Edinburgh Regional Computing Centre

Introduction to EMAS

A simple guide to EMAS

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EDINBURGH REGIONAL COMPUTING CENTRE

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1. Introduction

This guide is intended for the person who is unfamiliar with the facilities offered by the ERCC. It describes at a simple level the concepts of the Edinburgh Multi-Access System (EMAS), how data may be stored in files within the computer and how programs may be used to calculate results from data.

Anyone who would like to discuss whether a computer is the correct tool to assist in solving a problem should contact

Mr W. Aitken,
59 George Square,
Edinburgh EH8 9JU.

telephone 031-667 1011 ext. 6543.

Every new user must start by applying to the Service Support Unit for a user code and number. The combination of code and number, e.g. EKLD91, is used in accounting for documents, data preparation and use of computers. This six character identifier is usually referred to as 'Job number' or 'username'. The Service Support Unit is situated in Room 2009, James Clerk Maxwell Building, telephone 031-667 1081 ext. 2622.

If you wish to study EMAS and its facilities more fully then the EMAS 2900 User's Guide should be obtained from the ERCC Advisory receptionists at the King's Buildings (031-667 1081 ext. 2976) or 59 George Square, 031-667 1011 ext. 2300. The EMAS 2900 Information card and the ERCC Information card, both obtainable from Advisory receptionists, are handy reference sources. You may also choose to attend one or more of the courses presented at 59 George Square (031-667 1011 ext. 2300). Details of all courses are advertised in the ERCC Newsletter which appears monthly, except possibly in July and August. This Newsletter is sent free of charge to all users who have asked the Service Support Unit to add their names to the circulation list.

Before you start collecting data it is worth seeking advice about the best way of recording it from Mr W. Gordon at 59 George Square, (031-667 1011 ext. 2300). This should allow his staff to create the file for you from manuscript or typescript with the minimum delay.

If you have a problem with a program or any other computing matter then you should contact the ERCC Advisory Service. Advisors are on duty for part of the day at the three ERCC sites and may be visited without the necessity of making an appointment:

James Clerk Maxwell Building	031-667 1081	ext. 2976
59 George Square	031-667 1011	ext. 2300
The Bush Estate	031-445 4471	ext. 27

If an advisor is not on duty when you call, the receptionist will take a note of your query and you will be contacted later by an advisor.

2.1 User's view of EMAS

EMAS is a system which allows several users concurrent access to a large computer from their separate terminals. The system shares the resources between the active users as fairly as possible so that each user appears to be the sole user of the computer, which therefore may respond more slowly than if there were literally only one user.

Each autonomous computing activity is known as an EMAS process.

Each user is allocated a certain amount of space on discs coated with a magnetic medium for the storage of data. Every set of data, regardless of its nature, is stored as a discrete entity known as a file: this is analogous to using a new notebook to record serially the observations of each experiment. The owner of a file is the only person who has access to its contents unless access permission is deliberately offered to other users. The number of files, the size of any file and total size of all files are limited to values determined by the System Manager, but most users will not find these limits a handicap. In order to hold details about the files which a user owns, the system allocates to each user a special small file known as the file index: both the system and the user have access to the contents of this file.

2.2 Naming Files

Every file must have a name which identifies it uniquely. A name may be any combination of letters and numbers provided that

(i) the name has not more than 11 characters
(ii) the first character is a letter.

Typical valid file names are:

DEVONIAN under5 Jan47Snow

The file names in any file index are independent of names in all other indexes. Thus two users, say EKLD91 and EKLD92, could each have a file named MINE. If user EKLD91 needed access to both these files he could refer to his own file as MINE but he would have to prefix the other file name by his colleague's job number and a full stop, i.e.

EKLD92.MINE

EKLD91 would not actually get access to this file unless EKLD92 had previously set the appropriate access permission (see Section 5.1).

2.3 Preserving Files

All EMAS files are initially stored on discs. To protect a file against loss or alteration due to hardware or system failures, the owner of the file can request the system to keep a second copy of the file on a magnetic tape. The status of the original file is then described as cherished and the duplicate file is known as the back-up copy. A back-up copy of any cherished file that has been altered, or has acquired cherished status, during the day is taken each night. In the very rare event of a file on disc suffering damage, the system will destroy it. Whenever a file is lost by the system for any reason, a message is displayed at the owner's terminal next time he logs on. If the file was cherished, the system replaces a copy of the back-up version on disc and displays a message stating that the file has been reloaded. Remember that the back-up copy is taken only once every 24 hours, so the reloaded version could be different from the lost version.

A different way of safeguarding files to which immediate access is no longer required is provided by the archive mechanism. For this you nominate the files to be archived and then at least once a week any such files are transferred from disc to magnetic tape.

The system does not send you a message when a file is transferred to archive, though it does so when a file is restored from archive. There is a command which lists the names of all your files which are on archive and another command for restoring a particular file from archive to disc (see Section 5.1). When the file is restored a copy of the archived version is created on disc whilst the archive copy remains unaltered. Thus the restored copy can be used and destroyed and there will still be the archived version from which a further copy can be restored.

If a cherished file has not been accessed for some time (currently three or four weeks) it will automatically be archived, so check your list of archived files before despairing about any lost file.

2.4 Modes of Operating

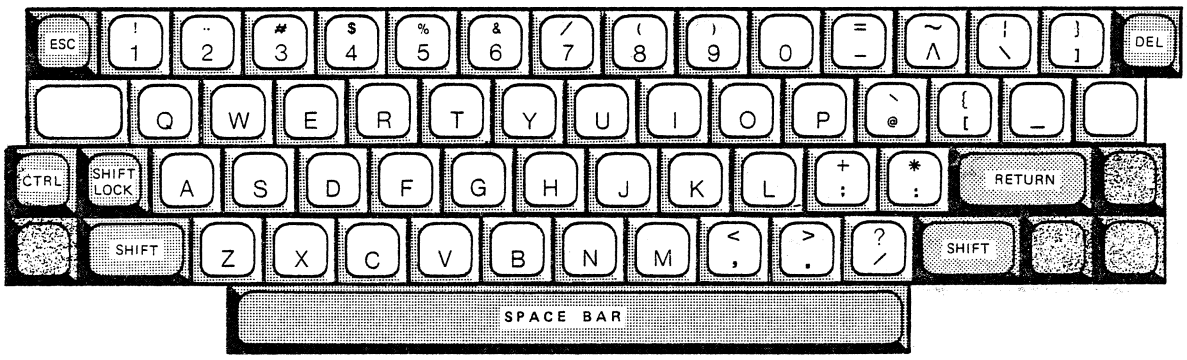
A computer can be used in one of two ways. When you are using a computer from a terminal, this is referred to as using EMAS in the foreground or interactive mode. In contrast with activities involving you, such as file editing, you may prefer not to be in attendance at a terminal when the computer is being used to perform calculations on data. Instead, a job (consisting of a program package and the data) could be run in background or batch mode. The job would be set up to be run at the first convenient (to the system) opportunity. Occasionally the system may choose to proceed with the job while you are working in foreground mode, so background mode need not imply that you have to wait a long time for the results.

