functions required to maintain FLT tapes. The functions are accomplished by specific modules for each task.

In addition, other modules and routines are provided for I/O assignment, function dispatching, I/O operations, and interrupt handling.

3.1 DETAILED DESCRIPTION

3.1.1 INITIALIZATION

Following IPL the program is enabled for an I/O attention interrupt on any valid multiplex channel. When the attention is received, the 1052 I/O typewriter causing the interrupt is assigned as the primary operator interface. Using the channel received in the interrupt, an attempt is made to assign a card reader and printer. A printout informs the operator if none are found. Following initialization a message is output requesting operator entry.

3.1.2 INPUT MESSAGE ANALYSIS/DISPATCHER MODULE

All input messages are moved into the "DATAIN" area for analysis by this module. Messages which use incorrect message codes are rejected. When a correct message code is found a branch is made to the correct module to handle the operator request. Most modules return to "IMAD100" following task completion to analyze any messages remaining in the "DATAIN" area. If input is from cards or tape another read is made to the input device. When all input is complete, control is returned to the I/O typewriter.

3.1.3 I/O DEVICE ASSIGNMENT MODULE

The devices which are assigned by this module are old and new tape drives, high speed printer, and designation of the card reader or tape as the input device.

3.1.3.1 HIGH SPEED PRINTER ASSIGNMENT

High speed printer assignment will also attempt to assign a card reader. These devices are normally assigned during initialization but when this does not take place an operator message must be entered to call this module.

3.1.3.2 NEW TAPE DRIVE ASSIGNMENT

The new tape message is analyzed and the channel and unit numbers specified are checked for validity. If valid, the unit address is stored into the proper slot of the "NTAPE: table and the count of table entries is updated.

3.1.3.3 OLD TAPE DRIVE ASSIGNMENT

The old tape message is analyzed and the channel and unit address specified is checked for validity. If valid, the unit address is stored into "MTAP".

3.1.3.4 READER/TAPE INPUT DESIGNATION

The card reader is assigned as input device by setting the "RDRFLG" flag. If a unit address is included in the input message, the channel and unit address are checked for validity. If valid, the unit address is stored in "CRDIN" and tape is assigned as input device by setting the "CRDINFLG" flag. Following input device assignment a read is executed to the assigned device.

3.1.4 ADD MODULE

The add module first sequences the tape record numbers specified in the input message and stores the records in "RECSAV". The data is read into storage from the input device and converted to binary. The old tape is searched for the correct record by calling the "SEARCH" routine. This process causes writing of the old tape records on to the new tapes. When the correct record is located the new data is written onto all new tapes. This is repeated until all requested records have been found.

3.1.5 CARD TO TAPE ROUTINE

This routine will cause a read to the card reader and will write each card read to all new tapes. This action will continue until a TERM card is read.

3.1.6 DELETE MODULE

The delete module first sequences the tape record numbers specified in the input message and stores the records in "RECSAV". The old tape is searched for the correct record by calling the "SEARCH" routine. This process causes writing of the old tape records onto the new tapes. When the correct record is found, writing to the new tape is suppressed. The procedure is continued until all requested records have been found.

3.1.7 DUPLICATE MODULE

The duplicate module will issue mount messages for the old and new tapes upon entry. The old tape is read, with each record read being written on all new tapes, until an End-Of-File is encountered. When End-Of-File is encountered tape marks are written on all output tapes and all tapes are rewound by branching to the "REWIND" routine.

3.1.8 LIST MODULE

The list module will cause a mount message to be issued for the old tape drive. Tape records are read and the header of each record is converted to EBCDIC and stored for printing. When a full line has been stored the tape headers are printed on the high speed printer. The "LSTTYPDE" routine formats IOCE and 9020A CD FLT headers. The "LSTTYPF" routine formats 9020D/E FLT headers. A tape sequential record number is assigned to each header record.

This module is also used to complete the copying of records from the Old Master Tape to the New Master Tape (when appropriate) upon the entry of an END/ message.

3.1.9 MODIFY MODULE

The modify module first sequences the tape record numbers specified in the input message and stores the records in "RECSAV". The modification word start number is also taken from the input message and stored at WDSAV. The modification data is read in from the input device and stored in the "CDINA" area. Binary conversion of the data is done, followed by a search for the first requested record by branching to the "SEARCH" routine. This process causes writing of the old tape records onto the new tapes. The record, when found, is read into the "TPINA" area and the data modification is carried out. Following the data modification, the updated record is written to all output tapes. This procedure is repeated until all requested records have been modified.

