INTERNATIONAL COMPUTERS AND TABULATORS LIMITED

THE ATLAS 1

COMPUTER SYSTEM

OPERATOR'S MANUAL

PART ONE

CENTRAL MACHINE AND SUPERVISOR

2nd Edition

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ATLAS 1 COMPUTER SYSTEM

OPERATOR'S MANUAL

PART ONE

INTRODUCTION TO 2ND EDITION

This document describes the features of the Atlas 1 computer and Supervisor as they affect operators. Details of the peripheral equipment and their operation are given in Part 2 of this manual, which is issued as a separate document.

The operating system as described here is intended to be that in actual operation at the end of March 1965. Any items previously proposed and described elsewhere are covered here only if they are implemented by this date. Particulars of errors in this document, changes made and further facilities as added will be given in the Atlas 1 Systems Programs Bulletins.

Any comments, criticisms and reports on errors in this manual should be sent to S.J. Dawes at 21 Portland Place, W.1.

C O N T E N T S

ATLAS 1 COMPUTER SYSTEM

OPERATOR'S MANUAL PART ONE

1. THE WORKING OF THE OVERALL SYSTEM

To the operators the Atlas system consists of the following main items:

1. The Engineers Console.
2. Teleprinters (capable only of printing out from the computer) to give information to operators or engineers on the state of the system.
3. Input peripherals (paper tape readers, card readers etc.).
4. Output peripherals (paper tape punches, card punches, line printers etc.).
5. Magnetic tape decks.

The Supervisor program is partly built in to the computer (the fixed store) and has part use of the main store (drums and core store). It also has exclusive use of the working store. The remaining parts of the Supervisor (i.e. those not in fixed store) are kept on a magnetic tape called the Supervisor tape, and are called into the main store whenever the system is started up (or re-started). The Supervisor tape is normally kept isolated as writing to it during normal operation is not required.

Ordinary programs are known as jobs. A job consists of a number of documents, i.e. a number of paper tapes and/or packs of cards. To perform a job these documents are all read in through input devices and any magnetic tapes required by the job are mounted. Then follows (not necessarily immediately) execution of the job, and then output from it. The time sharing facilities of the system are such that input for several jobs, execution of others and output for yet a third group may be progressing at one point in time.

Input and output information is held for a time on the system tape(s) by the Supervisor. This buffering arrangement is necessary to match the low speeds of input/output devices with the high speed of the central processor.

More details of the operation of the Supervisor are given in the remaining sections of this document. This is presented as a series of fairly self-contained topics, and it must be emphasised that this corresponds to the real-life behaviour of the Atlas system, with a large number of somewhat independent activities proceeding at one time, and with various incidents affecting operators liable to happen at any time. Thus the remaining sections of the document are not in any particular logical order, as no such order exists.

2. MACHINE TESTS

There are a number of machine test programs in the fixed store and these are used by the engineers during maintenance of the machine. However, there is also a series of tests, written so as to give a general test of certain parts of the machine without destroying any information belonging to programs in progress. They are entered every five minutes, and normal activity will be resumed automatically after three seconds provided no faults are found. During this three seconds all peripheral and magnetic tape activity will cease.

If faults are detected, an indication is printed on the engineers teleprinter. Them a loop stop occurs. The engineers should be notified. Normal activity can only be resumed by a restart. The indications given are as below (this information is intended mainly for the engineers, and is given here only for completeness).

The indication printed is

MACHINE TESTS FAILED XXXXXXXX

where XXXXXXXX is the "or" of various octal numbers from the table below, each bit indicating a failed test. The octal number is also displayed as B120 on the engineers console.

Digit and Lamp	Test
00000001	Instruction Counter will not store correctly.
00000002	Instruction Counter interrupting at the wrong time.
00000004	Instruction Counter failing to interrupt.
00000010	B-Store Switching Test failing.
00000020	Accumulator Test 12 Subtest 1 failing
00000040	" 12 " 2 "
00000100	" 12 " 3 "
00000200	" 12 " 4 "
00000400	" 12 " 5 "
00001000	" 12 " 6 "
00002000	" 12 " 7 "
00004000	" 16 " 1 "
00010000	" 16 " 2 "
00020000	" " 16 " 3 "
00040000	" 17 " 1 "
00100000	" 17 " 2 "
00200000	" 17 " 3 "
00400000	" 17 " 4 "

The purpose of these machine tests is to give a regular check on those parts of the machine which are not checked by hardware, and where faults arising might go unnoticed for a considerable time. It should be noted they cannot guarantee a complete absence of faults in the machine, as there may be an intermittent fault, or one only happening in circumstances not created by the tests.

(Note. The above does not apply on MUSE, where machine test failures lead to fault monitoring as described in the next section.)

2. MACHINE FAULTS

Various machine fault conditions are signalled immediately they occur to the Supervisor. They are then classified into two types, those where no repetition of the failed operation is made, and those where it is (all drum transfer failures).

The first group includes fixed and core store parity failures, crisis time failures on accessing core store for tape transfers, and drum transfers incomplete after one second. A full list is only of interest to the engineers. On one (or more) of these faults occurring, a five-second loop is entered to permit all peripherals to stop, and then the following is printed on the engineers teleprinter.

f XXXXXXXX

XXXXXXXX is 8 octal digits, each bit indicating one type of fault (see below for interpretation). If there are four or more faults, a loop stop is entered with XXXXXXXX also showing in B120. For three or fewer faults, test programs are entered. The details printed out should be passed to the engineers. The Supervisor then restarts automatically and the comment

SUPERVISOR RE-ENTERED
RESTART ALL INPUT FROM BEGINNING

is printed. (Note that this may not appear if there is a tape fault following the central machine fault). All input equipments and tape decks other than the Supervisor and System tapes are disengaged, and normal work may then recommence (i.e. all jobs completely in at time of failure will be executed, all others must be read again from the beginning).

The second type of fault is a drum transfer failure. The transfer is repeated until it has been tried seven times. If success is achieved before this nothing is printed. After seven attempts, information on the fault will be printed, and a further 43 attempts made. If no success is achieved after 50 attempts overall, the test programs are entered as above. Note that the fault printing may not in fact appear, as the program which performs it may itself be on the drum.

The fault printing takes the form

f drum (a) (b) (c)

where (a) is r for read
or w for write
(b) is one of

PARITY	
DCF	(Drum Count Failed)
DBI	(Drum Band Isolated)
DCA	(Drum Cabinet Absent)
DRI	(Drum Request Ignored)

(c) is four digits

Sector Number	(0-5)
Band Number	(0-7)
Drum Number	(0-3)
Cabinet Number	(0 on all machines at present)

Note that DBI will only come up through machine fault or because an isolation switch has been moved during operation, as the Supervisor checks all drum bands at start or restart and uses only non-isolated bands.

The various faults each have one bit which is printed and/or shown in B120 as above. The information is intended for the engineers, but is given here for completeness

Bit	Meaning
20000000	Non-equivalence on Interrupt Control
00000040	Non-equivalence tape or drum *
01000000	Fixed Store Parity
00200000	Working Store Parity
00400000	Tape parity or crisis time
4000000A	DRI
1000000A	DBI
0200000A	DCA
0040000A	DCF
0010000A	Drum parity
0002000A	Transfer complete after one second

A is 1 for drum read transfers, 5 for write.

When this printing appears on the teleprinter for a drum transfer, a second octal number follows the first, in the form 0a0b0c0d, where a,b,c,d are respectively, sector, band, drum and cabinet number.

* Footnote

This fault sometimes arises because of a faulty tape rather than machine error. This is when a block being read appears to contain more than 512 words.

4. PERIPHERAL EQUIPMENT FAULTS

All peripheral faults are detected by the Supervisor, and reported on the chief operator's teleprinter (except for faults in the teleprinter itself, for which see below). A list, with the necessary actions, is given below. In all cases the peripheral is disengaged. The comment as given below is printed followed by "reader" for an input device, or "p" for an output device, and then the identifier of the peripheral concerned. (See section 9).

4.1. Input Devices

DISABLED or OVERDUE

Report the fault to the engineer. When repaired (or alternatively using another reader), the document must be re-read from the beginning.

PARITY (7-track tape only)

Inspect the paper tape. If an even-parity character exists, or the tape is badly punched, the job cannot be run until a correct tape is prepared.

If the tape seems correct, the document should be read again from the beginning. Persistent failure should be reported to the engineer.