2.5 Passwords

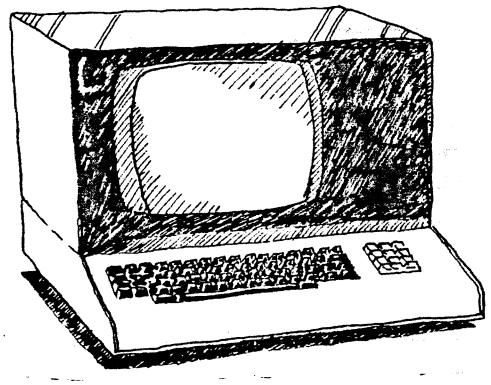
Each user has two passwords for access to EMAS: one password is used for foreground access, the other for background mode. Each password consists of any four printable characters excluding comma. Anyone not entitled to know your password cannot discover it except by very inspired guesswork (with 67 valid characters there are 67^4 i.e. 20,151,121 possible passwords). However, to achieve this level of security you should avoid the obvious passwords consisting of names, sets of initials, dictionary words, etc., and you should change your passwords regularly. The command for changing either or both passwords is described in Section 5.1.

3.1 The Terminal

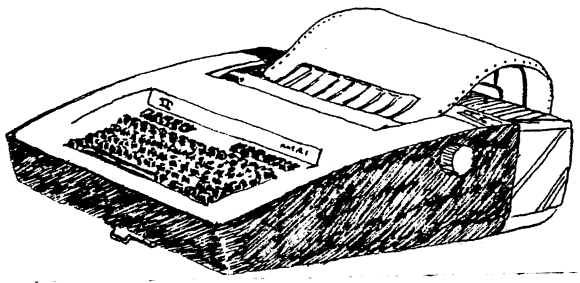
ERCC provides four different models of terminal in publicly accessible rooms. Any terminal will always have a keyboard but will display information in one of two ways. One model prints the information on continuous stationery, and is a Teletype model 43 which will in future be referred to simply as a teletype. The other three models of terminal display information on the screen of a cathode ray tube: these are known as visual display units (vdu). One model is made by Hazeltine, another by Newbury, and the third by Perkin-Elmer.



A terminal keyboard



A Video Display Unit



Teletype Model 43

3.2 The Route from Terminal to Computer

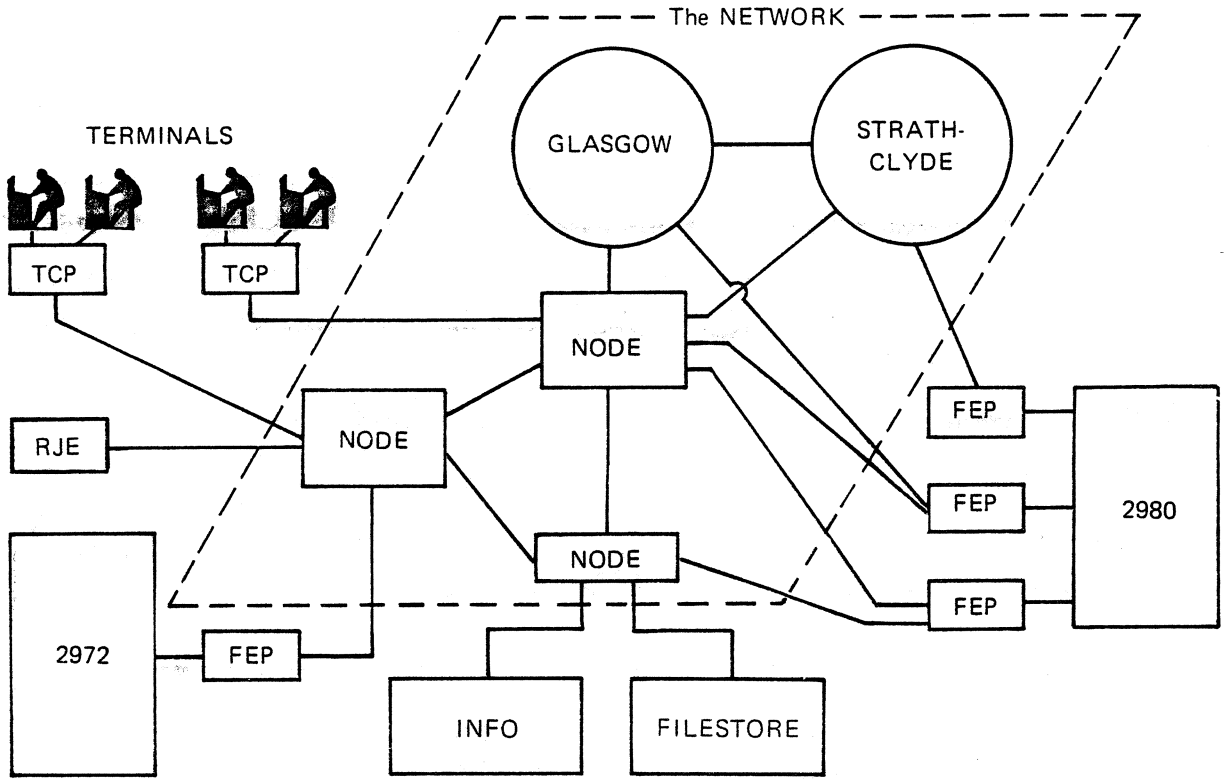
Terminals are connected to the main computer ('mainframe') in what is known as 'duplex mode'. This means that information can travel between the terminal and the mainframe in both directions simultaneously. On teletypes you may have to press a key on the top right-hand side of the keyboard to obtain full duplex mode.

Until something goes wrong the terminal appears to be connected directly to the mainframe, so you may choose to skip to Section 4.1. However, when something does go wrong it is reassuring to know a little about the pathway from terminal to mainframe.

Every terminal is connected to a small computer known as the Terminal Control Processor (TCP); several terminals may be connected to the same TCP. The purpose of the TCP is to smooth out irregularities in users' typing speeds and to separate incoming messages from outgoing messages. The TCP echoes on the screen or paper of the terminal whatever has been typed at the keyboard, except that deletions may be tidied up in the display on some screens and passwords are never echoed. No information is sent forward from the TCP until the user completes the current line by depressing the RETURN key. If information from the mainframe is being displayed at the user's terminal too rapidly to be assimilated by the user then all he need do is tap the space bar. The display will be frozen until the RETURN key is pressed when the flow will continue.

