IBM 1410 DATA PROCESSING SYSTEM BULLETIN

IBM 1410 PROCESSOR OPERATING SYSTEM
USING MAGNETIC TAPE AND IBM 1301 DISK STORAGE
PRELIMINARY SPECIFICATIONS

INTRODUCTION

Purpose of This Publication

This bulletin is intended to introduce systems planning and operating per-
sonnel of 1410 installations to the principal features and advantages of the
IBM Processor Operating System. Although primarily directed at systems
planning and operating personnel, the bulletin is of general interest to all
1410 programmers.

Purpose of the System

The IBM 1410 Processor Operating System (formerly called "1410 Compiler
System") is designed to enable IBM 1410 installations to use the FORTRAN,
COBOL, RPG (Report Program Generator) and Autocoder processors with a
minimum of machine time and operating effort. It can be used within a wide
range of system configurations.

Additional Functions of the System

The 1410 Processor Operating System also provides a convenient means of
 (a) updating and/or duplicating the operating system, itself; and
 (b) printing out specified sections of the library.

Advantages

The system offers these principal advantages:

1. Storage of all processor programs on one storage medium (i.e., one
   reel of magnetic tape, or one module of IBM 1301 Disk Storage).
2. Convenient and efficient use of all 1410 processors by any installa-
   tion meeting certain minimum machine requirements.
3. Convenient facilities for temporary or permanent modification of the
   system to meet configuration requirements of different 1410
   installations.
4. An efficient and convenient means for distributing all IBM 1410
   processors on one reel of magnetic tape.

TABLE OF CONTENTS

The IBM 1410 Processor Operating System thus contributes to the economy and flexibility of 1410 installations. It significantly reduces the machine time and human handling required to produce machine-language programs from source programs written in higher-level languages.

Specifically, the system:
- reduces the number of tape reel changes;
- permits substitution of IBM 1301 Disk Storage for work tapes and the system tape;
- permits a wide range of system configurations for running of the 1410 Processor Operating System;
- permits individual installations to define operating procedures for all 1410 processors;
- provides a convenient and uniform method of updating and modifying all system programs;
- minimizes human handling and operator intervention, and permits speedy distribution of possible future improvements and/or additional system programs.

The 'Processor Operating System'

The term "Processor Operating System" is used throughout this bulletin to refer to the collection of programs that together accomplish the functions listed above. As indicated in Figure 1, the system consists of the FORTRAN, COBOL, RPG, and Autocoder processors, the library facilities for all of these programs, and the supervisory programs. The latter perform the control and auxiliary functions needed to insure effective and integrated performance of the system.

The Term 'System Program'

The term "System Program" is used throughout this bulletin to refer to any of the programs forming the Processor Operating System.

The System Programs

A brief description of the system programs follows.

THE 'SYSTEM SUPERVISORY PROGRAMS'

The Control Program, the Updating Program, and the Print Program will henceforth be referred to collectively as the "System Supervisory Programs."