CHECK FAIL (Card Reader only)

Take the rejected card from the reject stacker, place at the base of the pack and re-engage. Persistent failure should be reported, and a specially prepared ***A card should be read to terminate the document. (In some conditions ***Z may be used, but it should be noted this permits the program to proceed with only part of the input stream present. A ***A card is one with 7 and 8 punched in Column 1, and "A" in column 80. Similarly for ***Z).

CARD LEVEL

The input hopper should be replenished with more cards and the reader re-engaged. Alternatively the stacker may be full, and should be emptied before re-engagement.

CARD WRECK

If a card is genuinely wrecked, report to the engineer. If the card appears good (or is damaged but can be reperforated) it may be placed at the bottom of the pack and the reader re-engaged. If the trouble is persistent, treat as CHECK FAIL.

4.2 Output Devices

In all cases, provided the device has been repaired or attended to as requested, the Supervisor will recommence output on re-engagement from the beginning of the record where failure occurred.

LEVEL

This implies a low level of stationery. The device should be re-loaded and re-engaged. (This stop on the line printer is sometimes due to paper break rather than low stationery.)

C FAIL

This is check fail on a card punch or Creed 3000 paper tape punch.

On the card punch no action other than re-engagement is necessary and the card will be re-punched. Cards to be removed from the pack are off-set. These may include correctly punched cards, since the punch is already punching another card when mis-punching in one is detected. However, such cards will be punched again on re-engagement, and so all off-set cards should be removed.

C FAIL on the card punch may also occur because of too many or too few interrupts (i.e. a hardware fault). This will lead to repeated failures and should be reported to the engineers.

On the Creed 3000 only re-engagement is necessary but the output tape must be labelled with a note indicating that it may contain spurious characters: it will be unsuitable for re-input and will not produce a clean print-out without editing.

On both devices frequent faults should be reported to the engineer.

O DUE and DA

Report to the engineer

O FLOW (Line printer only)

This implies more than 120 characters have been sent to a line. The Supervisor has a programmed check against this, so this message implies equipment fault and should be reported to the engineer.

DISENGAGEMENT OF TELEPRINTER

If a fault arises on the teleprinter itself, it will disengage, and the system will stop as soon as a queue of messages develops. The supply of paper should be checked. If this is adequate and correctly loaded, report to the engineer. The output can be transferred to another suitable device by an operators request to permit work to continue (See Section 10)

4.3 Log punch and teleprinters 0 and 1

If a fault develops, or paper runs out, on the log punch or teleprinter 0 or 1, the Supervisor will eventually idle. B120 will display (for a limited period only) an identifier for the device as follows.

Log Punch	0004202	(Muse)
	0004200	(London/NIRNS)
Teleprinter 0	0004260	
Teleprinter 1	0004261	

5. MAGNETIC TAPE FAULTS

Faults on magnetic tape are printed on the tape operator's teleprinter. They fall into two distinct types, known as E and F. With E-type faults it is possible for the Supervisor to attempt the operation called for again and this is done indefinitely if hand-switch 4 is set to zero. If however this switch is set to one, the number of attempts is limited to seven, and if this limit is reached the fault becomes F-type (F9). The occurrence of the fault is always reported, with the number of repetitions that took place.

With F-type faults it is not possible for the Supervisor to try to repeat the operation. The program concerned is stopped. TAPE FAIL is printed, and the usual monitor printing. It is common practice to try the job again using a different deck, or in some circumstances, a different tape, as this is often the easiest way of determining whether the fault is due to the deck or the tape.

The format of the E-type fault printing is

E m/n DECK N

xxxx yyyy

m is the fault number, n the number of repetitions made and N the deck number. Note that n will be printed as a maximum of 7, even if more than 7 repetitions have taken place. xxxx and yyyy are two block addresses (in octal) relevant to the fault. The faults are

E 1 Leading block address fault. xxxx is the block address encountered, yyyy is that required.

E 2 Trailing block address fault. Block addresses as with E 1.

E 3 Checksum failure.

E 4 Not 512 words.

E 5 Deck failure (e.g. vacuum or servo).

E 6 Store parity failure during tape transfer, also read or write crisis failure at London and N.I.R.N.S.

For E 3 to E 6, xxxx is the last block address read, and yyyy is the address of the block involved. Normally xxxx will be zero for forwards reading (because a trailing address was read last), but for backwards reading it will be yyyy-1.

The format of F-type fault printing is

F m DECK N

m is the fault number, N the deck number. The faults are as below. It should be noted the information is mainly for engineers rather than operators.

F 1 Failure to align tape to stop in time, after trying seven times.

F 2 Failure to stop when expected.

F 3 Stop bit not set in tape command register.

F 4 Direction and read bias level not set correctly.

F 5 Deck interrupt cannot be reset.
(A common cause of this fault is the opening of the door of the deck, or switching it to standby, whilst the tape is in actual operation. The program will be faulted on TAPE NOT DEFINED if it attempts a further operation whilst the deck is in this state. Thus if the door has been opened or the deck switched to standby inadvertently, the job should be run again.)

F 6 Failure to read block address interrupts.

F 7 Write bit not reset in tape command register after write transfer.

F 8 Read bit not set or reset before or after read transfer.

F 9 Failure to clear an E-type fault after at least seven attempts.
The E fault is also recorded.

6. JOB DESCRIPTION, WARNING SEQUENCE AND JOB TITLE FAULTS

Job descriptions are read and decoded immediately by the Supervisor, (as opposed to almost all other information, where the Supervisor merely performs a simple code translation and stores the information for later interpretation by the compiler or program concerned). Thus faults in job descriptions are reported immediately on the chief operators teleprinter, introducted by

INCORRECT FORMAT READER n

where n is the identifier for the input device concerned. This is followed by a copy of the line in which a fault has been detected. The device is disengaged. The job may be tried again when the job description has been corrected.

The only other fault in input information with which the Supervisor is concerned is when an incorrect warning sequence is found, e.g. ***Z not preceded by any information. In this case

FAULT READER n

is printed and the device disengaged.

A difficulty that occasionally arises is when wrongly prepared data results in no reported fault, but leads to the job failing to register as complete. Sometimes this is caused by the lack of ***Z at the end of a document: in this case a short tape, or cards, containing ***Z may be fed in immediately after that document and on the same input device. This procedure should only be attempted where the cause of the trouble is clear, or on consultation with a duty programmer if available. Note that if a further document is read in on an input device where a termination has been missing, it will have to be fed in again as it will not have registered.

More often failure to register is due to a discrepancy between the document headings and the input section of the job description. The operators should check that all required documents have been read in and that their titles do tally with those listed in the job description. The Spring Cleaning Routine is useful in analysing matters of this nature. (See Section 11).

7. PROGRAM RESULTS

The output from a program is mainly created by the program, and may take almost any form. However, the output is processed by the Supervisor, and certain standard information is printed before and after each stream of output from the program to permit identification and gives other useful information.

An example of what appears before each output stream is as follows.

```
00.00.01 / 20.11.63  16.50.49

OUTPUT 0

F1234, BEATLE SURVEY
```

00.00.01 is a number given to the output document by the Supervisor, and has no significance to the operator or programmer. Then comes the date and time at which the output concerned began to be printed. OUTPUT 0 indicates output stream 0 (a program is allowed up to 7 output streams). F1234, BEATLE SURVEY is the job title (the F1234 being in fact an account number).

Following these three lines is the program's output, and at the end of this will be, for example, END OUTPUT 5 BLOCKS, showing that there were 5 blocks of output in this stream.

There is also some standard output from the Supervisor at the end of a job, and this is printed on Output Stream 0. An example is as follows.

```
INSTRUCTION   990   450

STORE         32/24

INPUT 0       10 BLOCKS

OUTPUT 0      ANY 5 RECORDS
```

This shows that:

(i) 990 instruction counter interrupts had been encountered by the end of the program, of which 450 has occurred during compiling. (One such interrupt corresponds to 2048 instructions.)

(ii) 32 blocks of store were reserved by the program, and 24 were in fact in use on termination.

(iii) INPUT 0 contained 10 blocks (this line is repeated for all input streams).

(iv) Output 0 contained 5 records and this output was originally designated for "any" output peripheral. "Any" can however only be the line printer (this line is repeated for all output streams).

The above applies if the program terminates normally (i.e. on completion of the calculations). However, programs are often terminated by the Supervisor because of faults in the program or data, and in this case there is some further printing on Output Stream 0 just before the standard printing described above.