The TCPs are connected to the Communications Network. Within the Network, communication lines run from TCPs to one of a number of small computers which act as switches to ensure that messages go forward to the correct destination. These switches are known as Nodes.

The pathway from the terminal continues from the Node out to a another small computer known as the Front End Processor (FEP). This performs a service for the mainframe similar to that provided by the TCP for the terminal. The route through the Network from any terminal to mainframe may vary between uses depending on the load on the nodes at the time.



A representation of the communication Network

4.1 Logging on

1. Switch on terminal (method depends on type of terminal).

2. Press space bar slowly, up to five times if there is no response. If there is still no response then

   (i) if using a teletype check that it is in full duplex mode
   (ii) type RETURN and try pressing the space bar again
   (iii) the TCP is temporarily out of service: try again later.

3. To *Host:* respond with 2972 or 2980 followed by RETURN.
   The response to each of the next two prompts must also be followed by RETURN.

4. To *User:* respond with your username.

   If the prompt *User:* does not occur then refer to Section 4.2.

5. To *Pass:* respond with your foreground password.
   The TCP (see Section 3.2) does not echo your password for all and sundry to see.

A complete dialogue looks like this:

```
Host:2980
User:EKLD91
Pass:
Logged on
SS 2.06
10/09/81 15.37.36  Users=44  Fsys=1

Group Holder : EKLD01    Funds left :  106.63

Command:
```

The second and third lines printed by the system tell you the version number of the system in use, the date and time, the number of users currently logged on, and the number of the file system holding your files and index. *Command:* means success, so skip to Section 4.3.

4.2 Failing to Log on

During an attempt to log on the TCP may respond to your request for a connection to a particular host in one of the following ways for the reason given:

* TCP Busy	The TCP is temporarily congested and will not permit you to log on. This usually takes a few minutes to clear.
* Network Inaccessible	The TCP is not attached to the network. Try a nearby terminal which may be connected to a different TCP, and report the failure to the operators (031-667 1081 ext. 2737) if it persists.
* Network Busy	Try later. Check with the operators if the congestion persists.
* Host Inaccessible	Try later.
* Rejected by host	Try later: contact the operators if the rejection continues.
??	The response to *Host:* is not recognised - start again with space bar.

The log-on sequence may be terminated after your response to Host: by this message from the FEP:

**2900 DOWN	The mainframe you are trying to access is temporarily out of service.

This last message will also appear if your working in foreground mode is terminated by a failure of the mainframe. Your foreground work could also be terminated with one of the following messages:

* Connection to host fails	This indicates a break in the connection between the TCP and the host: try logging on again for more information.
* Terminal Violation	Either 32 successive invalid characters have been typed (possibly by a fault of the terminal), or you have attempted to type in information ahead of the computer's demands for it when the TCP is unable to pass it forward.

There is another machine connected to the Network which can give useful information about the mainframes and components of the Network. To obtain access to this information, start logging on in the same way as described above in Section 4.1. When the prompt *Host:* appears, your reply should be INFO. You will not be prompted *User:* and *Pass:*, but should get the prompt *Command:*. The responses you are most likely to need are:

ALERT	To get information about the mainframes and network, including advance warnings of when components are going to be taken out of service, and estimates of when withdrawn components might be returned to service.
HELP	To find details of all valid responses to the prompt *Command:* when using the INFO host.
STOP	To log off.

A typical dialogue looks like this:

*Host:*INFO
Network Information Facility Vsn. 9.01 7/8/81
10:Sep:81 13:38:10

*Command:*ALERT

8th September 1981 10.55 hrs

***2972**Service closing tonight 18.00-18.15*

*Command:*STOP
INFO LOGGED-OFF

If you complete the EMAS log-on dialogue the mainframe can still reject you with one of the following messages:

NO USER SERVICE — This indicates that the system is running but is not available to users. If this occurs within the normal service period, try to find an explanation by logging onto INFO.

SYSTEM FULL — Try later.

INVALID NAME — Either the response to *User:* was mistyped or the disc containing your file index (see Section 2.1) is temporarily out of service.

INVALID PASS — The response to *Pass:* was mistyped or wrong.

PROCESS RUNNING — Someone else with whom you share your username is using EMAS, or a background job is running (see Section 2.4), e.g. a new file is being created from cards or paper tape: try again several minutes later.

NO FUNDS — The FUNDS scheme is an attempt to distribute resources more fairly during periods of scarce resources, i.e. when many users are logged onto a particular mainframe. The command HELP(FUNDS) gives full details of this scheme, but briefly its characteristics are these. The scheme introduces an additional form of currency which will only be spent during periods of scarcity. Foreground use during busy periods will result in the expenditure of Funds at the same rate as is used for normal charging. On the other hand use of the system during a quiet period will spend none of your Funds, and background use will never deplete your Funds.
You will be given an allocation of Funds weekly, on Monday morning, for use during that week. Any Funds remaining unspent by the following Monday morning will be lost. At log-on and log-off you will be told what Funds you have left (see examples in Sections 4.1 and 4.4). The log-on message will also indicate whether this is a period of scarcity, i.e. a period when Funds are being spent. If a period of scarcity starts whilst you are logged on a message to that effect will be printed at the start of the next command.
If you spend all your Funds the following restrictions will apply:
   You will not be able to log on during periods of scarcity.
   You may be logged off if a period of scarcity starts whilst you are logged on.
Remember that use at quiet times in no way reduces your entitlement to use the system at busy times.

4.3 Assistance from the TCP

There is a facility which allows you to make working at a terminal easier. Instructions are sent to the TCP by holding down the control key (CTRL) and typing a single letter. The possibilities include:

Type CTRL +	Effect
Y	Terminate current input from the terminal. Useful if running from the terminal a program with an insatiable demand for data.
X	Cancel current line. Useful whenever a line gets badly typed.
R	Repeat the current line, tidying up any deletions.
A	Enter Set mode. Read on for your next action.

