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MASKED SEARCH PROGRAM

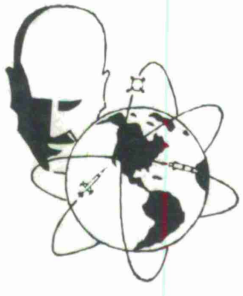
TECHNICAL DOCUMENTARY REPORT NO. ESD-TDR-64-629

JANUARY 1965

G. S. Stoller

Prepared for

DIRECTORATE OF COMPUTERS
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts



Project 508.0

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THE MITRE CORPORATION
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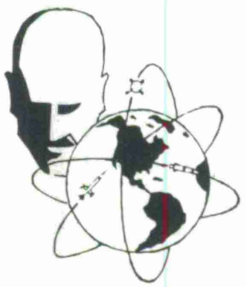

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ABSTRACT

The Masked Search Program is a static trace and can be used for debugging or modifying a 7090 program. This report describes the program and how it is used in most cases. Additional information is provided to cover unusual occurrences during the program run.

REVIEW AND APPROVAL

This technical documentary report has been reviewed and is approved.

JOHN F. EGAN
Project Officer

MASKED SEARCH PROGRAM

SECTION I

INTRODUCTION

Sections II through VI of this document describe the Masked Search Program and how it is used for most cases. Sections VII through XII provide additional information to cover an unusual occurrence during the running of the program. Sections VII through XII are also useful for changing the program for a non-M90 run or for running the program with a different monitor system. For example, any tape unit can be chosen as the input tape and any other tape unit may be designated as the output tape. The input tape can be prepared by a peripheral card-to-tape unit and the output tape can be listed on a peripheral tape-to-printer unit.

SECTION II

PURPOSE OF PROGRAM

By means of specification cards (described in Section IV), the user specifies a mask and a search area (block of storage) to the program. In accordance with the specification request, the program prints out a list of the locations in the search area that satisfy the conditions set up by the specification cards.

For instance, an address mask may be used to find all locations that have anything to do with a particular entry point to a subroutine; i.e., from which locations is this subroutine entered? After obtaining a list of the locations having this entry point as their address, a listing of the data being searched would normally tell where in the search area this subroutine is being entered.

Another example involves finding how certain storage locations are used; i.e., what is stored there and when is it read?* By means of an op-code mask, one can find all locations that contain instructions which change memory, i.e., all "store" instructions and RDS.

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* This routine is a tool that was used to change a large system program (the META assembler) which was the working program.

SECTION III

DIRECTIONS FOR USE OF MASKED SEARCH PROGRAM

The Masked Search Program uses a relocatable column-binary deck. This deck should be preceded by a "relocate origin" card when it is being loaded. This card will have a 7-9 punch in column 1. The origin at which the Masked Search Program is to be loaded into the memory will be specified in the address field of what is usually the checksum word (the bottom three rows of column 5 and all of column 6).

The Masked Search Program can be loaded using the M90 load card. Along with the Masked Search Program, one should load the data that is to be searched.

After the loading is completed, control is given to the Masked Search Program. The program expects to find the specification cards on the community input (COMIN) tape. The specification cards should be BCD cards stored one-per-record (in BCD records) on the COMIN tape. If redundancy or EOF is encountered while attempting to read a specification card, the program aborts.

All output is written on the community output (COMOUT) tape for offline printing.

The deck for a sample run using the Masked Search Program could be arranged as follows:

III JOB

III LOAD 2COMIN

binary deck of program to be searched

"relocate origin" card

binary deck of Masked Search Program

III 1401 DATA, 1

input specification cards for the search

III ENDJOB

It is assumed that the program to be search contains exactly one transfer card. The number of transfer cards in that program determines the coefficient of "COMIN" on the M90 LOAD card.

The Masked Search Program occupies $224_{10}(340_8)$ locations of which the last 24_{10} (30_8) are buffer locations. For this reason it is restricted to be loaded with a new origin between 6_8 and $7\emptyset47\emptyset_8$.

SECTION IV

FORMAT OF (INPUT) SPECIFICATION CARDS

The first two columns of a specification card contain characters which tell the program what function to perform. Six functions are provided and can be called for by using the characters EQ, RL, RA, BD, MK, HO.

Following the characters which request a function are two fields each containing an octal integer (possibly signed). Both fields are required on the RL, RA, and BD cards. Only the first field is required on the EQ and MK cards. No fields are required on the HO card. The terms "argument 1" and "argument 2" shall refer to the contents of the first and second fields of a specification card (respectively).

Each of these two fields begins at a fixed length and a fixed column. The first field begins at column 6 and extends through column 18. The second field begins at column 24 and extends through column 36. Thus each field occupies 13 columns. In each field, the low-order 12 columns are interpreted as though each contained an octal digit. That is, only the three low-order bits of the six-bit character code are used when interpreting these columns. Hence, a blank column is equivalent to a column with a Ø punched in it. The first column of each field (columns 6 and 24) is examined for a minus sign. If this column contains a minus sign, then the corresponding argument is made negative through an SSM instruction. If this column does not contain a minus sign, the corresponding argument is unchanged.