This monitoring printing begins with a reason for termination e.g. INPUT ENDED (a full list is in the programming manual) followed by some standard printing and possibly some private monitoring if the program has arranged for any. This printing is described in the programming manual. If the program is rejected before the end of compiling the two instruction counter interrupt figures will be the same.

It should be noted that compilers also use Output Stream 0 for monitoring printing. This printing is described in the appropriate compiler manuals.

8. THE LOG TAPE

Punch 0 (1 on MUSE) is reserved for the log tape. This may be printed out for inspection, and/or processed by a further computer run to give statistical records and accounting information. It gives basically one entry per job run, with an occasional report of starting or restarting of the Supervisor.

On each start or restart, the following is printed

RESTART SUPERVISOR XXXXXXXX

XXXXXXXX is the time (but is not readily comprehensible being 6 4-bit BCD digits expressed in octal).

On a machine fault

JOBS n

is punched on the log tape, where n is the number of jobs completed at the time.

For each job in general there are 7 lines of print. Specimens, with explanation, are given below

16.50.47 20.11.63

F1234, BEATLE SURVEY

This is the time of beginning to execute the program, date and job title.

10 X

This shows 10 blocks of input. X indicates the device, for which see table below.

5 YZ

This shows 5 units of output. Y determines whether the unit is blocks or records, and Z indicates the device (table below). There is one such entry for each output stream, across the line.

2 155 16

This shows 2 tape decks were reserved, 155 blocks were transferred, and 16 seconds were spent waiting for tape transfers.

32 24 2 812 990 371 627 1276

This indicates

32 store blocks reserved by the program

24 store blocks in use when program ended

2 is the number of the compiler used (see table below)

812 instruction counter interrupts at end of compiling

990 instruction counter interrupts at end of program

371 drum transfers

627 instruction counter interrupts obeyed in Supervisor since the last such logging

1276 times around the Supervisor idling loop since the last such logging. Note that 4 times round the idling loop is approximately equivalent to one instruction counter interrupt.

16.51.07

This is the time the program finished execution.

Table of input device code letters (X above)

B	TR5 0	
C	TR5 1	
D	TR5 2	
E	TR5 3	
F	CRO	(Muse only)
G	TR7	(Muse only)

At London and N.I.R.N.S., as above except

F	CRO	
G	CR1	

Table of output devices (YZ above)

RA	Records (lines) on ANY
BB	Blocks of 7-track tape
RC	Records (lines) on printer
BD	Blocks of 5-track tape
RE	Records (cards) on card punch

Table of compilers

Note: the numbers given do not indicate the order of the compilers on the Supervisor tape. This list only includes the compilers commonly used.

1	IIC
2	ABL
3	EMA
4	AA
5	MAC
6	CC
7	TAD
8	BINA
9	HARTRAN
12	ALGOL

9. PERIPHERAL IDENTIFIERS

Each peripheral has an identifier, consisting of 3 octal digits. This is in fact the V-store address of it (less a constant), and is used when the peripheral is referred to by the Supervisor when printing error messages etc.

160	TR5 0	
161	TR5 1	
162	TR5 2	
163	TR5 3	
200	Teletype 0	
201	Teletype 1	
202	Teletype 2	
203	Teletype 3	
100	Line Printer 0	(London and N.I.R.N.S. only)
101	Line Printer 1	(all machines)
040	TR7 0	(Muse only)
140	Creed 3000 0	(Muse only)
000	CR 0	
001	CR 1	(London and N.I.R.N.S. only)
220	CP 0	
260	Teleprinter 0	
261	Teleprinter 1	
262	Teleprinter 2	(London and N.I.R.N.S. only)
164	Data link input	(Muse only)
164	8-track TR5	(London only)
166	Data link input 0	(London only)
167	Data link input 1	
204	Data link output	(Muse only)
206	Data link output 0	(London only)
207	Data link output 1	

It should be noted that the three teleprinters are intended for messages to the chief operator, tape-room operators, and engineers. However, it is possible to have alternative arrangements as to which teleprinter is used for various types of message, and local systems prevail.

10. OPERATOR REQUESTS

10.1 Introduction

The facilities described in this section enable an operator to 'communicate' with the Supervisor. The operator may interrogate the Supervisor in order to obtain certain information pertaining to the system as a whole or to a particular job in the system, or he may inform the Supervisor of changes that may have happened to the peripheral system, about which the Supervisor would otherwise have no knowledge, or he may pass on other information usually of a temporary nature which could cause a certain amount of disrupting to the normal flow of the Supervisory system.

10.2 Conventions and Headings

At the start of day the operators input is defined as the engineers reader 160 (see section on identification of peripherals). Operator requests are only acceptable on the operators input peripheral; the only exception to this rule is the request to change the allocation of the operators input which is acceptable at any input device (since the need for such a request may arise because the current operators input device has become unserviceable). Note that ordinary programs and data may also be fed into the operators input peripheral in the normal way.

As mentioned in Section 9, teleprinters are used for messages to operators. If a fault condition arises on any of these output devices, the Supervisor makes no attempt to take over another output peripheral for operators use, but disengages the faulty device every 1 second; it is the operators responsibility to notice this and to take the necessary action. There are requests available to redefine the operators output media.

All requests must begin with the two letters XR or XT (but see section 10.7); this defines the request type, and these must be followed by two octal digits which identify the particular request. These 4 characters are collectively termed the request identifier. The letter X indicates to the Supervisor that what follows is to be treated as an operators request; R indicates that the request must have been input on the operators input and T indicates that the request is to be accepted irrespective of which input device the request was read in on. Each request has a unique type, this type being cross-checked against a list kept by the Supervisor, and if a discrepancy is found then the request is faulted.

All action taken by the Supervisor as the result of an operators request initiates some output on the main operators output; a request should not be assumed to have been completed until this output has appeared and has been checked (the output may be fault printing). For the majority of requests this output is immediate, but in some cases, especially those which involve tape transfers, this output may be delayed.

All requests must be terminated by ***Z, or if a string of requests is being input then each may be terminated by ***C and the final one only by ***Z.

All requests normally consist of 3 records. The first record consists of the request identifier as explained above, and it may also contain a comment. There is no need for an introductory warning character before this comment. The Supervisor takes no notice of this comment, and it is purely for the convenience of the operator. The second record is called the information line. This varies for each request and full details are listed below. The third record is the terminator, usually ***Z.

Note that it is not possible to include a comment in the information line.

The total number of characters in any operators request must not exceed 512. Spurious run out characters are included in this total but these, together with all shift, set change, layout, backspace and erase characters, are ignored by the decoding routine.

10.3 Identification of Peripherals

Peripherals referred to in requests are identified as in Section 9, but note also that magnetic tape decks are specified by T followed by the deck number.

10.4 Faults

Whenever a fault is detected in an operator request information is printed out on the operators output to enable the operator to detect the error. Fault printing consists of not more than 3 lines. The first line is always of the form 'operator request f n' where n is the fault number and lies in the range (0,7). The second line consists of the request identifier with a space character inserted between the request type and the request number. The third line is the information line of the request printed out in its unreconstructed form, but this line is only printed out if the detected fault lies within the line itself. Multiple faults are not detected, fault printing being activated as soon as the first fault has been found.

A detailed description of the faults detected and the monitor information given is given in section 10.6

10.5 Description and Action of Available Requests

Out of a possible total of 64 requests only about 30 have so far been defined. The requests are divided into groups of 8 (corresponding to the first octal digit in the identifier) and there are 8 groups in all. Groups or requests not mentioned are not used.

10.5.1 Group 0 Requests

This group of requests is concerned with changing the priorities of jobs within the machine or with finding out the state of a particular job.

The information line of the request is the title of the job concerned and must be punched obeying the same rules that apply to job titles in ordinary job decriptions, viz. backspace is ignored, all erases are ignored, multiple spaces or tab are all treated as a single space unless they occur at the end of the title in which case they are ignored altogether. A single space at the end of a title is also ignored and a title must not contain more than 80 useful characters.

XR00: gives a job top priority. The specified job is dealt with as soon as possible, and any programs currently under execution are suspended if necessary to make room for it. The only exceptions to this are (a) if the specified job needs more store or tape decks than are currently available or (b) if all suitable output peripherals are engaged in long sets of output. However, when the store and peripheral requirements of the job can be met, it will be immediately executed.

