

MEMORANDUM  
RM-3327-PR  
SEPTEMBER 1962

THE RAND-SHARE  
OPERATING SYSTEM MANUAL  
FOR THE IBM 7090 COMPUTER

G. E. Bryan, Editor

PREPARED FOR:  
UNITED STATES AIR FORCE PROJECT RAND

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*The* **RAND** *Corporation*  
SANTA MONICA • CALIFORNIA

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## PREFACE

This manual is a workbook for the use of The RAND Corporation version of the SHARE Operating System (SOS) for the IBM 7090 computer. It describes the use of new features and tools which have been added to the system to aid programmers in the solution of problems on the computer, and to smooth the physical operations required in computer use.

An operating system is a complex of computer routines which are used to get programs and data into and out of the machine, transform data (including program assembly and compilation), supervise job and task sequencing, and facilitate communication between the programmer and components of the operating system. The SHARE Operating System for the IBM 709/7090 Data Processing Systems was designed by a committee of SHARE, an organization of computer users formed to facilitate the exchange of computer programs, and was implemented by IBM and some of the users. The RAND Corporation has been associated with this effort from its start. A year before the delivery of the IBM 7090 now in use at RAND, it was decided that SOS would be used on that machine. Since it is not desirable to use more than one operating system in an installation if this can reasonably be avoided, the task of revising the algebraic compiler, FORTRAN, was initiated so that it would be available to programmers using SOS. Concurrently with this work, a number of other additions and improvements to SOS were made. The most notable additions, other than FORTRAN, were the Information Processing Language V processor which was written at RAND, a 7090 assembler (BE FAP), a 1401 assembler (PP PEST), a new system tape editing program developed at RAND, and an elaborate set of accounting routines used by the operating system.

This manual describes the modifications to SOS and supplements the IBM manual which describes the basic system.\*

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\*See Ref. 2.

It was prepared so that this work would be readily available to other military and civilian users of the IBM 7090. Tapes containing the operating system are available from The RAND Corporation.

## SUMMARY

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The RAND Operating System\* is a somewhat improved version of the SHARE Operating System (SOS) with the MockDonald monitor. Six processors have been added -- FORTRAN, BEFAP, IPL, PEST, RSWST, TRACE.

This manual assumes that the reader is familiar with the SHARE SOS Manual and the published descriptions of the other processors. This manual is concerned with the changes and additions which have been made in the various components of the system. The exception to this is RSWST, the RAND system tape writer, processor, and editor. A description of this processor appears as Appendix A.

The system is distributed on a single tape which contains not only the absolute files of the operating system, but also a SQUOZE file containing base (generally MD8 and MD12 level decks) and current SQUOZE decks for each system component and a file containing the MOD packages in CRUNCH form which relate current and base SQUOZE. This is done so that RAND MODS may be examined in detail. The system subroutine RSWST is provided to process these files. A miscellaneous file is provided which contains the initiation deck peripheral programs and certain useful job setups.

It is contemplated that the C.E. diagnostics and system teaching programs will be added eventually.

It is intended that all programs, decks, and write-ups necessary to the operation, maintenance, and modification of the system be contained on the system tape.

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\*The system has been revised under the direction of G. H. Mealy. G. W. Armerding, J. D. Babcock, C. L. Baker, G. E. Bryan, R. J. Hewitt, and H. S. Kelly contributed to the project.

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\*The current edition does not contain an Appendix C.

## I. INTRODUCTION

The speed, size, complexity, and cost of modern computers has given rise to the development of mechanized aids to increase the efficiency of computer use. These programmed aids are particularly necessary where the computer is used to solve a wide range of problems which differ in size, complexity, and method of specification, and for those problems which are short-lived. The operating aid, which takes the form of standard programs gathered together and made available to the programmer and to the machine operator, is usually called an operating system. Such a system tries to promote operational efficiency in three basic ways:

- 1) Machine time savings;
- 2) Operational efficiency;
- 3) Programmer time savings.

Machine time savings accrue through the techniques and standards established for operating efficiency and efficiency of programming.

Operational efficiency is achieved by providing, through the operating system, a standard way of processing jobs and a method of automatically sequencing jobs. Typically, a sequence of individual jobs is prepared away from the main processor by putting the job descriptions on a magnetic tape which is read by the computer under control of the operating system. The system reads, interprets, and executes the instructions from these job descriptions. The instructions are calls by the programmers for the use of one or more of the many facilities available as part of the operating system.

It is the operator's job to provide assistance to the system only in cases of exception or trouble. He is asked to mount tapes and provide other physical services, but his most important function is to recognize abnormal action on the part of the system or object program and take corrective action through one of the standard procedures provided



by the system. Thus, the system provides a standard framework for solving problems in which it normally works problem after problem, accounting for and providing service for each, stopping or asking for help only when an abnormal situation is encountered.

Programming efficiency is provided in an operating system by making easily available a set of processors and routines for accomplishing many of the detailed tasks which are commonly necessary in using the computer. These fall into several broad categories.

Interpretation. The operating system interprets instructions from the programmer to determine the desired processors, standard routines, and modes for each job. As each instruction is read, the system causes the appropriate action to occur.

Communication. The system has responsibility for providing communication between programs, between programs and the system, and between parts of the system which are used in the job processing. This is probably the most important single task of the system, since it enables the various programs to operate together without interference.

Translation. The system has several processors which translate from some language convenient to human beings into the precise language of the machine. Several are provided, since each is generally useful for a particular class of problems. The FORTRAN language is useful for a broad class of mathematically-expressible problems, IPL is useful in problems of complex structure, and a symbolic form of machine language is useful for problems where detailed machine action must be carefully controlled.

Input-Output Transmission. Modern machines have methods for communicating with external devices which are complex and rather independent of the operation of

the main processor. Since many of the subprocessors of the system as well as the programmer must communicate with these devices, there is a need for coordinating the various input-output transmissions to prevent interference of one with another. The system provides this coordination through the use of a common set of input-output routines and conventions for their use.

Input-Output Conversion. In all computer problems there is a need for conversion of data from the external form, say punched cards, to the internal form usable by the machine and, vice versa, from the machine's internal form to the printed page for convenient use by human beings. The system provides a set of programs which perform these functions in a flexible and convenient way, thus eliminating the necessity of providing conversion facilities separately in each program that is written.

Debugging. Inevitably in every program there are mistakes in the original coding. These are called "bugs." The system provides a set of routines to aid the programmer in the determination and correction of these errors by producing this debugging information in a form conveniently usable by the programmer.

Each of the subprocessors provides translation comments to the programmer when it discovers errors or inconsistencies in the programs. Many hours of machine and programmer effort are saved through these diagnostics.

When it is necessary for the operator to intervene in the operation of a program, he does it by the use of standard system programs already in the machine. These are provided to get the machine quickly to the next job and at the same time record enough information so that the programmer may determine and repair the trouble.

Updating and Maintenance. Programming (particularly in the area of programming systems) is one of today's fastest changing fields. Thus, it is extremely important to provide means and methods for conveniently adding to and modifying the system itself. The system contains its own procedures and programs for updating itself. This feature makes available as quickly as possible new techniques, processors, and subsystems.

Accounting. Since the system is in overall control of the machine, it can and does provide automatic accounting of the machine usage. Operational statistics are also kept which aid in the future development of the system by indicating what parts of the system are used most heavily.

In providing for efficient machine operation, the operating system utilizes a standard set of programs for each of several common computer tasks and provides the methods and standards for communicating among these programs, the problem-solving program itself, the machine, and the machine operator. It must provide these aids in a way which is subject to easy change and growth with the advancing state-of-the-art.

CERTAIN CONTROL CARDS HAVE BEEN ADDED TO THE SYSTEM AND SOME EXISTING ONES HAVE BEEN AUGMENTED. THE DIFFERENCES FROM STANDARD MOCK-DONALD ARE...

JOB

THE JOB CARD FORMAT IS...

• JOB JN,RN,MN,ERT,EMO,EPO,TYPE

WHERE

JN IS THE JOB NUMBER.  
RN IS THE RUN IDENTIFICATION.  
MN IS YOUR MAN NUMBER (ABBREVIATED NAME OR INITIALS AT CERTAIN INSTALLATIONS).  
ERT IS THE ESTIMATED RUNNING TIME IN MINUTES AND MAY BE SUFFIXED BY 'MIN'.  
EMO IS THE ESTIMATED NUMBER OF WORDS OF MEDIARY OUTPUT EXPECTED DURING EXECUTION.  
EPO IS THE ESTIMATED NUMBER OF PAGES OF PRINTED OUTPUT.  
TYPE IS THE JOB TYPE CONSISTING OF ONE CHARACTER. IT IS CARRIED THROUGH THE ACCOUNTING SYSTEM.

JN,RN,MN RESPECTIVELY REPLACE 'SYSID1,2,3' AT THE BEGINNING OF THE JOB IF NOT REPLACED BY THE USE OF AN 'IDENT' CARD. THE FIRST TWO (JN AND RN) ARE USED AT THE TOP OF LISTINGS AND MN IS USED IN THE ID FIELD OF PUNCHED CARDS.

## II. CONTROL CARDS

## FAP AND FOR

THE CONTROL CARD VARIABLE FIELD FORMAT FOR 'FAP' AND 'FOR'  
JOBS IS...

A,B,C,D,E,F,G

WHERE

A = NOGO	DON'T EXECUTE.
GOIF	EXECUTE IF NO DEFINITE ERRORS OF MISSING SUBROUTINES.
GO	EXECUTE IF NO DEFINITE ERRORS.
GOGOGO	EXECUTE IN ANY CASE.
B = NOBIN	DON'T PUNCH OBJECT DECK.
BIN	PUNCH OBJECT DECK.
C = R	PUNCH ROW BINARY.
C	PUNCH COLUMN BINARY.
D = NOSAP	DON'T PRODUCE SYMBOLIC LISTING.
LIST8	PRODUCE OCTAL LIST OF OBJECT PROGRAM.
SAP	PRODUCE SYMBOLIC LISTING. ('FAP' ALWAYS DOES THIS.)
E = NOMAP	NO LOADING MAP.
MAP	PRINT LOADING MAP.
F = DEBUG	LOAD WITH DEBUGGING ROUTINES ('SNAP').
NOBUG	LOAD WITHOUT DEBUGGING ROUTINES.
G = SYSXRN	IF SOURCE IS 'SYSXRN'.
SYSPIT	IF SOURCE IS 'SYSPIT'.
	G IS USED TO ASSEMBLE, USING AN INPUT TAPE OTHER THAN 'SYSPIT'.

DEFINITE ERRORS CONSIST OF MULTIPLY-DEFINED SYMBOLS,  
UNDEFINED SYMBOLS, MISSING OP CODES, ETC. IN THESE CASES,  
THE BINARY DECK IS NOT PUNCHED.

THE NORMAL CASE IS...

GO,BIN,C,SAP,MAP,NOBUG,SYSPIT

REL

RELOCATABLE LOADING OF ALREADY COMPILED DECKS IS CONTROLLED BY USING THE CONTROL CARD...

REL A,E,F

WHERE A, E, AND F ARE AS DESCRIBED FOR THE FORTRAN-FAP CONTROL CARD.

THE PARAMETERS ON THE 'FAP' AND 'FOR' CARDS CONTROL ONLY THE PARTICULAR ASSEMBLY OR COMPILATION IN QUESTION. IF A 'REL' CARD IS PRESENT, THE LOADING OPTIONS ARE CONTROLLED BY THE PARAMETERS OF 'REL'. IF 'REL' IS NOT PRESENT, LOADING OPTIONS ARE CONTROLLED BY THE PARAMETERS ON THE LAST 'FAP' OR 'FOR' CARD.

THE FIRST PROGRAM LOADED WILL BE ORIGINATED AT THE CURRENT VALUE OF 'SYSORG'. THE 'BSS' LOADER ASSEMBLES EIGHT (8) WORDS OF CODE JUST ABOVE THE LAST PROGRAM LOADED, AND THIS CODE IS EXECUTED PRIOR TO TRANSFER TO THE MAIN PROGRAM IN PHASE 2. THIS CODE...

- (1) ADDS THE SPACE BETWEEN THE END OF THE CODE AND 'COMMON' AS BUFFERS USING 'SYSBFD'.
- (2) TURNS OFF THE SENSE LIGHTS.
- (3) ZEROES OUT 'COMMON'.

NOTE THAT VARIABLE STORAGE IN THE PROGRAM AREA (I.E., THAT NOT IN 'COMMON') WILL HAVE BEEN SET TO 'TSX SYSERR,4' NOT TO ZEROES.

IF MORE THAN ONE ROUTINE LOADED CONTAINS THE SAME ENTRY POINT NAMES, THE LAST ONE LOADED WILL BE USED AT EXECUTION TIME. THE OTHER DUPLICATIONS WILL STILL OCCUPY CORE SPACE, HOWEVER. DECKS ON 'SYSPIT' ARE LOADED BEFORE THE RESULTS OF 'FAP' AND 'FOR' RUNS ARE LOADED.

IN CASE A TRANSFER VECTOR ENTRY CALLS FOR AN ENTRY POINT NOT IN ANY OF THE ROUTINES LOADED, AND IF IT IS OF THE FORM 'SYSXYZ', THE LOADER TRIES TO GET ITS EQUIVALENCE FROM THE SYSTEM SYMBOL TABLE. IF NOT FOUND HERE OR IF NOT OF THE FORM 'SYSXYZ', THE TRANSFER VECTOR ENTRY IS REPLACED BY 'TTR SYSERR' AND ASTERISKS PRINT IN PLACE OF THE LOCATION ON THE LOADING MAP. SYSTEM SYMBOLS REFERRED TO AND FOUND WILL NOT BE PRINTED ON THE LOADING MAP.

## PEST

THERE ARE NO VARIABLES FOR A 'PEST' ASSEMBLY. A LISTING AND OBJECT DECK ARE ALWAYS PRODUCED. THE ORIGINAL SHARE-DISTRIBUTED VERSION OF PEST IS USED.

## IPL

THE IPL-V PROCESSOR IS CALLED BY THE CONTROL CARD...

IPL A

WHERE A MEANS BLANK. (COMMENTS PERMITTED AFTER COL 17, HOWEVER).

## LOAD AND SCAT

FOUR FIELDS HAVE BEEN ADDED TO THE 'LOAD' AND 'SCAT' CONTROL CARDS FOLLOWING THE 'TRMAC' FIELD...

... TRMAC,A,B,C,D

## WHERE

A = PUNCH	PUNCH SYMBOLIC INSTEAD OF LIST.
CRUNCH	PUNCH 'CRUNCH' INSTEAD OF LIST.
NPUNCH	DON'T PUNCH. (I.E., JUST LIST.)
B = SYMBOL	REGULARIZE DICTIONARY FOR PUNCH.
NOSYM	DON'T REGULARIZE DICTIONARY FOR PUNCH.
C = TRACE	EXECUTE WITH 7094 TRACE PROGRAM
NTRACE	DON'T
D = SYSPIT	TAKE INPUT FROM 'SYSPIT'
SYSXRN	TAKE INPUT ('SQZ' DECK) FROM 'SYSXRN'.

NORMAL CASE FOR THESE FIELDS IS...

... TRMAC,NPUNCH,NOSYM,NTRACE,SYSPIT

## 'REWIND' AND 'UNLOAD'

THESE CONTROL CARDS, WHICH MAY ALSO BE WRITTEN 'REW' AND 'RUN,' CAUSE THE IMMEDIATE REWINDING OR UNLOADING OF THE TAPE NAMED IN THE VARIABLE FIELD. IF THE CARD IS OF THE UNLOAD TYPE THE TAPE IS DISASSIGNED. THERE IS NO NORMAL CASE.

THE OPTION IS USEFUL WHEN A TAPE MAY BE LOGICALLY REWOUND ONLY BY THE SYSTEM. FOR INSTANCL IN THE SEQUENCE...

II. CONTROL CARDS

JOB  
LOAD SYSAR1  
MOD CARDS  
REWIND SYSAR1  
LOAD SYSAR1  
MOD CARDS

THE PROGRAMMER WISHES THE SYSTEM TO LOAD THE SAME DECK FROM TAPE WITH DIFFERENT MOD PACKAGES TO BE EXECUTED WITHIN THE SAME JOB.

REMARK

THIS CARD CAUSES NO SYSTEM ACTION EXCEPT PRINTING OF THE CARD BOTH ON- AND OFF- LINE.

ASSIGN

ONE FIELD HAS BEEN ADDED TO THE ASSIGN CARD. ITS CONTENTS MAY BE...

NOW	CAUSES IMMEDIATE ASSIGNMENT OF THE TAPE
NOTNOW	ORDINARY TAPE ASSIGNMENT

THE NORMAL CASE IS NOTNOW. THE FIELD IS USEFUL WHEN THE SYSTEM MUST BE TOLD ABOUT THE NECESSITY OF IMMEDIATE ASSIGNMENT, FOR EXAMPLE WHEN A SCAT RUN WILL USE A RESERVED LIBRARY TAPE...

' JOB 2091,LBR,GRB929,1,1000,10,C ED BRYAN  
' ASSIGN A5=SYSAR1,NOW  
' SCAT GO  
SOURCE DECK FOR SCAT



ONEJOB, PPTPOT, ACCT, CLOCK

THESE CARDS ARE SYSTEM MODALS AND ARE USED IN THE INITIATION DECK EXCLUSIVELY. ONLY ACCT AND CLOCK HAVE VARIABLE FIELDS...

ONEJOB	IF PRESENT IN THE INITIATION DECK CAUSES THE SYSTEM TO PROCESS EACH JOB IN TURN THROUGH THE THREE PHASES. SYSPIT IS ASSIGNED THROUGHOUT ALL OPERATION AND INTERPHASE STOPS AND COMMENTARY ON-LINE ARE ELIMINATED. OPERATION IS SLIGHTLY SLOWER DUE TO INCREASED SYSTEM TAPE TIME IN THE OUTPUT PHASE.
PPTPOT	IF PRESENT CAUSES BOTH PRINT (BCD) AND PUNCH (ALWAYS BINARY, EVEN BINARY IMAGES OF BCD CARDS) OUTPUT TO APPEAR ON 'SYSPOT'. THE NORMAL PUNCH OUTPUT TAPE IS RELEASED FOR OTHER USE.
ACCT	CONTENTS OF THE SINGLE VARIABLE FIELD MAY BE 'ONLINE' OR 'OFFLINE', CAUSING ACCOUNTING CARDS TO BE PUNCHED ON OR OFF LINE. 'ONLINE' IS THE NORMAL CASE. 'ONLINE' IS IMPLIED BY THE ABSENCE OF THE CARD
CLOCK	CONTENTS OF THE SINGLE VARIABLE FIELD MAY BE 'READ' OR 'NOREAD' CAUSING READING OR IGNORING OF THE PRINTER CLOCK. 'READ' IS THE NORMAL CASE AS IS IMPLIED BY THE ABSENCE OF THE CARD.

SIX NEW PROCESSORS HAVE BEEN ADDED TO THE BASIC 'SOS'  
SYSTEM...

BEFAP  
IPL  
PEST  
RSWST  
FORTRAN  
TRACE

## BEFAP

'BEFAP' IS CALLED BY THE 'FAP' CONTROL CARD. THIS 'BEFAP' IS THAT OF NOVEMBER, 1961. IT READS AND PRODUCES 'CRUNCH' DECKS AND HAS 'ALTER' MODIFICATION FACILITIES ON INPUT. THE EXTENSIVE MACRO COMPILER FACILITIES OF THE PROCESSOR ARE AVAILABLE.

THE INPUT-OUTPUT HAS BEEN TOTALLY REPLACED TO COMMUNICATE WITH 'SOS'. A FEW PSEUDO-OPERATIONS HAVE BEEN CHANGED...

PLB N - NOT AVAILABLE.

DECK T - PUNCH 'CRUNCH' DECK ON TAPE T.

IF T IS BLANK, THE DECK IS PUNCHED ON 'SYSPPT' (ON-LINE IF SWITCH 6 WAS DOWN AT THE BEGINNING OF PHASE 1). A 'CRUNCH' CARD IS NOT WRITTEN. IF T IS 'SYSXUN' OR 'SYSXRN', THE DECK IS FOLLOWED BY A FILE MARK IN ORDER TO BE PROCESSABLE AS A SINGLE ITEM BY 'WST'.

CRUNCH T - READ CRUNCH DECK.

IF T IS BLANK, THE DECK FOLLOWS ON 'SYSPIT' AND OTHERWISE ON 'SYSXUN' OR 'SYSXRN'. AT THE END OF THE DECK, THE PREVIOUS INPUT UNIT IS RESTORED.

MOD PACKAGES FOR A 'CRUNCH' DECK INPUT TO 'FAP' MUST PRECEDE THE 'CRUNCH' DECK AND CONSIST OF 'ALTERS' IN ASCENDING ORDER BY ALTER NUMBER. THE 'CRUNCH' DECK ITSELF MUST BE PRECEDED BY A CARD WITH THE WORD 'CRUNCH' BEGINNING IN COLUMN 8.

TAPE T - USE NEW INPUT TAPE T.

AT THE NEXT FILE MARK ON T, THE PREVIOUS INPUT TAPE IS RESTORED. WITH T BLANK, THE PREVIOUS INPUT TAPE IS ALSO RESTORED (NORMALLY, TO RETURN TO 'SYSPIT').

EDIT T - WRITE NEW SYMBOLIC CARDS ON T.

IF T IS BLANK, 'SYSPOT' IS USED. IF 'CARDS' APPEARS, 'SYSPPT' IS USED. FOR OTHER T, 'BCD' CARD IMAGES ARE WRITTEN ON T. WITH 'EDIT' USED, 'FAP' RETURNS CONTROL TO THE MONITOR WITHOUT DOING ITS SECOND PASS.

COUNT N - N CARDS TO BE ASSEMBLED.

THIS VERSION OF 'BEFAP' USES TWO INTERMEDIATE TAPES (AS DOES 'WDFAP'). EACH LOGICAL RECORD CONSISTS OF 2+K WORDS WHERE K IS THE NUMBER OF WORDS ON THE CARD EXCLUDING TRAILING WORDS OF BLANKS. THESE RECORDS ARE PLACED IN THE 'COREA' BUFFER (238 WORDS, AT PRESENT). IF THE BUFFER IS FILLED, IT IS WRITTEN ONTO AN ERASE TAPE USING 'NPUT'. (IF NOT FILLED AT THE END OF

PASS I, NO TAPE IS USED, A LA 'BEFAP'.) WHENEVER 'COREA' IS FILLED, AND IF N LOGICAL RECORDS HAVE BEEN WRITTEN, THE SECOND ERASE TAPE IS USED. N IS NOT STRICTLY A CARD COUNT AS IN 'WDFAP' -- PARTICULARLY IN THE PRESENCE OF CARDS GENERATED BY MACRO CALLS.

DEFINITE ERRORS (O, P, M, U, ..., FLAGS OR A FORCED 'END' CARD DUE TO A PASS I ERROR) CAUSE A SUPPRESSION OF BINARY CARD OUTPUT.

'COMMON' STARTS AT 77461 (OCTAL), FOR COMPATIBILITY WITH THE CURRENT 'FORTRAN' COMPILER.

CURRENTLY, 'REW' AND 'WEF' ARE ASSEMBLED WITH A TAPE CLASS ADDRESS BIT (UNLIKE SCAT).

## IPL

'IPL-V' OPERATING UNDER SOS IS AVAILABLE. SECTION IV NOTES THE DIFFERENCES BETWEEN THE RAND IPL-V AND THE OFFICIAL VERSION DESCRIBED IN REFERENCE 1, AND EXPLAINS HOW TO PUT IPL-V UNDER OTHER MONITORS. AN EXPERIMENTAL IPL-TO-SCAT COMPILER IS INCLUDED AND DESCRIBED IN SECTION IV.

## PEST

'PP PEST' IS CALLED BY THE 'PEST' CONTROL CARD. 1401 PROGRAMS ARE ASSEMBLED. REFERENCE 3 DESCRIBES ITS USE AND OPERATION.

## WST

THE SYSTEM TAPE WRITER ('WST') IS COMPLETELY NEW. IT CONTAINS 'SYSPIT' EDITING FACILITIES AND EXTENSIVE 'CRUNCH' PROCESSING FACILITIES, AS WELL AS AN ELABORATE TAPE UPDATING MECHANISM. A COMPLETE WRITE-UP IS GIVEN IN APPENDIX A.

## FAP/FORTRAN OBJECT PROGRAM I/O

A SPECIAL RELOCATABLE SUBROUTINE LIBRARY IS USED IN 'SOS'. SINCE THE SOURCE LANGUAGES HAVE NOT BEEN CHANGED IN ANY RESPECT, REPLACEMENT OF THE SUBROUTINES WILL ALLOW A PROGRAM TO BE RUN UNDER CONTROL OF ANY OTHER MONITOR. 'FORTRAN' INTEGER TAPE REFERENCES ARE RELATED TO MONITOR SYMBOLIC TAPE ASSIGNMENTS SO THAT TAPE FRAME TREATMENT MAY BE HANDLED INDEPENDENTLY OF PROGRAM DECKS BY THE OPERATING STAFF. RESERVED TAPES ARE REWOUND AND UNLOADED AT THE CONCLUSION OF A JOB-- SCRATCH TAPES ARE RETURNED TO THE MONITOR.

'READ', 'PRINT', AND 'PUNCH' USE THE MONITOR PERIPHERAL TAPES VIA THE PHASE 1 AND PHASE 3 ROUTINES ('READ INPUT TAPE 41' AND 'WRITE OUTPUT TAPE 42' ARE EQUIVALENT TO 'READ' AND 'PRINT'). ('IOH') IS USED FOR CONVERSION. SINCE 'YSMIT' AND 'YSMOT' MAKE USE OF THE BUFFERING ROUTINES, THESE OPERATIONS RUN AS FAST AS THE FORTRAN MONITOR VERSION. BINARY TAPE OPERATIONS USE THE MONITOR BUFFERING ROUTINES (A PROGRAM IS AVAILABLE FOR CONVERTING PRESENT TAPES INTO 'SOS' BUFFERED FORMAT)-- WITHOUT SPECIAL DISPATCHING, THESE OPERATIONS RUN FASTER THAN THE FORTRAN MONITOR VERSIONS -- WITH DISPATCHING ADDED BY MEANS OF A SIMPLE 'FAP'-CODED SUBROUTINE, THESE WILL RUN SIGNIFICANTLY FASTER FOR INPUT.

AN ('EXE') ROUTINE IS PROVIDED WHICH PRINTS OFF-LINE ERROR COMMENTS FOR ALL PRESENT 'HPR Y,T' STOPS AND RETURNS CONTROL TO THE MONITOR.

'PDUMP' AND 'DUMP' USE 'SNAP' AND THE PHASE 3 ROUTINES FOR CONVERSION. SINCE THE SAVING AND RESTORING OF CORE IS NOT NECESSARY DURING THE DUMP, PROGRAMS IN CHECKOUT RUN FASTER BY CONSIDERABLE AMOUNTS (AN ORDER OF MAGNITUDE IN SOME CASES). IN ADDITION, MORE OUTPUT FORMAT CONVERSION TYPES ARE AVAILABLE FOR DEBUGGING OUTPUT.

THE SOURCE LANGUAGE DEBUGGING FEATURES DESIGNED BY THE SHARE FORTRAN DEBUGGING SUBCOMMITTEE AND PROVIDED IN VERSION 2 OF 709/7090 FORTRAN ARE NOT AVAILABLE.

## III. ADDED COMPONENTS

## FORTRAN

## JOB SET UP FOR A FORTRAN RUN

A TYPICAL JOB SETUP FOR A SOS-FORTRAN RUN IS AS FOLLOWS...  
A SINGLE QUOTE MARK REPRESENTS 7-8-9 PUNCHES IN COLUMN ONE.

```

•      JOB      2091,FORFAP,GEB929,1,10000,20,C
•      IDENT    FORTRN,JOB,FOR
•      FOR
•      FORTRAN SOURCE DECK INCLUDING END CARD WITHOUT VARIABLE FIELD
•      FOR
•      FORTRAN SOURCE DECK INCLUDING END CARD WITHOUT VARIABLE FIELD
•      FAP
•      BEFAP SOURCE DECK INCLUDING END CARD
•      REL      DEBUG
•      SOS-FORTRAN LIBRARY PACKAGE.
•      DATA    NOEDIT
•      DATA PACKAGE.

```

## COMPILER

IN 'SOS', THE 'FORTRAN' COMPILER IS ESSENTIALLY A 24K MEMORY SIZE MODEL. NO SOURCE PROGRAMS ARE KNOWN WHICH CANNOT BE COMPILED BECAUSE OF SPACE LIMITATION EXCEPT THOSE WHICH ARE ALSO SPACE LIMITED IN 'IB-FORTRAN'. ONE PROGRAM IS KNOWN WHICH IS SPACE LIMITED IN 'IB-FORTRAN' BUT COMPILES IN 'SOS-FORTRAN', BUT THIS IS A RATHER UNIQUE PROGRAM. COMPILE TIMES FOR 'SOS-FORTRAN' ARE EQUIVALENT TO THAT OF '709/90 FORTRAN' VERSION 2 (11/15/61) OR 15-20 PER CENT FASTER THAN VERSION 1.

ALL 'I/O' IS CENTRALIZED THROUGH A 'COMMON' REGION WHICH CONTAINS A SELECT AND CHECK ROUTINE AND WHICH SUPERVISES CONTROL OF THE COMPILER DURING COMPILATION. A LARGE PORTION OF TAPE RECOVERY IS ACCOMPLISHED THROUGH THE STANDARD 'SOS BAD SPOT' ROUTINE. THE BASIC PERIPHERAL TAPE WRITING ROUTINE ('O\$WPT' IN THE MONITOR) IS USED FOR ALL SECTIONS.

WORKING CORE IS CLEARED BETWEEN COMPILATIONS.

THE DISTRIBUTION SYSTEM HAS ALL 'IB' CORRECTIONS INCORPORATED THROUGH CORRECTION NO. 95.

## SECTION I

- (A) THE SOURCE PROGRAM IS READ DIRECTLY FROM THE INPUT TAPE DURING PASS 1. AN 'END' CARD IS OPTIONAL-- PASS 1 WILL PUT ONE ON WHEN IT SEES THE NEXT MONITOR CONTROL CARD.