Beyond the required columns, all punches are ignored. Hence comments may be inserted on all specification cards after column 37.

The EQ card (equals) causes the program to investigate the search area for words which are identical to argument 1 of the EQ card when looked at through the mask. The locations of these words are printed out (offline).

The RL card (range, logical) is used for a range search on logical quantities (i.e., unsigned numbers from Ø to 2^{36}-1). Here the sign bits of the arguments are considered as numerical bits. The program examines the search area for words which, considered as logical quantities, lie between (logical) argument 1 and (logical) argument 2 inclusive, when all of these quantities are looked at through the mask. The locations of these words are printed out (offline).

The RA card (range algebraic) causes the same processing as an RL card except that here the comparisons are algebraic (i.e., signed).

The BD card sets boundaries for the search area. Argument 1 is the first-word location and argument 2 is one more than the last-word location. These two arguments are not masked. A search area consisting of more than 77776_8 locations should not be used. The addresses set by a BD card are initialized to the values that they would contain if a BD card having $Ø_8$ as argument 1 and 77776_8 as argument 2 had been read in.

Argument 1 of the MK card (mask) is a mask which will be used on all subsequent searches until overridden by another MK card. Obviously this argument is not masked by the present mask. An initial mask of "all ones" is assumed.

The HO card (whoa) terminates the reading of specification cards. Its fields are ignored. A normal return to the monitor results after this card is read.

SECTION V

FORMAT OF COMMENT CARDS

A card that has been read into the computer by this program is considered a comment card only if column 2 is blank. Column 1 is then assumed to contain a carriage-control character for the printer. (Use a blank in column 1 if you wish to single space when printing this card; i.e., print on the line now available and then space up once.)

SECTION VI

OUTPUT FORMAT

All input cards (specification cards and comments cards) will be printed out (offline). The card will be printed basically as it is punched; i.e., characters in adjoining columns will be printed in adjoining print positions. The only exceptions to this rule are columns 1 and 2 which will be offset to the left.

Program-generated data will be printed out immediately after the specification card that caused it. If a specification card's conditions are not met anywhere in the search area, the line following the one on which the specification card was printed will be blank.

SECTION VII

ERROR RETURNS TO MONITOR

There are two conditions that cause a return to the error-entry point of the monitor. One of these is a format error on an input card; i.e., column 2 is not blank and none of the acceptable identifying characters, namely EQ, RL, RA, BD, MK, HO, have been found in columns 1 and 2. An EOF redundancy encountered while attempting to read a specification card (from COMIN) is the other error condition.

When an error occurs, the program either drops into or transfers to an expansion of the macro BAH. This macro expansion consists of the following two instructions:

```
-Ø 625ØØ Ø ØØ3Ø5   STL   LCTN
 Ø Ø2ØØØ Ø ØØØØ3   TRA   ERRPRT
```

The address portion of the symbolic location LCTN, which is at nominal location $3Ø5_8$, shows the actual location at which the error was made known. From this, the nominal location at which the error was made known may be computed. The comment appearing on the BAH card that is found near this nominal location in the attached listing will identify the error.

In the dump that is given, all of memory and all of the central processor's registers will be shown exactly as they were at the time that the error was made known, except for the accumulator and the MQ. (Memory locations LCTN and ERRPRT+2 may also be changed, but this is expected, and the previous contents of these registers are not needed for any debugging.)

SECTION VIII

ADDITIONAL NOTES ON (INPUT) SPECIFICATION CARDS

For both range searches (RL and RA), if argument 1 is identical to argument 2 when both are looked at through the mask, the program goes to the EQ routine. This is indicated in the printout on the line printed out immediately after the line on which the specification card was printed. In this situation, the line will always be printed out; a blank line will be printed if no program-generated data is available. If some program-generated data is to be printed out, then this line will be indented 12 print positions over its usual indentation. (Program-generated data is usually indented six print positions. The first digit of program-generated data to be printed on a line usually occupies print position 8.)

Optimization (of time-expenditure) in a range search may be possible if one has some knowledge of the data to be search. The first comparison against an argument will be made against argument 1, and if this comparison shows that the word cannot lie between argument 1 and argument 2 (when all are masked) no comparison against argument 2 is made. There is no "size" or "magnitude" ordering inherent in the arguments. (The program compares them to find out which is the greater of the two arguments.) That is, argument 1 can be less than, equal to, or greater than argument 2 when both are looked at through the mask. This allows the search to be optimized, as in the following two cases. If one is looking for all memory references to a block of storage which is near the end of his program, then he should choose the first-word location of that block as argument 1 and the last-word location of that block as argument 2. However, if this block lies near the beginning

of his program, then he should choose the last-word location of that block as argument 1 and the first-word location of that block as argument 2. Naturally, an address mask is used.

SECTION IX

ADDITIONAL NOTES ON OUTPUT FORMAT

A comment card is printed out which looks nearly the way it did when it was read in. Column 1 of the card was used as a carriage-control character. The character that appeared in column 3 is printed in print position 9, column 4 is printed in print position 10, and so on for the other columns, ending with column 8Ø being printed in print position 86.