XR01: gives a job high priority. The specified job is put at the head of the queue of the jobs waiting to go to the active list; if it is already on the active list then it will be put to the head of that list. The job will then be put onto the execute list in the normal manner.

XR02: gives a job normal priority. No exceptional treatment will be accorded this program; this request will only be used for a job which has previously been accorded some other priority.

XR03: gives a job low priority. The specified job is treated as a normal job until it reaches the execution stage when it is always placed at the bottom of the execute list. The job will only be executed when all other jobs on the execute list are halted.

For requests 00 - 03 two lines of printing are printed on the operators output. The first line is the job title and the second is

JOB GIVEN (-) PRIORITY

where (-) may be TOP, HIGH, NORMAL or LOW.

XR04: gives the state of job. This request will normally only be used to find the state of long computing jobs. The response consists of a maximum of 3 lines. The first line is the job title and the second is of the form

JOB ON (a) LIST. (b) PRIORITY

where (a) is JOB, ACTIVE or EXECUTE and (b) is TOP, NORMAL or LOW. Alternatively the second line of output may be

JOB COMPLETED

or INPUT INCOMPLETE

In this case the job has not been found on any of the job, active or execute lists. The fact that the job has been completed should be obvious to the operator (bearing in mind that this request is only intended for use on long computing jobs). The alternative statement will only apply if the job is a multi-document job and the missing document(s) do not include the job description document. Note that JOB COMPLETED will appear if the job has never been in the machine, or if a title is wrongly quoted. No information as to where the output was sent is given if the job has been completed.

If the job is on the execute list and also is the job that is currently in control of store then a third line of the form

INSTRUCTIONS OBEYED n

is printed where n is a decimal number indicating the number of instruction count interrupts so far logged against the program.

XR05: kill job. This causes cessation of all activity on the specified job, provided it is on any of the job, active or execute lists, except that any output generated at the time of the request will appear. The response consists of two lines. The first is the job title and the second is

JOB KILLED

The log output will relate to the work done on the job up to termination, and on Output Stream 0 will be recorded

ENDED BY REQUEST

10.5.2 Group 2 Requests

This group of requests is used to remove peripherals from the Supervisor system, to put them back into the system again and also to redefine the operators input and output media. The information line of the request is the peripheral identifier.

XT20: transfer operators input. Note that this is an XT type request and is therefore acceptable on any input device. The response printed out for this request is

OPERATORS INPUT TRANSFERRED TO (-)

where (-) is the identifier of the new peripheral. Although this request is intended to be used primarily if the original operators input is disabled, no check is made to verify this.

XR21: transfer operators output. This request will be used when the operators output breaks down, but it does not check this. The response to this request is

OPERATORS OUTPUT TRANSFERRED TO (-)

Note that the response will be put out on the new device. If the specified peripheral is already being used by the Supervisor to output documents for a job then this output together with any backlog of output will be completed before the response to this request is given.

XR22: transfer tape operators output. This request is identical to XR21 except that it operates on the tape operators output. The response is

TAPE OPERATORS OUTPUT TRANSFERRED TO (-)

It is not permissible for the main operators output and the tape operators output to be defined as the same peripheral.

XR23: free peripheral. This request is to tell the Supervisor that a certain peripheral is to be unavailable to the system for a considerable period of time.

Freeing an input device has the effect of immediately disengaging the device and setting a disabled marker in the peripheral table in the working store. No attempt is made to complete the reading in of any current document. For an output device however, the output of the current document is completed and then the device is disengaged and taken out of the system. Further output is diverted to another (if possible, similar) peripheral, and any linking involving this peripheral (as set up previously for a Group 4 request) is overridden.

The response printed for this request is

(-) FREED

XR24: stop and transfer peripheral. This request permits a peripheral to become vacant almost immediately either because there appears to be something wrong with it or because it is urgently wanted for a high priority job and would otherwise not become available for a long time. This request has the same effect as XR23 except that for an output device, the current document is abandoned at the point reached. The document is re-output, from the beginning, on another, (if possible similar) peripheral and any linking (as set up by a group 4 request) is overridden.

The response printed for this request is

(-) STOPPED AND TRANSFERRED

XR25: reconnect peripheral. This request is the complement of XR23 and XR24. Normally a peripheral will be assumed to be available whenever its engaged button is pressed, but if an XR23 or XR24 request has been made on the peripheral, then it will be treated by the Supervisor as if it were non-available until this request has been made. The response printed for this request is

(-) RECONNECTED

Peripherals may also be reconnected by certain of the group 4 requests.

For requests XR23, 24 and 25 the term peripheral includes magnetic tape decks.

XR26: delete current output. Causes termination of output of a document currently coming out on a specified peripheral. The second line of the request is the peripheral identifier. The response is

(-) OUTPUT DELETED

10.5.3 Group 4 Requests

This group of requests is mainly concerned with the linking of input and output channels. There are five distinct types of linking available which give the operator varying degrees of control over the destination of output documents. Within the private stores of all peripherals (working space used by the Supervisor) are certain digits which indicate whether the peripheral is in a REMOTE or SEMI-REMOTE state. Combinations of these digits determine the nature of the linking.

At present the linking of peripherals is strictly (1,1) but this may be changed at a later date.

The information line of requests XR40 - XR45 consists of two peripheral numbers separated by an oblique stroke (solidus), magnetic tape decks cannot be specified as either input or output peripherals.

If either or both of the peripherals to be linked is in a freed state (see XR23), then the letter R implying reconnect must be punched before the peripheral number.

XR40: permanently lock peripherals (input A remote output B remote). Irrespective of the type of device requested in the job description all jobs read in on A (more specifically, jobs whose job description document is read in on A) will have all their output streams put out on B. No other output will appear on B.

XR41: Link peripherals (A remote, B semi-remote).

Provided the job description is compatible (i.e. specifies the same peripheral type) all output for jobs read in on A will appear on B. Other output documents may also appear on B.

XR42: lock peripherals (A remote, B remote).

Provided the job description is compatible all output for jobs read in A will appear on B. No other output will appear on B.

XR43: make peripherals semi-remote. (A semi-remote, B semi-remote).

Provided the job description is compatible output will probably appear on B. Output for other jobs may also appear on B. (Probably here means in effect, if the peripheral is not already in actual use).

XR44: associate peripherals (A semi-remote, B remote).

Provided the job description is compatible output may appear on B but it may also appear elsewhere Output from other jobs will not appear on B.

The responses printed for requests XR40 - 44 are of the form

(a) AND (b) (c)

where (a) and (b) are the peripheral identifiers and (c) is appropriately PERMANENTLY LOCKED
LOCKED
LINKED
ASSOCIATED
MADE SEMI REMOTE

All of these requests can be countermanded by an XR45 request (see below) but note also that due to the linking being strictly (1,1) if a is linked to b, c to d and a request is used to link a to d, then peripherals b and c are both made normal.

XR45: normalize peripherals

normally used to countermand a request in the XR40 to XR44 range.

The response printed is (a) AND (b) NORMALIZED

XR46: give state of peripherals. This request needs no information line. The amount of output depends on the state of the peripheral system, but the response always begins with the following two lines:

STATE OF PERIPHERALS

OPERATORS INPUT AND OUTPUT ARE (a) (b) (c)

where (a) is the operators input, (b) the operators output and (c) the tape operators output. Next, each disabled peripheral is listed

(a) DISABLED

Following this any linked peripherals are listed

(a) AND (b) (c)

where (c) may be PERMANENTLY LOCKED
LOCKED
LINKED
ASSOCIATED
or SEMI REMOTE

The final line to be printed is

REMAINING PERIPHERALS NORMAL

and this is printed even if all the peripherals in the system have been mentioned in the preceding lines of output. No information on the state of magnetic tape decks is given.

XR47: give state of Supervisor parameters. Like XR46 this request needs no information line. The parameters printed are only those concerned with the amount of core store and drum store available. The response to this request lists the areas of main store that are not available to the main programmer. Initially the line

STATE OF SUPERVISOR PARAMETERS

is printed. Next, lines of the form CORE PAGES a b c d ... are printed, where a, b c etc. are absolute page numbers of the parts of core not available. A maximum of 16 page numbers is printed so that for a 32K core store machine 4 such lines could be printed. The heading CORE PAGES is always printed even if there are no available pages in a section of 16 so that for example MUSE with 16 K of store available will have this heading printed twice.

