



**1440/1460 Administrative Terminal System**

**(1440-CX-07X and 1460-CX-08X)**

**Application Description**

This system consists of control and functional programs that permit many different text-processing and data-handling activities to be carried on simultaneously through different terminals.

This publication contains a general discussion of the features of the program, an indication of some of the areas in which it may be applied, and the machine configuration required.

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## PROGRAM ABSTRACT

The IBM 1440/1460 Administrative Terminal System (ATS) consists of the control and functional programs that permit many different text-processing and data-handling activities to be carried on simultaneously through up to 40 different terminals. The IBM 2741 Communications Terminals used by this system are essentially IBM SELECTRIC<sup>®</sup> typewriters. Disk storage is used to hold both working items and items to be recalled for use or modification. In addition, users may add programs to the system that will permit concurrent execution of simple peripheral operations such as card-to-tape and tape-to-print.

The system has many functional capabilities. Some of these are:

- Enter information through a typewriter keyboard, with backspacing and retyping to correct errors.
- Replace a word, phrase, or sentence in text which has been entered or recalled from storage.
- Add or delete lines or sentences.
- Copy information.
- Transmit information to any other terminal or to a punched card or magnetic tape.
- Store and retrieve any defined set of information. Provision is made to prohibit unauthorized retrieval of information.
- Produce precisely formatted output from rough input, including such features as automatic page heading, footing, and numbering, and right-margin justification, if desired. Free-form text and fixed-format information may be intermixed.
- Perform basic desk calculator functions -- add, subtract, multiply, and divide.

## SYSTEM DESCRIPTION

ATS consists of a unique combination of operating programs and an IBM 1440/1460 Data Processing System and related input/output equipment, especially prepared to handle text streams. A text stream is any combination of spaces, characters, words, sentences, or paragraphs in any sequence and entered at any period of time, which may be required to be assembled as output. The output may be used directly, reproduced, or be read as input to be processed by a conventional data processing operation.

ATS stores input information in the computer system and returns the information automatically as typewritten data upon demand. Simultaneous operation of a number of remote terminals is permitted, each of which may be handling a different application (see Figure 1). The output may be formatted by specific editing processes selected by the terminal operator.

Typed or printed output is prepared in lines of a length designated by the operator. Right-margin justification may be selected as an option. Justification is implemented by analysis of the spaces between text words and placement of additional single spaces distributed across the line. Uniform captions may be inserted automatically at the top and bottom of each page. The pages are numbered if the operator so elects. Any number of sections of stored text may be obtained upon demand by the operator.

The backspace key is used to erase (cancel) erroneous data during the initial typing operation. Text in storage can be modified by the deletion or insertion of new words, phrases, sentences, and paragraphs.

Lines of fixed-format information or unit sections of free-form text designated by the typist are sequentially numbered in storage. This number sequence is automatically changed whenever the text is modified. Thus, a count of unit items is available as a tally for recordkeeping purposes.

Information placed into storage as a document can be kept confidential by tagging the document with a security code to prevent unauthorized access to, or accidental modification of, the stored data.

The System provides for the output of information at any terminal although the data may have been originally entered or revised at one or more different terminals. In addition, ATS permits communication among the several terminals of a system by storing requests for output at specified terminals. The terminal operator may accept these requests whenever it is convenient to do so.

The primary concept of ATS is to provide a typewriter which is an entry to a system for text stream processing. The operator's basic methods are not changed, but are enhanced by the capability of the system.