The Control Program

The Control Program, guided by control-card information, determines which of the 1410 processors (FORTRAN, COBOL, RPG, or Autocoder) is to be used by the system to convert a given source program into a 1410 machine-language program. The Control Program also furnishes other services, including: error checking, phase control, header checking, tape assignment, and control functions required for updating of the system programs and for library print-outs.
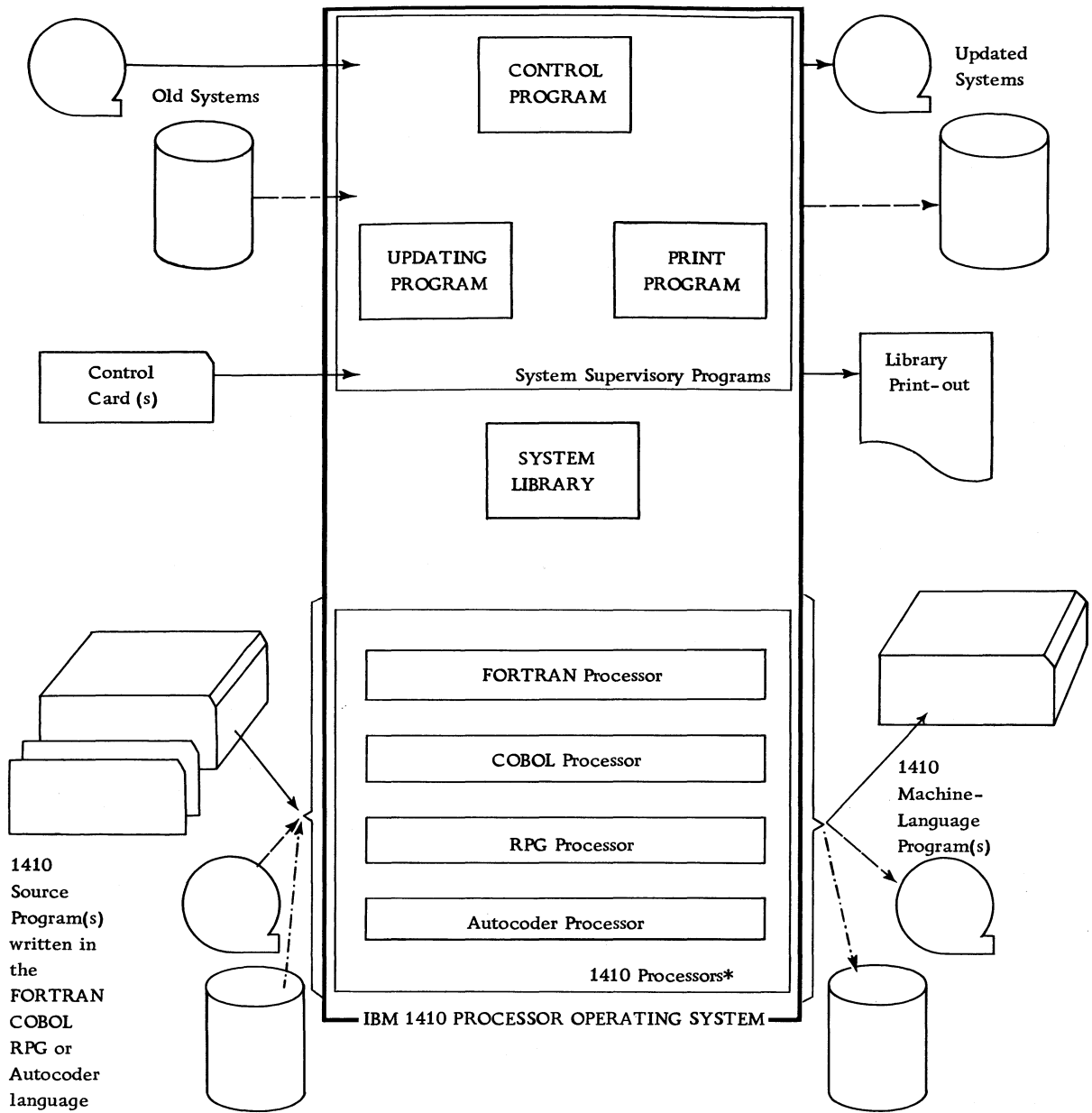
Old Systems

CONTROL
PROGRAM

Updated
Systems

Control
Card (s)

UPDATING
PROGRAM

PRINT
PROGRAM

System Supervisory Programs

Library
Print-out

SYSTEM
LIBRARY

1410
Source
Program(s)
written in
the
FORTRAN
COBOL
RPG or
Autocoder
language

FORTRAN Processor

COBOL Processor

RPG Processor

Autocoder Processor

1410 Processors*

1410
Machine-
Language
Program(s)

IBM 1410 PROCESSOR OPERATING SYSTEM

* Note that the final phase of the FORTRAN, COBOL and RPG processors consists of program assembly and/or macro-expansion handled by the Autocoder processor.

Figure 1. The Programs Forming the 1410 Processor Operating System

The Updating Program

The Updating Program provides the routines needed to update the system programs. It provides facilities for making corrections, additions and/or major improvements to the system, and it also permits deletion of any system program(s).

The Print Program

This program provides the routines needed to print out any specified section of the System Library.

THE SYSTEM LIBRARY

The System Library consists of a collection of subroutines, such as IOCS macros, IOCS subroutines, and other system macros and subroutines. User's macros and subroutines may be added to the System Library at the option of the installation.

