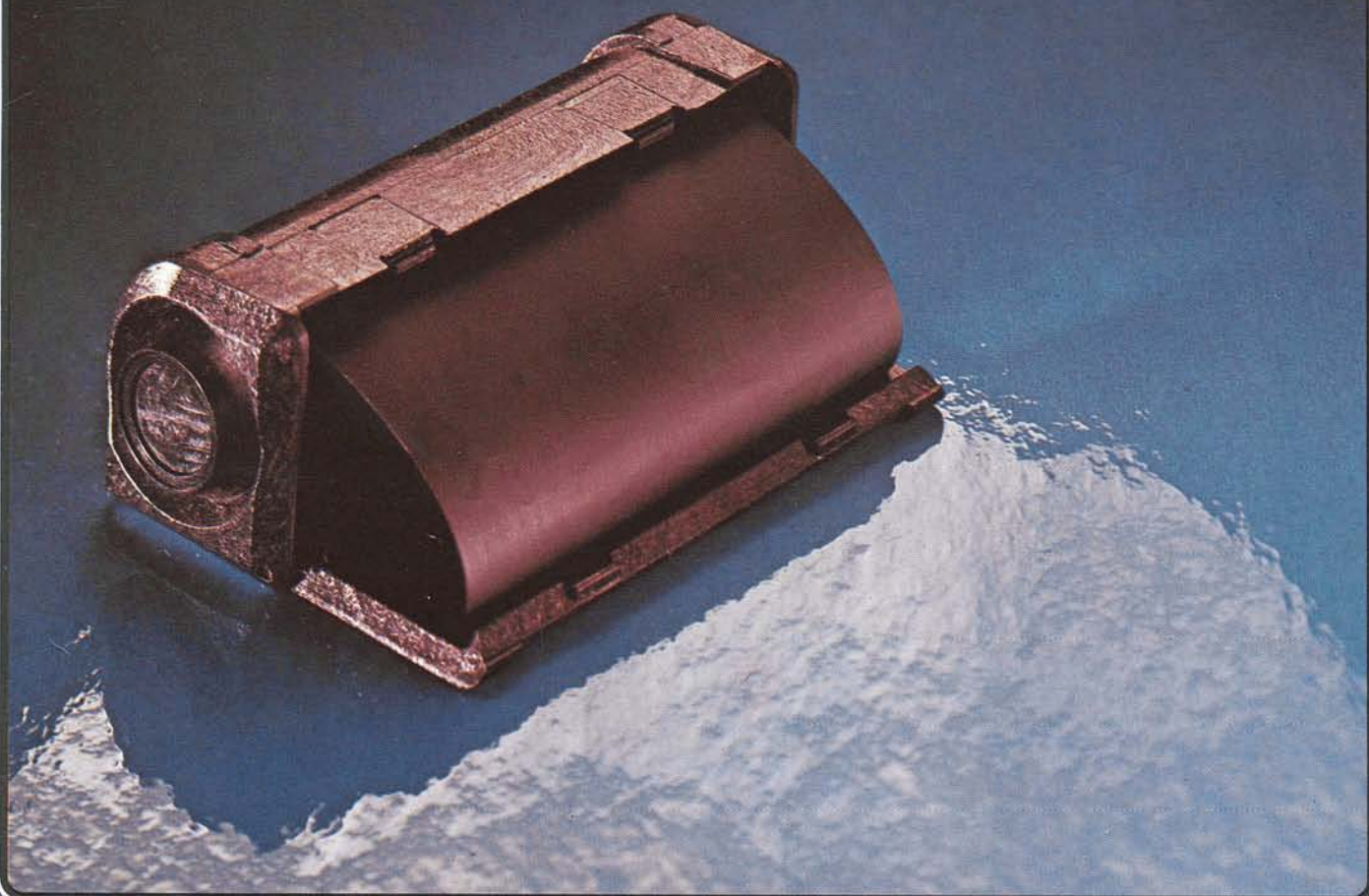# The Data-Set Approach to On-Line Mass Storage

"The 'volume' approach, announced earlier, to on-line storage still looks good in various ways. But Control Data's newly announced system presents at least one major advantage and several other decidedly valuable ones.

"CDC's brochure, THE DATA-SET APPROACH, deals briefly with all of them. It's a summary for the executive expected to know what forward moves are being made in this tremendously important area. It brings him quickly and authoritatively up to date on mass storage of processable data."

What The Industry Needs Now...