## III. ADDED COMPONENTS

- (B) A '\$' SIGNALS THE END OF A STATEMENT, AND ALL INFORMATION TO THE RIGHT OF IT WILL BE CONSIDERED REMARKS, INCLUDING ANY FOLLOWING CONTINUATION CARDS.
- (C) J,G FORMATS ARE LEGAL -- \$ AND ' ARE LEGAL UNDER 'NH' CONTROL.
- (D) 'INPUT', 'OUTPUT' ARE EQUIVALENT TO 'READ INPUT TAPE', 'WRITE OUTPUT TAPE', RESPECTIVELY.
- (E) DURING PASS 1, DIAGNOSTICS ARE OUTPUT DIRECTLY AFTER THE STATEMENT IN ERROR --- IN PASS 2, THE STATEMENT IS REPEATED PRIOR TO THE MESSAGE. THE DIAGNOSTIC RECORD (FORMERLY 'REC 12') IS IMBEDDED AS PART OF PASS 1 ('REC 10') AND GIVES OPERATOR OPTIONS FOR RETRIES. NO 'REC 12' APPEARS ON THE SYSTEM TAPE.
- (F) FOR SECTION I - DOUBLE PRIME DIAGNOSTICS, THE SPECIAL GENERAL DIAGNOSTIC 'REC DR003' IS PLACED ON 'SYSTAP' DIRECTLY AFTER SECTION I - DOUBLE PRIME ('REC 14.0') AND IS NAMED 'REC 14.1'. THIS RECORD IS ENTERED FOR EACH COMPILATION-- AND ANY ERRORS ARE OUTPUT THERE, FOLLOWED BY A RETURN TO 'SOS'. IF THERE ARE NO ERRORS, SECTION II IS ENTERED.

## SECTIONS II-V

- (A) NO SPECIAL DIFFERENCES FROM THE 'IB' SYSTEM EXIST, EXCEPT FOR 'I/O' AND COMPILER STORAGE MAPPING.

## SECTION VI

- (A) THE GENERAL 'I/O' PACKAGE IS USED AND COMMUNICATES WITH 'SOS' ACTIVITY CELLS, ETC.
- (B) ALL 'END' CARD OPTIONS ARE DETERMINED BY INDICATOR SETTINGS LEFT BY THE 'SOS' MONITOR CONTROL CARD SCAN.
- (C) THE MULTIPLICATION FACTOR USED IN LIMITING THE NUMBER OF LITERAL APPEARANCES OF SUBROUTINE ARGUMENTS IS 32-- HOWEVER THE GENERAL DIAGNOSTIC MESSAGE STILL READS 'EIGHT'.

## GENERAL DIAGNOSTIC

THE ENTIRE FILE CONSISTS OF ONE RECORD (MINUS THE SPECIAL RECORD REQUIRED BY SECTION I - DOUBLE PRIME).

ONLY MACHINE ERRORS ARE PRINTED ON-LINE. SOURCE PROGRAM ERRORS ARE PRINTED OFF-LINE.

OPTIONS FOR RETRY ARE GIVEN BY THIS FILE.

A LARGE PORTION OF THE 'R/W' ERROR DIAGNOSTICS HAVE BEEN REMOVED, BEING REPLACED BY 'SOS' DIAGNOSTICS.



## III. ADDED COMPONENTS

## DEBUGGING

SENSE SWITCH 5 DOWN CAUSES A HALT IN THE COMMUNICATION REGION (CALLED 'FN COMMON') AFTER EXECUTION OF EACH RECORD. DUMPS MAY BE KEYED IN AS FOLLOWS, BUT THE COMPILATION CANNOT BE CONTINUED SINCE 'SNAP' HAS BEEN CALLED INTO CORE.

## CORE...

S = 0  
 DECR = LAST LOCATION  
 KEY 18 = 1 FOR OCTAL LIST  
           = 0 FOR BCD LIST  
 ADDR = FIRST LOCATION

## TAPE...

S = 1  
 KEY 1,2 = 00 FTAPE2 (TABLE TAPE)  
           = 01 FTAPE3 (FN SCRATCH)  
           = 10 FTAPE4 (FN SCRATCH)  
 KEY 5 = +,- DIRECTION FOR WORDS  
 KEY 6,7,8 = NUMBER OF WORDS  
 KEY 11 = +,- DIRECTION FOR RECORDS  
 KEY 12-17 = NUMBER OF RECORDS  
 KEY 18 = (SAME AS FOR CORE)  
 KEY 19 = 1 FOR REW BEFORE DUMP  
 KEY 24-29 = OCTAL NUMBER OF FILES TO SKIP  
 KEY 30-35 = OCTAL NUMBER OF FILES TO DUMP

## EXAMPLE...

DUMP FILE 3 OF 'FTAPE4', FIVE WORDS PER RECORD, IN OCTAL-- 'REW' BEFORE...

KEYS = 6 05000 6 00201

IN ORDER TO PATCH A 'FORTRAN' RECORD, THE STANDARD 'SOS' INITIATION DECK IS USED TO PATCH A SPECIAL PATCH REGION IN 'FN COMMON'. THE PATCHES ARE TRANSMITTED FROM THIS REGION TO THE CORRECT RECORD AS IT IS CALLED.

- (A) MAKE [-1] = 777777777777  
 (B) FOR EACH RECORD...  
 FIRST PATCH WORD...  
       PREFIX = 3  
       DECR = NUMBER OF PATCHES  
       TAG, ADDR = RECORD NUMBER IN BCD TIMES 10  
 SECOND WORD = 0---0  
 THIRD WORD = LOCATION (ADDR)  
 FOURTH WORD = PATCH  
 FIFTH, SIXTH, ETC. = MORE LOCATIONS, PATCHES

NUMBER OF PATCHES IS TOTAL WORD COUNT, INCLUDING THIRD WORD ON, BUT NOT INCLUDING FIRST, SECOND WORD.

LAST WORD SHOULD BE = 0---0-- I.E., ONE LOCATION AFTER  
LAST PATCH WORD.

THE CURRENT INITIATION DECK CODE FOR THE 'FORTRAN' FILE  
IS 14.

EXAMPLE...

CHANGE 'LOC 15241' IN 'REC 28'.

TO... +0761 00 0 00000.

DECK --

LOCATION OF 'PATCH' = (77642)8.

PATCH CARD...

	L	R
9ROW	000014077642	+300002021000
8ROW	000014077643	+000000000000
7ROW	000014077644	+0-----15241
6ROW	000014077645	+07610-----0
5ROW	000014077646	+0-----0

NOTE THAT

NUMBER OF PATCHES	= 2
REC 28	= 02 10 00 IN BCD (MULTIPLIED BY 10)
5ROW	= ZERO AND IS NOT INCLUDED IN COUNT

A MORE COMPLETE WRITE-UP OF THE 'FORTRAN' COMPILER  
DEBUGGING PROCEDURES CAN BE FOUND IN THE LISTING FOR 'FN  
COMMON'.

## III. ADDED COMPONENTS

## TRACE (7094)

AVAILABLE AS A PARAMETER ON THE SOS CONTROL CARDS LOAD OR SCAT IS THE WORD 'TRACE'. THIS ACTIVATES THE NECESSARY MONITOR FUNCTIONS TO LOAD THE TRACE PROGRAM INTO CORE AT THE FIXED LOCATION, (6272).

THIS LOCATION IS ABOVE TRMAC AND ANY OBJECT PROGRAM MUST NOT ORG LOWER

THE TRACE PROGRAM USES THE STANDARD TRAP TRANSFER FEATURE OF THE 7090 TO PRODUCE A FREQUENCY DISTRIBUTION OF INSTRUCTION EXECUTED, THE NUMBER OF CYCLES REQUIRED FOR THE 7090 AND THE 7094, THE NUMBER OF INSTRUCTIONS EXECUTED, THE NUMBER OF TRANSFERS EXECUTED AND THE CPU IMPROVEMENT FACTOR OF THE 7094 OVER THE 7090 ASSUMING A 40 PERCENT EFFICIENCY IMPROVEMENT DUE TO THE LOOK-A-HEAD ON THE 7094. OPERATING CONDITIONS AND OPTIONS ARE...

- (1) FULL TRACE IS ASSUMED AT ENTRY.
- (2) ENTRY KEY 'S' DOWN ALLOWS THE PROGRAM TO RUN AT FULL SPEED (NO TRACE).
- (3) THE DECREMENT OF SYSTRA CAN BE USED BY THE OBJECT PROGRAM TO CONTROL TRACING...  
     DECR. = 0, FULL TRACE (AT ENTRY)  
     DECR. NOT 0, NO TRACE.  
 TRACING DEPENDS ON THE LOGICAL 'AND' OF CONDITIONS (2) AND (3).
- (4) DUE TO THE HIGHLY INTERPRETIVE NATURE OF THE PROGRAM, FULL TRACE TIME WILL VARY FROM 5 TO 30 TIMES THE RUNNING TIME OF THE OBJECT PROGRAM.
- (5) ALL ENTRY KEYS DOWN WILL TERMINATE THE EXECUTION OF THE JOB AND WILL CAUSE THE OUTPUT OF RESULTS TO THAT POINT. WHEN THE PROGRAM RUNS TO COMPLETION OR IS TERMINATED BY AN 'STR SYSERR' FROM THE CONSOLE ALL RESULTS ARE OUTPUT BEFORE RETURNING CONTROL TO THE MONITOR.

THE VERSION AVAILABLE UNDER RS-SOS IS BASED ON AN ORIGINAL PROGRAM DEVELOPED AT WDPC BY R. E. MOORE AND B. R. CABANISS, IBM SYSTEMS TESTING. THE ORIGINAL PROGRAM OPERATES UNDER THE IBM FORTRAN MONITOR.

THIS WRITE-UP INCLUDES ONLY DEVIATIONS FROM AND ADDITIONS TO THE BASIC IPL-V MANUAL, INFORMATION PROCESSING LANGUAGE V MANUAL, SECTION II, PROGRAMMERS' REFERENCE MANUAL, A. NEWELL, EDITOR, PRENTICE-HALL INC., JULY, 1961.

FAMILIARITY WITH THIS MANUAL IS ASSUMED, AND REFERENCES ARE TO PAGE NUMBERS IN THAT MANUAL.

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## SEC 1...OMITTED FEATURES.

- 1...IPL COMPRESSED AND IPL BINARY MODES ARE NOT AVAILABLE (P.204).
- 2...SPECIFIC ORIGINS FOR REGIONS ARE NOT RECOGNIZED (P.215-216).
- 3...DIFFERENCES BETWEEN THE HEADER ON THE CONTROLLING UNIT AND A HEADER ON THE ALTERNATE UNIT ARE NOT DETECTED. THE HEADER ON THE ALTERNATE UNIT IS IGNORED BUT LISTED (P.220).
- 4...TWO PRIMITIVES, J106 AND J141 ARE MISSING.

J106...FILE STRUCTURE (0) IN FAST AUXILIARY.  
 J141...READ SYMBOL FROM CONSOLE.

## SEC 2...CHANGES

- 1...TRACE MODE (P.208-209).  
 THE THREE EXTERNALLY IMPOSED TRACE CONDITIONS (NO TRACE, FULL TRACE, AND SELECTIVE TRACE), ARE ACTUALLY IMPOSED INTERNALLY BY THE INTEGER DATA TERM NAMED BY W31. THE CODE IS...  
     0 = NO TRACE  
     1 = FULL TRACE  
     2 = SELECTIVE TRACE  
 W31 IS SET FOR SELECTIVE TRACE INITIALLY. THE PROGRAMMER MAY CHANGE W31 ANYTIME. THE CHANGE BECOMES EFFECTIVE WHEN THE NEXT MONITOR POINT IS ENCOUNTERED.  
  
 NOTE THAT THE SNAPSHOT MECHANISM (P.208) IS OPERATIVE AT MONITOR POINTS REGARDLESS OF THE W31 SETTING. THE SNAPSHOT CELLS (W12 THRU W15) INITIALLY CONTAIN 'J0', MEANING 'NO OPERATION'.
- 2...1W14 (P.207,208). WHEN SENSE SWITCH 5 ON THE CONSOLE IS DEPRESSED, THE ROUTINE IN W14 IS EXECUTED ON THE NEXT IPL INTERPRETATION CYCLE, RATHER THAN AT THE NEXT MONITOR POINT. 1W14 MAY BE ANY ROUTINE, INCLUDING J166-J165 (TERMINATE FOR RESTART) OR J7 (TERMINATE). IN ANY CASE, THE JOB IS TERMINATED WITH A POST-MORTEM.
- 3...1W15 (P.207,208).  
 THE ROUTINE IN W15 IS NOT TRIGGERED BY A CONSOLE SIGNAL, BUT IS EXECUTED AUTOMATICALLY AFTER THE STANDARD POST-MORTEM IS GIVEN. 1W15 MAY BE ANY PROGRAM, INCLUDING TERMINATE FOR RESTART, BUT IS

ESPECIALLY USEFUL FOR PRINTING OUT TERMINAL DEBUGGING DATA ON A SELECTIVE BASIS. NOTE THAT THE ATTEMPT TO EXECUTE 1W15 MAY FAIL. IN THIS CASE THE REASON IS GIVEN, BUT A SECOND POST-MORTEM IS NOT.

#### 4...UNUSED REGIONAL SYMBOLS.

THE MANUAL SPECIFIED (P.216) THAT UNUSED REGIONALS BE ADDED TO THE END OF THE AVAILABLE SPACE LIST AUTOMATICALLY AT THE END OF INITIAL LOADING. THIS IS NOT DONE IN THE CURRENT SYSTEM. INSTEAD, A NEW PRIMITIVE IS PROVIDED, J171, TO DO THE SAME TASK.

J171...ADD UNUSED REGIONAL SYMBOLS TO THE END OF THE AVAILABLE SPACE LIST. NO INPUT, NO OUTPUT, DOES NOT CHANGE H5.

'UNUSED' HERE MEANS THE SYMBOL DOES NOT APPEAR IN ANY 'NAME', 'SYMB', OR 'LINK' FIELD AND HAS NOT BEEN SPECIFICALLY RESERVED BY A TYPE-3 CARD.

#### 5---TYPE-9 CARD. (P.220)

THE CONTROLLING UNIT FOR INITIAL LOADING IS NOT THE UNIT ON WHICH THE FIRST TYPE-9 CARD IS READ, BUT IS THE UNIT NAMED BY THE INTEGER IN SYMB OF THE FIRST TYPE-9 CARD. IF THIS INTEGER=0, OR IF SYMB IS BLANK, OR IF THERE IS NO TYPE-9 CARD, THEN SYSPIT (THE NORMAL INPUT TAPE) IS THE CONTROLLING UNIT.

NOTE THAT COMMENTS ON A TYPE-9 CARD MUST BE RESTRICTED TO THE STANDARD COMMENT FIELD, CONTRARY TO THE MANUAL.

STACKING RUNS SEPARATED BY TYPE 9 CARDS IS ALLOWED. CONTROL DOES NOT RETURN TO THE SOS MONITOR BETWEEN RUNS, BUT A FRESH COPY OF THE IPL SYSTEM IS READ INTO CORE FROM SYSMIT. TAPE ASSIGNMENTS ARE THE SAME FOR ALL RUNS. PROGRAMMER TAPES WHICH ARE IN WRITE-STATUS ARE END-FILED AT THE END OF EACH RUN, BUT NOT REWOUND.

### SEC 3...ADDED FEATURES

#### 1...TYPE-8 CARDS.

AN 8 IN COLUMN 41 IDENTIFIES A SPECIAL TYPE OF HEADER. A TYPE-8 HEADER INHIBITS THE LOADING OF ITS ASSOCIATED BLOCK OF PROGRAM OR DATA, BUT ALLOWS THE LISTING AND OUTPUT OPTIONS. IT IS INTENDED TO BE USED ON THE CONTROLLING UNIT (P.220) TO SKIP OVER UNWANTED BLOCKS ON AN ALTERNATE INPUT UNIT. IT TREATS THE ENTIRE SEQUENCE OF CONTIGUOUS TYPE-2 AND TYPE-3 CARDS NORMALLY FOUND AT THE START OF AN INPUT TAPE AS 1 BLOCK. IT MAY BE USED ON A BLOCK WHICH IS IN IPL STANDARD (P=0, BLANK) OR ABSOLUTE COLUMN BINARY MODE (P=3).

#### 2...OUTPUT DURING LOADING (P218,220).

TRANSLATION OF THE INPUT FROM ONE MODE TO ANOTHER IS NOT AVAILABLE. IT IS POSSIBLE TO EDIT INPUT FROM VARIOUS SOURCES ONTO ONE OR SEVERAL OUTPUT TAPES HOWEVER. FOR THIS PURPOSE, THE LINK FIELD

## IV. PART 1...DEVIATIONS FROM THE IPL-V MANUAL

OF TYPE 5,6,7,8 AND 9 CARDS (P.220) IS INTERPRETED AS FOLLOWS...

D=0 OR BLANK IF NO OUTPUT WANTED.

D=9 IF OUTPUT OF THE FOLLOWING IPL STANDARD BLOCK IS DESIRED.

D=3 IF OUTPUT OF THE FOLLOWING COLUMN BINARY BLOCK IS WANTED.

B=BLANK IF OUTPUT TO UNIT 1W19 IS WANTED(INITIAALLY=SYSBR1).

B=1-10 IF OUTPUT TO OTHER UNIT IS WANTED.

'D' MEANS COL 61, 'B' MEANS COL 57-58.

EXERCISING THE OUTPUT OPTION ON A TYPE-9 CARD CAUSES THE ENTIRE SEQUENCE OF CONTIGUOUS TYPE-2 AND TYPE-3 CARDS TO BE OUTPUT AS IF IT WERE A BLOCK OF IPL STD TEXT. THE TYPE-9 CARD ITSELF IS NOT OUTPUT.

HEADERS ON THE CONTROLLING UNIT ARE OUTPUT WITH SYMB BLANKED OUT UNLESS SYMB IS REGIONAL (START CARD). TYPE-8 CARDS ARE CHANGED TO TYPE-5 CARDS. HEADERS ON ALTERNATE INPUT UNITS ARE NOT OUTPUT.

### 3...INPUT MODE 4 = RESTART MODE.

THE RESTART TAPE PRODUCED BY J166 IS CONSIDERED TO BE ANOTHER MACHINE-DEPENDENT INPUT MODE PROVIDED FOR IN THE IPL-V MANUAL (P.219). WHEN A TYPE-5 CARD WITH P=4 IS ENCOUNTERED ON THE CONTROLLING UNIT, MAIN AND AUXILIARY STORAGE ARE RELOADED FROM THE ALTERNATE UNIT NAMED BY SYMB. (P.220 AND 223). THUS IT IS POSSIBLE TO RELOAD FROM ANY UNIT, AT ANY OR SEVERAL TIMES DURING A RUN.

### 4...TRAP ON H3 (CYCLE COUNT) EQUAL TO W32. (SEE J170, P.224-225)

W32 IS AN INTEGER DATA TERM THAT IS COMPARED TO H3 EACH CYCLE. WHEN H3 IS EQUAL TO W32, THE ACTION ASSOCIATED WITH THE SYMBOL 'H3' ON 1W26 IS EXECUTED AND THE PROGRAM CONTINUES. W32 IS INITIALLY ZERO. THE PROGRAMMER SETS W32 AND ASSOCIATES THE NAME OF A ROUTINE TO 'H3' ON 1W26 TO USE THIS FEATURE.

### 5...READ LINE PRIMITIVES, J180-J189.

THE LINE READ PRIMITIVES PROVIDE A MEANS OF READING A BCD CARD UNDER CONTROL OF AN IPL-V PROGRAM AND TRANSLATING SELECTED FIELDS INTO IPL SYMBOLS OR DATA TERMS.

#### CONTROL CELLS

1W18 NAMES THE INPUT UNIT FOR J180. 1W18=0 MEANS SYSPIT.

1W24 NAMES THE CURRENT READ LINE. ('READ LINES' AND 'PRINT LINES' ARE IDENTICAL AND INTERCHANGEABLE. LINES FOR EITHER OR BOTH PURPOSES ARE SPECIFIED BY TYPE 3, Q=1 CARDS.)

1W25 IS A DECIMAL INTEGER DATA TERM SPECIFYING THE LEFT COLUMN OF THE CURRENT INPUT FIELD.

1W30 IS A DECIMAL INTEGER DATA TERM SPECIFYING THE SIZE (NUMBER OF COLUMNS) OF THE CURRENT INPUT FIELD.

## PRIMITIVE DEFINITIONS

- \*J180 READ LINE. THE NEXT RECORD ON UNIT 1W18 IS READ TO LINE 1W24. (THE RECORD IS ASSUMED TO BE BCD, 80 COLS.) COL 1 OF THE RECORD IS READ INTO COL 1 OF THE READ LINE, AND SO FORTH. H5 IS SET +. IF NO RECORD CAN BE READ (END OF FILE CONDITION), THE LINE IS NOT CHANGED AND H5 IS SET -. AN SOS CONTROL CARD (7-8-9 PUNCHES IN COL 1) IS TREATED AS AN END OF FILE. AN IPL TYPE-9 CARD IS NOT, HOWEVER.
- \*J181 INPUT LINE SYMBOL. THE IPL SYMBOL IN THE FIELD STARTING IN COLUMN 1W25 AND OF SIZE 1W30, IN LINE 1W24, IS INPUT TO H0, H5 IS SET +. THE SYMBOL IS REGIONAL IF THE FIRST (LEFTMOST) COLUMN HOLDS A REGIONAL CHARACTER, OTHERWISE IT IS ABSOLUTE INTERNAL. ALL NON-NUMERICAL CHARACTERS EXCEPT IN THE FIRST COLUMN ARE IGNORED. IF THE FIELD IS ENTIRELY BLANK, OR IGNORED, THERE IS NO INPUT TO H0, AND H5 IS SET -. IN EITHER CASE, 1W25 IS INCREMENTED BY THE AMOUNT 1W30.
- \*J182 INPUT LINE DATA TERM (0). THE FIELD SPECIFIED AS IN J181 IS TAKEN AS THE VALUE OF A DATA TERM, INPUT DATA TERM (0) IS SET TO THAT VALUE AND LEFT AS OUTPUT (0). H5 IS SET +. THE DATA TYPE OF INPUT (0) DETERMINES THE DATA TYPE OF THE OUTPUT. IF THE INPUT (0) IS A DECIMAL OR OCTAL INTEGER OR BCD THE READ LINE FIELD IS INTERPRETED AS THAT TYPE. ANY OTHER DATA TYPE IS TREATED AS BCD. IN COMPOSING BCD DATA TERMS, THE FIELD IS LEFT-JUSTIFIED AND THE FULL DATA TERM COMPLETED WITH BLANKS ON THE RIGHT IF NECESSARY. IF THE SPECIFIED FIELD EXCEEDS FIVE COLUMNS, THE RIGHTMOST FIVE COLUMNS ARE TAKEN AS THE FIELD. IN COMPOSING DECIMAL AND OCTAL INTEGER DATA TERMS, NON-NUMERICAL CHARACTERS ARE IGNORED, IF THE RESULTING INFORMATION EXCEEDS THE CAPACITY OF THE DATA TERM, THE RIGHTMOST DIGITS ARE RETAINED. IF THE READ LINE FIELD IS ENTIRELY BLANK (OR NON-NUMERICAL, FOR INTEGER DATA TYPES), (0) IS CLEARED (TO BLANKS FOR BCD, TO ZERO FOR INTEGER) AND H5 IS SET -. IN EITHER CASE, 1W25 IS INCREMENTED BY THE AMOUNT 1W30.
- \*J183 SET (0) TO NEXT BLANK. (0) IS TAKEN AS A DECIMAL INTEGER DATA TERM. LINE 1W24 IS SCANNED, LEFT TO RIGHT, STARTING WITH COLUMN 1W25+1, FOR A BLANK. ONE IS ADDED TO (0) FOR EACH COLUMN SCANNED, INCLUDING THAT IN WHICH THE SCANNED-FOR CHARACTER ('BLANK' IN J183) IS FOUND. (0) IS LEFT AS OUTPUT (0). H5 IS SET + IF THE CHARACTER IS FOUND IN THE LINE, AND - IF IT IS NOT.

{THUS, IF INPUT (0) = 1W25, AFTER SCANNING OUTPUT (0) WILL SPECIFY THE COLUMN HOLDING THE SCANNED-FOR CHARACTER. IF INPUT (0) = DECIMAL INTEGER 0, AFTER SCANNING



## IV. PART 1...DEVIATIONS FROM THE IPL-V MANUAL

OUTPUT (0) WILL BE THE SIZE OF A FIELD BEGINNING IN COLUMN 1W25 AND DELIMITED ON THE RIGHT BY THE NEXT OCCURRENCE OF THE SCANNED-FOR CHARACTER.)

- \*J184 SET (0) TO NEXT NON-BLANK. SAME AS J183, EXCEPT SCANS FOR ANY NON-BLANK CHARACTER.
  
- \*J185 SET (1) TO NEXT OCCURRENCE OF CHARACTER (0). SAME AS J183, EXCEPT SCANS FOR CHARACTER (0), COUNTING INTO DECIMAL INTEGER DATA TERM (1). INPUT (1) IS LEFT AS OUTPUT (0). IF INPUT (0) IS A REGIONAL SYMBOL, ITS REGION CHARACTER IS THE CHARACTER SCANNED FOR, IF INPUT (0) IS INTERNAL, ITS LAST (LOW-ORDER) DIGIT IS THE CHARACTER SCANNED FOR.
  
- \*J186 INPUT LINE CHARACTER. THE CHARACTER IN COLUMN 1W25 OF LINE 1W24 IS INPUT TO H0, H5 IS SET +. IF THE CHARACTER IS NUMERICAL THAT INTERNAL SYMBOL IS INPUT, IF THE CHARACTER IS NON-NUMERICAL, THE ZEROth SYMBOL IN THE REGION DESIGNATED BY THAT CHARACTER IS INPUT. IF THE CHARACTER IS A BLANK, THERE IS NO INPUT AND H5 IS SET -. IN EITHER CASE, 1W25 IS NOT ADVANCED.
  
- \*J189 TRANSFER FIELD. THE FIELD IN LINE 1W24, STARTING IN COLUMN 1W25 AND OF SIZE 1W30, IS TRANSFERRED TO LINE (0), STARTING IN COLUMN 1W21, H5 IS SET +. IF THE ENTIRE FIELD CANNOT BE TRANSFERRED (LINE (0) IS TOO SHORT), AS MUCH IS TRANSFERRED AS CAN BE, AND H5 IS SET -. IN EITHER CASE, 1W25 IS SET TO THE LAST COLUMN TRANSFERRED PLUS ONE.

## NOTE...

BECAUSE A LOADER SUBROUTINE IS USED IN CONVERTING INPUT, AN ERROR CONDITION (UNDEFINED SYMBOL DURING LOADING) WILL OCCUR IF THE SYMBOL INPUT BY J181 OR J186 DOES NOT LIE WITHIN A DEFINED REGION.

## 6...PARTIAL-WORD PRIMITIVES, J190-J197.

THESE PRIMITIVES ALLOW MANIPULATION AND TESTING OF THE P, Q, SYMB, OR LINK OF IPL WORDS. THE WORDS ARE ASSUMED TO BE STANDARD WORDS, NOT DATA TERMS. THE P, Q, SYMB, OR LINK IS INPUT TO, OR OUTPUT FROM, THE SYMBOL PORTION OF H0, AND MAY BE TREATED AS ANY OTHER IPL SYMBOL.

- J190...INPUT P OF CELL (0) TO H0. (THE Q OF H0 WILL BE INTERNAL.)
- J191...INPUT Q OF CELL (0) TO H0. (THE Q OF H0 WILL BE INTERNAL.)
- J192...INPUT SYMB OF CELL (0) TO H0. (Q OF H0 WILL BE REGIONAL.)

J193...INPUT LINK OF CELL (0) TO HO. (Q OF HO WILL BE REGIONAL.)

J194 THRU J197 POP HO AFTER STORING THE SYMBOL IN HO APPROPRIATELY.

J194...STORE (1) AS THE P OF CELL (0).

J195...STORE (1) AS THE Q OF CELL (0).

J196...STORE (1) AS THE SYMB OF CELL (0). (Q OF CELL (0) UNCHANGED)

J197...STORE (1) AS THE LINK OF CELL (0).

## IV. PART 2...EXPLANATIONS AND EXAMPLES

## PART 2...EXPLANATIONS AND EXAMPLES.

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ERROR TRAP.....	SEC 14

## SEC 1...TO RUN IPL JOBS UNDER SOS

- 1...PREPARE YOUR IPL PROGRAM DECK AS DESCRIBED ON PAGE 221.
- 2...PREFACE THIS DECK WITH A 'JOB' CARD AND AN 'IPL' CARD.  
THE JOB CARD FORMAT IS...

X      JOB      JOBNUM,PASS,MANUM,TIME,MEDOUT,PAGES,TYPE    YOUR NAME.

WHERE...X SIGNIFIES A 7-8-9 PUNCH IN COL 1.  
 'JOB' IS PUNCHED IN COLS 8-10.  
 JOBNUM STARTS IN COL 16 AND IS THE JOB NUMBER FOR ACCTING  
 PASS IS AN ARBITRARY ID OF THIS RUN.  
 MANUM IS YOUR ASSIGNED MAN NUMBER.  
 TIME IS THE ESTIMATED RUNNING TIME IN MINUTES.  
 MEDOUT IS NO. OF LINES OF MEDIARY OUTPUT, ALWAYS 0 FOR IPL  
 PAGES IS THE MAXIMUM NO. PAGES OF OUTPUT YOU ALLOW.  
 TYPE IS A CODE FOR ACCTING PURPOSES, E.G., C=CODE-CK.

THE IPL CARD FORMAT IS...

X      IPL      ANY COMMENTS DESIRED, STARTING IN COL 17 OR LATER.

- 3...IF YOUR JOB USES TAPES OTHER THAN THE STANDARD INPUT, OUTPUT AND AUXILIARY STORAGE TAPES, READ SEC 2, 'IPL TAPES', BELOW. OTHERWISE, IT IS READY TO SUBMIT FOR RUNNING, AND SHOULD LOOK LIKE THIS...

X      JOB      8144,THINK1,G742,3,0,30,C      BOB GAINES  
 X      IPL  
       (IPL PROGRAM DECK HERE)

THE IPL SYSTEM KNOWS ABOUT AND USES THE FOLLOWING LIST OF TAPES WITHOUT ANY ACTION ON THE PART OF THE USER...