Unavailable areas of drum store are printed out as follows

DRUM n

b i

b j s k b j s l

where n is the drum number and band i and sectors k and l on band j are unavailable. The heading DRUM n is always printed, and any unavailable areas on that drum are listed below it.

Finally the total number of blocks available is printed

TOTAL STORE AVAILABLE n BLOCKS

This gives all blocks which can be used by Supervisor and ordinary programs. The number used by the Supervisor is not fixed, varying with the workload, but is about 50. Thus approximately n-50 blocks are available for programs, including compilers. Full details are in Section 20.

10.5.4 Group 5 Requests

This group consists of requests to print lists of jobs currently in the system

XR50: print state of active list. For each job on the active list, the title is printed. The list is preceded by

STATE OF ACTIVE LIST

XR51: as XR50, but for execute list

10.5.5. Group 6 Requests

This group consists of miscellaneous requests, and the information line is dependent on the request number.

XR60: Remove core store pages from system.

XR62: Replace core store pages back in system.

The purpose of these requests is to change the amount of core store available at any time.

The information line of these requests consists of two absolute page numbers P_1 and P_2 separated by an oblique stroke (solidus). If only a single page is affected then the information line need only be that single page number. Note that e.g. 20/16 is the same as 16/20.

If a page specified is locked down (this is the case if the contents are involved in a peripheral, drum or tape transfer) then the response to an XR60 request will be delayed until this locked down page is free to be removed from the core store.

The response printed for both requests is of the form

SUPERVISOR PARAMETERS ACCEPTED

XR61: Remove drum sectors from system.

XR63: Replace drum sectors back in system.

This pair of requests is very similar in nature to the XR60 and XR62 requests, except that they deal with the drum store. The information line of both requests is of the form

$$d \;/\; b \;/\; S_0\ S_1\ S_2\ S_3\ S_4\ S_5$$

where d, b, and all the S_i are all single digit numbers.

d is the drum number (0 to 3)
b is the band number (0 to 7)
and S are sector numbers (0 to 5)

Alternative permissible formats are

i) d
ii) d / b

where i) a complete drum is required to be removed or replaced and ii) where a complete band is similarly to have its state changed. Not all S_0 - S_5 need be specified so a permissible format would be 0 / 1 / 234

The response printed for both these requests is the same as that for the preceding pair of requests, but if the band specified, or in the alternative case (i) one of the implied bands, has been reserved by a main program, then for the XR61 request the following is printed and that particular band is <u>not</u> removed from the system

REMOVE DRUM STORAGE

Dd Bb RESERVED

where d and b are respectively the drum and band numbers.

XR64: Batch Compile

This request tells the Supervisor that a number of jobs are expected using a specified compiler, and that once it has been called into main store from tape it should be kept there until further notice.

The information line of this request consists of the compiler name punched exactly as it would be in a job description document.

The response printed is

COMPILER (n) AVAILABLE

where (n) is the compiler name.

XR65: End batch compiling

This countermands XR64. The information line is the same as for XR64 but the response is of the form

COMPILER (n) DELETED FROM STORE

where (n) is the compiler name.

The effect of this request is immediate. The job list is not scanned to see whether any of the uncompiled programs need the specified compiler.

When batch compiling is in operation the amount of store available is reduced by the amount of space that the compiler itself occupies, so that batch compiling with large compilers and certainly with more than one compiler is not to be recommended. What will probably happen is that the Supervisor will reject jobson the grounds that no space is available.

10.6 Operator Request Fault Printing

10.6.1 Introduction

Whenever a fault is detected in an operator request the heading

OPERATOR REQUEST F n

is printed, where n is the fault number. If the fault has occurred in the first line of the request this line is then printed direct from the input buffer; the fault itself will lie in the request identifier, but if the operator has put any comment after the identifier then this will also be printed. If the fault has occurred in the information line of the request then after the heading has been printed the request identifier is printed in its reconstructed form on a new line and this will then be followed on a new line by the faulty second line printed directly from the input buffer.

Throughout this document all responses have been printed in upper case characters, but in actual fact all printing is in lower case characters. Certain characters that are available in the Flexowriter code are not printable on the teleprinter. However, all the information necessary to implement any request is available both in Flexowriter and teleprinter character codes. All run-out (upper case) characters are ignored provided they are introduced and terminated by a newline character. If a fault occurs in a line containing spurious run-out characters then these will appear on the teleprinter as square brackets.

Multiple faults in a request are not detected, i.e. once a fault has been found fault printing is initiated and any further faults that may be present are ignored

Faults common to all requests are as follows:

f0 Buffer exceeded. All requests must contain not more than 512 characters; this includes shift, set change and spurious run-out characters. This fault is never likely to arise unless the operator has punched 10 ft. of run-out in the middle of the request. (1)

f1 character missing in first line of request e.g. only one octal digit in the request number. The complete unreconstructed first line (together with any comment that may be present) of the request is printed.

f2 request not read in on operators input, or, unassigned request, or,

XR or XT followed by the wrong request number.

The printing for faults 0 - 2 consists of a heading and then the unreconstructed first line of the request.

The meanings of the remaining fault numbers 3 - 7 are dependent on the request number. The printing for these faults consists of 3 lines, the first is the heading, the second the reconstructed request identifier (if any comment was punched this is not printed), and the third is the unreconstructed information line.

10.6.2 Group 0 Requests

f3 title of job too long. A title must not contain more than 80 characters.

If the job title is not recognised then the following is printed

```
XR 0 -
(title)
TITLE NOT RECOGNISED
```

10.6.3 Group 2 Requests XT20 to XR26

f3	format
f4	unassigned peripheral (or input device for XR26)
f5	device out of use (does not apply to XR25, and may mean non-existent tape deck)
f6	wrong type of device, or not in correct state.
f7	new device same as current one (XT20 to XR22 only)

10.6.4 Group 4 Requests XR40 to XR45

f3	format error
f4	unassigned peripheral
f5	peripheral freed and R not in request
f6	both input or both output devices
f7	output device given first, or already waiting to be linked

10.6.5 Group 6 Requests XR60 to XR63

f4	format error
f5	drum or page number too large

10.6.6 Group 6 Requests XR64 and XR65

f3	format error
f4	more than eight characters in compiler name

and if the compiler title is not recognised

XR64 (or XR65)
COMPILER (n) NOT RECOGNIZED

where (n) is the compiler name, is printed.

Note that no fault printing (other than f0, 1 or 2) can arise from the requests XR46, XR47, XR50 and XR51.

10.6.7 Examples

Below is a list of examples, which if punched as printed would be accepted as valid requests.

```
XR01            Give job high priority
F1234, SQRT  OF  1M  NUMBERS
***Z

XT20            Transfer operators input to reader 161
161
***Z

XR25            Reconnect punch 203
203
***Z

XR40            Permanently lock 161 to 101
161/101
***Z

XR43            Reconnect 162 and make semi-remote to 200
R162/200
***Z

XR46            Give state of peripherals
***Z

XR60            Remove core pages 26-31 from system
26/31
***Z

XR62            Replace page 29
29
***Z

XR61            Remove band 3 drum 2 from system
2/3
***Z

XR63            Replace sectors 3 and 5 band 7 drum 0
0/7/35
***Z

XR64            Batch compile with ABL
ABL
***Z
```

10.7 Differences in the Form of Operators Input Messages for the London and N.I.R.N.S. Atlas Installations

These differences are all concerned with the format of the requests, namely instead of a symbolic request identifier such as XR43 an English statement is used. The information line of the request remains unchanged.

One important difference is that it is not permissible to punch comments alongside the request identifier.

There is no need to include the type of request with the request identifier.

Whenever fault printing occurs an English request identifier is printed rather than a symbolic one.

These differences should be made clear by the examples at the end of this section.

It is still necessary to be able to distinguish requests from ordinary main programs input, so for this reason an X is still needed before all requests.

Below is a list of the MUSE identifiers and the corresponding identifiers that must be used on the London and Harwell machines.