A specification card is printed in a similar fashion. First, a carriage-control character is inserted in the line to cause the printer to space up two lines before printing the specification card. Columns 1 and 2 of the specification card are printed in print positions 3 and 4, respectively, column 3 is printed in print position 9, column 4 is printed in print position 1Ø and so on, ending with column 8Ø being printed in print position 86.

If there is an error in the format of an input card, this card is not printed out and the program goes to its error exit. Hence, the last input card printed is the one that appeared just before the card that is in error.

The buffer size for program-generated output is 22 words. The first word is a word of blanks. At most, 21 words of program-generated output are printed per line. In fact, a full line of program-generated data for EQ, RL, and RA output will normally contain 21 locations. An abnormal case occurs when an RL or RA specification card is read in, and arguments 1 and 2 are identical when looked at through the mask. In this case, the first line of program-generated output is indented 12 print positions if there is any program-generated data to be printed out. If no program-generated data exists for this specification card after the search is completed, a blank line is printed out.

SECTION X

DESCRIPTION OF SYMBOLIC DECK

The symbolic deck is sprinkled with comments to aid anyone who sees a need to change it. The notation "C(PLACE)" is to be read "the contents of location PLACE," and "CA(PLACE)" is to be read "the contents of the address field of location "PLACE." The notations "GR(TH1, TH2)," "EQ(TH1, TH2)," "LS(TH1, TH2)" are almost self-explanatory; a full description of these functions can be found in supplement 1 to the META manual (MITRE TM-77 #2, S1).

The symbolic deck is set up to punch a relocatable column-binary deck with nominal origin ∅.

This program is dependent upon the regular monitor (i.e., the monitor that is left in main memory after an M90 LOAD card) for its I/O. All parts of this program that are in any way dependent upon the monitor are grouped together near the beginning of the program. (They are contained between card numbers 15 and 50 of the Appendix.)

SECTION XI

DESCRIPTION OF BINARY DECK

The binary deck is a column-binary relocatable deck with nominal origin ø.

Exactly 224_{10} (340_8) locations are required by the Masked Search Program for instructions, constants, and buffers. Only the first 200_{10} (310_8) locations are loaded. In the last 24_{10} locations arguments 1 and 2 are stored, input is read into, and output is written from.

Those parts of the program which are dependent on the monitor occupy nominal locations 1_8 through 23_8.

SECTION XII

BLOCK DIAGRAM AND LISTING

All tricks, except for the obvious ones, have been avoided in coding this program. Tricks have been used at symbolic locations EXIT1 and ADRES1 (nominal locations 17_8 and 236_8 respectively). The tricks are documented in the comments appearing on these cards and on the following REM cards. Several other tricks could have been used, but they cause undue hardship in recoding parts of this program and do not give a big enough reduction in the size of the program to warrant their use.

Several locations have two symbolic names (e.g., PRINTI and PRINTO for 7_8, REDIN and BUFFER for 312_8), while others, which are not referenced, are assigned symbolic names. The extravagance of assigning two symbolic names to a nominal location allows us to identify somewhat the reason for the reference to that nominal location. For example, a TSX PRINTI, 4 means "go to the closed subroutines that prints out an input card," while a TSX PRINTO, 4 means "go to the closed subroutine that prints out a line of program generated data." These two subroutines are identical although they could be different. Since they are performing different functions (although identically) they are given different symbolic names.

The symbolic locations that are not referenced have been named to show a special property which is explained by the comments accompanying the word.

All I/O performed by the Masked Search Program is by tapes.