SYSPIT...NORMAL INPUT TAPE---IS THE CONTROLLING UNIT FOR INITIAL LOADING UNLESS AN INITIAL TYPE-9 CARD DESIGNATES SOME OTHER TAPE WITH AN INTEGER 1-10 IN SYMB. W18 NAMES THE CONTROLLING UNIT FOR J165 (IN-PROCESS LOADING) AND W18 ALSO INITIALLY NAMES SYSPIT.

SYSPOT...NORMAL OUTPUT TAPE---ASSEMBLY LISTING, TRACING, ERROR MESSAGES AND POST-MORTEM ALWAYS GO TO SYSPOT. SINCE 1W20=0=SYSPOT INITIALLY, THE PRINT PROCESSES WILL WRITE ON SYSPOT NORMALLY UNTIL THE USER CHANGES 1W20.

SYSES1 AND SYSES2 ARE USED FOR AUXILIARY DATA STORAGE (P.194).

SYSMIT...IPL SAVES SOS AND ITSELF ON SYSMIT, THEN USES THE REST OF THE TAPE FOR AUXILIARY ROUTINE STORAGE (P.196).

ONLY UNRECOVERABLE REDUNDANCY CHECKS CAUSE ERROR MESSAGES. THE READ PRIMITIVES AND LOADING PROCESSES REMARK ABOUT END-OF-FILE MARKS BUT NEVER PASS OVER THEM. SOS CONTROL CARDS ARE TREATED AS END-OF-FILE MARKS.

ANY OF THE FOLLOWING SYMBOLIC TAPES CAN BE USED BY THE PROGRAMMER FOR HIS OWN PURPOSES...

SYSAR1	AND	SYSBR1
SYSAR2		SYSBR2
SYSAR3		SYSBR3
SYSAR4		SYSBR4
SYSAR5		SYSBR5

AN 'ASSIGN' CARD FOR EACH TAPE USED MUST FOLLOW THE JOB CARD, PRECEDING THE 'IPL' CARD. THE FORMAT FOR 'ASSIGN' CARDS IS...

X        ASSIGN    PHYSICAL-UNIT=SYMBOLIC TAPE

WHERE...X IS AS ABOVE.

'ASSIGN' STARTS IN COL 8.

PHYSICAL-UNIT STARTS IN COL 16.

THE PHYSICAL UNITS AVAILABLE AT RAND ARE A5,A6,A7, B5,B6,B7.

ANY PHYSICAL UNIT CAN BE EQUATED TO ANY SYMBOLIC UNIT, E.G....

X        ASSIGN    B7=SYSAR1 (COMMENTS OK AFTER AT LEAST 1 BLANK SPACE).

SINCE AN IPL PROGRAM REFERS TO TAPES BY THE INTEGERS 1-10, THE FOLLOWING EQUIVALENCE IS USED...

1=SYSAR1	6=SYSBR1
2=SYSAR2	7=SYSBR2
3=SYSAR3	8=SYSBR3
4=SYSAR4	9=SYSBR4
5=SYSAR5	10=SYSBR5

## SAMPLE DECK SETUP FOR A JOB USING IPL TAPES 1 AND 8...

```

X      JOB      8144,SAV-IT,G742,2,0,100,C      BOB GAINES
X      ASSIGN   B5=SYSAR1 (IPL TAPE 1 FOR USE BY J180...6/18/62)
X      ASSIGN   A5=SYSBR3 (IPL TAPE 8. FOR USE BY J166.
X      IPL
      (FOLLOWED BY THE IPL PROGRAM DECK).

```

## SEC 3...LOADING. (PAGES 214-222)

IF ERRORS ARE DETECTED DURING INITIAL OR IN-PROCESS LOADING, THE SYSTEM PRINTS OUT THE ERROR MESSAGES BUT ATTEMPTS TO COMPLETE THE LOADING AND AND EXECUTION OF THE PROGRAM. UNDEFINED REGIONAL SYMBOLS ARE ASSIGNED AN EQUIVALENT FROM AVAILABLE SPACE BY TREATING THEM AS INTERNAL SYMBOLICS. THIS PROCESS DOES NOT GUARANTEE A UNIQUE EQUIVALENT HOWEVER.

'OUTPUT' DURING LOADING ( AS DISTINGUISHED FROM 'LISTING') GOES ONTO THE TAPE NAMED IN COLS 57-58 OF THE HEADER IF COL 61=9 (STD) OR 3 (COL BINARY). IF COL 61 CALLS FOR OUTPUT BUT NO UNIT IS NAMED IN COLS 57-58, THE OUTPUT WILL GO TO TAPE 1W19. 1W19 IS INITIALLY ZERO, NAMING TAPE SYSBR1. THE PROGRAMMER MUST HAVE ASSIGNED THIS TAPE.

TYPE 2 CARDS DO NOT HAVE THE FULL FLEXIBILITY DESCRIBED ON PAGES 215-216. ONLY THE NAME AND LINK FIELDS ARE READ-- THE FIRST CHARACTER OF THE NAME FIELD MUST BE THE REGION SYMBOL-- THE LINK FIELD MUST CONTAIN THE EXTENT OF THE REGION. THE FIRST EXAMPLE ON PAGE 216 IS THE ONLY ACCEPTABLE FORMAT FOR TYPE 2 CARDS.

TYPE 3 CARDS (P.216 AND P.221). IF Q=1, THE NUMBER OF WORDS SET ASIDE FOR A PRINT LINE IS LIMITED ONLY BY AVAILABLE SPACE. 1 WORD IS REQUIRED FOR EACH POSITION IN THE PRINT LINE. THE WORD AT SYMB IS SET TO P=0,Q=0,SYMB=LOCATION OF LINE,LINK=LENGTH OF LINE. IF, IN ADDITION, P IS NOT ZERO OR BLANK, THE LINE IS FILLED FROM THE FOLLOWING CARDS. CARE MUST BE TAKEN TO PROVIDE ENOUGH CHARACTERS TO FILL THE LINE COMPLETELY WHEN P=1, OR FOLLOWING HEADERS WILL BE CONSUMED. EIGHTY CHARACTERS ARE READ PER CARD, BLANK CARDS ARE LEGITIMATE.

Q=2 IS USED TO RESERVE A BLOCK OF STORAGE FOR BINARY IPL-V ROUTINES WRITTEN IN MACHINE LANGUAGE. LINK SPECIFIES THE EXTENT OF THE BLOCK-- THE STARTING POSITION OF THE BLOCK WILL DEPEND UPON THE NUMBER OF LOCATIONS PREVIOUSLY ASSIGNED BY TYPE 2 OR TYPE 3 CARDS. IF THIS IS THE FIRST CARD TO RESERVE SPACE, THE ORIGIN WILL BE AT 100 (OCTAL). Q=3 IS USED TO RESERVE A BUFFER FOR ROUTINES TO BE STORED IN AUXILIARY STORAGE. LINK SPECIFIES THE EXTENT OF THE BLOCK-- THE STARTING POSITION WILL AGAIN DEPEND UPON PREVIOUS ASSIGNMENTS.

THE RESTRICTION OF 150 LOCAL SYMBOLS PER STRUCTURE AND 100 INTERNAL SYMBOLS PER PROGRAM HAS BEEN REMOVED.

TYPE 6 AND 7 CARDS ARE TREATED IDENTICALLY, AS ONLY SLOW AUXILIARY STORAGE IS PROVIDED.

IF Q IS ZERO OR BLANK, THE FOLLOWING ROUTINES ARE LOADED INTO THE AUXILIARY BUFFER, WHICH MUST HAVE BEEN RESERVED BY A TYPE 3, Q=3 CARD. EACH ROUTINE IS THEN WRITTEN ON TAPE SYSMIT (FOLLOWING THE RECORD WHICH WAS USED TO SAVE MEMORY). THE HEAD OF A ROUTINE LOADED TO AUXILIARY IS SET TO P=0, Q=7, SYMB= NUMBER OF THIS ROUTINE ON THE AUXILIARY TAPE. ROUTINES PLACED ON AUXILIARY STORAGE ARE AUTOMATICALLY CALLED IN BY THE INTERPRETER FOR EXECUTION AND ARE AUTOMATICALLY SAVED AND RELOADED BY J166 AND THE RESTART PROCESS. DATA IN AUXILIARY STORAGE IS LIKEWISE SAVED AND RELOADED AUTOMATICALLY.

ABSOLUTE BINARY INPUT. A TYPE 5 CARD WITH P=3 INDICATES THAT A BLOCK OF ABSOLUTE, COLUMN BINARY CARDS FOLLOWS. THESE MUST LOAD INTO THE SPACE RESERVED BY THE SINGLE TYPE 3, Q=2 CARD AT THE BEGINNING OF THE PROGRAM. THE LAST BINARY CARD MUST BE A TRANSFER CARD-- THE ADDRESS IS IGNORED, HOWEVER. AFTER THE BINARY CARDS HAVE BEEN READ, THE SYMBOLS HO, JO, AND WO ARE STORED IN THE ADDRESS PARTS OF THE FIRST THREE CELLS OF THE RESERVED BLOCK. THIS PERMITS THE PROGRAMMER TO REFER TO THESE REGIONS CONVENIENTLY WHEN CODING MACHINE LANGUAGE ROUTINES. IF NO SPACE HAS BEEN RESERVED FOR MACHINE LANGUAGE ROUTINES, THE CARDS WILL STILL BE LOADED. THIS FEATURE MAY BE USED TO LOAD INTO UNUSED AVAILABLE SPACE-- CARE MUST BE TAKEN TO TERMINATE AVAILABLE SPACE OR TO LINK IN AROUND THE ROUTINES SO LOADED. WHEN THIS OPTION IS USED, THE SYMBOLS HO, JO, AND WO ARE PLACED IN THE ADDRESS PARTS OF CELLS -3, -2, AND -1.

#### IN-PROCESS LOADING...J165 (P. 223)

1W18 NAMES THE CONTROLLING UNIT DURING IN-PROCESS LOADING. IT MAY BE CHANGED FOR EACH EXECUTION OF J165 BUT IS NOT CHECKED DURING THE COURSE OF LOADING FOR A CHANGE. AS IN INITIAL LOADING, 1W19 NAMES THE OUTPUT UNIT ONLY IF A HEADER SPECIFIES OUTPUT BUT DOES NOT SPECIFY AN OUTPUT UNIT IN COLS 57-58. ('OUTPUT' IS NOT SYNONYMOUS WITH 'LIST' ).

ANY RESTRICTIONS THAT APPLY TO INITIAL LOADING ALSO APPLY TO INPROCESS LOADING. NOTE THAT TYPE 2 AND TYPE 3 CARDS MAY NOT BE LOADED. NEW ROUTINES OR DATA MAY BE LOADED TO AUXILIARY STORAGE, AS MAY NEW COPIES OF OLD ROUTINES OR DATA, REGARDLESS OF WHETHER THE OLD VERSIONS WERE IN MAIN OR AUXILIARY MEMORY.

WHEN J171 IS EXECUTED, UNUSED REGIONALS ARE RETURNED TO AVAILABLE SPACE. LOCATIONS OF UNUSED REGIONAL SYMBOLS RETURNED TO AVAILABLE

## IV. PART 2...EXPLANATIONS AND EXAMPLES

SPACE ARE STILL REFERENCED BY THE INTERNAL SYMBOL TABLE, HOWEVER, AND AN ERROR WILL NOT BE DETECTED IF J165 LOADS INTO THEM. ALL SUCH REFERENCES WILL BE TO CELLS ON AVAILABLE SPACE-- THIS WILL RESULT IN AN IMPROPERLY CONSTRUCTED AVAILABLE SPACE LIST AND WILL USUALLY LEAD TO ERRORS WHEN THE PROGRAM IS RUNNING.

## SEC 4...TRACING AND POST-MORTEM (P.206-211)

SEE NUMBERS 1,2, AND 3 UNDER SEC 2 OF PART 1 OF THIS WRITE UP.  
NOTE THAT AN ENDLESS LOOP WILL OCCUR IF 1W12 OR 1W13 ARE TRACED.

THE POST-MORTEM IS A PRINT-OUT OF THE LISTS NAMED ON THE LIST NAMED BY SYSTEM CELL W23. INITIALLY THIS LIST NAMES ALL THE SYSTEM CELLS, HO THRU W33, PLUS 13 CELLS CONTAINING INFORMATION ABOUT J105-J107 USAGE (SEE AUXILIARY DATA STORAGE). THE PROGRAMMER MAY ADD TO THIS LIST. IN ADDITION, THE CURRENT PRINT LINE, 1W24, IS PRINTED AND THEN 1W15 IS EXECUTED.

IF AN ERROR OCCURS DURING THE EXECUTION OF 1W15, AN ERROR MESSAGE IS PRINTED BUT NO POST-MORTEM GIVEN.

## SEC 5...SAVING FOR RESTART (PAGE 223)

J166 SAVES ON THE TAPE SPECIFIED BY THE INTEGER DATA TERM NAMED (0). IF THIS DATA TERM IS 0, MEMORY IS SAVED ON TAPE SYSAR3. OTHER ALLOWABLE TAPES ARE SPECIFIED AS FOLLOWS...

1=SYSAR1	6=SYSBR1
2=SYSAR2	7=SYSBR2
3=SYSAR3	8=SYSBR3
4=SYSAR4	9=SYSBR4
5=SYSAR5	10=SYSBR5

OTHER VALUES OF (0) WILL CAUSE AN ERROR, AS WILL REFERENCE TO AN UNASSIGNED TAPE. ALL OF MEMORY, PLUS ANY AUXILIARY ROUTINES OR AUXILIARY DATA USED, IS SAVED ON TAPE, AND THE PROGRAM CONTINUES FROM THAT POINT. THE TAPE IS REWOUND AFTER WRITING, SO THAT MULTIPLE OCCURRENCES OF J166 WITH THE SAME INPUT WILL CAUSE THE TAPE TO BE REWRITTEN.

ONE NORMALLY SAVES FOR RESTART WITH THE INSTRUCTION 'J166-J165'. THIS ALLOWS IMMEDIATE LOADING UPON RESTART, WHICH IS USEFUL FOR MAKING CORRECTIONS.

## SEC 6...RESTARTING

SAMPLE DECK SETUP FOR RESTARTING...

X        JOB        ETC,ETC.

```

X      ASSIGN  A5=SYSBR1    RELOAD TAPE IS IPL TAPE 6
X      IPL
      SYSPIT IS THE CONTROLLING UNIT    9          0
CONTROLLING UNIT SAYS 'RELOAD FROM 6'  5          4 6
ANY CORRECTIONS OR NEW ROUTINES HERE.
KICKOFF CARD SAYS START PROGRAM AT X1  5          X1

```

## SEC 7...PRINTING (PAGES 211-214)

THE SYSTEM WILL TERMINATE YOUR PROGRAM WHEN THE OUTPUT FROM THE PRINT PRIMITIVES AND FROM TRACING EXCEEDS YOUR PAGE ESTIMATE ON THE JOB CARD. OUTPUT FROM INITIAL LOADING, IN-PROCESS LOADING OR FROM THE 'WRITE-TAPE' PRIMITIVES IS NOT TALLIED AGAINST YOUR ESTIMATE.

THE OUTPUT UNIT FOR J150, J151, J152, J153, AND J155 IS CONTROLLED BY THE INTEGER DATA TERM NAMED IN W20. IF THIS DATA TERM IS 0, THE OUTPUT UNIT IS SYSPOT. OTHER UNITS ARE SPECIFIED AS FOLLOWS...

```

1 OR 11 = SYSAR1    6 OR 16 = SYSBR1
2 OR 12 = SYSAR2    7 OR 17 = SYSBR2
3 OR 13 = SYSAR3    8 OR 18 = SYSBR3
4 OR 14 = SYSAR4    9 OR 19 = SYSBR4
5 OR 15 = SYSAR5   10 OR 20 = SYSBR5

```

IF THE DATA TERM IS 10 OR LESS, THE PRINT LINE 1W24 IS WRITTEN ON THE SPECIFIED TAPE FOR SUBSEQUENT OFF-LINE PRINTING-- I.E., THE FIRST CHARACTER IS THE SPACING CHARACTER AS DETERMINED FROM 1W22. IF THE DATA TERM IS GREATER THAN 10, THE REFERENCED LINE IS WRITTEN ON THE SPECIFIED TAPE FOR SUBSEQUENT OFF-LINE PUNCHING-- I.E., THE FIRST 80 CHARACTERS ARE WRITTEN OUT WITHOUT A SPACING CONTROL CHARACTER. ALL TAPES WRITTEN BY THESE PROCESSES ARE WRITTEN WITH AN END-OF-FILE AT THE END OF THE IPL-V RUN.

J155 PRINTS A LINE GREATER THAN 119 CHARACTERS BY BREAKING IT INTO SEVERAL 120 WORD RECORDS ON THE OUTPUT TAPE. AT PRESENT IT WILL NOT DO THE SAME FOR LINES GREATER THAN 80 CHARACTERS THAT ARE BEING PUNCHED.

IF A LIST STRUCTURE WITH A LOCAL NAME IS PRINTED BY J150, THE CONVERTED NAME WILL BE 9-0. SUBLISTS OF ANY LIST STRUCTURE ARE ALWAYS NUMBERED CONSECUTIVELY STARTING WITH 9-1.

DATA TERMS ARE ALWAYS PRINTED IN THE FORMAT GIVEN ON PAGE 71, WITH THE EXCEPTION OF FLOATING POINT NUMBERS. THE FORMAT FOR THESE IS '-.123456-12'-- PLUS SIGNS ARE NOT PRINTED. THE FIELD LENGTH IS THUS EITHER 10 OR 11 COLUMNS.

WHEN LOCAL SYMBOLS ARE PRINTED (EXCEPT IN THE CASE OF THOSE TRANSLATED BY J150), THEY ARE FOLLOWED BY AN ASTERISK. CELL W24 INITIALLY NAMES AN INTERNAL PRINT BUFFER OF 120 CELLS (ONE CHARACTER PER CELL) LENGTH. OTHER PRINT LINES MAY BE ASSIGNED BY TYPE 3, Q=1 CARDS AT INITIAL LOADING. J158 AND J159 LEAVE 1W25 POINTING TO THE FIRST COLUMN TO THE



## IV. PART 2...EXPLANATIONS AND EXAMPLES

LEFT OF THE ENTERED INFORMATION.

## SEC 8... READ-WRITE TAPE (J140-J146---P. 205-206)

THESE PRIMITIVES WORK AS SPECIFIED IN THE MANUAL BUT CAN ONLY BE USED TO READ OR WRITE STRUCTURES IN THE STANDARD IPL FORMAT.

## SEC 9...AUXILIARY STORAGE ( P. 194-197)

J106 IS NOT AVAILABLE, AS ONLY SLOW STORAGE IS PROVIDED. A DATA LIST STRUCTURE IS FILED AS A SERIES OF BINARY RECORDS ON THE CURRENT AUXILIARY TAPE UNIT-- THE ADDRESS OF THIS UNIT (SYSES1 OR SYSES2) IS CONTROLLED AUTOMATICALLY. THE HEAD OF A LIST STRUCTURE FILED IN AUXILIARY STORAGE CONTAINS THIS ADDRESS IN SYMB, THE NUMBER OF THE FIRST RECORD OF THE STRUCTURE ON THE TAPE APPEARS IN LINK, AND Q=7. WHEN A STRUCTURE IS MOVED TO MEMORY FROM TAPE, THE RECORDS THAT IT OCCUPIED ON TAPE ARE NO LONGER AVAILABLE. A TALLY OF THESE DEAD RECORDS IS KEPT-- AND WHEN THE RATIO OF INACTIVE TO ACTIVE RECORDS EXCEEDS 1/4, THE TAPE IS AUTOMATICALLY COMPACTED ONTO THE OTHER UNIT USED FOR AUXILIARY STORAGE, ELIMINATING THE INACTIVE STRUCTURES. THE NEW UNIT BECOMES THE CURRENT AUXILIARY TAPE UNIT. STORAGE FOR DATA LIST STRUCTURES THUS ALTERNATES BETWEEN TAPES SYSES1 AND SYSES2. (NOTE... INACTIVE DATA LIST STRUCTURES AT THE END OF THE TAPE ARE WRITTEN OVER BY J107, AND ARE NOT COUNTED IN THE ACTIVE/INACTIVE RATIO.)

THE LAST 13 CELLS PRINTED BY THE POST MORTEM CONTAIN PERTINENT INFORMATION ABOUT AUXILIARY DATA STORAGE USAGE. THESE CELLS HAVE INTERNAL ADDRESSES AND ARE, IN ORDER...

1. NUMBER OF TIMES COMPACTING OCCURRED.
2. TOTAL NUMBER OF RECORDS ELIMINATED BY COMPACTING.
3. NUMBER OF TIMES NEXT WRITE POSITION WAS UPDATED.
4. NUMBER OF RECORDS ELIMINATED BY UPDATING.
5. NUMBER OF J72 USAGES INVOLVING AUXILIARY.
6. NUMBER OF J74 USAGES INVOLVING AUXILIARY.
7. NUMBER OF J105 USAGES (J100 AND J101 USE J105 AUTOMATICALLY, IF NECESSARY).
8. NUMBER OF J107 USAGES.
9. TOTAL NUMBER OF WORDS WRITTEN BY J107.
10. TOTAL NUMBER OF RECORDS WRITTEN BY J107. (RECORDS VARY IN LENGTH UP TO 125 WORDS.)
11. RECORD NUMBER OF NEXT WRITE POSITION.
12. CURRENT POSITION OF AUXILIARY TAPE.
13. LIST OF STRUCTURES CURRENTLY ON AUXILIARY, EACH FOLLOWED BY THE NUMBER OF RECORDS OCCUPIED BY THE STRUCTURE. THE FIRST ENTRY REPRESENTS THE DEAD RECORDS AND IS FOLLOWED BY THE TOTAL NUMBER OF SUCH RECORDS.

## SEC 10...ARITHMETIC PROCESSES (P.197-199)

J110, J111, J112, J113, J115, AND J116 ADMIT INTEGER, FLOATING, AND OCTAL DATA TERMS ONLY. THE TYPE OF THE RESULT (O) OF J110-J113 IS AS FOLLOWS...

(1)	(2)	(O)
FLOATING	ANY	FLOATING
ANY	FLOATING	FLOATING
INTEGER	INTEGER	INTEGER
INTEGER	OCTAL	INTEGER
OCTAL	INTEGER	OCTAL
OCTAL	OCTAL	OCTAL

J125 ADMITS INTEGER, FLOATING, AND OCTAL DATA TERMS ONLY. J128 WILL TRANSLATE INTEGER TO FLOATING, FLOATING TO INTEGER, OCTAL TO INTEGER, AND INTEGER TO OCTAL. IN ADDITION, FLOATING AND BCD DATA TERMS ARE 'TRANSLATED' TO OCTAL BY SETTING P=3, AND OCTAL IS 'TRANSLATED' TO BCD BY SETTING P=2. ALL OTHER TRANSLATIONS (BCD TO INTEGER, OCTAL OR BCD TO FLOATING, AND INTEGER OR FLOATING TO BCD) ARE ILLEGAL.

## SEC 11...GENERATORS (PAGES 182-185)

THE GENERATOR TRACE CONTEXT AND LEVEL CONTEXT ARE HANDLED AS DESCRIBED, PROVIDED THAT GENERATORS ARE ALWAYS EXECUTED FROM THE LEFT. BOTH GENERATORS AND SUBPROCESSES MAY BE ON AUXILIARY STORAGE-- SUBPROCESSES MUST HAVE REGIONAL NAMES IF ON AUXILIARY.

IF GENERATORS ARE EXECUTED FROM THE LINK OF AN INSTRUCTION, THEY WILL NOT BE TRACED SUCCESSFULLY.

## SEC 12...ERROR MESSAGES

INTERPRETATION BEGINS WITHIN THE SYSTEM BY INTERPRETING THE INSTRUCTION

000 XXX J7,

WHERE XXX IS THE ROUTINE NAMED ON THE FINAL TYPE 5 TERMINATION CARD. INTERPRETATION WILL CONTINUE UNTIL THE J7 IS LINKED TO, AT WHICH TIME THE PROGRAM WILL PRINT PROGRAM RAN TO COMPLETION ON THE OUTPUT TAPE. OTHER TERMINATIONS WILL OCCUR IF THE PROGRAMMER EXECUTES THE ROUTINE J7, OR IF THE INTERPRETER OR A PRIMITIVE PROCESS DETECTS ANY ONE OF A NUMBER OF ERRORS. IN CASE OF SUCH A TERMINATION, THE REASON WILL BE PRINTED ON THE OUTPUT TAPE, FOLLOWED BY A POST-MORTEM.

THE FOLLOWING ARE ERRORS DETECTED DURING INITIAL OR IN-PROCESS LOADING. THE MESSAGE IS PRINTED AND LOADING CONTINUES.

'UNDEFINED SYMBOL (XX) DURING LOADING'

## IV. PART 2...EXPLANATIONS AND EXAMPLES

'END-OF-FILE READING TAPE UNIT XX'  
 'TYPE-9 CARD...TAPE XX' (NON-INITIAL TYPE-9 CARDS ARE TREATED AS  
 AN END-OF-FILE, NEVER SKIPPED OVER.)  
 'CALLED FOR UNASSIGNED UNIT NO. X'  
 'UNRECOVERED REDUNDANCY WRITING ONTO TAPE XX'  
 'UNRECOVERED REDUNDANCY READING FROM TAPE XX'  
 'AUXILIARY ROUTINE BUFFER SIZE EXCEEDED'

THE FOLLOWING ERRORS ARE DETECTED DURING EXECUTION OF A PROGRAM. THE MESSAGE IS PRINTED, A POST-MORTEM IS GIVEN, 1W15 EXECUTED, AND THE JOB TERMINATED.

'CELL ZERO NOT EMPTY'  
 'ATTEMPTING TO EXECUTE CELL ZERO'  
 'AVAILABLE SPACE EXHAUSTED' (10 CELLS ARE ADDED TO ALLOW 1W5 TO RUN.)  
 'OUTPUT LINE COUNT ESTIMATE EXCEEDED'  
 'NOT ENOUGH INPUTS IN HO FOR PROCESS XX'  
 'CELL ZERO NOT AN ACCEPTABLE INPUT'  
 'ILLEGAL DATA TYPE FOR ARITHMETIC PROCESS'  
 'ARITHMETIC RESULT OUT OF RANGE'  
 'AUX-DATA SYSTEM CLOBBED AT LOC XX'  
 'WRITE-CHECK WHILE COMPACTING TAPE XX'  
 'READ-CHECK WHILE COMPACTING TAPE XX'  
 'UNRECOVERED REDUNDANCY READING FROM TAPE XX'  
 'UNRECOVERED REDUNDANCY WRITING ONTO TAPE XX'

OTHER POSSIBLE TERMINATIONS OF THE JOB...

'OPERATOR INTERRUPTED JOB WITH SWITCH 5 (DO 1W14)'  
 'OPERATOR INTERRUPTED JOB BY 'TRA SYSTEM' (NO P-M)'

THE FOLLOWING ERRORS, IF DETECTED DURING EXECUTION, DO NOT CAUSE THE JOB TO BE TERMINATED THE MESSAGE IS PRINTED AND EXECUTION RESUMED.

'CALLED FOR UNASSIGNED UNIT NO. X'  
 'END-OF-FILE READING TAPE UNIT XX'  
 'UNDEFINED SYMBOL DURING LOADING' (J180 USES A LOADER ROUTINE)

## SEC 13...SYSTEM CELLS (PAGE 177)

H0 INITIALLY CONTAINS THE SYMBOL 0.  
 H2 WILL INITIALLY CONTAIN ABOUT 22,000 CELLS.  
 H3 IS SET TO 1 BY THE INITIAL LOADER.  
 H4 RECORDS CURRENT AUXILIARY ROUTINE.  
 H5 IS INITIALLY SET TO J4(+).  
 H6 IS USED BY MACHINE LANGUAGE RECURSIVE ROUTINES TO HOLD INDEX 4.  
 H7 IS A DATA TERM WHICH IS SET TO THE CURRENT LEVEL. IT IS SET TO 0 BY THE INITIAL LOADER, AND BY J165 IF CARDS ARE READ.  
 H8 IS THE HIDE-OUT CELL USED BY THE GENERATOR PROCESSES.

H9, H10, H11, AND H12 ARE GENERATOR-WORKING CELLS.  
W0 ... W9 INITIALLY CONTAIN THE SYMBOL 0.  
W10 INITIALLY NAMES A DATA TERM FOR RANDOM NUMBER GENERATION.  
W12 ... W15 INITIALLY CONTAIN JO.  
W16 AND W17 ARE NOT USED.  
W18 INITIALLY NAMES A DATA TERM EQUAL TO 0, MEANING TAPE SYSPIT, INPUT.  
W19 INITIALLY NAMES A DATA TERM EQUAL TO 0, MEANING TAPE SYSBR1,P205,220  
W20 INITIALLY NAMES A DATA TERM EQUAL TO 0, MEANING TAPE SYSPOT, OUTPUT.  
W21 INITIALLY NAMES A DATA TERM EQUAL TO 1. (LEFT MARGIN COL)  
W22 INITIALLY NAMES A DATA TERM EQUAL TO 1. (SPACING-PRINT ON NEXT LINE)  
W23 INITIALLY NAMES A LIST OF THE SYSTEM CELLS.  
W24 INITIALLY NAMES A 120-WORD INTERNAL BUFFER FOR LINE PRINT-  
ING.  
W25 INITIALLY NAMES A DATA TERM EQUAL TO 1.  
W26 NAMES A DESCRIPTION LIST OF TRAP ATTRIBUTES AND ASSOCIATED  
TRAP ACTIONS (ROUTINES). INITIALLY THE ONLY ATTRIBUTE  
IS INTERNAL ZERO---THE ACTION IS 'JO' OR 'NO OPERATION'.  
W27 HOLDS H1 AT THE TIME A TRAP OCCURRED. INITIALLY EMPTY.  
W28 HOLDS THE TRAP SYMBOL. INITIALLY EMPTY.  
W29 NAMES THE ROUTINE BEING TRACED...INITIALLY EMPTY.  
W30 INITIALLY NAMES A DATA TERM EQUAL TO 1, FIELD LENGTH FOR J180'S.  
W31 INITIALLY NAMES A DATA TERM EQUAL TO 2, TRACE MODE=SELECTIVE TRACE.  
W32 IS A DATA TERM EQUAL TO ZERO. (SEE ADDED FEATURES, 'TRAP ON H3').  
W33 IS UNASSIGNED.