THE 1410 PROCESSORS*

The Autocoder Processor

The 1410 Autocoder Processor is a program that converts source programs written in Autocoder language into 1410 machine-language programs.

The RPG Processor

The 1410 RPG Processor is a program that converts source programs consisting of 1410 RPG specification statements into 1410 machine-language programs.

The COBOL Processor

The 1410 COBOL Processor is a program that converts programs written in the COBOL '61 language into 1410 machine-language programs.

The FORTRAN Processor

The 1410 FORTRAN Processor is a program that converts programs written in the FORTRAN II language into 1410 machine-language programs.

System Operation

Method

The operation of the system is entirely automatic. After the system operation has been initiated from the console, operator activity consists solely of pressing the Console RESET and START keys.

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* Note that the final phase of the FORTRAN, COBOL and RPG processors consists of program assembly and/or macro-expansion handled by the Autocoder Processor.

Standard Configuration

Individual 1410 installations can pre-assign the input/output units they wish to use regularly for the running of the Processor Operating System. (This is done by means of a system "update" run.) This arrangement of input/output units then becomes the installation's "standard configuration" for the running of the Processor Operating System.
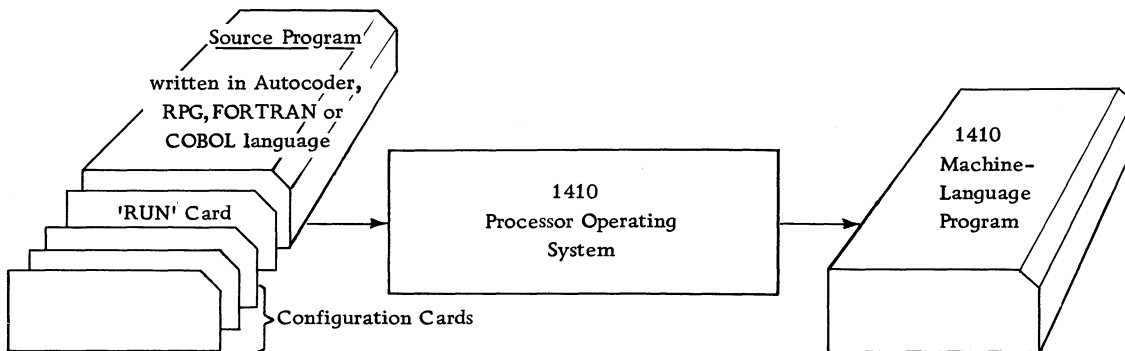

Figure 2. Two Types of Control Cards required by the 1410 Processor Operating System

Control Cards

Figure 2 shows the two types of control cards associated with the 1410 Processors. The two types are described below.

THE 'CONFIGURATION' CARDS

Any deviation from the installation's pre-assigned standard configuration must be indicated to the system by means of special control cards, called "Configuration Cards." These cards precede the source program(s). Individual configuration cards are used to specify changes from the standard configuration regarding the input units, the output units, the work units, and other basic characteristics specified for the standard configuration. This permits convenient substitution of unit-record equipment for tapes, of tapes for unit record equipment, etc.

THE 'RUN' CARD

The "Run Card" specifies whether the system is to be used for processor operation, system updating, or library print-out.

OTHER CONTROL CARDS

Other control cards are used to specify the sections of the system to be updated or printed out.