Setmode Commands

When you have typed CTRL+A the TCP replies

Set [

You then reply with one or more Setmode commands separated by one or more spaces and terminated by RETURN. The commands consist of a letter (lower or upper case) sometimes followed by a space and a number. The commands available include:

L	Lower case mode	The input is not converted from lower to upper case. Useful when working on a text file.
U	Upper case mode	All the lower case letters you type are converted to upper case before being sent out into the Network.
V	Video echo	Causes backspace, space, backspace to be echoed for Delete on the video, i.e. deletions are tidied up.
W	Line width	Sets the terminal line width assumed by the TCP (default 72) to the number after W, which must be in the range 15-160 inclusive.
CTRL+D		Disconnect the terminal from the host machine abruptly. The TCP replies

*Set [* EOT *]*

Chapter 3 of the EMAS 2900 User's Guide contains fuller details of instructions to the TCP.

4.4 Logging off

The command STOP will terminate your current session with EMAS. Lines of the form:

*Command:*STOP
10/09/81 14.29.51 CPU=3.36 Secs CT=17 Mins PT=3304 Ch=118p
Funds left: 106.63

Log-off

indicate a tidy termination: possibly the most likely item of interest is the cost of the whole session which appears at the end of the first line: this is the sum that would be deducted from your Funds if the whole interactive session occurred during a period of scarce resources.

5.1 Commands

The prompt *Command:* appears whenever EMAS is expecting instruction from the terminal. The first part of each command is a command word specifying the action that is required. The second part directs this action by providing details of the filenames, devices, quantities etc. that are involved. These details are supplied by means of an ordered parameter list enclosed in brackets, though not all commands need a parameter list. The list may consist of either a single parameter or two or more parameters separated by commas. Sometimes a command assumes that a particular parameter will have some value, known as the default, unless a user supplies a value (which need not differ from the default). If an optional parameter is omitted from the command issued then only the parameter is omitted, the adjacent comma remains so that the parameters retain their ordinal positions. E.g.

*Command:*BID(first,second,third)
*Command:*BID(first,,third)

Start typing the command on the same line as the prompt and finish by typing RETURN.
Whenever a line printer is referred to in a command the mnemonic .LP is used; the terminal has a special mnemonic .OUT.
All the commands available are fully described in the EMAS 2900 User's Guide and usefully summarised in the EMAS 2900 Information card.
A selection of useful commands follows in an order more or less matching the sequence in which their functions have been described in earlier Sections.

PASSWORD

This command can be used to alter one or both of your passwords. Two passwords are used, one for foreground and one for background use: they can be the same. Passwords consist of four printable characters other than comma.

Examples:	PASSWORD(X@3D,J&K*)	change foreground and background passwords
	PASSWORD(,/\/\)	change only the background password

ALERT

This command displays information on the current state of the system, any major faults, and corrections to the HELP information. If no parameter is used output goes to your terminal; otherwise to the device or file specified.

Example:	ALERT(.LP)	print the information on the line printer

HELP

HELP(COMMANDS) gives a useful list of entries in the HELP index.

Information about individual commands may be obtained by typing the name of the command as the parameter to the HELP command.
Example: HELP(FILES)

FILES

This command provides a list of your files on disc, in the archive store or both. It takes up to three parameters:

FILES(mask,group,out)

mask - All filenames by default: use HELP(FILES) or see page 5-1 of the EMAS 2900 User's Guide if you want details of selecting a subset of filenames by using this parameter.

group - The group of files is determined as follows:

- E include extra information (size and permissions) for each file and temporary files (T# names) on disc
- A files in the ARCHIVE store.

On output, a file name is preceded by * if the file is cherished and by ** if it is waiting to be archived.

out - This may be either output device code (the terminal by default) or output file name. If a file of the same name already exists it will be overwritten.

Example:	FILES(,A,.LP)	print the list of all archived files on the line printer.

CHERISH

This command is used to mark a file or list of files for copying to back-up storage.
Examples: CHERISH(FILE1)
CHERISH(TEST,DATA,PROG27)
The files will be copied onto magnetic tape once each day if they have been altered since the last backup, until either they are DESTROYed or the command HAZARD is used. In the event of a major system failure cherished files will be restored from the latest back-up copy, with CHERISH status and access permissions preserved.

HAZARD

This command causes the files specified to be marked as not requiring copying to back-up storage or to archive.

This command is the reverse of command CHERISH.
Examples: HAZARD(FILE1)
HAZARD(TEST,FILE2,DATA)

ARCHIVE

This command is used to mark one or more files for transfer to the Archive store. Files so marked are indicated with ** by the FILES command. Within one week the files concerned will be removed from the disc store and put in the Archive (magnetic tape) store.
Example: ARCHIVE(FILE23,MASTER0202)

RESTORE

This command is used to request the transfer of a copy of a file from the Archive store to the disc store. Note that the command sends a request which will normally be honoured within about 15 minutes; meanwhile other commands can be used. When the file is restored a message will be sent to you, which will be stored until you log on again if necessary. The restored file is not cherished. The command takes two parameters:
the name of the file to be restored
and the date on which it was archived.

If the second parameter is omitted then the most recent file with that name in your archive store is restored.
Examples: RESTORE(MASTER)
RESTORE(DATELIST,14/12/78)

DESTROY

This command is used to destroy one or more files from the disc store. Back-up and archived copies of these files are unaffected.
Examples: DESTROY(ABC)
DESTROY(FRED1,FILE2,KK)

PERMIT

This command is used to give other users access permission to one or more of your files. It may also be used to restrict your own access permission. The format of the command is:

PERMIT(filename,user,access)

The command may be used repeatedly to give access to selected users. If 'user' is null, then all other users are permitted access. Access is specified by an abbreviation:

R	Read Shared	this is the default
W	Read/Write	
N	No access	
C	Cancel specific access permission previously given for an individual user - cannot be used to cancel a permission granted to self or "all other users"	
P	Protect from being DESTROYed by self - implies only Read by self	

To check the access permissions set for each of your files use the option 'E' in FILES.
Example: If user EKLD92 uses the command

PERMIT(MINE,EKLD91,R)

then user EKLD91 can read the file named MINE belonging to EKLD92. For instance, EKLD91 might choose to copy the file thus

COPY(EKLD92.MINE,HIS)

Then EKLD91 and EKLD92 each have identical copies of the file known as HIS and MINE respectively. Knowing that EKLD91 requires access EKLD92 can also protect MINE from alteration and destruction by

PERMIT(MINE,EKLD92,P)

FUNDS

This command can be used at any time to find out what Funds you have left. It also indicates whether resources are scarce, i.e. Funds are being spent.

DETACH

This command is used to put a job in the background job queue to be executed without an interactive terminal. The command takes one obligatory parameter, the name of a character file containing the commands and data for the job.
The second parameter is used to specify the time in seconds for the job. Note that at the time of writing the default time is 30 seconds and the maximum is 7200 seconds.
The third parameter can be used to nominate the source of further scheduling information. It may be the name of a file or .IN, meaning the interactive terminal. Full details can be found by using HELP(DETACH). The output which would come to your terminal if the job

were run in foreground mode is sent by DETACH to the line printer directly connected to the computer. You can redirect this output to a nearby line printer by use of the OUT parameter.