SEC 14...ERROR TRAP (P.224-225)

J170 IS AVAILABLE FOR PROGRAMMER USE AS DESCRIBED ON P.225.  
THE STANDARD ACTION, TO BE TAKEN WHEN A SPECIFIED TRAP  
ATTRIBUTE IS NOT ON W26, IS CURRENTLY JO. CHANGE  
THIS TO YOUR LIKING BY ASSIGNING (J11) YOUR ROUTINE AS THE  
VALUE OF INTERNAL 0 ON THE DESCRIPTION LIST OF W26.

CAUTION---DO NOT ERASE (J14) THE ATTRIBUTE 0 FROM W26.  
W26 LINKS TO THIS CELL IN ORDER TO DISPLAY THE TRAP  
ATTRIBUTES ON THE POST MORTEM.

THE SYSTEM ERRORS LISTED IN SEC 12 ABOVE DO NOT TRAP TO  
J170 AS YET. A SET OF STANDARD ERRORS, THEIR ATTRIBUTE  
SYMBOLS AND ASSOCIATED ACTIONS IS UNDER CONSIDERATION.

## IV. PART 3...IPL UNDER OTHER MONITORS

ALTHOUGH THE SYSTEM HAS BEEN ORGANIZED SO AS TO WORK WITHIN THE MOCKDONALD MONITOR SYSTEM, IT SHOULD BE EMPHASIZED THAT IT IS IN NO WAY DEPENDENT UPON ANY OF THE ROUTINES OF THAT SYSTEM. ONLY THE TAPE CONTROL WORDS OF THAT SYSTEM NEED BE REPRODUCED (IN THE FORMAT EXPLAINED BELOW) TO GAIN COMPLETE INDEPENDENCE OF THAT SYSTEM.

ALL INPUT AND OUTPUT ROUTINES ARE CONTAINED WITHIN THE IPL-V SYSTEM ITSELF. DATA IS READ, IN BCD, FROM TAPE SYSPIT-- OUTPUT IS WRITTEN IN BCD ON TAPE SYSPOT. NEITHER TAPE IS REWOUND, NOR IS AN END-OF-FILE EVER WRITTEN ON SYSPOT. TAPE SYSMIT IS USED FOR SAVING CORE AND FOR AUXILIARY ROUTINE STORAGE. SYSAR1, 2, 3, 4, 5, SYSBR1, 2, 3, 4, AND 5 MAY BE USED BY THE IPL-V INTERPRETED PROGRAM. SYSES1 AND SYSES2 ARE USED BY THE AUXILIARY DATA STORAGE SYSTEM.

SOS CONTROL CARDS (7-8-9 PUNCH IN COL 1) ARE TREATED AS END-OF-FILE MARKS BY THE READ PROCESSES. SUBROUTINE 'A5' (6 WORDS LONG) SHOULD BE RECODED TO RECOGNIZE THE CONTROL CARDS OF YOUR INSTALLATION.

## CALLING SEQUENCE

```

CS - 1 = LDI CNTRL
CS      = TSX AO,4
CS + 1 = PZE SYSTAP,,...
CS + 2 = PZE SYSPIT,,SYSMIT
CS + 3 = PZE SYSPOT,,PAGES
CS + 4 = PZE SYSES1,,SYSES2
CS + 5 = ...
CS + 6 = PZE ..., ,SYSERR
      .
      .
      .
CS + 13 = PZE SYSORG,,...
      .
      .
      .
CS + 29 = RETURN
      .
      .
      .
CS + 37 = PZE SYSTSL,,...

```

THE ABOVE CALLING SEQUENCE IS THAT USED WITHIN THE MOCKDONALD OPERATING SYSTEM-- HENCE ITS STRANGE FORMAT. WORDS OR PARTS OF WORDS INDICATED BY '...' ARE NOT SIGNIFICANT.

## CALLING SEQUENCE INFORMATION

SYSPIT, SYSMIT, SYSMOT, SYSES1, SYSES2 ARE THE LOCATIONS OF TAPE CONTROL WORDS. THESE WORDS MUST CONTAIN THE ADDRESS OF THE PHYSICAL UNIT ASSOCIATED WITH THE SYMBOLIC TAPE. (E.G., IF SYSPIT IS ON PHYSICAL UNIT B2, THE CONTROL WORD WOULD HAVE AN OCTAL ADDRESS OF 02202.) IF THE ADDRESS IS ZERO, THE UNIT IS

INTERPRETED AS BEING UNAVAILABLE.

SYSTSL IS THE LOCATION OF THE TAPE STATUS LIST FOR RESERVED TAPES. IT IS ARRANGED SUCH THAT

```

AXT CHANNEL,2      (1 FOR CH. A, 2 FOR CH. B, ETC.)
AXT UNIT,1        (3 FOR UNIT 3, ETC.)
CLA* SYSTSL,2

```

WILL PUT THE ADDRESS OF THE CORRESPONDING TAPE CONTROL WORD INTO THE DECREMENT OF THE ACCUMULATOR. TAPES SYSAR1, 2, 3, 4, 5, SYSBR1, 2, 3, 4, AND 5 ARE INTERROGATED. AGAIN, A ZERO ADDRESS IS INTERPRETED AS MEANING THAT THE CORRESPONDING UNIT IS UNAVAILABLE.

SYSERR AND SYSEKR-2 ARE THE LOCATIONS TO WHICH THE OPERATOR IS TO TRANSFER IN CASE OF PROGRAM ERROR, LOOP, TOO MUCH TIME, ETC. BOTH SYSEKR AND SYSERR-2 ARE REPLACED WITH A TRANSFER TO THE RECOVERY ROUTINE FOR IPL-V-- THE CONTENTS OF THESE CELLS IS SAVED AND RESTORED. THEY MUST LIE IN THE RANGE 0001 - 0077 (OCTAL). THE ENTRY FROM SYSERR ATTEMPTS TO GIVE AN IPL-V POST MORTEM BEFORE EXIT-- THE ENTRY FROM SYSEKR-2 CAUSES AN IMMEDIATE EXIT FROM IPL-V.

SYSORG IS THE NAME OF A CELL CONTAINING THE LOCATION OF THE FIRST WORD FOLLOWING THE SYSTEM IN CONTROL. MEMORY UP TO LOCATION C(SYSORG) IS LEFT UNDISTURBED BY THE EXECUTION OF IPL-V (WITH THE EXCEPTION OF CELL ZERO).

PAGES IS THE LOCATION OF A CELL CONTAINING THE APPROXIMATE NUMBER OF PAGES OF OUTPUT EXPECTED. THIS NUMBER IS MULTIPLIED BY 64 TO GIVE A LINE COUNT. (A LINE COUNT OF ZERO IS REPLACED WITH A COUNT OF 6000.) AN ERROR CONDITION IS SENSED WHEN THE OUTPUT (FROM ASSEMBLY, TRACING, J150, J151, J152, J153, OR J155, PRINTING OR PUNCHING) EXCEEDS THE EXPECTED AMOUNT. THE LINE COUNT IS THEN RESET SO THAT A POST MORTEM MAY BE PRINTED.

OPERATION OF THE IPL-V EXECUTIVE ROUTINE, A0

1. ALL TRAPS ARE DISABLED.
2. THE TAPE CONTROL WORDS ARE INTERPRETED, AND A TABLE OF TAPE INFORMATION IS CONSTRUCTED.
3. MEMORY IS SAVED ON TAPE SYSMIT FROM LOCATIONS 100(OCTAL) TO C(SYSORG) AND FROM 'IPLV' TO 'A2', IN 1 RECORD.
4. LOADING OF THE OBJECT PROGRAM PROCEEDS UNTIL A TYPE-5 KICKOFF CARD IS MET, INDICATING WHERE INTERPRETATION BEGINS.
5. CONTROL IS PASSED TO THE IPL-V SYSTEM INTERPRETER.
6. AT THE CONCLUSION OF THE IPL-V RUN (PROGRAM FINISHED, ERROR, OR MANUAL TRANSFER TO SYSEKR-2 OR SYSEKR), MEMORY IS RESTORED FROM TAPE SYSMIT AND CONTROL RETURNED TO WORD 29 OF THE CALLING SEQUENCE.

## EXAMPLE

FOLLOWING IS A COMPLETE CALLING SEQUENCE REQUIRING NO INFORMATION FROM THE MOCKDONALD SYSTEM...

```
START  LDI  CNTRL
        TSX  A0,4
        PZE
        PZE  SYSPIT,,SYSMIT
        PZE  SYSPOT,,PAGES
        PZE  SYSES1,,SYSES2
        PZE
        PZE  0,0,3  (MANUAL ERROR TRANSFER TO 3 (OCTAL) OR 1 (OCTAL).)
        PZE
        PZE
        PZE
        PZE
        PZE  SYSORG
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        TRA  OUT
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE
        PZE  SYSTSL
CNTRL  OCT  0
SYSPIT  OCT  2201 UNIT B1 FOR SYSPIT
SYSMIT  OCT  2202 UNIT B2 FOR SYSMIT
SYSPOT  OCT  2203 UNIT B3 FOR SYSPOT
SYSES1  OCT  1204 UNIT A4 FOR SYSES1  (AUX. DATA STORAGE)
SYSES2  OCT  2204 UNIT B4 FOR SYSES2  (AUX. DATA STORAGE)
SYSAR1  OCT  1201 UNIT A1 FOR SYSAR1
SYSAR2  OCT  1202 UNIT A2 FOR SYSAR2
SYSAR3  OCT  1203 UNIT A3 FOR SYSAR3
SYSAR4  PZE       SYSAR4 NOT USED
SYSAR5  PZE       SYSAR5 NOT USED
SYSBR1  PZE       SYSBR1 NOT USED
SYSBR2  PZE       SYSBR2 NOT USED
```

IV. PART 3...IPL UNDER OTHER MONITORS

```

SYSBR3 PZE      SYSBR3 NOT USED
SYSBR4 OCT 1205 UNIT A5 FOR SYSBR4 (IF USED)
SYSBR5 OCT 2205 UNIT B5 FOR SYSBR5 (IF USED)
SYSORG PZE 16384SAVE LOWER HALF OF CORE.
        PZE CHNLB,1
        PZE CHNLA,1
SYSTSL PZE      TAPE STATUS LIST
        PZE 0,,SYSAR5
        PZE 0,,SYSAR4
        PZE 0,,SYSAR3
        PZE 0,,SYSAR2
        PZE 0,,SYSAR1
CHNLA  PZE
        PZE 0,,SYSBR5
        PZE 0,,SYSBR4
        PZE 0,,SYSBR3
        PZE 0,,SYSBR2
        PZE 0,,SYSBR1
CHNLB PZE
PAGES DEC 200 APPROXIMATE NUMBER OF PAGES (EXAMPLE)
    
```



ALL SYSTEM SUBROUTINES ARE AT LEAST AT THE LEVEL OF  
MID12' AND CONTAIN THE ADVANTAGES AND RESTRICTIONS OF THIS  
PROGRAM LEVEL. MANY OF THE SUBROUTINES HAVE HAD FEATURES  
ADDED OR DEFICIENCIES CORRECTED AS NOTED BELOW.

## MONITOR

## ACCOUNTING ROUTINES

EXTENSIVE ACCOUNTING ROUTINES HAVE BEEN ADDED TO THE MONITOR. THESE PROVIDE, IN ADDITION TO THE CHARGEABLE TIME ACCOUNTING, DETAILED TIMING OF SYSTEM SUBROUTINES USED AND ACCOUNTING SUMMARIES FOR INDIVIDUAL JOBS. THE OPERATION OF THE ACCOUNTING ROUTINES IS DESCRIBED IN APPENDIX D.

## RESERVED TAPE ASSIGNMENT

AN ASSIGN ROUTINE HAS BEEN PROVIDED TO ASSIGN RESERVED TAPES IN PHASE 1. THIS PERMITS EDITING OF DATA ONTO RESERVED TAPES AND PROCESSING OF SOURCE SYMBOLIC OR 'SQUOZE' DECKS FROM RESERVED TAPES. FOR EXAMPLE...

```

• LOAD   NOGO,SYSARI
  MOD
  ALTER  2,40
  ENDMOD
  BLANK

```

WILL CAUSE MODIFY AND LOAD TO TAKE ITS 'SQUOZE' DECK FROM 'SYSARI', INSERTING THE MODS FROM 'SYSPIT'. DUE TO AN UNBELIEVABLY UNFORTUNATE COMBINATION OF CIRCUMSTANCES IN THE MONITOR AND MODIFY AND LOAD, THE BLANK CARD IS NECESSARY FOLLOWING THE MOD PACKAGE AND TWO (REPEAT TWO) BLANK CARDS ARE REQUIRED IF NO MOD PACKAGE IS PRESENT. THE BLANK CARD IMBEDDED IN THE 'SQUOZE' DECK ON 'SYSARI' MUST BE WRITTEN IN BINARY -- IF CARD-TO-TAPE WAS USED, ANY BINARY CARD MAY BE SUBSTITUTED FOR THE BLANK.

## OUTPUT LIMITS

THE OUTPUT LIMITS SPECIFIED BY THE 'JOB' CARD HAVE BEEN ENABLED. ANY JOB WHICH EXCEEDS THESE LIMITS WILL BE AUTOMATICALLY TERMINATED. HOWEVER THE MONITOR INSERTS A LOWER LIMIT OF 500 WORDS OF MEDIARY OUTPUT AND FIVE PAGES OF PERIPHERAL OUTPUT IF THE 'JOB' CARD HAS SPECIFIED LESS.

THE LIMIT-CHECKING ROUTINE, 'SYSTEMO', EXAMINES THE DECREMENT OF CELL 'SYSTEMO'. IF IT HAS BEEN SET BY THE PROGRAMMER AND TOO MUCH OUTPUT HAS OCCURRED, THE ROUTINE WILL EXECUTE A 'STL' INSTRUCTION WITH THAT ADDRESS AND THEN RETURN NORMALLY. THIS PROCEDURE ENABLES A PROGRAM TO MAKE A MORE ORDERLY RETREAT, AS IN THE CASE OF SENSE SWITCH 5 CUT-OFF.

## 1401 PERIPHERAL PROGRAM

A SPECIAL 1401 PERIPHERAL PROGRAM, DESCRIBED IN APPENDIX F, PRINTS THE 'BCD' RECORDS ON THIS TAPE AND PUNCHES THE BINARY RECORDS. A COPY OF THE 'JOB' CARD IS PRODUCED FOR EACH JOB AS OVERALL DECK IDENTIFICATION. THE PROGRAM RECOGNIZES A SPECIAL CARD PRODUCED EACH TIME AN 'IDENT' APPEAR IN THE SOURCE DECK AND RESETS DECK IDENTIFICATION AND SEQUENCING IN COLUMNS 73-80.

## SENSE SWITCH ASSIGNMENTS

SENSE SWITCH ASSIGNMENTS HAVE BEEN MODIFIED SOMEWHAT. IF DOWN, THEY INDICATE...

1. STOP BEFORE PROCESSING JOB.
2. ON-LINE INPUT.
3. ON-LINE OUTPUT. 'WPT' WRITES BOTH ON AND OFF IF 3 WAS UP AT THE BEGINNING OF PHASE AND IS CURRENTLY DOWN.
4. READ KEYS FOR TAPE ASSIGNMENT.
5. RECOVERY IF INITIATING.  
PRINT FILE NAMES AS THEY ARE CALLED FROM 'SYSTAP'.  
STANDARD FOR CONSOLE INTERRUPT OF OBJECT CODE EXECUTION.
6. ON-LINE PUNCH.

SWITCH 1 CONTROLS A 'JOB STOP'. IF THIS SWITCH IS DOWN, THE MONITOR WILL HALT AFTER PRINTING THE JOB LINE AND WILL SKIP THE JOB IF 'START' IS PUSHED WITH SWITCH 1 STILL DOWN. IT WILL RUN THE JOB IF SWITCH 1 IS UP BEFORE PUSHING START.

PERIPHERAL TAPES HAVE BEEN END FILED AND MAY BE REMOVED IF DESIRABLE.

## USE OF THE INITIATION DECK

THE INITIATION DECK FOR 'SOS' IS USED TO BEGIN OPERATION OF THE 'SOS' SYSTEM. IT INCLUDES PATCHING FEATURES SO THAT ANY OPERATING FILE ON THE SYSTEM TAPE MAY BE PATCHED JUST PRIOR TO ITS EXECUTION. THE FORMAT OF THE INITIATION DECK IS...

- |         |  |
|---------|--|
| CARD 1  | A ONE CARD LOADER TO LOAD THE SYSTEM INITIATION ROUTINE FROM B1. ACTUALLY THIS IS A GENERAL LOADER WHICH WILL LOAD AND TRANSFER TO THE FILE WHOSE BCD NAME APPEARS IN THE 12R WORD OF THE CARD. THE 'MISC.' FILE, USED FOR DISTRIBUTION PURPOSES, IS CALLED BY A SIMILAR CARD. |
| CARD 2  | THE CODE CARD FOR PATCHES TO SYSTEM OPERATING FILES. THIS CARD ESTABLISHES A CORRESPONDENCE BETWEEN BCD FILE NAMES (IN LEFT WORDS) AND PATCH CODES (IN RIGHT WORDS)  |
| PATCHES | FOLLOWING THE CODE CARD ARE AS MANY PATCH CARDS AS ARE NECESSARY. AN UNLIMITED NUMBER OF PATCHES MAY BE MADE TO 'EXCCRD', BUT ONLY 40 PATCHES MAY BE   |

## V. CHANGED COMPONENTS

MADE TO ALL OTHER FILES COMBINED. THE PATCH CARD FORMAT IS...

9LD PATCH CODE (CORRESPONDING TO FILE NAMED ON CARD 2).  
9LA ADDRESS OF PATCH.  
9R PATCH WORD.

PATCHES ARE READ UP THE CARD FROM THE 9 ROW UNTIL A BLANK LINE IS ENCOUNTERED. ANY PATCHES WITH 9LD GREATER THAN 10000 ARE IGNORED.

ENDPATCH A CARD WITH 9 PUNCHES IN COLUMNS 1-3 SIGNALS THE END OF THE PATCH DECK.

MDCONTROL ANY MEANINGFUL MD CONTROL CARDS MAY BE INSERTED FOLLOWING THE END-PATCHES CARD. THESE ARE SYSTEM MODALS AND GENERALLY INCLUDE TAPE 'ASSIGN' CARDS, A 'DATE' CARD, PPTPOT, ETC. (SEE SECTION II FOR OTHER CONTROL CARDS).

GO THE 'GO' CARD TERMINATES THE INITIATION DECK AND STARTS SYSTEM OPERATION. ANY CARDS FOLLOWING THE 'GO' CARD ARE COMPLETELY IGNORED.

## INITIATION AND RECOVERY

INITIATION AND RECOVERY PROCEDURES HAVE BEEN SPEEDED UP. THE TIME TAKEN FOR EITHER PROCESS IS JUST THAT REQUIRED TO REWIND 'SYSTAP' AND READ IN THE INITIATION DECK. ALL INFORMATION NECESSARY TO RECOVERY (ABOUT 25 WORDS) IS KEPT ON 'SYSMOT', AND THE PROCEDURE HAS BEEN ACCOMPLISHED IN SUCH A WAY THAT REASSEMBLY OF THE MONITOR IS NOT NECESSARY WHEN REORDERING FILES ON THE SYSTEM TAPE. RECOVERY USES THE SAME DECK AS INITIATION, WITH SWITCH 5 INDICATING WHICH IS DESIRED. THE OPERATOR IS REQUIRED TO INDICATE THE LOCATION OF 'SYSMOT' IN THE ADDRESS PART OF THE KEYS. HE MAY ALSO RESTART A PHASE BY INDICATING THE PHASE IN THE DECREMENT KEYS.

ONE FEATURE OF THE MOCKDONALD MONITOR WHICH HAS BEEN ENABLED TO ACCOMPLISH THIS AND OTHER SPEED-UPS IS THE ABILITY TO MOVE THE SYSTEM TAPE ONE FILE AT A TIME TOWARD A GIVEN FILE. THUS DURING INITIATION, LISTING, OBJECT PROGRAM EXECUTION, AND OUTPUT CONVERSION, THE SYSTEM TAPE IS MOVING TOWARD THE NEAREST SUPERVISORY CONTROL FILE. IN MANY CASES THIS MEANS THAT SYSTEM TAPE MOVEMENT HAS BEEN ELIMINATED AS A SOURCE OF LOST TIME.

THE PROVISION FOR MULTIPLE OCCURRENCES OF FILES ON THE SYSTEM TAPE HAS LED TO THE CREATION OF OPERATING POINTS ON THE SYSTEM TAPE. THEREFORE, IT IS NOT NECESSARY IN A SEQUENCE OF 'FORTRAN' OR 'SCAT' JOBS TO PASS OVER THE CODE FOR THE OTHER PROCESSORS ON THE SYSTEM TAPE.

## STOPS

ONLY THREE STOPS ARE NORMAL IN THE RS-SOS SYSTEM...

LOCATION 23(8)

STORAGE HTR \*

CAUSE LOADER DOES NOT RECOGNIZE SYSTAP.  
A. MAKE SURE CORRECT SYSTAP IS MOUNTED. TRY AGAIN.  
B. IF ANOTHER FAILURE, TRY SYSTAP MOUNTED ON  
ANOTHER TAPE UNIT.  
C. IF THIS AGAIN FAILS, NOTIFY CE'S OF POSSIBLE  
CHANNEL B TROUBLE.

LOCATION 40(8)

STORAGE HTR \*

CAUSE THIS IS SYSHTR. AT THIS STOP, THE SYSTEM WILL HAVE  
PRINTED OUT ON-LINE WHAT HAS CAUSED THE STOP.

LOCATION 41(8)

STORAGE HTR 1,4

CAUSE THIS IS SYSHPR. AT THIS STOP, THE SYSTEM WANTS THE  
OPERATOR TO CHECK SOME ON-LINE PRINTING.  
PUSH START TO GO IF INFORMATION IS RIGHT.

## OPERATOR TRANSFERS

INSTEAD OF A TRANSFER TO 'SYSERR' AND 'SYSTEM', THE 'STR' INSTRUCTION IS USED FOR OPERATOR RETURNS TO THE SYSTEM.

```
STR  SYSERR      5 00000 0 00044
STR  SYSTEM      5 00000 0 00042
```

THIS ENABLES THE SYSTEM TO SAVE THE ENTIRE PANEL, INCLUDING THE LOCATION COUNTER. IT ALSO GIVES THE PROGRAMMER A SCOOP OF THE FIVE-WORD AREA AROUND THE ERROR LOCATION SO THAT IT IS NOT NECESSARY FOR THE OPERATOR TO RECORD ANY CONSOLE INFORMATION.

THE TRANSFERS TO 'SYSTEM' AND 'SYSERR' (0 02000 0 00042 AND 0 02000 0 00044) STILL WORK AND CAN BE TRIED IF THE 'STR' DOES NOT WORK. IF THESE DO NOT WORK, TRANSFERS TO 'SYSTEM'+1 AND 'SYSERR'+1 MAY BE TRIED AS ON PREVIOUS TAPES (0 02000 0 00043 AND 0 02000 0 00045).

## SYSTEM SELECT AND CHECK ROUTINES

THREE ROUTINES FROM THE MONITOR ARE AVAILABLE TO THE PROGRAMMER FOR 'I/O' WHICH OPERATE WITHIN THE SYSTEM RULES FOR 'I/O' COMMUNICATION, ACTIVITY, AND DISPATCHING. ANY 'I/O' PROGRAMS MAY BE SPECIFIED, AND THE PROPER CHECKING AND CHANNEL SYNCHRONIZATION IS ASSURED. THE ROUTINES ARE... SELECT ('SYSSEL'), CHECK ('SYSCHK'), AND WAIT AND TEST ('SYSWAT').

## SELECT SUBROUTINE

## CALLING SEQUENCE

```
TSX SYSSEL,4
OP L(U)
MODE Y,,CHECK
RETURN
```

## WHERE OP IS SELECT INSTRUCTION

```
L(U) IS THE LOCATION OF THE I/O UNIT ADDRESS
MODE = PZE OR PTW FOR BINARY MODE
MODE = MZE OR MTW FOR DECIMAL MODE
MODE = MON OR MTH TO SUPPRESS RESET AND LOAD CHANNEL
```

IF THE SECOND BIT OF THE PREFIX IS 1, THE STANDARD CHECKING ROUTINE (SYSCHK) WILL BE EMPLOYED TO CHECK THE CHANNEL INDICATORS AFTER THE I/O OPERATION IS COMPLETE. IF IT IS A 0, THE SPECIAL CHECKING PROCEDURE SPECIFIED BY THE CHECK PARAMETER WILL BE USED.

Y IS THE LOCATION OF THE INITIAL DSC COMMAND CHECK, IN THE STANDARD CASE, IS THE LOCATION

IN WHICH THE RETURN INDICATORS FROM CHK ARE TO BE STORED OR, IN THE SPECIAL CASE, IS THE LOCATION OF THE SUBROUTINE WHICH IS TO CHECK THE I/O OPERATION.

THIS ROUTINE INITIATES A DSC PROGRAM ON THE SPECIFIED CHANNEL AFTER EXECUTING THE NECESSARY CHECKING AND CHANNEL SYNCHRONIZATION.

## CHECK SUBROUTINE

CALLING SEQUENCE

TSX SYSCHK,4  
PZE L(U),,L(D)  
RETURN

WHERE L(U) IS THE LOCATION OF THE I/O UNIT ADDRESS  
L(D) IS THE LOCATION FOR CHECK DATA STORAGE

IF L(U) = 0, THE CHANNEL INDEX IS PRESUMED TO BE IN  
INDEX REGISTER 1.

IF L(D) = 0, THE SENSE INDICATORS ARE USED

ON RETURN

BIT 35 OF L(D) = 1  
BIT 34 OF L(D) = 1 IF BTTX WAS ON  
BIT 33 OF L(D) = 1 IF ETTX WAS ON  
BIT 32 OF L(D) = 1 IF TEFX TRANSFERRED  
BIT 31 OF L(D) = 1 IF TRCX TRANSFERRED

THIS ROUTINE, NORMALLY ENTERED FROM A ROUTINE ENTERED VIA THE DECREMENT OF SYSXAC (THE CHANNEL ACTIVITY CELL), CHECKS BTTX, ETTX, TEFX AND TRCX FOR THE PROPER CHANNEL, LEAVING INDICATORS IN L(D). ADDITIONALLY, THIS ROUTINE RESETS CHANNEL ACTIVITY (SYSXAC).

## WAIT AND TEST SUBROUTINE

CALLING SEQUENCE

TSX WAT,4  
PZE L(U)  
RETURN

WHERE L(U) IS THE LOCATION OF THE I/O UNIT ADDRESS  
IF L(U) = 0, CHANNEL INDEX IS IN REGISTER 2

THIS ROUTINE CAUSES THE MAIN PROGRAM TO WAIT UNTIL THE I/O OPERATION ON THE SPECIFIED CHANNEL IS COMPLETE AND THEN EXECUTES THE CHECK ROUTINE DESCRIBED IN SYSXAC.

## BAD SPOT PROCEDURE

THE SYSTEM HAS A NEW 'BAD SPOT' ROUTINE WHICH PRINTS COMMENTS ON-LINE FOR EACH ENTRY, INCLUDING SUCCESSFUL RECOVERY. THIS HELPS THE OPERATOR TO LOCATE FAULTY TAPE UNITS AND REELS MORE QUICKLY. THE ROUTINE ALSO CHECKS THE DECREMENT OF 'SYSBAD' AND RETURNS TO THAT LOCATION IN THE EVENT OF AN UNRECOVERABLE TAPE CHECK WITH THE LOCATION OF THE OFFENDING 'I/O' UNIT CONTROL WORD IN INDEX REGISTER 2.

THE CALLING SEQUENCE IS...

```
TSX SYSBAD,4
PFX L(U),T,Y
```

WHERE

```
PFX = PZE FOR READ.
      = MZE FOR WRITE.
L(U) = LOCATION OF THE I/O UNIT CONTROL WORD.
T = 0 FOR BCD.
  = 1 FOR BINARY.
Y = BEGINNING OF I/O CHAIN OR '0' FOR WEF RECOVERY.
```

ENDLESS CHAINS IN THE I/O STRING WILL CAUSE A COMMENTED ERROR EXIT FROM 'SYSBAD'. THE TAPE RECOVERY PROCEDURE USED IS AS FOLLOWS...

WRITE REDUNDANCY

TWELVE REWRITES ARE ATTEMPTED-- IF UNSUCCESSFUL...

- (A) ERASE THE ENTIRE SET OF RECORDS WRITTEN BY THE I/O STRING.
- (B) BACKSPACE THE TAPE AND READ.
  - (1) IF A SHORT RECORD (LESS THAN FOUR WORDS) IS READ WITH A TAPE CHECK OR A LONG RECORD (FOUR OR MORE WORDS) IS READ, THE ERASURE IS ASSUMED SUCCESSFUL, THE TAPE IS SPACED OVER THE ERASED AREA, AND THE CURRENT SET OF RECORDS IS WRITTEN.
  - (2) IF A SHORT RECORD (LESS THAN FOUR WORDS) IS SUCCESSFULLY READ, IT IS ASSUMED THAT THE TAPE HAS AN UNRECOVERABLE BAD SPOT. IF THE BAD SPOT PERSISTS AFTER FOUR ATTEMPTED ERASURES, THE OPERATOR IS NOTIFIED THAT AN UNRECOVERABLE BAD SPOT HAS OCCURRED.

READ REDUNDANCY

THE RECORD IS REREAD...

- (A) IF A TAPE CHECK OCCURS AND THE WORD COUNT IS LESS THAN FOUR WORDS, THE RECORD IS ASSUMED TO BE NOISE, THE FOLLOWING RECORD IS READ, AND RECOVERY IS SUCCESSFUL.
- (B) IF THE RECORD CONTAINS MORE THAN THREE WORDS AND THE TAPE CHECK PERSISTS AFTER TWELVE TRIES, THE ERROR IS ASSUMED UNRECOVERABLE.



ALL UNSUCCESSFUL RECOVERIES (READ AND WRITE) RETURN TO 'SYSTRC' AND THENCE TO 'SYSERR'.