XR00	XGIVE JOB TOP PRIORITY
XR01	XGIVE JOB HIGH PRIORITY
XR02	XGIVE JOB NORMAL PRIORITY
XR03	XGIVE JOB LOW PRIORITY
XR04	XGIVE STATE OF JOB
XR05	XKILL JOB
XT20	XTRANSFER OPERATORS INPUT
XR21	XTRANSFER OPERATORS OUTPUT
XR22	XTRANSFER TAPE OPERATORS OUTPUT
XR23	XFREE PERIPHERAL
XR24	XSTOP AND TRANSFER PERIPHERAL
XR25	XRECONNECT PERIPHERAL
XR26	XDELETE CURRENT OUTPUT
XR40	XPERMANENTLY LOCK PERIPHERALS
XR41	XLINK PERIPHERALS
XR42	XLOCK PERIPHERALS
XR43	XMAKE PERIPHERALS SEMI REMOTE
XR44	XASSOCIATE PERIPHERALS
XR45	XNORMALIZE PERIPHERALS
XR46	XGIVE STATE OF PERIPHERALS
XR47	XGIVE STATE OF SUPERVISOR PARAMETERS
XR50	XACTIVE LIST STATE
XR51	XEXECUTE LIST STATE

```
XR60    XREMOVE CORE PAGES
XR61    XOMIT DRUM STORAGE
XR62    XREPLACE CORE PAGES
XR63    XINCLUDE DRUM STORAGE
XR64    XBATCH COMPILE
XR65    XCEASE BATCH COMPILING
```

No deviation in the spelling of these identifiers is permitted.

Examples

```
XGIVE JOB TOP PRIORITY
F1234,  SQRT OF 1M NUMBERS
***Z

XREMOVE CORE PAGES
19
***Z
```

Note that although only one page is to be removed from the system it is still essential that 'PAGES' and not 'PAGE' is punched in the request identifier.

```
XNORMALISE PERIPHERALS
163/101
***Z
```

This request would produce the following fault punching since 'NORMALIZE' is spelt incorrectly.

```
OPERATOR REQUEST F2
XNORMALISE PERIPHERALS
```

10.8 Additional message at London and N.I.R.N.S.

A message has recently been added at London and N.I.R.N.S. to disengage a tape deck. This is not necessary on MUSE because of the lack of tape switching facilities there. The message is used to disengage a tape which is currently off-channel, e.g. a tape that has been mounted and engaged in error. The message is

```
XDISENGAGE DECK
n
```

where n is the deck number.

The only fault possible with the message is if n specifies a non-existent deck, and then is printed

```
DECK NUMBER UNKNOWN
```

11. THE "SPRING CLEANING" ROUTINE

It is often useful to obtain a report on the state of documents associated with incomplete jobs currently within the machine. This is done by reading in a short program known as "Spring Cleaning".

There will then be printed on the line printer two lists of document titles. The first list is headed by

SPARE DOCUMENTS

and gives the title of each document currently in the system for which no call by a job description yet exists. The second list is headed by

DOCUMENTS NOT HERE

In this list each document title is followed by

REQUIRED BY JOB

and the job name.

12. CONSOLE OPERATION

The Atlas console is normally used by the engineers. Once the Supervisor is running and jobs flowing through the system, no console operation is required. However, it is necessary to start the system off from the console and similar actions are necessary for restarting after various incidents.

Most of the actions on starts or restarts are determined by the number set up on the 8-bit register on the console labelled "Operand". The bits are numbered 7 down to 0, from the most significant end, and the contents of the register are often expressed as an octal number in the range 0.0 to 31.7.

The normal course of events on starting assuming that Supervisor and System tapes(s) are loaded and on "Auto", is as follows.

1. Press "Reset" button.
2. Set 6.6 on the operand register.
3. Press "Engineers Interrupt" button.
4. Press "Single" button (if "Prepulses" light is off).
5. "Engage" Supervisor tape and all output devices.
6. Set value of Mode in operand register. Bit 0 (least-significant bit) last (See below for Mode).
7. Engage system tape(s).

Notes

a) The machine must be in the "Auto" condition before the procedure for starting will work. It should normally be left this way after any engineering intervention, but if it is not, the engineers should be notified.

b) "Reset" disengages all tape decks, and stop prepulses.

c) The 6.6 is read by a fixed store program entered by the Engineers Interrupt. Other values of the operand at this point are used by engineers only.

d) Once "single" has been pressed, the fixed store program assumes the highest number engaged deck holds the Supervisor. If no decks are engaged (as will be the case following the above procedure), it waits until one becomes engaged.

e) The pressing of Bit 0 in Stage 6 above for normal modes of operations, causes the Supervisor idling loop to be entered. Any tapes then engaged are detected as system tapes if they are so labelled in their block 0. The Supervisor will not accept input (input devices engaged will immediately be disengaged) until a Systems Input tape has been engaged or until Bit 0 is changed back to 0. If Bit 0 is changed to 0 before any Systems Input tape has been engaged, the Supervisor will operate without one, but of course at much reduced efficiency for most work. Once ordinary input has commenced System Tapes must not be engaged unless all peripherals have stopped, with all current documents complete, and no program is in execution.

The beginning of input must await not merely the engagement of the system tapes, but a correct report on this on the magnetic tape teleprinter.

f) For restarting, the procedure above can be simplified if the Supervisor tape is already engaged. "Reset" should be omitted and it will not be necessary to re-engage any device. "Single" should be pressed if and only if there are no prepulses. The Supervisor tape must be on the highest numbered engaged deck.

g) The normal modes of operation are as follows:

(i) Start Clear Mode 16.1

This assumes no jobs in the machine

(ii) Normal Restart Mode 0.1

Complete jobs on the system tape will be run, provided the system deck(s) are unchanged. Note that complete documents associated with incomplete jobs are lost, and so must be read again. All partially executed jobs are started from the beginning. Thus some output may appear twice.

(iii) Restart after Deck Change Mode 8.1

As (ii), but system tape decks changed.

With any of the above, bit 5 may be set and from then on one job at a time will be run. This bit may be changed (either to or from the one-job-at-a-time mode) at any time. The precise effect of setting bit 5 to 1 is to prevent new jobs entering the execute list until that list is empty, but jobs already time sharing continue to do so. Clearing bit 5 takes effect either from the end of a job or on a new job being added to the job list.

The type of job to be executed in this mode can be specified by setting Handswitch 4, 3 and 2 to form an octal digit corresponding to a job type as follows.

0	Top Priority Job
1	Tape job
2	Anelex Job
3	7-hole Job
4	5-hole Job
5	Card Job
6	Long Job

This selection is only operative if handswitch 0 is set to 0. If there are no jobs in the selected queue, a job will be chosen from another queue, with preference given to jobs of highest priority.

This facility is currently only included at London and N.I.R.N.S.

h) Other special modes of operation are as follows:-

(iv) Restart and await modifications

Use any combination above, but also set bit 1 (giving modes 16.3, 0.3, 8.3, 16.7, 0.7 and 8.7). This is for use by Supervisor Programmers only.

(v) Store Restart Information Mode 2.1

This entry is used as an alternative to running down the system by ceasing input and waiting for all jobs to be finished. Its effect is to transfer enough information on current jobs to the system input tape (or combined input/output tape) to permit restart later with this tape.

On entering in this manner there will be a loop until the system tape(s) are engaged, then the "restart block" will be transferred to the system input (or combined) tape. Then a further loop stop with tape faults (if any) displayed in B120. Thus provided B120 is clear, the tape may be unloaded for use later.

(iv) Recover Restart Information Mode 10.1

This is associated with (v). On entry there will be a loop until some tape other than the Supervisor is engaged. It will then assume the restart block is on this tape, recover it, disengage this tape and enter the idling loop. Re-engagement of the system

tape will then permit restart as in (iii).

i) It should be noted that in item 5 "all output devices" must include the log tape and the teleprinter. No start is possible on any work until these are engaged.

13. THE JOB QUEUES AND THE SUPERVISOR DISPLAY

In principle any set of jobs may be presented to the system in any order, and all will be executed. However operation will be more efficient if the "mix" of jobs is planned to exploit the scheduling features, and this section is intended to give enough information to permit operators and others to understand the way in which jobs flow through the system.

As its input is completed, each job is placed in one of several queues depending on certain characteristics as stated in the job description. Within each queue, the jobs are listed in the order in which this input is completed. There are three main queues:-

Tape queue	All jobs specifying the use of tapes.
Long job queue	Jobs not specifying tape, but estimating more than 20,000 instruction counter interrupts.
Short job queue	All other jobs. These jobs are further classified by the type of output equipment specified for the longest output document.

There is also a top priority queue, but this is only called into existence if an operator request nominates a job for it, or if tape addressing is in progress, since this is automatically given top priority.