G. S. Stoller gsh

APPENDIX

```
META
                                BAH     MACRO                                                   0003    3
                                        STL     LCTN                                            0004    4
                                        TRA     ERRPRT                                          0005    5
                                        END                                                     0006    6
                                *               MASKED SEARCH  PROGRAM.                         0001    1
                                *               DO NOT USE  RC  WORDS IN THIS PROGRAM.          0002    2
                                        REL                     PUNCH A RELOCATABLE BINARY DECK.        0007    7
                          26    BSIZE   EQU     22              BSIZE  MAY NOT BE LESS THAN  15  BECAUSE  0008    8
                                        REM             THE INPUT BUFFER STARTS AT THE SAME LOCATION AS 0009    9
                                        REM             THE OUTPUT BUFFER AND REQUIRES  15  LOCATIONS.  0010    10
                          25    EBSIZE  EQU     BSIZE-1                                         0011    11
                          25    RBSIZE  EQU     EBSIZE                                          0012    12
                0               ORG     0                                                       0013    13
                0  0 02000 0 00013      START   TRA     CLRBUF          CLEAR THE I/O BUFFER.   0014    14
                                        EJECT                   RESTORE THE PAGE.               0015    15


                                *               ROUTINES DEPENDENT ON THE REGULAR MONITOR BEING IN      0016    16
                                        REM     CORE STORAGE.                                   0017    17
                                *               GET OUT.                                        0018    18
                1  0 07400 4 77252      HO      TSX     S9EMTS,4        ENTER THE SUBROUTINE THAT EMPTIES THE   0019    19
                                        REM             OUTPUT BUFFERS.                         0020    20
                2  0 02000 0 77777              TRA     -1              NORMAL RETURN TO MONITOR.       0021    21
                                *               ERROR EXIT ROUTINE.                             0022    22
                3  0 63400 4 00005      ERRPRT  SXA     *+2,4                                   0023    23
                4  0 07400 4 77252              TSX     S9EMTS,4        ENTER THE SUBROUTINE THAT EMPTIES THE   0024    24
                                        REM             OUTPUT BUFFERS.                         0025    25
                5  0 77400 4 00000              AXT     **,4                                    0026    26
                6  0 02000 0 77776              TRA     -2              ERROR RETURN TO MONITOR.        0027    27
                                *               OUTPUT ROUTINES.                                0028    28
                                          7     PRINTI  SYN     PRINTO          USE THE SAME OUTPUT ROUTINE TO PRINT OUT        0029    29
                                        REM             BOTH THE INPUT CARDS AND THE SEARCHED FOR DATA. 0030    30
                7  0 63400 4 00017      PRINTO  SXA     EXIT1,4                                 0031    31
               10  0 07400 4 77246              TSX     S9PRCS,4        GO TO THE SUBROUTINE THAT PRINTS THE    0032    32
                                        REM             OUTPUT GIVEN TO IT.                     0033    33
               11 -0 00026 0 00312              MZE     BUFFER,,BSIZE                           0034    34
               12  0 00000 0 00000      PZERO   PZE     0,0,0           C(*) = +0 .             0035    35
               13  0 56000 0 00303      CLRBUF  LDQ     BLANKS                                  0036    36
               14  0 77400 4 00026              AXT     BSIZE,4                                 0037    37
               15 -0 60000 4 00340              STQ     BUFEND,4                                0038    38
               16  2 00001 4 00015              TIX     *-1,4,1                                 0039    39
               17  0 77400 4 77760      EXIT1   AXT     1-RDELAY,4      CA(*) = 1-RDELAY  INITIALLY ONLY.       0040    40
                                        REM             THIS ALLOWS US TO ENTER THE PART OF THE OUTPUT  0041    41
                                        REM             ROUTINE THAT CLEARS THE OUTPUT BUFFER BEFORE    0042    42
                                        REM             WE DO ANY PRINTING.                     0043    43
               20  0 02000 4 00001              TRA     1,4                                     0044    44
                                *               INPUT ROUTINE.                                  0045    45
               21  0 07400 4 77253      RDELAY  TSX     S9READS,4                               0046    46
               22  0 00016 0 00313              PZE     READIN+1,,14                            0047    47
               23  0 02000 0 00053              TRA     BA2             EOF  OR  REDUNDANCY .   0048    48
                                        EJECT                   RESTORE THE PAGE.               0049    49
```

```
                                *                ROUTINES ENTIRELY INDEPENDENT OF  M90 .                    0050      50
                                *                CHECK FOR TYPE OF SPECIFICATION CARD.                      0051      51
24   0 774CC 1 CC007                    AXT      TYPES-TYPE1,1                                               0052      52
25   0 754CC 0 CC000                    PXA      ,0                                                          0053      53
26   0 560CC 0 CC313                    LDQ      REDIN+1                                                     0054      54
27  -0 763CC 0 CCC14                    LGL      6*2                                                         0055      55
30  -0 34000 1 00272                    LAS      TYPES,1                                                     0056      56
31   2 CC0C1 1 C0030                    TIX      *-1,1,1                                                     0057      57
32   2 CC0C1 1 CC055                    TIX      SETIT,1,1                                                   0058      58
33   2 CC0C1 1 CC030                    TIX      *-3,1,1                                                     0059      59
                                *                THE PRESENT CARD IS NOT A SPECIFICATION CARD.              0060      60
34   0 602CC 0 00310                    SLW      KEY           HERE,  KEY  IS BEING USED AS TEMPORARY        0061      61
                                        REM                 STORAGE.                                        0062      62
35   0 322CC 0 00303                    ERA      BLANKS                                                      0063      63
36  -0 32000 0 00302                    ANA      LOCHAR                                                      0064      64
37   0 10000 0 00042                    TZE      ABA1                                                        0065      65
                                        BAH                    ERROR IN FORMAT OF INPUT CARD.              0066      66
40  -0 625CC 0 00305                    STL      LCTN                                                        0004