REPRESENTATIVE REMOTE OPERATING STATIONS

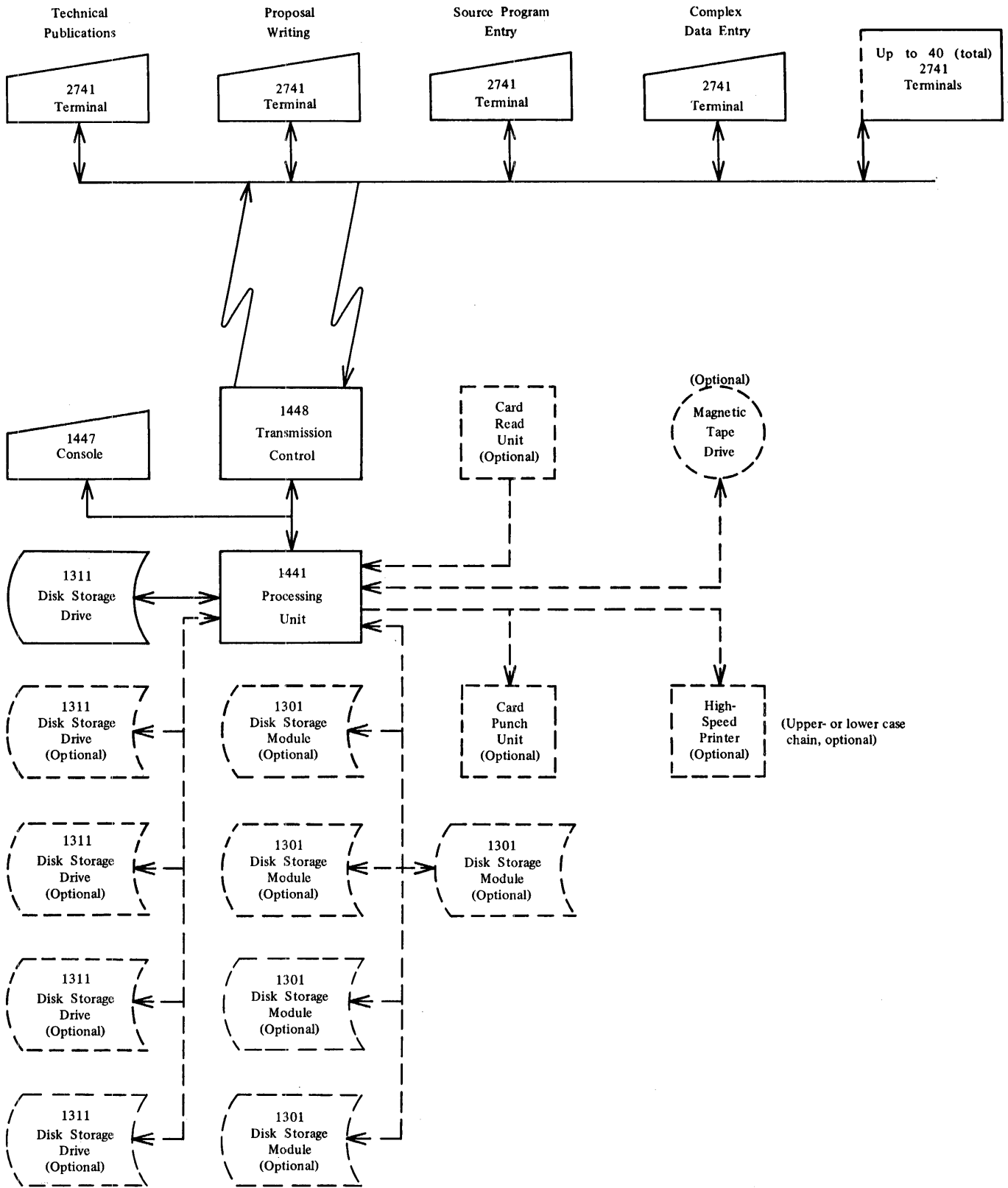


Figure 1. IBM 1440/1460 Administrative Terminal System - block diagram, showing optional equipment in dotted lines

## ADMINISTRATIVE TERMINAL SYSTEM APPLICATIONS

ATS provides a new concept for the production of large-volume transcriptions. Text is held in accessible storage while copy is proofread and edited. The typist then revises the stored text by means of program-controlled deletion and insertion. Manual retyping of corrected drafts and of final text is eliminated.

The ATS concept is dynamic to the point that its total possibilities challenge the imagination. A description of a few of the applications follows.

