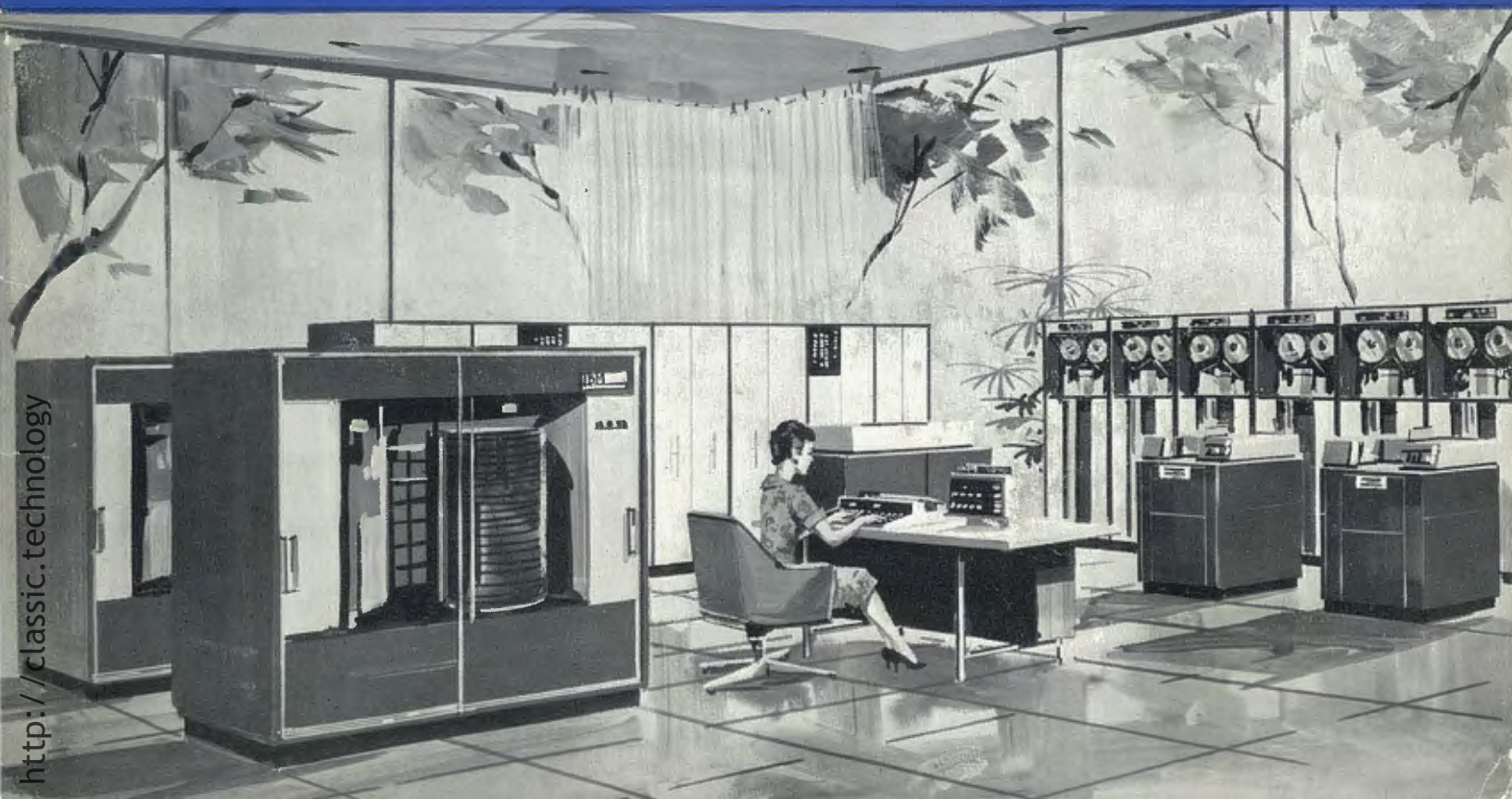
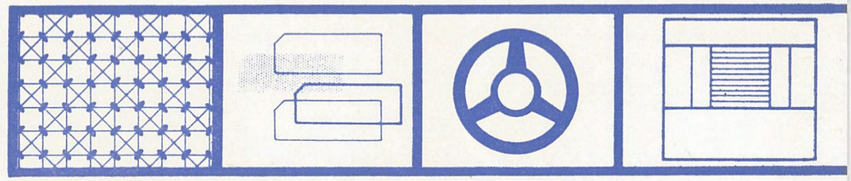
IBM 7070