41   0 020CC 0 00003                    TRA      ERRPRT                                                      0005
                                *                THE PRESENT CARD IS A COMMENT CARD.  COLUMN  1  CONTAINS    0067      67
                                        REM      A CARRIAGE CONTROL CHARACTER FOR THE OUTPUT LISTING.        0068      68
42  -0 500CC 0 00303    ABA1    CAL      BLANKS                                                              0069      69
43  -0 765CC 0 00014            LGR      6*2                                                                 0070      70
44  -0 60000 0 00313            STQ      REDIN+1                                                             0071      71
45   0 560CC 0 00303            LDQ      BLANKS                                                              0072      72
46  -0 50000 0 00310            CAL      KEY                                                                 0073      73
47  -0 76500 0 00014            LGR      6*2                                                                 0074      74
50  -0 60000 0 00312            STQ      REDIN                                                               0075      75
51   0 074C0 4 00007            TSX      PRINTI,4                                                            0076      76
52   0 02000 0 00021            TRA      RDELAY                                                              0077      77
                        BA2     BAH                    EOF  OR  REDUNDANCY  FROM  COMIN .                  0078      78
53  -0 625CC 0 00305            STL      LCTN                                                                0004
54   0 020CC 0 00003            TRA      ERRPRT                                                              0005
                                *                THE PRESENT CARD IS A SPECIFICATION CARD.                   0079      79
55   0 767C0 0 00014    SETIT   ALS      6*2           POSITION TYPE SPECIFICATION CHARACTERS                0080      80
                                        REM                 FOR PRINTING.                                   0081      81
56  -0 501C0 0 CC274            ORA      CARRAG        BRING IN BLANKS AND THE CARRIAGE                      0082      82
                                        REM                 CONTROL CHARACTER.                              0083      83
57   0 60200 0 CC312            SLW      REDIN         STORE FOR PRINTING.                                   0084      84
60  -0 765C0 0 00014            LGR      6*2                                                                 0085      85
61  -0 600CC 0 CC313            STQ      REDIN+1                                                             0086      86
62  -0 50000 0 00315            CAL      REDIN+3                                                             0087      87
63   0 074C0 4 00223            TSX      8TO2,4                                                              0088      88
64  -0 50000 0 C0314            CAL      REDIN+2                                                             0089      89
65   0 074CC 4 C0223            TSX      8TO2,4                                                              0090      90
66  -0 500CC 0 CC313            CAL      REDIN+1                                                             0091      91
67   0 074C0 4 00237            TSX      SIGN,4                                                              0092      92
70  -0 60000 0 C0310            STQ      KEY           STORE ARGUMENT 1.                                     0093      93
71  -0 50000 0 00320            CAL      REDIN+6                                                             0094      94
72   0 074C0 4 00223            TSX      8TO2,4                                                              0095      95
73  -0 50000 0 00317            CAL      REDIN+5                                                             0096      96
74   0 074C0 4 00223            TSX      8TO2,4                                                              0097      97
```

```
 75 -0 50000 0 00316          CAL    REDIN+4                                          0098   98
 76  0 07400 4 00237          TSX    SIGN,4                                           0099   99
 77 -0 60000 0 00311          STO    KEY+1          STORE ARGUMENT 2.                 0100  100
100  0 07400 4 00007          TSX    PRINTI,4                                         0101  101
101  0 02000 1 00110          TRA    NOWGO,1                                          0102  102
                      *               TRANSFER TABLE.  THIS IS TIED TO THE  TYPES  TABLE.  0103  103
102  0 02000 0 00123          TRA    EQ                                               0104  104
103  0 02000 0 00143          TRA    RL                                               0105  105
104  0 02000 0 00146          TRA    RA                                               0106  106
105  0 02000 0 00113          TRA    BD                                               0107  107
106  0 02000 0 00110          TRA    MK                                               0108  108
107  0 02000 0 00001          TRA    HO                                               0109  109
                    110       NOWGO  SYN    *                                        0110  110
                      *               OBTAIN MASK.                                    0111  111
110 -0 50000 0 00310 MK       CAL    KEY                                              0112  112
111  0 60200 0 00307          SLW    MASK                                             0113  113
112  0 02000 0 00021          TRA    RDELAY                                           0114  114
                      *               SET BOUNDARIES FOR SEARCH.                      0115  115
113 -0 50000 0 00311 BD       CAL    KEY+1                                            0116  116
114  0 62100 0 00306          STA    UB                                               0117  117
115  0 62100 0 00126          STA    SETE                                             0118  118
116  0 40100 0 00236          ADM    ADRES1                                           0119  119
117  0 62100 0 00200          STA    SETR                                             0120  120
120 -0 40000 0 00310          SBM    KEY                                              0121  121
121  0 62100 0 00124          STA    INDEX                                            0122  122
122  0 02000 0 00021          TRA    RDELAY                                           0123  123
                      *               LOOK FOR EQUALS.                                0124  124
123  0 77400 2 00025 EQ       AXT    EBSIZE,2                                         0125  125
                    124       RGEQ   SYN    *              ENTRY POINT TO  EQ  ROUTINE WHEN A  0126  126
                              REM           RANGE-SEARCH ROUTINE FINDS THAT BOTH ARGUMENTS  0127  127
                              REM           ARE IDENTICAL WHEN LOOKED AT THROUGH THE MASK.  0128  128
124  0 77400 1 77777 INDEX    AXT    -1,1           CA(*) = -1  INITIALLY.  THIS ADDRESS WILL  0129  129
                              REM           BE SET BY  BD  SPECIFICATION CARDS.             0130  130
125  1 77777 1 00126          TXI    *+1,1,-1                                         0131  131
126 -0 50000 1 77776 SETE     CAL    -2,1           CA(*) = -2  INITIALLY.  THIS ADDRESS WILL  0132  132
                              REM           BE SET BY  BD  SPECIFICATION CARDS.             0133  133
127  0 32200 0 00310          ERA    KEY                                              0134  134
