

SYSTEM CONTROL PROGRAMMING

**5652-VS1 - OS/V S1 (RELEASE 7 on)
5741-VS1 - OS/V S1 (Through RELEASE 6.7)
OPERATING SYSTEM/VIRTUAL STORAGE 1**

PURPOSE

The Operating System/Virtual Storage 1 (OS/V S1, also known as VS1) programs perform the systems control programming functions for the S/370 mdls 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 165II, 168, the 3031, 3032 and 3033 Processors, and the 4331 (Model Group 11 is not supported) and 4341 Processors utilizing Dynamic Address Translation (DAT), and the Extended Control Mode (EC) of these systems.

DESCRIPTION

The maximum size real storage supported by OS/V S1 is 8,388,608 bytes.

The minimum systems supported by OS/V S1 are the 3135 mdl GD (147,456 bytes), the 3138 mdl I (524,288 bytes), the 3145 mdl GE (163,840 bytes), the 3148 mdl J (1,048,576 bytes), the 3155II mdl H (262,144 bytes), the 158 mdl I (524,288 bytes), the 3165II mdl J (1,048,576 bytes), the 3168 mdl J (1,048,576 bytes), the 3031 mdl 2 (2,097,152 bytes), the 3032 mdl 2 (2,097,152 bytes), the 3033 mdl U4 (4,194,304 bytes) the 4331 mdl 11 (524,288 bytes), the 4341, mdl L1 (2,097,152 bytes), and 4381 Processors. Processors.

A system with processor storage size of 160K bytes of available real storage is sufficient for all VS1 standard features, but the use of optional SCP features will probably require additional real storage. In general, function, advantages and performance depend upon the amount of real storage available; therefore, most users will find a processor storage size of 240K bytes or larger to be more effective for their VS1 system.

The virtual storage size which can be supported is highly dependent on a number of factors, such as application characteristics, programming techniques, and system resources. VS1 supports a maximum virtual storage size of 16,777,216 bytes provided there are enough system resources to support the workload.

Smaller Main Storage Considerations: Lack of available real storage reduces the capabilities and performance of OS/V S1. The following restrictions apply to the 144K real storage programming design point:

- The release 6 or later starter systems are not supported.
- Two-partition support is the recommended maximum.
- The external trace option of the Generalized Trace Facility is not supported.
- Two megabytes of virtual storage is the recommended maximum.
- Only one partition is allowed if the system includes RES.

OS/V S1 is a compatible extension of OS/360 Multiprogramming with a Fixed Number of Tasks (MFT), providing up to 16,777,216 bytes (hereafter referred to as 16 million or 16 megabytes) of virtual storage for a customer's installation independent of the real main storage size of his installation. Virtual Storage is the name given to the address space referenced by a S/370 or 4300 processor that is equipped with the Dynamic Address Translation feature. This address space may be as large as the logical addressing capability of the system; that is, if a user can write an address, the location addressed can be included in virtual storage.

Although the addressing range of virtual storage is equal to the address range of the system, the user is limited to a virtual storage capacity that is determined by the installation at System Generation time or at IPL on the basis of such factors as real storage capacity, job characteristics, number and size of virtual partitions, secondary storage capacity, and control program storage requirements.

OS/V S1 virtual storage organization is similar to OS/360 MFT real storage organization. OS/V S1 virtual storage is divided into two main areas: the Control Program area (containing the supervisor and Job Entry Subsystem - JES) and the Problem Program area. The Problem Program area is divided into fixed partitions (maximum of 15) at 64K bytes (or multiples thereof) or system task partitions (maximum of 37), with a total maximum of 52 partitions.

As in OS/360 MFT, the partition size, class, and other attributes can be changed by the operator while the system is in operation. Partition allocation appears to the problem programmer and to the operator just as it appears in OS/360 MFT with one exception: maximum partition size is not limited by the real storage size, but by virtual storage size as defined at System Generation or IPL. Partitions must be allocated in 64K multiples with a minimum of 64K.

Real storage in OS/V S1 is automatically managed by the operating system in discrete blocks of 2K bytes called pages. As a page in virtual storage is referenced, it is brought into real storage for processing, if it is not already in real storage. When pages are not being used and the processor storage is needed for another task, they are written out to auxiliary storage unless an exact copy already exists (i.e. the page was not modified during execution). Some sections of the control program are not paged but are fixed in real storage. OS/V S1 divides real storage into two sections: one fixed and the other paged.

The fixed section of real storage contains the resident supervisor. Any jobs that are currently executing in the "Virtual Equals Real" mode are also fixed in real storage. This "Virtual Equals Real" mode makes provision for the types of programs that cannot run in a paged environment: programs that modify the channel program while it is active; programs that are highly time-dependent; programs that have user written I/O appendages to support EXCP where the appendages do not adhere to VS1 appendage programming rules; and programs that require all of their pages in processor storage while they are executing.

The paged section of real storage contains the active pages of the virtual tasks and the active portions of the paged section of the supervisor.

A section of the supervisor called the Page Supervisor is responsible for allocating and deallocating pages in real storage and for initiating page-in and page-out operations between auxiliary storage and processor storage.

OS/V S1 includes features to improve the security/integrity of the system: Fetch Protect, DEB Validity Checking, Password Protected Page File, Protected TIOT (Task I/O Table), and APF (Authorized Program Facility). Fetch Protect is optional support that combines hardware and software support to protect a user's main storage from disclosure to any task but a system task. The entire dynamic storage area (virtual partitions assigned to job steps and system tasks) and all region key subpools are protected. The Data Extent Block (DEB) Validity Checking is an option that prevents the user from unauthorized modification of direct access extents or gaining control in the supervisor state. Password Protection capability for the Page File available in VS1 also includes special processing to allow the size of a protected SYS1.PAGE to be varied at IPL time. Protected TIOT prevents a problem program from accidentally or intentionally storing into the TIOT. APF (Authorized Program Facility) is a function that permits designated problem programs access to certain restricted system functions.

The SUs integrated into Release 6.7 and 7.0 are shown in Chart 1 of the Announcement Letter for Release 6.7.

Additional OS/V S1 Facilities: I/O Load Balancing in VS1 provides a method of allocating non-specific requests for data sets based upon the utilization of devices across the entire configuration.

Dynamic Dispatching provides for the alteration of the dispatching priorities of selected users tasks. Processor and I/O characteristics of these tasks are constantly monitored during execution and changes are dynamically taken into account in the dispatching process.

Automatic IPL can be performed when system initialization parameters have been included in a data set (SYS1.PARMLIB). The operator can avoid keying in responses to system initialization message requests by indicating a list of SYS1.PARMLIB members which contain most of the necessary system initialization parameters needed for a particular IPL.

The time of day can be requested in Greenwich Mean Time (GMT). Interrupts can be requested at a specific time of day based on Greenwich Mean Time.

ISSP (Installation Specified Selection Parameters) permits system programmers to control the handling of job input and output classes, job priorities and message classes.

VS1 can execute as a virtual machine under VM in an arrangement called *VM/VS Handshaking*. Some of the most significant features include: Closing of CP (Control Program) spool files at job end instead of virtual machine termination; elimination of VS1 paging control, which would otherwise be redundant with similar VM function; and the ability to perform task switching within the VS1 subsystem during VM processing of VS1 real page faults caused by VS1 real page faults.

The 4341 Processor, the S/370 mdls 135-3, 138, 145-3 148, 158 and the 3031 Processor are provided with OS/V S1 hardware assists that provide improved supervisor performance. These assists, to which access is generated at SYSGEN time, are designed to be executed only by the VS1 supervisor. This hardware is a standard feature on all of the processors mentioned, except for the 158, where it is optional. These assists may be used if VS1 is running native or under VM/370. In the S/370 Processors, a VM assist is provided as part of the feature, but the benefits of the assists will not usually be additive. For the 4341 Processor, two mutually exclusive assists are provided: ECPS:VS1 and ECPS:VM/370. The former is usually recommended for VS1 native; the latter when VM/370 is run dedicated or when OS/V S1 operates under VM/370.

The preceding is summarized in the following table:

Processor	Feature Name	Std/Optional	Recommended for
135-3,138	Extended Control	Standard	OS/V S1 native
145-3,148	Program Support		OS/V S1 under VM/370

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158,158-3	OS/V _{S1} ECPS	Optional (#8750)	OS/V _{S1} native or OS/V _{S1} under VM/370
3031	OS/V _{S1} ECPS	Standard	OS/V _{S1} native or OS/V _{S1} under VM/370
4341*	ECPS:V _{S1} Assist ECPS:VM/370 Assist	Standard Standard	OS/V _{S1} native OS/V _{S1} under VM/370

* These features are mutually exclusive at SYSGEN. The benefits realized may vary in individual situations according to workload and environment with the result that the recommended application and use of assists may not be the most appropriate one for the customer. It is the customer's responsibility to make this determination.

This hardware assist provides improved supervisor performance. The assist may be used if V_{S1} is running native or under VM/370. The V_{S1} hardware assist is designed to be executed only by the V_{S1} Supervisor. Access to the assist is generated at SYSGEN time.

Supervisor: The OS/V_{S1} Supervisor is a part of the System Control Programming that monitors each unit of work being done in the system. The Supervisor, in general, controls the use of the processor, I/O, and real and virtual storage automatically or as requested by a user through system macro instructions or higher level language statements. It provides a variety of services such as allocating virtual storage space, performing I/O operations, loading programs into virtual storage, moving pages of programs into and out of real storage, and maintaining the address space (virtual storage) on an auxiliary storage device. To perform its function, the supervisor receives control of the processor following an interruption which may have resulted from a specific service request or through an asynchronous interruption by the computing system.

The OS/V_{S1} Supervisor performs the same functions as the OS/360 Supervisor. In addition to interruption handling, the OS/V_{S1} Supervisor performs: Task Dispatching in up to 15 problem program partitions ... Task Supervision ... Fetch ... Contents Supervision ... Timer Supervision ... Storage Supervision (virtual) ... I/O Supervision ... Exception Condition Handling ... System Management Facilities (SMF).

Functions that have been added to support Dynamic Address Translation are real storage supervision and paging supervision.

OS/V_{S1} is designed to take advantage of Dynamic Address Translation hardware. The system operates on the basis of virtual storage and real storage. Real storage is the storage of S/370 from which the central processing unit can directly obtain instructions and data and to which it can directly return results. Virtual storage is address space that appears to the user as real storage. From this address space, instructions and data are mapped into real storage locations. Partitions are assigned from available virtual storage; the system assigns real storage only as it is actually needed for program use.

The OS/V_{S1} relocate concept operates through Dynamic Address Translation. When a program is executing, the system translates each virtual address into a corresponding real storage address as the instruction is executed.

With address translation, all 24 bits of an address are usable. Thus virtual address space can be (and real storage can appear to be) 16,777,216 bytes. This address space is divided into 256 segments of 64K bytes each. The segments are subdivided into 32 pages of 2K bytes each.

OS/V_{S1} real storage contains a fixed section and a paged section. The fixed section located in the lower portion of real storage contains the resident supervisor and any jobs executing in a virtual= real (V= R) mode. The size of the fixed area depends on the amount of storage the user requires to execute his programs in (V= R) space (which is fixed only while the V= R program is executing), the resident supervisor requirements, the System Queue Area (SQA), and the Recovery Management Support (RMS) area. In OS/V_{S1}, the fixed area is that part of real storage into which the nucleus is loaded at IPL.

The Paged section in the upper portion of real storage contains portions of the problem programs currently executing and the pageable portions of the Supervisor as they are needed. It also contains, as needed, two transient areas: the SVC transient area and the I/O transient area. JES is also located in this section.

Before an instruction can be executed, it must be brought into real storage. As instructions are required, the addresses are translated and the page(s) containing the instructions is moved into real storage. When pages are not being used and the real storage space is needed by another task, the page is written out onto auxiliary storage unless an exact copy already exists (i.e. the page was not modified during execution). This procedure is called demand paging. The Page Supervisor task for OS/V_{S1} consists of a set of functions that efficiently manages the contents of real storage as tasks are executing in a multiprogrammed, demand paging environment. It is responsible for: Ensuring that the contents of real storage are addressable through

the hardware DAT feature ... Exchanging virtual pages between auxiliary storage and real storage on a demand paging basis ... Keeping the most frequently referenced pages in real storage where possible ... Interfacing with and servicing auxiliary requests such as fixing virtual pages in real storage prior to I/O ... Providing these additional SMF statistics: Number of page-ins; Number of page-outs; Number of reclaimed pages.

The Page Supervisor task directly initiates page movement from real storage to auxiliary storage, when required. All other page movement comes about as a consequence of an implicit or explicit request from an external source. Thus, OS/V_{S1} is able to assume the image of a large contiguous real storage by keeping only required virtual pages in real storage during execution.

The default size of the allowable virtual equals real area is equal to 512K or the real storage size of the machine, whichever is smaller. Users with systems larger than 512K may set a higher (than 512K) upper boundary of the virtual equals real area so that large V=R programs can be run.

In addition to the paging support provided by OS/V_{S1}, the user can elect to utilize the virtual= real execution facility. This allows him to specify that real storage should be made available in which to run programs that cannot run in the paged environment or those that the installation determines should not be executed in the paged portion of real storage. Real storage will be allocated at the time of job execution for the equivalent amount of storage he has defined on the JOB or EXEC card for the partition (and task) involved.

Thus the job of the supervisor is to provide the resources and services that programs need in such a way that at any given time as many services and resources as possible are in use.

Scheduler/JES: The OS/V_{S1} scheduler is an extension of the OS/360 MFT scheduler. It provides an integrated Job Entry Subsystem (JES) for efficient job submission and control. The job scheduling services direct and control the flow of one or more jobs through the system. In general these services are: Analysis of the input stream ... Allocation of I/O devices ... Selecting jobs for execution ... Reading and writing job data ... Communication between the operator and the system.

Job Entry Subsystem: The Job Entry Subsystem is a standard centralized facility that provides spooling and scheduling of OS/V_{S1} primary input and output streams. The Job Entry Subsystem contains many features of the Type III HASP program of OS/360 MFT. The Scheduler/JES of OS/V_{S1} is pageable and will only occupy as much real storage as is necessary to execute a specific function.

JES performs three basic functions: All primary input streams are read from the input device and stored on a direct access storage device (DASD) in a format convenient for later processing by OS/V_{S1} and problem programs ... System (and selected user) print and punch output is similarly stored on DASD until a convenient time for producing a hard copy on a printer or punch device or via 3540 Diskette Input/Output Unit ... If system resources are in contention, JES schedules its activities to best utilize these resources.

JES is responsible for getting jobs into and out of the system as quickly as possible to enhance system throughput and performance. It accomplishes this by reading jobs into the system, dividing them into various segments (job control statements and data, for example), and storing them. When the jobs are selected for execution, the JCL is interpreted separately. This procedure reduces the need for executing system reader and interpreter functions sequentially when jobs are first read into the system, as in past operating system environments.

During execution of a job, JES spools the output into a data set; that is the data is stored on a DASD device in a manner that reduces the movement of the access mechanism.

JES supports a Logical Cylinder function that provides the user with the ability to more efficiently use the DASD workspace that is allocated for spooling.

JES supports a Writer Checkpoint function that provides the user with the capability of checkpointing his SYSOUT data sets.

JES supports an Output Separator facility that provides a means of identifying and separating the output of various jobs that are processed by the same output device.

JES also supports a Checkpoint/Restart Capability, thereby complementing other RAS facilities to ensure continuous operation.

JES supports a Job Log Facility that collects all WTOs, WTORs and replies to WTORs and includes them in the JCL listing.

The two components of JES are the Job Entry Peripheral Services (JEPS) and the Job Entry Central Services (JECS).

The functions provided by JECS are System READER and System WRITER. All input to OS/V_{S1} except console entered commands, passes through the JES Reader(s). OS/V_{S1} allows as many readers and writers as can be contained within the limits of the virtual storage allocation made for the JES area during SYSGEN. The readers/writers are part of JES and do not occupy separate partitions. They are

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resident in the JES area of storage and operate concurrently with problem programs.

All resource management for JES is consolidated in the Job Entry Central Services facility. JECS has three logical functions, each of which provides a management service for JES:

- Buffer Management** - A central buffer handling facility for JES
- Spool Management** - Has the responsibility to logically handle data such as JCL text, in line input data, procedure libraries, system messages, WTP, and spooled output data.
- DASD Work Area Management** - Suballocates DASD work space and performs I/O operations on DASD work space for JES.

All other scheduler operations such as interpretation, allocation, command processing, initiation and termination of system and program tasks, data management and system management facilities (SMF) interface with JES.

Remote Entry Services - RES: RES is a logical and functional extension of the Job Entry Subsystem (JES). It extends the JES functions so that remote users can be attached to OS/VS1. Using RES, jobs and commands can be submitted from remote terminals, and output can be routed back to the terminals. RES makes OS/VS1 available to teleprocessing terminals so that more users can have direct access to the central system for their job submission.

RES provides all remote batch processing facilities. Using normal JCL (no special statements or parameters), the user can submit a job or a batch of jobs from his terminal directly into the system. He avoids the inefficient procedure of putting the jobs together, submitting them to the computer center, having the operator enter the jobs into the computer, and waiting for his output to be processed on the same local facilities as the output from other users' jobs. By using a true subset of system operator commands, the remote user can inquire about and manipulate his jobs. Remote Entry Services supports the following stand-alone workstations and features:

- BSC Terminals**
- 2772 Multipurpose Control Unit
- 2780 Data Transmission Terminal
- 3741 Data Station, mdl 2 (in basic communications mode)
- 3741 Programmable Work Station, mdl 4 (in basic communications mode)
- 3771 Communication Terminal, mdls 1,2,3 (as a 2772)
- 3773 Communication Terminal, mdls 1,2,3 (as a 2772)
- 3774 Communication Terminal, mdls 1,2,P1,P2, (as a 2772)
- 3775 Communication Terminal, mdl 1,P1 (as a 2772)
- 3776 Communication Terminal, mdls 1,2 (as a 2772/3780)
- 3777 Communication Terminal, mdl 1 (as a 2772/3780)
- 3777 Communication Terminal, mdl 2 (as a S/360 mdl 20 MULTI-LEAVING Workstation)
- 3780 Data Communications Terminal
- 6670 (as a 2772)
- 1131 Central Processing Unit
- 5110 Computer (as a 2772)
- 5280 Distributed Data System (as a System/3)
- System/3
- System/32 (as a System/3)
- System/34 (as a System/3)
- System/34 (as a System/3 with multileaving)
- System/36 (as a System/3 with multileaving)
- System/38 (as a System/3)
- S/360 mdl 20
- S/360 mdls 25-195 (mdl 25 requires ICA - #4580)
- All virtual storage S/370 Processor in BC (Basic 360 Control) mode only (115, 125 with 1052 Compatibility Feature)
- All S/370, 303X, or 4300 Processors with the DOS/VSE RJE Workstation Program Product (5746-RC9)
- S/370 mdl 195
- 8100 with DPPX (as a S/360 mdl 25 MULTI-LEAVING Workstation)
- 8100 with DPPX/SP (as a S/360 mdl 25 MULTI-LEAVING Workstation)

- SDLC Terminals**
- 3771 Communication Terminal, mdls 1,2,3
- 3773 Communication Terminal, mdls 1,2,3
- 3774 Communication Terminal, mdls 1,2
- 3775 Communication Terminal, mdl 1
- 3776 Communication Terminal, mdls 1,2,3,4
- 3777 Communication Terminal, mdls 1,3
- 3791 Controller, Configuration Feature #9165 or #9169
- 5280 Distributed Data System (as a 3770)
- 8130 Processor with DPCX, mdls A21, A23 (as an MLU SNA device)
- 8140 Processor with DPCX, mdls A31, A33, A51, A53 (as an MLU SNA device)
- System/32 (as a 3770)
- System/34 (as a 3770)
- System/34 (as an MLU SNA device)
- System/36 (as an MLU SNA device)
- System/38 (as a 3770)
- S/8100 - DPPX (as an MLU SNA device)

- S/8100 - DPPX/SP (as an MLU SNA device)
- 6670 Information Distributor *

* The SNA attached 6670 requires the OS/VS1 Information Distribution Workstation Support program product (5740-XYE) for support. See Program Product pages for additional prerequisites.

- Features**
- Point-to-point nonswitched lines.
- Point-to-point switched lines.
- Line error recovery.

RES supports the SDLC non-programmable models of the 3771, 3773, 3774, 3775, 3776 and 3777 Communication Terminals, the 5285 and 5288 (as a 3770), the S/32 (as a 3770), the System/34 (as a 3770) and the System/38 (as a 3770). Transmission to the 3770 terminals (except 3777-2) is via Synchronous Data Link Control (SDLC). This provides RES remote entry support for SDLC terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, RES uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode.

Functional characteristics of the RES support for SDLC terminals are as follows: Half-duplex flow ... Multipoint operation ... Serial data transmission operation - e.g., no concurrent operation of printer and punch on the outbound flow from RES to the SDLC terminals ... 3770 disk operation is transparent to RES ... Data stream provides compression of repeated characters. SDLC Terminals supported by RES are the non-programmable models of the 3771, 3773, 3774, 3775, 3776, and 3777-1,3 Communication Terminals, the S/32 (as a 3770), and the S/34 (as a 3770). Additional 3770 products include the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader, the 2502 Card Reader, and the 3203 Printer.

Multiple Logical Unit (MLU) 3776 mdls 3,4 and 3777 mdl 3, with up to six independent and concurrent sessions are supported.

RES communication with the System/34 uses VTAM SDLC. A System/34 can support a single RJE workstation which will allow spooling of output data, batching of input data. Up to three readers, three writers, and three punches in SNA are supported on System/34.

RES communication with the System/36 uses VTAM SDLC. A System/36 can support a single RJE workstation which will allow spooling of output data, batching of input data. Up to 7 readers, 7 writers, and 7 punches in BSC and up to 15 readers, 15 writers and 15 punches in SNA are supported on System/36.

RES communication with the 8130/DPCX, 8140/DPCX and 3791 uses VTAM/SDLC. An 8100 or 3790 system can support a single RJE workstation which will allow spooling of output data, batching of input data, and editing of input data. A work station can support up to five logical concurrent sessions with RES. Workstations will accept compacted and compressed RES output.

The 3790 and 8100 RJE workstations have Network Control Program (NCP) support in the 3704/3705.

System Requirements - For BSC Transmission, Remote Entry Services (RES) requires a 2701, 2703, 3704/3705 (in emulation mode), or mdl 135 Integrated Communications Adapter (#4640) equipped for Binary Synchronous Communications. A minimum processor storage size of 144K bytes will allow the use of one terminal subject to the restrictions that apply to the 144K real storage design point (see Smaller Main Storage Considerations). However, to obtain more effective function and performance it is recommended that a processor storage size of 240K bytes or larger be available. For SDLC transmission, RES requires a 3704 or 3705 in network control mode and a minimum processor size of 384K of real storage. The real storage requirements are dependent upon the user's definition of VS1 and the RES line and terminal configurations.

Job Scheduling: The Initiator for OS/VS1 is pageable and has no resident modules. When the command is entered from the console specifying an Initiator procedure, the initiating task is established in the specified partition to schedule job execution. The Initiator job selection routine dequeues the highest priority job from the first job input queue associated with its partition.

A program required for execution is fetched from the program library and placed in virtual storage. It is paged as needed and execution begins after the entire program's relative addresses (created by the Linkage Editor) are resolved into absolute virtual addresses.

When the final step of the job is terminated, or if the job is bypassed, any temporary or deleted data sets are returned to the system and the Initiator is ready to select another job.

The OS/VS1 Interpreter operates as a subroutine of the Initiator. Its function is to analyze the contents of job control statements and build tables that are used during the initiation and execution of job steps.

The Allocation function operates as a subroutine to the Initiator. Its function is to analyze the I/O device requirements of job steps, allocate

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devices to them, issue volume mounting instructions, and verify that the volumes were mounted on the correct device. OS/VS1 Allocation also supports dedicated data sets. The use of dedicated data sets reduces the time required to schedule a job step by eliminating the time normally required for allocating prespecified data sets.

When a job completes execution, the OS/VS1 termination routines free (deallocate) all resources used by the program and performs the necessary "cleanup" operations to allow the system to continue functioning for other problem programs.

Command Processing: Programmer and operator commands can be entered into the system via the console or the input job stream. Some commands may be entered only through the console. Others may be entered through either the console or the input job stream. OS commands are compatible with OS/VS1 with one notable enhancement: The WRITER command provides the ability for the operator to manipulate printed output.

This command can only be entered from the console and enables the user to: Obtain multiple copies of job output on a data set or job basis, within a job output class ... Immediately stop the job output stream and start writing again from the beginning ... Forward space and back space the output data ... Go to the next data set or restart the output writing of the current data set ... Suspend the writing of a job's output data and requeue it on the output queue to be written out later.

OS compatible command facilities available in OS/VS1 include:

Providing the flexibility to manipulate jobs by displaying the class, priority, and the number of jobs to be processed; suspending the execution of certain jobs or classes of jobs; releasing jobs that have been suspended; direct canceling of a particular job; and changing the priority or class of a particular job.

Redefining the size of a partition. In a virtual storage environment, the partitions actually reside in virtual storage so that the change in partition size is made in virtual storage and not in real storage as in OS.

Preparing for shutting down the system at the end of the day by enabling the operator to save important statistics and data records.

Modifying certain processing characteristics such as: changing output writer classes and conditions under which the output writer pauses for servicing; changing job classes associated with direct system output processing (DSO); changing programmer-specified values providing the programmer has set the proper indicators in his program to allow such revision.

Starting a job called via the console from a procedure library to override the normal selection of jobs entered via the input job stream.

Establishing the date, time of day, or the device to be used as the input work queue and whether this queue is to be formatted, as well as specifying the location of the library containing certain program procedures (procedure library), and which automatic commands the user wishes to override.

Mounting an input/output device for all job steps that require a particular volume, without intervening demountings and remountings of the volume. (The volume must be removable).

Placing input/output devices (other than a communication line) into an online or offline status.

System Management Facilities - SMF: System Management Facilities (SMF) is an optional support in OS/VS1 that collects and records system information. The information obtained can be used in management information reports that describe system efficiency, performance and usage. The SMF records collect such data as: System Configuration ... Job and job step termination ... Processor wait time ... Processor and input/output device usage ... Temporary and non-temporary data set usage and status ... Virtual and real storage usage ... Status of removable direct access volumes ... Paging statistics.

SMF provides exits to installation-supplied routines that can monitor the operation of a job or job step and generate the installation's own SMF records. The exit routines can cancel jobs, write records to the SMF data set, open and close user-defined data sets, suppress the writing of certain SMF records, and enforce installation standards (such as identification of users). Dummy routines are automatically provided for all unused exits.

Recovery Management Support: OS/VS1 recovery management consists of five functions: machine check handling, channel check handling, dynamic device reconfiguration, alternate path retry, and missing interrupt checker.

The Machine Check Handler (MCH) records all machine checks and determines if recovery from a malfunction was made by the Instruction or Micro Instruction Retry or Error Checking and Correction facilities of the Processor. If the malfunction is not corrected by the machine facilities, MCH assesses the damage and attempts to repair intermittent real storage errors. If recovery is not possible, MCH determines whether operation can continue either in full or degraded mode and

isolates the failure to a task for orderly selective termination of the task. Failing real storage is isolated on a page size basis.

The Channel Check Handler (CCH) analyzes information which results from Channel Data Checks, Channel Control Checks, and Interface Control Checks. CCH attempts to have the error corrected and determines whether or not the system can continue operation. In all cases, the channel check handler passes data to OBR for formatting and recording appropriate error records.

Dynamic Device Reconfiguration (DDR) allows a demountable volume to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error. This support may be deleted at the user's option. Additional support for non-standard tape labels may be included at the user's option.

Alternate Path Retry (APR) automatically retries input/output operations in error and marks offline those data paths that are unusable. APR is automatically included when optional channel paths are specified.

The operator may vary paths online and offline by using the VARY path command. He may not vary the last remaining path to a device offline, nor may he vary teleprocessing paths or paths to shared DASDs.

The Machine Check Handler and Channel Check Handler are standard parts of the OS/VS1 control program. They reside in the control program area of virtual storage and operate in the fixed section of processor storage. Dynamic Device Reconfiguration is a user option while Alternate Path Retry is an optional extension to the Input/Output Supervisor.

The Missing Interrupt Checker (MIC) polls active I/O operations to determine if a channel end and/or device end interruption has been pending for more than a three (3) minute period. In this manner, it provides the operator a reminder message for outstanding mount requests.

Operator Communications: Communications Task - The communications task processes communications between the operator and the operating system via the system console. Write-to-operator (WTO) and write-to-operator with reply (WTOR) macro instructions, operator commands and replies, and switching from the primary console to an alternate are all processed by this task. JES supports a Job Log Facility that collects all WTOs, WTORs and replies to WTORs and includes them in the JCL listing.

Optional Multiple Console Support (MCS) enables systems to be configured with a Master Console and one or more secondary consoles with each console dedicated to one or more system facilities. The Multiple Console user, by selecting which routing codes each console is to receive, tailors his system to his requirements. Through the use of routing codes, both system and problem programmers can indicate to which functional area(s) a message is to be sent.

A hard copy log may be selected to record system and problem program messages and operator commands and responses. The hard copy log can be either a console or the System Log (SYSLOG). Multiple copies of the System Log can be obtained at the option of the user.

The hard copy log is mandatory when (1) there is more than one active console in the console configuration, or (2) a graphic console is being used as the Master Console.

Device Independent Display Operator Console Support (DIDOCs) is an additional option under Multiple Console Support that provides uniform operator console support for graphic display units.

Status Display Support provides for writing multiple-line messages to the operator using the WTO macro instructions. It also provides time-interval updating for the display of active job status, and provides a means of separating status displays and certain WTO messages from operator's message traffic. This is done by designating certain consoles or separate areas of the display console screen exclusively for these displays and messages. Console device support is summarized in the following matrix.

OS/VS1 (5652-VS1) (cont'd)

SYSTEM CONSOLE SUPPORT

Console Type	Standard (Single Console)	Multiple Console Support (8)	MCS with DIDOCS (8)
3215	X	X	X
3210	X	X	X
1403 (1)	X	X	X
3203-4, -5 (1)	X	X	X
4245-1	X	X	X
4248-1	X	X	X
3262-5 (1)	X	X	X
3286-2 (9)	X	X	X
3211 (1)	X	X	X
2540 (1)	X	X	X
2250 (2)			X
2260 (3)			X
2740		X	X
3274 (4)			X
3277 (4)			X
3066 (5)	X	X	X
138 Console	X	X	X
148 Console	X	X	X
158 Console (6)	X		
3213-1 (6)	X		
1052-7/2150 (7)	X		
3278-2A (10)	X	X	X

Notes:

- (1) A console must consist of a printer-keyboard or a card reader and printer to simulate the actions of a printer-keyboard.
- (2) 2250 mdl 1 and 3.
- (3) 2260 mdl 1 on a 2848 mdl 3 (local attachment).
- (4) Support for the 3270 under DIDOCS. The 3277 mdl 1 attaches via a 3272 mdl 1 or 2. The 3277 mdl 2 attaches via a 3272 mdl 2 only. The 3278 mdl 1-4 are only supported in default mode via 3274 mdl 1B.
- (5) Mdl 165 II and mdl 168 only.
- (6) Printer-Keyboards mode only and only on mdl 158.
- (7) Mdl 155 II, 165 II, and 168.
- (8) Maximum of 32 devices.
- (9) When attached to mdl 138, 148.
- (10) With 4300 Processors.

Data Management: Data management controls all operations associated with input/ output devices, such as allocation of space on volumes, storing, naming, and cataloging data sets, and movement of data between main and auxiliary storage.

Virtual Storage Access Method - VSAM: VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the data set to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records, relative record data sets are fixed length records only.

VSAM is composed of two major elements: a data organization which minimizes data movement and which is suitable for data base applications; and routines for creating data sets in the VSAM organization, adding and deleting records, and performing other data management functions. Because the VSAM data organization and the access method routines are supported for both OS/VS and DOS/VS, VSAM provides full data portability between these systems.

The VSAM user can expect to see performance improvements relative to OS/VS ISAM and DOS ISAM. Performance gains with VSAM can become increasingly significant as the number of insertions to the data set rises. This is due to the elimination of the "chained record overflow" concept employed by ISAM. VSAM effectively maintains its sequential, non-inserted performance as records are added to the data set. Also, VSAM requires less time to perform a record insert than does ISAM. These factors, coupled with the efficient VSAM index structure and with the VSAM performance options, offer the potential of performance improvements relative to ISAM.

VSAM Highlights

- Access to data via VSAM is controlled by macro instructions written under the conventions of Assembler language. Access to data sets may be either direct or sequential, and may either be keyed (controlled by index key) or addressed (controlled by relative byte address).
- With VSAM, certain device-dependent calculations such as the optimum block sizes for a given device type are carried out automatically and all data addressing is by relative bytes within the storage space allocated to the data set. These features minimize programmer effort when he wants to change device types.
- Most existing and new COBOL, PL/I, and Assembler language programs written for use with ISAM data sets may be used with VSAM data sets by means of the VSAM ISAM Interface Program. The ISAM Interface Program maps ISAM macro instructions into the corresponding VSAM requests. Refer to the Program Product section of the sales manual for details regarding COBOL and PL/I support of VSAM.