http://classic.technology



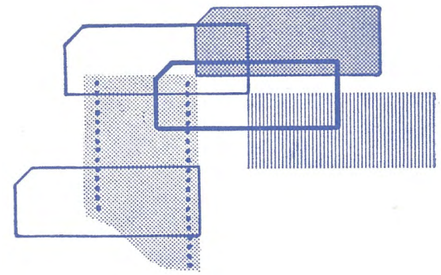
The IBM 7070 Data Processing System is the first of a new line of computers making use of transistors in place of electronic tubes. The recent development of transistors offers notable economies in the computer field—the physical size of a machine is as little as half that of a conventional computer, while the power and air-conditioning requirements are reduced by as much as 70%. IBM's designers, with their unrivalled computer experience, have incorporated these economies in their latest product. The result is the "Seven-O-Seventy", a very powerful computer in the medium- to large-size range, which offers an unusually favourable job:cost ratio.

http://classic.technology

The IBM 7070

Medium- to large-sized computer for both commercial and scientific applications
Improved modular (*building block*) design
Decimal input, output and processing
Parallel read-out, serial arithmetic
Large primary store of magnetic cores
Very large backing stores of magnetic tapes and RAMAC—random access magnetic discs
Powerful instruction logic
Mixed alphabetic and numerical data easily handled
Priority processing
Simultaneous Peripheral Operations On Line—SPOOL
Double-precision floating decimal arithmetic
99 indexing registers for fast, flexible program modification
Three 10-position accumulators, with independent sign control
Addition and subtraction into any word in the primary store
Three table look-up instructions (equal, equal or high, lowest)
Scatter and *gather* operations under the control of record definition
Simultaneous operations for increased speed
Tape compression to increase tape capacity and effective tape speeds
Format control of input and output without programming
Console control of machine operations
Console typewriter for manual input, data display and automatic logging of all console operations
Automatic programming systems
Large library of standard programs

http://classic.technology



Card Systems

The IBM 7070 combines the very high input and output speeds required for large-scale commercial data processing with the calculating speeds required for the complex calculations encountered in scientific work. The overall speeds of the system are increased by the use of synchronisers (or *buffers*). These mean that a number of operations can take place simultaneously: while the results of one calculation are being printed and punched, another calculation is taking place, and the factors for yet a third are being read.

The 7070 is designed on the building block principle, of adding to a basic system those components which are needed for each individual application. One of the basic units is the IBM 7150 Console, which gives overall control over machine operations, and provides communication between the operator and the computer.

Punched Card Input

One IBM 7500 Card Reader can be attached to each of up to three input synchronisers. Each unit is capable of reading 500 cards a minute, so that the maximum rate of input with all input synchronisers in operation is 120,000 alphanumerical characters a minute. Control panel wiring allows format control of different card layouts without programming.

Punched Card and Line Printed Output

One card punch or line printer can be attached to each of up to three output synchronisers.

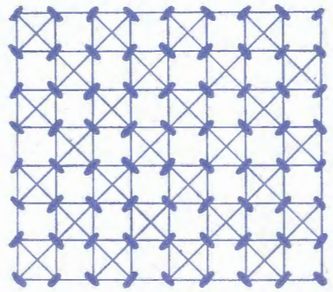
The IBM 7550 Card Punch, which offers double punch and blank column detection and format control by means of control panel wiring, is capable of punching 250 cards a minute.

The IBM 7400 Printer will print up to 150 lines a minute. Control panel wiring allows characters to be printed anywhere in the 120 printing positions. There is a tape-controlled carriage for forms spacing, as well as selectors and emitters.

Calculating Speeds

The time taken by the IBM 7601 Arithmetic and Program Control Unit to perform arithmetical operations is affected by the factors involved, but the following are representative figures.