### PUBLICATIONS

All publications activity is concerned with presenting information for different purposes. A few of the more common types of publications are:

- Advertisements
- Technical Manuals
- Proposals
- Reports

The primary advantage that ATS has to offer the publishing field is time, both in the initial production of documentation and in the revision cycles. Advertisements are for the most part rather brief, and little is to be gained by using the terminal for this application. Proposals, reports, and technical manuals, however, can all be profitably produced by means of the system.

### Initial Production

In the process of accumulating the material which makes up a publication, it is very difficult to keep the material in such a way that later parts of the manual can be readily added to the original portions or that the entire document can be produced quickly and accurately for perusal of the authors or others with regulatory authority.

### Revisions

It is often necessary to revise documents, both before and after publication. It is often vital that the revised material be available as quickly as possible. In the past, revisions of sections in the middle of a document required that all subsequent material be retyped and repaginated, that all figures and tables be renumbered, and that the changed document be re-proofread. With ATS, the changes can be made readily, the document need not be proofread, and the document can be typed out on the terminal in camera-ready condition. The saving of time on the part of the authors, editors, and typists is truly significant.

## Technical Manuals

Most major military systems require several hundred separate manuals. This amounts to a total of about two million pages per year. An estimate for a major aerospace company would be 50,000 to 80,000 pages per year. Technical documentation costs have been estimated to amount to 2.4% of the cost of all hardware contracts that involve a technical manual requirement. Each year some \$400 million is spent by the military on the production of technical manuals. This includes writing, editing, illustrating, producing, and publishing.

One of the major problems in this activity is the total elapsed time in the revision cycle for technical manuals. In many instances, it may require 40 to 60 days to introduce a change to the field because of documentation lag.

The initial production of manuals can be better planned, but pressure to get the manuals out on time is still considerable. Late delivery of manuals can hold up payment on an entire contract. Some of the other problems in manual preparation are:

- The morale of the typist herself, which is related directly to production performance
- Maintaining quality of finished copy (right-hand justification, heading, footing, etc.)
- Peaks and valleys in workload. These create higher costs because of overtime and/or purchase of outside vendor service.
- Conservation of author's editing time

ATS helps to solve these problems in the following ways:

- Erasures are made in working storage and not on paper. The operator will not be slowed down by the worry of stopping to erase. Rough draft is speeded up considerably by automatic right-hand justification. The typist need not concern herself with this problem. The program automatically calculates spacing to arrive at justified format. It also automatically types heading and footing information as well as page numbers.
- Repetitive typing is not only time-consuming and therefore expensive, but also boring to the typist. Much of the information is retyped only to make changes. This can run as high as eight revisions; an average would be about four. With ATS the document is called out from permanent storage to working storage. There the typist makes only the additions, changes, or deletions and returns it to permanent storage. She may ask that it be typed out in total for author editing or final printing. An optional method would be to have the documents printed out periodically on the high-speed printer. This may require an uppercase and lowercase chain on the printer.
- Workload peaks and the pressures of meeting deadlines are greatly relieved. Manuals can be accumulated in permanent storage and changes made as they occur. Then when the release date arrives, the printed document incorporates the latest changes. This capability is also valuable for subsequent revisions.

- The author has the advantage of getting rapid turnaround service on his proofs. He can concentrate on fewer problems or projects at one time. He also gets better copy and spends less time editing minor items. He develops confidence in the system.

A rule of thumb for economic justification analysis would be one typist servicing seven authors with ATS, versus one typist servicing four with conventional typing. This is based on industry studies and actual experience at a pilot installation.

- A spirit of competition develops between typists with ATS and those without it. Secretaries and clerical personnel appreciate having terminal capability. Production has improved significantly in many installations. In addition the number of iterations is reduced, because the retyped data (which is done at machine speed) is more accurate.

### Proposal Preparation

The advantages of ATS for technical writing apply to proposal preparation. However, there are some unique characteristics of this activity:

- A proposal is a selling tool. It must represent the best of what a company intends to accomplish.
- Many proposals are written in the face of rigid deadline requirements.
- Standard phraseology which describes capability and/or products is used many times over.