Example:
```
DETACH(SHOWJOB,,.IN)
DOC param:OUT=LP23
DOC param:.END
```

If the DETACH command is correct a message is printed giving the identifier of the job.

LIST

This command can be used to list a file on the interactive terminal (.OUT), or the line printer (.LP). The first parameter must be the name of the file. If the second parameter is omitted the output will be sent to the terminal.

Use HELP(DEVICES) to find the most convenient line printer.

DELIVER

This command is used to specify the text which will be printed by the line printer at the start and finish of files so that Job Reception staff can deposit the listing at the most convenient pick-up point for you. If the text is enclosed in quotation marks then spaces are preserved, commas can be included and lower case letters are not converted to upper case. The length of the text must not exceed 31 characters. The surname registered for your username is printed automatically, so it need not be included in the delivery text. If the parameter is a question mark, the current delivery information is displayed.

Example:
```
DELIVER(?)
Current delivery information: ERCC KB
DELIVER("Aeolus 59, George Square")
LIST(WINDS,.LP40)
DELIVER("ERCC KB")
```

LOOK

This command is used to look at the contents of a file without altering them. LOOK uses the EDIT commands A, B, E, H, M, P, Q, T described in Section 6.4.

5.2 Queries

If you are logged-on and cannot remember the details of a particular command then type HELP(command word) to display on the terminal details of the parameter part and the effect of the command. If you cannot quickly solve your problem this way or by reference to the EMAS 2900 Information Card or User's Guide, then refer to your nearest Advisory Service.

6.1 Creating Files

Before a program or package can operate on the data collected in a project, it is sometimes necessary to write the data into an EMAS file.

Substantial quantities of data may be typed professionally for you by the Centre's Data Preparation Service at 59 George Square, using a key-to-disc system. In this case your data will be transferred to a file on EMAS in your username. Alternatively you can create the file in one of two ways.

6.2 Card and Paper Tape held data

A file may be created for data held on either cards or paper tape by providing in the same medium a header and a terminator of this form:

```
//DOC USER=username, PASS=back, DEST=NEWFILE, NAME=filename

        contents of file

//DOC
```

where

username	is	your EMAS identifier.
back	is	your background password.
filename	is	the name for the file which is being created.

The cards or tapes should then be handed in to Job Reception at James Clerk Maxwell Building or Appleton Tower. At Job Reception you will be able to pick up a Job Request Card upon which you record your name and the number of tapes or boxes of cards. This docket accompanies your data to the card or tape reader and ensures that the relevant staff feed all your data into the correct machine (2972 or 2980) and return all your tapes and cards to you.

6.3 An Editor

A file may be created by using the Edinburgh Subsystem editor. The command

*Command:*EDIT(filename)

where filename is a valid name and is not currently in use, will produce the response *filename is a new file* followed by the prompt

Edit:

The editor is now ready to receive your data. The form of the instruction to input the data is I followed by the text (data) enclosed in delimiters which may be one of slash /, stop . or query ?. If your data includes the chosen delimiter then simply repeat it to distinguish the two uses of the same character. Once you have started typing your data the editor will issue a prompt consisting of your delimiter followed by a colon whenever you take a new line. When all the data has been typed in, signify this by typing the closing delimiter. The editor will then prompt *Edit:* to which you reply E, meaning end.

Assuming that CTRL+A and L has been typed a typical session looks like this:

```
Command:EDIT(EXAMPLE)
EXAMPLE is a new file
Edit:I/Thou art as tyrannous, so as thou art,
/:As those whose beauties proudly make them cruel;
/:For well thou know'st to my dear doting heart
/:Thou art the fairest and most precious jewel.
/:Yet, in good faith, some say that thee behold,
/:Thy face hath not the power to make love groan.
/:To say they err I dare not be so bold,
/:Although I swear it to myself alone.
/:And, to be sure that is not false I swear,
/:A thousand groans, but thinking on thy face,
/:One on another's neck, do witness bear
/:Thy black is fairest in my judgement's place.
/:In nothing art thou black save in thy deeds,
/:And thence this slander, as I think, proceeds.
/:/
Edit:E

EDIT EXAMPLE completed
```

6.4 Altering Details within a File

The Subsystem editor may be used to alter details within an existing file as well as to create new files.

The editor has a pointer which can be moved through the file to the point at which you want to remove or insert text. This pointer is usually referred to as the cursor, and is represented on the display at your terminal as an upward pointing arrow, ↑. At the start of editing, the cursor is at the top of the file. The commands for moving the cursor and making changes to the contents of the file consist of a single letter sometimes followed by either text between delimiters, e.g. I/text/ described above, or a number.

The following commands may be used to alter the position of the cursor in the file: none of these commands changes the contents of the file.

T — Move the cursor to the Top of the file. When the cursor is at the top of the file this will be shown on your terminal by **T**

B — Move the cursor to the Bottom of the file: this will be shown on your terminal by ↑**B**

M Move the cursor. This command must be qualified either by a number indicating the number of lines the cursor is to be moved or by text between delimiters indicating that the cursor is to be moved down to the first occurrence of this text.

M0 Move to the beginning of the current line.

M3 Move down three lines from the current line.

M/Thou/ Move to the next occurrence of Thou in the file: note that 'Thou' differs from 'thou'.

Note the difference between M3 and M/3/.

A After. This command must be qualified either by a number indicating the number of characters (including space and newline characters) by which the cursor is to be moved beyond its current position, or by text between delimiters indicating that the cursor is to be moved to immediately after the next occurrence of this text.

A3 After three characters from the current position.

A/Thou/ After the first occurrence of Thou in the file.

If the text being sought is not found then the cursor moves to the bottom of the file. In this event the next command is useful:

H Return the cursor to where it was before the last command was issued.

When you have moved the cursor to what seems to be the required point it is often useful to look at more than one line of context before making any alterations to the file.

P Print: this command must be qualified either by a number indicating the number of lines (including the current line) which are to be printed, or by text between delimiters meaning print the line containing the cursor and such following lines as are scanned until the text is encountered.

This command does not move the cursor.

Once the cursor is at the text which needs altering there are two commands for taking out text.

D Delete: this command is followed either by a number indicating the number of complete lines (including the one containing the cursor) which are to be deleted, or by text between delimiters in which case everything from the cursor up to and including the given text is deleted.

R Remove: this command is followed either by a number indicating the number of characters (including space and newline characters) to be removed, or by the text (between delimiters) which is to be removed.