Addition or subtraction—		
5 digits	60	microseconds
10 digits	72	microseconds
Addition or subtraction, with recomplementing—		
5 digits	108	microseconds
10 digits	132	microseconds
Shifting— 5 positions	44	microseconds
10 positions	68	microseconds
Branching	24	microseconds
Internal transfer	36	microseconds
Multiplication—		
multiplier 0000000001	0.7	milliseconds approx.
9999999999	1.6	milliseconds approx.
Division—		
quotient 0000000001	0.8	milliseconds approx.
9999999999	5	milliseconds approx.



Primary Storage

The IBM 7301 Core Storage provides a large primary store of 5,000 or 10,000 *words* of magnetic core storage, with an access time of 6 microseconds. This fast access time, together with parallel read-out, increases program efficiency by giving faster data flow and by making the next program instruction available more quickly.

A word consists of ten decimal digits with sign (plus, minus or alphabetic). Alphabetic characters are coded as two digits, and alphabetic words are indicated as such by the special alphabetic sign. A digit is stored in a two-out-of-five code which allows for automatic validity checking of all data flow to and from core storage.

Tape and RAMAC Systems

Backing Storage

Backing storage is provided by up to 12 magnetic tape units and up to four random access magnetic disc units. There are two channels for the transfer of data between tape or RAMAC units and the primary store. As well as simultaneous card operations, therefore, a tape can be read while another is being written and calculation is taking place.

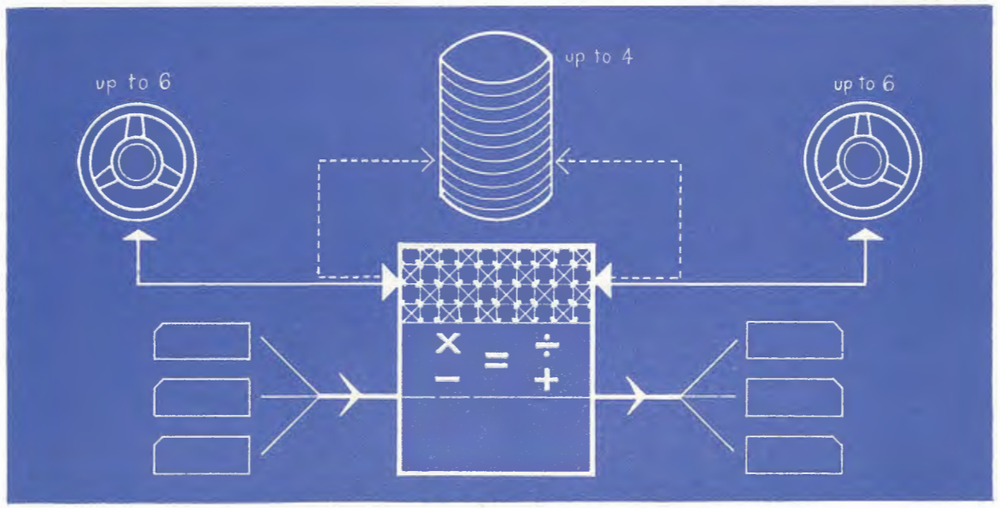
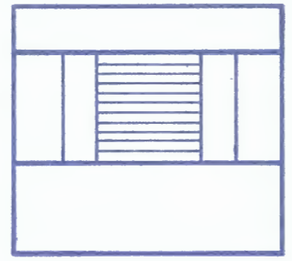


Figure 1. Blueprint for a data processing system designed to keep up with an expanding business.



IBM 729 Magnetic Tape Units provide high-speed input and output of large volumes of data. The tape code, providing for automatic validity checking, is compatible with other IBM Electronic Data Processing systems, and the two-gap read-write head allows for the automatic read-back and checking of all written information. Records can be of any length, provided a sufficient area is allocated in the primary store, and can be composed of mixed alphabetic and numerical words. The suppression of high-order zeros can increase tape capacity and, therefore, effective information transfer speeds.

The 729 is available in two models, the Model II and the Model IV. These models can be used in any combination in the 7070 system.

	Model II	*Model IV*
Density (characters per inch)	200	555
Passing speed (inches per second)	75	112.5
Information transfer rate (characters per second)	15,000	62,500
Start/stop time (milliseconds)	10	7.5

When random access is required to files which are too large to be economically stored in magnetic core storage, IBM *in-line processing* machines are necessary. The IBM 7300 RAMAC Magnetic Disc Storage Unit consists of fifty magnetic discs with a total capacity of six million digits. A new instruction, Provide, allocates the first of the three access arms to become available to seek a record. Thus maximum speed and efficiency are obtained without the need to program the use of each arm individually.