130 -0 32000 0 00307          ANA    MASK                                             0135  135
131  0 10000 0 00136          TZE    FOUNDE                                           0136  136
132  2 00001 1 00126          TIX    SETE,1,1                                         0137  137
133  3 00024 2 00021          TXH    RDELAY,2,EBSIZE-1                                0138  138
134  0 07400 4 00007 EQLPR    TSX    PRINTO,4                                         0139  139
135  0 02000 0 00021          TRA    RDELAY                                           0140  140
136  0 07400 4 00245 FOUNDE   TSX    2TO8,4                                           0141  141
137 -2 00001 1 00134          TNX    EQLPR,1,1                                        0142  142
140  2 00001 2 00126          TIX    SETE,2,1                                         0143  143
141  0 07400 4 00007          TSX    PRINTO,4                                         0144  144
142  1 00024 2 00126          TXI    SETE,2,EBSIZE-1                                  0145  145
                      *               LOOK FOR RANGE (LOGICAL).                       0146  146
143  0 56000 0 00275 RL       LDQ    LGLCMP         IC(LGLCMP) = (LAS **) .           0147  147
144 -0 50000 0 00276          CAL    XCHLGL         IC(XCHLGL) = (XCL) .              0148  148
145  0 02000 0 00150          TRA    R                                                0149  149
                      *               LOOK FOR RANGE (ALGEBRAIC).                     0150  150
```

```
146   0 56000 0 00277        RA      LDQ     ALGCMP          IC(ALGCMP) = (CAS **) .                 0151    151
147  -0 50000 0 00300                CAL     XCHALG          IC(XCHALG) = (XCA) .                    0152    152
                                     REM                     DROP THROUGH TO  R  ROUTINE.            0153    153
                                *            LOOK FOR RANGE.                                         0154    154
150   0 60200 0 00203        R       SLW     XCH                                                     0155    155
151  -0 62000 0 00165                SLQ     COMPR                                                   0156    156
152  -0 62000 0 00204                SLQ     COMPA1                                                  0157    157
153  -0 62000 0 00213                SLQ     COMPA2                                                  0158    158
154  -0 50000 0 00307        RG      CAL     MASK            ENTRY POINT OF RANGE-SEARCH ROUTINE WERE WE  0159  159
                                     REM                TO HAVE ONLY ONE POSSIBLE RANGE-SEARCH.      0160    160
155   0 32000 0 00311                ANS     KEY+1                                                   0161    161
156  -0 32000 0 00310                ANA     KEY                                                     0162    162
157   0 60200 0 00310                SLW     KEY                                                     0163    163
160  -0 13000 0 00000                XCL                                                             0164    164
161   0 52200 0 00203                XEC     XCH                                                     0165    165
162   0 77400 2 00025                AXT     RBSIZE,2                                                0166    166
163   0 53400 1 00124                LXA     INDEX,1                                                 0167    167
164  -0 77400 4 00000                AXC     0,4                                                     0168    168
165   0 34000 0 00311        COMPR   CAS     KEY+1           THE OPERATION TO BE PERFORMED HERE IS   0169    169
                                     REM                EITHER  CAS  OR  LAS .  THIS OPERATION IS SET  0170  170
                                     REM                BY  RL  AND  RA  SPECIFICATION CARDS.        0171    171
166   1 77777 4 00170                TXI     *+2,4,-1        GR(C(KEY),C(KEY+1)) = 1 .               0172    172
167   1 77776 2 00124                TXI     RGEQ,2,(RBSIZE-2)-RBSIZE     EQ(C(KEY),C(KEY+1)) = 1 .  0173  173
                                     REM                     DROP THROUGH IF  LS(C(KEY),C(KEY+1)) = 1 .  0174  174
170  -0 50000 4 00271                CAL     ADRESS,4                                                0175    175
171   0 62100 0 00207                STA     COMPA1+3                                                0176    176
172   0 77100 0 00022                ARS     18                                                      0177    177
173   0 62100 0 00214                STA     COMPA2+1                                                0178    178
174  -0 50000 4 00272                CAL     ADRESS+1,4                                              0179    179
175   0 62100 0 00205                STA     COMPA1+1                                                0180    180
176   0 77100 0 00022                ARS     18                                                      0181    181
177   0 62100 0 00216                STA     COMPA2+3                                                0182    182
200  -0 50000 1 77777        SETR    CAL     -1,1            CA(*) = -1  INITIALLY.  THIS ADDRESS WILL  0183  183
                                     REM                BE SET BY  BD  SPECIFICATION CARDS.          0184    184
201  -0 32000 0 00307                ANA     MASK                                                    0185    185
202  -0 13000 0 00000                XCL                                                             0186    186
203   0 13100 0 00000        XCH     XCA                     THE OPERATION TO BE PERFORMED HERE IS   0187    187
                                     REM                EITHER  XCA  OR  XCL .  THIS OPERATION IS SET  0188  188
                                     REM                BY  RL  AND  RA  SPECIFICATION CARDS.        0189    189
204   0 34000 0 00310        COMPA1  CAS     KEY             THE OPERATION TO BE PERFORMED HERE IS   0190    190
                                     REM                EITHER  CAS  OR  LAS .  THIS OPERATION IS SET  0191  191
                                     REM                BY  RL  AND  RA  SPECIFICATION CARDS.        0192    192
205   2 00001 1 00000                TIX     **,1,1                                                  0193    193
206   2 00001 1 00217                TIX     FOUNDR,1,1                                              0194    194
207   2 00001 1 00000                TIX     **,1,1                                                  0195    195
210   3 00024 2 00021                TXH     RDELAY,2,RBSIZE-1                                       0196    196
211   0 07400 4 00007                TSX     PRINTO,4                                                0197    197
212   0 02000 0 00021                TRA     RDELAY                                                  0198    198
213   0 34000 0 00311        COMPA2  CAS     KEY+1           THE OPERATION TO BE PERFORMED HERE IS   0199    199
                                     REM                EITHER  CAS  OR  LAS .  THIS OPERATION IS SET  0200  200
                                     REM                BY  RL  AND  RA  SPECIFICATION CARDS.        0201    201
```

```
214   0 02000 0 00000          TRA    **                                    0202      202
215   0 02000 0 00217          TRA    FOUNDR                                0203      203
216   0 02000 0 00000          TRA    **                                    0204      204
217   0 07400 4 00245  FOUNDR  TSX    2TO8,4                                0205      205