Fast random-access storage has moved the computer industry a long way ahead. But still there is tape. With other aspects of data processing having moved up to new levels of sophistication, manual handling of off-line tape has become a major item of operating expense. This expense is a serious dent in efficiency for any sizeable processing facility. So Control Data and other makers started years ago to develop mass storage systems for automatically entering and withdrawing those masses of data now residing on tape.

The great advantage of Control Data's Mass Storage over all other approaches to on-line data storage is practicality. Here is a new machine, capable of handling masses of tape data at speeds several orders of magnitude beyond anything ever seen before for its capacity. But Control Data has not permitted runaway emphasis on masses of data for the sake of size alone. And although data is staged to disk drives, the system does not waste space by handling data in terms of disk drive 'volumes.' Control Data has plotted its course by the most familiar and useful star in data-management navigation: the data set.

The Data-Set Approach...

In addition to using the working unit most familiar to the experienced user and most natural to large-job processing, the data-set approach saves a great deal of storage space on disk by using only the tracks required by any data set rather than a volume filled with incomplete pages.

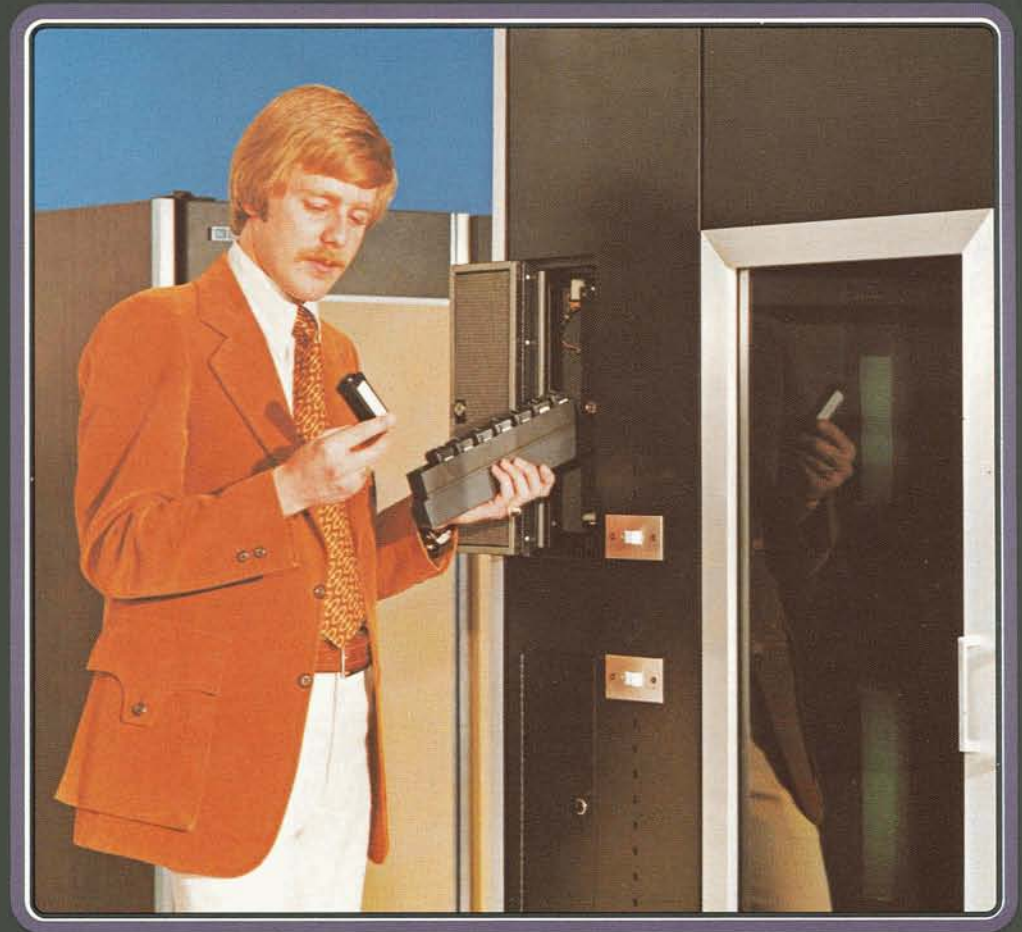A CONTROL DATA Mass Storage Cartridge stores 8 megabytes. Surveys show that 70% of all tape
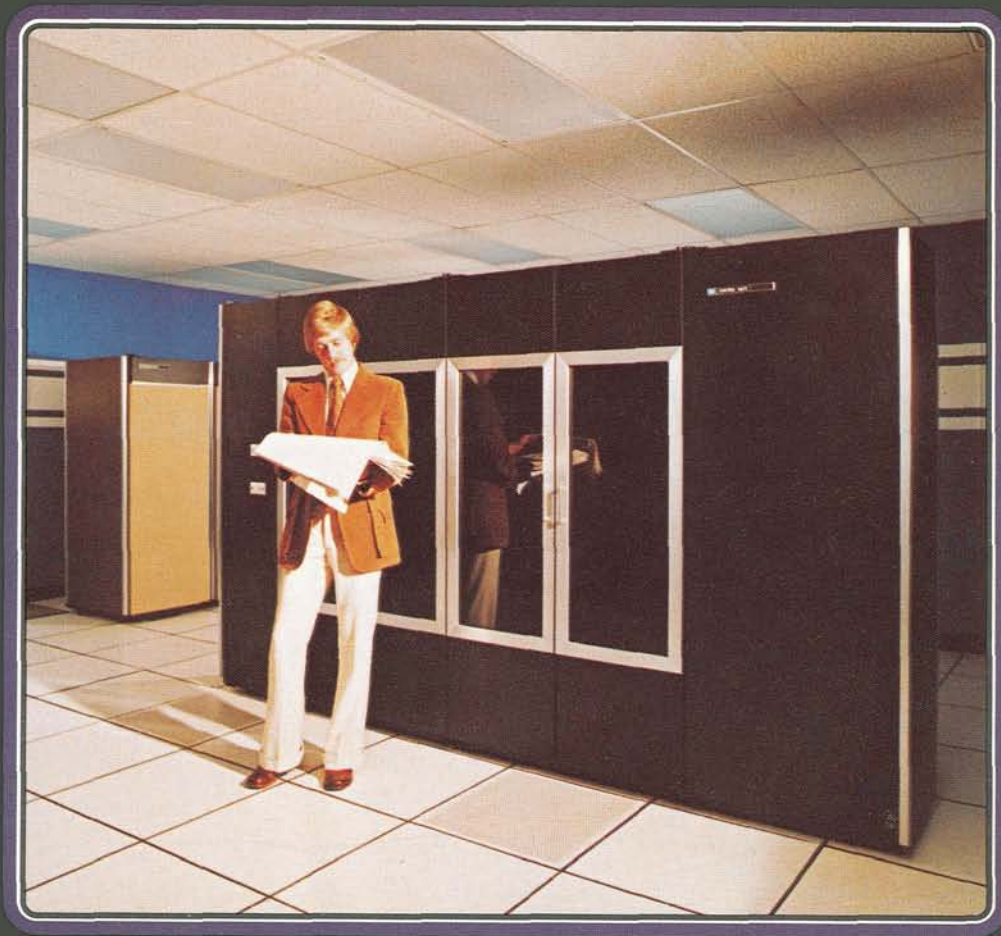
Cartridge-storage unit of CDC Mass-Storage System, with openings for manual insertion or removal of storage cartridges barely visible at far left. To the rear at left is cabinet of Mass Storage Adapter.