IBM is providing two versions of the 1410 Processor Operating System. One is a system that is stored on magnetic tape, with intermediate processing handled via magnetic tape. The other is stored in IBM 1301 Disk Storage, with intermediate processing handled via 1301 Disk Storage. Although different storage media are used for the two systems, operating procedures for the tape and disk systems are nearly identical. The two versions-are discussed separately in the following sections.
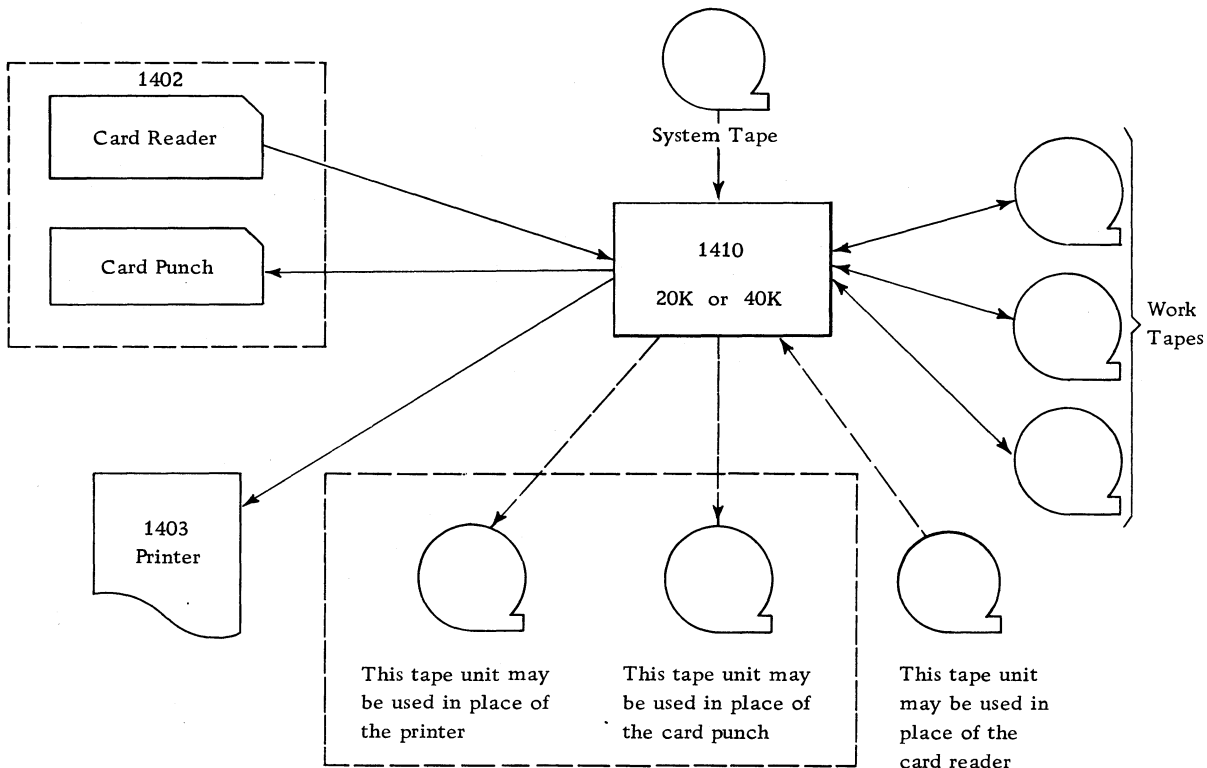
Machine Requirements

The following are the minimum machine requirements for the system:
20,000 positions of core storage
4 IBM 729 II, 729 IV, 729 V or 7330 Magnetic Tape Units (may be intermixed)
1 IBM 1402 Card Read-Punch, Model 2
1 IBM 1403 Printer, Model 2

NOTE 1: One tape unit each may be substituted for the card reader, the card punch, and the printer.

NOTE 2: At the option of the user, punch and printer output may be inter-mixed on one tape for subsequent automatic off-line punching or printing on the IBM 1401. (See Figure 3.) If this option is chosen, the information on the combined punch and printer tape will automatically be preceded by a self-loading 1401 program that can selectively punch and/or print the data files on the intermixed tape.

1402

Card Reader

Card Punch

System Tape

1410

20K or 40K

Work Tapes

1403 Printer

This tape unit may be used in place of the printer

This tape unit may be used in place of the card punch

This tape unit may be used in place of the card reader

At the option of the user, punch and printer output may be intermixed on one tape for subsequent auto-matic off-line punching and printing on the IBM 1401.

NOTE: The minimum tape requirement for a tape-oriented system is 6 tape units.