220   2 00001 2 00200          TIX    SETR,2,1                              0206      206
221   0 07400 4 00007          TSX    PRINTO,4                              0207      207
222   1 00024 2 00200          TXI    SETR,2,RBSIZE-1                       0208      208
                       *             SUBROUTINES.                          0209      209
                       *             PROCESS THE FIELDS ON A SPECIFICATION CARD.  0210  210
223  -0 76500 0 00003  8TO2   LGR    3                                     0211      211
                               DUP    2,5                                   0212      212
224   0 77100 0 00003          ARS    3                                     0213      213
225  -0 76500 0 00003          LGR    3                                     0214      214
226   0 77100 0 00003          ARS    3                                     0213
227  -0 76500 0 00003          LGR    3                                     0214
230   0 77100 0 00003          ARS    3                                     0213
231  -0 76500 0 00003          LGR    3                                     0214
232   0 77100 0 00003          ARS    3                                     0213
233  -0 76500 0 00003          LGR    3                                     0214
234   0 77100 0 00003          ARS    3                                     0213
235  -0 76500 0 00003          LGR    3                                     0214
                        236    ADRES1 SYN    *          CA(*)  MUST BE  1 , OTHERWISE CHANGE  0215  215
                               REM          ADRES1 .                        0216      216
236   0 02000 4 00001          TRA    1,4                                   0217      217
237   0 32200 0 00301  SIGN    ERA    MINUS                                 0218      218
240  -0 32000 0 00302          ANA    LOCHAR                                0219      219
241  -0 10000 4 00001          TNZ    1,4                                   0220      220
242  -0 76000 0 00003          SSM                                          0221      221
243   0 76500 0 00000          LRS    0                                     0222      222
244   0 02000 4 00001          TRA    1,4                                   0223      223
                       *             A LOCATION HAS BEEN FOUND TO MEET THE REQUIREMENTS ON  0224  224
                               REM    THE LATEST SPECIFICATION CARD.  STORE THIS LOCATION  0225  225
                               REM    NUMBER IN THE OUTPUT BUFFER.          0226      226
245   0 75400 1 00000  2TO8    PXA    ,1                                    0227      227
246  -0 40000 0 00306          SBM    UB                                    0228      228
247  -0 76500 0 00003          LGR    3                                     0229      229
250   0 76700 0 00003          ALS    3                                     0230      230
251  -0 76500 0 00006          LGR    6                                     0231      231
252   0 76700 0 00003          ALS    3                                     0232      232
253  -0 76500 0 00006          LGR    6                                     0233      233
254   0 76700 0 00003          ALS    3                                     0234      234
255  -0 76500 0 00006          LGR    6                                     0235      235
256   0 76700 0 00003          ALS    3                                     0236      236
257  -0 50100 0 00304          ORA    L9BLNK                                0237      237
260  -0 76500 0 00017          LGR    3+6+6                                 0238      238
261  -0 60000 2 00340          STQ    BUFEND,2                              0239      239
262   0 02000 4 00001          TRA    1,4                                   0240      240
                       *             TABLE OF IDENTIFYING CHARACTERS ON SPECIFICATION CARDS.  0241  241
                               REM    THIS IS TIED TO THE  NOWGO  TRANSFER TABLE.  0242  242
263  -3 30000 0 00025  TYPE1   BCD    1,0000EQ                                    0243  243
264  -3 30000 0 00051          BCD    1,0000RL                                    0244  244
265  -3 30000 0 00051          BCD    1,0000RA                                    0245  245
```

```
266 -3 30000 0 00022              BCD     1,0000BD                                          0246   246
267 -3 30000 0 00044              BCD     1,0000MK                                          0247   247
270 -3 30000 0 00030              BCD     1,0000HU                                          0248   248
                   272    TYPES   SYN     *+1                                        0249         249
                          *               TABLE OF ADDRESSES USED BY THE  R  ROUTINE.  0250         250
271  0 00200 0 00200      ADRESS  PZE     SETR,,SETR                                 0251         251
272  0 00217 0 00213              PZE     COMPA2,,FOUNDR                             0252         252
273  0 00200 0 00200              PZE     SETR,,SETR                                 0253         253
                          *               CONSTANTS                                  0254         254
274 -3 34260 0 00060      CARRAG  BCD     1,K CO                                            0255   255
275 -0 34000 0 00000      LGLCMP  LAS     **              USED FOR  RL  SEARCH.      0256         256
276 -0 13000 0 00000      XCHLGL  XCL                     USED FOR  RL  SEARCH.      0257         257
277  0 34000 0 00000      ALGCMP  CAS     **              USED FOR  RA  SEARCH.      0258         258
300  0 13100 0 00000      XCHALG  XCA                     USED FOR  RA  SEARCH.      0259         259
301 -3 30000 0 00000      MINUS   BCD     1,00000-                                          0260   260
302  0 00000 0 00077      LOCHAR  OCT     77                                         0261         261
303 -3 36060 6 06060      BLANKS  BCD     1,                                                0262   262
304  0 00000 0 60000      L9BLNK  OCT     60000           THIS LOCATION CONTAINS THE HOLLERITH CODE  0263  263
                          REM             FOR A BLANK, SHIFTED LEFT  9  BIT POSITIONS  0264         264
                          REM             (3/2 COLUMNS).                             0265         265
                          *               STORAGE.                                   0266         266
305  0 00000 0 00000      LCTN    PZE     **              ERROR FINDING AID.         0267         267
306  0 00000 0 77776      UB      PZE     -2              CA(*) = -2  INITIALLY.  THIS ADDRESS WILL  0268  268
                          REM             BE SET BY  BD  SPECIFICATION CARDS.        0269         269
307 -3 77777 7 77777      MASK    OCT     777777777777  INITIAL SETTING.  THIS LOCATION WILL BE  0270  270
                          REM             SET BY  MK  SPECIFICATION CARDS.           0271         271
310                 2     KEY     BSS     2                                          0272         272
                  312     REDIN   SYN     BUFFER          THE INPUT BUFFER IS IDENTICAL IN STARTING  0273  273
                          REM             LOCATION TO THE OUTPUT BUFFER.             0274         274
312                26     BUFFER  BSS     BSIZE                                      0275         275
                  340     BUFEND  SYN     BUFFER+BSIZE                               0276         276
                    0             END     START                                      0277         277
```