IN ORDER TO INTRODUCE THIS BAD SPOT PROCEDURE, WHICH IS MORE OR LESS ACCORDING TO 'IBM' AS REGARDS THE NOISE RECORD TREATMENT, THE BUFFERING ROUTINES ('K\$EMPTY') HAVE BEEN CHANGED TO WRITE A PHYSICAL RECORD OF AT LEAST THREE WORDS. IN ADDITION, MODIFY-AND-LOAD HAS BEEN REVISED TO READ TEXT UNDER RECORD, RATHER THAN COUNT, CONTROL. ERRORS MADE BY SYSBAD WILL IN ALMOST ALL CASES BE DUE TO A WRITE RECOVERY FOLLOWING WRITING A RECORD WHICH FOLLOWS A SHORT RECORD WHICH RESULTS IN SYSBAD'S THINKING THAT THE SHORT RECORD WAS A NOISE RECORD. IF READING THE SHORT RECORD DURING B2, THE SHORT RECORD WILL BE ERASED IF IT DOES NOT PRODUCE A TAPE CHECK. OTHERWISE IT WILL REMAIN. (FORTRAN WRITES LOTS OF SHORT RECORDS.)

## SYSTEM SYMBOL TABLE

SEVERAL ADDITIONS HAVE BEEN MADE TO THE 'SYSTEM SYMBOL TABLE' FOR PROGRAMMER CONVENIENCE. THE ENTIRE LIST OF SYSTEM SYMBOLS, EXCLUSIVE OF THE TAPE NAMES AND CHANNEL ACTIVITY CELLS IS-

## SYSTEM ROUTINE ENTRY POINTS

SYSBAD	ENTRANCE TO THE SYSTEM BAD SPOT ROUTINE
SYSCAP	ENTRANCE TO ON-LINE PRINTER ROUTINE.
SYSCHK	CHECK ROUTINE
SYSCHT	ENTRY TO SPECIAL TRAP SUPERVISOR
SYSCRI	CONVERT TO ROW IMAGE ROUTINE
SYSDSN	ROUTINE RETURNS CHANNEL AND UNIT OF SYMBOLIC TAPE
SYSERR	ERROR RETURN TO THE SYSTEM
SYSHPR	STANDARD SYSTEM PAUSE. CONTAINS TRA 1,4
SYSHTR	STANDARD SYSTEM DEAD STOP. CONTAINS HTR *
SYSIOC	ENTRANCE TO THE I/O CHECK RECOVERY ROUTINE
SYSIT1	INTRAN STL STORAGE
SYSIT2	INTRAN ENTRANCE POINT
SYSMTL	ENTRANCE TO THE MEDIARY TAPE LOADER (LOADS CODE)
SYSNAM	SYMBOLIC TAPE NAME FOR SYSDSN
SYSOED	STORAGE FOR OUTPUT EDITOR ENTRY
SYSOT1	OUTRAN STL STORAGE
SYSOT2	OUTRAN ENTRANCE POINT
SYSPCS	ENTRANCE TO PRESET CORE STORAGE ROUTINE
SYSPII	ENTRANCE TO THE FLOATING SPILL ROUTINE
SYSSEL	SELECT ROUTINE
SYSSTR	ENTRANCE TO STR ROUTINE (GOES DIRECTLY TO \$ERR, AT PRESENT)
SYSSYS	ENTRANCE TO THE SYSTEM TAPE LOADER
SYSTAS	ENTRANCE TO THE TAPE ASSIGNMENT ROUTINE
SYSTDC	ENTRY TO DIVIDE CHECK ROUTINE
SYSTEM	NORMAL RETURN TO THE SYSTEM
SYSTMT	ENTRANCE TO THE TOO MUCH TIME ROUTINE
SYSTOF	ENTRANCE TO THE FLOATING OVERFLOW ROUTINE
SYSTRC	ENTRANCE TO REDUNDANCY TAPE CHECK ROUTINE
SYSTRP	ENTRANCE TO THE SYSTEM TRANSFER TRAP ROUTINE
SYSTST	ENTRANCE TO THE TEST ROUTINE
SYSTUF	ENTRANCE TO THE FLOATING UNDERFLOW ROUTINE
SYSWAT	WAIT AND TEST ROUTINE
SYSWPT	ENTRY TO PERIPHERAL TAPE WRITER (NOT AVAILABLE TO OBJECT CODES)
SYSXTR	ENTRANCE TO EXTERNAL INTERRUPT ROUTINE

## SYSTEM COMMUNICATION CELLS.

SYSDSB	SYSTEM TRAP DISABLE WORD
SYSENB	SYSTEM TRAP ENABLE WORD
SYSFSI	STORAGE FOR FLOATING SPILL INDICATORS
SYSLMO	CONTAINS MEDIARY OUTPUT LIMIT FOR THE CURRENT JOB
SYSLOT	CONTAINS THE EXECUTION TIME LIMIT FOR THE CURRENT JOB
SYSLPO	CONTAINS THE OUTPUT PAGE LIMIT FOR THE CURRENT JOB

SYSMOC	CONTAINS MEDIARY OUTPUT WORD COUNT
SYSORG	CONTAINS THE NAME OF THE LOWEST CELL OF THE OBJECT CODE
SYSPOC	CURRENT OUTPUT PAGE COUNT FOR THE JOB
SYSTAT	DECREMENT CONTAINS THE CURRENT PHASE, ADDRESS SYSTEM MODALS
SYSTEL	BITS DESCRIBING DYNAMIC SYSTEM STATUS
SYSTPS	DECREMENT CONTAINS CURRENT SYSTEM TAPE FILE POSITION
SYSTRA	CONTAINS THE TRANSFER ADDRESS OF EACH OBJECT CODE LOADED.
SYSTRX	CALCULATED TRANSFER TRAP RETURN

## SYSTEM CONSTANTS

SYSBNK	CONSTANT SIX BLANKS
SYSCHN	ADDRESS EQUALS THE NUMBER OF CHANNELS ON THE MACHINE
SYS.D1	CONSTANT DECREMENT = 1
SYS..A	MASK ADDRESS
SYS..D	MASK DECREMENT
SYS..P	MASK PREFIX
SYS.PA	MASK PREFIX AND ADDRESS
SYS.PT	MASK PREFIX AND TAG
SYS.P1	CONSTANT PREFIX = 1
SYSKT1	LOCATION OF SYSTAP MOVEMENT FLAG (USED BY 'TEST')
SYSNAM	LOCATION OF SYMBOLIC TAPE NAME FOR SYSDSN
SYSONE	CONSTANT ADDRESS = 1
SYSPTA	MASK PREFIX, TAG, AND ADDRESS
SYSTEM	UNUSED
SYSTLT	ORIGIN,,LENGTH OF SYSTEM TAPE FILE IDENTIFIER TABLE
SYSTSL	LOCATION OF TAPE STATUS LISTS (X1=UNIT)
SYSTWO	CONSTANT ADDRESS = 2
SYSXNT	NUMBER OF TAPES PER CHANNEL (X1=CHANNEL)
SYSZRO	CONSTANT ZERO

## CHANNEL COMMAND EXECUTE TABLES

SYSBTT	BEGINNING OF TAPE TEST
SYSCTR	TRANSFER ON TAPE CHECKS (X4=LOCN)
SYSETT	END OF TAPE TEST
SYSRCH	RESET AND LOAD CHANNEL (X1=UNIT)
SYSSCH	STORE CHANNEL (X4=-LOCN)
SYSSPR	SENSE PRINTER (X4=-EXIT)
SYSSPU	SENSE PUNCH (X4=-EXIT)
SYSTCH	TRANSFER CHAN NOT IN OPER (X4=-LOCN)
SYSTCN	TRANSFER TABLE CHANNEL NOT IN OPERATION (X4=-LOCN)
SYSTCO	TRANSFER CHAN IN OPER (X4=-LOCN)
SYSTEF	TRANSFER ON END OF FILE (X4=-LOCN)
SYSTRT	TRANSFER ON REDUNDANCY (X4=-LOCN)
SYSTSL	TAPE STATUS LISTS (X2=CHANNEL, X1=UNIT)
SYSXAC	ACTIVITY CELLS (X1=CHANNEL)
SYSXDP	DISPATCHER PRIORITY CELLS (X1=CHANNEL)
SYSXSP	SYSTEM PRIORITY CELLS (X1=CHANNEL)

## BUFFERING ROUTINE ENTRY AND COMMUNICATION CELLS

SYSBFD	ENTRANCE TO THE ADD BUFFER ROUTINE
SYSBFL	ADDRESS CONTAINS THE CURRENT BUFFER LENGTH
SYSBKS	ENTRANCE TO THE LOGICAL BACKSPACE ROUTINE
SYSBLK	ENTRANCE TO THE WRITE BLOCK FLAG ROUTINE
SYSCPF	CONTAINS CURRENT PHASE FLAG
SYSDIS	ENTRANCE TO THE DISPATCH ROUTINE
SYS DPI	ENTRANCE TO THE DISPATCH INITIATE ROUTINE
SYS DRA	ENTRANCE TO THE BUFFER DRAIN ROUTINE
SYS DSK	ENTRANCE TO THE BUFFER DISCONNECT ROUTINE
SYS EMP	ENTRANCE TO THE EMPTY-START ROUTINE
SYS IBC	DECR LINKS TO FIRST INACTIVE BUFFER, ADDR = NO. IN LIST
SYS INF	ENTRANCE TO THE WRITE AN INFORMATION WORD ROUTINE
SYS LER	LOGICAL RECORD END FLAG WORD.
SYS LOD	ENTRANCE TO THE LOAD-START ROUTINE
SYS NPT	ENTRANCE TO THE BUFFERED WRITE ROUTINE
SYS PEF	PHYSICAL END OF FILE FLAG LOCATION
SYS PER	PHYSICAL END OF RECORD FLAG LOCATION
SYS PHF	CURRENT PHASE FLAG LOCATION
SYS RST	ENTRANCE TO SYSWTK RESTORE ROUTINE
SYS RTK	ENTRANCE TO BUFFERED READ A RECORD ROUTINE
SYS RWD	ENTRANCE TO BUFFERED REWIND ROUTINE
SYS SBF	LOCATION OF FIRST SYSTEM BUFFER
SYS WHT	ENTRANCE TO WRITE A WHYTE FLAG ROUTINE
SYS WTK	ENTRANCE TO BUFFERED WORD READ ROUTINE

## TRANSMISSION MACRO ENTRY CELLS

SYSTEMA	TRANSMISSION MACRO ENTRANCE	READ
SYSTEMB	TRANSMISSION MACRO ENTRANCE	STEPR
SYSTEMC	TRANSMISSION MACRO ENTRANCE	STEPF
SYSTEMD	TRANSMISSION MACRO ENTRANCE	WRITE
SYSTEME	TRANSMISSION MACRO ENTRANCE	WEOF
SYSTEMF	TRANSMISSION MACRO ENTRANCE	BACKR
SYSTEMH	TRANSMISSION MACRO ENTRANCE	BACKF
SYSTEMJ	TRANSMISSION MACRO ENTRANCE	BAKT
SYSTEMK	TRANSMISSION MACRO ENTRANCE	IN
SYSTEML	TRANSMISSION MACRO ENTRANCE	OUT
SYSTEMM	TRANSMISSION MACRO ENTRANCE	RUSH
SYSTEMN	TRANSMISSION MACRO ENTRANCE	DISP

## BUFFERING ROUTINES

THE BUFFERING ROUTINES ARE SLIGHTLY ABOVE THE LEVEL OF THE NORTH AMERICAN 'ISOS' BUFFERING ROUTINES. THE PRINCIPAL ADDITIONS WERE NA'S CODE TO ALLOW READ FOLLOWED BY WRITE ('K\$PUT') AND WRITE, BACKSPACE, AND READ ('K\$BKSPC'). IN THE PROCESS, A NUMBER OF SMALLER FIXES WERE INCORPORATED...

- (1) 'RESTOR' DID NOT RESTORE THE BUFFER COUNTER PROPERLY WHEN USED WHILE 'WOTAK' WAS IN THE MIDDLE OF AN 'INFO' BLOCK. THE FIX ALSO REQUIRED A FIX IN 'OUTED', WHICH PREVIOUSLY COPEDED WITH THIS BUG EMPIRICALLY.
- (2) 'DRAIN' WHEN ASKED TO PROVIDE A BUFFER ON CHANNEL X DID NOT DRAIN QUIET OUTPUT BUFFERS ON THE SAME CHANNEL.
- (3) 'SYSBFL' IS USED CONSISTENTLY. THIS MEANS THAT THE OBJECT PROGRAM MAY USE ANY PHYSICAL RECORD LENGTH BY PUTTING THAT LENGTH IN 'SYSBFL', DISCONNECTING ALL BUFFERS IN USE (NORMALLY, ONLY 'SYSMOT' -- SEE 'K\$DISC' BELOW) BY STORING ZERO IN 'SYSIBC', AND DOING A 'BUFAD'. THE SYSTEM WILL RESTORE ITS OWN BUFFERS WHEN IT RECOVERS CONTROL. THIS FACILITY IS USED BY 'WST'. CAUTION... IF ALL SYSTEM BUFFERS ARE NOT DISCONNECTED, THINGS CAN GO HAYWIRE IN SHORT ORDER. ALSO, SYSMOT OUTPUT MUST USE SYSTEM BUFFER SIZE -- C(SYSBFL)=256.
- (4) THE ROUTINE 'K\$DISC' WAS PULLED OUT OF 'K\$REWND' IN ORDER TO MAKE IT AVAILABLE TO OBJECT PROGRAMS. THE CALLING SEQUENCE IS...

```
TSX SYSDSK,4
PZE L(U) '
```

IT DOES NOTHING IF NO BUFFERS ARE ATTACHED TO THE UNIT. IF OUTPUT BUFFERS ARE ATTACHED, IT FORCES THEM OUT ONTO THE TAPE. IF INPUT BUFFERS ARE ATTACHED, IT SUPPRESSES DISPATCHING AND RETURNS THE BUFFERS TO THE INACTIVE BUFFER LIST ('SYSIBC') WITHOUT MOVING THE TAPE. 'DISC' MUST BE USED BEFORE MOVING A BUFFERED TAPE USING ROUTINES OTHER THAN THE BUFFERING ROUTINES.

- (5) AN ADDITION TO K\$PUT HAS SPEEDED UP OPERATION ON OUTPUT BY APPROXIMATELY 2-1. WHEN A BUFFER IS FILLED, IF THE DISPATCHER PREFERENCE CELL IS NOT IN USE, THE COMPLETED BUFFER IS DISPATCHED AND THEN WE GO TO 'TEST' TO START OUTPUT IMMEDIATELY IF THE CHANNEL IS FREE. THIS FIX HAS SPEEDED UP SOME PROGRAMS BY AS MUCH AS 4-1.

IN THE 'IB MD10' DISTRIBUTION, A FIX TO 'K\$BKSPC' WAS INCORPORATED IN ORDER TO EXERCISE THE BEGINNING OF TAPE RETURN (ERRONEOUSLY CALLED ERROR RETURN IN THE 'SOS' REFERENCE MANUAL). THIS DID NOT WORK BECAUSE THE 'BTT' TRIGGER TURNS ON

AFTER CHANNEL DISCONNECT UNLESS THE TAPE IS ACTUALLY AT LOAD POINT. THE FIX INVOLVED FOLLOWING EACH 'BSR' BY A 'RDS' AND 'BSR' IN ORDER TO ENSURE THAT THE 'BTT' WOULD BE NOTICED. WE HAVE MADE THE FIX IN ANOTHER WAY AT NO LOSS IN SPEED AND A NET REDUCTION OF SYSORG BY TWO CELLS. (THE TROUBLE WAS ACTUALLY IN K\$LOADE.)

'RETAK' EXITS WITH THE ADDRESS OF THE ACCUMULATOR SET TO THE LOCATION FOLLOWING THAT INTO WHICH THE LAST WORD OF THE RECORD WAS STORED, REGARDLESS OF THE PREFIX USED. THIS CAN BE USED TO COMPUTE RECORD LENGTH IN THE 'PZE' CASE.

IN THE USE OF 'WOTAK', NOTE THAT BLOCK, IMMOVABLE BLOCK ('IOSP'), SYMBOL, AND SEQUENCE FLAGS ALL TAKE THE BLOCK RETURN. ALL OTHER FLAGS ARE CLASSED AS 'WHYTE' FLAGS.

TWO ADDITIONAL FLAGS ARE USED IN THE SYSTEM, BUT ARE NOT NOTED IN THE 'SOS' REFERENCE MANUAL...

- (1) IOCD K,,L - TYPE FLAG. THESE FLAGS ARE DISREGARDED BY 'RETAK' (AS ARE ALL 'WHYTE' FLAGS) BUT CAUSE THE 'WHYTE' EXIT FROM 'WOTAK' TO BE USED. THEY MAY BE USED TO PROVIDE IDENTIFICATION FOR BLOCKS OF DATA OR MAY BE USED INTERPRETATIVELY IN ORDER TO TREAT DIFFERENT DATA TYPES IN DIFFERENT MANNERS.

- (2) IOCT A,,0 - TRANSFER FLAG. THIS IS USED BY 'WST' AND '\$SYS' IN ORDER TO RECORD THE TRANSFER ADDRESS FOR AN ABSOLUTE PROGRAM ON THE 'SYSTAP'.

END OF PHYSICAL TAPE HANDLING HAS BEEN PROVIDED IN THE BUFFERING ROUTINES...

1. IF PHYSICAL END OCCURS WHILE WRITING, THE SYSTEM ASKS THE OPERATOR FOR A NEW REEL AND CONTINUES.
2. IF PHYSICAL END OCCURS WHILE READING, THE SYSTEM PRESUMES THAT A MULTI-REEL FILE IS BEING PROCESSED AND ASKS FOR THE SECOND REEL.
3. THE SYSTEM KEEPS A REEL COUNT AND IF BACKSPACE OR REWIND OCCURS, ASKS FOR THE APPROPRIATE REEL.

## MISCELLANEOUS

A 'NOPAN' PROCEDURE HAS BEEN ADDED TO 'SNAP'. THE SEQUENCE...

```
NOPAN
CORE  A,B
```

WILL RESULT IN THE CORE SNAP ALONE, WITHOUT THE PANEL.

'DATA NOEDIT' WRITES 14 WORD 'BCD' AND 28 WORD BINARY RECORDS ON 'SYSMOT' RATHER THAN THE 12 AND 24 PREVIOUSLY WRITTEN. THIS IS SIGNIFICANT ONLY WHEN OFF-LINE INPUT IS USED, OF COURSE.

A SPECIAL CONSOLE TRANSFER WHICH WILL END THE INPUT PHASE (E.G., IN THE CASE OF AN INPUT TAPE WITH NO END CARD) IS TO LOCATION 11 (OCTAL) ('0\$MCR32'). SC MUST BE IN CORE AT THE TIME, AS IT WILL BE AT A JOB STOP (SWITCH 1 DOWN) OR IF THE INPUT TAPE HAS RUN AWAY WHEN SEARCHING FOR THE NEXT JOB.

MEMORY DUMPS MAY BE MADE FROM THE CONSOLE BY A TRANSFER TO LOCATION 26 (OCTAL). THE CODING AT LOCATION 26 IS...

```
ENK
STQ      ERR2
TRA      ERR1
```

THE ROUTINE AT ERR1 CALLS SNAP IF NECESSARY (CLOBBERING LOCATIONS 5000 TO 6000 DECIMAL) AND TAKES A DUMP FROM THE KEY SPECS... ADDRESS = FIRST LOCATION, DECREMENT = LAST LOCATION. THE BUFFERING ROUTINES ARE USED SO THAT THE DUMP IS ONLY USEFUL WHEN THE SYSTEM IS UNCLUBBERED.

ALTHOUGH SYSTEM TAPE ASSIGNMENTS MAY BE CHANGED BY INITIATION DECK ASSIGNMENTS TO SUIT THE INSTALLATION, THE STANDARD ASSIGNMENTS ARE...

TAPE	ASSIGNED	PHASE
SYSTAP	B1	1,2,3
SYSMIT	A3 (PHASE 1)	1,2,3
SYSMOT	B3 (PHASE 1)	1,2,3
SYSPOT	A1	1,2,3
SYSPIT	A2	1
SYSPPT	B2	1,2,3 (NOT REQUIRED IF = SYSPOT)
SYSES1	A4	1
SYSES2	B4	1

'SYSDOT' IS PERMANENTLY DISASSIGNED. DEBUGGING OUTPUT IS ON 'SYSPOT'.

A CHRONOLOG CLOCK IS USED FOR ACCOUNTING. IT IS READ BY THE 'CLK' ROUTINE THROUGH THE ECHO ENTRY HUBS ON THE PRINTER. THE BOARD IS PROVIDED WITH A SPECIAL DECODE MATRIX SO THAT THE



TIME READ IS IN 'BCD' FORM WITH TWO DIGITS EACH FOR HOURS, MINUTES, AND SECONDS. (A SET OF PRINTS FOR THIS MATRIX IS AVAILABLE FROM RAND ON REQUEST.)

THE MONITOR HAS BEEN FIXED TO ALLOW MULTIPLE USE OF PROCESSORS WITHIN THE SAME JOB. NOT ONLY MAY THE SAME PROCESSOR BE USED TO PRODUCE MULTIPLE CORE LOADS, BUT DIFFERENT PROCESSORS MAY BE USED ON DIFFERENT PARTS OF THE SAME PROBLEM. THE ACTUAL EXECUTION MAY OCCUR IN MORE THAN ONE PHASE. IN THIS CASE, CODE FOR A LATER PHASE MUST BE ON SYSPIT BEFORE CODE FOR AN EARLIER PHASE, IF SYSMIT AND SYSMOT ARE USED FOR COMMUNICATION BETWEEN CORE LOADS. THE DATA CARD FOR DATA USED BY CODES EXECUTED IN PHASE 1 MUST APPEAR BEFORE THE CORRESPONDING LOAD CARD APPEARS, AND A UTILITY OR RESERVED TAPE MUST BE USED FOR THE DATA OUTPUT FROM DATA.

AS A SPECIAL CASE, A CONVENIENCE ESPECIALLY FOR LARGE PROGRAMS AND/OR SYSTEM MAINTAINERS, MODIFY AND LOAD WILL WRITE ABSOLUTE OUTPUT ON UNIT A5 IF ALL CONSOLE KEYS ARE DOWN AT THE TIME ABSOLUTE IS TO BE WRITTEN (M5 IN CORE).

M8

THE LISTER FOR MODIFY AND LOAD HAS BEEN MODIFIED IN SUCH A WAY THAT EITHER SYMBOLIC OR 'CRUNCH' DECKS MAY BE PUNCHED INSTEAD OF LISTING. THE DICTIONARY MAY BE PREPROCESSED INTO A REGULARIZED FORM. APPENDIX B IS A WRITE-UP OF THIS PROGRAM.

M8 REQUESTS 'SYSTAP' MOVEMENT TOWARD SC AND ENTERS 'TEST' TO CARRY THIS OUT. THUS 'SYSTAP' MOVES TOWARD SC AT THE SAME TIME AS THE LISTING IS PRODUCED.

M8 COMMUNICATES WITH 'SYSBAD'-- HOWEVER UNRECOVERABLE REDUNDANCIES ON 'SYSPOT' ARE IGNORED.

## INPUT EDITOR

INSTALLATION CLASS CODE 1 HAS BEEN ADDED TO THE INPUT EDITOR. ANY CARD WITH A '1' IN COLUMN ONE IN A 'DATA EDIT' PACKAGE WILL BE PROCESSED AS IF THE FORMAT  
 FORMAT 1,A79  
 HAD APPEARED AND AN 'ENDRCD' CARD FOLLOWED EACH DATA CARD.

NOTE THAT IF THE INPUT IS ON-LINE, THE LAST EIGHT CHARACTERS WILL BE BLANK.

FORMATS S TO Z ARE OPERATIVE. THAT IS, THEY MAY BE USED AS FORMAT NAMES IN DATA PACKAGES.

'R' IS A LEGITIMATE FORMAT STATEMENT CODE. IT CAUSES A RECORD MARK TO BE WRITTEN ON THE MEDIARY TAPE WHEN DATA IS BEING CONVERTED, JUST AS IF AN 'ENDRCD' CARD HAD OCCURRED. THUS, A SINGLE CARD MAY BE BROKEN INTO SEVERAL LOGICAL RECORDS OR SEVERAL CARDS MAY BE INCLUDED IN A LOGICAL RECORD, DEPENDING ON THE WAYS R'S ARE INSERTED INTO THE FORMAT STATEMENT.

## OUTPUT EDITOR

PRINTING OF LINES UP TO 132 CHARACTERS IN LENGTH IS ALLOWED. 'XPRINT'S SPECIFYING CONVERSION OF UP TO 132 DATA WORDS FOR A SINGLE LINE OF PRINT IS ALLOWED. A TEST IS MADE FOR ATTEMPT TO PRINT FROM MORE THAN 132 DATA WORDS PER LINE, AND THE ADDITIONAL WORDS ARE IGNORED.

END-OF-TAPE IS RECOGNIZED ON 'SYSPOT' AND A REQUEST FOR REPLACEMENT IS MADE.

INSTALLATION CLASS CODE 1 HAS BEEN ADDED. IT OPERATES AS IF THE FORMAT  
 FORMAT 1,A132

HAD APPEARED IN THE DECK. NO CARRIAGE CONTROL IS INSERTED.  
 'FORTRAN' OBJECT PROGRAM OUTPUT USES THIS MECHANISM FOR PRINTING.

## SCAT

THE 'LIB' AND 'LBR' PSEUDO-OPERATIONS IN SCAT HAVE BEEN ENABLED. A DESCRIPTION OF THIS IS GIVEN IN THE IBM SOS MANUAL. THIS DESCRIPTION IS DEFICIENT IN THAT THE 'LBR' CARD MAY HAVE A THIRD FIELD IN ORDER TO SPECIFY USE OF THE 'LBR' FILE ON A RESERVED OR UTILITY TAPE THUS...

LBR X004,U,SYSAR1

SOME DECKS MAY NOT BE RELATIVIZED BY 'LBR' (FAILURE OF THIS IS ALWAYS NOTED IN THE COMPILER ERROR LIST). ROUGHLY SPEAKING, FAILURE OCCURS WHEN 'SCAT' WOULD HAVE TO USE THE RATHER COMPLEX LOCATION ASSIGNMENT PROCEDURE OF MODIFY AND LOAD IN ORDER TO COMPUTE RELATIVE NUMBERS. THE MAJOR CASES IN WHICH RELATIVIZATION FAILURE WILL OCCUR ARE...

1. 'BSS' OR 'BES' WHOSE VARIABLE FIELD CONTAINS A SYMBOL WHICH IS UNDEFINED OR NOT DEFINED BY 'SYN', 'EQU', OR 'BOOL'.
2. OCCURRENCE OF 'ORG' OR 'TCD'.

'LBR' TAPES MAY BE WRITTEN USING WST. A SAMPLE CONTROL CARD SETUP FOR DOING THIS IS...

JOB	2091,LBRFIL,GHM450,0,0,3,P
ASSIGN	A5=SYSAR1
WST	,SYSAR1
FILE	LBR,1,CARDS
CODE	LBR,1
ITEM	X004
SQUOZE DECK	
ITEM	X014
SQUOZE DECK	
ITEM	X021
SQUOZE DECK	
LAST	
SCAT	
* TEST LBR FILE	
X004 LIB	(ALWAYS FROM SYSLBR)
SPCF LBR	X014, SYSAR1
LBR	X021 (FROM SYSLBR)
END	
BLANK	CARD

PROGRAMMERS CAN USE THE ABOVE MECHANISM FOR BUILDING AND MAINTAINING THEIR OWN LIBRARIES. NOTE THAT THE FILE NAME MUST BE 'LBR'.

SYSLBR IS SYSTAP UNLESS AN ASSIGN CARD FOR SYSLBR HAS BEEN INSERTED IN THE INITIATION DECK.

## CURRENT IBM SOS SYSTEM RESTRICTIONS, IMPROVEMENTS, AND COMMENTARY

## GENERAL

1. A PROGRAM MAY NOT ORIGIN AT 0.
2. LITERALS ARE NOT AVAILABLE.
3. ON A SCAT CARD, IF THE 'NOSQZ' OPTION IS SELECTED, THE ONLY ALLOWABLE OPTION COMBINATION PERMITTED IS 'NOSQZ,NOLIST'. ON A 'LOAD' CARD, THE 'SQZ,B,ABS' COMBINATION WILL NOT WORK.
4. PROGRAMMER MACROS DEFINED AT ML TIME MUST BE PLACED IN THE MOD PACKET PRIOR TO ALTERS OR CHANGES WHICH USE THE MACRO.
5. MACRO DEFINITIONS ARE NOT LISTED.

## COMPILER (SCAT)

1. IF MACROS APPEAR WITHIN PROGRAMMER MACROS, THE ELEMENTS IN THE VARIABLE FIELD OF THE INCLUDED MACROS WILL BE PREFIXED BY A PLUS SIGN, AND MAY CAUSE TROUBLE.
2. PRINCIPAL PSEUDO-OPS CANNOT OCCUR WITHIN THE RANGE OF A DUP.
3. IT IS RECOMMENDED THAT ANY USE OF 'SQZ' SHOULD BE PRECEDED BY A 'HEAD (BLANK)' AND FOLLOWED BY A 'HEAD X' WHERE X IS THE PREVAILING HEAD CHARACTER.
4. SOME DECKS, WHEN IMBEDDED BY AN 'SQZ' OP, MAY CAUSE A DISASTER DURING THE COMPILATION- SUCH AS A LOOP IN M4 OR SEVERAL UNDEFINED SYMBOLS. THIS CAN USUALLY BE CURED BY DELETING AND RE-INSERTING THE END CARD OF THE DECK TO BE IMBEDDED BY 'SQZ' OPERATION. THE COMPILER ASSUMES THAT THE FOOTNOTE FOR THE END CARD IS THE LAST FOOTNOTE. THIS WILL BE TRUE IF THE SQUOZE DECK RESULTS FROM A 'SCAT' RUN BUT WILL NOT, IN GENERAL, BE TRUE IF THE SQUOZE DECK RESULTED FROM A PUNCH NO SQUOZE RUN. THE REASON FOR THIS IS THAT MODIFY AND LOAD APPENDS FOOTNOTES RESULTING FROM SYMBOLIC MODIFICATIONS TO THE OLD FOOTNOTES. THE 'LBR' PSEUDO-OPERATION OF 'SCAT' IS UNAFFECTED BY THIS PECULIARITY OF MODIFY AND LOAD.
5. NO SUBFIELD OF A 'DEC' NOR SECOND SUBFIELD OF A 'BCI' NOR HOLLERITH SUBFIELD OF A 'VFD' MAY EXCEED SIX CHARACTERS IN LENGTH IN A PROGRAMMER MACRO DEFINITION.
6. 'DUP' WITH AN ILLEGAL FIELD HAS THAT FIELD REPLACED BY '1,2'.
7. 'SCAT' IMBEDDED SQUOZE DECKS WITH DICTIONARIES TOO LARGE CAUSE JOB TO BE ABANDONED WITH AN APPROPRIATE ERROR MESSAGE.