data sets comprise fewer than 2 MB, and 90% can be contained with 16 MB of space. Thanks to the data-set approach, the 16 billion bytes stored on 2,000 cartridges in a single unit of a CONTROL DATA Mass Storage Facility can handle the total needs of most users and can be expanded modularly to satisfy the needs of any large data requirement.

Control Data's facility will be available for IBM System/370, using OS/MFT-MVT or OS/VS, as well as for CONTROL DATA major systems. It will support configurations of multiple processors, and with standard procedures no changes are needed in users' job-control language.

CONTROL DATA Mass Storage uses a storage magazine in which tape cartridges are filed according to an X-Y grid. Any specific cartridge is selected by a mechanical arm and moved from storage to an entry station within an average of 2.5 seconds. Then, after a two-second move to a read/write station, the cartridge is opened and its tape is unwound and drawn into two vacuum columns but remains attached to a spool in the cartridge. After being read, the tape is rewound into the cartridge and sealed. The cartridge is moved to an exit station from which it is returned to its addressed storage position. Operations of selection, transfer, reading, writing and storage can be overlapped to maintain a continuous flow of data between the facility and any disks of the central computer system.

Any similarity to other systems ends here. The CONTROL DATA Facility features assets which make it a distinctly different and, in the opinion of most observers, a decidedly superior system.

Operator about to insert an Octopack with eight storage cartridges at the data-entry door of cartridge-storage unit. Removal door is beneath.