In each case the text in the file which was after the line or part line that was removed will close up to be immediately after the cursor. Thus

the cursor is correctly placed for the insertion of the necessary line or part line to make the alteration.

After doing a fair bit of editing, say 15 minutes work, it is worth writing the modified file away to disc so that it will survive any system failure which would lose all the work that has been done. The necessary command is simply W, after which the cursor will be at the top of the file.

If mistakes in the editing make it desirable to ignore all changes to the file then there is a command for this: it is the letter Q. The editor then prompts *QUIT:* to which the reply Q or Y will cause the editor to leave the file as it originally was or as it was after the last W, whichever is more recent. Any other reply to *QUIT:* allows editing to continue.

When all the desired changes have been made, the command E will end the editing session.

6.5 Summary of Editor Commands

The following table lists the commands in alphabetical order, states the function of each, and describes the effects of commands which must be followed by either a number n or text delimited by one of the three valid delimiters . ? / (/ has been used for the examples below).

Command	Function	Effect of number n	Effect of delimited /text/
A	After	n characters	next occurrence of /text/
B	Bottom		
D	Delete	n lines including present one	up to and including /text/
E	End		
H	Help		
I	Insert		/text/
M	Move	n lines from present one	forward to /text/
P	Print	n lines including present one	up to line including /text/
Q	Quit		
R	Remove	n characters	next occurrence of /text/
T	Top		
W	Write		

7.1 Writing and Compiling your own Program

If you prefer to run an existing program package then skip to Section 8.1.

Descriptions of three of the languages available on EMAS can be found in:

The Edinburgh ALGOL Language Manual
The Edinburgh FORTRAN77 Language Manual
The Edinburgh IMP Language Manual.

Each of these manuals is complemented by the manual

System Library Manual for Edinburgh 2900 Compilers

which gives details of the routines available for use in programs written in any of these languages. For example, you can find how to take the square root of a quantity, and what the consequence will be if the quantity is less than zero.

Once you have written your program it has to be translated into a language that the computer understands. The program which performs this translation is called a compiler. The translation is effected by a command of the form

Command: compiler(source code, object code, listing, errors)

where

compiler is either ALGOL, FORT77 or IMP80.

source code is the name of the file containing the program you have written.

object code is the name of the file into which the compiler writes its translation.

listing is the name of a file into which the compiler will copy your program, numbering each line as it does so. If the compiler finds an error in your program it will write a suitable comment below the offending line. If your compiled program fails to run because of some event that you overlooked then this listing is an essential aid. If you do not nominate this file then the compiler will use a temporary file named T#LIST.

errors is the name of a file into which the compiler will write any erroneous line of your program followed by a comment, i.e. it is a shorter version of the listing file. It is not necessary to nominate any file.

For example, if a file called FRED (maybe created by use of the Editor) contains the text of an IMP program, then the compilation instruction might be

Command: IMP80(FRED,FREDDY,FREDLIST)

7.2 Linking Channels to Devices and Files

The computer needs to know where the data for your program is to come from, and where the output is to be written. When your program is run in foreground mode EMAS assumes that you will type the data at your terminal and that the results are to be returned to the terminal. If instead you want to define a file which contains your data and either a file or a line printer to receive your results, then there is an EMAS command allowing you to do this. For example, traditionally Fortran programs expect data from channel 5 and write results to channel 6. Therefore before running a Fortran program these two commands might be issued:

Command: DEFINE(5,MYDATA)
Command: DEFINE(6,.LP23)

Any definition lasts only until you issue a new definition for that channel, or until you log off.

7.3 Running your Program

Once you have successfully compiled your program and made any necessary channel definitions you simply issue a command of the form

Command: RUN(object code)

Thus continuing the example at the foot of Section 7.1,

Command: RUN(FREDDY)

8.1 Availability of Packages

A program package (frequently called simply a package) is a set of instructions assembled to ease the task of using a computer for calculations of a particular nature, e.g. analysis of variance. Many of the packages you might require have been mounted on EMAS by the Program Library Unit (PLU). These packages are accessed via the directory PLULIB.PACKDIR which is searched automatically if the command

Command: OPTION(SEARCHDIR=PLULIB.PACKDIR)

has been issued; this command need be issued only once.
The command

Command: HELP(PACKAGES)

will display on your terminal a complete list of all PLU packages currently available.

If you want to find out more about any particular package then use its name as the parameter to the command HELP, e.g.

Command: HELP(GENSTAT)

This will give you the most recent information on how to bring together your data and the package, as well as telling you what documentation about the package is available. It is worth remembering that when you are using an interactive system such as EMAS it is more economical and sometimes quicker to direct the output from a package to a file instead of printing it all directly on the terminal. Details of how to create files of output are included in the HELP(package) information.

Other sets of packages are available from the EMAS username ERCLIB. The Centre maintains and offers some advice on packages which were written by Centre staff or at other university computing centres.

The command VIEW is provided to lead you through a question and answer dialogue to give information as conveniently as possible about either a particular package or the packages available to perform tasks within a nominated topic, e.g. sorting or the graphical display of data. This command will also tell you which directory needs to be included in your search list in order to access the package.

Finally there is a set of packages contributed by users for the benefit of the user community available from the username CONLIB. Any support that is forthcoming will be provided by the contributors. Details of what is available may be obtained by using the command VIEW.

If you want to find out which directories have been nominated for searching, then the instruction

Command: OPTION(?)

will print out information about your EMAS process, ending with a list of these directories.

It is inefficient to have unnecessary directories in your list, so you can remove unwanted directories with

Command: OPTION(REMOVEDIR=directory)

Further, directories are searched in the order in which they appear in your list, so you can save yourself time by promoting the most popular ones to the top by reissuing

Command: OPTION(SEARCHDIR=directory)

8.2 Software Support Scheme

Packages available on EMAS, except those in PLULIB, are allocated a software support category. The four categories have the following meanings:

ERCC Software Support Categories

Assistance to Users	Error Correction	Life
A Full: Sufficient for experienced or first time computer users, i.e. courses, full documentation. Advice to personal and telephone callers.	Priority Remedial: Verified, published and corrected as a matter of urgency.	Guaranteed: Support level guaranteed for one academic year with six months notice of intention to downgrade.
B Standard: Sufficient for experienced computer users unfamiliar with the software concerned, i.e. full documentation. Advice available by appointment.	Normal Remedial: Verified and published as a matter of urgency. Corrected when convenient.	Guaranteed: Support level guaranteed for one academic year with six months notice of intention to downgrade.
C Partial: Sufficient for users generally familiar with the software concerned but who require more information to use it efficiently. Adequate documentation and limited advice.	Deferred Remedial: Verified and published when convenient and corrected at leisure.	Not guaranteed: Support level and specification not permanent but ERCC will endeavour to give adequate notice of changes.
D Minimal: Sufficient for users generally familiar with the software concerned to make some use of it, i.e. limited documentation. Advice not available.	Non-Remedial: Verified and published when convenient.	Not guaranteed: Support level and specification not permanent but ERCC will endeavour to give adequate notice of changes.