(SIZE MUST BE LESS THAN 1/4 TOTAL AREA AVAILABLE FOR CP'S DICTIONARY STORAGE -- I.E., 5600/4.)

## MODIFY AND LOAD

1. ANY INSERTION WHICH IS ATTEMPTED IN THE MIDDLE OR AT THE END OF A BLOCK OF REMARKS CARDS OR LISTING PSEUDO-OPS WILL ALWAYS BE INSERTED BEFORE THE BLOCK, EXCEPT IN THE CASE OF INITIAL COMMENTARY--IN WHICH CASE THE INSERTIONS WILL COME AT THE END OF THE BLOCK.
2. LOADING MULTIPLE SQUOZE DECKS IS NOT AVAILABLE.
3. NO PROGRAMMER MACRO MAY CONTAIN AN OPERATION OF THE FORM 'OP A\$B' WHERE A IS A MACRO PARAMETER MORE THAN ONE CHARACTER IN LENGTH.
4. INDIRECTLY ADDRESSED I/O COMMANDS MAY NOT BE INSERTED. IT IS NECESSARY TO USE A 4 IN THE TAG TO GET AROUND THIS.
5. THE 'TAPE' MACRO WITH -0 COUNT DOES NOT WORK IN A MODIFICATION.
6. PRINCIPAL PSEUDO-OPS, REMARKS CARDS, AND LISTING PSEUDO-OPS MAY BE INSERTED BY A 'CHANGE'.
7. 'EXEMPT' MAY BE INSERTED AT MODIFY AND LOAD TIME. IT MAY CONTAIN ONLY ONE SYMBOL IN ITS VARIABLE FIELD.
8. TWELVE CHARACTER SYMBOLS CAN BE INSERTED IN THE HOLLERITH SUBFIELDS OF A 'VFD', IN A BCI, AND IN A 'DEC' WITHIN A MACRO.
9. TROUBLES CAUSED BY CONSECUTIVE MULTIPLY-DEFINED SYMBOLS HAVE BEEN CORRECTED.
10. IN AN 'ETC' FOLLOWING A 'VFD', THE SLASH (/) IS HANDLED CORRECTLY.
11. SYMBOLS MAY BE DEFINED AT LOCATION ZERO.
12. A 'HEAD' CHANGE IS NOT PERMITTED IN THE SAME MOD PACKAGE AS AN 'EXEMPT'.
13. ALL SYMBOLS TO BE 'EXEMPT' MUST BE WELL-DEFINED.
14. THE VARIABLE FIELD OF PRINCIPAL PSEUDO-OPS MAY CONTAIN A CONSTANT C WHERE C IS GREATER THAN 2E12 AND LESS THAN 2E18-1.
15. G AND H CHANNEL OPERATION INCLUDING SELECTS, 'RDCX', 'SDNX', 'RUNX', 'TQO' AND ALL EXTENDED-RANGE OPERATIONS CAN BE INSERTED.
16. 'HEAD .' IS TREATED AS ILLEGAL AND AN ERROR MESSAGE PRODUCED.
17. AN ERRONEOUS 'HEAD' CARD IS HANDLED PROPERLY.

18. COMMENTS ON 'EJECT', 'SPACE' AND 'DETAIL' ARE IGNORED WHEN THERE IS NO VARIABLE FIELD.
19. UNDEFINED OPERATIONS ARE ENCODED ///, NOT DISCARDED. THE ABSOLUTE CODE IS 'STR'.
20. ANY INSTRUCTION IN A PROGRAMMER MACRO, INCLUDING THE FIRST, MAY HAVE A PARAMETRIC LOCATION SYMBOL.
21. ANY MACRO AND ALSO THE OPERATION 'MACRO' MAY HAVE A VARIABLE FIELD WHICH EXTENDS TO COLUMN 72.
22. THE LISTING OF MODS WILL PRINT COLUMNS 73-84.
23. THE FOLLOWING-
  - 1) ERASE
  - 2) ERASE N,M
  - 3) ERASE MACRO
  - 4) ERASE QAA
  - 5) ERASE QAA,QBB,...,QZZ
  - 6) ERASE N

OPERATE CORRECTLY WHERE QAA, QBB, ETC. ARE PARTICULAR MACROS AND M AND N ARE INTEGERS. SIX ABOVE IS EQUIVALENT TO 'ERASE N,N'. IN THE CASE OF (4) AND (5), AN ERROR MESSAGE WILL PRINT IF ANY SUBFIELD IS NOT THE NAME OF A MACRO IN THE 'MACRO NAME TABLE.' ANALYSIS IS TERMINATED UPON DETECTING THE FIRST ERROR. CASES (3), (4), AND (5) AFFECT THE SIZE OF THE 'MACRO NAME TABLE' AND 'MACRO SKELETON TABLE' BUT DO NOT AFFECT THE LISTING OF TEXT. OPERATION IN CASE (1) WHERE THE INPUT DECK HAS MACROS AND 'ERASE' MACROS HAS BEEN IMPROVED.
24. COMMENTS MAY BE INDENTED. THE COLUMN OF THE ORIGIN OF THE COMMENT, ON THE FIRST INSTRUCTION HAVING A COMMENT, IS SAVED. THE COLUMN OF THE ORIGIN OF THE COMMENT FOR EVERY OTHER CARD IN THE MOD PACKET, NOT MERELY FOR THE SAME ALTER OR CHANGE SUBPACKET, IS COMPARED WITH THAT OF THE FIRST CARD TO DETERMINE WHETHER INDENTATION SHOULD BE SIGNALLED.
25. THE ERROR MESSAGE 'ORIGIN IN MONITOR' IS PRINTED ONLY ONCE, EVEN IF MANY LOW ORIGINS OCCUR.
26. THE PSEUDO OPERATION 'SYMBOL' IS OPERATIVE.
27. VOID INSERTIONS WILL NOT CAUSE A JOB TO BE ABANDONED.
28. THE ERROR MESSAGE 'MODIFY AND LOAD ERROR TABLE OVERFLOWED' IS PRINTED IN THE EVENT THAT THE 100 ERROR CAPACITY OF THE ERROR TABLE HAS BEEN MET OR EXCEEDED.

29. 'HEAD' CHANGES MAY NOW BE MADE WITHOUT REQUESTING THAT NEW SQUOZE BE PUNCHED.
30. IF A 'LOAD' CARD REQUESTS THE SQZ OPTION EVEN THOUGH NO MODIFICATIONS ARE INCLUDED, AN ERROR MESSAGE WILL BE PRINTED AND THE JOB WILL BE RUN AS IF 'NOSQZ' HAD BEEN SPECIFIED.
31. 'VFD' WITH A BLANK VARIABLE FIELD WILL BE DISCARDED AND AN ERROR MESSAGE PRINTED.
32. 'VFD' MAY BE FOLLOWED BY ONE, OR MORE, 'ETC' CARDS. THERE IS NO LIMIT ON THE NUMBER OF 'ETC' CARDS. THE MONITOR WILL CONTINUE TO SEARCH FOR THEM PROVIDED EACH CARD, WHETHER 'VFD' OR 'ETC', IS TERMINATED BY A COMMA.
33. AN 'ETC' FOLLOWING A MACRO IS PROPERLY HANDLED EVEN IF IN ERROR.
34. THE 'ASSIGN' PSEUDO-OP IS FULLY OPERATIONAL.
35. IF A MODIFICATION RESULTS IN NO INSERTION OR DELETION, AN ERROR MESSAGE WILL BE PRINTED.
36. HEADED CONSTANTS ARE NOW CORRECTLY HANDLED.
37. EXTENSIVE INITIAL COMMENTARY CAN NOW BE PROCESSED WHEN A NEW DECK IS PUNCHED.
38. 'NOSQZ' COMBINED WITH 'LIST' IS A PERMISSIBLE OPTION ON A 'LOAD' CARD USED WITH A SQUOZE DECK CONTAINING MODIFICATIONS.
39. ALL, OR PORTIONS OF, INITIAL COMMENTARY CAN NOW BE ERASED.

## DEBUGGING

1. IN THE 'TAPE' MACRO A -O AS WORD OR RECORD COUNT PARAMETER APPEARS IN THE LISTING AS (-16384) (10).
2. THE 'DRUM', 'ON', 'OFF', 'TRAP', AND 'UNTRAP' MACROS HAVE BEEN REMOVED FROM THE DEBUGGING SYSTEM. USE OF THESE MACROS WILL CAUSE AN IMMEDIATE RETURN.
3. ON-LINE OUTPUT OF 'SNAP' INFORMATION WITH SYMBOLS IS POSSIBLE.

## TRANSMISSION MACROS

1. THE MODIFICATIONS, RECOMMENDED BY THE SOS COMMITTEE, TO 'TRMAC BACKF' HAVE BEEN INCORPORATED. 'BACKF 0' IS MEANINGFUL AND LEAVES THE READ-HEAD POSITIONED IN FRONT OF THE FIRST RECORD OF THE FILE IN WHICH THE READ-HEAD WAS POSITIONED. IN CASE IT WAS POSITIONED IN FRONT OF THE FIRST RECORD OF THE FILE, IT REMAINS THERE.  
IN GENERAL, 'BACKF Y,T,N' MOVES THE TAPE TOWARD THE LOAD POINT OVER N+1 END-OF-FILE MARKS AND LEAVES THE TAPE POSITIONED TO READ THE FIRST RECORD OF THE NTH FILE PRECEDING

THE FILE IN WHICH THE READ-HEAD WAS POSITIONED.

2. THE OPERATIONAL TRANSMISSION MACROS MAKE THEIR ERROR RETURNS WITH THE COMPLEMENT OF THE LOCATION OF THE MACRO IN THE ADDRESS FIELD OF THE AC.
3. THE TRANSMISSION MACROS USE THE 'BADSPOT' ROUTINE PROPERLY. IF RECOVERY IS NOT POSSIBLE, THE ERROR BITS ASSOCIATED WITH THE 'IN' AND 'OUT' MACROS WILL INDICATE OPERATION COMPLETED BUT UNSUCCESSFUL.

#### INPUT EDITOR

1. 'ENDATA' AND 'ENDGRP' CONTROL CARDS FORCE AN 'ENDRCD' FLAG IF THE 'ENDRCD' CARD IS OMITTED.

#### INTRAN

1. USAGE OF THE 'SYSIT1' ERROR RETURN OPTION WILL NO LONGER BE RUINED BY PICKING UP A NEGATIVE ADDRESS FROM 'SYSIT1'.
2. SOME REMOTE CODES OF FAULTY 'IINT' CONVERSION HAVE BEEN CORRECTED.
3. AN ERROR RETURN HAS BEEN PROVIDED IN THE EVENT THAT AN 'ISCRIB' IS GIVEN WHICH REFERS TO AN UNASSIGNED UNIT. RETURN WILL BE TO 'IREDUN' WITH THE MQ = 3.
4. 'IFLOAT' GIVES AN 'ISPILL' RETURN, I.E., MQ = 2, IF A LEADING DECIMAL POINT IS FOLLOWED BY 12 OR MORE CHARACTERS (ZEROS INCLUDED).

#### OUTPUT EDITOR

1. CERTAIN COMBINATIONS OF N AND K (F4.1, F5.1, F6.1) IN 'FORMAT' STATEMENTS FORMERLY RESULTED IN A LOSS OF CHARACTER FOLLOWING THE DECIMAL POINT. MODIFICATION HAVE BEEN MADE TO THE 'OFLFIX' MACRO TO CORRECT THIS CONDITION.
2. EIGHTY COLUMNS CAN NOW BE PUNCHED CORRECTLY OFF-LINE.
3. THE INTERROGATION OF COUNTER VALUES BY 'XHEAD' OR 'XFOOT' FORMERLY PROVIDED INCORRECT VALUES. THIS CONVERSION HAS NOW BEEN CORRECTED.

#### OUTRAN

1. OUTRAN COMPLETELY RESETS THE 'OMASK' MACRO.
2. ERRORS IN 'OINT' CONVERSION HAVE BEEN CORRECTED.



3. THE 'OMASK' MACRO WORKS EVEN IF THE VALUE OF C IS GREATER THAN 36.
4. THE 'OREDUN MACRO WORKS EVEN IF IT IS PRECEDED BY THE 'OTPEND' MACRO.
5. RECOVERY FROM AN 'EOT' CONDITION DOES NOT DESTROY THE FIRST CHARACTER OF THE PRINT IMAGE.
6. AN 'OFLFIX' WITH A K FIELD OF SEVEN OR GREATER DOES NOT GIVE SUPERFLUOUS DECIMAL POINTS.
7. 'OFIX' WITH PARAMETERS  $N + K = 5$  CONVERTS A NORMAL ZERO TO 0 (OR -0) WITH LEADING BLANKS.
8. 'OCTAL' WITH PARAMETER  $N = 13$  CONVERTS A ZERO TO A SIGN AND TWELVE ZEROS.
9. TWO FORMERLY ILLEGAL CHARACTERS ARE HANDLED IN ORDER THAT OUTRAN MAY PREPARE INPUT CARDS FOR OTHER IBM MACHINES, E.G., THE 1620. THEY ARE-

	STORAGE	PUNCHES
RECORD MARK	72)8	0,2,8
END-OF-LINE MARK	37)8	12,5,8

EXCCRD	ABS	IN CORE SECTION OF MONITOR
MISC.	MULTI	
. . . MISC.	ABS	INTRODUCTORY REQUEST PROCESSOR
. . . DECK	ABS	INITIATION DECK
. . . F-SI/O	REL	SOS-FORTRAN I/O AND MATH LIBRARY
. . . INIT	JOB	PROGRAM TO LIST INITIATION DECK
. . . LIST	JOB	PROGRAM TO LIST CONTENTS OF SYSTAP
. . . 1401P	JOB	PROGRAM TO PUNCH 1401 PERIPHERAL PROGRAM
. . . MANUAL	JOB	PROGRAM TO LIST MANUAL
IPL	JOB	PROGRAM TO PRODUCE SQZ DECK AND LISTING OF IPL
WST	ABS	SYSTEM TAPE WRITER AND SYSPIT EDITOR
PEST1	ABS	1401 ASSEMBLER
PEST2	ABS	1401 ASSEMBLER
FAP	MULTI	BEFAP ASSEMBLER
. . . PASS0		COMMUNICATION
. . . PASS1		PASS 1
. . . PASS2		PASS 2 AND PUNCH BINARY
FNDIAG	ABS	FORTRAN DIAGNOSTIC FILE
ERRFL	ABS	MONITOR ERROR FILE
SC	ABS	BETWEEN JOB MONITOR
FORTRN	MULTI	FORTRAN TRANSLATOR
. . . RC05.0	ABS	FORTRAN TRANSLATOR - COMMUNICATION AND COMPILED CONTROLLER
. . . RC10.0	ABS	FORTRAN TRANSLATOR - SEC ONE, PASS 1
. . . RC11.0	ABS	FORTRAN TRANSLATOR - SEC ONE, PASS 2
. . . RC13.0	ABS	FORTRAN TRANSLATOR - SEC ONE PRIME
. . . RC14.0	ABS	FORTRAN TRANSLATOR - SEC ONE DOUBLE PRIME
. . . RC14.1	ABS	FORTRAN TRANSLATOR - SEC ONE DOUBLE PRIME DIAGNOSTICS
. . . RC15.0	ABS	FORTRAN TRANSLATOR - SEC TWO, BLOCK 1
. . . RC16.0	ABS	FORTRAN TRANSLATOR - SEC TWO, BLOCK 2
. . . RC17.0	ABS	FORTRAN TRANSLATOR - SEC TWO, BLOCK 3A
. . . RC18.0	ABS	FORTRAN TRANSLATOR - SEC TWO, BLOCK 3B
. . . RC19.0	ABS	FORTRAN TRANSLATOR - SEC TWO, BLOCK 4
. . . RC20.0	ABS	FORTRAN TRANSLATOR - SEC TWO, BLOCK 5
. . . RC21.0	ABS	FORTRAN TRANSLATOR - SEC TWO, BLOCK 6
. . . RC22.0	ABS	FORTRAN TRANSLATOR - SEC THREE, BLOCK 1A
. . . RC23.0	ABS	FORTRAN TRANSLATOR - SEC THREE, BLOCK 1B
. . . RC24.0	ABS	FORTRAN TRANSLATOR - SEC THREE, BLOCK 2
. . . RC25.0	ABS	FORTRAN TRANSLATOR - SEC THREE, BLOCK 3
. . . RC26.0	ABS	FORTRAN TRANSLATOR - SEC FOUR, PART 1
. . . RC27.0	ABS	FORTRAN TRANSLATOR - SEC FOUR, PART 2
. . . RC28.0	ABS	FORTRAN TRANSLATOR - SEC FOUR, PART 3
. . . RC29.0	ABS	FORTRAN TRANSLATOR - SEC FIVE, PART 1
. . . RC30.0	ABS	FORTRAN TRANSLATOR - SEC FIVE, PART 2
. . . RC31.0	ABS	FORTRAN TRANSLATOR - SEC FIVE, PART 3
. . . RC32.0	ABS	FORTRAN TRANSLATOR - SEC FIVE, PART 4
. . . RC33.0	ABS	FORTRAN TRANSLATOR - SEC SIX, PASS 1
. . . RC34.0	ABS	FORTRAN TRANSLATOR - SEC SIX, PASS 2
SCAT1	ABS	SCAT COMPILER, PASS 1
LBR	SQZ	SQUOZE LIBRARY
SCAT2	ABS	SCAT COMPILER, PASS 2
ERRFL	ABS	MONITOR ERROR FILE
SC	ABS	(SUPERVISORY CONTROL)
SNAP	ABS	DEBUGGING SUPERVISOR
SYSXYZ	ABS	SYSTEM SYMBOL TABLE

LG	ABS	MODIFY AND LOAD SUPERVISOR
MO	ABS	MODIFY AND LOAD - PROCESS SYMBOLIC CARDS
M3	ABS	MODIFY AND LOAD - MERGE MODIFICATIONS
M4	ABS	MODIFY AND LOAD - ASSIGN DICTIONARY
M5	ABS	MODIFY AND LOAD - ASSIGN TEXT
M6	ABS	MODIFY AND LOAD - ERROR ROUTINE
IPL	MULTI	
. . . IPL5	ABS	INFORMATION PROCESSING LANGUAGE - V
. . . CMP1.3	ABS	IPL SOURCE TO SCAT SYMBOLIC COMPILER
M9	ABS	MODIFY AND LOAD - CATASTROPHIC ERROR ROUTINE
M8	ABS	MODIFY AND LOAD - ASSEMBLY LISTER
INTRAN	ABS	DATA INPUT MACROS
INED	ABS	DATA INPUT PROCESSING CODE GENERATOR
SNPTRN	ABS	DEBUGGING OUTPUT TRANSLATOR
OUTRAN	ABS	DATA OUTPUT MACROS
OUTED	ABS	DATA OUTPUT PROCESSING CODE GENERATOR
M7.1	ABS	MODIFY AND LOAD - PUNCH NEW SQUOZE
M7.2	ABS	MODIFY AND LOAD - PUNCH NEW SQUOZE
M7.3	ABS	MODIFY AND LOAD - PUNCH NEW SQUOZE
M7.4	ABS	MODIFY AND LOAD - PUNCH NEW SQUOZE
M7.5	ABS	MODIFY AND LOAD - PUNCH NEW SQUOZE
TRMAC	ABS	TRANSMISSION MACROS
TRACE	ABS	7094 TRACE ROUTINE

## CRUNCH

## FILE OF PROGRAMS AND MOD PACKAGES IN CRUNCH SYMBOLIC FORM

. . . FAPMOD	RAND MOD PACKAGE FOR BEFAP
. . . MANUAL	THIS MANUAL
. . . 1401P	OPERATING 1401 PERIPHERAL PROGRAM
. . . 1401S	SPS SYMBOLIC FOR ABOVE
. . . S1	RAND MOD PACKAGES FOR FORTRAN - SEC 1
. . . S1P	RAND MOD PACKAGES FOR FORTRAN - SEC 1 PRIME
. . . S1PP	RAND MOD PACKAGES FOR FORTRAN - SEC 1 DOUBLE PRIME
. . . S2BK1	RAND MOD PACKAGES FOR FORTRAN - SEC 2, BLOCK 1
. . . S2BK2	RAND MOD PACKAGES FOR FORTRAN - SEC 2, BLOCK 2
. . . S2BK3	RAND MOD PACKAGES FOR FORTRAN - SEC 2, BLOCK 3
. . . S2BK4	RAND MOD PACKAGES FOR FORTRAN - SEC 2, BLOCK 4
. . . S2BK5	RAND MOD PACKAGES FOR FORTRAN - SEC 2, BLOCK 5
. . . S2BK6	RAND MOD PACKAGES FOR FORTRAN - SEC 2, BLOCK 6
. . . S3BK1	RAND MOD PACKAGES FOR FORTRAN - SEC 3, BLOCK 1
. . . S3BK2	RAND MOD PACKAGES FOR FORTRAN - SEC 3, BLOCK 2
. . . S3BK3	RAND MOD PACKAGES FOR FORTRAN - SEC 3, BLOCK 3
. . . S4	RAND MOD PACKAGES FOR FORTRAN - SEC 4
. . . S5	RAND MOD PACKAGES FOR FORTRAN - SEC 5
. . . S6	RAND MOD PACKAGES FOR FORTRAN - SEC 6
. . . GIOP	RAND MOD PACKAGES FOR FORTRAN - GENERAL I/O PKG. (FOR SEC 6 ONLY)
. . . FPTM	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . 9XP1	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . XP3S	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . 9ATN	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . XPFS	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . LOGS	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . 9SCN	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . SQRS	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY

. . . 9TNH	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . KICK	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . IOMD	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . ERRM	SYMBOLIC DECK FOR SOS-FURTRAN LIBRARY
. . . IOHN	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . 9XLO	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . FULL	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . BOBK	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . MDMP	SYMBOLIC DECK FOR SOS-FORTRAN LIBRARY
. . . IPLCMP	IPL SYMBOLIC FOR THE IPL COMPILER
. . . J139	SYMBOLIC DECK FOR IPL COUNT LIST PRIMITIVE
. . . RSBSL1	SYMBOLIC DECK FOR ONE CARD SYSTAP LOADER
. . . RSCVT1	SYMBOLIC - RS EDT 1 TO RSWST TAPE CONVERTER
. . . RSCVT2	FORTRAN BINARY TO MD BUFFERED TAPE CONVERTER
. . . BEFAP	BASE BEFAP
. . . SNPTRN	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . OUTRAN	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . INTRAN	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . OUTED2	RAND AND IB MODS FOR MD8 LEVEL SQUOZE
. . . INED	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . SCAT1	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . SCAT2	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . M1	RAND AND IB MODS FOR MD8 LEVEL SQUOZE
. . . MOB	RAND AND IB MODS, SECOND LEVEL
. . . M3/D	RAND AND IB MODS FOR MD11 LEVEL SQUOZE
. . . M4	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . M5	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . M6	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . M7/D	RAND AND IB MODS FOR MD11 LEVEL SQUOZE
. . . M8	RAND AND IB MODS FOR MD8 LEVEL SQZ
. . . M8PCH	RAND SECOND LEVEL MODS FOR PUNCH SYMBOLIC
. . . TRACE	RAND MODS TO BASE 7094 TRACE
. . . MD12B	RAND MONITOR MODS MD10F TO MD12B
. . . M9	RAND AND IB MODS FOR MD8 LEVEL SQZ

SQUOZE

SQZ FILE CONSISTING OF SQUOZE DECKS

. . . MISC.	INTRODUCTORY REQUEST PROCESSOR
. . . INIT	INITIATION DECK LISTER
. . . LIST	SYSTAP LISTER
. . . S1	BASE SQUOZE FOR FORTRAN - SEC 1
. . . S1P	BASE SQUOZE FOR FORTRAN - SEC 1 PRIME
. . . S1PP	BASE SQUOZE FOR FORTRAN - SEC 1 DOUBLE PRIME
. . . S2BK1	BASE SQUOZE FOR FORTRAN - SEC 2, BLOCK 1
. . . S2BK2	BASE SQUOZE FOR FORTRAN - SEC 2, BLOCK 2
. . . S2BK3	BASE SQUOZE FOR FORTRAN - SEC 2, BLOCK 3
. . . S2BK4	BASE SQUOZE FOR FORTRAN - SEC 2, BLOCK 4
. . . S2BK5	BASE SQUOZE FOR FORTRAN - SEC 2, BLOCK 5
. . . S2BK6	BASE SQUOZE FOR FORTRAN - SEC 2, BLOCK 6
. . . S3BK1	BASE SQUOZE FOR FORTRAN - SEC 3, BLOCK 1
. . . S3BK2	BASE SQUOZE FOR FORTRAN - SEC 3, BLOCK 2
. . . S3BK3	BASE SQUOZE FOR FORTRAN - SEC 3, BLOCK 3
. . . S4	BASE SQUOZE FOR FORTRAN - SEC 4
. . . S5	BASE SQUOZE FOR FORTRAN - SEC 5
. . . S6	BASE SQUOZE FOR FORTRAN - SEC 6

. . . GIOP	BASE SQUOZE FOR FORTRAN - GENERAL I/O PKG. (FOR SEC 6 ONLY)
. . . FNCOM	FORTRAN SUPERVISOR
. . . GDIAG	FORTRAN GENERAL DIAGNOSIC BASE
. . . RPEST1	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . RPEST2	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . IPL5	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . CMP1.3	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . WSTJ4	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . SNP.RA	SECOND LEVEL SQUOZE
. . . SNP\$DA	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . INT.\$B	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . OUT\$BA	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . OED\$BB	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . IED.RB	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M1\$A.B	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M0\$C.B	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M3/D.A	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M4\$A.A	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M5\$A.A	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M6/D.B	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M7/D.A	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M9/D.A	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M8\$BRC	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . M8\$A	SECOND LEVEL SQUOZE
. . . C1\$A.B	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . C2\$A.B	SQUOZE DECK FOR OPERATING FILES ON TAPE
. . . MD..A	MD8 SECOND LEVEL SQUOZE
. . . TRACE	BASE LEVEL SQUOZE
. . . TRACEA	SQUOZE FOR OPERATING FILE
. . . SNPTRN	MD8 LEVEL BASE SQZ
. . . OUTRAN	MD8 LEVEL BASE SQUOZE
. . . INTRAN	MD8 LEVEL BASE SQUOZE
. . . OUTED	MD8 LEVEL BASE SQUOZE
. . . INED	MD8 LEVEL BASE SQUOZE
. . . SCAT1	MD8 LEVEL BASE SQUOZE
. . . SCAT2	MD8 LEVEL BASE SQUOZE
. . . M1	MD8 LEVEL BASE SQUOZE
. . . M0	MD8 LEVEL BASE SQUOZE
. . . M3/D	MD11 LEVEL BASE SQUOZE
. . . M4	MD8 LEVEL BASE SQUOZE
. . . M5	MD8 LEVEL BASE SQUOZE
. . . M6	MD8 LEVEL BASE SQUOZE
. . . M7/D	MD11 LEVEL BASE SQUOZE
. . . M8	MD8 LEVEL BASE SQUOZE
. . . M9	MD8 LEVEL BASE SQUOZE
. . . MD12B	SQUOZE DECK FOR CURRENT MONITOR

## RS WST 1 -- SOS SYSTEM TAPE EDITOR

RS WST HAS THREE BASIC FUNCTIONS...

- I. SYSTEM TAPE WRITING.
- II. EDITING MAKING UP SYSPIT'S AND CAUSING THEIR EXECUTION.
- III. GENERALIZED CRUNCH DECK PROCESSING.

WST IS A SYSTEM SUBPROCESSOR CALLED BY CONTROL CARD AS A PART OF A REGULAR JOB RUN.

IT WILL PERFORM AS A SYSTEM TAPE WRITER AND UPDATER WHEN CALLED BY THE MOCKDONALD CONTROL CARD 'WST', AS AN EDITOR WHEN CALLED BY 'EDIT', AND AS A CRUNCH DECK PROCESSOR WHEN CALLED BY 'EDIT' WITH EITHER OF THE CRUNCH MODALS 'LIST' OR 'PUNCH' PRESENT.

THE SYSTEM CONTROL CARD FORMAT IS...

WST	OLDTAP,NEWTAP
EDIT	OLDTAP,NEWTAP

ON EITHER CONTROL CARD, THE VARIABLE FIELD MAY BE OF ONE OF THE FORMS...

- (1) BLANK VARIABLE FIELD
- (2) A
- (3) ,B
- (4) A,B

A AND B MAY BE ANY SYSTEM, UTILITY, OR RESERVED TAPE NAME. IN CASES (1) AND (3), SYSTAP IS USED AS THE OLDTAP. IN CASES (1) AND (2), THE SYSTEM ERASE TAPE ON A CHANNEL DIFFERENT FROM THAT OF SYSTAP IS USED AS THE NEWTAP. IN THE EDIT MODE, HOWEVER, IF NEWTAP IS A SYSTEM TAPE, THE EDITOR WILL REQUEST THE OPERATOR TO ASSIGN SYSAU1 AND WILL USE THAT AS NEWTAP.

IN ATTACHMENT 2 TO THIS APPENDIX THERE ARE A NUMBER OF EXAMPLES OF CONTROL CARD SEQUENCES FOR VARIOUS USES OF WST.

## I. SYSTEM TAPE WRITING (WST)

SYSTEM TAPES PRODUCED BY WST CONSIST OF FILES OF INFORMATION CURRENTLY OF TWO TYPES. WITHIN MULTI-ITEM FILES ALL ITEMS MUST BE OF THE SAME TYPE.