Figure 3. Tape System Configuration

9

Expanded Core Storage

Each of the 1410 processors (FORTRAN, COBOL, RPG and Autocoder) can operate on 1410 systems with 20,000, 40,000, 60,000 and 80,000 positions of core storage. The Autocoder and COBOL Processors take advantage of the larger core-storage capacities (i.e, 60,000 and 80,000 positions) by reserving larger areas in core storage for tables used by these two processors. This reduces the time required to produce object programs from some Autocoder and COBOL source programs. (Such time savings are realized primarily for programs that use a large number of labels.) The time required to produce object programs from FORTRAN and RPG source programs is not affected by the larger storage capacities. Each of the four processors can produce object programs for 1410 systems of any core-storage size.

The System Configuration

Figure 3 shows the configuration of the IBM 1410 Processor Operating System for Magnetic Tape. As indicated, source programs enter the system via the 1402 Card Read-Punch (or via a tape unit substituted for the card reader). The entire Processor Operating System is stored on one reel of tape known as the "System Tape." Intermediate processing takes place on three work tapes.

The machine-language programs produced by the system are punched into cards by the 1402 Card Read-Punch (or via a tape unit substituted for the card punch).

A program listing, showing the symbolic source statements and the corresponding assembled machine-language statements, is also produced. It is either printed on the 1403 Printer, or it is written on a tape unit substituted for the printer, if so specified. See NOTES 1 and 2 above.

Note that the minimum tape requirement for a tape-oriented system is six tape units.

THE IBM 1410 PROCESSOR OPERATING SYSTEM FOR IBM 1301 DISK STORAGE

It is assumed that the reader is familiar with the philosophy of the 1410 Processor Operating System for Magnetic Tape as described on the preceding pages of this bulletin.

The functions performed by the Processor Operating System for IBM 1301 Disk Storage are the same as those described above for the tape system, but it uses IBM 1301 Disk Storage in place of the system tape and the work tapes used by the tape system.

Machine Requirements

The following are the minimum machine requirements for operation of the system:

40,000 positions of core storage
Processing Overlap and Priority special features
2 IBM 729 II, 729 IV, 729 V, or 7330 Magnetic Tape Units*
50 cylinders of IBM 1301 Disk Storage (see details below)

Expanded Core Storage

Each of the 1410 processors (FORTRAN, COBOL, RPG and Autocoder) can operate on 1410 disk systems with 40,000, 60,000, and 80,000 positions of core storage. The Autocoder and COBOL Processors take advantage of the larger core-storage capacities (i.e., 60,000 and 80,000 positions) by reserving larger areas in core storage for tables used by these two processors. This reduces the time required to produce object programs from some Autocoder and COBOL source programs. (Such time savings are realized primarily for programs that use a large number of labels.) The time required to produce object programs from FORTRAN and RPG source programs is not affected by the larger storage capacities. Each of the four processors can produce object programs for 1410 systems of any core-storage size.

Explanation of Cylinder Requirements

The system requires 15 consecutive cylinders for storage of the system programs. The remaining 35 cylinders are required for working storage and may be contained in up to three disk-storage modules, with a minimum of 10 consecutive cylinders per module.

The following are examples of permissible cylinder distributions:

Module 1	Module 2	Module 3
15	20	--
10	15	10

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* Users who do not have tape units can substitute an IBM 1402 Card-Read Punch, Model 2, and a 1403 Printer, Model 2, for these two tape units.

Note that the 35 cylinders specified for working storage may be used for any other purpose when the Processor Operating System is not in use:

DISTRIBUTION OF CYLINDERS

The 50 cylinders required by the system can be on one disk storage module, but the operation of the system will be more efficient if the 50 cylinders are distributed over more than one module.

TRACK FORMAT

The format track of the cylinders used by the system must be set to the "Full-Track Format" (i.e., one record per full track).

The format tracks of the 15 cylinders on which the system is stored must be set to the LOAD mode.

The format tracks of the 35 cylinders used for working storage must be set to the MOVE mode.

The proper settings of the format tracks must be provided by the user prior to loading or operating the Processor Operating System.

REQUIREMENTS FOR ADDITIONAL CYLINDERS

System Storage

Users should allow one additional cylinder for each 1,000 library source statements added by the user.