VSAM functional extensions relative to ISAM include concurrent direct and sequential processing, expanded catalog support for OS/VS and enhanced device independence. A single VSAM OPEN macro instruction may be used to initiate both direct and sequential accessing, without the need of issuing an intervening CLOSE instruction.

- VSAM offers a multi-function service program (Access Method Services) to facilitate overall management of data. Such services as defining data sets initially, deleting VSAM data sets from the VSAM catalog, printing and copying data, listing the VSAM catalog, and providing backup and portability features are controlled by this multi-function program. Converting data sets from the VSAM or SAM format to the ISAM format is another important function of this program.
- A significant feature of VSAM is that of data set and volume portability between DOS/VS and OS/VS systems. Portability of data sets and volumes is made possible by the user catalogs and the multi-function service program, Access Method Services.
- VSAM offers multiple levels of password protection to enhance data set security. VSAM also offers a user exit so that user-written security routines may be included.
- VSAM operating under OS/VS1 establishes its own master catalog independently from the OS/VS1 catalog. VSAM operating under OS/VS1 also supports user catalogs to reduce contention for the master catalog and to enhance data set integrity and portability. Each VSAM catalog defines VSAM volumes, whether mounted or not. This enhances space allocation because it is not necessary to mount a volume in order to determine whether or not space is available. Each VSAM catalog also supports non-VSAM data sets. Volumes may contain a mixture of VSAM data sets and non-VSAM data sets.

The primary objective of these features is to provide functions which reduce the need to schedule redundant work. These optional features are:

Alternate Indexes

This new feature permits application programs to access the records of a VSAM entry or key sequenced data set on the basis of keys other than the prime key. These alternate keys may be non-unique and must be contained in the base data record. Once an Alternate Index has been constructed by using Access Method Services, it may optionally be automatically updated whenever a data record is changed in the base data set to which it relates.

Relative Record Data Set

With this feature the data set is viewed as a numbered sequence of fixed length slots. Records may be inserted, updated, read, or erased in these slots using VSAM keyed processing, with the slot (i.e., record) number as the key. No index is used since each record's physical location is calculated directly by VSAM from its record number and the characteristics of the data set.

Get Previous

This feature permits retrieval and update processing on the basis of descending key values, relative record numbers, or relative byte addresses. Processing may begin either within or at the end of the data set.

OS/VS1 (5652-VS1) (cont'd)

Reusable Data Set

This "new" capability allows a data set to be reused (i.e., reset to "empty" when opened and reloaded) many times without being deleted and redefined. A reusable data set may be any key sequenced, entry sequenced, or relative record data set that does not have an alternate index associated with it and that does not reside on unique space. However, an alternate index may be a reusable data set.

Spanned Record

Originally VSAM did not permit a record to exceed a control interval in size. The Spanned Record feature removes the restriction, allowing a record to occupy multiple control intervals within a control area. If indexed, the keys must be in the first control interval.

Recovery

Extensions to the facilities within VSAM Catalog Management and Access Method Services will now permit limited access, via Access Method Services, to data that is not addressable by the catalog (due to the loss of, or damage to, the catalog). Further, the user can restore addressability of the data and reconstruct the associated catalog entries.

Improved Control Interval Processing

This feature is designed to reduce processor utilization for users of control interval processing with user buffers and with minimal processing options.

VSAM Shared Resources

This option provides new interfaces to allow the user to create and control his own resource pool, permitting buffers and control blocks to be shared among data sets. Its use minimizes the storage requirement in a data base environment in which a large number of data sets may remain open over an extended period.

Catalog Recovery

Additional catalog recovery capability has been added to Access Method Services for VSAM users on OS/VS1 Release 6. The RESETCAT command provides the capability for validity checking and rebuilding a VSAM catalog from information contained in its catalog recovery areas without the necessity of moving VSAM data Sets.

VSAM Minimum System Configuration

These VSAM options retain the same general system configuration requirements as the original version, however, one of the following no charge special features is required for either S/370-135 or S/370-145.

#1001 Advanced Control Program Support*
S/370-145 mdl's IH, J2, JI2, or K2
(*standard on 145-3 and 148)

#1051 Conditional Swapping**
S/370-135 All mdl's
S/370-145 All mdl's
(** standard on 135-3 and 138)

Note: Insert PSW Key and Set PSW Key from Address which are part of Advanced Control Program Support are standard on the S/370 135-3 and 138 and are called PSW Key Handling.

VSAM coexists with existing data management access methods. The data management functions supplied by VSAM are: opening data sets, closing data sets, end of volume processing, cataloging VSAM data sets, allocating space, Checkpoint/Restart processing, and processing records by index key or by address.

The operating system job control language (JCL) is expanded to include VSAM catalogs and access method parameters.

Sequential Access Methods: In the Basic Sequential Access Method (BSAM), data is sequentially organized and physical blocks of data are stored or retrieved. The READ/WRITE macro instruction causes the initiation of an input/output operation. The completion of these operations is tested by using synchronization macro instructions. Automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

In the Queued Sequential Access Method (QSAM) logical records are retrieved or stored as requested. The access method anticipates the need for records based on their sequential order, and normally will have

the desired record in virtual storage, ready for use, before the request for retrieval. When writing data, the program normally will continue as if the record had been written immediately, although the access method routines may block it with other logical records and defer the actual writing until the output buffer has been filled. As with BSAM, automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

Basic Partitioned Access Method - BPAM: This access method, when used in conjunction with BSAM, is designed for efficient storage and retrieval of discrete sequences of data (members) belonging to the same data set on a Direct Access device. The data set includes a directory that relates the member name with the address where the sequence begins. Each member has a simple name. Members may be added to a partitioned data set as long as space is available in the directory and the data set. Other than directory manipulation, all I/O is performed by BSAM.

Basic Direct Access Method - BDAM: In the Basic Direct Access Method (BDAM), records within a data set are organized on direct access volumes in any manner chosen by the programmer. Storage and retrieval of a record is by actual or relative address within the data set. This address can be that of the desired record or a starting point within the data set where a search for the record, based on a key furnished by the programmer, begins. Addresses are also used by BDAM as a starting point for searching for available space for new records.

Indexed Sequential Access Methods: Sequential and direct processing are provided by the Indexed Sequential Access Methods (ISAM). Records are maintained in control field sequence by key. A multilevel index structure is system maintained, allowing retrieval of any record by its key. Additions can be made to an existing ISAM data set without rewriting the data set.

The Basic Indexed Sequential Access Method (BISAM) stores and retrieves records randomly from an indexed sequential data set. Selective reading is performed using the READ macro instruction, and specifying the key of the logical record to be retrieved. Individual records can be replaced or new records added randomly.

The Queued Indexed Sequential Access Method (QISAM) is used to create an indexed sequential data set or to retrieve and update records sequentially from such a data set. Synchronization of the program with the completion of input/output transfer, and record blocking/deblocking are automatic. QISAM is also used to reorganize an existing data set.

3850 Mass Storage System - MSS: OS/VS1 supports attachment of a single 3850 Mass storage System MSS (up to two A mdl 3851s).

The 3850 Mass Storage System (MSS) programming support includes an MSC (Mass Storage Control) Table Create program, Access Method Services functions to aid in mass storage volume management, and a Mass Storage System Communicator (MSSC) which communicates the Staging/Destaging commands to the MSC and contains Mass Storage Volume Control (MSVC) functions to assist in volume management. In addition, most of the facilities available for the control and management of real 3333/3330 Disk Storage drives and the data sets contained on 3336 mdl 1 and 11 Disk Packs are applicable to virtual 3333/3330 addresses and the data sets contained on mass storage volumes. Brief descriptions of the significant areas of support follow. More detailed information can be found in the publication *OS/VS Mass Storage System (MSS) Planning Guide*.

MSC Table Create: Creates and initializes the tables required by the Mass Storage Control (MSC). The tables are of four types:

Configuration Information: describes the hardware present in the 3850 Mass Storage System and the interconnections between the various hardware components.

Cartridge Information: describes the locations and volume serial numbers of the mass storage volumes in the 3851 MSF.

Activity Information: describes the status of staging and destaging of data.

Control Information: contains information required to locate all the above tables and also the basic information required to start the MSC initial microprogram load.

This program must be run at the initial installation of the 3850 MSS and whenever the configuration changes. It must be run prior to an OS/VS1 System Generation, if the 3851 IODEVICE macros are being changed, because it generates IODEVICE and UNITNAME card images to be used in Stage I of SYSGEN.

OS/V51 (5652-V51) (cont'd)

OS/V51 System Generation: The 3851 Mass Storage Facility is a new device type for which an IODEVICE macro must be included. The number of virtual 3333/3330 addresses will be limited by the OS/V51 UCB limit (see *OS/V51 System Generation Reference*) and by the available subchannels (see appropriate Processor or channel functional characteristics manual). An IODEVICE macro for each virtual 3333/3330 address is required. Certain system data sets must reside on real direct access units known to OS/V51. The four real unit addresses 0, 1, 8 and 9 on Staging Adapter 0 and Staging Adapter 1 are reserved for direct access to the MSC tables. More detailed information can be found in the publication *OS/V51 Planning & Use Guide*, GC24-5070. If the only direct access units in an installation are the 3333/3330 Disk Storage drives included in the 3850 MSS, then one or more of these 3333/3330 drives must be assigned addresses that have been identified to OS/V51 as real 3333/3330 units. These 3333/3330 drives can then be used for the system data sets. For further information on system generation, refer to the publication *OS/V51 System Generation Reference*, GC26-3791.

Staging/Destaging Initiation: Staging and destaging is based upon Job Control Language (JCL) Data Definition (DD) statement parameters. UNIT = 3330V indicates that the data set defined by DSNNAME resides on a mass storage volume whose serial number is identified either by the VOLUME parameter or in the catalog. This mass storage volume is "mounted", i.e. made active, by the Mass Storage Control at job step initiation. If DISP = OLD, SHR, or MOD is specified, the staging of the data set is initiated when the data set is OPENed. Staging will be initiated for new data sets only when the space request is not on a cylinder boundary. Destaging of new data sets for which DISP = KEEP or CATALOG and the portions of old data sets that were modified is initiated when the mass storage volume is demounted.

Mass Storage System Communicator (MSSC): The MSSC includes *Mass Storage Volume Control* (MSVC) functions to assist users of the 3850 MSS to control and manage the use of mass storage volumes. MSVC centers around a new system data set, usercat.MSVI, which is a keyed sequential VSAM data set containing space and activity information about mass storage volumes and groups of mass storage volumes. It is created, initialized, and maintained by the user via the Access Method Services functions for creating a VSAM data set and for the manipulation of mass storage volumes. Usercat.MSVI is used by OS/V51 for the allocation of mass storage volumes to satisfy non-specific volume requests for new data sets. An Access Method Services function which produces a report of the status of mass storage volumes and groups of mass storage volumes is available. Access Method Services also list information concerning cartridges similar to the information listed concerning volumes. Included are two commands which enable the user to list or scratch and uncatalog non-VSAM data sets according to his specified criteria (e.g., creation date, expiration date or name qualifier). Access Method Services also list information on cartridges similar to the information listed on volumes. Included are two functions which enable the user to list or scratch non-VSAM data sets according to specified criteria such as: creation date, expiration date or name Qualifier. It is an installation responsibility to analyze these reports to determine the extent of space utilization on mass storage volumes and then to initiate the appropriate utility functions to scratch or copy inactive data sets.

Data Management Support: BSAM, QSAM, BPAM, BDAM, VSAM, EXCP, and XDAP may be used for data sets contained on mass storage volumes. The staging of such data sets is initiated at OPEN. ISAM data sets can be contained on mass storage volumes. However, staging for ISAM data sets is not initiated at OPEN but, rather, at the time a data record is accessed. One cylinder at a time is staged as requested by the "cylinder fault" mode of operation. The Direct Access Device Space Management (DADSM) facilities are applicable to mass storage volumes as well as to real direct access volumes. All of the catalog facilities of OS/V51 can be used for data sets contained on mass storage volumes.

Data Sharing: The catalog, user program libraries, and user data sets can be accessed by any processor. If 3333s are shared between hosts, the 3330V devices with paths to the shared 3330 drives may be SYSGENed as shared or unshared at user option.

Data Security: The password protection data security facilities of OS/V51 can be used to control access to MSC tables and data sets contained on mass storage volumes.

Data Set Utility Programs: All non-standalone OS/V51 Data Set Utilities can be used with data sets contained on mass storage volumes.

System Utility Programs: All non-standalone OS/V51 System Utility Programs except IEHDASDR and IEHATLAS can be used on mass storage volumes.

IEHDASDR Utility Function: OS/V51 System Utility Program IEHDASDR provides support for formatting the DASD volumes as Staging volumes. This utility function can only be performed external to the MSS.

Access Method Services Functions: Access Method Services provides mass storage volume commands which allow a user to initialize, modify, copy, and scratch mass storage volumes, to add and remove mass storage volumes from the 3850 MSS, and to convert real 3336 Mdl 1 Disk Packs to mass storage volumes and back again. There are commands which allow a user to create, modify, and scratch groups of mass storage volumes in usercat.MSVI, and to list the contents of usercat.MSVI.

Additional Commands allow the user to copy, swap, and compare the Mass Storage tables, to dump portions of the MSC or Staging Adapter storage, to dump the MSC tables, to audit cartridge locations within the MSF, and to check the consistency of the MSC tables, SA tables and Mass Storage Volume Inventory data set.

VIRTUAL TELECOMMUNICATIONS ACCESS METHOD - VTAM: (Also refer to the Program Products section for licensed options provided for TCAM).

A functionally superior alternative to BTAM, VTAM provides telecommunication support for the 3704/3705 in network control mode and for locally attached 3270s, 3730s and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM provides for the direct transmission of messages between application programs and terminals. Using NCP/VS, it makes the lines and communications controllers transparent to the application program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM initially supports switched and nonswitched lines. A switched line connection requires system operator assistance. Manual dial service is supported. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. VTAM subsequently supports SDLC terminals in switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upward compatible for DOS/VS, DOS/VSE, OS/V51, and OS/V52. It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer data base/data communications systems. TCAM application programs can use certain VTAM facilities through TCAM Message Control Program.

Network operator control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored OS/V51 RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a 3790 Installation Guide, is provided to facilitate installation of 3790 Communication Systems and the host communications subsystem.

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

To aid in installing the 8100 Information System with DPPX or DPPX/SP, the Host Command Facility licensed program with an SNA 3270 display station running under VTAM or TCAM, can be used to:

- Remotely operate an 8100/DPPX or 8100/DPPX/SP system from a 3270 display station.
- Run 8100/DPPX or 8100/DPPX/SP checkout routines remotely.
- Verify the operation of a link connecting S/370 and 8100 DPPX or 8100/DPPX/SP.
- Modify DPPX or DPPX/SP Network profiles.

VTAM System Requirements: VTAM operates in OS/VS1 on a S/370 and requires the Compare and Swap and the Compare Double and Swap instructions. These instructions are provided via the Conditional Swapping feature (#1051) for the mdl 135, and via the Advanced Control Program Support feature (#1001), or the Conditional Swapping feature (#1051) for the mdl 145, (see Note). The minimum OS/VS1 system under which VTAM operates is 256K of real storage.

See "Terminal Support Chart 1" for the devices supported by VTAM with OS/VS1.

Note: Conditional Swapping is standard on the mdls 135-3 and 138. Advanced Control Program Support is standard on the mdls 145-3 and 148. Insert PSW Key and Set PSW Key from Address, which are part of Advanced Control Program Support, are standard on the S/370 135-3 and 138 and are called PSW Key Handling.

Teleprocessing Online Test Executive Program - TOLTEP: TOLTEP is a component of VTAM and is designed to control the selection, loading, and execution of teleprocessing online terminal tests (OLTTS) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting, and remote test requests. TOLTEP performs control services, device accessing, and configuration-update functions for teleprocessing OLTTS of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTS concurrently with other processing programs, with VTAM, and with the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, TOTE and OLTEP are still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTT data set.

Telecommunications Access Method - TCAM: (Also refer to the Program Products section for licensed options provided for TCAM).

The Telecommunications Access Method (TCAM) is a teleprocessing support program which may execute in conjunction with VTAM or as a separate access method. It provides:

Providing facilities that permit exchange of data between a central OS/VS1 Processor and remote terminals.

A computer's resources in a real-time teleprocessing environment. Resources optimized include processor time, real-storage space and I/O paths (lines and channels).

- A high-level language composed of macro instructions designed specifically to facilitate the construction of a TP message control program. Please refer to the TERMINAL SUPPORT CHART(S) in this section for specific terminals and how supported.

TCAM provides unified management of terminal devices, local and remote, including BSC and SDLC devices, through a single Message Control Program. The TCAM application-program interface has been defined to provide maximum compatibility with BSAM (READ/WRITE level) and QSAM (GET/PUT level), yet provide the ability to identify or specify source and destination of terminal I/O. Network control functions may be provided in an application program able to issue TCAM operator control commands.

Teleprocessing applications using TCAM are constructed by providing a Message Control Program and one or more TCAM application programs.

TCAM does not provide emulation of the QTAM interface.

TCAM Message Control Program: The TCAM Message Control Program (MCP) serves as an interface between remote terminals, user-written application programs, and secondary storage devices on which messages are queued until their destinations are available to receive them. The MCP's job is to control the flow of messages to and from these terminals, application programs, and queuing media, in a manner that optimizes allocation and scheduling of the computer's resources.

By handling all line control and scheduling of I/O operations for remote terminals, the TCAM MCP insulates user-written application programs from the complex device-dependent considerations inherent in a TP environment.

In TCAM, messages entered by remote terminals or application programs are queued by destination. Queuing by destination permits overlap of line usage in I/O operations; messages having a common destination may be received simultaneously from more than one source, even while the destination itself is busy sending or receiving a message. Disk queuing permits a high volume of concurrent terminal operations to proceed without requiring excessive real storage for buffering. TCAM destination queues may be located in main storage or on disk.

A TCAM MCP contains one or more message handlers. These are user-coded sets of routines that process messages as they enter and leave the TCAM MCP. Message handler functions are included by the selection and coding of TCAM supplied macros; among these functions are the following: message editing ... validity checking ... message routing ... record keeping ... error handling ... system control.

Special message-handler facilities are furnished for inquiry and conversational applications. The path of a message through a message handler may be varied dynamically based on the source or destination of the message, or on the presence or absence of certain character strings in the message header. To supplement TCAM-provided functions, the user may code open or closed subroutines consisting of assembler macro instructions and include these in his message handlers. Assembly, linkage-editing, and execution of the MCP is similar to that for any other problem program. For performance reasons, the MCP is usually executed as the highest priority user task in the system, but this is not a requirement.

TCAM Application Programs: TCAM permits the user to code one or more application programs and interface these with the MCP. Application programmers are insulated from the TP environment; they issue ordinary GETs and PUTs or READs and WRITEs to move data between the MCP and application program work areas.

TCAM application programs can be SAM compatible, and may be debugged in a non-TP environment using BSAM or QSAM as the access method, and a tape, card-reader, disk, card punch, printer, etc., as I/O devices. Once debugged, many application programs can be plugged into TCAM without reassembly by changing a single job-control statement. The user can specify that either messages or user-defined records be transferred when he issues his GET/READ or PUT/WRITE macros.

TCAM application programs can be attached dynamically during execution by the MCP.

TCAM Service Facilities: TCAM offers an extensive set of service facilities. Among these are:

- A set of operator commands allowing the user to determine the status of his TP system and alter, activate, or deactivate portions of that system by entering appropriate commands from the system console, remote terminals, or application programs. An NCP may be referred to by its NCP name, and SNA entities are allowed as operands where applicable.
- A checkpoint/restart facility which allows the user to specify that his MCP environment be restored following system failure or shutdown.
- A facility for selectively logging incoming or outgoing messages or message segments.
- Comprehensive debugging aids, including error-recovery and event-recording facilities, and utilities which permit debugging information to be dumped to tape or disk and then printed out.
- An online test facility (TOTE) that allows the user to test transmission control units (270X and 3704/3705) and remote terminals without closing down the MCP or deallocating the device being tested. When TCAM uses VTAM, TOLTEP provides testing facilities for the VTAM network.

OS/VS1 (5652-VS1) (cont'd)

TCAM MFT, MVT/VS Compatibility: OS TCAM Message Control Programs must be reassembled to run in the OS/VS environment. This reassembly allows the MCPs to benefit from the virtual storage capability of OS/VS. Under OS/VS, TCAM runs as a subsystem in a virtual partition. Certain TCAM elements, such as the buffer pool, I/O appendages, control blocks, and tables are fixed in main storage for the duration of the TCAM task.

System Requirements and Device Support: TCAM operates under OS/VS1 on a S/370 having at least 144K bytes of main storage or on any 4300 Processor. Normally space on one or more 2314 or 3330/3333/3340 DASD units will be needed for intermediate storage of message queues.

TCAM supports a wide variety of start/stop and binary-synchronous terminals attached remotely via a 2701, 2702, 2703, 3704/3705 (in emulation mode) or S/370 mdl 135, 138 with ICA (#4640) or 4331 with Communications Adapter (#1601) for remote terminal and network configurations supported by OS/VS1. TCAM in this fashion is itemized in *Terminal Support Charts 1 and 2*. In addition to remotely attached terminals, OS/VS1 TCAM supports direct attachment to either the multiplexer or selector channel of the 2260-2848 Display Complex (Local), and direct attachment to the multiplexer channel of the 7770 mdl 3 Audio Response Unit. These devices are not supported by TCAM when running through VTAM.

TCAM/VTAM Relationship in OS/VS: VTAM controls the telecommunications environment that includes 3704/3705s in network control mode and, optionally for TCAM, locally attached 3270s. VTAM permits sharing of this telecommunications network among different applications including those applications which used TCAM 3704/3705 network control mode support in previous releases of the operating system. When the TCAM Message Control Program schedules a read or write operation for a station in the TCAM/VTAM network, this I/O request is routed to VTAM. To the TCAM applications, the message looks as if it were handled only by TCAM.

If a TCAM application program or a TCAM terminal operator issues TCAM 3704/3705 control commands, a unique return code and a response message is provided. This code and message indicate the command has been intercepted and cannot be executed. Similar 3704/3705 control functions are available through VTAM network operator commands. TCAM now shares this network with VTAM and is no longer the sole "owner" of the telecommunications network.

The installation can provide an interface to the terminal user similar to the TCAM interface by using the "simulated logon" capability of VTAM. However, to use the full sharing capabilities of VTAM, the installation instructs the terminal user to enter an installation-defined sequence requesting logon to TCAM and includes in the system the VTAM facility to monitor logons.

This VTAM facility provides the capability to interpret the sequence entered by the terminal user and to route the interpreted logon request to the appropriate VTAM application (e.g., TCAM).

Note: A TCAM MCP must be re-assembled for proper operation through VTAM.

Basic Telecommunications Access Method - BTAM: The facilities of the Basic Telecommunications Access Method (BTAM) are designed chiefly to provide the basic tools required to write a telecommunications program. BTAM provides support for terminals attached other than to the 3704/3705 in network control mode. These include facilities for creating terminal lists and for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Code translation ... Retransmitting messages which are received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

The support of Binary Synchronous Communications combined with that of the various start/stop devices gives BTAM a varying degree of applicability and flexibility. BTAM supports low, medium, and high speed devices.

BTAM supports Binary Synchronous Communication over nonswitched (leased or private direct connection) and switched (dial) networks in a S/370 to terminal communication.

All terminals (except Binary Synchronous Communication) on a multipoint nonswitched line must be the same type. Terminals may be mixed within the same problem program.

Further information on terminal support is provided by *Terminal Support Charts 1 and 2*.

Optional communication serviceability facilities are available in BTAM including error recovery procedures, diagnostic error information, error counts, and online terminal tests. It is strongly recommended that these facilities be included since they increase system availability.

OS/VS1 BTAM supports the same functions as OS BTAM and, therefore, requires no additional programmer training. The user is cautioned regarding any internal changes that he may have made to OS/MFT BTAM.

Graphic Programming Services: Graphic Programming Services consists of the functions necessary to handle graphic input/output, and a set of macro instructions and problem oriented routines that can be used as building blocks in the construction of graphic processing programs. These services support the 3250 Graphic Display System, the 2250 Display Unit, mdls 1 and 3, and the 2260 direct attachment (local). This access method includes:

Macro instructions to generate orders for the 3250 and the 2250 mdls 1 and 3, including the mdl 1 with the graphic design feature ... Data handling aids for arranging orders and data in virtual storage prior to transferring them to the graphic display buffer ... Problem-oriented routines that dynamically generate orders and data for displaying on the 3250 and the 2250 mdls 1 and 3: alphameric characters, rectangular grids (linear or semi-log), polar coordinate grids (linear or semi-log) and circles and arcs ... Input to these routines can be either fixed point or floating point and can be scaled by the routines ... Graphic Data Generation Subroutine to generate data, during program execution, for use with the 2-byte incremental data modes of the 3250 and the 2250 mdl 1 with the Graphic Design Feature and the 2250 mdl 3 ... Light Pen Tracking Subroutine - Generates a buffer subroutine during program execution which may be used on a 3255 or a 2840 mdl 2 to track the pen movement on the CRT and display a pattern showing its current position ... The Graphics Access Method (GAM) includes: Read/Write level macro instructions for transferring data between real storage and the graphic display buffer; Buffer management facilities that allocate, control, and protect sections of the 3255 or the 2250 mdl 1 or 2840 buffer; Routines that facilitate man-machine communication using 3250, or 2250 or 2260 local, at both the express and basic attention handling levels (provides synchronous attention handling).

Graphic Subroutine Package - GSP: The Graphic Subroutine Package provides support for graphic programs written in Assembler Language or for the following compilers:

- FORTRAN IV E, G or H
- PL/I (F)
- FORTRAN IV H-Extended or G1 (Program Products)
- PL/I Optimizing or Checkout Compilers (Program Products)

These services consist of subroutines and functions that enable a programmer to create a display on one or more 3251 Display Stations or 2250 Display Units (mdls 1 and 3) under OS/VS1. The displays produced consist of any figures that can be constructed with points, lines, or characters, including charts, circles, arcs, rectangles, etc. The subroutines are requested through the use of CALL statements in a sequence that produces desired characters or graphic forms on the 3251 or 2250 screen, and that provide two-way communication between the user's program and the 3251 or 2250 operator (if desired). In producing desired displays, the subroutines automatically: Generate necessary graphic orders and data for the displays ... Transfer the generated orders and data to the 3255 or the 2250 buffer for execution, relocating them as necessary ... Allocate, control and protect sections of virtual storage and of the 3255 or the 2250 buffer as required by the user's application program ... Diagnose asynchronous errors and accomplish necessary error handling.

Features available are:

- Two levels of graphic order and data grouping, each of which can be referenced by an entity: (1) element - all orders and data produced as one call to a GSP subroutine, and (2) sequences - all orders and data produced by several calls to GSP subroutines.
- Acceptance of input data in any two-dimensional rectangular coordinate system; the data is scaled as appropriate for use by the graphic subroutine package.
- Provision for temporarily removing an image from a display while its associated orders and data are in the buffer, and later redisplaying the image.
- Modification of graphic orders and data produced by a single call wherever they are located (in real storage or in a buffer) by another call to the same subroutine.
- Display of alphanumeric characters using either the character generator of the 3250, or 2250 or a series of lines called strokes.
- Capability to read information from the buffer into real storage.

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- Capability to locate the position of the light pen on the screen even if the light pen is pointed to a blank portion of the screen.
- Capability to place a tracking symbol on the screen and follow its motion as it is moved by a 3250 or 2250 operator with the light pen (restricted to 3250 or 2250 mdl 3).
- Allowance for in-buffer subroutines that can be repeatedly invoked through in-buffer linkage (restricted to 3250 or 2250 mdl 3).
- Ability to check the status of the program while it is being processed.
- Calling any of the subroutines from an assembler language program.
- Single and multiple queuing of attention information, and inline processing of that information.
- Access to the enhanced features of the 3250 Graphics Display System, including 4 character sizes, character-string rotation through 90 degrees counter clockwise, 4 line types, 8 intensity levels, and entity blinking.

Shared DASD: A pool of direct access storage devices may be shared by two to four S/370 or 4331-2, 4341, 4361, 4381 Processors. Devices supported are 2314/2319, 3333 mdls 1 and 11, 3330 mdls 1, 2 and 11, 3340 mdls A2, B1 and B2, 3344 mdls B2 and B2F, 3375 mdls A1 and B1 and 3350 mdls A2, A2F, B2 and B2F. Two S/370 mdls 145, 148, 155II, 158, 165II, 168, 4341 and 4381 Processors can share a pool of 2305-2 DASD. Two S/370 mdl 165II and 168 Processors can also share a pool of 2305-1 DASD. A 4331 Processor with 3340/3344 directly attached may share these devices with another processor. The catalog, program libraries, and user data sets may be accessed by any processor. Advantages are reduced file maintenance, improved operational flexibility, and reduced disk space requirements. The system establishes access for each catalog generation. Exclusive access for all other data sets is controlled by using the RESERVE macro.

System Support Programs Linkage Editor

The Linkage editor combines separately compiled or assembled object modules into one or more load modules that is in a format suitable for loading by the control program and for subsequent execution. It also combines previously edited load modules with each other or with object modules.

Features - Although linking or combining of program modules is its primary function, the linkage editor also:

- Provides CSECT ordering and page boundary alignment facilities.
- Incorporates modules from data sets other than those in its primary input, either automatically or upon request.
- Aids program modification by replacing and deleting control sections as directed by linkage editor control statements.
- Defines the storage requirements for the common control sections generated by the assembler and by FORTRAN compilers, and the static external areas generated by PL/I compilers.
- Provides processing options and logs diagnostic error messages.
- Maintains an audit trail of compilation, linkage editing dates and levels and modifications on a CSECT basis within a load module via the Identification Record (IDR).

System Requirements - The linkage editor is designed for a virtual partition of 192K bytes, but can operate in the minimum virtual partition of 64K bytes.

Loader: The Loader combines the basic editing and loading functions of the linkage editor with program loading (fetch) in one job step. It loads object modules produced by a language processor and load modules produced by the linkage editor directly into virtual storage for program execution.

System Assembler: The OS/VS1 System Assembler is a programming tool for the implementation of programs using the S/370 instruction set. The System Assembler gives the user access to hardware and operating system functions and permits the user to generate and maintain the Operating System/Virtual Storage 1. Among the features supported by this assembler are:

Macro Instructions - The macro capability provided by the assembler is a programming tool providing interfaces to the OS/VS1 Input/Output Supervisor by means of Data Management macros, access to the complete OS/VS1 capabilities through the use of Supervisor Macros, and the ability to include programmer defined macros in assembler programs for special applications.

Conditional Assembly Statements - Conditional assembly statements are used to alter the sequence in which statements are processed, or to specify selective assembly of instructions. The conditional assembly mechanism is a key element in the macro feature.

Private Libraries - A private library may contain assembler language statements. These can be macro definitions or code that is to be inserted into the program by the COPY statement.

Dynamic Work Areas - The assembler provides a mechanism for establishing addressability to independently allocated storage areas.

System Requirements - The OS/VS1 System Assembler uses the S/370 Standard Instruction Set. This assembler runs efficiently in 128K of virtual storage and requires a minimum of 64K of virtual storage. In addition to the standard OS/VS1 requirements, the System Assembler requires space in auxiliary storage for the following data sets: System Input and three Intermediate data sets for work storage.

Depending on program requirements, additional data sets may be needed for Macro Definition library, print output, object module output, and punch output.

The OS/VS1 System Assembler contains the following enhancements to OS Assembler F: SETC values and character relation terms may be up to 255 characters in length (the old limit was 8 characters) ... Fewer restrictions and extended functions for conditional assembly language ... Three additional system variable symbols (&SYSPARM, &SYSTIME and &SYSDATE) ... Extended mnemonics for RR-type branch instructions ... Improved diagnostics and debugging facilities.

System Utilities: These programs are used to maintain system control data at an organizational or system level. The functions performed by the system utility programs are:

- **IEHPROGM** - Builds and maintains system control data and modifies the password data set.
- **IEHMOVE** - Moves or copies logical collections of S/370 OS/VS1 data.
- **IEHLIST** - Lists system control data such as data sets cataloged in the system catalog, directory entries of partitioned data sets, and VTOC entries.
- **IEHIOSUP** - Updates entries in the supervisor call library.
- **IEHDASDR** - Initializes direct access volumes for use with the operating system and dumps data to or restores data from these volumes. Central and local service will be discontinued on January 22, 1981.
- **IFCDIPOO** - Reinitializes the system data set, SYS1.LOGREC.
- **IEHINITT** - Writes volume label sets in EBCDIC, in BCD, or in ASCII code on magnetic tapes.
- **IEHATLAS** - Locates and assigns an alternate track to replace a defective track.
- **IFHSTATR** - Selects, formats, and writes information from Type 21 (error statistics by volume) records.
- **Device Support Facilities** - Initializes direct access storage volumes for use with the Operating System, inspects count-key-data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged as defective and analyzes the operational status of the 3350, 3344 and 3350, and 3375, drives and the data and control paths. This aids the user in determining whether an error situation is drive or media related so the appropriate recovery procedures can be initiated. For the IBM 3340, 3344, 3350 and 3375, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. This utility is used to create a VTOC index when a volume is initialized on count-key data devices. The building of an index over existing volume VTOCs may be done via this utility on systems that have the Data Facility / Device Support program product installed.