ATS processing can contribute to proposed activity in the following ways:

- Very attractive copy is produced by automatic formatting and right-margin justification.
- Proposal deadlines become less fearsome when the information in storage can simply be called out to make changes. At deadline time the latest information is available for high-speed printing.
- Standard phraseology can be called from storage and incorporated as is or with minor changes in the writer's text.
- Communication of the latest changes or status of a proposal is assisted by the ability of any writer to request a printout of any other parts of the proposal with which he must coordinate.

### Report Writing

Many reports, technical and otherwise, are "to-date" reports. ATS can call from storage any or all of the to-date information and type it. The report writer or typist can add activity for the current



period and the report is finished. All of the other benefits of formatting, margin justification, heading, footing, and page numbering are there to assist.

#### PROGRAMMER'S AID

ATS can be a very valuable tool for programmers. The following are the results of comparisons and observation of programming activities at one ATS installation:

1. The programmer's production is increased because he has one tool available in his work space with which he can accomplish all his normal work. He has neither the excuse nor the need to go to another work center for keypunching and listing.
2. The programmer's production is further increased by the fact that the machine paces the operator. The give and take between the terminal and the programmer becomes a rhythmic response which induces a pace.
3. Production is greater because the programmer has complete documentation on his program, can make changes to it instantly, and can still maintain current up-to-date documentation without leaving his office.
4. The use of a terminal system allows a programmer (by taking inventory of the statements stored in his area) to keep track of his production and to measure it against his goal.
5. The learning curve to operate the ATS terminal is very short.
6. The following comparison was made of three procedures for maintaining one source program file consisting of 11,000 eighty-column card images:

<u>Assumptions</u>	<u>Working Time Total</u>	<u>Likely Waiting Time</u>	<u>Number of People Involved</u>
If on tape, no key-punch in programmer's office, assume print file on 1401 every second update.	32.0 min.	8 work hr.	2
If in cards, key-punch in programmer's office, assume print file on 1401 every fifth update.	9.5 min.	none (but no current hard copy)	2
If ATS terminal in programmer's office, assume print changed page on terminal each change to document.	2.5 min.	1.5 min.	1

7. In constructing new files the terminal input may be about equal to the single act of keypunching. The programmer is composing in finished form: keypunching, verifying, listing, verifying the finished list for accuracy, and documenting the program. At any step an error can be recognized and a change made without the programmer leaving the office.
8. Correcting a mistake in the current coding line, if the programmer is aware of the mistake just after it occurred, is a simple operation. By pressing the ATTN Key and then the Backspace Key, the erroneous characters are erased, and the correct ones can then be entered.
9. The system eliminates bulky card storage. All of a programmer's coding can be stored in the system.
10. Code is printed on coding forms. Coding that has many fixed fields is very difficult to read when printed on plain paper. With ATS, a printed coding sheet can be inserted into the terminal before printing a programmer's code. This feature saves time and eliminates many errors.

#### DATA ENTRY

In the capture of data for machine and/or computer processing, ATS has many advantages over other alternatives such as card punches, paper tape, and optical scanners. This is especially true in high-volume, complex jobs such as file conversions where the input data has any or all of the following characteristics:

- Input of uppercase, lowercase and special characters
- Variable-length data records (over 80 characters)
- Coding of input records
- Variations in quality and format of input information

The following are some of the advantages ATS has for data entry:

- ATS terminals may be placed at the source of the data, and the information can be captured and verified by the originating department. This eliminates the rekeying of data at the card punch and balancing to control totals.
- Uppercase and lowercase characters and variable-length records are handled automatically. ATS has an 88-character set without multiple key strokes; more with overstriking.
- Fewer employment and training problems. Typists are plentiful and the ATS terminal operation is easy to learn.
- Coding problems can often be minimized by ATS, thus eliminating the need for special coders. The large character set is a real advantage when coding is required.
- Control of source documents and audit trails is simple as compared with alternative methods such as optical scanning, where exception handling can be cumbersome.