The contents of ERCLIB will be classified at least at level C, the particular level for each item depending on user demand and the Centre's resources.

The contents of CONLIB will normally be given support at level D.

9.1 Using a Package

A use of the package GENSTAT is developed in the following Sections. GENSTAT is a program package providing a computing language for data manipulation and statistical analysis. The statistic calculated may not be the best one for describing the given data but it serves to illustrate the general approach.

9.2 Access to the Package

It is essential to find out how the package, control information and data should be brought together so that the computation can be performed. An instruction is issued to EMAS which prints out a general description of GENSTAT followed by particulars for running it. Several paragraphs which are not relevant to an understanding of this example have been omitted from the text reproduced below.

*Command:*PACKHELP(GENSTAT)

RCO 2980 EMAS Packhelp information on 10/09/81 at 10.50.31
GENSTAT 4.03 (PLU Release 2 20/05/81)

[13 lines of text omitted]

Documentation: GENSTAT - A General Statistical Program

[26 lines of text omitted]

Parameters:

Keyword: CONTROL (Primary (control card) input file)
Default: .IN
Type: Input file
Unit: 5

Keyword: DATA (Secondary data input file)
Default: .NULL
Type: Input file
Unit: 7

Keyword: OUTPUT (Primary (lineprinter) output file)
Default: .OUT
Type: Output file
Unit: 6 (DCB: ,,C)

Keyword: SYNTAX (YES or NO - whether syntax check only is required)
Default: NO

Keyword: INTERACTIVE (YES or NO - whether GENSTAT is to be used interactively or not)
Default: NO

Fixed assignments:

9 .TEMP,,V5000

9.3 Creating the Job File

A small file has to be created containing the statements necessary to control GENSTAT and the data which will be used. The syntax of these statements is described in the GENSTAT manual: the details are tailored to this particular example. The editor is used to create the file: this time the delimiter ? has been used to avoid confusion with the / required as part of the GENSTAT statement.

```
Command:EDIT(SHOWJOB)
SHOWJOB is a new file
Edit:I?GENSTAT(OUTPUT=BEANSPROUT)
?: 'REFERENCE' ANOVA(1) ''
?: Completely randomised 5X3X4 Factorial design:
?: Yield of Beans in allotment
?: Treatment factors: A - 5 Organic feeds
?: B - 3 Spacing of seeds; C - 4 Species of bean.
?: Only one replicate, thus 3 factor interaction used for error. ''
?: 'UNITS' $ 60
?: 'FACTORS' A $ 5 : B $ 3 : C $ 4
?: 'GENERATE' A,C,B
?: 'HEADING' YB='' Yield of beans''
?: 'DESCRIBE' YIELD $ ; YB
?: 'READ/PRIN=DE' YIELD
?: 'TREATMENTS' A*B*C
?: 'ANOVA/LIMA=2' YIELD
?: 'RUN'

?: 116 118 115 120 123 120 119 120 120 120 119 119
?: 122 119 117 123 120 119 120 120 119 119 117 117
?: 117 121 120 121 118 116 118 120 121 119 122 117
?: 119 122 121 119 121 118 117 120 121 120 121 120
?: 119 120 117 122 121 120 120 119 119 123 121 116
?: 'EOD'
?: 'CLOSE'
?: 'STOP'
?:?
Edit:E

EDIT SHOWJOB completed
```

9.4 Performing the Computation

The command DETACH (Section 5.1) is used to get EMAS to perform the computation in background mode. If one needed the results urgently the command OBEY(SHOWJOB) would achieve this, at a price, by performing the computation in foreground mode.

```
Command:DETACH(SHOWJOB)
SHOWJOB is Batch queue entry 416. Time limit 30 secs.
```

9.5 Looking at the Results

The 25 lines in file SHOWJOB (Section 9.3) cause GENSTAT to generate a file BEANSPROUT consisting of 52 lines of output giving details of this particular job, followed by 79 lines of results and then 5 lines of accounting information. It would be tedious and probably unnecessary to display the entire results on a terminal, so they can be listed at a line printer by using the command LIST(BEANSPROUT,.LP). You can get a quick look at some of the results by using the command LOOK (Section 5.1), e.g.

```
Command:LOOK(BEANSPROUT)
Look:M/ANALYSIS OF VARIANCE/
***** ↑ANALYSIS OF VARIANCE *****
Look:M1
↑
Look:P/*****/
↑
VARIATE: YIELD Yield of beans

SOURCE OF VARIATION          DF         SS         SS%         MS         VR

*UNITS* STRATUM
  A                           4      6.433        3.24      1.608      0.932
  B                           2     23.700       11.92     11.850      6.864
  C                           3     11.117        5.59      3.706      2.146
  A.B                         8     36.967       18.59      4.621      2.677
  A.C                        12     53.967       27.14      4.497      2.605
  B.C                         6     25.233       12.69      4.206      2.436
  RESIDUAL                   24     41.433       20.84      1.726
TOTAL                        59    198.850      100.00      3.370

GRAND TOTAL                  59    198.850      100.00

GRAND MEAN                        119.45
TOTAL NUMBER OF OBSERVATIONS          60


***** TABLES OF MEANS *****
Look:E

LOOK BEANSPROUT finished.

Command:
```

Other problems and other packages could easily generate much bulkier results.

9.6 Using other Packages

If you want to run some other package, for example SPSS, then follow steps similar to those just shown:

*Command:*OPTION(SEARCHDIR=PLULIB.PACKDIR)
*Command:*HELP(SPSS)

Use the information that will be printed to create a file containing the details which will control SPSS (c.f. Section 9.3). Then use the command DETACH to initiate the computation (see Section 9.4), and finally use LOOK or LIST to inspect the results if you have stored them in a file instead of directing them to your terminal or to a line printer.