System Data Set Utilities: These programs reorganize, change or compare data at the data set and/or record level, and are required for the proper generation and maintenance of the system control program. The following general functions are performed by these utilities:

- **IEBCOPY** - Copies, compresses, merges, loads, and unloads partitioned data sets.
- **IEBGENER** - Copies a sequential data set or members of a partitioned data set, or converts a data set from sequential to partitioned organization.
- **IEBPTPCH** - Prints or punches records residing in a sequential or partitioned data set.
- **IEBUPDTE** - Updates a symbolic library.

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- **IEBEDIT** - Edits input job stream data set from a master input job stream.
- **IEBTCRIN** - Constructs records from input read from the 2495 Tape Cartridge Reader. Generation of a 2495 is required for the inclusion of the IEBTCRIN utility into the operating system.
- **IEBDG** - Can create output data sets either with internally generated test data or externally supplied input. These data sets can be sequential, indexed sequential, or partitioned.
- **IEBCOMPR** - Compares two identically organized sequential or partitioned data sets at the logical record level.
- **IEBISAM** - Can copy, reorganize, load, or unload an indexed sequential data set.
- **IEBIMAGE** - New 3800 Utility provides means for the user to create or modify and to store in SYS1.IMAGELIB Forms Control Buffer records, Copy Modification records, Graphic Character Modification records, and Character Arrangement tables. Input to the Utility consists of simple control statements. User can specify for FCB records forms sizes, number of lines at each vertical spacing, and line positions for simulated channel control punches. For Copy Modification, control statements include the text and its position within each copy of the pages of a data set. Existing Copy Modification records can also be modified. Graphic Character Modification statements provide means for combining and naming groups of graphic characters, including any characters already in SYS1.IMAGELIB, and to assist in storing in the system new graphic characters of user's own design. Character Arrangement tables can be created or modified to print with different character sets, to include Graphic Character Modifications, and to assign data codes to graphics or to change existing assignments.
- **IEHDASDR** - Dumps and restores data sets. Central and local service will be discontinued on January 22, 1981.

Independent Utilities: The following independent utilities do not operate under the OS/V51 control program, but they support OS/V51 with the following services:

- **IBCDASDI** - Initializes direct access volumes for use with the operating system. Central and local service will be discontinued on January 22, 1981.
- **ICAPRTBL** - Performs stand-alone buffer loading for the 3211 and 3203-4 printers.
- **IBCDMPRS** - Performs unloading and loading of data between DASD and a removable volume.
- **Device Support Facilities** - Initializes direct access storage volumes for use with the Operating System, inspects count-key-data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged as defective and analyzes the operational status of the 3340, 3344, 3350 and 3375, drives and the data and control paths. This aids the user in determining whether an error situation is drive or media related so the appropriate recovery procedures can be initiated. This utility is used to create a VTOC index when a volume is initialized on count-key-data devices. Device Support Facilities will utilize the Skip Displacement bytes in an attempt to recover a defective track before assigning an alternate track for the IBM 3375 users.

An online test facility (TOLTEP) is provided for telecommunications networks under VTAM. See *Virtual Telecommunications Access Method - VTAM* for a description of TOLTEP.

Online Test Executive Program - OLTEP: The Online Test Executive Program (OLTEP) is a function designed to direct the selection, loading and execution of the Online Test sections (OLT's) in OS/V51.

OLTEP with the related OLT allows the testing of Input/Output Hardware components of a system, concurrent with the running of customer jobs. Concurrent debug with OLTEP is supported in OS/V51 for systems with 144K or more.

The OLTEP/OLT system is designed for: Diagnosing I/O errors ... Verifying I/O hardware repairs and Engineering Changes ... Exercising a device requiring dynamic adjustments ... Checking I/O Hardware ... Integrity of customer data.

As a job under OS/V5, it is called by standard Job Control Language and is under the control of the operating system at all times. It uses the facilities of OS/V5 to accomplish the testing and competes with other jobs in the system for use of these facilities when running in a multiprogramming environment.

Definition of Test Runs can be entered via console or non-console devices. Prompting is available on consoles to aid in defining tests to be run.

Customer Engineering will supply the OLTs to the customer on magnetic tape or cards. The OLTs must be reformatted and link edited into a partitioned data set in order to be used under the operating system.

OLTEP executes in the pageable area of real storage. It requires a minimum of 64K of virtual storage for the OLTEP modules, and a minimum of 4K of real storage for the OLTs to be loaded and executed.

Dynamic Support System - DSS: Dynamic Support System (DSS) is no longer supported on OS/V51 and is deleted from the distribution libraries for OS/V51 Release 6.7 and subsequent releases.

Additional Service Aids: The following service aid facilities are also available under the Operating System/Virtual Storage 1. These programs aid in the diagnosing of system or application program errors by: Gathering information about the cause of a failure ... Formatting and printing information in a form that makes it easy to use ... Aiding in the development and application of a fix for a given problem.

HMAPTFLE - This program aids in the application of a PTF to the system by producing the JCL statements that are required for the proper application of the temporary fix. When a PTF is to be applied to a module, the user supplies information on the module and CSECT to which the PTF is to be applied. The program then either produces the necessary Job Control Statements for application of the PTF; or, if specified, dynamically invokes the Linkage Editor to update the operating system. The program executes in the paged section of real storage and requires a virtual partition of 64K bytes unless the Linkage Editor is dynamically invoked, then a 128K virtual partition is required.

IFCEREPO - Edits and prints environment error records.

HMBLIST - This Linkage Editor service aid program produces various formatted listings which may be used for system serviceability and diagnostic purposes. Depending on options specified on HMBLIST control statements, the following listings may be produced: Formatted load module listings ... Formatted object module listings ... Load module map and cross-reference listings ... Map and cross-reference listings of the system nucleus ... Listings of the data stored in the CSECT Identification records of load modules ... Load module map and cross-reference listings showing relocated addresses ... Load module summary data including alias names entry point address(es), module attributes, and the contents of the module's System Status Index (SSI) ... Listing of program modifications to a load module library ... Map of the resident reenterable load module area.

The minimum virtual storage requirement for HMBLIST is 64K bytes. In addition to the standard system residence, HMBLIST requires space in auxiliary storage for at least the following data sets: System Input, Print Output, and one or more load modules and/or object module data sets (load module data sets require DASD).

HMASPZAP - This service aid program assists user authorized personnel to: Inspect and modify instructions and data in any load module that exists as a member of a partitioned data set ... Inspect and modify data in a specific data record that exists in a direct access data set ... Dump an entire data set, a specific member of a partitioned data set, or any portion of a data set residing on a direct access device.

HMDSADMP - This service aid is a macro instruction that allows the user to generate a stand-alone dump program that is specifically tailored to his needs. HMDSADMP can generate two types of dump programs: one high-speed, the other low-speed. The high-speed version can write the control registers, contents of real storage, and, optionally, the page data set onto a tape volume in large blocks. The low-speed version can write the control registers and the contents of real storage to a printer or tape volume in unblocked, printable format.

HMDPRDMP - This service aid allows the user to format and print a storage dump of either virtual or real storage when utilizing the dump tape produced by the high-speed version of the HMDSADMP service aid, dumps in the SYS1.DUMP data sets, or print a real storage dump when utilizing the tape produced by the low-speed version of HMDSADMP. It also edits and prints the Generalized Trace Facility trace data set and formats the SYS1.DUMP data set.

IMCJOBQD - This service aid produces a formatted copy of the contents of the job queue data set and related scheduler work area data sets. This program operates independent of the OS/V51 control program, and does not alter the existing status of the records that are displayed.

JESDUMP - This service aid provides selective, non-destructive main storage dumps of JECs and Queue Manager errors. This facility should only be used when a spool or Queue Manager error is suspected.

SYSTEM CONTROL PROGRAMMING

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JOB LIST VERIFICATION - A service aid that provides selective non-destructive main storage dumps of Job List Manager errors. This facility should only be used when a Job List Manager error is suspected.

HMASMP - This program is used for the application of Program Temporary Fixes (PTFs) prepared in the new Systems Modification Program format. It is designed to improve the quality and reliability of the support process by recording the status of the system so that modifications will not be applied where inappropriate. Also, updating will be easier since libraries, modules, macros, and PTFs can all be updated and applied via one programming procedure.

Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DAS error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error-related data are directed to SYSPRINT.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system. Central and local service will be discontinued on January 22, 1981.

Display Exception Monitoring Facility: The Display Exception Monitoring Facility (DEMF), Selectable Unit (SU) 24 is a serviceability aid, which offers users of 3270 Information Display Systems in local or BSC mode assistance in locating a hardware problem in a communication network. In remote mode, the 3270 must communicate through a 270X or 370X on E.P. mode.

DEMF is logically composed of two tasks: a logging function and a display function. The logging function runs as a system task under OS/V51. It is passed communication error records created for the SYS1.LOGREC data set. The display function is a component that runs under TCAM, CICS/VS, or IMS/VS. It presents a structured display of the errors accumulated by the logging function at the user request.

Generalized Trace Facility: The Generalized Trace Facility (GTF), is a standard feature in the OS/V51 system operating on S/370 Processors of 144K bytes or more. It is a program service that assists users in performing problem determination and diagnosis by tracing system events, user events, or both. GTF consists of two major functions, the Generalized Trace function and the Trace Edit function.

The Generalized Trace function is a system service that can be optionally started from the master console. It executes as a system task in a partition. When the Generalized Trace function is started, the user also has the option of tracing internally in the GTF partition or externally to a data set on an auxiliary device. The Generalized Trace function supports a S/370 processor storage size of 144K bytes or more for internal tracing and 160K bytes or more for external tracing.

The Trace Edit function is a feature of the HMDPRDMP service aid and provides the user with a selective data reduction capability for the trace data set or formats GTF trace data contained within a storage dump produced by HMDSADMP or dumps in the SYS1.DUMP data set. It runs as a problem program and can be invoked via JCL. The Trace Edit function supports the minimum system support size.

Conversational Remote Job Entry - CRJE: Conversational Remote Job Entry (CRJE) allows remote access to OS/V51 via low-cost printer-keyboard terminals. Terminal users share a central S/370 to submit jobs for execution, update and prepare programs and data, list job output, all concurrently with normal background OS/V51 operations. An easy-to-use command language is provided to control entry, editing, inquiry and other control functions provided.

Among the features supported are: Supports 2740, 2741, 3767 (as a 2740-1 or 2741), and 1052 Printer-Keyboards terminals using BTAM ... Logon security ... Data set protection ... Library storage of remotely entered programs and data ... Administrative aids ... Data editing and manipulation capability ... Operator control of network ... Job status inquiry at terminal or console ... Routing of output data to central computer output devices or selectively to a remote terminal.

DASD space on a 2314, 2319 or 3330-1,-2/3333-1 Disk Storage Facility is required for CRJE tables, System Data Sets and Work Areas. Additional DASD space must be provided for user library data sets and directories, the exact amount must be established by the using installation. The 3350, 3344, 3330 mdl 11 and 3333 mdl 11 DASDs are not supported by CRJE.

A 2701, 2702, 2703, 3704 or 3705 (in emulation mode only) or mdl 135 ICA (#4640) with a Type I terminal control is required on the multiplexer channel with appropriate features for attachment of 1050 (1051 control

unit mdl 1 or 2), 2740 mdl 1, 2741 or 3767 (as a 2740-1 or 2741) terminals over communication lines. All 2740 terminals must have the record checking feature and may not have the station control feature. If BTAM Online Test facilities are omitted from CRJE, full system resources must be made available to the Customer Engineer for terminal maintenance when required.

Note: Programming Support for CRJE was withdrawn effective December 15, 1978.

Program Products: There are a large number of program products which may be ordered to support OS/V5. The program product section of the sales manual pages should be referenced for more information and ordering instructions. For additional functional enhancements and device support for OS/V51, see the applicable sales manual pages for the following program products:

1. OS/V51 Basic Programming Extensions (5662-257)
2. OS/V51 Data Facility / Device Support (5740-AM6)

Current System Programs (CSP) Under OS/V5: Type I CSPs, such as Sort and the Language Compilers, are not distributed as part of the OS/V5 SCP. Those wishing to continue using them may transfer them over from their OS Release 21.8 or later system. If the CSP is on a DASD device accessible to a VS system, then the VS system's SYS1.PROCLIB need only be updated to include the CSPs cataloged procedures. These procedures should contain a JOBLIB or STEPLIB DD card referencing the data set containing the CSP. If the CSPs reside on a DASD device not accessible to VS, then they should be copied to one with the Utility IEBCOPY. The VS system's SYS1.PROCLIB should be updated accordingly.

Those customers not on OS Release 21.8 must order this or a later release of the OS DLIBs. They would then perform a processor only sysgen as described in the *OS System Generation Guide* (GC28-6554). In so doing, the CSP target library and the procedural library should be one accessible by the VS system.

Ordering instructions for the Release 21.8 DLIBs are the same as for Release 21.7, which are available in the *Release 21.7 Guide* (GC-6730).

Type I Current System Programs (CSP) Under VS

Program Name	Program Number	Notes
COBOL F	360S-CB-524	1
COBOL F Library	360S-LM-525	1
COBOL LCP	360C-CV-713	2
Full ANS COBOL V2	360S-CB-545	
Full ANS COBOL V2 Library	360S-LM-546	
FORTTRAN G	360S-FO-520	
FORTTRAN H	360S-FO-500	
FORTTRAN G & H Library	360S-LM-501	
FORTTRAN Syntax Checker	360S-FO-550	
PL/I F	360S-NL-511	3
PL/I F Library	360S-LM-512	
PL/I Syntax Checker	360S-PL-552	
SORT/MERGE	360S-SM-023	

Notes:

1. Programs withdrawn, but will operate on OS/V51 Release 1.
2. Orderable as an Independent Component Release.
3. Teleprocessing support is not available in this environment since TCAM is not supported by VS, and PL/I F does not support TCAM.

Minimum VS1 Configuration

The minimum configuration required for VS1 operation or SYSGEN is:

- S/370 mdl 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 165II, 168, 3031, 3032 or 3033 Processor or 4300 Processor.
- 144K bytes of available real storage †
- A multiplexer channel.
- A selector or block multiplexer channel.
- For VS1 operation, two of the following DASD spindles are required, 2314/2319, 3330 mdls 1, 11 or 3333 mdls 1, 2, 11, 3340/3344, 3375 mdls A1, B1 or 3350. These spindles must be of the same type. Additional spindles may be required to meet customer needs.
- For SYSGEN and distribution library and installation, the following DASD spindles are required: Three 3330 mdls 1,11; or 3333 mdls 1,2,11; or Three 3340 spindles with 3348 mdl 70 Data Modules; or Five 3340 spindles with 3348 mdl 35 Data Modules; or Two 3350 spindles; or Two 3375 spindles; or Five 2314/2319s.

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

The required number of 3330/3333 spindles may be the 3350 in 3330 mdl 1 or 11 compatibility mode, and the 3350 in native mode may be the new system residence device. The 3340 spindles may be provided by the appropriate logical 3340 volumes on the 3344.

- A SYSIN device (card reader, tape, or diskette).
- A SYSOUT Printer (printer or tape).
- A SYSOUT Punch (punch or tape).
- A console.
- A 9-track tape drive. *

† The OS/VS1 Release 7 starter systems require a minimum of 192K bytes of real storage. Previous starter systems still require a minimum of 160K.

* Distribution of the SCP, component releases, emulator SCPs and PTFs are made on 9-track; therefore, a 9-track tape on the system or access to another system meeting the minimum configuration requirements and having a 9-track tape at the customer installation is required for system generation and maintenance. Note, a tape drive is also recommended for the output from the high-speed stand-alone dump program (HMDSADMP). This may be the same drive used for generation and maintenance.

System Generation: This is the process of preparing a specially tailored operating system to match the machine configuration and operating system options selected by the user. This process uses the VS1 starter system or the user's current operational VS1 system, and requires the following programs: Control Program ... Data Management Data Set Control, BSAM, QSAM, BPAM ... Assembler ... Linkage Editor ... Utilities. PID distributes on tape for 2314/2319, 3330/3333, 3340 or 3350 residence the required libraries (Partitioned Data Sets) which contain the OS/VS1 system modules and the system macro instructions needed for the system generation process when OS/VS1 is ordered.

The same system requirements are required for maintenance as for generations since some changes may require a full or partial system generation.

Starter System: The standard starter system for OS/VS1 is a special VS1 system ordered separately.

The starter system has the basic elements necessary for system generation in a form that is directly usable by a majority of customers. The starter system functions with a variety of different I/O units at "standard" addresses. Customers may use the starter system to perform system generation if there are appropriate matching units and addresses in their own configuration.

Dedicated Data Set Support is used in SYSGEN for the utility data sets in assemblies, link edits, and data set copies.

The starter system runs on a S/370 or 4300 Processor which meets the minimum system requirements. RMS (Recovery Management System) routines for all S/370 or 4300 Processors are included in the system libraries thus allowing processor independence of the Starter System SCP. The OS/VS1 Release 7 starter systems require a minimum of 192K bytes of real storage. Previous starter systems still require a minimum of 160 K.

Customers should be encouraged to match unit addresses with those of the starter system to the greatest degree practical. Unit address are established as part of the normal physical planning and cable order process; therefore, physical installation plans should be reviewed where appropriate.

The following chart shows the devices supported by the starter system, the system functions for which they may be used, and the three character address assigned to each unit.

SYSTEM CONTROL PROGRAMMING

OS/V51 (5652-VS1) (cont'd)

STARTER SYSTEM REQUIREMENTS CHART

Min. Req'd	Function	Device	MPX Channel	Selector Channel 1	Device Address (Note 1)			Selector Channel 4
					Selector Channel 2	Selector Channel 3		
1	System Console	3066 3158 (Note 3) 3213 (Note 4)	019 010,014 011,015 025		219			
		3210/3215 (Note 5) 3278-2A (Note 8)	009,01F 016		209,21F			
1	System Input	2540 Reader 3505 Reader 1442 Reader/Punch 2400/3400(7-Tr-DC) 2400/3400(9-track)	00C,02C 012,029 00A,02A	180,181 182,183,184	280,281 282,283,284	380,381 382,383	480,481 482,483	
1	Punch Output	2540 Punch 1442 Reader/Punch 2400/3400(7-Tr-DC) 2400/3400(9-track) 3525 Punch	00D,02D 00A 013,026	180,181 182,183,184	280,281 282,283,284	380,381 382,383	480,481 482,483	
1	Print Output	3211 1403 2400/3400(7-Tr-DC) 2400/3400(9-track) 3800 3203-4,5 3262-1,-11)(Note 10) 3262-5 4245-1 4248-1 (Note 11)	002,004, 024 00E,00F 02E 018,028 016,017 027 00B 00B 02F 006	180,181 182,183 118	280,281 282,283 218	380,381 382,383	480,481 482,483	
1	New system	2305-2 2314 (or 2319 on CHAN 1) 3330-1/3333-1 3330-1,-11/3333-11 3340/3344 3350		1D0 130,131,132 133,134 150,151,152 153 158,159,15A 15B 1C0,1C1,1C2 1C3 148,149,14A 14B	230,231,232, 233,234 250,251,252, 253 258,259,25A, 25B 2C0,2C1,2C2, 2C3 248,249,24A, 24B	330,331,332, 333,334 350,351,352, 353 358,359,35A, 35B 3C0,3C1,3C2, 3C3 348,349,34A 34B		
5	Starter	2314 (or 2319 on CHAN 1)		130,131,132 190,191,192 193,194,195	230,231,232,	330,331,332,		
3	System and Distribution Libraries (See Note 7)	3340 (M35) 3330-1/3333-1 3330-1,-11/3333-11 3340/3344(M70) 3350		133,134,135 150,151,152 153 158,159,15A 1 1C0,1C1,1C2 1C3 148,149,14A 14B	233,234,235 Note 6 Note 6 Note 6 Note 9 200,201 210,211 Note 6	333,334,335 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	
	Three system generation utility data sets and the three object program data sets (Note 2)	2305-2 2314 (or 2319 on Chan 1) 3330-1/3333-1 3330-11/3333-11 3340/3344 3350		1D0 130,131,132 133,134 150,151,152 153 158,159,15A 15B 1C0,1C1,1C2 1C3 148,149,14A 14B	230,231,232, 233,234 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	330,331,332, 333,334 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	

Notes:

- DASD 3330/3333 mdls 1 and 11, 3340 and 3350 are generated on channel 1 and accessed on channel 1, with channels 2 thru 4 as optional channels.
- The three system generation utility data sets and the three object program data sets do not require additional direct access devices if sufficient space is available on the volumes that contain the new system and the starter system.
- The 3138 and 3148 consoles use the 3158 console support (Display Mode).
- 3286-2 optional printer for S/370 138/148.

SYSTEM CONTROL PROGRAMMING

OS/Vs1 (5652-Vs1) (cont'd)

5. 3138 and 3148 Console when IMPLed in Printer/Keyboard mode.
6. See the addresses under channel 1; use only those addresses for sysgen.
7. The DLIB Installation and Build process requires space equal and additional to the distribution library space. The spindle(s) available after DLIB installation and build may be used for the new system being generated.
8. For 4300 Processors.
9. For all Processors, last two digits of address may be C0, C1, C2, or C3. In addition, addresses ending with 00, 01, 10 or 11 may be used for 4331.
10. For 4331 processors. Support for the 3262 Printer is provided by the OS/Vs1 Basic Programming Extensions program product (5662-257).
11. To operate in 4248 mode, OS/Vs1 Basic Programming Extensions and Data Facility Device Support program products are required.

Direct Control	3274	3274	N/A	N/A	3274
Extended Precision Floating Point	3700	3700	STD	STD	STD
Extended Channels	N/A	N/A	3850	3855	N/A
Floating Point Arithmetic	STD	STD	STD	STD	STD
1401/1440/1460 Compatibility	3950	3950	N/A	N/A	N/A
1401, 1410/7010 Compatibility	3950	3950	N/A	N/A	N/A
High Speed Multiply	N/A	N/A	4520	4525	N/A
Integrated Storage Controls	N/A	4650	N/A	4650	N/A
2nd Byte Multiplexer Channel	4990	4990	N/A	N/A	N/A
OS/DOS Compatibility	5450	5450	N/A	N/A	N/A
7070/7074 Compatibility	7117	7117	7117	7127	N/A
7080 Compatibility	N/A	N/A	7118	7128	N/A
709/7090/7094II Compat.	N/A	N/A	7119	7129	N/A
Staging Adapter for ISC	N/A	7220	N/A	7220	N/A
3213 Printer Attachment	N/A	7840	N/A	N/A	N/A
3210 Adapter	7844-5	N/A	N/A	N/A	N/A
3215 Adapter	7855	N/A	N/A	N/A	N/A
Two-Channel Switch for ISC	N/A	7905	N/A	7905	N/A
Extended Control Program Support	N/A	8750	N/A	N/A	STD

Feature Support: The following features are supported by the Operating System/Virtual Storage 1. Other features, not listed, have no specific programming support; their existence is ignored by the control program. Attempts to use OS/Vs1 with unsupported features may cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device.

PROCESSOR SPECIAL FEATURES

Feature	135	135-3	138	145	145-3	148
Advanced Control Program Support	N/A	**	**	1001	STD	STD
Conditional Swapping	1051	STD	STD	1051	***	***
Block Multiplexer Channel	1421	1425-6	STD	1421	1STD	STD
Block Multiplexer Subchannels, Additional	N/A	N/A	N/A	N/A	1450	1450
Channel-to-channel	N/A	N/A	N/A	1850	1850	1850
Clock Comparator and CPU Timer	2001	STD	STD	2001	Pre-req	STD
Direct Control	3274	3274	3274	3274	3274	3274
Extended Control Program Support	N/A	STD	STD	N/A	STD	STD
Extended Precision Floating Point	3840	Pre-req	STD	3910	STD	STD
Floating Point Arithmetic Multiplexer Subchannels, Additional	3900	STD	STD	3910	STD	STD
1401/1440/1460 Compatibility	4457	4457	4457	4457	4457	4457
1401, 1410/7010 Compatibility	N/A	N/A	N/A	4458	4458	4458
Integrated Communications Adapter	4640	4640	4640	N/A	N/A	N/A
2319 Integrated File Adapter	N/A	4650	N/A	N/A	N/A	N/A
3330/3340 File Adapter	4655	4655	4655	*	N/A	N/A
Integrated Storage Controls	N/A	N/A	N/A	4660*	4660	4660
Integrated Printer Adapter	4670, 2,7	4670, 2,7	4670, 2,7	N/A	N/A	N/A
OS/DOS Compatibility	STD	STD	STD	STD	STD	STD
Selector Channel	6981-2	N/A	N/A	6982-4	N/A	N/A
3210 Adapter	7844-5	7844	N/A	7844-5	7844-5N/A	N/A
3215 Adapter	7855	7855	N/A	7855	7855	N/A
Integrated 3203-4 Printer Attachment	N/A	N/A	8075-6	N/A	N/A	8075-6
Two-Channel Switch for ISC	N/A	N/A	N/A	8100*	8100	8100
Word Buffer	N/A	N/A	N/A	8810	Pre-req	STD

- * 3345 mdl 3, 4, 5, available on 145.
- ** Insert PSW Key and Set PSW Key From Address, which are part of Advanced Control Program Support, are standard on these machines, but are called PSW Key Handling.
- *** These instructions are part of Advanced Control Program Support.

Feature	155II	158	165II	168	3031
Advanced Control Program Support	STD	STD	STD	STD	STD
Conditional Swapping	STD	STD	STD	STD	STD
Block Multiplexer Channel	1433-5	1433-5	N/A	N/A	N/A
Buffer Expansion	N/A	N/A	1432	1435	N/A
Channel-to-Channel	1850	1850	N/A	N/A	1850
Clock Comparator and CPU Timer	STD	STD	STD	STD	STD

Feature	4331	4341
Advanced Control Program	STD	STD
Block Multiplexer Channel	1421	STD (2)
Additional	NA	1870
Byte Multiplexer Channel	5248	STD
Channel to Channel Adapter	NO	1850
Communications Adapter*	1601	NA
Conditional Swapping	STD	STD
Diskette Drive/3540 Mode	3401	NA
Display/Printer Adapter **	STD	NA
Extended Control Program Support	NA	NA
Extended Control Program Support: OS/Vs1 Assist	NA	STD
Extended Precision Floating Point	STD	STD
Floating Point Arithmetic	STD	STD
Integrated Communications Adapter (See Communications Adapter)	NA	NA
3340/3344 Direct Attachment	7851	NA
Direct Access Storage Compatibility (2311 is not supported)	#7901	N/A
All other S/370 Processor Features Listed above	NA	NA

- * Start/Stop and BSC line protocols.
- ** 3278 mdl 2 and 3287 mdl 2.

I/O Features

1052 Printer-Keyboard (see VTAM, TCAM and BTAM Terminals Supported)

1287 Optical Reader (mdls 1,2,3,4,5) :
Supported: #3850 - Expanded Symbol Set
#3945 - Farrington 7B Font
#4470 - 1428 and ANSCS OCR Font
#5300 - NCR Optical Type Font
#5370 - Numeric Handwriting
#5479 - Optical Mark Reading

1288 Optical Page Reader (mdl 1) :
Supported: #5370 - Numeric Handwriting
#5479 - Optical Mark Reading

1403 Printer (mdls 2,3,7,N1) :
Supported: #8640 - Universal Character Set
#8641 - Universal Character Set

1419 Magnetic Character Reader (mdl 1) :
Supported: #1445 - Batch Numbering
#5739, #5741 - Program Control for Pocket Lights

1442 Card Read Punch (mdl N1) :
Supported: #1532 - Card Image (for problem program use only)

1442 Card Read Punch (mdl N2) :
Supported: #1531 - Card Image

1443 Printer (mdl N1) :
Supported: #5558 - 24 Additional Print Positions

2150 Console

2250 Display Unit (mdls 1,3)

SYSTEM CONTROL PROGRAMMING

OS/V51 (5652-VS1) (cont'd)

- 2260 Display Station (see *VTAM, TCAM and BTAM Terminals Supported*)
- 2305 Fixed Head Storage (mdls 1,2) :
 Required: 2835 Storage Control
 Not Supported: mdl 2 on S/370-135
- 2314 Direct Access Storage Facility (mdl A1) :
 Supported: #8170 - Two-Channel Switch
- 2319 Disk Storage
- 2401 Magnetic Tape Unit (mdls 1,2,3,4,5,6)
- 2402 Magnetic Tape Unit:
 Supported: #3472 - Dual Density (800-1600 bpi)
- 2403 Magnetic Tape Unit and Control:
 Supported: #3471 - Dual Density (800-1600 bpi)
- 2415 Magnetic Tape Unit:
 Supported: #3471,#3472 - Dual Density (800-1600 bpi)
- 2420 Magnetic Tape Unit (mdls 5,7)
- 2495 Tape Cartridge Reader
- 2501 Card Reader (mdls B1,B2) :
 Supported: #1531 - Card Image
- 2520 Card Read Punch (mdls A1,B1) :
 Supported: #1531 - Card Image
- 2520 Card Punch (mdls A2,A3,B2,B3) :
 Supported: #1531 - Card Image
- 2540 Card Read Punch (mdl 1) :
 Supported: #1531 - Card Image
- 2596 Card Read Punch (mdl 1)
- 2671 Paper Tape Reader
- 2740 Communication Terminal (mdl 1) (see "VTAM, TCAM and BTAM Terminals Supported")
- 2741 Communication Terminal (see "VTAM, TCAM and BTAM Terminals Supported")
- 2780 Data Transmission Terminal (see "VTAM, TCAM and BTAM Terminals Supported"):
 Supported: EBCDIC Transparency only
- 2803,2804 Tape Control (mdls 1,2,3) :
 Required: #3228,#3236 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended.)
 Supported: #7125-#7127,#7135 - 7-track Compatibility
 #7185 - 16 Drive Addressing
 #7900 - 2420 Attachment
- 2816 Switching Unit (mdl 1) :
 Supported: #1050-#1052,#1055,#2285, #2286,#4455, #6392,#6393 - Additional Switching
- 2821 Control Unit (mdls 1,2,3,5,6) :
 Supported: #1990 - Column Binary (for problem program use only)
 #8637-#8639 - Universal Character Set Adapter
- 2835 Storage Control (mdls 1,2) :
 Supported: #8170,#8171 - Two-Channel Switch
- 2844 Auxiliary Storage Control:
 Supported: #8171 - Two-Channel Switch
- 2860 Selector Channel (mdls 1,2,3) :
 Supported: #1850 - Channel-to-Channel Adapter
- 2870 Multiplexer Channel:
 Not Supported: Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer subchannel. Magnetic tapes are supported on the selector subchannels.
 Cross channel devices (2804 Tape Control, 2816 Switching Unit, 3803 Tape Control with communicator feature and
- either 2-control switch, 3-control switch or 4-control switch, 3803 Tape Control with #8100 Two-Channel Switch) attached between any 2870 selector subchannel and any other selector channel, or between any 2870 selector subchannel and a selector subchannel of a different 2870.
- 2880 Block Multiplexer Channel (mdls 1,2) :
 Supported: #7850,#7851 - Two Byte Interface
- 3066 System Console (mdl 1)
- 3101 Display Terminal (see "VTAM, TCAM and BTAM Terminals Supported")
- 3158 Console Function
- 3203 Printer (mdls 4, 5) :
 Required: (mdl 4): S/370 mdls 138, 148
- 3210 Console Printer-Keyboard
- 3211 Printer (mdl 1) :
 Required: 3811 Printer Control Unit
 Supported: #5554 - 18 Additional Print Positions
- 3213 Console Printer
- 3215 Console Printer-Keyboard
- 3232 Keyboard Printer Terminal (mdl 1) (see "VTAM, TCAM and BTAM Terminals Supported") 3232 Keyboard Printer Terminal (mdl 51) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3262 Printer (mdls 1,11). Requires the OS/V51 Basic Programming Extensions program product (5662-257).
- 3262 Printer (mdl 5)
- 3268 Printer (mdl 2) [supported as a 3284/3286].
- 3275 Display Station (mdls 1,2) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3277 Display Station (mdls 1,2) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3278 mdl 2A Display Console
 Required: 4331 and 4341 Processors
- 3284 Printer (mdls 1,2)
- 3286 Printer (mdls 1,2)
- 3287 Printer (mdls 1,2) [supported as a 3284/3286]
- 3288 Printer (mdl 2) (supported as a 3286-2)
- 3330 Disk Storage (mdls 1,2,11) :
 Required: 3333 Disk Storage and Control, or 3830 Storage Control
- 3333 Disk Storage and Control (mdls 1,11) :
 Supported: #8150 - String Switch
- 3340 Direct Access Storage (mdls A2,B1,B2) :
 Required: 3340 mdl A2
 Supported: #4301, 4302 Fixed Head Feature
 #6201,#6202 - Rotational Position Sensing
 #8150 - String Switch
- 3344 Direct Access Storage (mdls B2,B2F)
- 3350 Direct Access Storage Facility (mdls A2,A2F,B2,B2F,C2,C2F) :
 Supported: #8150 - String Switch
- 3375 Direct Access Storage (mdls A1, B1)
 Supported: #8150 - String Switch
 Required: 3880 Storage Control mdls 1 or 2
- 3410 Magnetic Tape Unit (mdls 1,2,3) :
 Supported: #3211 - Single Density
 #3221 - Dual Density
 #6550 - Seven-Track Tape Unit
 #7360 - S/370 Attachment
- 3411 Magnetic Tape Unit and Control (mdls 1,2,3) :
 Supported: #3211 - Single Density
 #3221 - Dual Density
 #6550 - Seven-Track Tape Unit
 #7360 - S/370 Attachment