Assets Add Up To A Breakthrough...

UNSEGREGATED DISKS: With Control Data's mass storage, segregated disks are not needed. Data can be staged to any available disk space in the system, reducing the possibility of contention at controllers or data channels. And the disks used can be of any type whatsoever.

LARGE DATA SETS: Another considerable advantage in the CONTROL DATA system is the elimination, where desired, of staging altogether. With very large data sets, for example, there is sufficient time-loss in staging onto disk to eliminate the advantages derived from the use of a mass storage system. For this reason, until now, it has been recommended that such data sets not be included in on-line mass storage at all but remain assigned to tape reels. The CONTROL DATA system, though, can read large data sets directly into central memory and return them directly to the mass-stored cartridges — without the delay of intermediate staging. This mode is called User-Sequential.

DIRECT ACCESS: As important as User-Sequential processing is User-Direct which also, as its name conveys, permits staging-free access to mass-stored data. The User-Direct mode provides access to specific records within a data set. This, of course, is a tremendous asset in retrieval for any purpose whatsoever, and it brings to tape data storage, probably for the first time anywhere, some of the advantages of random access.

READ/WRITE FREEDOM: The CONTROL DATA Mass-Storage Facility provides two read/write stations on the standard unit, with
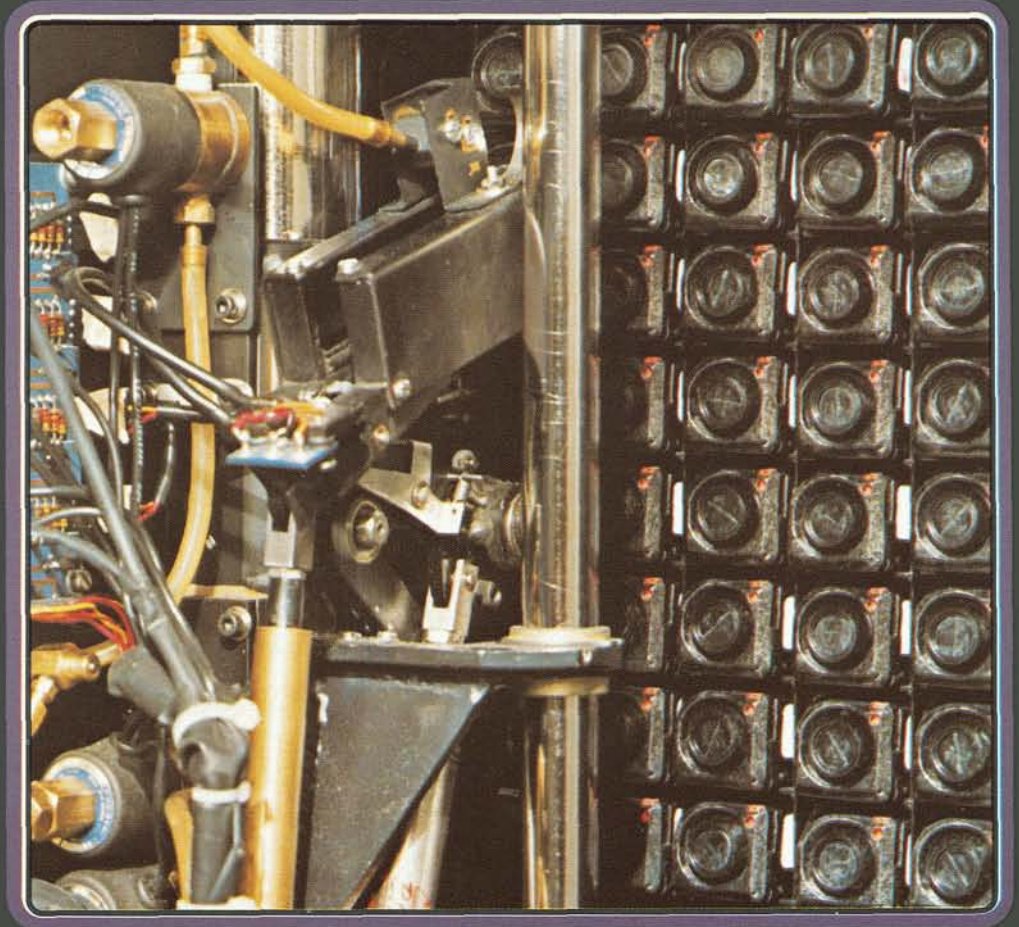

Closeup shows cartridge selector picking up or returning a stored cartridge. Selector transfers cartridges between x-y storage locations and a cartridge transport.

optional expansion to four per unit. Thus one read/write station can be loading or unloading tape from a cartridge while data is being read or written at others. This capacity, along with the response speed of cartridge handling, contributes to the continual flow of data and allows the user to tailor the system to his performance needs.