THE FOLLOWING SYMBOLS APPEAR TO BE CORRECT

```
      $2TO8=   165/000245        $8TO2=   147/000223        $R=   104/000150        $BD=    75/000113
      $EC=      83/000123        $HO=       1/000001        $MK=    72/000110        $RA=   102/000146
      $RG=     108/000154'       $RL=      99/000143        $UB=   198/000306        $BA2=   43/000053
     $KEY=     200/000310        $XCH=    131/000203        $ABA1=  34/000042        $LCTN=  197/000305
    $MASK=     199/000307        $RGEQ=    84/000124        $SETE=  86/000126        $SETR=  128/000200
    $SIGN=     159/000237        $BSIZE=   22/000026        $COMPR= 117/000165        $EQLPR=  92/000134
   $EXIT1=      15/000017        $INDEX=   84/000124        $MINUS= 193/000301        $NOWGO=  72/000110
   $PZERO=      10/000012'       $REDIN=  202/000312        $SETIT=  45/000055        $START=   0/000000
   $TYPE1=     179/000263        $TYPES=  186/000272  ******$ADRES1= 158/000236  ******$ADRESS= 185/000271
******$ALGCMP= 191/000277  ******$BLANKS= 195/000303  ******$BUFEND= 224/000340  ******$BUFFER= 202/000312
******$CARRAG= 188/000274  ******$CLRBUF=  11/000013  ******$COMPA1= 132/000204  ******$COMPA2= 139/000213
******$ERSIZE=  21/000025  ******$ERRPRT=   3/000003  ******$FOUNDE=  94/000136  ******$FOUNDR= 143/000217
******$L9BLNK= 196/000304  ******$LGLCMP= 189/000275  ******$LOCHAR= 194/000302  ******$PRINTI=   7/000007
******$PRINTC=   7/000007  ******$RBSIZE=  21/000025  ******$RDELAY=  17/000021  ******$XCHALG= 192/000300
******$XCHLGL= 190/000276
```

THE FOLLOWING SYMBOLS FROM THE COMPOOL WERE USED BY THE PROGRAM

******$S9EMTS= 32426/077252 ******$S9PRCS= 32422/077246 ******$S9REDS= 32427/077253

THE FOLLOWING MACROS HAVE BEEN DEFINED BY THE PROGRAM

BAH

END OF META ASSEMBLIES.

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DOCUMENT CONTROL DATA - R&D

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d.	

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	Directorate of Computers, Electronic Systems Division, L. G. Hanscom Field, Bedford, Massachusetts

13. ABSTRACT

The Masked Search Program is a static trace and can be used for debugging or modifying a 7090 program. This report describes the program and how it is used in most cases. Additional information is provided to cover unusual occurrences during the program run.

DD FORM 1 JAN 64 1473

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