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

- 3420 Magnetic Tape Unit (mdls 3,5,7) :
 - Supported: #3550 - Dual Density
 - #6407 - 7-track
 - #6631 - Single Density
- 3420 Magnetic Tape Unit (mdls 4,6,8) :
 - Supported: #6420 - 6250 Density
 - #6425 - 6250/1600 Density
- 3430 Magnetic Tape Unit
- 3505 Card Reader (mdls B1,B2) :
 - Supported: #5450 - Optical Mark Read
 - #6555 - Selective Stacker
- 3525 Card Punch (mdls P1,P2,P3) :
 - Supported: #1533 - Card Read
 - #5272 - Multiple Card Print
 - #8338 - Two-Line Card Print
- 3540 Diskette Input/Output Unit (mdls B1,B2)
 - Diskette Drive (#3401) of the 4331 Processor is program compatible with the 3540
- 3741 Data Station (mdl 2) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3741 Programmable Workstation (mdl 4) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3767 Communication Terminal (supported as a 2740-1 or 2741) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3770 Data Communication System (supported as a 2770; 3776/3777 also as a 3780) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3780 Data Communications Terminal (mdl 1) (see "VTAM, TCAM and BTAM Terminals Supported")
- 3800 Printing Subsystem (mdl 1) :
 - Supported: #1490 - Burster-Trimmed-Stacker
 - #5401 - 127 Character Generation Storage Positions
 - #8170 - Two-Channel Switch
- 3848 Cryptographic Unit (mdl 1)
- 3803 Tape Control (mdl 1) :
 - Supported: #1792 - Two-Control Switch
 - #1793 - Three-Control Switch
 - #1794 - Four-Control Switch
 - #3551 - Dual Density
 - #6408 - Seven-Track
 - #9071 - Communicator 1-2
 - #9073 - Communicator 3-4
- 3803 Tape Control (mdl 2) :
 - Supported: #1792 - Two-Control Switch
 - #1793 - Three-Control Switch
 - #1794 - Four-Control Switch
 - #5310 - Nine-Track NRZI
 - #6320 - Seven-Track NRZI
 - #8100 - Two-Channel Switch
 - #9071 - Communicator 1-2
 - #9073 - Communicator 3-4
- 3811 Printer Control Unit (mdls 1,2) :
 - Supported: #5553 - Additional (18) Print Positions
- 3830 Storage Control (mdls 1,2,3) :
 - Supported: #8170 - Two-Channel Switch
 - #8171 - Two-Channel Switch, Additional
- 3851 Mass Storage Facility (mdls A1,A2,A3,A4,B1,B2,B3,B4)
 - Supported: #4901, 4902 MSC Twin Port
 - #8171 - Two-Channel Switch
 - #8172 - Two-Channel Switch, Additional
- 3880 Storage Control (mdls 1, 2, 3)
 - Supported: #8170 - Two-Channel Switch
 - #8171 - Two-Channel Switch Pair, Additional
 - #8172 - Eight-Channel Switch feature (Requires #8170 and #8171)
 - #6550 - Speed Matching Buffer for 3380
 - #6560 - Speed Matching Buffer for 3375
- 3886 Optical Character Reader (mdl 1) :
 - Supported: #3210 - Additional Data Storage
- #4610 - Additional Instruction Storage
- #4720 - Line Marking
- #5360 - Numeric Handprinting
- #6450 - Serial Numbering
- 3890 Document Processor (mdls A1,A2,A3,A4,A5,A6) :
 - Supported: #5111 - Microfilming
 - #4666 - Item Number/Endorsing
- 4245 Line Printer mdl 1
- 4248 Printer mdl 1
 - Supported: #3157 Additional (36) Print Positions
- 6670 Information Distributor
- 6733 Typewriter Communication Module as a CPT-TWX 33/35 (See ACF/VTAM, ACF/TCAM and BTAM Terminals Supported)
- 1130 Computing System (see "VTAM, TCAM and BTAM Terminals Supported")
- 5280 Distributed Data System (see "VTAM, TCAM and BTAM Terminals Supported")
 - System/3 (see "VTAM, TCAM and BTAM Terminals Supported")
 - System/32 (see "VTAM, TCAM, and BTAM Terminals Supported")
 - System/34 (see "VTAM, TCAM, and BTAM Terminals Supported")
 - System/36 (see "VTAM and BTAM Terminals Supported")
 - System/38 (see "VTAM, TCAM, and BTAM Terminals Supported")
 - S/360 (see "VTAM, TCAM and BTAM Terminals Supported")
 - S/370 (see "VTAM, TCAM and BTAM Terminals Supported")
- 4331 (see "VTAM, TCAM and BTAM Terminals Supported")
- 4341 (see "VTAM, TCAM and BTAM Terminals Supported")
- 4361 (see "VTAM, TCAM and BTAM Terminals Supported")
- 4381 (see "VTAM, TCAM and BTAM Terminals Supported")

DEVICE SUPPORT

The *Device Support Chart* shows all devices that are supported by OS/VS1 for system functions and/or non-TP access methods. (For other telecommunications devices see "VTAM, TCAM and BTAM Terminals Supported". The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under OS/VS1 and their existence is not recognized by the control program.

Notes:

- 1) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
- 2) BSAM (device-dependent only).
- 3) The Selective Tape Listing Feature is not supported.
- 4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
- 5) Supported for read or punch, but not both simultaneously.
- 6) Mdl 1 only.
- 7) Multiple Requesting supported.
- 8) File Scan not supported.
- 9) Rotational Position Sensing supported (optional feature on 3340).
- 10) For message queues under TCAM.
- 11) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
- 12) Punch Feed Read is not supported.
- 13) As a workstation for RES.
- 14) Space Compression/Expansion is not supported.

SYSTEM CONTROL PROGRAMMING

OS/Vs1 (5652-Vs1) (cont'd)

- 15) Support shown is for 3330s or 3333s as virtual device types. If real 3330/3333s are included as part of 3851, see the 3330/3333 lines above.
- 16) With 3330/3333 as staging device, Rotational Position Sensing supported.
- 17) User Program Libraries only.
- 18) QSAM (device-dependent only).
- 19) Supported on mdl 138.
- 20) Supported on mdl 148.
- 21) Supported as a 3213 on mdl 138 or 148.
- 22) Supported by the OS/Vs1 Basic Programming Extensions program product.
- 23) Device recognition only: Supported by the OS/Vs1 Basic Programming Extensions program product.
- 24) Supported by the OS/Vs1 Data Facility Device Support program product.

Legend:**I/O Device Support Chart**

The following units to a maximum of 768 devices are supported at the Release 7.0 level by OS/Vs1, for the indicated functions.

- C = Console
- G = Graphic Programming Support
- S = Sequential Access Methods
- I = Indexed Sequential Access Methods
- P = Basic Partitioned Access Method
- D = Basic Direct Access Method
- A = Virtual Storage Access Method
- X = Function Supported



SYSTEM CONTROL PROGRAMMING

OS/V51 (5652-VS1) (cont'd)

DEVICE SUPPORT CHART

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1052 Printer-Keyboard	X		X			X			
1287 Optical Reader								X1	
1288 Optical Page Reader								X2	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X2	
1442 Card Read Punch	X5		X5			X4		X	
1442 Card Punch			X					X	
1443 Printer			X			X4		X	
2150 Console						X			
2250 Display Unit						X6	X		
2260 Display Station						X	X		
2305 Fixed Head Storage (Notes 7,8)	X9	X9		X	X9			X9	X9
2314 Direct Access Storage Facility (Notes 8,10)	X	X		X	X			X	X
2319 Disk Storage (Notes 8,10)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2415 Magnetic Tape Unit	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2495 Tape Cartridge Reader								X11	
2501 Card Reader	X		X			X4		X	
2520 Card Read Punch	X5		X5			X4		X5	
2520 Card Punch			X			X4		X	
2540 Card Read Punch	X12		X12			X4		X	
2596 Card Read Punch								X	
2671 Paper Tape Reader								X	
2740 Communication Terminal	X								
2741 Communication Terminal	X								
2770 Data Communication System	X13		X13						
2780 Data Transmission Terminal	X13		X13						
3066 System Console						X6			
3138 Console (Note 19)						X6			
3148 Console (Note 20)						X6			
3158 Console Function						X6			
3203 Printer			X			X4		X	
3210 Console Printer-Keyboard						X			
3211 Printer			X			X4		X	
3213 Console Printer						X			
3232-1 Keyboard Printer Terminal	X								
3232-51 Keyboard Printer	X								
3215 Console Printer-Keyboard						X			
3251 Display Station						X			
3262 Printer			X22					X22	
3268 Printer									
3275 Display Station						X			
3276 (supported as a 3277)						X3			
3277 Display Station						X			
3278 (supported as a 3277)						X3			
3278 mdl 2A Display Console						X4			
3284 Printer						X			
3286 Printer						X			
3286-2 Console Printer (Note 21)						X4			
3287-1, -2 Printer						X			
3288 Printer						X			
3330 Disk Storage (Notes 8,10)	X9	X9		X9	X			X9	X9
3333 Disk Storage and Control (Notes 8,10)	X9	X9		X9	X			X9	X9
3340 Direct Access Storage Facility (Notes 8,10)	X9	X9		X9	X9			X9	X9
3344 Direct Access Storage (Notes 8,10)	X9	X9		X9	X9			X9	X9
3350 DASD (Notes 8,10)	X9	X9		X9	X9			X9	X9
3375 Direct Access Storage (Notes 8, 10, 24)	X9	X9		X9	X9			X9	X9
3380 Direct Access Storage (Notes 8, 10, 24)	X9	X9		X9	X9			X9	X9
3410 Magnetic Tape Unit	X		X					X	
3411 Magnetic Tape Unit and Control	X		X					X	
3420 Magnetic Tape Unit			X					X	
3430 Magnetic Tape Unit			X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X5		X5			X4		X	
3540 Diskette I/O Unit	X		X						
3741 Data Station	X		X						
3741 Programmable Workstation	X		X						
3767 Communication Terminal	X								
3770 Data Communication System	X		X						
3777-2 Communication Terminal (as a S/360-20 MULTI-LEAVING Workstation)	X		X						
3780 Data Communications Terminal	X14		X14						
3790 Communication System	X		X						
3800 Printing Subsystem			X					X	
3848 Cryptographic Unit									
3851 Mass Storage Facility (Note 15)	X16				X16,17			X16	X16
3886 Optical Character Reader								X2	
3890 Document Processor								X18	
4245 Printer			X			X4		X	
4248 Printer			X					X	
4331 Processor	X13		X13						
4341 Processor	X13		X13						
4361 Processor	X13		X13						
4381 Processor	X13		X13						
5285, 5288	X		X						
6670 (as a 2772)	X13		X13						
1130 Computing System	X13		X13						
System/3	X13		X13						
System/32	X13		X13						

SYSTEM CONTROL PROGRAMMING

OS/V51 (5652-VS1) (cont'd)

DEVICE SUPPORT CHART - Cont'd.

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
System/34	X13		X13						
System/36	X13		X13						
System/38	X13		X13						
S/360	X13		X13						
S/370	X13		X13						
S/8100/DPCX Information System	X		X						
S/8100/DPPX RJE Workstation Facility	X		X						

VTAM, TCAM and BTAM TERMINALS SUPPORTED

VTAM, TCAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, TCAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does (do) support the terminal/feature is (are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by VTAM, TCAM or BTAM may also function satisfactorily with VTAM, TCAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT

Terminals and Terminal Features

SS LINES:

IBM TERMINALS

1030 Data Collection System on nonswitched lines: (TCAM,BTAM)

- 1031 Input Station (mdls A1,A2,A3,A4,A5,A6,A7) :
Supported: Attachment of 1031,1033,1034,1035
- 1031 Input Station (mdls B1,B2,B3,B4,B5,B6,B7) :
Supported: Attachment of 1035

- 1033 Printer
- 1034 Card Punch
- 1035 Badge Reader

1050 Data Communication System on switched or nonswitched lines:

- 1051 Control Unit (mdls 1,2) :
Supported: Attachment of 1052,1053,1054,1055,1056,1057,1058,1092,1093
#1313 - Automatic EOB
#4795 - Line Correction
#4796 - Line Correction Release
#5465 - Open Line Detection
#6100 - Receive Interrupt
#9698 - Text Time-Out Suppression
#9700 - Transmit Interrupt

- 1052 Printer-Keyboard (mdls 1,2) :
Supported: #1313 - Automatic EOB
#9567,#9597 - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code

- 1053 Printer (mdl 1) :
Supported: #9567,#9597 - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code

- 1054 Paper Tape Reader (mdl 1)
- 1055 Paper Tape Punch (mdl 1)
- 1056 Card Reader (mdls 1,3)
- 1057 Card Punch (mdl 1)
- 1058 Printing Card Punch (mdls 1,2)
- 1092 Programmed Keyboard (mdls 1,2)
- 1093 Programmed Keyboard (mdls 1,2)

2848 Display Control (mdls 1,2,3) on nonswitched lines: (TCAM,BTAM)

- Supported: Attachment of 2260,1053
3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
- Not Supported: Attachment of 1053 (TCAM)

2260 Display Station (mdls 1,2) :

- Supported: #3606 - Extended Cursor Control, Alphameric Keyboard
#4766 - Alphameric Keyboard
- Not Supported: Tab feature of #3606

1053 Printer (mdl 4) : (BTAM)

- Supported: #9567,#9597 - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code

2845 Display Control (mdl 1) on nonswitched lines: (TCAM,BTAM)

- Supported: Attachment of 2265,1053
#3301 - Destructive Cursor
#4801 - Line Addressing
- Not Supported: Attachment of 1053 (TCAM)
#7801 - Tab

2265 Display Station (mdl 1) :

- Supported: #4766 - Alphameric Keyboard

1053 Printer (mdl 4) : (BTAM)

- Supported: #9567,#9597 - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code

2740 Communication Terminal (mdl 1) on switched or nonswitched lines:

- Supported: #3255 - Dial Up
#6114 - Record Checking
#7479 - Station Control
#8028 - Transmit Control
8301 - 2760 Attachment (TCAM,BTAM)
#9567,#9597 - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code
Correspondence Code

2740 Communication Terminal (mdl 2) on nonswitched lines:

- Supported: #1495,#1496 - Buffer Expansion
#1499 - Buffer Receive
#6114 - Record Checking
#9571,#9591 - PTTC/EBCD Code

2741 Communication Terminal (mdl 1) on switched or nonswitched lines:

- Supported: #3255 - Dial Up
#4708 - Receive Interrupt
#7900 - Transmit Interrupt
#9567,#9597 - PTTC/BCD Code
#9571,#9591 - PTTC/EBCD Code
Correspondence Code

2760 Optical Image Unit (mdl 1) on switched or nonswitched lines (TCAM,BTAM)

3101 Display Terminal on switched lines: (BTAM, TCAM and VTAM)

3232 Keyboard Printer (mdl 51) on switched and nonswitched lines: (TCAM,VTAM) on switched lines supported as a CPT-TWX 33/35 (BTAM)

3767 Communication Terminal (mdls 1,2,3) (supported as a 2740-1) on switched or nonswitched lines:

- Required: #7111 - 2740-1 Start/Stop
- Supported: #9560 - Station Control

3767 Communication Terminal (mdls 1,2,3) (supported as a 2740-2) on nonswitched lines:

- Required: #7112 - 2740-2 Start/Stop

3767 Communication Terminal (mdls 1,2,3) (supported as a 2741) on switched or nonswitched lines:

- Required: #7113 - 2741 Start/Stop

5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines:

- Required: #1525 - Communications Adapter

6733 Typewriter Communication Module on switched and nonswitched lines as a CPT-TWX 33/35 (BTAM, ACF/TCAM and ACF/VTAM)

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

CMCST (Communicating Magnetic Card Selectric ® Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:
Supported: The CMCST is functionally equivalent to a 2741 with Dial Up, Receive Interrupt and Transmit Interrupt

IBM PROCESSOR AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

S/7 (supported as a 2740-1 with checking) on switched or non-switched lines:

Required: #1610 - Asynchronous Communication Control

Non-IBM TERMINALS

AT&T 83B3 Line Control Type on nonswitched lines

CPT-TWX (mdl 33/35) Line Control Type on switched lines

World Trade Telegraph on nonswitched lines

WU 115A Line Control Type on nonswitched lines

BSC LINES:

IBM TERMINALS

2790 Data Communication System on switched or nonswitched lines: (TCAM,BTAM)

2715 Transmission Control Unit (mdl 2) :

Required: 2740
Supported: Attachment of 2798,1035,1053
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
#9401 - Point-to-Point Nonswitched
#9402 - Point-to-point Switched
#9403 - Multipoint Nonswitched

2740 Communication Terminal (mdl 1)

2798 Guidance Display Unit (mdl 1)

1035 Badge Reader (mdl 1)

1053 Printer (mdl 1)

2770 Data Communication System on switched or nonswitched lines:

2772 Multipurpose Control Unit:

Required: #5010 - Multipoint Data Link Control (VTAM)
Supported: Attachment of 0050,0545,1017,1018,1053,1255,2203,2213,2265,2502,5496
#1340 - Automatic Answering
#1490 - Buffer Expansion (256 bytes)
#1491 - Buffer Expansion Additional (512 bytes)
#1910 - Conversational Mode
#3250 - Display Format Control
#3650 - EBCDIC Transparency
#3860 - 144 Character Print Line
#4610 - Identification
#4690 - Keyboard Correction
#5010 - Multipoint Data Link Control (TCAM,BTAM)
#5890 - Horizontal Format Control
#6555 - Space Compression/Expansion
#7705 - Synchronous Clock
#7950 - Transmit-Receive-Monitor -Print
#9140 - Extended Re-Entry
#9402 - Line Termination - 2-wire
#9761 - Transmission Code EBCDIC
#9762 - Transmission Code ASCII
#9936 - Immediate WACK

0050 Magnetic Data Inscrber

0545 Output Punch (mdls 3,4)

1017 Paper Tape Reader (mdls 1,2)

1018 Paper Tape Punch (mdl 1)

1053 Printer (mdl 1)

1255 Magnetic Character Reader

2203 Printer (mdls A1,A2) :

Supported: #5558 - Print Positions, 24 Additional

2213 Printer (mdls 1,2)

2265 Display Station (mdl 2)

2502 Card Reader (mdls A1,A2)

5496 Data Recorder

2780 Data Transmission Terminal on switched or nonswitched lines:

Supported: #1340 - Automatic Answering

#1350 - Automatic Turnaround
#3401 - Dual Communication Interface
#5010 - Multiple Record Transmission
#5020 - Multipoint Line Control
#5820 - 120 Character Print Line
#5821 - 144 Character Print Line
#6400 - Selective Character Set
#7850 - Terminal Identification
#8030 - EBCDIC Transparency
#9150 - Extended Retry Transmission
#9761 - ASCII Transmission Code
#9762 - EBCDIC Transmission Code

2980 General Banking System on nonswitched lines:

2972 Station Control Unit (mdl 8 - RPQ 858160, mdl 11 - RPQ 858231) :

Supported: Attachment of 2980,2971
RPQ 835503 - Buffer Expansion
RPQ 858165,858182 - 96-Character Buffer

2980 Teller Station (mdl 1 - RPQ 835504, mdl 4 - RPQ 858147)

2980 Administrative Station (mdl 2 - RPQ 835505)

2971 Remote Control Unit (mdl 3 - RPQ 858144)

3270 Information Display System on nonswitched lines:

3262 Printer (mdls 3, 13) [supported as a 3286-2]

3271 Control Unit (mdls 1,2):

Supported: Attachment of 3262, 3277, 3284, 3286, 3287, 3288

#1550 - Copy

#9761 - EBCDIC Code

3274 Control Unit (model 1C) [supported as a 3271] :

Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289

3276 Control Unit Display Station (mdls 1,2,3,4) [supported as a 3271] :

Supported: Attachment of 3268, 3278, 3287

#6350 - Selector Light-Pen

#9082 - EBCDIC Character Set

3277 Display Station (mdls 1,2) :

Supported: #6350 - Selector Light-Pen

#9089 - EBCDIC Character Set

3278 Display Station (mdls 1,2,3,4) [supported as 3277] :

Supported: #6350 - Selector Light-Pen

#9082 - EBCDIC Character Set

3268 Printer (mdl 2) [supported as a 3286-2] :

3284 Printer (mdls 1,2) :

Supported: #9089 - EBCDIC Character Set

3286 Printer (mdls 1,2) :

Supported: #9089 - EBCDIC Character Set

3287 Printer (mdl 1,2) [supported as a 3284 or 3286 attached to 3271-1 or -2]

Supported: #9082 - EBCDIC Character Set

3288 Printer (mdl 2) (supported as a 3286-2) :

Supported: #9089 - EBCDIC Character Set

3289 Printer (mdls 1,2) [supported as a 3286-2]

3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,TCAM,BTAM)

3275 Display Station (mdls 1,2) :

Supported: Attachment of 3284

#6350 - Selector Light-Pen

#9089 - EBCDIC Character Set

#9761 - EBCDIC Code

3284 Printer (mdl 3) :

Supported: #9089 - EBCDIC Character Set

3624 Consumer Transaction Facility (mdl 1, 2, 11, 12) (supported as a 2772): (BTAM)

Supported: Attached to a 3704/3705 via nonswitched lines only

3650 Programmable Store System (Supported as a S/3) on switched lines: (BTAM)

3651 Store Controller (mdls A25, B25, A75, B75, C75 D75)

Supported: Attachment of 3275, 3653, 3657, 3659, 3663, 3669, 3683, 3784

3653 Point of Sale Terminal (mdl 1 and 1P)

3683 Point of Sale Terminal

3663 Supermarket Terminal (mdl 1P, 2 and 3P)

3657 Ticket Unit (not available on 3651 mdls A25 and B25)

3275 Display Station (mdl 3)

Supported: Attachment of 3284

3284 Printer (mdl 3)

3659 Remote Communications Unit (mdl 1)

SYSTEM CONTROL PROGRAMMING

OS/VSI (5652-VS1) (cont'd)

- Required: 2400 BPS non-switched line
 - 3784 Printer (mdl 1) not available on 3651 mdls A25 and B25.
 - 3669 Remote Communications Unit. Not available on 3651 mdl A25 and B25.
 - 3660 Supermarket Scanning System (supported as a S/3) on switched lines: (BTAM)
 - 3651 Store Controller (mdls A60,B60) :
 - Supported: Attachment of 3663,3669
 - 3663 Supermarket Terminal (mdls 1,2) :
 - Supported: Attachment of 3666
 - 3666 Checkout Scanner (mdl 1)
 - 3669 Store Communications Unit (mdl 1)
 - 3660 Supermarket Key-Entry System (supported as a S/3) on switched lines: (BTAM) 3661 Store Controller:
 - Supported: Attachment of 3663
 - 3663 Supermarket Terminal (mdls 1,2)
 - 3670 Brokerage Communication System on nonswitched lines: (TCAM)
 - 3671 Shared Terminal Control Unit (mdl 1) :
 - Supported: Attachment of 3672,3673,3674
 - #3250 - Display Expansion
 - 3672 Executive Console (mdl 1)
 - 3673 Data Display (mdl 1)
 - 3674 Printer-Keyboard (mdl 1)
 - 3680 Programmable Store System supported on switched and nonswitched lines: (VTAM)
 - 3684 Point of Sale - Control Unit (mdls 1,-2):
 - Supported: Attachment of 3683 Point of Sale Terminal (mdl 2)
 - 3735 Programmable Buffered Terminal (mdl 1) on switched or nonswitched lines:
 - Supported: Attachment of 5496,3286
 - 5010 - Multipoint Data Link Control
 - #9761 - EBCDIC Code
 - #9762 - ASCII Code
 - 3286 Printer (mdl 3)
 - 5496 Data Recorder (mdl 1)
 - 3741 Data Station (mdl 2) on switched or nonswitched lines:
 - Supported: Attachment of 0129,3713,3715,3717
 - #1680 - Expanded Communications
 - #1685 - Expanded Communications/ Multipoint Data Link Control
 - #5450 - Operator Identification Card Reader
 - #7850 - Terminal Identification
 - 0129 Card Data Recorder (mdl 2)
 - 3713 Printer (mdl 1)
 - 3715 Printer (mdls 1,2)
 - 3717 Printer (mdl 1)
 - 3741 Programmable Workstation (mdl 4) on switched or nonswitched lines:
 - Supported: Attachment of 0129,3713,3715
 - #1680 - Expanded Communications
 - #1685 - Expanded Communications/ Multipoint Data Link Control
 - #5450 - Operator Identification Card Reader
 - #7850 - Terminal Identification
 - 0129 Card Data Recorder (mdl 2)
 - 3713 Printer (mdl 1)
 - 3715 Printer (mdls 1,2)
 - 3747 Data Converter (mdl 1) on switched or nonswitched lines:
 - Supported: #1660 - Communications Adapter
 - 3770 Data Communication System (supported as a 2770) on switched or nonswitched lines:
 - 3771 Communication Terminal (mdls 1,2,3) :
 - Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-Point, or #1462 - BSC Multipoint
 - Supported: #1201 - ASCII Code
 - 3773 Communication Terminal (mdls 1,2,3,P1,P2,P3) :
 - Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-Point, or #1462 - BSC Multipoint
 - Supported: #1201 - ASCII Code
 - 3774 Communication Terminal (mdls 1,2,P1,P2) :
 - Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-Point, or
 - 3775 Communication Terminal (mdls 1,P1) :
 - Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-Point, or #1462 - BSC Multipoint
 - Supported: #1201 - ASCII Code
 - 3776 Communication Terminal (mdls 1,2) (supported as a 2772/3780) :
 - Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-Point, or #1462 - BSC Multipoint
 - Supported: #1201 - ASCII Code
 - 3777 Communication Terminal (mdl 1) (supported as a 2772/3780) :
 - Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-Point, or #1462 - BSC Multipoint
 - Supported: #1201 - ASCII Code
 - 3777 Communication Terminal (mdl 2) (supported as a S/360-20 MULTI-LEAVING Workstation) :
 - Required: #3701 - EIA Interface
 - 3780 Data Communications Terminal (mdl 1) (supported as a 2772 without component select) on switched or nonswitched lines:
 - Supported: #3601 - EBCDIC Transparency
 - #5010 - Multipoint Data Link Control
 - #5701 - Print Positions, Additional
 - #9761 - EBCDIC Code
 - 5110 Computer (supported as a 2770) on switched and nonswitched lines:
 - Required: #2074 BSCA
 - Supported: Attachment of a 5103, 5106, 5114

The 5110 emulates the following 2770 features:

 - Auto Answer
 - Buffer expansion additional (512)
 - EBCDIC Transparency
 - 144 Character print line
 - Identification
 - Multipoint Data Link Control (TCAM, BTAM)
 - Horizontal Format Control
 - Space Compression/expansion
 - Synchronous Clock
 - Transmission Code EBCDIC
 - 5265 Retail System Communication mdl (supported as 3741) point-to-point operation. (TCAM,BTAM)
 - Required: #5500 - 1200 BPS Integrated Nonswitched Modem or #5501 - 1200 BPS Integrated Switched Modem or #3701 - EIA/CCITT Interface
 - 5275 Direct Numerical Control Station (mdl 1) [supported as a 3275 with EBCDIC Code and EBCDIC Character Set] on switched lines (BTAM) or nonswitched lines (VTAM, TCAM, BTAM).
 - 6670 Information Distributor (by TCAM/BTAM) as a 2772
- IBM PROCESSOR AS TERMINALS**
- (For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)
- 1130 Computing System on switched or nonswitched lines: (TCAM,BTAM)
 - 1131 Central Processing Unit:
 - Required: #7690 - Synchronous Communications Adapter
 - 1800 Data Acquisition and Control System on switched or nonswitched lines: (TCAM,BTAM)
 - 1826 Data Adapter Unit:
 - Required: #7550 - Communication Adapter
 - 5280 Distributed Data System (supported as a 3271-2) on a non-switched line:
 - 5285 and 5288 Controllers
 - Required: Refer to GSD Sales Manual for required features and related programming
 - 5280 Distributed Data System (supported as a 3741 or S/3 MRJE) on switched or nonswitched lines:
 - 5285 and 5288 Controllers

SYSTEM CONTROL PROGRAMMING
OS/Vs1 (5652-Vs1) (cont'd)

- Required: #2500 - Communications Adapter
 Series/1 (supported as a S/3) on switched or nonswitched lines: (BTAM)
 4953 or 4955 Processor:
 Required: #2074, #2075, or #2094 Binary Synchronous Communications Adapter
- System/3 on switched or nonswitched lines:
 5404, 5406, 5408, 5410, 5412, or 5414 Processing Unit:
 Required: #2074 - Binary Synchronous Communications Adapter
- System/7 (supported as a System/3) on switched or nonswitched lines:
 5010 Processor Module:
 Required: #2074 - Binary Synchronous Communications Adapter
- System/32 (supported as a System/3) on switched or nonswitched lines:
 5320 System Unit:
 Required: #2074 - Binary Synchronous Communications Adapter
- System/34 (supported as a System/3) on switched or nonswitched lines:
 5340 System Unit:
 Required: #2500, #3500 or #4500 - Communications Adapter feature
- System/34 (supported as a 3271 mdl 2) on a nonswitched line:
 5340 System Unit
 Required: #2500, #3500 or #4500 Communications Adapter feature
 #4900 or #4901 Workstation Control Expansion A or B
- System/36 (supported as a System/3) on switched or nonswitched lines:
 5360 System Unit:
 Required: #2500 or #4500 - Communications Adapter feature
- System/36 (supported as a S/360 mdls 25 and up) on switched or nonswitched lines:
 5360 System Unit
 Required: #2500 or #4500 Communications Adapter feature
- System/36 (supported as a 3271 mdl 2) on nonswitched lines:
 5360 System Unit:
 Required: #2500 or #4500 - Communications Adapter feature
 #4900 Workstation Control feature
- System/38 (supported as a System/3) on switched or nonswitched line:
 5381 System Unit:
 Required: #1501 or #1502 Communications Attachment feature
 #2001 or #2003 Communications Control feature
 #3200 Line Base feature
- System/38 (supported as a 3271 mdl 2) on a nonswitched line:
 5381 System Unit
 Required: #1501, #1502 Communications Attachment feature
 #2001, #2003 Communications Control feature
- S/360 mdl 20 on switched or nonswitched lines: (TCAM,BTAM)
 2020 Processing Unit:
 Required: #2074 - Binary Synchronous Communications Adapter
- S/360 mdls 25, 30, 40, 50, 65, 65MP, 67(65 mode), 75, 85, 91, 195 on switched or nonswitched lines: (TCAM,BTAM)
 Processing Unit:
 Required: #4580 - Integrated Communications Attachment, or
 2701 Data Adapter Unit, or
 2703 Transmission Control, or
 3704 Communications Controller in emulation mode, or
 3705-I Communications Controller in emulation mode, or
 3705-II Communications Controller in emulation mode
- All virtual storage S/370 Processors or 4300 Processors on switched or nonswitched lines:
 Processing Unit:
 Required: #4640 - Integrated Communications Adapter (TCAM,BTAM), on S/370 mdls 135, 135-3, 138 or
 #1601 - Communications Adapter (TCAM, BTAM) on 4331 or
 2701 Data Adapter Unit (TCAM,BTAM), or
 2703 Transmission Control (TCAM,BTAM), or
 3704 Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM), or
 3705-I Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM), or
 3705-II Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM)
- 8100 with DPPX on nonswitched lines: (BTAM, TCAM, VTAM)
 Required: Refer to 8100 pages for required features and for licensed programs supported.
- 8100 with DPPX/SP on nonswitched lines: (BTAM, TCAM, VTAM)
 Required: Refer to 8100 pages for required features and for licensed programs supported.
- SDLC LINES:**
COMMUNICATIONS CONTROLLERS
 3704 Communications Controller in network control mode (VTAM,TCAM)
 3705-I Communications Controller in network control mode (VTAM,TCAM)
- IBM TERMINALS**
 3232-1 Keyboard Printer Terminal (Mdl 1) on switched and non-switched lines (VTAM, TCAM)
 3270 Information Display System on nonswitched lines: (VTAM,TCAM)
 3271 Control Unit (mdls 11, 12) :
 Supported: Attachment of 3277,3284,3286,3287, 3288
 #1200 - ASCII Code
 #1550 - Copy
 #9761 - EBCDIC Code
 3277 Display Station (mdls 1,2) :
 Supported: #6350 - Selector Light-Pen
 #9089 - EBCDIC Character Set
 3284 Printer (mdls 1,2) :
 Supported: #9089 - EBCDIC Character Set
 3286 Printer (mdls 1,2) :
 Supported: #9089 - EBCDIC Character Set
 3287 Printer (mdls 1,2) [supported as a 3284 or 3286 attached to 3271-11 or -12]
 Supported: #9082 - EBCDIC Character Set
 3288 Printer (mdl 2) (supported as a 3286-2) :
 Supported: #9089 - EBCDIC Character Set
 3275 Display Station (mdls 11,12) :
 Supported: Attachment of 3284
 #1200 - ASCII Code
 #6350 - Selector Light-Pen
 #9089 - EBCDIC Character Set
 #9761 - EBCDIC Code
 3284 Printer (mdl 3) :
 Supported: #9089 - EBCDIC Character Set
 3270 Information Display System on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM/NCP Direct)
 [Supported as a 3790 with Configuration Support #9165]:
 3276 Control Unit Display Station (mdls 11,12,13,14) :
 Supported: Attachment of 3268, 3278, 3287
 #6350 - Selector Light-Pen
 #9082 - EBCDIC Character Set
 3278 Display Station (mdls 1,2,3,4) [Supported as 3277]:
 Supported: #6350 - Selector Light-Pen
 #9082 - EBCDIC Character Set
 3287 Printer (mdls 1,2) [Supported as a 3284 or 3286]:

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

- Supported: #9082 - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as a 3286-2]
- 3600 Finance Communication System on switched or nonswitched lines: (VTAM,TCAM) 3601 Controller (mdls 1,2A,2B,3A,3B):
Supported: Attachment of 3603,3604,3606, 3608,3610,-3611,3612,3614, 3615,3616,3618
- 3602 Controller (mdls 1A,1B) :
Supported: Attachment of 3603,3604,3606,3608,3610, 3611,3612,3614,3615,3616,3618
- 3603 Terminal Attachment Unit (mdl 1, 2) :
3604 Keyboard Display (mdls 1,2,3,4,5,6,7)
3606 Financial Services Terminal (mdls 1,2)
3608 Printing Financial Services Terminal (mdls 1,2)
3610 Document Printer (mdls 1,2,3,4,5,12,13)
3611 Passbook Printer (mdls 1,2)
3612 Passbook and Document Printer (mdls 1,2,3,12,13)
3618 Administrative Line Printer (mdl 1)
3614 Consumer Transaction Facility (mdls 1,2,11,12) :
Required: When attached to a 3601 or 3602 3601 or 3602 application programs
Supported: Attachment to a 3704/3705 (via non-switched lines only) or 3601,3602.
- 3615 Administrative Terminal Printer (mdls 1,2)
3616 Passbook and Document Printer (mdl 1)
3624 Consumer Transaction Facility (mdls 1,2,11,12) :
Required: When attached to a 3601 or 3602, 3601 or 3602 application programs
Supported: Attachment to a 3704/3705 (via non-switched lines only) or 3601, 3602.
- 3630 Plant Communication System on switched or non-switched lines (VTAM, TCAM)
3631 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646,3842, 7430 (RPQ)
- 3632 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646, 3842, 7430 (RPQ)
- 3604 Keyboard Display Terminal (mdl 6)
3641 Reporting Terminal (mdls 1,2)
3642 Encoder Printer (mdls 1, 2)
3643 Keyboard Display (mdls 2,3,4)
3644 Automatic Data Unit (mdl 1)
3646 Scanner Control Unit (mdl 1)
3647 Time and Attendance Terminal (mdl 1)
3842 Loop Control Unit (mdl 1)
7430 Document Printer (RPQ)
- 3650 Programmable Store System on switched or non-switched lines: (VTAM, ACF/VTAM)
3651 Store Controller (mdls A25, B25, A75, B75, C75, D75)
Supported: Attachment of 3653, 3683, 3663, 3657, 3275, 3659, 3669, 3784
- 3653 Point of Sale Terminal (mdl 1 and 1P)
3683 Point of Sale Terminal
3663 Supermarket Terminal (mdl 1P, 2 and 3P)
3657 Ticket Unit (Not available on 3651 mdls A25 and B25)
3275 Display Station (mdl 3)
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1)
Required: 2400 bps nonswitched line
3784 Printer (mdl 1) not available on 3651 mdl A25 and B25
3669 Remote Communications Unit (mdl 1) not available on 3651 mdl A25 and B25
- 3650 Retail Store System on switched or nonswitched lines: (VTAM,TCAM) 3651 Store Controller (mdls A50,B50) :
Supported: Attachment of 3653,3657,3275, 3659,3784
- 3653 Point of Sale Terminal
3657 Ticket Unit
3275 Display Station (mdl 3) :
Supported: Attachment of 3284
3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1)
3784 Printer (mdl 1)
- 3660 Supermarket Scanning System on switched lines: (VTAM)
3651 Store Controller (mdls A60,B60) :
Supported: Attachment of 3663,3669
- 3663 Supermarket Terminal (mdls 1,2) :
Supported: Attachment of 3666
3666 Checkout Scanner
3669 Store Communication Unit (mdl 1)
- 3660 Supermarket Key-Entry System on switched lines: (VTAM)
3661 Store Controller:
Supported: Attachment of 3663
3663 Supermarket Terminal (mdls 1,2)
- 3680 Programmable Store System supported on switched and nonswitched lines: (VTAM)
3684 Point of Sale - Control Unit (mdl 1,-2)
Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal
3683 Point of Sale Terminal
- 3730 Distributed Office Communication System on switched and nonswitched lines (VTAM and TCAM/NCP Direct).
3791 Controller, mdl 11C, 12A or 12B with: SDLC with clock (#6301) or SDLC without clock (#6302 or 6303), and required modem
3732 Text Display Station
3736 Printer
- 3767 Communication Terminal (mdls 1,2,3) on switched or non-switched lines: (VTAM,TCAM)
Supported: SDLC adapter provided unless one of the Start/Stop features are specified #1201 - ASCII Code
- 3770 Data Communication System on switched or nonswitched lines: (VTAM,TCAM)
3771 Communication Terminal (mdls 1,2,3) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3773 Communication Terminal (mdls 1,2,3,P1,P2,P3) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3774 Communication Terminal (mdls 1,2,P1,P2) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3775 Communication Terminal (mdls 1,P1) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3776 Communication Terminal (mdls 1,2) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3776 Communication Terminal (mdls 3,4) [VTAM] :
Supported: #1201 - ASCII Code
3777 Communication Terminal (mdl 1) :
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code
3777 Communication Terminal (mdl 3) [VTAM] :
Supported: #1201 - ASCII Code
- 3790 Communication System on switched or nonswitched lines (VTAM,TCAM/NCP):
4730 Personal Banking Machine on nonswitched lines (VTAM, ACF/VTAM, TCAM):
6670 Information Distributor
- 8100/DPCX Information System on switched or nonswitched lines (VTAM, TCAM/NCP)
- IBM PROCESSOR AS TERMINALS**
- 5280 Distributed Data System (supported as a 3274-1C) on switched and nonswitched lines: (VTAM)
5285 and 5288 Controllers
Required: Refer to appropriate pages for required features and programming
- 5280 Distributed Data System (supported as a 3770) on switched or nonswitched lines:
5285 and 5288 Controllers
Required: #2500 Communications Adapter
- System/32 (supported as a 3770) on switched or nonswitched lines: (VTAM,TCAM)

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

5320 System Unit:
Required: #1005 - Additional Storage (minimum of one)
#6301 - Synchronous Data Link Control

System/34 (supported as a 3770 or 3791) on switched or nonswitched lines (VTAM, TCAM) :

5340 System Unit:
Required: #2500, #3500 or #4500 Communications Adapter feature

System/34 (supported as a 3274 mdl 1C) on a nonswitched line (VTAM):

5340 System Unit
Required: #2500, #3500 or #4500 Communications Adapter feature
#4900 or #4901 Workstation Control Expansion A or B

System/36 (supported as a 3770 or 3791) on switched or nonswitched lines:

5360 System Unit:
Required: #2500 or #4500 Communications Adapter feature

System/36 (supported as a 3274 mdl 1C) on switched or nonswitched lines:

5360 System Unit
Required: #2500 or #4500 Communications Adapter feature
#4900 Workstation Control feature

System/38 (supported as a 3770) on switched or nonswitched line (VTAM, TCAM):

5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2001, #2001, #2002 or #2003 Communications Control feature
#3200 Line Base feature

System/38 (supported as a 3774) on switched or nonswitched line (VTAM, TCAM):

5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2001, #2001, #2002 or #2003 Communications Control feature
#3200 Line Base feature

8100 with DPPX on switched or nonswitched lines (TCAM, VTAM)
Required: Refer to 8100 pages for required features and licensed programs supported.

8100 with DPPX/SP on switched or nonswitched lines (TCAM,VTAM)
Required: Refer to 8100 pages for required features and licensed programs supported.

LOCAL ATTACHMENT

Transmission Control Units and Communications Controllers

Integrated Communications Adapter of S/370 mdl 135: (TCAM,BTAM)
Required: #4640 - Integrated Communications Adapter
Supported: EBCDIC Code is a standard feature
#9763-#9780 - Transparency
#9681-#9688 - ASCII Code
#9689-#9696 - 6-bit Transcode

Communications Adapter on 4331/4361 (TCAM, BTAM)
Required: #1601 Communications Adapter

2701 Data Adapter Unit on local channel: (TCAM,BTAM)
Supported: #1302,#1303,#1314 - Autocall
#3455 - Dual Code
#3463-#3465 - Dual Communication Interface
#8029 - Transparency
#9060 - EBCDIC Code
#9061 - ASCII Code
#9062 - 6-bit Transcode

2702 Transmission Control Unit on local channel: (TCAM,BTAM)
Supported: #1290 - Autocall
#1319 - Autopoll
#8055 - 2741 Break

2703 Transmission Control Unit on local channel: (TCAM,BTAM)

Supported: #1340,#1341 - Autocall
#7715 - EBCDIC Code
#7716 - ASCII Code
#7717 - 6-bit Transcode
#8055 - 2741 Break
#9100 - Transparency for ASCII

2715 Transmission Control Unit (mdl 1) on local channel: (TCAM,BTAM)

Supported: See "2790" under *Local Terminals*

3704/3705-I/3705-II Communications Controller on local channel:

Supported: EBCDIC Code, ASCII Code, Autopoll and EBCDIC Transparency do not have special feature codes in the 3704/3705
EP/VS (TCAM,BTAM)
NCP/VS (VTAM,TCAM)
PEP
#8002 - Two-Channel Switch (VTAM,TCAM)

LOCAL TERMINALS

2848 Display Control (mdls 1,2,3) on local channel: (TCAM)

Supported: Attachment of 2260,1053
#3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter

Not Supported: Attachment of 1053

2260 Display Station (mdls 1,2) :

Supported: #3606 - Extended Cursor Control, Alpha-numeric Keyboard

Not Supported: Tab feature of #3606

2790 Data Communication System on local channel: (TCAM,BTAM)

2715 Transmission Control Unit (mdl 1) :

Supported: Attachment of 2740,2791,2793
#3801 - Expanded Capability
#4850 - Local 2740 Adapter

Not Supported: #8110 - Two Processor Switch

2740 Communication Terminal (mdl 1)

2791 Area Station (mdls 1,2) :

Supported: Attachment of 1035,2795,2796,2797,2798, 1053

1035 Badge Reader (mdl 1)

2795 Data Entry Unit (mdl 1)

2796 Data Entry Unit (mdl 1)

2797 Data Entry Unit (mdl 1)

2798 Guidance Display Unit (mdl 1)

1053 Printer (mdl 1)

2793 Area Station (mdl 1) :

Supported: Attachment of 2795,2796,2797,2798, 1053

2795 Data Entry Unit (mdl 1)

2796 Data Entry Unit (mdl 1)

2797 Data Entry Unit (mdl 1)

2798 Guidance Display Unit (mdl 1)

1053 Printer (mdl 1)

3270 Information Display System on local channel:

3272 Control Unit (mdls 1,2) :

Supported: Attachment of 3277, 3284, 3286, 3287, 3288

3277 Display Station (mdls 1,2) :

Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set

3284 Printer (mdls 1,2) :

Supported: #9089 - EBCDIC Character Set

3286 Printer (mdls 1,2) :

Supported: #9089 - EBCDIC Character Set

3287 Printer (mdls 1,2) [supported as a 3284 or 3286 attached to 3272-1 or -2]

Supported: #9082 - EBCDIC Character Set

3288 Printer (mdl 2) (supported as a 3286-2) :

Supported: #9089 - EBCDIC Character Set

3270 Information Display System on local channel: (Supported as a 3272)

3274 Control Unit (mdl 1B, 1D)

Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289

3277 Display Station (mdls 1,2)

Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set

3268 Printer (mdl 2) [Supported as a 3286-2]

3278 Display Station (mdls 1,2,3,4) [Supported as 3277]

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set

3284 Printer (mdls 1,2)

Supported: #9089 - EBCDIC Character Set

3286 Printer (mdls 1,2)

Supported: #9089 - EBCDIC Character Set

3287 Printer (mdls 1,2) [Supported as a 3284 or 3286]

Supported: #9082 - EBCDIC Character Set

3288 Printer (mdl 2) [Supported as a 3286-2]

Supported: #9089 - EBCDIC Character Set

3289 Printer (mdls 1,2) [Supported as a 3286-2]

3270 Information Display System on local channel: (VTAM, TCAM through VTAM) [Supported as 3790 with Configuration Support #9165]

3274 Control Unit (mdl 1A)

Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289

3277 Display Station (mdls 1,2)

Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set

3268 Printer (mdl 2) [Supported as a 3286-2]

3278 Display Station (mdls 1,2,3,4)

Supported: #6350 Selector Light-Pen
#9082 EBCDIC Character Set

3284 Printer (mdls 1,2)

Supported: #9089 - EBCDIC Character Set

3286 Printer (mdls 1,2)

Supported: #9089 - EBCDIC Character Set

3287 Printer (mdls 1,2) [Supported as a 3284 or 3286]

Supported: #9082 - EBCDIC Character Set

3288 Printer (mdl 2) [Supported as a 3286-2]

Supported: #9089 - EBCDIC Character Set

3289 Printer (mdls 1,2) [Supported as a 3286-2]

3730 Distributed Office Communication System on local channel (VTAM)

3791 Controller, mdl 11C, 12A or 12B with: Local Channel Attachment (#1515)

3732 Text Display Station

3736 Printer

3790 Communication System on local channel (VTAM,TCAM)

7770 Audio Response Unit (mdl 3) on local channel (TCAM)

Legend:

(VTAM) = VTAM only

(TCAM) = TCAM only

(BTAM) = BTAM only

SYSTEM CONTROL PROGRAMMING

OS/V51 (5652-VS1) (cont'd)

TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM	TCAM	TCAM	TCAM or BTAM		via 13X ICA or 4331 CA	RES RTAM
	via NCP/VS (c)	via VTAM (c)	via NCP/VS (f)	via EP/VS (g)	via 270X (h)		
SS Lines:							
1031				X	1,2,3		
1051	X	X	X	X	1,2,3	X	
2260				X	1	X	
2265				X	1	X	
2740-1,-2	X	X	X	X	1,2,3	X	
2741	X	X	X	X	1,2,3	X	
2760				X	1,2,3	X	
3101	X	X		X			
3232-51	X	X	X	X		X	
3767-1,-2 (2740-1)	X	X	X	X		X	
3767-1,-2 (2740-2)	X	X	X	X	1	X	
3767-3 (2740-2)	X	X	X	X	1		X
3767-1,-2 (2741)	X	X	X	X		X	
5100 (2741)	X	X	X	X		X	
5110 (2741)	X	X	X	X		X	
CMCST (2741)	X	X	X	X	1,2,3	X	
System/7 (2740-1)	X	X	X	X	1,2,3	X	
AT&T 83B3 or WU 115A							
Line Control Type	X	X	X	X	1,2,3		
CPT-TWX (M33/35)							
Line Control Type	X	X	X	X	1,2,3	X	
WT Telegraph	X	X	X	X	1,2,3		
6733 (CPT-TWX 33/35)	X	X	X	X	-	X	-
BSC Lines:							
2715-2			X	X	1,3	X	
2772	X	X	X	X	1,3	X	X
2780	X	X	X	X	1,3	X	X
2972-8,-11	X	X	X	X (B)	1,3 (B)	X (B)	
3271-1,-2	X	X	X	X	1,3	X	
3274-1C (3271-1,-2)	X	X	X	X	1,3	X	X
3275-1,-2	X	X	X	X	1,3	X	
3276 (3276 (3271-1,-2)		X	X	X	1,3	X	X
3624-1,-2,-11,-12 (2772)				X (B)			
3651-A25,-B25,-A75 B75, C75, D75				X (B)		X (B)	
3651-A60,-B60 (S/3)				X (B)		X (B)	
3661 (S/3)				X (B)		X (B)	
3670				X (T)	1,3 (T)	X (T)	
3684				X (B)	1,3(B)	X (B)	
3735	X	X	X	X	1,3	X	
3741-2,-4	X	X	X	X	1,3	X	X
3747	X	X	X	X	1,3	X	
3771-1,-2,-3 (2772)	X	X	X	X	1	X	X
3773-1,-2,-3 (2772)	X	X	X	X	1	X	X
3773-P1,-P2,-P3 (2772)	X	X	X	X	1	X	
3774-1,-2 (2772)	X	X	X	X	1	X	X
3774-P1,-P2 (2772)	X	X	X	X	1	X	X (i)
3775-1 (2772)	X	X	X	X	1	X	X
3775-P1 (2772)	X	X	X	X	1	X	X (i)
3776-1,-2(2772/3780)	X	X	X	X	1	X	X
3777-1 (2772/3780)	X	X	X	X	1	X	X
3777-2 (S/360-20)							X
3780 (2772)	X	X	X	X	1,3	X	X
4331	X	X	X	X	1,3	X	X
4341	X	X	X	X	1,3	X	X
4361	X	X	X	X	1,3	X	X
5110 (2772)			X	X		X	X
5265 Communicating mdl (3741)			X	X		X	
5275 (3275-1,-2)	X	X	X	X	1		
5285/5288 (3741)	X	X	X	X (B)	1,3	X (B)	
5285/5288 (System/3)	X		X	X (B)	1,3		X
5285/5288 (3271-2)	X	X	X	X (B)	1,3	X	
6670 (2772)		X	X	X	1,3	X (M)	X
1131			X	X	1,3	X	X
1826			X	X (B)	1,3 (B)	X (B)	
Series/1 (System/3)				X (B)	1 (B)		
System/3	X	X	X	X	1,3	X	X
System/7 (System/3)	X	X	X	X	1,3	X	X
System/32 (System/3)	X	X	X	X	1,3	X	X
System/34 (System/3)	X	X	X	X	1,3	X	X
System/34 (3271)	X			X (B)	1,3		
System/36 (System/3)	X	X	X	X	1,3	X	X
System/36 (3271)	X			X (B)	1,3		
System/38 (System/3)	X	X	X	X	1,3	X	X
System/38 (3271)	X			X	1,3	X	X
System/38 (3274)	X			X	1,3	X	X
S/360-20			X	X	1,3	X	X
S/360 (b)			X	X	1,3	X	X
S/370 (b)	X	X	X	X	1,3	X	X
S/8100	X		X	X	1,3	X	X

SYSTEM CONTROL PROGRAMMING

OS/V51 (5652-VS1) (cont'd)

TERMINAL SUPPORT CHART 1 - cont'd

SDLC Lines:	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (T)	RES VTAM
3232-1	X	X	X	
3271-11,-12	X	X	X	
3274-1C (3791)	X	X	X	
3275-11,-12	X	X	X	
3276 (3791)	X	X	X	
3601	X	X	X (d)	
3602	X	X	X (d)	
3614	X	X	X	
3624	X (j)	X (j)	X (j)	
3631	X			
3632	X			
3651-A25,B25,A75 B75,C75,D75	X	X		
3651-A50,-B50	X	X		
3651-A60,-B60	X			
3661	X			
3684	X			
3767-1,-2,-3	X	X	X	
3771-1,-2,-3	X	X	X	X
3773-1,-2,-3	X	X	X	X
3773-P1,-P2,-P3	X	X	X	
3774-1,-2	X	X	X	X
3774-P1,-P2	X	X	X	X
3775-1	X	X	X	X
3775-P1	X	X	X	
3776-1,-2	X	X	X	X
3776-3,-4	X			X
3777-1	X	X	X	X
3777-3	X			X
3791	X	X	X	X
4730-F01,-F02 -R01,-R02	X (j)	X (j)	X (j)	
6670	X		X	X (l)
5285/5288 (3770)	X	X	X	X
5285/5288 (3274-1C)	X	X	X	
3791 (for 3730)	X		X	X (k)
8130/DPCX -A21,-A23	X	X	X	X
8140/DPCX-A31, A33,-A51,-A53	X	X	X	X
System/32 (3770)	X	X	X	X
System/34 (3770)	X	X	X	X
System/34 (3790)	X	X	X	
System/34 (3274-1C)	X	X	X	
System/36 (3770)	X	X	X	X
System/36 (3790)	X	X	X	
System/36 (3274-1C)	X	X	X	
System/38 (3770)	X	X	X	X
System/38 (3274)	X	-	X	-
S/8100/DPPX(j)	X	X	X	X
S/8100/DPPX(j)	X	X	X	X

Local Terminals:

2260				X	
3272-1,-2	X	X	X	X	
3274-1A (3791)	X				
3274-1B (3272-2)	X	X	X	X	X
3791	X (e)	X			X
3791 (for 3730)	X	-	-	-	X (k)
7770-3				X	

Legend:

SS = Start/Stop
BSC = Binary Synchronous Communication
SDLC = Synchronous Data Link Control

X = supported now
(date) = date when support will be available.

Notes:

- (B) BTAM only.
- (T) TCAM only.
- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7(2740-1)" means "the S/7 is supported as a 2740-1".
- (b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. S/370 mdls 115-168MP, 3031, 3032, and 3033 Processors or 4300 Processors with BOS, BPS, DOS, OS, DOS/VS, DOS/VSE, OS/VS1 or OS/VS2.
- (c) OS/VS1 Release 3.1 or later.
- (d) Available with TCAM NCP/VS Direct.
- (e) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s, and precludes concurrent operation of 3704/3705 or 3272 controllers through VTAM or TCAM through VTAM.
- (f) OS/VS1 Release 3.0 only, or the current OS/VS1 release when TCAM direct NCP/VS support becomes available in July, 1977.
- (g) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.
- (h) 270X = 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.
- (i) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).
- (j) Nonswitched support only.
- (k) Concurrent 3730-3790 systems only.
- (l) SNA support for the 6670 requires the OS/VS1 Information Distribution Workstation Support Program Product. See the Program Product Sales Manual pages for additional information.
- (m) The 6670 is not supported by the 4331 ICA.

Local Channel Attach	VTAM (c)	TCAM via VTAM (c)	TCAM	BTAM	RES VTAM
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ICA, TCUs, Local Communications Controllers:

ICA			X	X	
2701			X	X	
2702			X	X	
2703			X	X	
2715-1			X	X	
3704 (EP/VS)			X	X	
3704 (NCP/VS)	X	X	X		
3705-I (EP/VS)			X	X	
3705-I (NCP/VS)	X	X	X		
3705-II (EP/VS)			X	X	
3705-II (NCP/VS)	X	X	X		

SYSTEM CONTROL PROGRAMMING

OS/VS1 (5652-VS1) (cont'd)

- (b) Supports EBCD communications code only.
- (c) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. S/370 mdls 115-168MP and 3031 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.
- (d) The 3791 Controller, as part of the 3790 Communication System/Data Entry Configuration, does not support ASCII code.
- (e) The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, NCP/VS requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.
- (f) Terminal operates on switched line using manual dial/manual and/or auto answer procedures and nonswitched VTAM-NCP/VS programming support. The 3651-A50,-B50 uses manual answer and the 3791 uses manual or auto answer procedures. These manual dial procedures will not be required when switched VTAM-NCP/VS support is available.
- (g) IPL of System/7 is not supported in this network configuration.
- (h) Switched network support by BTAM only.

SCP PROGRAMMING SERVICES

Class 2 SCP (Prior to Release 7); Class 1 SCP (Release 7)

SYSTEM CONTROL PROGRAMMING

VM/370 (5749-010) (cont'd)

However, it can be said that VM/370 gives highest priority to the interactive users for short periods of time, while the heavy computing user will be given less frequent but longer periods of use.

VM/370 system performance data is obtainable by users both at the console and, in an extended form, through a general-purpose data collection and recording facility with the VM/370 Measurement Facility, as follows:

Data obtainable at the console will show current load conditions on the system. Information on utilization and contention for major system resources (Processor, real storage and devices) will allow the system analyst to identify possible bottleneck conditions.

The data collection and recording facility can record a wide range of performance related statistical data for more detailed information. Several classes of data collection are provided which may be activated either separately or together. The accumulated data is recorded on tape for later examination and reduction by the user.

The 3270 remote and binary-synchronous line configurations affect response times observed at the 3270 remote display devices. On the basis of the speed of the communication line, users of the CMS Editor may choose between multiple line transmission to the 3270 device (similar to CMS editor support for local 3270s) and a single line at a time mode (as though the display screen were a 2741).

Considerations regarding performance can also be found in the *IBM VM/370: Introduction* (GC20-1800), "Virtual Machine Operating System" section and in the *VM/370: System Programmer's Guide* (GC20-1807).

INSTALLATION PLANNING

Generating and installing the initial release of VM/370 requires coordinated planning between the customer, DP marketing representative, systems engineers (providing marketing support services), FE programming and service representatives and the communications common carrier. The *IBM Virtual Machine Facility/370: Planning and System Generation Guide* (GC20-1801) should be reviewed thoroughly before ordering or generating the VM/370 system.

PROGRAMMING UPDATE SERVICE

Programming update service for VM/370 is provided using the VM/370 Program Level Change (PLC) service.

A given release of VM/370 consists of the release base as well as all updates made available to date via the VM/370 PLC service. The release is designated by both the base number and the PLC number. Support for a given release of VM/370 will be available for six months following the next subsequent release of VM/370. PLCs issued to distribute fixes to an old base, after a new base is released, do not constitute a new release of the system.

The VM/370 PLC is a system update service that can include new functions as well as cumulative system changes. The latest PLC tape is made available at PID as well as all previous updates since the last VM/370 release base. Field Engineering is responsible for initially ordering the PLC service. Thereafter, PID will automatically ship the PLC tapes to the the FE location, and FE is responsible for applying the updates to the user's system. These tapes are not automatically distributed to customers of record by PID.

DOCUMENTATION
(available from Mechanicsburg)

Title	Number
VM/370 System Logic and Problem Determination Guide Vol.1. Control Program (CP)	SY-0886
VM/370 System Logic and Problem Determination Guide Vol 2. Conversational Monitor System (CMS)	SY-0887
VM/370 System Logic and Problem Determination Guide Vol 3. Remote Spooling Communications System(RSCS)	SY-0888
VM/370 Planning and System Generation Guide	GC20-1801
VM/370 Operator's Guide	GC20-1806
VM/370 System Programmer's Guide	GC20-1807
VM/370 System Messages	GC20-1808
VM/370 Terminal User's Guide	GC20-1810
VM/370 RSCS User's Guide	GC20-1816
VM/370 CMS Command and Macro Reference	GC20-1818
VM/370 CMS User's Guide	GC20-1819
VM/370 CP Command Reference for General Users	GC20-1820
VM/370 Release 6 Guide	GC20-1834
VM/370 Interactive Problem Control System User's Guide	GC20-1823
OS/VS and VM/370 Assembler Programmer's Guide	GC33-4021
VM/370 Introduction	GC20-1800

VM/370 OLTSEP and Error Recording Guide	GC20-1809
VM/370 Glossary and Master Index	GC20-1813
VM/370 Operating Systems in a Virtual Machine	GC20-1821
VM/370 Quick Guide for Users (Reference Summary)	GX20-1826
VM/370 Summary of VM/370 CP and CMS Commands reference card)	GX20-1961
VM/370 Service Routines Program Logic	SY20-0882
VM/370 Data Areas and Control Block Logic	SY20-0884
VM/370 Control Program Listings Microfiche	SY80-0900
VM/370 Conversational Monitor System Listings Microfiche	SY80-0901
VM/370 Remote Spooling Communications Subsystem Microfiche	SYC0-9000
VM/370 Interactive Problem Control System Microfiche	SYC0-9001
VS2 EREP Microfiche	SJD2-4350
VM/370 Environmental Recording, Editing and Printing (EREP) Program	GC29-8300
VM/370 Environmental Recording, Editing and Printing (EREP) Program Logic	SY25-7701
OS/VS, DOS/VS and VM/370 Assembler Language	GC33-4010
OS/VS and VM/370 Assembler Logic	SY33-8041

SCP PROGRAMMING SERVICES: Class 1 SCP

5752-VS2 - OPERATING SYSTEM/VIRTUAL STORAGE 2

PURPOSE

Operating System/Virtual Storage 2 (OS/VS2) (also known as VS2) is an operating system, upward compatible from MFT, MVT and OS/VS1. OS/VS2 Release 1 (SVS) makes available a single address space of 16 megabytes for programs and data. In MVS (VS2 Release 2 and subsequent MVS releases), each job or timesharing user is provided with individual 16 megabyte virtual address space. The 16 megabytes include the space required for system code and tables. OS/VS2 supports the S/370 mdls 145, 148, 155II, 158, 165II, 168 and the 3031, 3032 and 3033 Processors. In addition, MVS supports the 158MP, 168MP, 158AP, 168AP and 3031AP systems.

DESCRIPTION

MVS Release 3.8 is a refresh release with SUs integrated in the release described in Chart 1 of the Announcement Letter.

In MVS Release 2, Job Entry Subsystem 2 (JES2), which is upward compatible with HASP, is provided. MVS Release 3 allows two to seven JES2 systems to operate in a JES2 Multi-Access Spool environment. JES3 is an SU to MVS Release 3.7 and Release 3.8 and is upward compatible with ASP. Both have been incorporated in the system control program as an SCP component. One or the other must be used for job entry.

Virtual storage can exceed the available main storage ("real storage") in the system. This is possible because virtual storage resides on direct access devices as well as in real storage.

Virtual storage is organized in 4K-byte blocks called pages which are loaded from direct access storage into real storage for execution and written out to direct access storage when not actively being used and the space they occupy is needed and an exact copy does not exist on the paging device.

Virtual storage reduces the need for programmers to be aware of storage constraints.

Real storage utilization can be increased, providing the capability to increase multiprogramming and resource utilization.

TSO user regions are paged. Real storage utilization for TSO reflects actual requirements to execute the program as compared to fixed MVT time shared region.

Virtual storage allows most programs to run in a system with less real storage than the program was designed for. This enables testing and backup on smaller real storage systems.

Link Pack Area (LPA) is paged. All transient SVCs, transient ERPs, Appendages, most data management and most job management modules as well as any reentrant programs can be included in LPA without dedicating real storage for each program. A portion of the LPA may be fixed in real storage.

OS/VS2 includes features which are designed to improve the integrity of the system. These include Region Protection, Authorized Program Facility and DEB Validity Checking. The combination of fetch protection, a standard feature on VS2 supported Processors and the dispatcher's manipulation of segment table validity bits prevents unauthorized access of user regions. The use of control program services may be restricted to designated programs, using Authorized Program Facility (APF). The DEB Validity Checking facility aids in preventing an unauthorized user from modifying direct access extents or gaining control in supervisor state.

Note: For SVS restrictions, refer to the *OS/VS2 Planning Guide* (GC28-0600) and for MVS the *Introduction to OS/VS2 Release 2* (GC28-0661).

Facilities to Support Virtual Storage

Enhancements to the Linkage Editor permit the programmer to group related CSECTs together and place them on page boundaries. The result is the ability to localize references within a page, and help to reduce the number of pages brought into real storage.

Extensions to System Management Facilities (SMF) are made to record information regarding paging activity.

Additional VS2 Facilities Over MVT

An enhancement to IEBCOPY to allow unloading a partitioned data set to a removable volume and loading it at a later date to the same or a different type of volume.

RMS facilities are expanded to check for missing interrupts and alert the operator so that action can be taken.

VS2 Assembler supports all available S/370 instructions, improved macro instructions, conditional assembly statements and dynamic work area.

A Quick-Start IPL can be performed when a previously created LPA is in external page storage eliminating the necessity of having to recreate pageable LPA in external page storage and to reconstruct the BLDL table during each IPL.

SVS HIGHLIGHTS

In addition to the availability of 16 megabytes of virtual address space described previously, SVS provides the following facilities:

Virtual Telecommunications Access Method - VTAM: Refer to the VTAM section below for a description.

Resource Management

Dynamic dispatching is a feature of the task supervisor included in the system when the automatic priority group (APG) option is selected. Installation-designated groups of tasks are dispatched based on their operational characteristics: Processor-oriented or I/O-oriented. Processor and I/O characteristics of the group of tasks are constantly monitored during their execution and changes are taken into account in the dispatching process.

VS2 will select low priority jobs and migrate their pages from the primary paging device to the secondary paging device when the system specified level of activity on the primary paging device is reached.

I/O load balancing provides an improved method of allocating data sets that do not have a specific volume assignment, based upon the use of devices across the entire configuration.

HASP II Version 4 and ASP Version 3.2 are supported under SVS.

Analysis Program-1 (AP-1): aids the operator in analyzing 3350 or 3344 DASD error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSPRINT.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system.

MVS HIGHLIGHTS

Multiprocessing With Shared Real Storage

Support either two Model 158MP processors or two mdl 168MP processors providing flexibility in the use of computing resources through shared main storage, alternate path I/O control, and inter-processor communication.

Provide the potential for improved installation workload scheduling over that attainable with two separate uniprocessing systems by pooling resources such as main storage, secondary storage and central processing units.