Working Storage

The fifty cylinders specified for the system are expected to provide sufficient storage for the creation of object programs requiring up to 80,000 core-storage positions. For example, two phases of a program requiring 40,000 core-storage positions for each phase can be processed in one run.
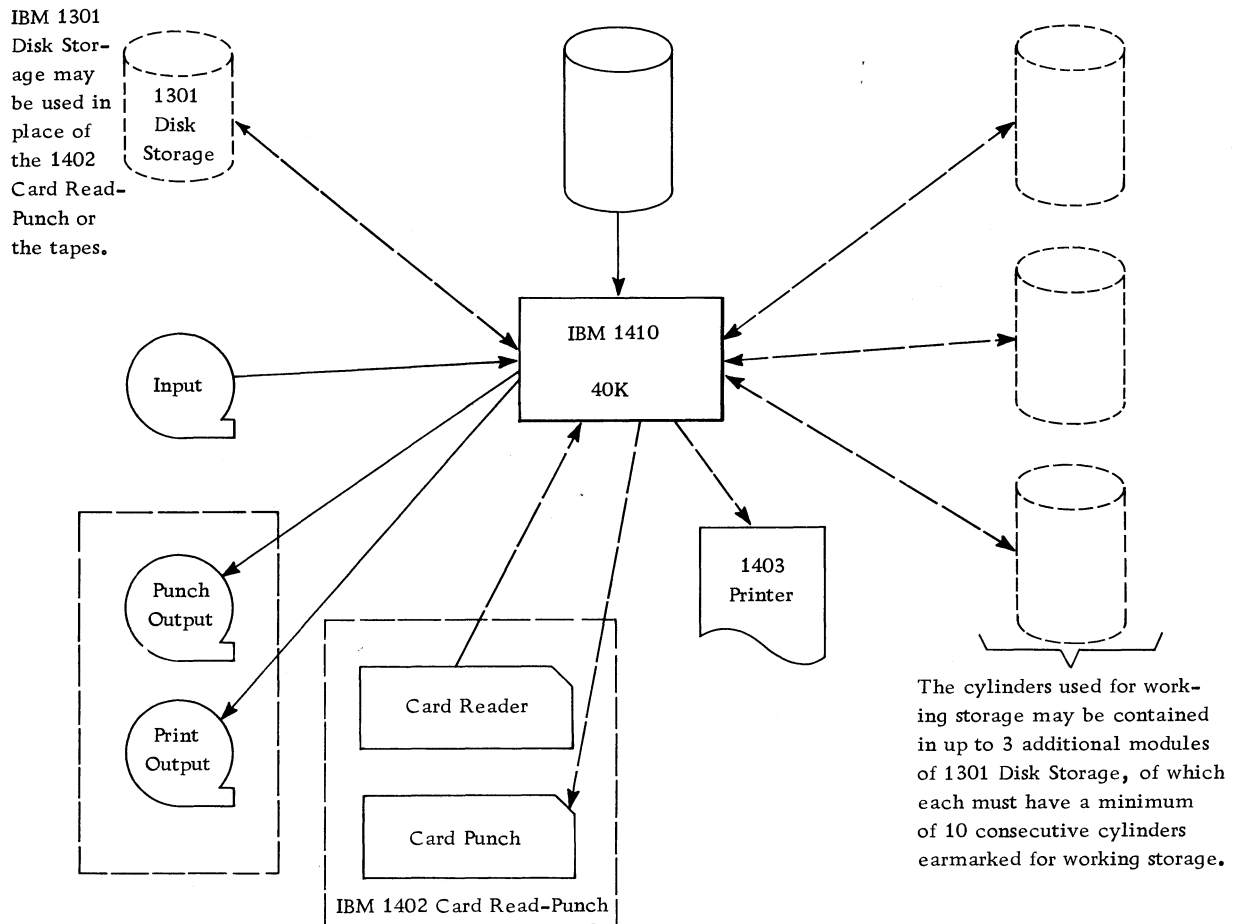
Users should allow one additional cylinder for each 4,000 core-storage positions in excess of 80,000 required by the object program.

The System Configuration

Figure 4 shows the configuration of the IBM 1410 Processor Operating System for 1301 Disk Storage. Note that an IBM 1402 Card Read-Punch and an IBM 1403 Printer or IBM 1301 Disk Storage can be substituted for the tapes indicated.