The display (B120) on the console is set as follows by the Supervisor throughout normal running.

a) Number of jobs completely input, but with execution incomplete is shown modulo 64 in bits 5-0.

b) Number of jobs which have completed execution since last start or restart is shown modulo 64 in bits 11-6.

c) Queues containing one or more jobs with execution incomplete (including those where execution has not begun) are marked by a single digit, as follows:-

Queue	Bit
Top Priority	23
Tape	22
Short	
a) Line Printer	21
b) 7-track punch	20
c) 5-track punch	19
d) Card punch	18
Long	17

Each job, once completely input, passes through the following phases in order, not initiating any phase until the previous one is complete (and sometimes not then, see below).

a) Loading of all magnetic tapes called for. (The end of this phase only comes when all tapes called are recognized from their titles).

b) Assembly of input from system tape (i.e. the loading of all or at least the initial parts of it into main store).

c) Loading of compiler from Supervisor tape.

d) Compilation.

e) Execution.

Jobs are selected for this process in the order:-

i) If no job on execute list, leading long job.

ii) If no tape job in phase a), leading tape job.

iii) Leading short job (taking the sub-queues above in order)

iv) If no long job in execution, leading long job.

These criteria effectively mean that long jobs pass through the system serially (i.e. each clears all stages, except output, before another begins), tape jobs also pass through serially except that once one has entered b) another can enter a), and short jobs can be progressed through all stages independently of them. The following rules governing overlap must however be noted.

i) One job only is allowed to be in phases b) or c) at one time (i.e. one in b) or one in c) but not one in each)

ii) One job only is allowed in phases c) or d) at one time.

iii) Only one short job is allowed to be in d) or e) at one time.

iv) Only one tape job is allowed to be in d) or e) at one time.

The overlap can be suppressed altogether if the "One job at a time" mode of using the Supervisor is used (See Section 12).

As an example, the following is a typical sequence of events.

1) Assemble input for a long job, and request tapes for a tape job.

2) Load compiler for long job (when input ready)

3) Compile long job. If tapes ready, assemble input of tape job, and request tapes for next tape job.

4) Execute long job. Load tape job compiler.

5) When tape job compiler loaded, assemble input for short job. Compile tape job.

6) Execute tape job (long job still in execution). Load compiler, then compile, then execute short job.

And so matters proceed, and clearly the exact sequence of events depends entirely on the times taken by each phase of each job.

14. THE SUPERVISOR AND SYSTEM TAPES

There are two types of tape used by the Supervisor, the Supervisor tape itself and the input/output buffering tapes, usually known as System Tapes. These have titles as follows

Supervisor Tape	SYSTEM TAPE 5
System Input Tape	SYSTEM TAPE 4
System Output Tape	SYSTEM TAPE 3
Combined Input/Output Tape	SYSTEM TAPE 2

Any of these titles can be written to a free tape by a small program an example being as follows.

```
JOB
(Any convenient title)
TAPE FREE
1 SYSTEM TAPE 2
COMPILER ABL
1117  0  0  0
EAO
***Z
```

This gives a new tape the title SYSTEM TAPE 2. The Supervisor tape itself is created by copying from a master tape, but the title SYSTEM TAPE 5 must be written first. The task of copying the information forming the Supervisor is not yet performed by fully standardised and specified programs, and so for the time being is done only by Supervisor programmers.

For system tapes, the title as given above is sufficient to make the tape immediately usable. They are mounted as described in section 12. When recognised by the Supervisor, messages as follows are printed.

OUTPUT TAPE ON DECK n

INPUT TAPE ON DECK m

It is possible to have various combinations of input, output and combined tapes. However if a combined tape is in use, no other tapes should be provided. It is possible to operate with no system tape at all (with severe restrictions on job size) or with an input tape only or an output tape only. However there are only two normal modes of operation, a combined tape or an input and an output tape.

The information accumulated on system tapes is not over-written, (except of course when a "clear start" is made) so they slowly move forwards, "swinging" to and fro between information being retrieved and information being recorded. The rate of progression varies, but it is estimated that with separate input and output tape in use, full-length (5000 block) tapes should last for the order of 8 hours. Thereis no way of continuing on to another tape, so if the end of a system tape approaches, the system must be allowed to run down until all jobs terminate and complete their output. Then a CLEAR RESTART is necessary.

On an E-type fault on Supervisor and system tapes, a normal report is made, and the system continues. If the fault is or becomes F-type, a display is made on B120, and input ceases. The system will run down as far as it can, but a restart is necessary at some stage.

The display is:

Bits 5-3	Channel Number
Bits 15-12	E or F Number
Bit 16	0 for E, 1 for F

The display persists until a major Supervisor event, e.g. completion of a job. Thus it may not always be present long enough to be visible.

In use, the system tapes must of course have writing permitted. With the Supervisor tape, a write permit ring is normally used, but the deck is switched to writing inhibited. Certain programs (those concerned with developing new compilers) are permitted to write to this tape. These begin by a loop displaying 07070707 in B120. On this occurring, writing should be permitted until the loop occurs again. Writing should then be inhibited again.

15. LOADING AND UNLOADING OF MAGNETIC TAPES

When jobs using tapes are running, operators have the option of mounting tapes they know will be required, or of awaiting instructions from the Supervisor on the tape room teleprinter.

If a tape is mounted and engaged before requested, the following message appears

MOUNTED ON DECK n
(Tape title)

If a titled tape not mounted and engaged is required, the following is printed

MOUNT ON DECK n
(Tape title)

If a NEW tape is requested, the following is printed

MOUNT ON DECK n
NEW TO BE TITLED
(Tape title)

Note that the MOUNT messages are indented on the teleprinter for easy recognition. The tape may in fact be mounted on any available deck.

If mounted on the deck nominated, no further message appears, but if on a different deck, then is printed

MOUNTED ON DECK n
(Tape title)

If a tape not required has been mounted in error, the tape may be unloaded. (But see 10.8) No message will appear until another tape is mounted. If an operator interferes (e.g. opens the door) with a deck in actual use, an F5 fault message appears, and the job will have to be run again. If the deck is restored to an engaged state and no F5 appears, then no harm has been done.

On conclusion of a job, private tapes are rewound and the decks disengaged by the Supervisor, and messages as below appear

```
UNLOAD DECK n
(Tape title)
```

The title may have been changed by the job, and the new name should be noted.

The message

```
WRONG TAPE DECK n
```

is printed if, in response to a request to load a given tape, the operator loads a tape of a different title on the only remaining free tape deck.

16. TAPE ADDRESSING AND READDRESSING

The tape to be addressed should be mounted on Channel 7 with writing permitted.

A Tape Addressing Parameter tape should be prepared, as follows

```
JOB
TAPE ADDRESSING
COMPILER TAD
A   E197        ----  REEL NUMBER
n               ----  NUMBER OF BLOCKS
***Z
```

The title is immaterial, except that it is printed on the log, and n, which must be on a separate line, is the number of blocks to be addressed. (In practice slightly more than this are attempted; as some may be bad, and therefore discarded, slightly more or less than n will usually appear. The tape reel number can be any sequence of up to eight symbols and it must be written on the same line as the A (or the R if re-addressing.)

On reading the Tape Addressing Parameters on any reader, instructions to the operator will appear on the tape operators teleprinter, and are largely self-explanatory. These are as follows:-

ENGAGE DECK 7	The deck should be modified (the engineer will show how to do this if necessary), and engaged. If the deck has not been modified on engagement, it will be immediately disengaged, and the next message printed.
MODIFY CHANNEL 7	(Modify and re-engage)

Four passes of the tape now take place, each one being preceded by the comment

ADDRESSING PASS n (with n = 1, 2, 3 or 4)

The deck is then disengaged, and the next message is

UNMODIFY CHANNEL 7 Unmodify the deck and re-engage.

At this point is printed

IDENTIFIER XXXXXXXX YYYYYYYY

NUMBER OF BLOCKS n

XXXXXXXX and YYYYYYYY are two octal numbers, being the date and time at which the message is printed. They are not in comprehensible form, being intended to serve only as a unique identifier of the tape. n is the number of blocks actually on the tape.

After the final pass, during which patterns are written to every block, the tape is rewound and then is printed

UNLOAD DECK 7

FREE

The tape may be unloaded, and has the title FREE.

If a breakdown occurs during passes 3 or 4, addressing or readdressing will resume at pass 3. If the breakdown occurs after pass 4, the job will not be restarted as all that remains to be done is to check the tape and title it "FREE". Breakdowns before pass 2 is completed will be restarted at pass 1 in the case of tape addressing and the job terminated when readdressing. In the latter instance it will not then be possible to readdress the tape. If passes are repeated persistently, there is probably a fault which should be reported.