Can be operated as an MP system or partitioned through operator commands. While one system continues operation, the other system may be reinitialized with another operating system. The two systems are then operated as two independent systems.

Extend MP availability with an alternate Processor recovery (ACR) facility allowing the non-failing Processor to attempt recovery processing for the operating system without using the failing Processor. The timing facility allows continued operation after failure of the time-of-day clock on one of the Processors. A new recovery facility allows resetting a specific channel or subchannel and attempts the restart of I/O operations by the non-failing Processor. Storage reconfiguration facilities allow logical isolation of failing main storage in 4K byte elements.

Provide less disabled code through the use of a new locking structure in the control program. The existence of multiple locks allows the processing of non-intersecting queue structures without interference from the other Processor.

Allow an installation to specify that a specific program (e.g., emulator) should run on a certain Processor.

On 168MP systems, channels attached to a stopped Processor may be accessed via the Channel 6 interface of the still running Processor via Channel Reconfiguration Hardware (CRH) support. With this support, all channels in both the stopped and the running Processor remain accessible for I/O. Note that CRH cannot be activated when DSS is active in the system.

Attached Processor support of the attachment of a 3052 or 3062 APU.

Work Scheduling: In MVS the job scheduler has been restructured so that the Job Entry Subsystem now performs: reading ... writing ... job queuing ... job selection... warm start processing.

Job Entry Subsystem 2 (JES2) is upward compatible from HASP Versions 2, 3 and 4 and streamlines job processing by providing:

- Preallocated external storage for SYSIN and SYSOUT data sets.
- Transparent buffering and spooling.
- Control of starting and stopping initiators.
- Optional SYSOUT writing at data set close time rather than at the end of a job.

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

- MULTI-LEAVING to intelligent workstations.
- Support for high-speed binary synchronous terminals through 270X or 3704/3705 in emulation mode.
- a warm start facility allowing installations to perform warm start processing concurrent with other jobs or following high priority jobs.

In MVS Release 3, JES2 support is extended to allow from two to seven systems to share the JES2 input, job, and output queues through use of Shared DASD to support a JES2 Multi-Access Spool environment.

An SU to MVS Release 3.7 provides Job Entry Subsystem 2 (JES2) Release 4 support for the non-programmable models of the 3770 SDLC Terminals, the System/32, the 3790 Communication System, the 8100 Information System under DPPX, the 8100 Information System under DPPX/SP, and the 8100/DPCX Information System (as Remote Job Entry devices) via VTAM and the 3704/3705 in network control mode. The 3790 RJE workstation is also supported via Local Channel Attachment (LCA).

An SU to MVS Release 3.7 and MVS Release 3.8 when available, provides Job Entry Subsystem 3 (JES3) Release 3 support for the 3770 SDLC terminals (except for the 3773 P1, P2, P3, all models are supported), the S/32, and the 3790 Communication System (as Remote Job Entry devices) via VTAM and the 3704/3705 in network control mode. The 3790 RJE workstation is also supported via Local Channel Attachment (LCA). JES3 Release 3 support is designed to be generally upward compatible from the JES3 ICR, Release 2, and Release 2.1 as well as ASP Versions 3.0, 3.1 and 3.2. In addition to the basic JES facilities, JES3 Release 3 provides:

- Generalized job selection.
- Deadline scheduling.
- Dependent job control.
- Dynamic system interchange.
- Centralized operator interface.
- Single Global control of access to a single job queue with shared spool for MVS Release 3.7 and release 3.8 processors.
- Centralized device scheduling.
- Loosely coupled asymmetric system support.
- Support of OS/MVT and SVS operating systems as attached ASP main processors.
- Dynamic system interchange.
- Centralized operator interface.
- Single Global control of access to a single job queue with shared spool for MVS Release 3.7 and Release 3.8 processors.
- Centralized device scheduling.
- Loosely coupled asymmetric system support.
- Support of OS/MVT and SVS operating systems as attached ASP main processors.

Other job scheduler changes in MVS include:

The elimination of **SYS1.SYSJOBQE** - Each initiator now has its own scheduler work area (SWA), a pageable portion of each address space. The SWA contains most of the control blocks that were part of the job queue data set, thus reducing contention caused by frequent access to the job queue. To facilitate recovery, the control blocks can be recorded on direct access storage. Since control blocks are not built until a job is selected for execution, auxiliary storage requirements are less.

Revised I/O devices and data set allocation routines - installations can specify priorities for device types during allocation. Requests for different device types can now be satisfied in parallel. In addition, serialization on operator action is reduced. The routines also provide for more extensive recovery processing and data set release before job end. Permanently resident and reserved direct access devices have direct, unserialized allocation paths, allowing increased parallelism in allocation and deallocation.

Dynamic allocation extensions - dynamic allocation supports both background and foreground jobs. Support also includes most of the allocation options available via JCL such as all device types ... multi-volume or multi-unit data sets ... generation data groups ... concatenation of data sets ... optional freeing of data sets at CLOSE.

Data Management: In MVS the system paging mechanism can be used to perform data set access. This is known as virtual I/O; it handles data in page-size (4K) blocks. System-named temporary data sets accessed with BSAM, QSAM, BDAM, BPAM, XDAP, and EXCP can be processed by virtual I/O. This facility can be used without change to JCL or object code.

The VSAM master catalog has become the MVS system catalog. In addition to optionally containing pointers to VSAM user catalogs, it may also contain pointers to OS control volume catalogs. JCL extensions are also provided for the user to designate specific catalogs to be used for his job or job step.

The virtual telecommunications access method (VTAM) is a new direct-control teleprocessing access method. VTAM facilities are available to application programs including those using TCAM.

Virtual Storage Support: Extended virtual storage support in MVS provides each system user with a private 16-megabyte virtual address space (region) for user programs, system programs and work areas, and shared program and data areas. This design provides:

- More address space for jobs than could be provided in the fixed real regions of MVT or the virtual regions of SVS, permitting the use of programming techniques such as real storage addressing for "spill files".
- A potential for a high level of multiprogramming, since the number of concurrent users or jobs is limited only by the amount of auxiliary storage available for paging and the amount of real storage available for required resident system programs and control blocks.
- Elimination of inter-region virtual storage fragmentation.
- Extended protection features, since each job or foreground user is isolated in an independent address space.
- Effective management of large real storage.

Timesharing: Timesharing (an option in OS/MVT and SVS) is integrated and standard in the control program in MVS. With MVS:

Each timesharing user has a private virtual address space. Inter-user scheduling dependencies caused by sharing of storage regions by multiple users have been eliminated.

The data set handling commands are extended to allow allocation of multi-volume and multi-unit data sets, non-direct access data sets, and VSAM and virtual I/O data sets. Terminal users can allocate and unallocate concatenated data sets (other than VSAM and ISAM). Timesharing users may be selectively authorized by the installation to allocate data sets requiring volume mounting. Under installation control, timesharing users can direct SYSOUT data sets to remote stations defined to either Job Entry Subsystem.

The installation may specify a time interval which establishes a period that will permit a timesharing user to reconnect to the system in the event of a line disconnect. Should the interval lapse prior to the user reconnecting to the system, then the system will automatically save any data set which the user was in the process of editing.

Remote Entry Subsystem workstations are identified to the system in the same manner as TSO terminal users.

Resource Management: In MVS, the control program can dynamically regulate the utilization of most system resources. A central set of system resource management routines coordinates the scheduling of various system resources attempting to both maintain efficient resource utilization and also to satisfy installation specified performance objectives.

With this support ...

Each job/user will belong to one of several installation defined performance groups. The scheduling of system resources will then be controlled so that each job/user receives resources at a rate prescribed for the associated performance group by the installation.

The load on various system resources is monitored and resource scheduling decisions are made which will attempt to correct detected imbalances and overloads.

A measurement facility, MF/1, is provided which allows the installation to obtain System Profile reports on the utilization of Processor, paging activity, channels, devices, and performance groups. Overlap information between Processor and channels will also be available. This is in addition to SMF.

SYSTEM INTEGRITY

At the time MVS System Control Programming became available, it was stated that all known System Integrity exposures had been removed from MVS. This statement was based on IBM's knowledge of System Integrity at that time. Because it is never possible to certify that any system has perfect integrity, it was expected that additional exposures would come to light; and, therefore, it was also stated at that time that APARs describing additional exposures would be accepted. Since the release of MVS, a number of APARs on MVS System Integrity problems have been accepted as valid.

Since development of MVS began, a System Integrity Programming standard has been in place within IBM, and specific design and coding guidelines for System Integrity have been in use. As APARed integrity problems have been investigated and corrected, understanding of System Integrity has increased, more effective use has been made of

SYSTEM CONTROL PROGRAMMING

OS/V2 (5752-VS2) (cont'd)

the design and coding guidelines, and procedures have been established to make application of these guidelines a formal part of the design/development process.

System Integrity is defined for MVS as the inability of any program not authorized by a mechanism under the customer's control to:

1. Circumvent or disable store or fetch protection.
2. Access a password-protected or a RACF-protected resource. (RACF is the Resource Access Control Facility), or
3. Obtain control in an authorized state, that is, in Supervisor state, with a protection key less than eight (8), or APF-authorized.

MVS System Integrity does not specifically include data protection between concurrently executing applications within a single address space (e.g., one CICS/VS application's in-storage data from another CICS/VS application); the level of protection in such situations will be addressed in product documentation.

Program documentation, subject to change as IBM deems appropriate, informs the customer of what action must be taken and which facilities must be restricted to complement the System Integrity support provided by MVS. The customer is responsible for the selection, application, adequacy, and implementation of these actions and restrictions, and for appropriate controls.

SUPERVISOR (SVS and MVS)

The VS2 Supervisor is a part of the System Control Programming that monitors each unit of work being done in the system. The Supervisor, in general, automatically controls the use of the Processor, I/O, and real and virtual storage. It provides a variety of services such as allocating virtual storage space, performing I/O operations, loading programs into virtual storage, moving pages of programs into and out of real storage, and maintaining the address space (virtual storage) on auxiliary storage devices. To perform its function, the supervisor receives control of the Processor following an interruption which may have resulted from a specific service request or through an automatic interruption by the computing system.

SVS SUPERVISOR

The SVS Supervisor performs the same functions as the OS/MVT Supervisor. In addition to interruption handling, the SVS Supervisor performs Task Dispatching, Task Supervision, PCI Fetch, Contents Supervision, Timer Supervision - (using TOD Clock, Comparator and Processor Timer), Storage Supervision (virtual), I/O Supervision, Page Supervision, and Main Storage Supervision.

A function that has been added to support Dynamic Address Translation is paging supervision.

VS2 takes advantage of Dynamic Address Translation hardware. The system operates on the basis of virtual storage and real storage. Real storage is the storage of S/370 from which the central processing unit can directly obtain instructions and data and to which it can directly return results. Virtual storage is address space that appear to the user as real storage. From this address space, both system and user instructions and data are mapped into real storage locations. The size of virtual storage is limited by the addressing scheme of the computing system and available auxiliary storage space, not by the actual number of real storage locations. Regions are assigned from available virtual storage; the system assigns real storage only as it is actually needed for program use. In SVS, paged regions are assigned from one 16-megabyte virtual address space.

The VS2 virtual storage concept operates through Dynamic Address Translation. When a program executes, the system translates each virtual address into a corresponding real storage address as the instruction is executed.

With address translation, all 24 bits of an address are usable. Thus virtual address space can be (and real storage can appear to be) 16 megabytes. This address space is divided into 256 segments of 64K bytes each. The segments are subdivided into 16 pages of 4K bytes each.

VS2 requires that the system nucleus be in the non-paged part of real storage at IPL time. SQA and LSQA which is an extension of the TSO concept are fixed in real storage as required. An installation specifies a limit for the amount of real storage which can be used for non-pageable jobs. However, the real storage for non-pageable (virtual equals real) jobs, but not assigned to them, will be made available for paging tasks.

The remaining real storage is allocated for pages of the problem programs currently executing, paged system services and functions such as Link Pack Area, etc.

Real Storage is automatically managed by the operating system in discrete blocks of 4K bytes called pages. As a page in virtual storage is referenced, it is brought into real storage for processing, if it is not already in real storage. When pages are not being used and the real storage space is needed by another task, the page is written out onto auxiliary storage unless an exact copy already exists (i.e., the page was not modified during execution). This procedure is called demand

paging. Paging Supervision consists of a set of functions that efficiently manages the contents of real storage as tasks are executing in a multiprogrammed, demand paging environment. It is responsible for:

Ensuring that the contents of real storage are addressable through the hardware DAT feature.

Exchanging virtual pages between auxiliary storage and real storage on a demand paging basis.

Interfacing with and servicing auxiliary requests such as fixing virtual pages in real storage prior to I/O and while I/O is in progress.

Paging Supervision directly initiates page movement from real storage to auxiliary storage, when required. All other page movement comes about as a consequence of an implicit or explicit request from an external source.

VS2 is able to assume the image of a large contiguous real storage by keeping only required virtual pages in real storage during execution.

The job of the supervisor is to provide the resources and services that programs need in such a way that at any given time as many services and resources as possible are in use.

MVS SUPERVISOR

Additional supervisor functions are provided in MVS. These include: Resource management ... Multiprocessing ... Multiple address space supervision ... Service management ... Recovery management ... IOS redesign.

Multiple address space supervision is provided by real storage management routines, auxiliary storage management routines, and virtual storage management routines. The functions performed by the real storage manager (RSM) and the auxiliary storage manager (ASM) correspond to those performed by the SVS paging supervisor with some additions to support multiple virtual address spaces and the virtual I/O facility. The real storage manager: directs the movement of virtual pages between real storage and auxiliary storage ... creates a segment table for each job or timesharing (TSO) user in the system (each segment table defines an individual virtual address space) ... handles virtual page requests (e.g., fix, free, page-in, page-out).

The auxiliary storage manager: initiates the actual paging I/O necessary to transfer pages in and out of real storage ... performs space management for all external page storage which includes temporary virtual I/O data sets.

The virtual storage manager services the GETMAIN and FREEMAIN macro instructions by allocating/deallocating storage within the virtual address space.

The service management function consists of new dispatching and queuing techniques that provide the potential for system components to provide services that execute enabled, unserialized, and in parallel on a tightly-coupled multiprocessing (MP) as well as a uniprocessing system. The basic control structure used by the service manager incorporates two levels of system priority; global and local. Service requests queued at the global level are given a higher priority than that of any address space, regardless of the address space in which they will be dispatched. (An address space is allocated for each job.) Service requests queued at the local level are given a priority equal to that of the address space in which they will be dispatched, but higher than any task within that address space.

Recovery management monitors the flow of control through recovery processing for; system, address space, and task failures, and performs normal and abnormal task and address space termination processing. It provides to system functions, and optionally to problem programs, the means necessary to intercept, attempt recovery, and record unexpected or expected error situations. The recovery processing is designed to operate at different levels of control. If a recovery routine for a process operating at one level of control is unable to recover from an error, the error is passed to a recovery routine at a previous (higher) level of control.

The I/O supervisor (IOS) routines have been redesigned for MVS to provide the potential for greater parallelism on multiprocessing systems as well as a reduced amount of page fixing for I/O operation. Concurrent execution of I/O operations and other supervisory functions on multiprocessing systems is made possible by a hierarchical structure of locks.

MVS Release 3 Supervisor Additions: The number of UCBS supported is increased to up to 1,023. They may reside between locations 4,096 and 65,535.

A new EVENTS macro allows the user to wait on the completion of one of n events without the POST routine and the user application repeatedly scanning a long list of Event Control Blocks.

Additional recovery capability for the 168MP system (Channel Reconfiguration Hardware support) permits all channels in a running Processor and a stopped Processor to remain accessible for I/O. The channels attached to the stopped Processor can be accessed via the

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Channel 6 interface of the still running Processor. It should be noted that CRH cannot be activated when DSS is active in the system.

JOB MANAGEMENT (SVS and MVS)

VS2 job management is a part of the system control program that controls the processing of jobs. It performs a variety of functions that include processing commands, reading and interpreting job and step definitions, allocating data sets and I/O devices, scheduling jobs, and writing system messages and job output.

SVS JOB MANAGEMENT

The master scheduler and job scheduler are major parts of the operating system that control the processing of jobs. The master scheduler initializes the system and responds to operator commands by initiating the requested actions. The job scheduler reads and interprets job definitions, schedules the jobs for processing, initiates and terminates the processing of jobs and job steps, and records job output data.

Master Scheduler: The master scheduler is one of the system tasks established when the system is loaded. Its functions can be divided into two categories: initializations and command processing.

Master scheduler initialization functions are: Initializing the time-of-day clock ... Initializing the system log ... Initializing the System Management Facilities (SMF) ... Initializing the Resource Manager ... Initializing Missing Interrupt Handler Task ... Establishing an ESTAE environment to handle system task failure during initialization.

Command processing is the reading, scheduling, and executing of operator commands issued via either a console device or an input job stream.

The reading of commands entered via a console device is performed by routines operating under a console communication task; the reading of commands entered via an input job stream is performed by routines operating under a converter task associated with JES2.

The scheduling of a command consists of storing the command and the readying of a task to continue processing the command. A command scheduling routine operates under either the console communications task (when the command was issued via a console device) or a JES2 task (when the command was issued via an input job stream).

The executing of a command is the performance of the function specified in the command. The functions are performed either as new tasks established by the master scheduler or as parts of existing system tasks.

Job Scheduler: The job scheduler is divided into three major parts: the converter/interpreter, the initiator/terminator, and the output writer. Each part is a separate task and thus can be executed concurrently with and independently of the others.

Converter/Interpreter: The converter/interpreter performs as a subroutine of JES2, analyzes the definitions, and builds control blocks and tables that are used during execution of the job steps. The converter also analyzes commands encountered in the input stream.

The control blocks and tables constructed by the interpreter contain job attributes, job step attributes, information needed to assign devices to data sets, and data set attributes.

Initiator/Terminator: The initiator/terminator invokes JES2 to obtain jobs and job steps to be executed. It analyzes the I/O device requirements of the job steps, allocates devices to them, creates tasks for them, and at completion of the jobs, supplies control information to JES2 for writing job output on a system output unit.

After receiving an interpreted job to be executed, the initiator/terminator examines the types of regions requested for the job. If the job requires nonpageable storage for execution, the initiator/terminator reserves a unique non-zero protection key for the job.

During allocation, in order to reduce contention for I/O devices, a new algorithm for I/O load balancing is used. The new algorithm allocates devices for data sets that have nonspecific device requests. Rather than basing the algorithm on a count of allocated data sets on a device (as in MVT), in VS2 the actual number of I/O requests to a tape or direct access device will be monitored to get a more accurate picture of I/O load. The device determined to be the best candidate for allocation to a given data set is then selected.

All user pageable regions have the same protect key value, that is "8" including TSO regions. Each nonpageable region is assigned a unique protect key value within the range of 9 to 15. Pageable regions are allocated virtual storage in 64K byte segments while nonpageable regions are allocated real storage in 4K byte increments.

Output Writer: The output writer transfers system messages and system output data sets from the direct access volume on which they were initially written by the system to a specified output device.

Output data sets can be directed to a class of devices, and references to the data are then placed on an output work queue. Because the queue is maintained in priority sequence, the system output writers can select jobs in the output work queue on a priority basis.

MVS JOB MANAGEMENT

In MVS, job management functions are performed by the master scheduler, JES2, and the job scheduler.

The master scheduler initializes the system and responds to operator commands by initiating the requested actions. The job entry subsystem reads job definitions, schedules the jobs for processing, and records job output data. The job scheduler builds control blocks in the scheduler work area (SWA) and initiates and terminates the processing of jobs and job steps.

Master Scheduler: The master scheduler is a system-initiated task that is established when the system is loaded. Its functions can be divided into two categories: initialization and command processing.

Master scheduler initialization consists of:

- Initializing the communications task to handle all communication with the operator console.
- Initializing the time-of-day clock.
- Creating the subsystem CVTs.
- Initializing the SWA management function.
- Initializing the system management facilities (SMF).
- Initializing the missing interruption checker.
- Establishing an ESTAE environment to handle system task failures during initialization.

Command processing includes the reading, scheduling, and executing of operator commands issued through a console device, an input job stream or a remote workstation.

The scheduling of a command consists of storing the command and readying of a task to continue processing the command. A command scheduling routine operates under either the console communications task (when the command was issued from a console device), or the reader task (when the command was issued through an input job stream).

The executing of a command is the performance of the function specified by the command. The functions are performed either as new tasks established by the master scheduler or as parts of existing system tasks.

JOB ENTRY SUBSYSTEM 2 - JES2 (MVS)

JES2 is an integral part of MVS and provides support in the areas of job management, data management for subsystem data sets, and Remote Job Entry. JES2 operates as a system task in a private address space and communicates with MVS via formally defined subsystem interfaces.

Features that may add to system performance are efficient SPOOL management routines and the MULTI-LEAVING line manager. MULTI-LEAVING is employed with all Processor workstations and will tend to maximize line effectiveness and provide concurrent operation of all supported workstation devices.

The job input and output services provided for local peripheral devices along with a subset of the JES2 operator command capability are optionally extended to remote workstations, including both Processor and non-Processor terminals. Workstation programs for S/360/370 Processors, 1130, and S/3 are generated as extensions to JES2 and operate in the workstation on a 'stand-alone' basis. The JES2 RJE implementation for binary synchronous Processor workstations is based upon the HASP MULTI-LEAVING philosophy which provides the capability for concurrent operation for all supported terminal job input, output, and console devices. Concurrent operation of devices on SNA Workstations is provided through support for the Multiple Logical Unit (MLU) protocols of SNA.

JES2 Description: JES2 is a specialized program which operates in the same Processor with MVS to perform the peripheral functions associated with batch job processing.

JES2 is started as a job entry subsystem. Control of designated unit-record devices is taken, the specified intermediate storage direct access device(s) are initialized, and job processing begins. JES2 has four major processing stages which relate to its four major external functions. These are:

1. **INPUT STAGE** - This stage reads jobs simultaneously from a variable number of various types of online card readers and remote terminals. These jobs are then entered into a priority queue to await processing by the next stage.
2. **CONVERTER STAGE** - This stage passes the Job Control Language (JCL) to the MVS Converter which merges the specified procedures from the appropriate Procedure Library, performs a basic syntactical scan, and converts the JCL statements into an "internal text" format which JES2 SPOOLS for later use by the MVS Interpreter. The jobs are then queued by job class to await processing by the next stage.
3. **EXECUTION STAGE** - This stage removes jobs based upon priority and class from the queue established by the Converter Stage and passes those jobs to MVS for processing. Input cards are supplied as required to the executing program and print and punch records

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are received and written onto JES2 intermediate storage. This stage can simultaneously control all jobs being processed by MVS. At the completion of a job, it is placed in a queue to await processing by the next stage.

4. **OUTPUT STAGE** - This stage transcribes the print and punch output generated by jobs in the previous stage to printers and punches. A variable number of various types of printers, punches, and remote terminals can be operated simultaneously.

All of these processes are controlled by reenterable code so that no additional code is required to support multiple, simultaneous functions. Since all of the above functions can occur simultaneously and asynchronously, a continuous flow of jobs may pass through the system.

Following are some of the more significant algorithms employed by JES2 to improve function and performance:

Specialized Direct-Access Storage Allocations: JES2, through the use of an allocation bit map in main storage, dynamically allocates space for intermediate storage on a record basis, within definable track groups, for jobs. The use of this technique offers the following advantages:

1. Disk-arm motion and interference is minimized by dynamically allocating space based upon the position of the access mechanism.
2. Disk area fragmentation is automatically eliminated by allocation of the smallest possible increment of space.
3. The data for a single data set can be spread across multiple direct-access volumes. In addition to further optimizing arm motion, this capability allows for multiple selector channels to increase the data rate for a given job.
4. Space is allocated as required, minimizing the loss of space as a result of over-estimated output requirements.
5. The release of previously used space is accomplished by a simple algorithm which requires no I/O operations.

Unit Record Device Command Chaining: While operating any reader, printer or punch, rather than handling each record separately, JES2 constructs a chained sequence of channel command words to pass to the channel. Thus, instead of the overhead of the EXCP and the ensuing interrupts for each record transmitted, only one EXCP and associated interrupt is required for a series of records. For example, when reading a job into the system, JES2 might chain 40 commands together to instruct a card reader. This would cause the next 40 cards to be read into storage without requiring the execution of any Processor instructions.

Transparent Blocking: All input, print and punch for every job is automatically blocked by JES2 to improve performance. Since all deblocking is also done by JES2, any program, even if designed to operate with unblocked records, can benefit from the blocking.

JES2 Standard Features: The standard features of JES2 are as follows:

- **Job input service** provides for low-overhead reading of job streams and storing of data on SPOOLing volumes for later high-speed retrieval for up to 99 concurrently active local card readers in any combination of devices as follows: 2540 reader ... 2501 reader ... 2520 punch (with read feature) ... 3505 reader (80-column punched cards only) ... 3525 punch (with read feature).
- **Converter service** provides for the merging of the submitted JCL with user or installation selected procedure libraries and for an early scan of this combined JCL for syntactical errors.
- **Execution service** provides for selection of jobs and execution monitoring for up to 99 concurrently executing jobs as follows: selection of jobs based upon job class and initiator priority class list of up to 36 classes for each initiator ... automatic delaying of jobs with duplicate OS jobnames ... automatic deblocking and blocking of user SYSIN/SYSOUT data ... counting of lines, cards, and execution duration with optional operator notification and/or cancellation ... interface for SMF counting of SYSIN data.
- **Multiple SPOOLing volume support** provides for balanced utilization of up to 36 volumes for any combination of any models of the following devices (one required): 2314 ... 3330 ... 2305.
- **Warm start capability** provides for checkpointing critical JES2 information sufficient for: optionally restarting jobs which were executing ... restarting print and punch at the last checkpoint.
- **Job output print service** provides for low overhead printing of job stream, system message, and user data print output for up to 99 concurrently active local printers in any combination of devices as follows: 1403 Printer ... 3211 Printer.
- **Special forms support** provides for the routing of print (on a job or data set basis) and punch data (on a data set basis) to special forms output queues for output as directed by the operator.

- **Internal Reader facility** provides the ability for any task within the system to submit jobs to JES2 for batch execution as though entered from a JES2 card reader.
- **Console Support** provides for direct entry for JES2 commands and JES2 abbreviated replies to WTORs through MVS operator consoles.
- **JES2 interfaces directly with the MVS SMF writer** to produce seven SMF records (types 6, 26, 43, 45, 47, 48, and 49). JES2 also provides two user SMF exits (IEFUSO and IEFUJP).

JES2 Optional Features: In addition to the standard features, the following optional features are available:

- **Job output punch service** provides for low overhead punching of job stream user punch output for up to 99 concurrently active local punches in any combination of devices as follows: 2520 punch ... 2540 punch ... 3525 punch.
- **Execution Batching** provides the facility for passing jobs directly to a processing program such as a "one-step" monitor, reducing the overhead of OS scheduling and allocation for short running jobs requiring limited system facilities.
- **Priority Aging** provides for automatically increasing the JES2 scheduling priority of jobs which have been in the system for extended periods of time.
- **Remote Job Entry** provides for high speed communications with binary synchronous and SDLC batch workstations which may be used for job stream input and output as well as operator control of the devices and jobs associated with the remote (see *JES2 RJE Features*).

JES2 RJE Features: Those features common to all JES2 RJE configurations are as follows:

- JES2 RJE supports up to 255 remote workstations communicating over nonswitched (point-to-point) or switched lines.
 - JES2 RJE provides for concurrent operations over up to 255 lines assigned to unique communication line adapter addresses of the following types: SDA Type II on a 2701 for Binary Synchronous ... Synchronous Base on a 2703 for Binary Synchronous ... 3704 providing 270X emulation ... 3705 providing 270X emulation.
 - **Output routing control** provides for print and punch output to be directed to the devices attached to the remote, to the central system, or to other remotes as designated by JES2 initialization parameters, by control cards submitted with the job, or by operator command.
 - **Remote operator control** provides a subset of the JES2 operator commands for display of information and control of jobs and devices associated with the remote.
 - **Operator message output** provides for transmission of messages and responses to remote operators with online MULTI-LEAVING workstations with consoles immediately and optional saving of messages for all other remotes until the remote is online and has a printer available.
 - **Workstation programs**, when required, are supplied as extensions of JES2 and are contained on the JES2 distribution libraries in source form.
 - **Terminal support on the central system** provides for communication with: 2772 (Binary Synchronous) ... 2780 (Binary Synchronous) ... 3780 (Binary Synchronous) ... 5110 Computer (as a 2772 BSC) ... S/360 mdls 20, 25, 30, 40, 50, 65, 65MP, 67 (in 65 mode), 75, 85, and 195 (MULTI-LEAVING) ... All virtual storage S/370 Processors (MULTI-LEAVING) ... 1131 (MULTI-LEAVING) ... System/3 (MULTI-LEAVING) ... System/32 or System/34 (MULTI-LEAVING as a System/3) and System/32 or System/34 (SDLC as a 3770) (MULTI-LEAVING) ... System/36 (MULTI-LEAVING as a System/3 or MULTI-LEAVING as a S/360 or S/370) and System/36 (SDLC as a 3770 or multiple logical units) ... 5285 and 5288 (MULTI-LEAVING as a System/3 and SDLC as a 3770) and 8100/DPPX (multiple logical unit SDLC) or 8100/DPPX/SP (multiple logical unit SDLC).
 - The sign-on feature provides for remote identification and line security through remote and line passwords.
 - **Remote characteristics support** utilizes the unique features on each remote as follows: full text transparency (required for object decks) ... text compression ... print line width truncation ... buffer size and blocking capabilities.
- Note:** Multipoint or multidrop line features are prohibited.
- **Remote job priority adjustment** provides for favoring or limiting the JES2 scheduling priority of jobs submitted from each remote workstation.
 - **Line restart feature** provides for warm starting of print output after remote workstation or line failures.

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- Line error recovery provides for continuous retry until successful transmission.

JES2 MULTI-LEAVING RJE Features

MULTI-LEAVING is a term which describes a computer-to-computer communication technique developed for use by the HASP system. In a gross sense, MULTI-LEAVING can be defined as the fully-synchronized, pseudo-simultaneous, bi-directional transmission of a variable number of data streams between two or more computers utilizing binary synchronous communications facilities. Those features common to all JES2 RJE configurations are provided with MULTI-LEAVING configurations with additional features as follows:

- Concurrent device operation capability** provides for all supported devices to operate concurrently in accordance with the device characteristics, line speed, and characteristics of the data streams.
- Dual reader/punch device support** provides for use as both reader and punch under automatic or operator control.
- Unit record error recovery** provides a minimum of operator intervention and continued operations using unaffected devices on operator console configurations.

JES2/2770 RJE Workstation: The 2770 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support of the 2772 provides for job stream input and output on the following devices: 2213 Printer mdl 2... 2203 Printer mdl A1 or A2 ... 2502 Reader mdl A1 or A2 ... 0545 Output Punch mdl 3 or 4.

Note: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job stream input (a job stream must fit entirely within the 2772 buffer).

Extended support provides for special features: Buffer expansion ... Buffer expansion additional ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Space compression/expansion ... Horizontal format control ... 144 character print line (2203 only, requires buffer expansion).

The Terminal ID and Security ID features may be present but are not supported by JES2.

Note: Other features not prohibited by JES2 RJE and transparent to line control programming are permitted.

JES2/2780 RJE Workstation: The 2780 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support provides for job stream input and output on the following 2780 configurations: Mdl 1 Printer and Reader ... Mdl 2 Printer, Reader, and Punch.

Extended support provides for special features: Multi-record transmission ... 120 and 144 character print line ... Horizontal format control ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC.

The Terminal ID and Security ID features may be present but are not supported by JES2.

Note: Other features not prohibited by JES2 RJE and transparent to line control programming are permitted.

JES2/3741 RJE Workstation: The 3741 Data Station, mdl 2, and 3741 Programmable Work Station, mdl 4, are supported by the JES2 RJE feature as Binary Synchronous workstations for submission (and control) of jobs to JES2 for MVS processing. The support operates in 2780-compatible mode and allows for diskette jobstream input and output to diskettes. Supported features are: Fixed, unblocked input up to 80 character records ... Fixed, unblocked output up to 128 characters, including printer control characters ... EBCDIC or ASCII Transmission Code ... Multiple data sets on multiple diskettes or a single data set on multiple diskettes can be transmitted to MVS, however, the data will be concatenated into a single job or data set ... Null records (STX ETX) are accepted but not used as data set delimiters ... Status message (SOH) is accepted.

No special features are required.

JES2/3777-2 MULTI-LEAVING Workstation: The 3777 mdl 2 is supported as a S/360 mdl 20 Binary Synchronous MULTI-LEAVING Workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RMTM20 workstation program is generated by JES2 remote generation procedures for a S/360-20 Submodel 5 with 12K of main storage.

Device support provides concurrent operations on each reader, printer, punch and console device: 3203-3 Printer (required)

(specify 1403) ... 2502 Reader (required) (specify 2501) ... 3521 Punch (optional) (specify 1442) ... Console Display (optional) (specify 2152).

JES2/3780 RJE Workstation: The 3780 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support provides for job stream input and output on the following devices: Card Reader ... Line Printer ... Card Punch.

Supported features are: 512 character buffer ... Variable length record ... Space compression/expansion ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Print positions (additional) for 144 character print line ... Horizontal format control.