- Verification can be made by a proofreader instead of a verifier operator, and corrections can be easily made without reentering the entire record.
- Data can be entered with a minimum of formatting requirements (no fixed fields).
- Personnel costs are reduced as fewer typists and proofreaders are needed.
- Since ATS source data entry is faster, fewer terminals are needed.
- No cards are used as an intermediate medium, card costs and card-handling costs are eliminated.

In capturing data by keypunching, the following sequence of events usually takes place:

1. Source documents are written or typed in a form acceptable for card punching.
2. The data is keypunched.
3. Some or all of the data is verified.
4. Computer and peripheral device time is used for card-to-tape, editing, batch totals, and listing operations.

With ATS these events can be reduced to no more than two steps. The creator of the source information can input the data, and a proofreader can verify either line-printer or terminal-printed output and enter any corrections. Data is then transmitted to tape or disk storage for further processing. The system thus captures the information in machine-readable form at the source, thereby saving time and simplifying operations.

#### FILE MAINTENANCE

ATS also attacks the basic problem of maintaining current and accurate changes to a file. Who should be responsible for this accuracy? In the past, accuracy has depended on the originator of the information. Data processing then receives the input, converts it, processes it, and returns answers as required. Although ATS still depends on the originator of the information for accuracy, the change to the file is immediate, and the originator has proof positive that the copy is correct because the system types back what it has recorded. Tremendous benefits result when design engineering and/or manufacturing engineering is able to reflect accurate and immediate changes to bills of material. This, of course, implies the possibility of being able to call out a listing of the latest bill when desired.

The same capability is applicable whenever there are data files such as names and addresses, stockholders, insurance records, credit information, and other master records.

## DESK CALCULATOR

The desk calculator feature in ATS can add, subtract, multiply, and divide. It can also take roots, powers, and factorials, and can evaluate simple algebraic expressions. It is as useful in an engineering department as it is in an accounting department. Engineering labor reporting, engineering drawing control, basic engineering data control, plus the inquiry capabilities, make the ATS terminal a real problem-solver for engineering departments.

## INFORMATION RETRIEVAL

ATS provides a method of data retrieval. Related documents may be assigned contiguous groups of numbers. A storage report on a group of numbers gives a list of all documents in that group by title, number, and date stored. Specific documents to be retrieved at a terminal could be selected from the storage report. A separate index of documents, such as a KWIC index, could also be maintained outside the system and used for locating pertinent documents stored in the system. ATS is also an excellent means of data input for subsequent entry into other information retrieval systems by punched cards or magnetic tape.

## TERMINAL COMMUNICATIONS

Any terminal may transmit its working storage to any other terminal and as many messages as desired to the same terminal. Since the system does not poll, the receiving terminal must request that messages be transmitted to it. The computer attracts the receiving terminal operator's attention by typing the word (MSG) the first time that terminal is used after a message has been directed to it.

## OTHER APPLICATIONS

ATS indeed challenges the imagination. The system is receiving acceptance across a wide variety of industries and applications. A few of these are:

- Patent documents
- System and procedure manuals
- Legislative drafts
- Legal abstracts
- Contracts
- Directories
- Trust deeds and wills
- Price lists
- Automotive shop manuals
- Instruction manuals for users  
of manufactured products

## FUNCTIONAL SPECIFICATIONS

The system is a multiterminal, multiapplication, real-time processor with time-sharing capabilities. A keyboard terminal is the basic input device. Key combinations supply control to the system. Output is provided by typewriter, printer, tape deck, disk, or card punch. Maximum record lengths on tape or disk for user-written programs depend on the amount of buffer area needed for terminals and the amount of core storage used for other resident programs. Features included in the program are given below.