10.1 Interrupting a Command

Occasionally you may want to interrupt the command being obeyed, for example if a listing to your terminal turns out to be unexpectedly lengthy. Press the escape key, marked ESC (see illustration in Section 3.1), and the prompt *Int:* will appear. There are five responses depending on what you wish to happen:

Response	Effect
A	Abandon the current activity and return to the prompt *Command:*. If you had typed in another command then it will be obeyed before the prompt appears (see next response).
C	Abandon the current activity, ignore any data and commands that have been typed in and not yet used, and return to the prompt *Command:*.
Q	Abandon the current activity, print diagnostics and return to the prompt *Command:*.
T	Print the CPU time used and the number of page turns since the start of the command being executed, and the number of users logged-on, without otherwise affecting the command.
Return	Ignore the interruption: useful if you press the escape key either by mistake, or on purpose to freeze the flow of information from the computer to your terminal (c.f. space and return, Section 3.2).

A typical sequence might be:

```
Command:LOOK(BEANSPROUT)
Look:M/ANALYSIS OF VARIANCE/
***** ↑ANALYSIS OF VARIANCE *****
Look:M1
↑
Look:P*
↑
VARIATE: YIELD Yield of beans

SOURCE OF VARIATION          DF          SS          SS%          MS          VR

*UNITS* STRATUM
  A                           4       6.433         3.24       1.608       0.932
  B                           2      23.700        11.92      11.850       6.864
  C                           3      11.117         5.59       3.706       2.146
  A.B                         8      36.967        18.59       4.621       2.677
  A.C                        12      53.967        27.14       4.497       2.605
  B.C                         6      25.233        12.69       4.206       2.436
  RESIDUAL                   24      41.433        20.84       1.726
TOTAL                        59     198.850       100.00       3.370

GRAND TOTAL                  59     198.850       100.00

GRAND MEAN                        119.45
TOTAL NUMBER OF OBSERVATIONS          60


***** TABLES OF MEANS *****

VARIATE: YIELD Yield of beans


    GRAND MEAN    119.45

Int:A

            A         1         2         3         4         5

Command:
```

Sometimes the effect of an interruption is slow to appear: you gain nothing by repeatedly issuing the same interruption, as EMAS will simply act on the first and ignore the later ones.

If you interrupt the creation or alteration of a file and respond to *Int:* with A, C or Q then the consequence could be that the file may exist in name but without the expected contents.

Glossary

This glossary does not set out to be complete: it defines most of the computing jargon used in this text and some of the jargon used in a wider context.

Archive Store A long term store for users' files, held on magnetic tape.

Background mode A mode of using EMAS where the computation proceeds without interaction between the user and the computer.

Back-up Store A short term store for users' files, held on magnetic tape. Used only by EMAS to replace any file that may have become unreadable.

Batch mode Similar to background mode as far as the user is concerned: a collection of jobs requiring the same facilities is batched together for greater operational efficiency.

Central Processing Unit (CPU) The unit in a computer where instructions are obeyed; known as the Order Control Processor (OCP) on the 2900s.

Console An alternative name for a terminal.

Cursor The pointer, represented by ↑ or _ on your terminal, which marks the place in the text displayed.

Data Preparation The process by which information is recorded on a medium suitable for input to a digital computer, e.g. key punching of cards or paper tape.

Default The value given to a parameter by the system if you do not provide a value.

Device A unit which can be accessed by a computer for use in input and/or output, e.g. a card reader, line printer or terminal. It may be part of the central installation or be attached to a remote TCP or other computer.

Digital computer A machine capable of performing operations on data represented in digital form, e.g. an abacus.

Disc An item of hardware used to store programs, data and the results derived by the computer.

Duplex mode The situation when information can travel along a communications link concurrently from user to computer and vice versa.

File A discrete collection of data - numeric, textual or both, or programs - held on a storage device. Files are usually stored on disc though copies may be taken onto magnetic tape.

File Index A file maintained by EMAS to hold details of the names, sizes and access permissions of your files.

Filestore (FSTORE) A depository for files of data which can be accessed from the Network: it can be used as an alternative or in addition to the conventional EMAS archive. Users must be accredited by the Service Support Unit.

Foreground mode A mode of using EMAS where the user controls the computational work from a terminal.

Front End Processor (FEP) A small computer which connects a mainframe to the Network.

Hardware The mechanical, electrical and electronic apparatus of a computer.

Host A service available on the Network, currently including:

2972	the ICL 2972 at ERCC, KB
2976	the ICL 2976 at Glasgow University: note that this uses VME/B and not EMAS
2980	the ICL 2980 at ERCC, Bush Estate
FSTORE	see Filestore above
INFO	see below.

INFO The Network enquiry service, described in Section 4.2.

Interactive terminal The terminal through which you interact with a program: the terminal is passive and therefore a safe butt on which to vent your frustrations.

I/O An abbreviation for Input or Output.

Job A unit of work for a computer, consisting of a program and the data it will use.

Line Printer An output unit which prints information from a computer at high speed, one line at a time.

Magnetic tape A strip of plastic coated with magnetisable material on which information can be recorded serially. It is usually 1/2" wide and 300, 600, 1200 or 2400 ft in length and is wound on a spool of about 11" diameter.

Mainframe Either the ICL 2972, ICL 2976 or ICL 2980.

Multi-Access System An operating system allowing several users to communicate concurrently with a computer through terminals.

Network A communications system consisting of connected inlets, switches and outlets so that users and mainframes may communicate.

Node A small computer which acts as a switch within the Network.

Operating system The software that controls usage of a computer.

Overwrite Destroy the contents of a storage unit and substitute new information.

Paper tape A ribbon of paper, usually one inch wide, and of indefinite length, in which patterns of holes may be punched in order to represent characters.

Parameter A mechanism for passing necessary information to an EMAS command. The particular information provided by the user as the parameter value is accessed by the command.

Password A sequence of any four printable characters other than comma. The foreground password is used during the log-on sequence; the background password is used when creating files from cards or paper tape.

Process An autonomous computing activity which is allowed a share of the computer's resources.

Program package A set of software items to ease the task of instructing the computer to perform calculations of a particular nature, e.g. analysis of variance, regression, etc.

RJE Remote Job Entry. A device for connecting card and paper tape readers to the Network.

Software Any set of instructions for directing the activity of the computer.

Sub-system An item of software providing facilities additional to the basic operating system, but which can function only together with that operating system.

System Usually means operating system.

Teletype A brand name for an item of hardware resembling a typewriter which may be used to type information into the computer and upon which the computer produces a hard copy display of information for the user.

Terminal A teletype or video display unit.

Terminal Control Processor (TCP) A small computer used to connect a group of terminals to the Network.

Username The unique six character identifier assigned to each user of EMAS. It is used when you log on, as part of the full name of a file belonging to you, is printed beside your name on line printer output, and is used for accounting.

Video Display Unit (vdu) A device consisting of a cathode ray tube on which characters may be displayed, and a keyboard for typing information into the computer.