The Terminal ID and Security ID features may be present but are not supported by JES2.

JES2/360-20 MULTI-LEAVING Workstation: The S/360 mdl 20 with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RMTM20 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage on a Model 20 submodels 2, 4, 5, and 6. Larger core (up to 32K) may be used for additional buffer storage if available.

Device support provides concurrent operations on one of each reader, printer, punch, and console device: 2203 Printer or 1403 Printer (one required) ... 2501, 2520, or 2560 Reader device (one required) ... 1442, 2520, or 2560 Punch device (optional) ... 2152 Console (optional).

Dual 2520 device support provides automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Dual 2560 device support provides selection of functions by feed hopper as follows: Primary feed assigned to reader ... Secondary feed assigned to punch.

Unit record data checks which require operator intervention may be corrected without stopping other functions when the 2152 console is available.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) over all available Binary Synchronous line speeds; however, speeds requiring the high speed feature (19.2K baud and above) are not recommended for the submodels 2 or 4.

JES2/360/370 MULTI-LEAVING Workstation: Any S/360/370 Processor except 2022 and 2020 with Binary Synchronous adapter and JES2-provided workstation programs are supported as Binary Synchronous MULTI-LEAVING workstations for submission of jobs to JES2 for MVS processing and have the following features:

The RMTM360 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to support single reader, printer, punch, and console device configurations. Larger storage (up to 32K) may be used as space for additional buffers and to support additional devices for up to seven readers, printers, punches (the number of printers when added to the number of punches must not exceed eight).

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch and Punch ... 2520 Reader/Punch and Punch ... 2540 Reader Punch ... 1403 Printer ... 3203 Printer ... 3211 Printer ... 3262 Printer mdl 5 (supported as a 4248) ... 4245 Printer ... 4248 Printer ... 5203 Printer ... 1052 Printer-KeyBoard ... 3210 Printer-KeyBoard ... 3215 Printer-KeyBoard.

Notes: At least one reader and one printer along with the printer-keyboard are required ... Each device (including communications adapter) must be on a separate non-shared subchannel.

Dual reader/punch support for 1442 and 2520 provides for automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Note: 2540 reader/punch has two independent card paths which operate concurrently.

Communications adapter support on the workstation provides for EBCDIC transmission (transparency optional) via: SDA Type II on a 2701 ... Synchronous base on a 2703 ... 270X emulation mode in a 3704 or 3705 ... Integrated Binary Synchronous adapter on mdls 25, 115, 125, and 135.

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JES2/1130 MULTI-LEAVING Workstation: The 1130 Computing System with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RTP1130 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core (up to 32K) may be used for additional buffer storage.

Device support of the 1131 provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch or Punch ... 1132 Printer ... 1403 Printer ... Standard Printer-KeyBoard.

Note: At least one reader required.

Dual reader/punch support for the 1442 provides for operator assignment of function.

Console output support provides for color-coded messages for separation of JES2 messages from workstation messages and operator input.

Single 1403 printer configurations support 132-character lines (RPQ feature required).

Note: This feature does not include support for UCS printers.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the standard Binary Synchronous adapter attachable to the 1131.

JES2 System/3 MULTI-LEAVING Workstation: The System/3 with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The System/3 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core is utilized when available.

Device support provides for concurrent operations on each of the supported devices as follows: 5424 Reader/Punch ... 1442 Reader/Punch ... 5203 Printer ... 1403 Printer ... 5471 Printer-KeyBoard (console) ... 5475 Data Entry Keyboard (in lieu of 5471).

Note: At least one card reader and printer are required.

Dual reader/punch support for 1442 and 5424 provides for automatic determination of each card path as follows: Operator places blank cards in feed to designate punch ... Operator places job stream in feed to designate reader.

Each 96-column card punched is interpreted.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the Binary Synchronous adapter selected (either Binary Synchronous Adapter #1 or Binary Synchronous Adapter #2).

Printer support provides for extra print positions and UCS images of LC and PN trains (PN recommended).

System/32 MULTI-LEAVING Work Station for JES2: The System/32 with Binary Synchronous Communications Adapter and its associated MRJE/WS System Utility Program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/32 must be specified as a System/3. The System/32 MRJE/WS System Utility Program is supplied as a component of the System/32 SCP.

Device support provides for concurrent operations on each of the supported facilities of the 5320 System Unit: Disk storage simulation of card I/O and/or printer data streams ... Line or serial printing ... Keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Binary Synchronous Communications Adapter special feature.

System/34 MULTI-LEAVING Workstation for JES2: The System/34 with Communications Adapter and its associated MRJE System Utility Program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/34 must be specified as a System/3. The System/34 MRJE System Utility Program is supplied as a component of the System/34 SSP.

Device support provides for concurrent operations on each of the supported facilities of the 5340 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text transparency optional) at any speed available to the Communications Adapter.

System/36 MULTI-LEAVING Workstation for JES2: The System/36 with its Communications Adapter and its associated MSRJE feature of the System Support Program (SSP) is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/36 must be specified as a System/3 or as a S/360. The System/36 MSRJE is a feature of the System Support Program and also requires the Communications Extension feature of the SSP as well as the SSP.

Device support provides for concurrent operations on each of the supported facilities of the 5360 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console). Disk files are sent in card image (80 characters) and are received and built into a final form from card images.

Communications adapter support on the workstation provides for EBCDIC code (text transparency optional) at any speed available to the Communications Adapter.

5280 MULTI-LEAVING Work Station for JES 2: The 5280 Distributed Data System with the Communications Adapter and the Communications Utilities licensed program is supported as a Multileaving workstation for submission of jobs to JES 2 for MVS processing. See *5280 Communications Utilities* (5208-DC1) licensed program for details of the support.

Job Entry Subsystem 2 (Release 4.1): Subsequent to MVS Release 3, JES2 supports the non-programmable models of the 3770 Data Communication System, the S/32 (as a 3770), the 3600 Finance Communication System [i.e., 3602 Controller and the 3694 Document Processing System, when the IBM program product CHX/3694 (5748-F53) is used to supply the interface], and the 3790 Communication System as Remote Job Entry devices. Transmission to the 3770 terminals and to the 3602 and 3694 systems is via Synchronous Data Link Control (SDLC). Transmission to the 3790 system is via SDLC and LCA. This provides JES2 remote entry support for SDLC terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, JES2 uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode.

SDLC Terminal Support: SDLC terminals supported by JES2 in MVS are the non-programmable models of the 3771, 3773, 3774, 3775, 3776 and 3777 Communication Terminals, 5285 and 5288 (as a 3770), the System/32 (as a 3770), the 3602 and 3694 with program product CHX/3694 (5748-F53), the System/34 (as a 3770), the System/36 (as a 3770 with multiple logical units), the 6670 Information Distributor (through the program product MVS/Information Distribution Workstation Support (5740-AMA), the 3790 Communication System and the 8100/DPCX Information System. Support for the 3770 family of devices includes the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader and the 2502 Card Reader.

Functional characteristics of the JES2 support for 3770 SDLC terminals are as follows: Half-duplex flow ... Multipoint operation ... Serial data transmission operation (e.g., no concurrent operation of printer and punch on the outbound flow from JES2 to the SDLC terminals other than 3776-3,-4 and 3773-3 Multiple Logical Unit models) ... Multiple Logical Unit models of 3776 and 3777 support up to 6 independent and concurrent sessions inbound and outbound ... 3770 disk operation is transparent to JES2 ... Data stream provides compression of repeated characters outbound (3771, 3773, 3774, 3775), inbound and outbound (3776, 3777). Decompression of outbound compacted data stream is supported by 3776 mdls 3 and 4 and the 3777 mdls 1 and 3.

JES support for the 3602 and 3694 Systems is limited to users of the program product CHX/3694 (5748-F53). Functional characteristics are as follows: Half-Duplex flow ... Multipoint Operation ... Concurrent device operation ... Full outbound compression and compaction of printer data sets to improve transmission line efficiency.

Support for the 3790 Data Communication System and the 8100/DPCX Information System provides: Printer features; Disk (spool), 3277 mdls 1 and 2 as consoles; 3277 mdls 1 and 2, 3276 mdls 2-4 and 12-14, and the 3278 as input devices.

Functional characteristics of the JES2 support for the 3790 System and 8100/DPCX System are as follows: Half-Duplex flow ... Multipoint Operation ... Concurrent device operation (Multiple printer features, maximum 2; Reader and Printer functions; Keyboard to disk and host communications) ... Outbound remote spooling - allowing data from host to be stored on disk for subsequent printing ... Full outbound compression of Printer data sets with an additional technique called compaction (combining pairs of characters into a single byte) to further improve transmission line efficiency.

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Support for the 8100 Information System under DPPX or DPPX/SP includes device support through the DPPX or DPPX/SP Device Independent Interface. This support includes the print functions, Disk (Spool), and DPPX- or DPPX/SP-supported keyboard/printer or keyboard/display as a console (or a pair of DPPX or DPPX/SP data sets or a card/reader-printer) combination as a console substitute and any DPPX or DPPX/SP devices supported for sequential input.

Functional characteristics of the JES2 support for 8100/DPPX or 8100/DPPX/SP are:

- Half-Duplex Flow.
- Multipoint Operation (SNA only).
- Concurrent Device Operations:
 - Multiple printers.
 - Reader and printer functions.
 - Keyboard to disk and host communication.

Outbound remote spooling (Printer Sharing Function), allowing data from the host to be stored for subsequent printing.

Full outboard decompression of printer data sets with an additional technique called compaction (combining pairs of characters into a single byte) to further improve transmission efficiency.

In addition, the JES2 Output Service function is extended to include support for the 3800 Printing Subsystem as a standard JES2 output device.

The JES2 support of the 3344 and 3350 Direct Access Storage devices is extended to incorporate a new technique for track address allocation called "Track Ceiling" and to provide for simultaneous formatting of SPOOL volumes.

The JES2 installation procedure is simplified by the elimination of all JES2 generation parameters. JES2 will now use parameters defined in the initialization parameter library to establish table values at initialization time rather than build the system from input parameters supplied during generation. This allows more dynamic changes to processing options and simplifies user tuning techniques.

Output device routing is enhanced by allowing symbolic names to be assigned to output devices and output to be routed to these symbolic names through user-coded control cards (JCL) and through operator commands.

Improvements are made to operator commands including modifications to make the commands more keyword oriented, and to provide routing extensions which allow routing to specific local devices using symbolic destination names.

JES2 serviceability is enhanced through the integration of all applicable updates and through a new service map concept which permits rapid and accurate diagnosis of current code level. A new module and control block map eases analysis of diagnostic dumps by providing a quick reference to the location of all modules and control blocks.

Job Entry Subsystem 2 Multi-Access Spool (MVS Release 3): In addition to those functions supported in JES2 in MVS Release 2, a new feature of JES2 allows from two to seven MVS Release 3 systems to share the JES2 input, job, and output queues through the use of Shared DASS. This feature This feature may be used to share the workload or a pool of JES2-controlled devices among processors. Jobs may be routed to any specific system or all systems in this multi-access spool complex. Furthermore, JES2-controlled unit record and remote devices need not, but may, be attached to each processor.

Each processor operates asynchronously within the multi-access spool complex, i.e., there is no master-slave relationship. Because of this operating design, any system in the complex can recover the workload accepted into the complex by any other system. Another system in the complex can have the RJE, TSO and unique unit record devices of the failing system physically switched to it and continue processing those jobs previously entered into the spool queue.

Another function supplied by the JES2 multi-access spool feature is the ability to isolate a processor for testing purposes. A processor may be designated as operating in independent mode, and in so doing, will only process jobs that are both routed to it and are themselves designated to be executed on that processor in independent mode.

The operator command set for JES2 in MVS Release 3 is much the same as the JES2 command set used in MVS Release 2. Additional facilities, however, have been added to control the multi-access spool complex. These facilities allow an operator to:

- Add, delete, or explicitly identify the system affinity (routing) of jobs.
- Display active and queued jobs for any processor or group of processors in the complex.
- Take a system in the complex out of or place it into independent mode.

**JOB ENTRY SUBSYSTEM 3 - JES3
(SU on MVS Release 3.7 and Release 3.8)**

JES3 provides a generally compatible extension of ASP Release 3.2 and is designed to improve the operational environment of the computer installation by aiding many of the operator functions. JES3 can improve installation workload scheduling, increase the workload capacity, and reduce turnaround time. JES3 provides a single system image for the execution of many jobs concurrently on the connected processors.

JES3 can support up to eight JES3 processors, any of which can be a tightly coupled multiprocessor, operating under the control of MVS Release 3.7 and Release 3.8. JES3 can also support ASP main processors, operating under the control of OS/MVT or SVS. JES3 can logically interconnect up to 32 processors. A JES3 configuration consists of a global processor that controls all job input and output, and the scheduling of time sharing users, batch jobs and, optionally, devices. One to seven additional JES3 processors, called *JES3 local processors*, can be connected to the JES3 global processor. Each processor is attached to the JES3 global processor by a channel-to-channel (CTC) adapter which is used to interchange control information. The JES3 global processor handles all SYSIN and SYSOUT to and from peripheral devices.

JES3 design and the shared spool concept help to improve the overall availability of MVS Release 3 by permitting any JES3 local processor, if properly configured, to assume JES3 global functions. Should the JES3 global processor fail in a loosely coupled multiprocessing configuration, the operator can move the JES3 global function to any properly configured JES3 local processor. The degree of this availability depends on the presence of appropriate alternate CTC paths and switchable peripheral devices.

The JES3 global processor must operate under MVS Release 3.7 or Release 3.8. JES3 supports ASP main processors. Remote job processing from binary synchronous communication (BSC) and system network architecture (SNA) terminals is supported. JES3 also provides multiprogrammed background utilities which the operator can invoke.

As the installation workload grows, capacity can be increased by increasing the size of processors, by using multiprocessor configurations, and/or by adding additional JES3 local processors, operating under the control of MVS Release 3.7 or Release 3.8 or ASP main processors, operating under the control of OS/MVT or SVS. JES3 enables such expansion with minimal disruption to the operational environment. Jobs are distributed to available processors depending on job priority, device requirements, user specification, and processor dependencies. (A processor dependency is an attribute of a job that requires it to execute on a specific JES3 or ASP main processor. For example, if a job uses a device that is attached to only one processor, then the job has a processor dependency and must execute on the processor than can access the device).

Some of the features of JES3 are:

- Automatic scheduling of attached OS/MVT and SVS ASP main processors and MVS Release 3 JES3 local processors (including multiprocessors).
- New JCT Access Method with optional core resident JCTs. This access method facilitates reduced contention for JCT resources.
- Single operator interface to the entire system.
- Centralized console service.
- Logical device grouping with consoles defined for the group.
- Installation-specified, operator-controlled job selection algorithms for scheduling JES3 and ASP processors.
- Automatic scheduling of interdependent jobs (dependent job control).
- Deadline scheduling.
- Simulated console support for non-programmable remote terminals (2770, 2780, 3780).
- Multitasking of the MVS Release 3.7 or Release 3.8 Converter and Interpreter and the SVS Reader/Interpreter.
- Checkpoint/Restart support for jobs that execute under MVS Release 3.7 or Release 3.8.
- SMF support.
- Generalized peripheral scheduling and improved output service that includes related INQUIRY/MODIFY processing.
- Early JCL diagnosis through JES3's use of the VS2 Converter and Interpreter or the Reader/Interpreter.
- ASP to JES3 migration features.
- Support of TSO Foreground Initiated Background functions.
- Extensive RAS capability, for example:

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- Functional recovery routines.
- Alternate Path Channel to Channel (ACTC).
- Shared DASD for spool and JES3 checkpoint data sets.
- Dynamic system interchange.
- Spool I/O error recovery.
- Dynamic device reconfiguration (DDR) support for non-shared setup devices.
- HOTSTART of JES3 address space.
- WARMSTART of JES3 system.

- Operation in a virtual machine in the IBM Virtual Machine Facility (VM/370).

REMOTE JOB PROCESSING (RJP)

Binary Synchronous Communication (BSC): JES3 Remote Job Processing (RJP) permits the input, processing, and output of jobs to and from terminals remote from the installation. This function is achieved through the use of the 3704 or 3705 Communications Controller (emulator mode), the 2701 Data Adapter, or the 2703 Transmission Control Unit to interface with binary synchronous communication (BSC) terminals. BSC remote terminals are used as remote card readers, printers, and card punches, with job output routed optionally to any remote terminal or local output device.

For detailed information related to JES3 BSC RJP see *Introduction to JES3 GC28-0607*.

Synchronous Data Link Control (SDLC): JES3 SNA RJP will support the 3600 Finance Communication System (3602 and 3694), the 3790 Communication System, 8100/DPCX Information System and certain SDLC models of the 3770 Data Communication System and the 5280 Distributed Data System. JES3 SNA RJP will support the 8100 Information System under DPPX or the 8100 Information System under DPPX/SP with DPPX/SP/RJE with the Remote Job Entry Workstation Facility (DPPX/RJE) licensed program at the first customer shipment of DPPX/RJE or DPPX/SP/RJE. Transmission to the 3770 and the 3790 is via Synchronous Data Link Control (SDLC) through VTAM and NCP. This provides JES3 remote job processing support for SNA terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, JES3 uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode. This use of the performance-oriented authorized path of VTAM enhances the performance of JES3 SNA RJP.

SDLC job entry stations supported by JES3 are 3600 Finance Communication System (3602 and 3694), the 8100 Information System under DPPX, the 8100 Information System under DPPX/SP, the 8100/DPCX Information System, the 5280 Distributed Data System, the System/34 (as a 3770 with multiple logical units), the System/36 (as a 3770 with multiple logical units), the 3790 Communication System and the 3770 Data Communication System (except for the 3773 P1, P2, P3, all SDLC models are supported). Multiple Logical Unit (MLU) 3776 mds 3, 4 and 3777 mdl 3 with up to six independent and concurrent sessions are supported. Also supported are the 3784 Line Printer, the 3203-3 Printer, the 3521 Card Punch, the 3501 Card Reader and the 2502 Card Reader when attached to a 3770. In addition, JES3 supports the 6670 Information Distributor (SNA version) through the MVS/Information Distribution Workstation Support (see program product 5740-AMA). The 3790 Communication System and 8100/DPCX Information System support a single RJE workstation which can handle up to five logical concurrent processing sessions with JES3.

Functional characteristics of the JES3 SNA RJP support for SDLC terminals are as follows:

- Half-duplex session flow.
- Multidrop operation.
- 3770 diskette, 5280 diskette, 8100/DPPX and 8100/DPPX/SP disk operations, 8100/DPCX disk operations, and 3790 disk operations are transparent to JES3.
- Data stream provides compression of repeated characters outbound to the 8100 Information System under DPPX with DPPX/RJE or the 8100 Information System under DPPX/SP with DPPX/SP RJE, the 3790 Communication System, the 5280 Distributed Data System, the System/34 with the SSP (SRJE MLU), the System/36 with the SSP and MSRJE (MLU), the 8100/DPCX Information System, the 3600 Finance Communication System (3602 and 3694), and to the 3770 Data Communication System.
- Data compaction is supported outbound to the 8100 Information System under DPPX with DPPX/RJE, the 8100 Information System under DPPX/SP with DPPX/SP/RJE, the 3790 Communication System, the 3776 mds 3 and 4, the 3600 Finance Communication System (3602 and 3694), 3777 mds 1 and 3 of the 3770

Data Communication System, the 5280 Distributed Data System and 8100/DPCX Information System.

- Single or multiple LUs (allowing multiple sessions) in a job entry station.
- Provides device setup for the 3600, the 3790 and the 8100 Information System under DPPX with DPPX/RJE, or the 8100 Information System under DPPX/SP with DPPX/SP/RJE, and 8100/DPCX by use of the Peripheral Data stream Information Record (PDIR).

JES3 support for the 3600 Finance Communication System is limited to users of program product CHX/3694 (5748-F53).

Job Scheduler: The job scheduler is divided into two major parts: the Converter and Interpreter and the Initiator/Terminator. The Converter and Interpreter consists of two separate subroutines that can be executed concurrently. The Converter may be executed independently of the Initiator/Terminator.

Converter/Interpreter: JCL interpretation is performed in two phases. The first phase (Converter) syntax checks the JCL and converts it along with procedures read from **SYS1.PROCLIB** into an internal text data set. The second phase (Interpreter) processes the internal text data set and builds control blocks for the job into a JES3 system data set. The job entry subsystem was designed to invoke the Converter and Interpreter before job selection so that jobs with JCL syntax errors will not be passed to an initiator for execution.

After job selection, the initiator invokes a job entry subsystem routine which reads the job's control blocks from the JES3 system data set and builds control blocks in the scheduler work area (SWA). The tables and control blocks constructed by the Interpreter contain the following information: job attributes ... job step attributes ... information needed to assign devices to data sets ... data set attributes.

Initiator/Terminator: The initiator/terminator requests a job from the job entry subsystem. It analyzes the I/O device requirements of the job steps, allocates devices to them and creates tasks for them. At the completion of the job, it informs the job entry subsystem the job has ended.

After the job entry subsystem selects a job, the initiator examines the type of address space requested for the job. If the job requires non-pageable real storage for execution, the initiator reserves a unique non-zero protection key for the job.

All user pageable address spaces, including timesharing address spaces, have the same protect key value, that is "8". Each non-pageable region is assigned a unique protect key value within the range of 9 to 15.

I/O device and data set allocation routines have been revised for VS2. Installations can now specify priorities for allocation of device types. Data sets may be released before job completion. Increased parallel processing is provided by changes such as the direct unserialized path through allocation for permanently resident and reserved direct access. Dynamic allocation processing is extended to background users and provides new functions for both foreground and background users.

Device, Volume and Data Set Management: JES3 device, volume and data set management provides for reservation of system resources ('SETUP').

JES3 3850 MSS Features include:

- Allocation to mounted volumes for non-specific requests for new, non-VSAM data sets.
- Access to Mass Storage Volumes can be shared by all JES3 system processors physically connected to the same 3850
- Virtual units may be partitioned (fenced) for use by specific job class groups or dependent job networks
- Data reuse is encouraged (without access to 3850 controller tables)
- JES3 algorithms attempt to equalize the amount of staging/destaging activity across Staging Drive Groups
- Multiple 3850s can be supported in a JES3 loosely coupled processor configuration, where each 3850 is attached to a separate host (as previously announced, one operating system can only be attached to one MSS)

JES3 Release 3 contains all the functions provided by the JES3/3850 Selectable Unit which extend the 'SETUP' facility of JES3 Release 2 to include the 3850 Mass Storage System. SETUP highlights include:

- Centralized scheduling and control of pooled and non-pooled I/O devices.
- High watermark setup.
- Early resource release.
- Dynamic allocation and unallocation of data sets and devices.

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Reserving of devices to dependent job control networks and job class groups.

Projected mounting and verifying of private data volumes, including:

DASD data set setup on a system-wide basis which honors JCL disposition parameters.

Volume location control, i.e., use awareness.

Job Management: Some of the major facilities provided by job management are multiple console support, system log, hardcopy log, checkpoint/restart, and system management facilities.

Multiple Console Support - MCS: Multiple console support (MCS) allows one operating system to use many operator consoles. Each console in a multiple console configuration is defined by specifying the operator commands the system will accept from that console, a console to act as an alternate if a failure occurs, and the types of messages the console will receive.

In a system with MCS, one console acts as the master console and the rest (up to thirty-one) are secondary consoles. The master console is the basic console required for operator-system communication; it alone can accept all possible operator commands, change the status of the hardcopy log and the messages to be recorded on it, switch to a different master console, and receive all messages not specifically assigned to any other console. A secondary console is any console other than the master console; it handles one or more functions assigned to it (for example, it might handle tape activity).

Console devices supported: 158 Console (5) (6) ... 1403 (1) ... 1443-N1 (1) ... 2150/1052-7 ... 2260 (3) (5) ... 2540 (1) ... 2520 (1) ... 2740-1 ... 3036 (5) ... 3066 (5) ... 3505 (1) ... 3210 ... 3211 (1) ... 3215 ... 3525 (1) ... 3277 (4) (5) ... 3284 (4) (5) ... 3213 (1) (6) ... 3286 (4) (5) ... 3287-1,2 (as a 3284/3286) (5) (7) ... 3288-2 (as a 3286-2) (4) (5) ... 3767 (as a 2740-1) ... 2250 (2) (5).

Notes:

- (1) A composite console must consist of a printer-keyboard or a card reader and printer to simulate the actions of a printer-keyboard. MCS allows output only consoles as secondary consoles.
- (2) 2250 mdls 1 and 3.
- (3) 2260 mdl 1 on 2848 mdl 3 (local attachment).
- (4) The 3277 mdl 1, 3284 mdl 1 and 3286 mdl 1 attach via a 3272 mdl 1 or 2. The 3277 mdl 2, 3284 mdl 2, 3286 mdl 2 and 3288 mdl 2 attach via a 3272 mdl 2 only. The 3278 mdls 1-4 are only supported in default mode via 3274 mdl 1B attachment.
- (5) DIDOCS supported.
- (6) 158 Display Console is supported in printer-keyboard or display mode. When in printer-keyboard mode, a 3213 is required. When used in display mode, it is suggested that addresses 014 or 016 be used for the console and 015 or 017 for the 3213.
- (7) 3287 mdls 1 and 2 with 3271/3272 Attachment (8330) and 480 character print operation (9520) attaches via a 3272 mdl 1 or 2. 3287 mdls 1 and 2 with 3271/3272 Attachment (8330) and 1920 character print operation (9522) attaches via a 3272 mdl 2 only.

Device-Independent Display Operator Console Support (DIDOCS) Status Display Support (SDS): Device independent display operator console support (DIDOCS) is a facility of VS2 that enables graphic display devices to be used as operator consoles. Its use can result in faster communication between the system and the operator than can be achieved with standard printer-keyboard or composite console devices.

DIDOCS provides the following advantages to the operator: He can respond to a message or enter a command while messages are being written to the screen ... He sees action messages to be answered and can delete any he no longer needs ... He can use the cursor, or selector light-pen when available, to delete messages and perform other display-oriented functions ... He can initiate automatic command entry either with the selector light-pen or with the program function keyboard (PFK) by an operator command.

Status display support (SDS) provides a clear and understandable presentation of information to a system operator. It provides the following advantages to the operator: He can obtain a contiguous out-of-line display within specified display screen areas ... He can obtain a dynamic status display from an operator command.

System Log: The system log consists of data sets on which the communication between problem programs, operators, and the system is recorded. It may contain the following kinds of information: Operating data entered by problem programs using a write-to-log (WTL) macro instruction ... Descriptions of unusual events that occurred during a shift ... Write-to-operator (WTO) and write-to-operator with reply (WTOR) messages ... Accepted replies to WTOR messages ... Commands issued through operator's consoles and the input stream, and commands issued by the operating system.

Hardcopy Log: The hardcopy log is a permanent record of system activity that is mandatory for systems with an active graphic console or multiple active consoles; for other systems, the primary console device serves as the hardcopy log. The hardcopy log is kept on another, non-graphic, console device or can also be kept on the system log.

Since multiple console support allows more than one console in a system, an installation might find it helpful to record all the messages issued by and to a system. The hardcopy log is a place to collect these messages, and therefore, an installation can review system activity by reviewing message activity.

Checkpoint/Restart: If a job step is terminated before successful completion, checkpoint/ restart can make it possible to resume execution from the beginning of the step or from a place within the step. Either way, the restart can be made to occur automatically when the failure occurs.

The CHKPT macro instruction is coded in the user's program at a checkpoint to be taken. A checkpoint is the point at which information about the status of a job can be recorded so that the job step can be later restarted.

Checkpoint/restart includes a checkpoint routine and several restart routines.

The checkpoint routine gathers and records on a checkpoint data set enough information about the status of the job step and its related control blocks to allow a restart from the place where the checkpoint is taken.

The restart routines can be invoked when a job step is resubmitted for restart, or they can be invoked automatically when a failure occurs. The functions performed by restart routines depend upon the type of restart that is requested.

If the restart is to be made from the beginning of a job step, for deferred restart only, the RESTART parameter of the JOB statement must contain the name of the step to be restarted, and routines of the initiating task simply bypass preceding steps and begin processing with the named step.

If a step is to be restarted from the beginning automatically, the RD parameter is used, then restart processing begins during step termination. The step termination routine of job management invokes routines to verify that a restart can be performed and requests the operator to authorize the restart.

If a step is to be restarted from a place where a checkpoint was taken and the job is resubmitted, the RESTART parameter of the JOB statement must identify the step and checkpoint identifier and a SYSCHK DD statement must describe the checkpoint data set.

If a step is to be restarted automatically from a place where a checkpoint was taken, the step termination routine invokes routines to ensure that all data sets for the step are kept.

In MVS, restarted jobs are processed by the job entry subsystem, JES, which returns them to its job execution queue for subsequent initiation based upon priority and resource availability.

SYSTEM MANAGEMENT FACILITIES - SMF

System Management Facilities (SMF) collect and record system information. The information obtained can be used in management information reports that describe system efficiency, performance, and usage. The SMF records contain such data as: System configuration ... Job and job step identification ... Processor wait time (SVS only) ... Processor and input/output device usage ... Temporary and non-temporary data set usage and status ... Virtual and real storage usage ... Status of removable direct access volumes ... Allocation recovery records ... Paging statistics.

SMF provides exits to installation-supplied routines that can monitor the operation of a job or job step and generate the installation's own SMF records. The exit routines can cancel jobs, write records to the SMF data set, open and close user-defined data sets, suppress the writing of certain SMF records, and enforce installation standards (such as identification of users). Dummy routines are automatically provided for all unused exits. Changes to SMF for VS2 are: SMF is a standard facility of VS2 ... SMF records in VS2 contain additional accounting information to reflect new system environmental characteristics ... SMF in VS2 provides one new exit from the system control program, which receives control each time an SMF record has been formatted and is ready to be written out; this exit can prevent the record from being written ... In MVS a new exit is provided whenever a job is ready to be purged from the system ... In VS2, SMF recording data sets must reside on a direct access device ... In SVS, the OUTLIM facility is not supported; in MVS, OUTLIM is supported.

System Activity Measurement Facility - MF/1 (MVS): The system activity measurement facility (MF/1) is a standard feature in MVS. It collects information about system activities, including hardware resource utilization, performance group management, and paging.

MF/1 produces, optionally, measurement outputs in two forms. Data may be written to the SMF data set and/or reports may be formatted

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and printed in real time. Measurements are obtained for such system areas as: Processor Activity ... Channel Activity ... Channel-Processor Overlap Activity ... I/O Device Activity and Contention: Unit Record; Graphics; Direct Access Storage; Communications Equipment; Magnetic Tape ... Paging Activity ... Performance Group Activity.

The measurement data and formatted reports produced by MF/1 can aid in: Improving system performance ... Analysis of system trends ... Evaluating future system requirements.

Interactive Problem Control System - MVS IPCS: The Interactive Problem Control System (IPCS) provides MVS TSO installations with expanded capabilities for diagnosing software failures and facilities for managing problem information and status.

IPCS (SU57) executes as a command processor under MVS TSO and provides both the customer's system programmer and the IBM Programming Service Representative (PSR) with facilities for interactive examination and analysis of MVS storage image dumps. In addition to the various data formatting options available, functions are provided to locate link pack area modules and key MVS control blocks and to validate them, where possible. The support also includes high-level summaries of several key system components.

IPCS provides functions in the installation to centrally maintain problem status data, including specifics associated with problem occurrence, environment, responsibility, severity and resolution, as well as an abstract and problem description. It also allows users to record the names of data sets containing problem-specific data.

The enhanced diagnostic capability provided by IPCS should improve the service by:

- Reducing problem analysis time.
- Reducing the number of dumps to be printed and thus printing costs.
- Providing a centralized reference point for locating problem-related data.
- Providing a structure within which the new interactive dump examination and analytic facilities can be used in conjunction with existing tools such as CLISTs and AMDPRDMP exits.

Highlights

- Dump Data Examination.
 - IPCS need only be operational on one MVS/TSO system within an installation. It can be used to analyze any DASD-resident catalogued data set containing an MVS (Release 3.7 with SU7) high speed stand-alone SVC, or SYSMDUMP (produced by SU 33) dump. For dump data sets not on devices accessible from that TSO system, MVS data set utility functions may be used to move or copy the dump.
 - The user may tailor the formatting of dumps to provide: hexadecimal displays character displays traditional dump formatting of combined hexadecimal and character displays.
 - Facilities are provided to scan control blocks and to search for specific values or character sequences within the dump.
 - The user can reference and find link pack area modules and key MVS control blocks by name.
 - Users can equate symbolic names to specific addresses in dump storage for debugging purposes and assign attributes to them such as length, offset, address space, or data type.
- Specific Analytic Routines
 - The status of auxiliary storage management is summarized, highlighting any outstanding WTOR messages, and those to which messages have been queued but not yet transmitted.
 - ENQ/DEQ resource management chains are summarized. A selective display of the chains associated with a major resource name is provided.
 - The status of the I/O supervisor component is summarized highlighting critical statistics and the location of key data areas.
 - The ASCBs, ASXBs, TCBs, and RBs are located, formatted and summarized.
 - IBM and user-written command processors, as well as CLISTs, may be invoked from IPCS. CLISTs invoked from IPCS may contain IPCS subcommands interspersed among the normal command procedure language, TSO commands and TSO CLISTs invocation statements. Exceptions are command processors which require authorization, have an entry point name (except TIME), or do not expect the standardized command processor parameter list (e.g. TEST).
 - User exits for the AMDPRDMP-supported interface for TCB, ASCB, and user control statement exits can be invoked under IPCS.