If too many errors are detected in any one pass, the tape is rewound and the comment below appears.

TOO MANY FAULTS

UNMODIFY CHANNEL 7

When the tape has been rewound and the deck disengaged, unmodify the deck and re-engage. (This is necessary to permit the routine to check the deck has been unmodified.) The deck is then disengaged again and the next comment appears.

DISMOUNT CHANNEL 7

It is then possible to start again with the same or another tape. The current tape has not, of course, been correctly addressed.

In some circumstances

SHORT BLOCKS

is printed. This implies the tape is probably not correctly addressed, and a fault in the tape hardware.

Tape Re-addressing is similar to Addressing, but the format (assuming tape E2/18, which has 480 blocks and identifiers 06210544, 06032447 and faulty blocks 5, 73, 421 and 537 (octal numbers)) is as follows.

```
JOB
TAPE READDRESSING
COMPILER TAD
R E2/18          ----  TAPE NUMBER
480              ----  NUMBER OF BLOCKS
06210544)
06032447)        ----  IDENTIFIERS
5  )
73 )             ----  FAULTY BLOCKS TO BE
421)                   READDRESSED
537)                   (OCTAL NUMBERS)
***Z
```

Various miscellaneous facilities are associated with the TAD compiler, as follows.

i) Write "Free" to an identified tape

Format

```
JOB
WRITE FREE
COMPILER TAD
F
480          ----  NUMBER OF BLOCKS
06210544)
06032447)    ----  IDENTIFIERS
***Z
```

ii) Write "Free" to an identified tape

Format

```
JOB
WRITE FREE
COMPILER TAD
Z
***Z
```

iii) Print the identifiers and other information from block 0.

Format

```
JOB
PRINT BLOCK 0
COMPILER TAD
P
***Z
```

iv) Check a tape by reading from it.

Format

```
JOB
CHECK READ
COMPILER TAD
CR
***Z
```

v) Check a tape by writing to it.

Format

```
JOB
CHECK WRITE
COMPILER TAD
CW
480          ----  NUMBER OF BLOCKS
06210544)
06032447)    ----  IDENTIFIERS
***Z
```

vi) Copy a tape from block n

Format

```
JOB
COPY TAPE
TAPE †         (Title of tape to be copied to)
COMPILER TAD
B
n              (in octal)
***Z
```

This copies from block n onwards of the tape on Channel 7 to the nominated tape, from block n onwards. (The purpose of this is for salvaging information from damaged tapes.)

NOTE The output of iv) and v) is in the form of a job for re-addressing the tape.

17. SUPERVISOR LOOP STOPS

Following is a list of loop stops which can occur in the Supervisor. It should be noted that the reasons given can never be guaranteed to be correct, as it is always possible for a machine fault to divert the Supervisor from its correct course, and this may lead into a loop stop. Bearing this in mind however, the loop stops fall into three categories, as shown.

Supervisor faults

1. Extracode Control * 3442533

   "Block not defined". This almost always implies the Supervisor is trying to address a non-existent area of store.

2. Extracode Control * 3434657

   Space for Job Titles exhausted. Restart is necessary. This happens after about 150-200 jobs have been run without incident. It will be removed in due course, as the titles will not be retained indefinitely.

Machine faults

3. Extracode Control * 4004777

   A store fault condition has been detected by the peripheral routines, i.e. information correctly written at an earlier stage is found to be inconsistent when read back. This stop is extremely rare in practice.

4. Interrupt Control * 4006562

   This occurs if too many machine faults occur simultaneously to make worthwhile entrance to the monitor routines followed by automatic restarts. The faults are displayed on B120 as described in Section 3, and no printing takes place. This stop is uncommon.

5. Extracode Control * 3570

   The clock is detected as having stopped by the machine tests. This stop occurs only occasionally.

Operating Incidents

6. Extracode Control * 34023000 (B120 = *70707070)

   The Supervisor is waiting for the write permit/inhibit state of the Supervisor tape to be changed. On this being done, B120 is cleared and the Supervisor carries on.

7. Interrupt Control * 4006276

   The Supervisor is waiting for Teleprinter 0 to be engaged.

8. Interrupt Control * 4017557

The Supervisor is waiting for Anelex 0 to be engaged. (This can occur only when post-mortems are being taken.)

Note that none of 6, 7, 8 are genuine loop stops, but programmed waits; in each case the Supervisor proceeds when the necessary action has been taken.

18. TAPE SWITCHING SYSTEMS

(i) Tape-switching at N.I.R.N.S.

There are sixteen decks and eight channels. Tape operations on a deck are obeyed by coupling the deck to a channel, and hence only eight decks can be transferring simultaneously.

The channels are connected in pairs; each pair can control four decks, coupled as follows:

Decks	0, 1, 8, 9	are	connected	via	channel 0 or 1
	2, 3, 10, 11	"	"	"	" 2 or 3
	4, 5, 12, 13	"	"	"	" 4 or 5
	6, 7, 14, 15	"	"	"	" 6 or 7

When a tape order is given for a deck, it is brought onto channel unless both available channels are already in use, in which case the tape order is held up. When the queue of tape orders for one deck is exhausted, the deck is disconnected, and the channel made available to another deck which has previously been held up.

Supervisor Restrictions

Supervisor and System Tapes must be mounted on decks 0 to 7, not on decks 8 to 15.

Tape-addressing

Tape-addressing requires channel 7, and any one of the decks 6, 7, 14 or 15 might be used. However, at present the standard deck is deck 7, and this is permanently connected to channel 7; thus decks 6, 14 and 15 have access only to channel 6. Modifications are available to permit any one of this group of four decks to be used for tape-addressing.

Advice on Use

Since only two of the four tapes in each group can be transferring or searching simultaneously, it is advisable to mount a maximum of two high-activity tapes on each group of four decks, and one only on the group of decks 6, 14, 15. In this connection, the system input and output tapes should be regarded as high-activity tapes; the supervisor-compiler tape could be regarded as of low activity.

(ii) Tape-switching at London

There are fourteen decks and eight channels. One pair of channels controls eight of the decks; the remaining decks are connected to one channel each, as follows:-

Decks	0, 1, 8, 9) 16, 17, 24, 25)	are connected via channel 0 or 1
Deck	2	is connected via channel 2
"	3	" " " " 3
"	4	" " " " 4
"	5	" " " " 5
"	6	" " " " 6
"	7	" " " " 7

The same restrictions on tape-addressing and supervisor tapes apply as at N.I.R.N.S.; tape-addressing is carried out on channel 7, and the Supervisor and Systems tapes may be mounted only on decks 0 to 7.

High-activity tapes may be mounted on any of the decks 2 to 7, and any two of the decks connected to channels 0 and 1.

19. EMERGENCY SHUTDOWN

In certain conditions, the machine will automatically enter a switch-off sequence, and this is signalled by alarm bells. It is normal practice for all tape decks to be switched to "Stand-by" on this occurring, as rapidly as possible, otherwise there may be a risk of tapes being overwritten. Local instructions from the engineers should be sought on this matter.

20. STORE USED BY THE SUPERVISOR

The total store available is different at all installations, and that used by the Supervisor varies dynamically according to conditions. This section gives the present state, but it should be noted that the amounts used by the Supervisor are likely to change as additions are made from time to time. Figures are in blocks of 512 words.

	MUSE	London	N.I.R.N.S.
Maximum store for user			
(No tape addressing or operator requests, and no input stream greater than one block)			
Supervisor	48	51	52
Object Programs	176	205	236
Minimum store for user			
(Operator requests in use, and input streams of 16 blocks or more)			
Supervisor	72	75	76
Object Programs	152	181	212
(If also tape addressing in use)			
Supervisor	80	83	84
Object Programs	144	173	204

Notes

1. The store used by the Supervisor includes amongst other items

   2 Blocks of Restart Information on the drum

   1 Empty page/sector

   6 Blocks reserved for possible buffering

2. Should need arise, modification can be provided to increase the maximum limit from (176, 205, 236) by 4 blocks to (180, 209, 240), and to make (176, 205, 236) blocks available to a program with long input streams. More drastic modification could increase these limits to (185, 214, 245).

3. The above limits are maxima; in order to run jobs approaching them it is advisable to set Hand Key 5 to 1 to ensure minimum use of buffers by other jobs.

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