System Availability...
The CONTROL DATA system combines such innovations as these with current, well-established disk and tape technologies. The CONTROL DATA system assures the reliability, availability and maintainability of its performance and the integrity of its data through error detection and correction as well as on-line diagnostics. CDC maintains that a mass-storage system must have the physical and logical capability to reconfigure its hardware automatically in the event of component failure. Through automatic reconfiguration the system decides when an element has failed, discontinues logically to use it, routes the data path logically to an alternate path, and notifies the outside world of what was done. Such a capability can assure near-100% continuity of system functions and has been the objective maintained in designing the CONTROL DATA Mass Storage System.

These, in brief, are some of the advantages of Control Data's new, more flexible approach to on-line mass storage. Facilities are entirely modular. But what is more important is practicality from the very beginning. The data set approach will effectively achieve the breakthrough in on-line mass storage.
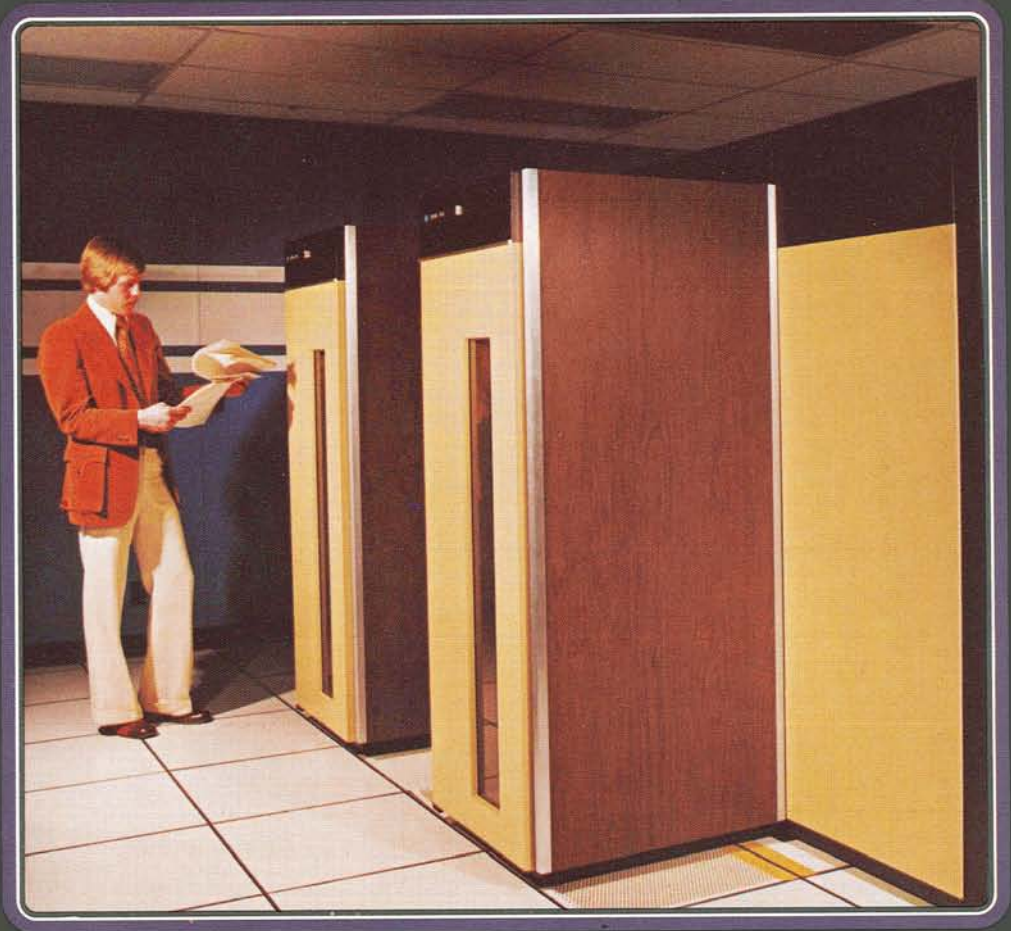
Cartridge transports, back-to-back with storage units.

CONTROL DATA
CORPORATION