Up to ten IBM 7900 Inquiry Typewriters can also be installed, at distances up to 2,500 feet from the 7070, for the interrogation of the disc files. This means that information about a stock item or a customer can be extracted for reference with the least possible delay.



http://classic.technology

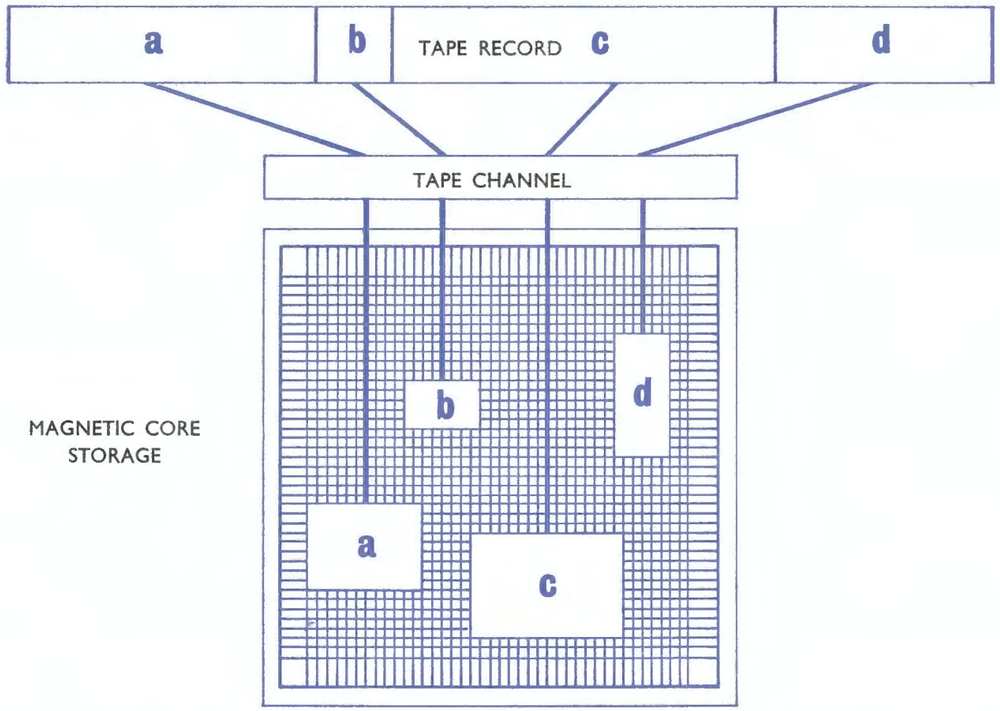


Figure 2. This diagram shows, in simplified form, an example of the principle of record scatter and gather.

Programming Features

The program is stored sequentially in the primary store. This means that it is not normally necessary to specify the address of the next instruction: one step is followed automatically by the next, until a special branching code causes the computer to refer elsewhere for the next instruction.

The ten-digit instruction is normally made up of: two digits giving the *operation code* (the use of the sign allows for additions to the present range of over 120 possible instructions); two digits specifying one of the 99 *indexing registers* for address modification; two digits for *field definition*, where only a part of a word is to be processed; and four digits for the *address*. The address is normally the location of the data to be processed, but it is also used to control branching, shifting, etc.

Record definition is an important new feature of 7070 programming. In one step it is possible to *scatter* data from an input synchroniser into various blocks of core storage, or to *gather* data from storage for integrated output. This feature, which is represented schematically in Figure 2, offers great economies in programming time, processing time, and storage capacity.

Priority processing, yet another new feature, gives even higher productivity by making the best possible use of the various input and output channels. When one program is delayed on account of an input/output interlock, the 7070 automatically transfers to another program, returning to the priority program as soon as the interlock is released. In this way two programs—one requiring considerable calculation with moderate input and output, the other considerable input and output without extensive calculation—can be run simultaneously in little more time than one would take. One example of this process is Simultaneous Peripheral Operations On Line—*SPOOL*—whereby routine tape-to-card/printer and card-to-tape operations are performed without special off-line equipment.