3.1.10 PRINT MODULE

The print module determines the first and last records requested. The start word and length are also determined and stored in the "WDSAV" and "LENSAV" areas. The requested record is read in by branching to the "SEARCH" routine. Requested data to be printed is converted to EBCDIC and moved into the "CDINA" area. The data is then formatted and printed on the 1403. If the data to be printed exceeds 4000 hexidecimal bytes, a second conversion is executed to handle the remaining data. This procedure is repeated until all requested records have been printed.

3.1.11 COMMON I/O ROUTINES

3.1.11.1 PRINT 1052 ROUTINE

This routine is used for all I/O typewriter output.

3.1.11.2 PRINT 1403 ROUTINE

This routine is used for all high speed printer output.

3.1.11.3 READ 1052 ROUTINE

This routine is used for all I/O typewriter input.

3.1.11.4 READ 2540 ROUTINE

This routine is used for all card reader input.

3.1.11.5 TAPE READ ROUTINE

This routine is used for all tape input.

3.1.11.6 TAPE WRITE ROUTINE

This routine is used for all tape output.

3.1.11.7 COMMON START I/O ROUTINE

This routine issues all Start I/O commands for the program. All successful I/O interrupts return to this routine at "SI005."

3.1.12 COMMON INTERRUPT ROUTINE

3.1.12.1 EXTERNAL INTERRUPT HANDLER

This routine handles all external interrupts. Normal program operation is not enabled for external interrupts. If an external interrupt were handled it would cause return to the program at the address following the instruction where the interrupt occurred.

3.1.12.2 SUPERVISOR CALL INTERRUPT HANDLER

A supervisor call interrupt will result in a program hang following an information printout at the I/O typewriter.

3.1.12.3 PROGRAM INTERRUPT HANDLER

A program interrupt will result in a program hang following an information printout on the I/O typewriter.

3.1.12.4 MACHINE CHECK INTERRUPT

A machine check interrupt will result in a program hang.

3.1.12.5 I/O INTERRUPT HANDLER

The I/O interrupt handler will process all I/O interrupts received. Abnormal conditions will result in a retry to the failing device, or, if unrecoverable, an information printout to the I/O typewriter. Retry situations are executed at tag IOR02. Normal returns to the program are at tab IOR03.

3.1.13 HOUSEKEEPING ROUTINES

3.1.13.1 RESET ROUTINE

The reset routine conditions all necessary flags and counts to their initial values.

3.1.13.2 REWIND ROUTINE

The rewind routine is used to rewind all tapes in use - new, old, and input.

3.1.13.3 FUNCTION EDIT ROUTINE

The function edit routine is branched to by all function modules of the program. The "CURRFUNC" flag is examined to determine if the current function is valid following the last function. If the current function is invalid an error printout results. The results of any function combination is shown in Table 3-1.

TABLE 3-1

FUNCEDIT ROUTINE

DETERMINE IF REQUESTED FUNCTION MAY
FOLLOW THE PREVIOUSLY REQUESTED FUNCTION

CURRENT REQUEST \ PREVIOUS REQUEST	80 ADD	40 DEL	20 MOD	10 PRT	08 LST	06 CTT	04 DUP	02 END	00 1ST REQUEST
80 ADD	YES	YES	YES	NO	YES	YES	YES	YES	YES
40 DEL	YES	YES	YES	NO	YES	YES	YES	YES	YES
20 MOD	YES	YES	YES	NO	YES	YES	YES	YES	YES
10 PRT	NO	NO	NO	YES	YES	YES	YES	YES	YES
08 LST	NO	NO	NO	YES[4]	YES	YES	YES	YES	YES
06 CTT	NO	NO	NO	NO	YES	YES	YES	YES	YES
04 DUP	NO	NO	NO	NO	YES	YES	YES	YES	YES
02 END	YES[1]	YES[1]	YES[1]	YES[2]	YES[3]	YES[3]	YES[3]	YES[3]	YES[3] *
00 INVALID [5]									

* 1ST REQUEST 'END'

1. 1 = BRANCH TO DUPMOD AND DUPE REST OF TAPE
2. 2 = REWIND OLD MASTER
3. 3 = NO ACTION TAKEN, REQUEST NEXT USER INPUT
4. 4 = YES, BECAUSE LSTMOD WILL REWIND THE OLD MASTER
5. 5 = CURRFUNC = 00 when calling FUNCEDIT, will HANG-UP program with an error message
6. YES = OK TO PROCESS, WILL RETURN TO CALLER
7. NO = "CURRENT REQUEST INVALID. CANNOT FOLLOW PREVIOUS REQUEST"
8. CURRFUNC = (1 byte) THE CURRENT FUNCTION REQUESTED (SET BEFORE BAL R10, FUNCEDIT)
9. LASTFUNC = THE LAST FUNCTION PROCESSED (UPDATED BY FUNCEDIT ROUTINE)