As indicated in Figure 4, source programs enter the system via tape (in card-image form), via the 1402 Card Read-Punch, or via 1301 Disk Storage. The entire Processor Operating System is stored on one module of 1301 Disk Storage. Intermediate processing takes place on the same or on up to three additional modules of 1301 Disk Storage.

One module of IBM 1301 Disk Storage contains all
system programs on 15 consecutive cylinders. This
module may contain 35 or more additional cylinders
earmarked for working storage for the Processor
Operating System.

IBM 1301
Disk Stor-
age may
be used in
place of
the 1402
Card Read-
Punch or
the tapes.

1301
Disk
Storage

Input

IBM 1410

40K

Punch
Output

Print
Output

Card Reader

Card Punch

IBM 1402 Card Read-Punch

1403
Printer

The cylinders used for work-
ing storage may be contained
in up to 3 additional modules
of 1301 Disk Storage, of which
each must have a minimum
of 10 consecutive cylinders
earmarked for working storage.

At the option of the user,
punch and printer output
may be intermixed on one
tape for subsequent auto-
matic off-line punching
and printing on the IBM
1401.

Users who do not have tape units
can substitute an IBM Card Read-
Punch, Model 2, and a 1403
Printer, Model 2, for the tape
units indicated.

Figure 4. Disk System Configuration

The machine-language programs produced by the system are written on tape (in card-image form), or are punched into cards by the 1402 Card Read-Punch, or written onto 1301 Disk Storage.

A program listing, showing the symbolic source statements and the corresponding assembled machine-language statements, is also produced. It is either printed on the 1403 Printer, or it is written on tape for subsequent off-line printing on an IBM 1401. See NOTES 1 and 2 on page 9.

System Operation

The operating procedures and principles described in the first section of this bulletin apply fully to the disk system. In addition, the Processor Operating System for 1301 Disk Storage will provide the means for specifying the cylinders to be used for system storage and work storage, respectively.

IBM 1410 PUBLICATIONS

IBM 1410 systems literature published to date includes the following:

Form Number   Title

GENERAL INFORMATION MANUALS
F22-6517   Introduction to IBM Data Processing Systems
F28-8053   COBOL
F28-8074   FORTRAN

BULLETINS
J24-1413   Basic Autocoder for the IBM 1410: Preliminary Specifications
J24-1415   Programs and Programming Systems for the IBM 1410
J24-1433   Autocoder: Preliminary Specifications
J24-1435   Utility Programs for the IBM 1410: Preliminary Specifications
J28-0244   IBM 1410 Utility Programs - Part I; Card/Tape Utility Programs
J24-1453   Simulation of the IBM 650 with the IBM 1410
J24-1460   1405 Disk Storage -- Utility Programs: Preliminary Specifications
J24-1466   IBM 1405 Disk Storage File-Organization Routines: Preliminary Specifications
J24-1468   FORTRAN for the IBM 1410: Preliminary Specifications
J28-0232   IBM 1410 Programming Systems -- COBOL: Additional Specifications
J28-0233   IBM 1410 Input/Output Control System for 1405 Disk Storage
               Preliminary Specifications
J28-1432   IBM 1410 Input/Output Control System for Card and Tape Systems
               Preliminary Specifications
J28-8064   IBM 1301 Input/Output Control System for 1410 and 7000 Series Data
               Processing Systems
J28-0243   IBM 1410 Processor Operating System Using Magnetic Tape and
               IBM 1301 Disk Storage
J29-1414   Sort 10, Sort 11, and Merge 12 for the IBM 1410: Preliminary Specifications
J29-1427   Simulation of the IBM 1410 with the IBM 704, IBM 709, and IBM 7090

IBM 1410 machine literature published to date includes the following:

GENERAL INFORMATION MANUALS
D22-6627   IBM 7750 Programmed Transmission Control
D24-1410   1410 Data Processing System
D24-1442   1410 Data Processing System
               1301 Disk Storage

REFERENCE MANUALS
A24-1407   1410 Data Processing System

BULLETINS
G24-1417   IBM 1412 Magnetic Character Reader, Model 1
G24-1440   Priority Feature
G24-1441   Telegraph Input-Output Feature
G24-1444   IBM 1014 Remote Inquiry Unit
G24-1445   IBM 1410/1009 Data Transmission Unit