### BASIC FUNCTIONS

1. Data entry. Information can be manipulated by line or by unit, where a unit is of any length and is defined by a double carriage return.
2. The user can manipulate information in the following ways:
  - a. Corrections
    - (1) Backspace and retype during entry
    - (2) Retype beginning with a particular word
    - (3) Replace a word or phrase
    - (4) Add to a line or unit
    - (5) Delete a line or unit
    - (6) Insert a line or unit
  - b. Data moves
    - (1) Store and retrieve information from file
    - (2) Gather stored data in any sequence
    - (3) Transmit to any other terminal
    - (4) Copy information by transmission to the originating terminal
3. Output Edit
  - a. Limit free-form text lines to a length specified from the terminal
  - b. Justify right-hand margins
  - c. Intermix free-form text with fixed-format information
  - d. Place page headings, title, or chapter headings on all pages of a document
  - e. Place specified lines at the foot of each page of a document

- f. Number document pages at top and/or bottom automatically
- g. Control vertical spacing of the output document
- h. Halt to let the operator change typewriter print elements or to permit other required manual action, including entry of variable information

#### EXTENDED FUNCTIONS

- Data capture ability for large installations of keypunches and key verifiers
- Capability for program card deck control for large programming groups and for assembling sections of the programs and selected test decks. Special functions provided for this type of activity are automatic duplicate, sequence numbering, and field definition
- Basic desk calculator functions (add, subtract, multiply, and divide), plus roots, powers and factorials, and evaluation of simple algebraic expressions
- A store-and-forward communication capability both from and to any terminals on the system
- Ability to perform normal peripheral operations simultaneously, such as card-to-tape and tape-to-printer (when using ATS on an IBM 1460 Data Processing System).

#### TIMING

Basic timing factors are:

- Typewriter output: 14.8 characters per second
- Typewriter input: As fast as a person can type
- Card reading: Up to 600 cards per minute
- Card punching: Causes system delays with a 1402 Card Read Punch, not recommended while terminals are in operation
- Peripheral printing: Up to 1100 lines per minute

The ability of the system to do peripheral work depends upon the amount of core storage available, which is in turn determined by the maximum number of active terminals on the system and the mix of operations being performed by active terminals. The criterion that must be satisfied to do any input/output operation is that the operation will never require more than 100 milliseconds of computer interlock time.

Information for proper interfacing of user-written peripheral programs is provided with the system documentation.

Terminal response depends upon the number of active terminals and upon what functions are being called for at any one time. The major factor is the required access time to the disk files.

The rate at which ATS documents may be written out on a high-speed printer or magnetic tape also depends on the number of active terminals and the types of operations being concurrently performed on these terminals. This rate is highly variable. The fastest form of magnetic-tape output is the permanent storage tape. This tape may be further processed by user-written programs operating offline from ATS.

## SYSTEM REQUIREMENTS

### PROGRAMMING SYSTEMS

ATS is coded using the IBM 1440/1460 Disk Autocoder (1401-AU-008). This system is not needed for its operation.

System initialization prior to operation may require the appropriate one of the following IBM utility programs.

- 1401/1460 Disk Utility Programs (1401-UT-053)
- 1440 Disk Utility Utility Programs (1440-UT-041)

### BASIC MACHINE SYSTEMS

#### Terminals

ATS uses IBM 2741 Communication Terminals. Depending upon the type of communication service connecting the terminal with the computer, an IBM Line Adapter (modem) or a Common Carrier Line Adapter may be required. See your IBM Data Processing sales representative for additional information concerning these requirements.

#### Computer System

ATS can use either of two central processing units. A basic IBM 1440 system requires one IBM 1441 Processing Unit, Model A6 (16,000 positions of core storage). A basic IBM 1460 system requires one IBM 1441 Processing Unit, Model B6 (16,000 positions of core storage).

Either of these 1441 Processing Units requires the following special features: Bit Test, Console Attachment, Direct Seek, Disk Storage Control, Indexing and Store Address Register, and Transmission Control Unit Attachment.