Other useful features include—

Add to Storage
Split Shift
Compare—whole words or parts of words
Loop count by indexing registers
Electronic switches

OP	OPERAND
ZAI	HOURS
M	RATE
STI	GROSS PAY
SI	DEDUCTION
STI	NET PAY

Programming Systems

A decisive factor in the efficiency and economy of a computer is the simplification of programming. If programming systems and utility programs are available even before installation, the time needed to write and test programs and put the computer to productive work is much reduced. These savings can have a considerable effect on the overall costs of an EDP installation.

IBM programming systems allow programs to be written in a condensed mnemonic form which reduces the time taken, and minimises errors. *Macro-instructions*, where one written instruction generates a number of machine instructions, increase program efficiency still further.

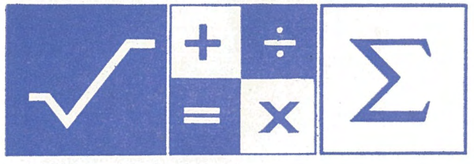
Autocoder, first developed for the 705, is intended to bring the full benefits of automatic programming systems to the problems of programming business applications. The inclusion of subroutines under the control of macro-instructions greatly reduces the clerical labour of the programmer, and leaves him free for his real work. If necessary, the use of Autocoder can be extended by combining it with other systems, including *Fortran* (see page 8).

In addition, a number of standard programs will be made available for 7070 installations. Generalised sorting and merging programs will be especially useful to the 7070 user, for this machine is ideally suited to these tasks. Utility programs will include testing and debugging routines, SPOOL, loading and zeroing routines, and many others.

Program Library

Besides these standard programs, the IBM program library is being adapted for the 7070. Many programs, originally written and tested for use on other computers for many different purposes, will be translated for use on the 7070—another aid to maximum programming efficiency.

http://classic.technology



The 7070 for Scientific Work

The 7070 has many features which make it an efficient and economical machine for the solution of problems of scientific computation. It is a decimal machine, with the consequent advantages of easy communication between scientist and computer; yet it offers calculating speeds comparable with those of many binary computers. The very large single-level store of up to 10,000 words of magnetic core storage makes it especially suitable for the solution of problems (such as matrix problems) involving large volumes of data. Both data and instructions, it should be emphasised, are available to the arithmetic and control unit in six microseconds, wherever they are stored in the primary store.

Floating decimal arithmetic is an essential feature for many scientific problems. This optional feature of the 7070 offers, besides nine single-precision operations, automatic *double-precision* addition, multiplication and division in floating decimal mode, thus saving programming and processing time when extreme accuracy is required.

Fortran is an IBM programming system developed to help mathematicians and scientists to write out their problems in a form very like their normal notation, yet suitable for automatic translation for use by any of the IBM computers—650, 704, 705, 709, and now the 7070 and 7090.

The Components

		Max. no. of units
7150	Console Control Unit	
7601	Arithmetic and Program Control	
7602	Core Storage Control	
7301	Core Storage	
7600	Input/Output Control	
7603	Input/Output Synchroniser	6
7500	Card Reader	3
7550	Card Punch	3*
7400	Printer	3*
7604	Tape Control	
729 II, 729 IV	Magnetic Tape Unit	12
7605	RAMAC Control	
7300	Disc Storage	4
7900	Inquiry Typewriter	10

* Card Punches and Printers may be added in any manner giving a combined total of up to three units.

http://classic.technology

Does More — Costs Less

To recapitulate, the 7070 is a powerful and economical computer in the medium to large range, for both commercial and scientific applications.

Favourable job:cost ratio
Reduced installation costs
Reduced running costs
High input and output speeds of card systems, giving economical handling of large volumes of data
Modular construction—the system keeps in step with the needs of the user

IBM's reputation in 85 countries has been built on a tradition going back to the earliest days of punched card data processing machines, a tradition of selling not machines alone, but a comprehensive *service*—expert sales and technical assistance, educational facilities, preventive maintenance, and service bureaus, as well as the widest choice of up-to-date data processing machines in the world. For further information on how IBM can help you, please get in touch with one of our representatives at your nearest IBM office, or at

IBM United Kingdom Limited, 101 Wigmore Street, London, W.1. (Tel. WELbeck 6600)

UK Form 54-5902
Printed in England by Greenaways - London.

http://classic.technology