FILL TYPES (TYPF) CURRENTLY ASSIGNED ARE...

- 0 - ABSOLUTE FILE
- 1 - MULTI-ITEM FILE

ITEM TYPES (TYPI) CURRENTLY ASSIGNED ARE...

- 0 - ABSOLUTE ITEM
- 1 - SQUOZE ITEM
- 2 - RELOCATABLE ITEM
- 3 - CRUNCH ITEM
- 4 - MISC ITEM

THE CONTROL CARDS PERTINENT TO SYSTEM TAPE UPDATING ARE GIVEN BELOW. THEY ALL REQUIRE 7-8-9 PUNCHES IN COLUMN ONE.

COPY	
FILE	IDF, TYPF, SOURCE
CODE	IDF, TYPI
ITEM	IDI, SOURCE
CHANGE	IDI1, IDI2
UPDATE	IDI
SKIP	SOURCE
LAST	

WHERE

IDF	IS THE FILE IDENT WORD.
IDI	IS THE ITEM IDENT WORD.
TYPI	IS THE ITEM TYPE.
TYPF	IS THE FILE TYPE. THE TYPE IS ASSUMED TO BE ABSOLUTE IF BLANK OR MISSING. IF 10000 IS ADDED TO THE TYPE, THE SOURCE IS ASSUMED TO BE BUFFERED. OLDTAP IS KNOWN TO BE BUFFERED.
SOURCE	IS A SYMBOLIC TAPE NAME, CARDS SIGNIFYING THE SYSTEM INPUT UNIT, OR BLANK INDICATING OLDTAP. SOURCE MAY BE EITHER CARD IMAGE OR BUFFERED FORMAT.
COPY	OCCURRING AS THE ONLY CONTROL CARD, REPRODUCES THE SYSTEM TAPE.

EXCEPT IN THE CASE OF A SIMPLE COPY, FILE CARDS ARE GIVEN TO SPECIFY THE ORDER AND CONTENTS OF THE NEW TAPE. THESE CARDS, WITH THE SECOND AND THIRD FIELDS BLANKED OUT, ARE PUNCHED OUT FOR EACH WST RUN. THE CARDS MAY BE GIVEN IN ANY DESIRED ORDER-- AND FILES MAY OCCUR MORE THAN ONCE, IN WHICH CASE THE SOURCE IS SET BY THE LAST FILE OCCURRENCE. A SORT TAPE IS USED IF FILES ARE ENCOUNTERED BEFORE THEY ARE NEEDED.

CODE CARDS PRECEDE ITEMS ON SYSPIT TO IDENTIFY THE FOLLOWING MATERIAL.

WITHIN A MULTI-ITEM FILE THE ITEMS ARE PRECEDED ON SYSPIT BY ITEM CARDS WITH CHANGE CARDS SPECIFYING THE POSITION OF THE NEW ITEM IN THE MANNER OF MODIFY AND LOAD. 'ITEM' CARDS NOT PRECEDED BY 'CHANGE' BUT FOLLOWING 'CODE' WILL BE INSERTED AT THE BEGINNING OF THE FILE.

UPDATE FOLLOWED BY ALTERS (SEE EDITING) COPIES THE NAMED ITEM AS MODIFIED BY THE ALTER PACKAGE. ONLY CRUNCH ITEMS MAY BE UPDATED.

SKIP SPACES FORWARD UNTIL IT FINDS EITHER... A SQUOZE DECK PREFACE CARD, A NEW ITEM ON A BUFFERED SOURCE (END OF GROUP), OR AN END OF FILE.

LAST SIGNALS THE END OF ANY WST RUN. IT MUST BE PRESENT EXCEPT IN THE CASE OF SIMPLE COPY.

THE FORMAT OF THE FILE CARD IS...

FILE            IDF, TYPF, SOURCE

IF SOURCE IS BLANK, OLDTAP IS USED AS THE SOURCE, AND THE FILE IS MERELY COPIED ONTO NEWTAP. IF SOURCE IS CARDS, SYSPIT IS USED AS THE SOURCE OF THE FILE OR ITEMS-- IF SOURCE IS A RESERVED OR UTILITY TAPE NAME, THAT TAPE IS USED AS THE SOURCE OF THE FILE (IF BUFFERED) OR THE CARDS FOR THE NEW FILE OR ITEMS (IF CARD IMAGES). IN THE CARD IMAGE CASE, A CODE CARD MUST BE PRESENT ON SYSPIT--IN THE FORMER CASE, TYPF MUST BE 10000 OR GREATER.

THE FILE TYPE IS GIVEN BY TYPF AND IS ASSUMED TO BE ABSOLUTE IF TYPF IS MISSING OR BLANK. THE SOURCE TAPE IS ASSUMED TO BE BUFFERED IF THE SOURCE IS OLDTAP OR IF 10000 IS ADDED TO TYPF-- E.G., IF TYPF = 10001, THE FILE IS A BUFFERED MULTI-ITEM FILE.

FILE CARDS MAY HAVE MULTIPLE OCCURRENCES. IN THIS CASE, THE FILE IS COPIED OR UPDATED ONTO SORTAP (SYSMIT) WHEN FIRST SEEN AND THEN IS COPIED ONTO NEWTAP AT THE PROPER TIMES. NO SOURCE TAPE OTHER THAN SORTAP IS BACKSPACED-- IF A FILE MUST BE READ FROM A SOURCE TAPE BEFORE IT IS REQUIRED FOR WRITING ON NEWTAP, IT IS PUT INTO SORTAP UNTIL NEEDED.

EACH ITEM TYPE IS HANDLED BY A DIFFERENT ROUTINE. WST IS CONSTRUCTED IN SUCH A WAY THAT NEW ITEM HANDLERS MAY BE ADDED QUITE EASILY. THESE ARE DISCUSSED BELOW...

#### 'SQUOZE' FILE

THE SQUOZE FILE CONSISTS OF CARD IMAGES AS LOGICAL RECORDS. THE IMBEDDED BLANK CARD IS NOT PRESENT, BUT WILL BE PROVIDED AS THE RESULT OF AN EDIT RUN. SEQUENCE CHECKING, CHECKSUMMING, AND THE PRESENCE OF ALL CARDS OF A COMPONENT ARE ALWAYS CHECKED



DURING PROCESSING.

'LBR' FILE

THE LBR FILE CONSISTS OF ONLY THE INFORMATION WORDS FROM THE SQUOZE DECKS PROCESSED, BUT NOT THE CONTROL WORDS FROM THE CARDS. THE MACRO NAME TABLE, MACRO SKELETON TABLE, AND INTRODUCTION ARE NOT WRITTEN. NO LOGICAL END-OF-RECORD FLAGS OCCUR, AND EACH LBR ITEM IS (AS USUAL) A LOGICAL GROUP.

'REL' FILE

THIS CONSISTS OF RELOCATABLE CARD IMAGES AS LOGICAL RECORDS. IF A DECK HAS MORE THAN ONE PROGRAM CARD, EACH ONE IS RECORDED AS A SEPARATE LOGICAL RECORD. THIS CODE IS PRESENT, BUT HAS NOT BEEN THOROUGHLY CHECKED OUT. IT IS INTENDED FOR USE AS A FORTRAN LIBRARY.

'MISC.' FILE

THIS CONSISTS OF CARD IMAGES AS LOGICAL RECORDS. EACH CARD IS PRECEDED BY A TYPE FLAG TO INDICATE THE MODE OF THE RECORD...

IOCD	5,,40000	BINARY CARD
IOCD	5,,40001	BCI CARD
IOCD	5,,40003	SYSTEM CONTROL CARD

IN WRITING THE 'MISC.' FILE, THE END OF EACH ITEM MUST BE SIGNALLED BY AN END-OF-FILE ON THE SOURCE TAPE.

'CRUNCH' FILE

THIS FILE CONSISTS OF BINARY CRUNCHED CARD IMAGES AS LOGICAL RECORDS. THE FORMAT OF CRUNCH CARDS IS 22-WORD-PER-CARD ABSOLUTE, WITH 9LP = 6.

IN WRITING A CRUNCH ITEM, A MIXTURE OF CRUNCH DECKS AND BCI CARDS MAY OCCUR ON THE SOURCE TAPE. THESE ARE CRUNCHED TOGETHER INTO ONE ITEM. THE END OF THE ITEM IS SIGNALLED BY AN END-OF-FILE OR A SYSTEM CONTROL CARD ON THE SOURCE TAPE. IF THE SOURCE IS OTHER THAN SYSPIT, AN END-OF-FILE MUST BE USED BETWEEN ITEMS TO BE CRUNCHED. ALL UPDATED OR NEW CRUNCH ITEMS ARE AUTOMATICALLY LISTED.

## II. TAPE EDITING (EDIT)

THE CONTROL CARDS PERTINENT TO EDIT OPERATION ARE...

FILE	IDF, TYPF, SOURCE
SKIP	SOURCE
COPY	IDI, TYPI, SOURCE
WORDS	N
CRUNCH	IDI
MOD	
ENDMOD	
NOMOD	
ALTER	A, B

WHERE THE FIELDS ARE AS DESCRIBED BEFORE-- BOTH A AND B ARE CRUNCH DECK ALTER NUMBERS.

FILE IN THE EDIT MODE POSITIONS THE SYSTEM TAPE TO THE FILE FOR WHICH COPY'S WILL BE GIVEN-- ONLY THE FILE NAME NEED APPEAR. IDF = CRUNCH OR SQUOZE AUTOMATICALLY IMPLIES THE CORRESPONDING ITEM TYPE AND A MULTI-ITEM FILE.

SKIP SPACES FORWARD ONE SQUOZE DECK ON SOURCE.

'COPY' WRITES THE NAMED ITEM ONTO 'NEWTAPE'. OF PARTICULAR IMPORTANCE IS THE SPECIAL CASE...

' COPY ,3,CARDS

THIS CONSTRUCTION MOVES ALL BCD CARDS FOLLOWING ON 'SYSPIT' TO 'NEWTAP' UNTIL A CONTROL CARD IS ENCOUNTERED.

THE 'WORDS' CONTROL CARD SETS A MODE (NORMALLY N=14) TO SPECIFY NOW MANY BCI WORDS FROM HOLLERITH CARD IMAGES ARE TO BE CRUNCHED.

ANY OF THE FOLLOWING CONTROL CARDS NECESSARY TO THE OPERATION OF THE RESULTING SYSPIT WILL BE COPIED DIRECTLY TO NEWTAP. THEY NEED NOT HAVE 7-8-9 PUNCHES IN COLUMN ONE.

JOB  
 ASSIGN  
 DATA  
 EDIT  
 IDENT  
 SCAT  
 LOAD  
 FAP  
 FOR  
 PEST  
 ENDATA  
 ERRORS  
 REL  
 REW

REWIND  
RUN  
UNLOAD  
IPL  
WST

AGAIN, SPECIAL RULES APPLY TO EACH TYPE OF ITEM...

#### SQUOZE ITEMS

THE COPY CONTROL CARD MUST BE FOLLOWED ON SYSPIT BY EITHER A NOMOD CARD OR A MOD PACKAGE, INCLUDING THE MOD AND ENDMOD CARDS. ALTERNATIVELY, A CRUNCH CARD MAY BE USED...

CRUNCH     IDI

IN THIS CASE, THE ITEM IDI IS ASSUMED TO BE A MOD PACKAGE IN THE CRUNCH FILE TO BE INSERTED IN THE SQZ DECK BEING EDITED. IT IS ASSUMED TO CONTAIN THE MOD AND ENDMOD CARDS. ALTER CARDS MAY FOLLOW THE CRUNCH CARD FOR THE PURPOSE OF MODIFYING THE MOD PACKAGE.

#### CRUNCH ITEMS

ITEMS WILL NORMALLY BE UNCRUNCHED FROM OLDTAP AND WRITTEN IN BCI ONTO NEWTAP. IN THIS CASE, ANY BCI CARDS FOLLOWING THE COPY CARD ON SYSPIT WILL BE WRITTEN OFF FIRST, AS WELL AS ANY CRUNCH DECKS PRESENT ON SYSPIT. THE FIRST SYSTEM CONTROL CARD (7-8-9 PUNCHES) SEEN WILL START PROCESSING OF THE ITEM FROM THE CRUNCH FILE, IF ANY. THE ITEM MAY BE UPDATED WITH ALTER CARDS AND MODS, IF DESIRED. THE ALTER CARDS MUST HAVE 7-8-9 PUNCHES IN COLUMN 1 AND MUST BE IN ASCENDING ORDER BY ALTER NUMBER. IF CRUNCH IS USED RATHER THAN COPY, THE CRUNCH ITEM WILL BE WRITTEN OFF IN CRUNCHED FORM, PRECEDED BY A CRUNCH CONTROL CARD FOR USE BY FAP.

## III. CRUNCH PROCESSING (EDIT)

CRUNCH IS A COMPRESSED FORM OF HOLLERITH CARDS IN WHICH BLANKS HAVE BEEN REMOVED. THE COMPRESSION IS ABOUT 5 TO 1 TO 10 TO 1 FOR SCAT SYMBOLIC CARDS, DEPENDING ON THE DENSITY OF REMARKS. THIS COMPRESSION IS ROUGHLY THAT ACHIEVED IN SQUOZE DECKS. THE ENCODING IS SUCH THAT THE ORIGINAL CARD FORM CAN ALWAYS BE EXACTLY RECOVERED.

THE APPEARANCE OF ANY OF THE CONTROL CARDS...

LIST	ON	START LISTING (ON SYSPOT)
LIST	OFF	STOP LISTING
PUNCH	BCI	PUNCH HOLLERITH CARDS (ON SYSPPT)
PUNCH	BIN	PUNCH BINARY CARDS (ON SYSPPT)
PUNCH	NILL	STOP PUNCHING

WILL CAUSE WST TO ACT AS A GENERALIZED CRUNCH PROCESSOR FOR LISTING, PUNCHING, AND ALTERING CRUNCH AND HOLLERITH DECKS. THE DECKS MAY COME FROM SYSPIT OR ANY SOURCE INCLUDING OLDTAP. NO NEWTAP FOR EXECUTION IS PRODUCED.

ALTER CARDS MAY BE USED TO MODIFY CRUNCH DECKS TAKEN FROM OLDTAP ONLY. THESE MUST HAVE 7-8-9 PUNCHES IN COLUMN ONE.

CRUNCH DECKS ON SYSPIT MAY BE PROCESSED, BUT MAY NOT BE MODIFIED BY ALTER. IN THIS CASE, THE DECK MUST BE PRECEDED BY

COPY        IDI,3,CARDS

NO FILE CARD IS NECESSARY IF OLDTAP IS NOT USED. A MIXTURE OF CRUNCH DECKS AND HOLLERITH CARDS MAY FOLLOW THE COPY CARD-- PROCESSING IS STOPPED BY THE NEXT CONTROL CARD ENCOUNTERED ON SYSPIT.

DECKS ON RESERVED OR UTILITY TAPES MAY ALSO BE PROCESSED AND ARE CALLED BY (E.G.)

COPY        IDI,3,SYSAR1

PROCESSING IS STOPPED BY ENCOUNTERING END-OF-FILE. EITHER HOLLERITH OR CRUNCH CARDS MAY EXIST ON THE SOURCE TAPE.

THE SYSTEM TAPE FORMAT IS MOCKDONALD BUFFERED FORMAT. THE FOLLOWING ADDITIONAL CONVENTIONS HOLD...

1. THE FIRST FILE ON THE TAPE (FILE NUMBER ZERO) CONSISTS OF 12-WORD LOGICAL RECORDS. THE FIRST CONTAINS THE CONTENTS OF SYSID1, SYSID2, AND SYSDAT FOR THE WST RUN THAT PRODUCED THE TAPE. THE OTHERS ARE THE FILE CARDS USED FOR WRITING THE TAPE.
2. ALL OTHER LOGICAL FILES BEGIN WITH A PHYSICAL RECORD CONTAINING A SYMBOL FLAG FOR FILE IDENTIFICATION AND A SEQUENCE FLAG...

IOSPN	0,,2	SYMBOL FLAG
BCI	1, IDF	FILE IDENTIFIER
IOCD	5,, TYPF	FILE TYPE
IOSPN	N,,0	SEQUENCE FLAG (FILE NUMBER)
TCH	SYSPER,,5	PHYSICAL END-OF-RECORD FLAG

3. IN MULTI-ITEM FILES (TYPF=1), EACH ITEM BEGINS...

IOSPN	0,,2	SYMBOL FLAG
BCI	1, IDI	ITEM IDENTIFIER
IOCD	5,, TYP1	ITEM TYPE

AND CONCLUDES WITH A LOGICAL END-OF-GROUP.

4. WHERE ITEMS CONSIST OF CARD IMAGES (SQUOZE, REL, CRUNCH, ETC. FILES), EACH CARD IMAGE FORMS A LOGICAL RECORD. AN ITEM IN THE LBR FILE CONTAINS NO LOGICAL RECORD ENDS.
5. ABSOLUTE FILES AND ITEMS ARE CONCLUDED BY A TRANSFER FLAG...

IOCT	START,,0	TRANSFER ADDRESS FLAG
------	----------	-----------------------

6. PHYSICAL RECORDS ARE A MAXIMUM OF 8191 WORDS IN LENGTH, EXCEPT FOR THE FOLLOWING FILES, WHICH ARE LIMITED TO SYSTEM BUFFER LENGTH (255 WORDS AT PRESENT)...

FILE ZERO	TAPE IDENTIFICATION FILE
LBR	SCAT LIBRARY
REL	FORTTRAN LIBRARY
MISC.	MISCELLANEOUS FILE

NOTE THAT A PRIME (') IS USED TO INDICATE 7-8-9 PUNCHES IN COLUMN 1.

A. COPY CURRENT SYSTEM TAPE TO RESERVED TAPE.

```
' JOB
' ASSIGN      A7=SYSAR3
' WST         ,SYSAR3
' COPY
```

B. PRODUCE A NEW SYSTEM TAPE WITH A NEW ITEM IN THE SQUOZE FILE. THE SQUOZE DECK DESIRED IS THE SECOND DECK ON SYSBR4. NEW TAPE WILL BE SYSTEM ERASE TAPE ON CHANNEL OTHER THAN THAT OF SYSTAP.

```
' JOB          ...
' ASSIGN      B5=SYSBR4
' WST
' FILE       EXCCRD
' FILE       SCAT1
'
'
' FILE       OUTED
' FILE       SQUOZE,1,CARDS
' FILE       CRUNCH
' CODE       SQUOZE,1
' CHANGE     SQZ17
' SKIP       SYSBR4
' ITEM       SQZ18,SYSBR4
' LAST
```

C. EDIT TO PRODUCE NEW ABSOLUTE SCAT1, INSERTING MODS INTO THE CURRENT MOD PACKAGE (MODIFY AND LOAD FOR MODIFY AND LOAD).

```
' JOB          ...
' ASSIGN      A5=SYSAU1
' EDIT        ,SYSAU1
' FILE       SQUOZE
' JOB
' IDENT      SCAT1,RS10D
' LOAD       NOGO,ABS
' COPY       SCAT1
' CRUNCH     MODC
' ALTER      15,17
' LAST
```

D. LIST THE SAME MOD PACKET USED ABOVE.

```
' JOB          ...
' EDIT
' FILE       CRUNCH
' LIST       ON
' COPY       MODC1
' ALTER      15,17
' LAST
```

## E. LIST CRUNCH DECK ON SYSPIT.

```

*   JOB           ...
*   EDIT
*   LIST
*   COPY          DECK,3,CARDS
*   THE CRUNCH DECK
*   LAST

```

## F. UPDATE CRUNCH FILE (SYSAR1) ONTO RESERVED TAPE (SYSBR1) WITH CARD IMAGE INPUT FROM RESERVED TAPE (SYSBR2). EDIT TO ASSEMBLE WITH BEFAP.

```

*   JOB           ...
*   ASSIGN        A5=SYSAU1
*   ASSIGN        B5=SYSBR1
*   ASSIGN        B6=SYSBR2
*   ASSIGN        A6=SYSAR1
*   IDENT         UPDATE,BASECR
*   WST           SYSAR1,SYSBR1
*   FILE          CRUNCH,1,CARDS
*   CODE          CRUNCH,3
*   CHANGE        GDCR,GDCR           (DELETE GDCR)
*   ITEM          S4CR,SYSBR2         (INSERT S4CR)
*   ITEM          S5CR,SYSBR2         (INSERT S5CR)
*   LAST
*   EDIT          SYSBR1,SYSAU1
*   FILE          CRUNCH
*   JOB           ...
*   IDENT         IB-FN,S4
*   FAP           NOGO
*   CRUNCH        S4CR
*   IDENT         IB-FN,S5
*   FAP           NOGO
*   CRUNCH        S5CR
*   LAST

```

## G. NOTE THAT IN AN EDIT RUN, ANY HOLLERITH CARDS MAY BE COPIED OVER FROM SYSPIT BY PRECEDING THEM WITH...

```

*   COPY          ,3,CARDS

```

FOR EXAMPLE, IN THIS JOB WHICH USES PRODUCTION DECKS AND MOD PACKAGES FROM A RESERVED LIBRARY TAPE, COPY IS USED TO PASS THE DATA PACKAGE AS WELL AS THOSE BLANK CARDS...

```

*   JOB           ...
*   ASSIGN        B6=SYSBR2
*   ASSIGN        B5=SYSBR1
*   ASSIGN        A5=SYSAR1
*   EDIT          SYSBR1           FIRST EDIT FOR SQUOZE DECK
*   FILE          SQUOZE
*   COPY          MASTER           PICK UP MASTER PRODUCTION DECK
*   LIST          OFF             DUMMY TO KILL EDIT EXECUTE
*   LAST

```

'	EDIT	SYSAR1	EDIT FOR MOD PACKAGES AND DATA
'	FILE	CRUNCH	
	JOB	...	JOB CARD FOR THE EXECUTE
	LOAD	SYSBR1	
'	COPY	MOD1	COPY FIRST STANDARD MOD PKG.
'	COPY	,3,CARDS	COPY A BLANK CARD (SEE SEC.V, P.47)
	BLANK CARD		
'	DATA	GD,SYSBR2	
'	COPY	,3,CARDS	COPY OVER DATA PACKAGE
	DATA PACKAGE FOR RUN		
'	ENDATA		
'	COPY	,3,CARDS	
	BLANK FOR INED		
'	REWIND	SYSBR1	
'	REWIND	SYSBR2	
'	LOAD	SYSBR1	
'	COPY	MOD2	COPY SECOND STANDARD MOD PKG.
'	COPY	,3,CARDS	
	ANOTHER BLANK CARD		
'	LAST		



THIS PROGRAM IS A MODIFIED VERSION OF THE LISTER (M8) FROM SOS MODIFY AND LOAD. UNDER INPUT OPTION IT PRODUCES SYMBOLIC CARDS OR CRUNCHED SYMBOLIC CARDS. IT MAY ALSO PREPROCESS THE DICTIONARY IN ORDER TO PRODUCE SYMBOLIC CARD OUTPUT IN WHICH ALL LOCATION SYMBOLS EXCEPT SPECIFICALLY-NAMED EXCEPTIONS ARE REPLACED BY A REGULARIZED SYMBOL OF THE FORM THREE CHARACTERS SUPPLIED BY THE PROGRAMMER FOLLOWED BY THREE DIGITS SUPPLIED BY THE LISTER. SYSTEM SYMBOLS, UNDEFINED SYMBOLS, AND DOUBLY DEFINED SYMBOLS ARE UNCHANGED.

IN THE SYMBOL MODE, THE LISTER READS CARDS FROM SYSPIT. (THEY SHOULD FOLLOW THE SQUOZE DECK.) THE FIRST THREE CHARACTERS OF THE FIRST CARD READ ARE SET AS THE FIRST THREE CHARACTERS OF THE REGULAR REPLACEMENT SYMBOL. THESE THREE CHARACTERS WILL BE FOLLOWED BY THREE DIGITS, AND EACH SYMBOL IN THE DICTIONARY IS REPLACED WITH A SYMBOL FROM THIS SET UNLESS THE SYMBOL HAS BEEN EXCEPTED.

ON SUCCEEDING CARDS ON SYSPIT, SYMBOLS -- ONE PER CARD BEGINNING IN COLUMN ONE -- ARE ENTERED AS EXCEPTIONS. THEY WILL NOT BE REPLACED. THE SYMBOLS MAY BE HEADED. THERE IS A LIMIT TO THE NUMBER OF SYMBOLS WHICH MAY BE EXCEPTED. IT IS DEPENDENT ON THE SIZE OF THE DICTIONARY, FOOTNOTES, AND INTRODUCTION OF THE SQUOZE DECK BEING PROCESSED, BUT PRACTICALLY THE NUMBER IS LIMITLESS. REFERENCES TO REGULARIZED SYMBOLS ARE REPLACED IN THE PUNCHED OUTPUT EXCEPT WHEN THE REFERENCE IS IN THE VARIABLE FIELD OF A MACRO CALL OR VFD. SYMBOLS IN THESE VARIABLE FIELDS ARE NEVER REPLACED.

SYMBOLS WHICH, IN THE LISTING, ARE NOT ATTACHED TO THE ORIGINAL LINE -- SUCH AS THOSE BELONGING TO MACRO CALLS AND VFD'S -- ARE RETURNED TO THE ORIGINAL LINE. THE M LINES FOLLOWING A DUP M,N ARE PUNCHED. SPACE N AND EJECT ARE PUNCHED AT THE PROPER POINT. MACRO DEFINITIONS ARE NOT PUNCHED. INSTRUCTIONS WITHIN THE RANGE OF UNLIST ARE NOT PUNCHED.

DECKS WITH REGULARIZED SYMBOLS MAY BE PRODUCED IN CRUNCH OR BCD FORM. A LISTING IS NEVER PRODUCED SIMULTANEOUSLY WITH A PUNCHED DECK.

AT PRESENT, VFD'S WITHIN A MACRO EXPANSION OR DUP ARE PUNCHED ERRONEOUSLY.

#### MONITOR COMMUNICATIONS

SEVERAL COMMUNICATION CHANGES ARE NECESSARY IN THE MONITOR FOR PUNCHING OPERATION...

THE LISTER IS CAUSED TO OPERATE IN THE PUNCH, CRUNCH, OR SYMBOL MODE BY THE OCCURRENCE OF BITS IN THE INPUT INDICATORS...

PUNCH	LEFT 100
CRUNCH	LEFT 200
SYMBOL	LEFT 400

SEVERAL MOCKDONALD SOS MONITOR ROUTINES AND CELLS ARE USED. THEIR ADDRESSES ARE EXPECTED IN THE MODIFY AND LOAD CALLING SEQUENCE (BCS) IN THE FOLLOWING PLACES...

SEL	30,4	ADDRESS
WAT	30,4	DECREMENT
SYPPT	9,4	DECREMENT
SYSTRC	6,4	ADDRESS
SYPIT	2,4	ADDRESS

OPERATION OF THE RS ACCOUNTING ROUTINES  
FOR THE MOCKDONALD MONITOR

THE RS ACCOUNTING ROUTINES OBTAIN A BREAKDOWN OF COMPUTER USAGE PER JOB PROCESSED, AND OF SYSTEM ROUTINE USAGE WITHIN A JOB BY WRITING TIME RECORDS ON THE MEDIARY OUTPUT TAPE AT SUITABLE TIMES WITHIN THE PROCESSING OF A JOB. AT THE CONCLUSION OF PROCESSING FOR A JOB ONLY ACCOUNTING RECORDS REMAIN ON THE MEDIARY OUTPUT TAPE. THIS INFORMATION IS COLLECTED, AND SUMMARIES ARE PREPARED ON PERIPHERAL OUTPUT FOR THE PROGRAMMER AND ON MEDIARY OUTPUT FOR TOTALING AT THE CONCLUSION OF EACH CYCLE. PRIOR TO ENTERING A NEW INPUT PHASE, AN ACCOUNTING PHASE IS TAKEN IN WHICH SUMMARIES OF TIME USAGE PER JOB AND PER MAJOR SYSTEM SUBROUTINE ARE PRINTED ON-LINE, AND CARDS ARE PUNCHED GIVING ALL COLLECTED INFORMATION FOR EACH JOB. OTHER PROGRAMS USE THE PUNCHED INFORMATION TO PROVIDE MORE ELABORATE STATISTICS THAN ARE AVAILABLE FROM THE ON-LINE LISTING.

## ACCOUNTING TYPES

AT EACH APPROPRIATE POINT IN THE PROCESSING OF A JOB, AN ACCOUNTING RECORD IS WRITTEN USING THE BUFFERING ROUTINES. THE RECORDS ARE IDENTIFIED BY TYPE FLAGS OF THE FORM

IOCD                    10,,N

WHERE N IS THE ACCOUNTING SUBTYPE. SIX SUBTYPES ARE USED AT PRESENT. THEY ARE GIVEN BELOW WITH THE MONITOR ROUTINE WHICH CAUSES THE RECORD TO BE WRITTEN. EACH RECORD, EXCEPT THE 'FINAL' ONE, CONSISTS OF THE TIME ELAPSED SINCE THE LAST RECORD (CLOCK READING) PLUS OTHER INFORMATION PERTINENT TO THE PARTICULAR RECORD.

TYPE	RECORDING ROUTINE	RECORDED INFORMATION
1. FINAL	TKF (FROM TJF IF NO MEDIARY OUTPUT).	ALL SUMMARY INFORMATION.
2. SYSTEM PROGRAM TIME	MCRS (ON RETURN FROM MAJOR SUBROUTINE).	SUBROUTINE NAME.
3. TAPE MOUNTING TIME	CST AND DCI (IF TAPES WERE USED).	NUMBER OF TAPES.
4. END OF JOB FOR TJF EACH PHASE		PERIPHERAL AND MEDIARY OUTPUT COUNTS.
5. EXECUTION	MCRS (ON RETURN TO SYSTEM OR SYSERR)	PHASE.
6. CARD-TO-TAPE SIMULATION	SIM	---

## MONITOR ROUTINES

THREE BASIC ROUTINES WERE ADDED TO THE MONITOR (SC) TO PRODUCE AND HANDLE ACCOUNTING RECORDS...