The following IBM units and features are also required for a basic system:

1. One 1311 Disk Storage Drive, Model 1, with the Direct Seek feature. (An additional 1311 Disk Storage Drive is strongly recommended. See "Additional Disk Storage" under "Optional System Features", below.)
2. One 1316 Disk Pack for each IBM 1311 Disk Storage Drive attached to the system.
3. One 1447 Console, Model 1, with the Sense Switches feature.
4. One 1447 Console, Model 4



5. One 1448 Transmission Control Unit, Model 1, with:
  - Attachment Feature 1050/1060.
  - RPQ feature E38485 for attaching 2741 terminals. This feature includes provisions for attaching one group of up to ten lines.
  - For attachment of additional groups of ten lines, up to a maximum of three additional groups, Line Group features, as required, and one RPQ feature 811390 for each line group.
  - Either a Line Adapter Set 1050/1060 feature (IBM modem), or a Common Carrier Adapter Set 1050/1060 feature for each two lines, up to a maximum of five per line group (20 in all). If modems are required for any terminal, the corresponding modem must be installed at the 1448. See your IBM Data Processing sales representative for additional information concerning these requirements.
6. One 1461 Input/Output Control for a 1460 system.

Some method of program loading must also be supplied. This may be either a card reader (as described in the following section) or another 1401, 1440, or 1460 system that can load the program on a 1316 Disk Pack to be mounted on one of the 1311 Disk Storage Drives on the system.

#### OPTIONAL MACHINE SYSTEM FEATURES

##### Additional Disk Storage

One or more additional disk storage units are required for the most effective operation of the system. These may include up to four 1311 Disk Storage Drives, Model 2, with Direct Seek and Seek Overlap features, and 1316 Disk Packs. These also require that the Seek Overlap Adapter feature be installed on the 1441 Processing Unit and that the Seek Overlap feature be installed on the 1311 Disk Storage Drive, Model 1.

From one to five modules of IBM 1301 Disk Storage may be used. If any 1301 Disk Storage is used, two 1311 Disk Storage Drives must be used, and the Expanded Disk Storage Control feature must be installed on the 1441 Processing Unit. It is suggested that one magnetic tape drive be included in a system with 1301 Disk Storage to provide for efficient backup procedures.

##### High-Speed Printing

One printer may be attached to the system to serve as a high-speed output terminal. On a 1440 system, a 1443 Printer with the 24 Additional Print Positions and Print Storage features, or a 1403 Printer, Model 2, 3 or 5 with a 1446 Printer Control, may be used.

On a 1460 system, a 1403 Printer with the Print Storage feature in the 1461 Input/Output Control may be used. On a 1403 Printer, the Auxiliary Ribbon Feeding feature for polyester film-ribbon, is recommended where output will be used for direct reproduction.

Instead of a regular 1403 Printer on either a 1440 or a 1460 system, a special printer may be attached that will permit both uppercase and lowercase letters and an expanded set of special characters at up to about 300 lines per minute. Installation of uppercase and lowercase printing capabilities will require the following:

- A 1446 Printer Control or a 1461 Input/Output Control, with RPQ feature 813148.
- A 1403 Printer, Model 2, with RPQ features 812033 and 812034, and either RPQ feature 898059 or the Interchangeable Chain Cartridge Adapter feature, and 33 RPQ features E33255. Part 823380 is required to provide the 120 characters of uppercase and lowercase Courier type, including special characters. RPQ features 818019 and 818020 must also be installed on the 1441 Processing Unit.

### Translate Feature

The system uses the translate feature on the 1441 Processing Unit, if installed, in the following functions:

- Uppercase and lowercase printing
- Loading documents from punched cards
- Loading documents from magnetic tape
- Offline printing of ATS archive tapes

Presence of the feature will significantly reduce the central processing unit time required for the foregoing functions.

### Magnetic Tapes

Up to six magnetic tape drives may be attached to the system to serve as high-speed output terminal and to provide archival document storage. A magnetic tape written on one of these drives may be used by another system as input for processing. On a 1440 system, a 7335 Magnetic Tape Unit, Model 1 or 2, may be used.

### Card Punching and Reading

One card punch or card read punch may be attached to the system to prepare punched cards. These may be either in a format prespecified by the user or in a special format suitable for storing information to be read back into disk storage at a later date. On a 1440 system, a 1442 Card Read Punch, Model 1 or Model 2, or a 1442 Card Reader, Model 4, and/or a 1444 Card Punch, Model 1, will provide this capability. On a 1460 system, a 1402 Card Read Punch, Model 3, will provide this capability.



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