- TKR - TO WRITE AN ACCOUNTING RECORD.
- TKF - TO PROCESS ACCOUNTING RECORDS FOR A JOB AND PRODUCE SUMMARIES FOR THE PROGRAMMER AND FOR TKZ. THE ROUTINE IS ENTERED AS SOON AS THERE IS NO MORE MEDIARY OUTPUT FOR THE JOB.
- TKZ - TO PROCESS THE FINAL SUMMARIES FOR EACH JOB AND PRODUCE A SUMMARY FOR EACH CYCLE OF OPERATION, PLUS PUNCHED CARDS GIVING A DETAILED HISTORY OF EACH JOB.

## MONITOR CHANGES

ACCOUNTING INFORMATION MUST BE PASSED FROM PHASE TO PHASE ON THE MEDIARY TAPES. IN ORDER TO PROVIDE FOR THIS WITHOUT THE USE OF PHASE FLAGS (WHICH CAN'T BE USED SINCE THE NUMBER OF PHASES NECESSARY IN ANY CYCLE IS NOT KNOWN) O\$MCR WAS CONVERTED TO RECOGNIZE ACCOUNTING TYPE FLAGS AND TO COPY THEM ONTO THE MEDIARY OUTPUT TAPE. ACCOUNTING RECORDS ARE ALWAYS WRITTEN AND COPIED PRESERVING THE SYSMOT USED STATUS, SO THAT THEY WILL NOT AFFECT THE TEST FOR JOB COMPLETION. IN ADDITION, IN PHASE ONE THEY ARE WRITTEN WITH A PHASE FLAG TO AVOID CONFLICT WITH INPUT EDITOR OUTPUT. IT IS NECESSARY, OF COURSE, TO USE O\$MCR AS THE EXECUTION PHASE MASTER CONTROL.

WJR HAS BEEN MODIFIED TO PRINT THE JOB SEQUENCE NUMBER (ORDER ON SYSPIT) ON-LINE FOR THE USE OF THE OPERATOR. THIS SEQUENCING IS CARRIED FORWARD TO THE CYCLE SUMMARY AND IS PUNCHED TOGETHER WITH DATE AND TIME AS ID ON THE SUMMARY CARDS.  
OUTPUTS

ATTACHED ARE SAMPLES OF THE OUTPUTS OF THE ACCOUNTING ROUTINES FOR THE PROGRAMMER AND FOR THE ACCOUNTING DEPARTMENT. IN ADDITION TO THE INFORMATION ALREADY NOTED, THE TAPE-TIME-PRODUCT IS COMPUTED AND LISTED. THIS IS THE TOTAL NUMBER OF DRIVE-HOURS ACCUMULATED DURING THE CYCLE.

## ACCOUNTING SUMMARY

1 121500 3/15/61

JOB 8198,INIT,GEB929,5,5280,5,C

PHASE	PROGRAM	TIME
2	EXECUTION	01MIN 30SEC
1	LG	30SEC
3	CONVERSION	20SEC
	TOTAL	02MIN 20SEC

MEDIARY OUTPUT COUNT	431 WORDS
PERIPHERAL OUTPUT COUNT	2 PAGES

## CYCLE SUMMARY

3/15/61

1451 HRS

JOB	IDENT	MAN	TAPES	PAGES	TIME	TYPE
8198	INIT	GEB929	0	24	02MIN	C
1234	BFFER	ABC123	6	29	01MIN	10SEC C
4321	PONX	SOB999	0	3		20SEC C
9876	VIPL	NSS530	0	5		20SEC P
X093	LOC1	GEB929	0	7		10SEC F
8198	MULTI	GEB929	8	41	01MIN	10SEC
			TOTAL		05MIN	10SEC

CARD-TO-TAPE SIMULATION

40SEC

TAPE MOUNTING TIME

03MIN 10SEC

TAPE-TIME PRODUCT

23MIN 50SEC

CYCLE SUMMARY

3/15/61

1451 HRS

SYSTEM ROUTINE	EXECUTION	TIME
IPL		10SEC
LG	01MIN	30SEC
SCAT1		40SEC
TOTAL	02MIN	20SEC

THE FOLLOWING LIST INDICATES THE RECOMMENDED LIBRARY PACKAGE FOR FORTRAN JOBS BEING RUN IN THE SOS MONITOR...

## MATH LIBRARY

I.D.	NAME	FUNCTION	CARDS	SPACE OCTAL	DECIMAL
FPTM	(FPT)	FLOATING POINT TRAP	2	12	10
9XP1	EXP(1	I**J	3	43	35
9XP2	EXP(2	A**J	3	46	38
XP3S	EXP(3	A**B	7	166	118
9ATN	ATAN	ARCTANGENT	5	115	77
XPFS	EXP	EXPONENTIAL	4	64	52
LOGS	LOG	LOG	4	64	52
9SCN	SIN-COS	SINE-COSINE	7	151	105
SQRS	SQRT	SQUARE ROOT	4	62	50
9TNH	TANH	HYPERBOLIC TANGENT	6	126	86
KICK	(KICK)	ERROR MESSAGE WRITER	4	52	42
				----	----
				1231	665

## I-O LIBRARY

IOMD	VARIOUS	I-O COMMUNICATION	22	617	399
ERRM	(ERR)	I-O ERROR MESSAGE WRITER	3	50	40
IOHN	VARIOUS	DECIMAL I-O CONVERTER	52	1770	1016
				----	----
				2657	1455

## MISCELLANEOUS

9XLO	XLOC	LOCATION FUNCTION	2	14	12
FULL	VARIOUS	FULL-WORD INTEGER ROUTINES	3	37	31
BOBK	BOBK	ON-LINE MESSAGE PRINTER	5	103	67
MDMP	DUMP AND	PDUMP	8	177	127
				----	----
				355	237
				----	----
				4465	2357



FLOATING POINT TRAP ROUTINE FOR FORTRAN-IN-SOS  
SUBROUTINE FPTM

## PURPOSE

TO HANDLE FLOATING-POINT OVERFLOWS AND UNDERFLOWS USING THE FACILITIES OF THE SOS MONITOR.

## RESTRICTION

MAY BE USED ONLY BY FORTRAN OR FAP PROGRAMS OPERATING WITHIN SOS.

## METHOD

EACH FORTRAN-COMPILED MAIN PROGRAM REQUIRES THE USE OF A FLOATING-POINT TRAP ROUTINE WITH THE ENTRY POINT (FPT). FPTM MEETS FORTRAN'S REQUIREMENTS BY USING THE OVERFLOW AND UNDERFLOW FACILITIES WITHIN THE SOS MONITOR.

- A. ON UNDERFLOW, THE OFFENDING REGISTER IS SET TO +0-- CONTROL RETURNS TO THE USER'S PROGRAM--
- B. ON OVERFLOW, THE MONITOR RETURNS TO SYSERR, PRINTING AN APPROPRIATE ERROR MESSAGE.

## USAGE

FPTM MAY BE USED IN PLACE OF 9FPT (WHICH IS THE STANDARD FORTRAN ROUTINE) OR FPT5 (WHICH IS RAND'S VERSION OF FPT, WITH ERROR MESSAGES-- SEE 9-60.30.05, 2-15-61).

## IDENTIFICATION

## FPTM

CARDS... FPTM0001 THROUGH FPTM0002  
SPACE... 12 (OCTAL) = 10 (DECIMAL)

## IOMD, INPUT-OUTPUT ROUTINE FOR FORTRAN IN SOS

## PURPOSE

TO PROVIDE FOR THE NECESSARY INPUT-OUTPUT COMMUNICATION BETWEEN FORTRAN OBJECT PROGRAMS AND THE MOCK-DONALD SOS MONITOR.

## USAGE

IOMD REPLACES ALL OF THE FORTRAN INPUT-OUTPUT LIBRARY (EXCEPT (IOH)-- SEE BELOW). IN ADDITION, IOMD CONTAINS AN ENTRY POINT FOR EXIT, AND THEREFORE REPLACES THAT ROUTINE ALSO. AN ENTRY POINT FOR (WOT) IS ALSO INCLUDED WITHIN IOMD.

## RESTRICTIONS

- A. FOR COMPATIBILITY REASONS, IOMD REQUIRES THAT A 132-CHARACTER VERSION OF IOH (SUCH AS IOHL OR IOHN) BE USED.
- B. IOMD REQUIRES AN ERROR ROUTINE (ERR). THE PRESENT VERSION OF THIS ERROR ROUTINE WRITES A MESSAGE AND RETURNS CONTROL TO THE SOS MONITOR. IF DESIRED, THE INDIVIDUAL PROGRAMMER MAY MODIFY (ERR) TO SUIT HIS OWN PURPOSES.

## METHOD

- A. DECIMAL INPUT-OUTPUT... DATA CARDS ARE READ FROM SYSMIT, USING THE BUFFERING ROUTINES-- OUTPUT LINES ARE WRITTEN ON SYSMOT USING THE OUTPUT EDITOR. ALL DECIMAL-TO-BINARY AND BINARY-TO-DECIMAL CONVERSION IS DONE BY (IOH).
- B. BINARY INPUT-OUTPUT... BINARY TAPES ARE WRITTEN AND READ USING THE MOCK-DONALD BUFFERING ROUTINES. REGULAR FORTRAN BINARY TAPES MAY NOT BE READ BY SOS-FORTRAN AND VICE VERSA. (RS CVT2, CONTAINED IN THE 'CRUNCH' FILE, MAY BE USED TO CONVERT FORTRAN BINARY TAPES TO SOS BUFFERED FORMAT.)

## TAPE ADDRESSES

THE FOLLOWING TABLE ESTABLISHES THE CORRESPONDENCE BETWEEN FORTRAN LOGICAL UNIT NUMBERS AND SOS SYMBOLIC TAPE ADDRESSES...

## TABLE OF LOGICAL-SYMBOLIC TAPE ADDRESSES

RESERVED TAPES		UTILITY TAPES	
LOGICAL TAPE NO.	SYMBOLIC TAPE ADDRESS	LOGICAL TAPE NO.	SYMBOLIC TAPE ADDRESS

1	SYSAR1	65	SYSAU1
2	2	66	2
3	3	67	3
4	4	68	4
5	5	69	5
6	6	70	6
7	7	71	7
8	8	72	8
9	SYSBR1	73	SYSBU1
10	2	74	2
11	3	75	3
12	4	76	4
13	5	77	5
14	6	78	6
15	7	79	7
16	8	80	8

THE 'STANDARD INPUT TAPE' IS LOGICAL TAPE 41  
 THE 'STANDARD OUTPUT TAPE' IS LOGICAL TAPE 42.

THE ABOVE TABLE MAY BE EXTENDED FOR ANY NUMBER OF CHANNELS BY  
 USING THE FOLLOWING FORMULAE...

- A. FOR RESERVED TAPES, SYSXRN, LOGICAL TAPE NO. =  $N + 8(X-1)$
- B. FOR UTILITY TAPES, SYSXUN, LOGICAL TAPE NO. =  $N + 8(X-1) + 64$   
 WHERE X = 1 FOR CHANNEL A,  
           = 2 FOR CHANNEL B,  
           = 3 FOR CHANNEL C,  
           ETC.

#### NOTES

- A. READ IS EQUIVALENT TO READ INPUT TAPE 41 (OR INPUT 41).  
 ON-LINE CARD READING IS NOT PERMITTED.
- B. PUNCH WRITES RECORDS ON SYSPT FOR OFF-LINE PUNCHING VIA  
 THE 1401. PUNCHING THUS BECOMES RELATIVELY INEXPENSIVE  
 AND PROVIDES A MEANS OF STORING INTERMEDIATE DATA WITHOUT  
 USING A RESERVED TAPE.
- C. PRINT IS EQUIVALENT TO WRITE OUTPUT TAPE 42 (OR OUTPUT 42).  
 ON-LINE PRINTING OF MESSAGES TO THE OPERATOR MAY BE  
 ACCOMPLISHED USING THE BOBK SUBROUTINE.
- D. FAP-CODED PROGRAMS MAY USE THE (WOT) ENTRY POINT OF IOMD  
 FOR WRITING BCD RECORDS ON THE STANDARD OUTPUT TAPE (42),  
 AS FOLLOWS...

```

      TSX $(WOT),4
      PZE A,,N
      --- RETURN
  
```

TO WRITE N BCD WORDS BEGINNING AT LOCATION A.

#### IDENTIFICATION

IOMD  
 CARDS... IOMD0001 THROUGH IOMD0022

SPACE... 617 (OCTAL) = 399 (DECIMAL)

SUBROUTINE (ERR)  
 ERROR MESSAGE ROUTINE FOR FORTRAN-IN-SOS

## PURPOSE

TO PRINT ERROR MESSAGES FOR ERRORS DISCOVERED IN THE IOMD INPUT-OUTPUT ROUTINE.

## METHOD

PRINTS A SIMPLE MESSAGE INDICATING THE NATURE OF THE ERROR ENCOUNTERED IN IOMD. THE ERROR TYPES ARE INDICATED BY AN 'HPR A,T,' AS FOLLOWS...

A	T	REASON FOR HALT
0	1	ILLEGAL CHARACTER IN FORMAT STATEMENT.
1	1	ILLEGAL CHARACTER IN DATA FIELD.
2	1	ILLEGAL CHARACTER IN DATA FIELD.
3	1	ILLEGAL CHARACTER IN DATA FIELD.
4	1	ILLEGAL CHARACTER IN DATA FIELD.
5	1	ILLEGAL CHARACTER IN OCTAL INPUT DATA FIELD.
0	2	ILLEGAL DATA CARD CHARACTER.
1	2	END-OF-FILE AT THE CARD READER.
0	3	I-O CHECK LIGHT TURNED ON BY THE LAST READ INSTRUCTION.
1	3	TEN CONSECUTIVE FAILURES IN READING TAPE.
2	3	END-OF-FILE READING TAPE.
0	5	I-O CHECK LIGHT TURNED ON BY THE LAST READ INSTRUCTION.
1	5	FIFTH CONSECUTIVE WRITE FAILURE.
2	5	FAILURE IN ERASING TAPE (BAD SPOT).
3	5	END-OF-TAPE ENCOUNTERED WHILE WRITING.
0	6	UNIT ADDRESS NOT FOUND IN THE IOU TABLE, OR IOU TABLE ENTRY IS ZERO.
0	7	ERROR RETURN FROM BINARY BACKSPACE ROUTINE.

PROGRAMMERS WHO WISH TO TAKE SPECIAL ACTION WHEN AN ERROR IS DETECTED MAY MODIFY (ERR) TO SUIT THEIR OWN PURPOSES.

## IDENTIFICATION

ERRM  
 CARDS... ERRM0001 THROUGH ERRM0003  
 SPACE... 50 (OCTAL) = 40 (DECIMAL)

## SUBROUTINE BOBK, MESSAGE PRINTER FOR FORTRAN-IN-SOS

## PURPOSE

TO PRINT AN ON-LINE MESSAGE TO THE SOS OPERATOR.

## RESTRICTION

MAY BE USED ONLY BY FORTRAN OR FAP PROGRAMS OPERATING WITHIN SOS.

## USAGE

## A. FORTRAN-COMPILED PROGRAMS...

```

                CALL BOBK (A,N)
OR
                CALL BOBK (A)

```

WHERE A IS THE NAME OF AN ARRAY OF BCD WORDS IN MEMORY (STORED BACKWARD, A LA FORTRAN). N, IF GIVEN, IS THE NUMBER OF WORDS IN THE ARRAY. IF N IS NOT GIVEN (OR IS ZERO OR GREATER THAN 12) IT IS TAKEN TO BE 12. IF N IS POSITIVE (OR NOT GIVEN) THE ON-LINE PAGE WILL BE SPACED AFTER PRINTING FOR EASE OF READING. IF N IS NEGATIVE, SINGLE SPACING RESULTS.

THE DATA OF ARRAY A WILL USUALLY RESIDE IN MEMORY AS A RESULT OF THE FOLLOWING STATEMENTS...

```

DIMENSION A(12)
.
.
.
READ INPUT TAPE I, F, (A(I), I = 1,12)
.
.
.
FORMAT (12A6)

```

## B. FAP-ASSEMBLED PROGRAMS...

```

TSX $BOBK,4
OP A,,M

```

WHERE A IS A STRING OF M BCD WORDS STORED FORWARD IN MEMORY (E.G., AS THE RESULT OF A BCI PSEUDO-OP). IF M IS ZERO OR GREATER THAN 12, ONLY 12 WORDS WILL BE PRINTED. OP IS PZE TO SPACE THE PAGE AFTER PRINTING, MZE TO SUPPRESS EXTRA SPACING AFTER PRINTING.

## IDENTIFICATION

BOBK

CARDS... BOBK0001 THROUGH BOBK0005

SPACE... 103 (OCTAL) = 67 (DECIMAL)

SUBROUTINE DUMP, PDUMP  
CORE DUMP ROUTINE FOR FORTRAN-IN-SOS

## PURPOSE

TO GIVE CORE DUMPS USING THE DEBUGGING FACILITIES OF THE SOS MONITOR.

## RESTRICTION

MAY BE USED ONLY BY FORTRAN OR FAP PROGRAMS OPERATING WITHIN SOS.

## USAGE

THIS ROUTINE IS USED AS FOLLOWS...

CALL DUMP (A(1),B(1),F(1),...A(N),B(N),F(N)) WHERE A AND B ARE VARIABLE NAMES INDICATING LIMITS OF CORE STORAGE TO BE DUMPED. EITHER A(I) OR B(I) MAY REPRESENT UPPER OR LOWER LIMITS. F(I) IS A FIXED POINT NUMBER INDICATING THE FORMAT DESIRED, AS

F = 0	OCTAL
= 1	FLOATING
= 2	INTEGER, HALF-WORD (DECREMENT)
= 3	OCTAL, WITH MNEMONICS (SAME AS 0)
= 4	INTEGER, FULL-WORD (AT 35)
= 5	BCD

THE CORE DUMP IS EFFECTED AS SPECIFIED AND CONTROL IS TRANSFERRED TO THE MONITOR TO INITIATE THE NEXT JOB. IF NO ARGUMENTS ARE GIVEN, ALL OF CORE STORAGE IS DUMPED IN OCTAL. (USE THIS OPTION WITH DISCRETION.) THE LAST FORMAT INDICATION (F(N)) MAY BE OMITTED, IN WHICH CASE IT WILL BE ASSUMED TO BE OCTAL.

CALL DUMP (A) OR CALL PDUMP (A) IS ALLOWED-- THE SINGLE CELL, A, IS DUMPED IN OCTAL.

THE EXISTING VACUOUS DUMP ROUTINES, 9DMPV AND 9PDMPV MAY BE USED, WITHOUT CHANGE, IN PLACE OF THE DUMP-PDUMP ROUTINE DESCRIBED ABOVE.

## IDENTIFICATION

MDMP  
CARDS... MDMP0001 THROUGH MDMP0008  
SPACE... 177 (OCTAL) = 127 (DECIMAL)



## APPENDIX F

## SWITCH CONTROL

THE 'I ADD REG' SHOULD BE SET TO 604. AT THE COMPLETION OF EACH ROUTINE THE PROGRAM RETURNS TO LOCATION 604, THIS IS THE FIRST INSTRUCTION IN THE ROUTINE TO TEST THE SWITCH SETTING.

D = DOWN            U = UP

ROUTINE	I/O	A	B	C	D	E	F	G
PRINT, PROGRAM CONTROL, 1 OR MORE FILES	D	U	U	U	D	D	D	D
PRINT, SINGLE SPACE, 1 OR MORE FILES	D	U	D	U	D	D	D	D
PRINT, DOUBLE SPACE, 1 OR MORE FILES	D	U	D	U	U	D	D	D
PRINT-PUNCH, FORTRAN COMBINED OUTPUT*	D	U	U	D	D	U	D	D
PRINT-PUNCH, SOS (PRINT BCD, PUNCH BINARY)	D	U	U	D	D	D	D	D
PUNCH, MIXED BCD AND BINARY, 1 FILE	D	U	D	D	U	D	D	D
PUNCH, BINARY ONLY, MULTIPLE FILES	D	U	D	D	U	U	D	D
PUNCH, BCD ONLY	D	U	D	D	D	D	U	D
WRITE, MIXED OR BINARY ONLY	U	U	D	D	D	U	D	D
WRITE, BCD ONLY	U	U	D	D	D	U	U	D

\* PROVIDED BY THE RAND VERSION OF THE FORTRAN MONITOR.  
THIS MAY ALSO BE USED FOR STANDARD FORTRAN MONITOR  
PRINT TAPE (A3), IF THE PUNCH SWITCH ON THE 1403 IS OFF.

## VALIDITY CHECK... (WHILE READING BCD CARDS ONLY)

CAUSE... AN ILLEGAL CHARACTER HAS BEEN DETECTED IN THE CARD JUST READ. THIS MEANS THAT THE HOLE CONFIGURATION IN A COLUMN OF THE CARD IS NOT AN ACCEPTABLE 1401 BCD CHARACTER. (SEE LISTING OF ACCEPTABLE 1401 CHARACTERS).

PROCEDURE 1... IF THE PERSON WHO IS RESPONSIBLE FOR THE CARDS IS READILY AVAILABLE TO CORRECT THE ERROR THEN GO TO PROCEDURE 2, IF NOT DO THE FOLLOWING...

- (A) REMOVE THE CARDS FROM THE STACKER. THE LAST CARD OF THE CARDS IN THE STACKER IS THE CARD IN ERROR. REMOVE THIS CARD AND SET ASIDE.
- (B) REMOVE THE CARDS FROM THE READ HOPPER.
- (C) PRESS THE 'NON-PROCESS RUNOUT' BUTTON TO CLEAR THE READ FEED OF CARDS. TWO CARDS SHOULD FALL OUT IN STACKER.
- (D) PLACE THE LAST CARD FROM THE STACKER (A) IN FRONT OF THE TWO CARDS FROM (C) AND PLACE THE THREE CARDS IN FRONT OF THE CARDS REMOVED FROM THE HOPPER (B).
- (E) PLACE A 'FLAG CARD' (THE CARD FOLLOWING CONTAINS AN 'ILLEGAL CHARACTER') IN FRONT OF THE CARDS FROM (D).
- (F) ASSEMBLE DECK IN PROPER ORDER AND RETURN CARDS TO PROGRAMMER.

PROCEDURE 2...

- (A) REMOVE THE CARDS FROM THE STACKER. THE LAST CARD OF THE CARDS REMOVED FROM THE STACKER IS THE CARD IN ERROR. SCAN THIS CARD FOR ILLEGAL CHARACTERS AND INFORM PERSON RESPONSIBLE OF COLUMN OR COLUMNS IN ERROR.
- (B) CORRECT THE CARD.
- (C) REMOVE THE CARDS FROM THE READ HOPPER.
- (D) PRESS THE 'NON-PROCESS RUNOUT' BUTTON TO CLEAR THE READ FEED. TWO CARDS SHOULD FALL IN THE STACKER.
- (E) PLACE THE CORRECTED CARD IN FRONT OF THE TWO CARDS IN THE STACKER (D) AND THEN PLACE THESE THREE CARDS IN FRONT OF THE CARDS REMOVED FROM THE READ HOPPER (C).
- (F) PLACE THE CARDS FROM (E) IN THE READ HOPPER.
- (G) ALTER I ADD REG TO 2721.
- (H) HIT START.

## TO SKIP FROM JOB TO JOB WHILE PRINTING OR PUNCHING

- (1) PUT SS F UP IN ADDITION TO SWITCH SETTING FOR OPERATION.
- (2) PROGRAM WILL STOP AT 0882 (PRINTING) OR 1338 (PUNCHING) WHEN THE JOB RECORD IS ENCOUNTERED.
- (3) TO PRINT OR PUNCH NEXT JOB PUT SSF DOWN AND HIT START.
- (4) TO CONTINUE SKIPPING, HIT START.
- (5) SS F MAY BE USED TO SKIP AND PRINT PORTIONS OF TAPE BETWEEN JOB RECORDS BY PUTTING IN THE UP POSITION TO SKIP AND IN THE DOWN POSITION TO RESUME PRINTING.

## TO SKIP FILES ON A PRINT OR PUNCH TAPE

- (1) PUT SS G UP IN ADDITION TO SWITCH SETTING FOR OPERATION.
- (2) WHEN AN EOF IS ENCOUNTERED THE PROGRAM WILL HALT AT 1980 AND PRINT THE MESSAGE 'FILE XX SKIPPED'.
- (3) THIS MAY BE USED IN CONJUNCTION WITH PUNCHING OR PRINTING OF A TAPE WITH MORE THAN ONE FILE WHEN ONLY CERTAIN FILES ARE TO BE PRINTED OR PUNCHED.
- (4) PUT SS G DOWN WHEN DESIRED NUMBER OF FILES HAVE BEEN SKIPPED AND HIT START, PUNCHING OR PRINTING WILL BE RESUMED.

## TO PRINT MORE THAN ONE FILE.

- (1) SET SENSE SWITCHES FOR DESIRED OPERATION.
- (2) WHEN SS C IS IN THE UP POSITION THE PROGRAM WILL HALT AT 1181 AS EACH EOF IS ENCOUNTERED AND PRINT MESSAGE 'FILE XX PRINTED'.
- (3) HIT START TO PRINT NEXT FILE.
- (4) WHEN THE DESIRED NUMBER OF FILES HAVE BEEN PRINTED, PUT SS C DOWN AND HIT START. TAPE 1 WILL REWIND AND THE PROGRAM WILL TRANSFER TO SWITCH CONTROL (SA=604).

## TO PUNCH MORE THAN ONE FILE (BCD TAPE)

- (1) SET SENSE SWITCHES FOR OPERATION.
- (2) WHEN SS F IS IN THE UP POSITION THE PROGRAM WILL HALT AT 1915 AS EACH EOF IS ENCOUNTERED AND PRINT THE MESSAGE 'FILE XX PUNCHED'.
- (3) HIT START TO PUNCH NEXT FILE.
- (4) WHEN THE DESIRED NUMBER OF FILES HAVE BEEN PUNCHED, PUT SS F DOWN AND HIT START. TAPE 1 WILL REWIND AND THE PROGRAM WILL TRANSFER TO SWITCH CONTROL (SA=604).

## TO PUNCH MORE THAN ONE FILE (BINARY TAPE)

- (1) SET SENSE SWITCHES FOR OPERATION.
- (2) WHEN SS D IS IN THE UP POSITION THE PROGRAM WILL HALT AT 1764 AS EACH EOF IS ENCOUNTERED AND PRINT THE

MESSAGE 'FILE XX PUNCHED'.

- (3) HIT START TO PUNCH NEXT FILE.
- (4) WHEN THE DESIRED NUMBER OF FILES HAVE BEEN PUNCHED, PUT SS D DOWN AND HIT START. TAPE 1 WILL REWIND AND THE PROGRAM WILL TRANSFER TO SITCH CONTROL (SA=604).

TO INTERRUPT WHILE PRINTING

1. PUT SS G UP.
2. PROGRAM WILL PRINT AND HALT.
3. LEAVE TAPE POSITIONED AS IS.
4. WHEN READY TO RESUME, JUST LOAD PERIPHERAL DECK IN AND GO.

INCORRECT MAN NO. FIELD IN JOB CARDS WHILE GOING CARD TO TAPE

1. PROGRAM CHECKS THE JOB CARD FOR PROPER MAN NO.

I.E.           H545  
                 RH545  
                 RZH545

IF NOT IN THE CONFIGURATION OF ONE OF THE EXAMPLES ABOVE, CARDS WILL CONTINUE READING AND STACKING NORMALLY BUT WILL NOT BE WRITTEN ON TAPE AND THE JOB CARD WILL BE PRINTED.

2. TO BY-PASS THIS CHECK (FOR OUTSIDE CUSTOMERS), PUT SS G UP ALONG WITH E.

#### PUNCH CHECK

WHEN THE MACHINE STOPS AT LOCATION 2288 THIS INDICATES THAT A PUNCH CHECK HAS OCCURED, THE OPERATOR SHOULD DO THE FOLLOWING...

- (1) THE CARD IN ERROR WILL FALL IN THE NP STACKER. THIS CARD SHOULD BE REMOVED AND DESTROYED.
- (2) HIT START.
- (3) WHEN PUNCHING RESUMES REMOVE THE FIRST CARD PUNCHED AND DESTROY IT.

## PROGRAM STOPS

3174

OCCURS WHEN BLANK RECORD HAS BEEN WRITTEN ON TAPE  
IN BINARY MODE

0882

OCCURS WHEN JOB RECORD IS ENCOUNTERED WHEN USING  
SS F TO SKIP FROM JOB TO JOB (PRINT TAPE)

1181

OCCURS WHEN EOF IS ENCOUNTERED WHILE PRINTING A  
MULTIPLE FILE TAPE.

1208

OCCURS WHEN SSG IS PLACED IN THE UP POSITION TO  
INTERRUPT PRINTING.

1338

OCCURS WHEN JOB RECORD IS ENCOUNTERED WHEN USING  
SS F TO SKIP FROM JOB TO JOB (PUNCH TAPE)

1559

OCCURS WHILE PUNCHING CARDS AND POCKETS 4 AND 8  
EACH CONTAIN ONE JOB, THIS ALLOWS THE OPERATOR  
TO KEEP THE PUNCHED CARDS FOR EACH JOB SEPARATE.

1587

OCCURS WHEN PUNCHING A MIXED MODE TAPE AND THE MODE  
HAS CHANGED FROM BCD TO BINARY.

1764

OCCURS WHEN EOF IS ENCOUNTERED WHILE PUNCHING A  
MULTIPLE FILE TAPE (BINARY).

1884

OCCURS WHEN PUNCHING A MIXED MODE TAPE AND THE MODE  
HAS CHANGED FROM BINARY TO BCD.

1915

OCCURS WHEN AN EOF IS ENCOUNTERED WHILE PUNCHING A  
MULTIPLE FILE BCD TAPE.

1980

OCCURS WHEN AN EOF IS ENCOUNTERED WHILE SKIPPING FILES  
WITH THE USE OF SS G.

2288

INDICATES A PUNCH CHECK HAS OCCURRED. SEE PROCEDURE  
FOR HANDLING PUNCH CHECKS.

0633

INDICATES NO SWITCH SETTING.

3333  
OCCURS WHEN A FULL REEL OF TAPE HAS BEEN USED AND  
THE REFLECTOR AT THE END OF THE TAPE HAS BEEN SENSED.  
THE OPERATOR SHOULD MOUNT A NEW TAPE AND CONTINUE  
CARD TO TAPE OPERATION.

MOCK-DONALD SYSPIT

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