- For Display Stations supported by TSO (3275 mdl 2, 3277 mdl 2, and 3276 mdls 2 and 12 and the 3278 mdl 2 via the 3276 and 3274), a full-screen option is available for examining virtual storage dumps. This option provides functions to utilize these display stations in a preformatted display mode. Data entry, cursor placement, or program function keys (where available) may be used for basic operations such as scrolling or splitting the screen to display multiple areas or multiple formats within a dump.
- IPCS function allows access to the titles of the dumps in the system dump data sets (SYS1.DUMPnn) so that the user may decide which dumps may be discarded without printing or copying.
- TSO HELP information is provided for IPCS commands and subcommands.

Account Facility (MVS): The account facility is available in MVS. It enables a batch-entry or remote user to update the user attribute data set (UADS) and the broadcast data set in a background environment.

RECOVERY MANAGEMENT SUPPORT (SVS and MVS)

SVS recovery management consists of five functions: machine check handling, channel check handling, dynamic device reconfiguration, alternate path retry, and missing interrupt checking. In addition, MVS provides alternate Processor recovery.

SVS RECOVERY MANAGEMENT SUPPORT

The Machine Check Handler (MCH) records all machine checks and determines if recovery from a malfunction was made by the Instruction Retry or Error Correction Code facilities of the S/370 Processor. If the malfunction is not corrected by the machine facilities, MCH assesses the damage and attempts to repair intermittent storage errors. If recovery is not possible, a determination is made whether system operation can continue either in full or degraded mode and isolates the failure to a task for orderly, selective termination of the task.

The Channel Check Handler (CCH) analyzes information which results from Channel Data Checks, Channel Control Checks, and Interface Control Checks. CCH attempts to have the error corrected and determines whether or not the system can continue operation. The Channel Check Handler formats and records appropriate error records.

Dynamic Device Reconfiguration (DDR) allows a demountable volume not marked permanently resident to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error.

Alternate Path Retry (APR) automatically retries input/output operations in error and marks off those data paths that are unusable. APR is automatically included when optional channel paths are specified.

The operator may vary paths online and offline by using the VARY path command. He may not vary the last remaining path to a device offline, nor may he vary teleprocessing paths or paths to shared DASDs.

The Missing Interrupt Checker support provides a function which performs polling of active units to assure that device and channel end interrupts are received within a specified time interval. The operator will be notified if any mounts or device and channel end interrupts that are left pending for longer than specified time interval. The operator may have to take specific actions depending upon the conditions encountered.

The Machine Check Handler, Channel Check Handler, Dynamic Device Reconfiguration and Interrupt Checker are standard parts of the VS2 control program. They reside in the control program area of virtual storage and operate in the unpagged section of processor storage except for part of DDR which resides in pageable LPA. Alternate Path Retry is an optional extension to the Input/Output Supervisor.

MVS RECOVERY MANAGEMENT SUPPORT

The Machine Check Handler (MCH) records, via recovery management, all machine checks and determines if recovery from a malfunction was made by the Instruction Retry or Error Correction Code facilities of the S/370 Processor. If the malfunction is not corrected by the machine facilities, MCH performs certain analyses and provides a record of the analysis to the Recovery Termination Manager. The appropriate software recovery routines are then invoked. In a tightly-coupled multiprocessing (MP) environment, if MCH processing is unsuccessful in a failing Processor, or if a Processor enters a check-stopped state, MCH will attempt to initiate recovery processing by marking the failing Processor offline and invoking the Recovery Termination Manager in the non-failing Processor.

The Channel Check Handler (CCH) analyzes information that results from channel data checks, channel control checks, and interface control checks. CCH attempts to have the error corrected by passing error information to the error recovery procedure. The Channel Check Handler formats appropriate error records which are recorded. In MVS,

OS/VS2 (5752-VS2) (cont'd)

when an error affects the entire channel, MVS will attempt to recover any active I/O on the failing channel.

Dynamic Device Reconfiguration (DDR) allows a demountable volume not marked permanently resident to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error. In MVS, DDR is also available for volumes containing data sets used for paging.

Alternate Path Retry (APR) ensures that an alternate path to a device is tried (whenever possible) when a failing path is detected. MVS always includes APR.

The operator may vary paths to a device online or offline by means of the VARY PATH command. In MVS, he can vary offline all paths except those to shared direct access storage devices which have an outstanding RESERVE.

The Missing Interrupt Checker (MIC) is a standard facility of VS2 that notifies the operator if a device-end, channel-end, DDR exchange, or mount interruption is not received within a specified period of time. The absence of such interruptions may mean that a mount message has not been satisfied or that a device has malfunctioned. Specific actions an operator may have to take depend upon the conditions he encounters. He may be required to ready a device on which a volume has been mounted, examine indicator lights on the device for abnormal signs, or terminate the job. In the case of channel end interruptions, MIC will invoke I/O restart to attempt to retry. Additionally, MIC will record via recovery management when device-end or channel-end interruptions are not received.

Alternate Processor Recovery (ACR) processing is invoked when a Processor in a tightly-coupled multiprocessing (MP) environment can no longer function. ACR processing is invoked by a signal that is sent by the failing Processor before it enters a permanent wait or stopped state. This signal is either a hardware-generated malfunction alert (MFA) or a software-generated emergency signal (EMS). When ACR processing is invoked on the non-failing Processor, it monitors the recovery processing of tasks and I/O on the failing Processor in an attempt to recover those activities which were on the failing Processor and continue system operations.

Any common pageable system areas (e.g., Link Pack Area) will be written to two separate paging data sets which may be on two separate devices. The additional copy will be utilized if on the first attempt to access the information, an I/O failure occurs.

MULTIPROCESSING WITH SHARED REAL STORAGE (MVS)

Multiprocessing (MP) is an extension of the MVS control program that supports two tightly-coupled Processor with shared real storage. Available with MVS, MP is an integral part of the system control programming. The two Processors are treated as system resources and are assigned by the resource manager to process any task. (Programs can also be designated by the installation to run on a particular Processor). Multiprocessing is designed to provide more efficient and more flexible allocation of execution time, I/O units, and main storage for a single job stream than uniprocessing with two separate Processor. Availability is extended by:

Recovery management support that reduces the impact of software and solid hardware failures.

Real storage reconfiguration that bypasses failing storage components in 4K blocks and terminates only affected tasks.

Alternate Processor Recovery (ACR) processing that allows the non-failing Processor to attempt recovery of tasks and I/O in progress on a failing processor.

In MVS Release 3, an additional availability improvement is included for the 168 Multiprocessing System. (Channel Reconfiguration Hardware support - CRH.) This facility permits the channels attached to a stopped Processor to be accessed via the Channel 6 interface of the still running Processor. It also allows a channel to be varied online for use by the system while the attached Processor is in an offline state. CRH is activated by either an ACR condition or by operator intervention with the **DIAGNOSE** instruction used to switch between the Channel 6 interface of the running Processor and the remote channels of the stopped Processor. With CRH, all channels in both the running and the stopped processor remain accessible for I/O. It should be noted that CRH cannot be activated when DSS is active in the system.

A new locking structure providing a number of locks in the control program allows more parallelism over systems having only one lock. With the use of separate address spaces for jobs and subsystems, queues and control blocks associated with only one virtual address space can be manipulated without preventing the other Processor from performing similar control program functions in other address spaces.

TIMESHARING OPTION - TSO (SVS and MVS)

An extension which provides VS2 users general purpose timesharing capability in a compatible VS2 environment. Terminal users share remote access to the powerful facilities of OS/VS2 for conversational

interaction -- preparation, syntax checking, execution, updating of programs and data -- concurrently with normal background VS2 operations. A comprehensive easy-to-use conversational command language is provided for the terminal user to communicate with the system. TSO provides conversational remote access to the VS2 environment for both the experienced professional programmer and the individual with little or no experience with computers.

Features

- General purpose time sharing capability operating concurrently with VS2 background operation within one operating system.
- Data sets can be dynamically allocated in the time sharing region. In MVS, devices can also be dynamically allocated.
- Real storage utilization reflects the actual requirements to execute the program in the time shared region as compared to a fixed requirement in OS/MVT.
- In SVS, multiple timesharing users share a timesharing region and their active pages (working set) are swapped (block paged) to the paging data sets.
- In MVS, each timesharing user is assigned to an individual virtual address space.
- Time sharing provides an environment for creating and executing conversational programs. A device-independent BSAM/QSAM interface to terminals is provided for ease of development and installation of terminal-oriented application programs.
- Programming languages and data management are compatible between conventional (batch) programs and programs developed at the terminal. Batch or terminal-developed programs can be stored, retrieved and executed locally (at the computer center) or from the remote terminal allowing the use of data sets by time shared or other regions/address spaces.
- Use of TCAM to handle timesharing terminal types (see Terminals Supported in this section) allows the same terminal and/or communications lines to be used for timesharing or other TCAM applications.
- Terminal-users may use any IBM language processors supported on VS2.
- The debugging command, **TEST**, allows system programmers and assembler language programmers to control the execution of a program, interrupting it at dynamically specified points.
- In MVS, The Interactive Problem Control System may be used to provide interactive examination and analysis of any MVS (Release 3.7 with SU7) high-speed stand-alone, SVC, or SYSDUMP (produced by SU33) dump.
- In MVS, the **ACCOUNT** facility may be executed in a background environment.
- In MVS, the installation may specify a time interval which establishes a period that will permit a timesharing user to reconnect to the system in the event of a line disconnect. Should the interval lapse prior to the user reconnecting to the system, then the system will automatically save any data set which the user was in the process of editing.

TSO offers comprehensive language support for online development, debugging and execution of programs in COBOL, FORTRAN, PL/I, BASIC and Assembler.

Language facilities available to the terminal user include: Compilation, usually invoked with a single command ... Linkage editing or loading ... Program execution with terminal I/O capabilities for interactive application ... Interactive debugging, using the data names and labels of the source program, of a program in execution for rapid program checkout.

In MVS Release 3, Expanded Command Procedure allows the user to specify compiler type functions to control execution of his CLISTs, with control options to handle error exiting, including nesting of CLISTs, If/Then/Else and Do While/End Syntax, Read/Write to/from CLIST, extensions of local and global options, external file - I/O and enhanced symbolic substitution. Also, a number of EDIT improvements have been added in MVS Release 3. In MVS Release 3, the use of VTAM allows the use of some SDLC terminal types (see *TSO Terminals Supported* in this section).

For more detailed descriptions of the language products designed for use under TSO, see the program product section of the sales manual.

TSO TERMINALS SUPPORTED

TSO supports the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use TSO with unsupported features can cause unpredictable results.

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

The access methods that support TSO are TCAM (through the TCAM Message Control Program provided) and VTAM. The access method shown in parenthesis after each terminal/feature is the one providing support for that terminal/feature.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by TSO may also function satisfactorily with TSO; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

Start/Stop Lines

- 1050 Data Communication System on switched or point-to-point nonswitched lines: (TCAM)
 - 1051 Control Unit (mdls 1,2):
 - Required: Attachment of 1052
 - Recommended: #1313 - Automatic EOB (or RQP E28235)
 - #6100 - Receive Interrupt
 - #9698 - Text Time-Out Suppression
 - #9700 - Transmit Interrupt
 - 1052 Printer-Keyboard (mdls 1,2):
 - Recommended: #1313 - Automatic EOB
 - #9571, #9591 - PTTC/EBCD Code
- 2741 Communication Terminal on switched or point-to-point nonswitched lines: (TCAM)
 - Recommended: #4708 - Receive Interrupt
 - #5501 - Print Inhibit
 - #7900 - Transmit Interrupt
 - #9571 - PTTC/EBCD Print Element (P/N 1167963)
 - Supported: #9567 - PTTC/BCD (P/N 1167938)
 - #9812 - Correspondence (P/N 1167043)
 - Not Supported: If 2741 is attached to a 2701:
 - #4708 - Receive Interrupt
 - #7900 - Transmit Interrupt
- 2845 Display Control (mdl 1) on nonswitched lines: (TCAM)
 - Required: Attachment of 2265
 - If 2845 is attached to a 2701: #4646, #4657 - IBM Terminal Adapter Type III
 - Recommended: #3301 - Destructive Cursor
 - Not Supported: Attachment of 1053
 - #4801 - Line Addressing
 - #7801 - Tab
- 2265 Display Station (mdl 1):
 - Required: #4766 - Alphameric Keyboard
- 2848 Display Control (mdls 1,2,3) on nonswitched lines: (TCAM)
 - Required: Attachment of 2260
 - Recommended: #3901 - Extended Cursor Control
 - #5340 - Non-Destructive Cursor
 - #5341 - Non-Destructive Cursor Adapter
 - Not Supported: Attachment of 1053
 - #4787 - Line Addressing
- 2260 Display Station (mdls 1,2):
 - Required: #4766 - Alphameric Keyboard
 - Recommended: #3606 - Extended Cursor Control, Alphameric Keyboard
 - Not Supported: Tab feature of 3606
- 3101 Display Terminal (mdls 10, 12, 13, 20, 23) on switched lines 110-1200 bps: (TCAM, VTAM)
- 3232 Keyboard Printer (mdl 51) on switched or nonswitched lines (VTAM, TCAM). On switched lines supported as a CPT-TWX 33/35 (BTAM)
- 3767 Communication Terminal (mdls 1,2) (supported as a 2741) on switched or nonswitched lines: (TCAM)
 - Required: #7113 - 2741 Start/Stop (which provides PTTC/EBCD and Correspondence Codes)
- 5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines: (TCAM)
 - Required: #1525 - Communications Adapter
- CPT-TWX (mdl 33/35) Line Control Type on switched lines: (TCAM)
 - Supported: Data Interchange Code (8-level) at 110 bps even or forced parity
- 6733 Typewriter Communication Module (supported as a CPT-TWX 33/35) on switched and nonswitched lines at 110, 150, 300, and 1200 bps (BTAM, ACF/TCAM, ACF/VTAM)

Binary Synchronous Lines

- **3270 Information Display System on nonswitched lines: (TCAM, VTAM)
 - 3271 Control Unit (mdls 1,2):
 - Required: Attachment of 3277
 - Supported: #9761 - EBCDIC Code
 - Not Supported: Attachment of 3284, 3286, 3287(as a 3284/3286) or 3288
 - #1550 - Copy
 - 3274 (mdl 1C) (Supported as a 3271):
 - Required: Attachment of 3278
 - Supported: Attachment of 3277
 - Not Supported: Attachment of 3268, 3284, 3286, 3287, 3288 or 3289
 - 3275 Display Station (mdls 1,2):
 - Supported: #9089 - EBCDIC Character Set
 - #9761 - EBCDIC Code
 - *User Supported: #4600 - Operator Identification Card Reader
 - #6350 - Selector Light-Pen
 - Program function keys
 - Additional flexibility in controlling screen formats
 - Not Supported: Attachment of 3284
 - 3276 Control Unit Display Station (mdls 1, 2, 3, 4) (Supported as a 3271)
 - Supported: Attachment of 3278
 - Not Supported: Attachment of 3268, 3287
 - 3277 Display Station (mdls 1,2):
 - Supported: #9089 - EBCDIC Character Set
 - *User Supported: #4600 - Operator Identification Card Reader
 - 6350 - Selector Light-Pen
 - Program function keys
 - Additional flexibility in controlling screen formats
 - 3278 Display Station (mdls 1, 2, 3, 4) (Supported as a 3277)
 - Supported: #9082 - EBCDIC Character Set
 - 5280 Distributed Data System on nonswitched lines (supported as a 3271-2) (BTAM, TCAM, VTAM):
 - 5285 and 5288 controllers
 - Required: Refer to appropriate pages for required features and programming
 - 8100 Information System on nonswitched lines (BTAM, TCAM, VTAM) [Supported as a 3271]:
 - Required: Refer to 8100 pages for required features and programming for communication as a 3271. In particular, refer to 8100/DPPX 3270 Data Stream Compatibility licensed program or the DPPX/SP 3270 Data Stream Compatibility component.
 - Supported: Use of 3277 and 3278
 - Not Supported: Use of 8100/DPPX or 8100/DPPX/SP printers and copy function
 - System/34 on nonswitched lines (BTAM, VTAM) (supported as a 3271):
 - 5340 System Unit:
 - Required: #2500, #3500 or #4500 Adapter Feature
 - #4900 or #4901 Workstation Control Expansion A or B
 - System/36 on nonswitched lines (BTAM, VTAM) (supported as a 3271):
 - 5360 System Unit:
 - Required: #2500 or #4500 Communications Adapter feature
 - #4900 Workstation Control feature
 - System/38 (supported as a 3271 mdl 2) on a nonswitched line (BTAM, TCAM, VTAM):
 - 5381 System Unit:
 - Required: #1501, #1502 Communications Attachment
 - #2001, #2003 Communications Control
- SDLC Terminals
 - 3232-1 Keyboard Printer Terminal on switched or nonswitched lines (VTAM, TCAM).
 - **3270 Information Display System on nonswitched lines: (VTAM)
 - 3271 Control Unit (mdls 11,12):
 - Required: Attachment of 3277
 - Supported: #9761 - EBCDIC Code

SYSTEM CONTROL PROGRAMMING

OS/V52 (5752-VS2) (cont'd)

- Not Supported: Attachment of 3284, 3286, 3287 (as a 3284/3286), 3288
#1550 - Copy
- 3275 Display Station (mdls 11, 12):
Supported: #9089 - EBCDIC Character Set
#9761 - EBCDIC Code
*User Supported: #4600 - Operator Identification Card Reader
#6350 - Selector Light-Pen
Program function keys
Additional flexibility in controlling screen formats
- Not Supported: Attachment of 3284
- 3277 Display Station (mdls 1, 2):
Supported: #9089 - EBCDIC Character Set
*User Supported: #4600 - Operator Identification Card Reader
#6350 - Selector Light-Pen
Program function keys
Additional flexibility in controlling screen formats
- 3270 Information Display System on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM/NCP Direct)
- 3276 Control Unit Display Station (mdls 11-14)
Supported: Attachment of 3278-2
Not Supported: Attachment of 3268, 3287
- 3278 Display Station (mdls 1-4)
Supported: #9082 - EBCDIC Character Set
- 3767 Communication Terminal (mdls 1, 2, 3) on switched or non-switched lines: (VTAM)
Supported: SDLC adapter provided unless one of the Start/Stop features are are specified
#1201 - ASCII Code
- 3770 Data Communication System on switched or nonswitched lines: (VTAM)
- 3771 Communication Terminal (mdls 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
- 3773 Communication Terminal (mdls 1, 2, 3, P1, P2, P3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
- 3774 Communication Terminal (mdls 1,2,P1,P2):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
- 3775 Communication Terminal (mdl 1, P1):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
Supported: #1201 - ASCII Code
- 3790 Communication System on switched and nonswitched lines: (VTAM, TCAM/NCP). TSO terminal sessions use the 3270 Data Stream Compatibility (DSC) mode
- 3791 Communication Controller
Required: 3791 Configuration feature code
#9165 for TSO/TCAM support
3791 Configuration Code #9169 for TSO/VTAM or TSO/TCAM support
3277 mdl 1, 2, and/or
3276 mdl 2-4, 12-14 and/or
3278 mdl 2
- 5280 Distributed Data System on switched or nonswitched lines (supported as a 3274-1C) (VTAM):
5285 and 5288 controllers
Required: Refer to machine pages for required features and programming
- 8100 Information System with DPX on switched or nonswitched lines: (VTAM, TCAM/NCP). TSO terminal sessions use the 3270 Data Stream Compatibility (DSC) mode.
- 8130 Information Processor (mdls A21, A23)
- 8140 Information Processor (Mdls A31, A33, A51, A53)
Required: Distributed Processing Communications Executive (DPX)
3277 mdl 1, 2 and/or
3276 mdl 2, 3, 4, 12, 13, 14 and/or
3278 mdl 2
- 8100 Information System under DPPX with 3270 Data Stream Compatibility on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM) [supported as a 3276]
- Required: Refer to 8100 sales pages for required features. In particular, refer to 8100/DPPX 3270 Data Stream Compatibility Licensed Program.
Use of 3277 and 3278
Use of 8100/DPPX printers and copy function.
- Supported: Use of 3277 and 3278
- Not Supported: Use of 8100/DPPX printers and copy function.
- System/34 on nonswitched lines (VTAM) (supported as a 3274):
5340 System Unit:
Required: #2500, #3500 or #4500 Communications Adapter feature
#4900 or 4901 Workstation Control Expansion A or B
- System/36 on nonswitched lines (VTAM) (supported as a 3274):
5360 System Unit:
Required: #2500 or #4500 Communications Adapter feature
#4900 Workstation Control feature
- System/38 (supported as a 3274) on switched or nonswitched line (VTAM, TCAM):
5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2000, #2001, #2002 or #2003 Communications Control feature
#3200 Line Base feature
- Local Channel Attachment**
- Local Terminals**
- 2848 Display Control (mdls 1,2,3) on a local channel: (TCAM)
Required: Attachment of 2260
Recommended: #3901 - Extended Cursor Control
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053
#4787 - Line Addressing
- 2260 Display Station (mdls 1,2):
Required: #4766 - Alphameric Keyboard
Recommended: #3606 - Extended Cursor Control, Alphameric Keyboard
Not Supported: Tab feature of 3606
- **3270 Information Display System on a local channel: (TCAM,VTAM)
- 3272 Control Unit (mdls 1,2):
Required: Attachment of 3277
Not Supported: Attachment of 3284, 3286, 3287 (as a 3284/3286) or 3288
- 3274 (mdl 1B) (Supported as a 3272)
Required: Attachment of 3278
Supported: Attachment of 3277
Not Supported: Attachment of 3268, 3284, 3286, 3287 3288 or 3289
- 3277 Display Station (mdls 1,2):
Supported: #9089 - EBCDIC Character Set
*User Supported: #4600 - Operator Identification Card Reader
#6350 - Selector Light-Pen
Program function keys
Additional flexibility in controlling screen formats
- 3278 Display Station (mdls 1, 2, 3, 4)(Supported as a 3277)
Supported: #9082 EBCDIC Character Set
- 3270 Information Control System on a local channel: (VTAM, TCAM through VTAM)
- 3272 Control Unit (mdls 1,2):
Required: Attachment of 3277
Not Supported: Attachment of 3284, 3286 or 3288
- 3274 Control Unit (mdl 1A)
Required: Attachment of 3278
Supported: Attachment of 3277
Not Supported: Attachment of 3268, 3284, 3286, 3287 3288 or 3289
- 3277 Display Station (mdls 1, 2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
- 3278 Display Station (mdls 1, 2, 3, 4)
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
- * Can be supported in user-written TSO Command Processors and TSO Application Programs using the TGET/TPUT ASIS macro instructions.

SYSTEM CONTROL PROGRAMMING

OS/V52 (5752-V52) (cont'd)

** TSO support of the 3270 utilizes brightness control to differentiate system-generated output (brightened intensity) from user input (normal intensity), and suppresses display of information entered in response to system prompt for password.

3790 Communication System on local channel: (VTAM, TCAM/NCP). TSO terminal session uses the 3270 Data Stream Compatibility (DSC) mode.

3791 Communication Controller
 Required: 3791 Feature Code #9165 for TSO/TCAM
 Feature Code #9169 for TSO via TCAM or VTAM
 3277 mdl 1, 2 and/or
 3276 mdl 2-4, 12-14 and/or
 3278 mdl 2

Transmission Control Units and Communication Controllers

2701 Data Adapter Unit on a local channel: (TCAM)
 Required: #4640 - IBM Terminal Adapter Type I and/or
 #4656, 4657 - IBM Terminal Adapter Type III and/or
 #7860-7862 - Telegraph Adapter Type I and/or
 #7885 - Telegraph Adapter Type II

2702 Transmission Control Unit on a local channel: (TCAM)
 Required: #4615 - IBM Terminal Control Type I and/or
 #7912 - Telegraph Terminal Control Type II
 #8200 - Type I Terminal Interrupt (necessary to support the 2741 and 1050 Transmit Interrupt and/or Receive Interrupt)

2703 Transmission Control Unit on a local channel: (TCAM)
 Required: #4696 - IBM Terminal Control Type I and/or
 #7912 - Telegraph Terminal Control Type II
 #8200 - Type I Terminal Interrupt (necessary to support the 2741 and 1050 Transmit Interrupt and/or Receive Interrupt)

3704/3705-I/3705-II Communications Controller on a local channel:
 Required: EP/VS (TCAM) or
 NCP/VS (TCAM,VTAM)

DATA MANAGEMENT (SVS and MVS)

Data management controls all operations associated with input/ output devices, such as allocation of space on volumes, storing, naming, and cataloging data sets, and movement of data between real and auxiliary storage.

Virtual Storage Access Method - VSAM: VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the data set to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records, relative record data sets are fixed length records only.

VSAM is composed of two major elements: A data organization which minimizes data movement and which is suitable for data base applications; and routines for creating data sets in the VSAM organization, adding and deleting records, and performing other data management functions. The data management functions supplied by VSAM are:

- Opening data sets
- Processing records by index key
- Processing records by address
- Closing data sets
- End-of-volume processing
- Cataloging VSAM data sets
- Data set password protection
- Allocating space
- Checkpoint/restart processing

Sequential Access Methods: In the Basic Sequential Access Method (BSAM) data is sequentially organized and physical blocks of data are stored or retrieved. The READ/WRITE macro instruction causes the initiation of an input/output operation. The completion of these operations is tested by using synchronization macro instructions. Automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

In the Queued Sequential Access Method (QSAM) logical records are retrieved or stored as requested. The access method anticipates the need for records based on their sequential order, and normally will have the desired record in virtual storage, ready for use, before the request for retrieval. When writing data, the program normally will continue as if the record had been written immediately, although the access method routines may block it with other logical records and defer the actual writing until the output buffer has been filled. As with BSAM, automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

Basic Partitioned Access Method - BPAM: This access method, when used in conjunction with BSAM, is designed for efficient storage and retrieval of discrete sequences of data (members) belonging to the same data set on a Direct Access device. The data set includes a directory that relates the member name with the address where the sequence begins. Each member has a simple name. Members may be added to a partitioned data set as long as space is available in the directory and the data set. Other than directory manipulation, all I/O is performed by BSAM.

Basic Direct Access Method - BDAM: In the Basic Direct Access Method (BDAM), records within a data set are organized on direct access volumes in any manner chosen by the programmer. Storage and retrieval of a record is by actual or relative address within the data set. This address can be that of the desired record or a starting point within the data set where a search for the record, based on a key furnished by the programmer, begins. Addresses are also used by BDAM as a starting point for searching for available space for new records.

Indexed Sequential Access Methods: Sequential and direct processing are provided by the Indexed Sequential Access Methods (ISAM). Records are maintained in control field sequence by key. A multilevel index structure is system maintained, allowing retrieval of any record by its key. Additions can be made to an existing ISAM data set without rewriting the data set.

The Basic Indexed Sequential Access Method (BISAM) stores and retrieves records randomly from an indexed sequential data set. Selective reading is performed using the READ macro instruction, and specifying the key of the logical record to be retrieved. Individual records can be replaced or new records added randomly.

The Queued Indexed Sequential Access Method (QISAM) is used to create an indexed sequential data set or to retrieve and update records sequentially from such a data set. Synchronization of the program with the completion of input/output transfer, and record blocking/deblocking are automatic. QISAM is also used to reorganize an existing data set.

VECTOR PROCESSING SUBSYSTEM - VPSS: The Vector Processing Subsystem (VPSS) is an access method designed to operate with the 3838 Array Processor. It provides a call level interface between the user program and the 3838 Array Processor. The user will, via CALL statements from FORTRAN or Assembler, be able to request that array calculations be performed by the 3838. VPSS is also available to the PL/1 program via PL/1's interlanguage communication facility.

Through the CALL statement procedure, the user establishes the processing sequence to be performed on the data. The 3838 capability is viewed as a set of vector arithmetic and logic instructions which include comparisons and conditional branches. By appropriately concatenating the instructions, in whatever sequence is desired, the user should be able to program complex processing functions unique to the installation.

Virtual I/O (MVS): The virtual I/O facility is available in MVS. It uses the system paging mechanism to transfer data set blocks between external page storage and real storage. The user can specify virtual I/O processing for system-named temporary data sets accessed through BDAM, BPAM, BSAM, QSAM, EXCP and XDAP interfaces. Virtual I/O processing for system-named temporary data sets is established at system generation time.

Page-size (4K bytes) physical blocks are dynamically allocated in external page storage as a virtual I/O data set is created. These blocks are not necessarily contiguous and the virtual I/O data set may span several volumes of external page storage. The blocks are released when the data set is deleted and the space is immediately made available for other paging needs.

Implementation of virtual I/O processing is compatible with the BDAM, BPAM, BSAM, QSAM, EXCP and XDAP macro interfaces to a DASD data set, and requires no change to user-written code or JCL. When a request is made for accessing a virtual I/O data set, the channel programs are intercepted and interpreted and the page table entries are manipulated if necessary, so that the desired data will be paged in or

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out of real storage as requested. For example, the control program reads a virtual I/O data set record into a virtual address space by modifying page table entries so that the 4K byte block(s) containing the record are identified as part of the virtual address space from which the request was made.

Restart processing currently available for temporary data sets is provided for virtual I/O data sets. Checkpoint and automatic step restart are provided for job failures. Checkpoint, step and job restart through the Job Entry Subsystem and automatic step restart are provided for system restart processing.

Some of the advantages of virtual I/O are: Centralized direct access storage device management ... Elimination of channel program translation and page fixing requirements ... Use of the I/O balancing of the paging mechanism ... Elimination of normal I/O device allocation and DADSM overhead for temporary data sets ... Compatibility at the object code and JCL level.

3850 MASS STORAGE SYSTEM - MSS (SVS and MVS)

SVS and MVS support attachment of a single 3850 Mass Storage System (MSS) (up to two A mdl 3851s).

The 3850 Mass Storage System (MSS) programming support includes an MSC (Mass Storage Control) Table Create program, Access Method Services functions to aid in mass storage volume management, and a Mass Storage System Communicator (MSSC) which communicates the Staging/Destaging commands to the MSC and contains Mass Storage Volume Control (MSVC) functions to assist in volume management. In addition, most of the facilities available for the control and management of real 3333/3330 Disk Storage drives and the data sets contained on 3336 Model 1 and 11 Disk Packs are applicable to virtual 3333/3330 addresses and the data sets contained on mass storage volumes. For SVS the 3350 devices may be attached to the 3830-3 or the ISC with staging adapter as a real device in native mode only. Brief descriptions of the significant areas of support follow. More detailed information can be found in the publication *OS/VS Mass Storage System (MSS) Planning Guide*.

MSC Table Create: Creates and initializes the tables required by the Mass Storage Control (MSC). The tables are of four types:

Configuration Information: describes the hardware present in the 3850 Mass Storage System and the interconnections between the various hardware components.

Cartridge Information: describes the locations and volume serial numbers of the mass storage volumes in the 3851 MSF.

Activity Information: describes the status of staging and destaging of data.

Control Information: contains information required to locate all the above tables and also the basic information required to start the MSC initial microprogram load.

This program must be run at the initial installation of the 3850 MSS and whenever the configuration changes. It must be run prior to a VS2 System Generation, if the 3851 IODEVICE macros are being changed, because it generates IODEVICE and UNITNAME card images to be used in Stage I of SYSGEN.

VS2 System Generation: The 3851 Mass Storage Facility is a new device type for which an IODEVICE macro must be included. The expanded addressing capability of the 3830 mdl 3 Storage Control and the Integrated Storage Controls (4650) with Staging Adapter special feature (#7220) on S/370 mdls 158 and 168 is identified to the system generation process as virtual 3333/3330 units. The number of virtual 3333/3330 addresses will be limited by the VS2 UCB limit (see *OS/VS2 System Generation Reference*) and by the available subchannels (see appropriate Processor or channel functional characteristics manual). An IODEVICE macro for each virtual 3333/3330 address is required. Certain system data sets must reside on real direct access units known to VS2. The four real unit addresses 0, 1, 8 and 9 on Staging Adapter 0 and Staging Adapter 1 are reserved for direct access to the MSC tables. If the only direct access units in an installation are the 3333/3330 Disk Storage drives included in the 3850 MSS, then one or more of these 3333/3330 drives must be assigned addresses that have been identified to VS2 as real 3333/3330 units. These 3333/3330 drives can then be used for the system data sets. For further information on system generation, refer to the publications *OS/VS System Generation Introduction (GC26-3790)* and *OS/VS2 System Generation Reference*.

Staging/Destaging Initiation: Staging and destaging is based upon Job Control Language (JCL) Data Definition (DD) statement parameters. UNIT 3330V indicates that the data set defined by DSNAMES resides on a mass storage volume whose serial number is identified either by the VOLUME parameter or in the catalog. This mass storage volume is "mounted", i.e. made active, by the Mass Storage Control at job step initiation. If DISP=OLD, SHR, or MOD is specified, the staging of the data set is initiated when the data set is OPENed. Staging will be initiated for new data sets only when the space request is not on a cylinder boundary. Destaging of new data sets for which DISP=KEEP or

CATALOG and the portions of old data sets that were modified is initiated when the mass storage volume is demounted.

Mass Storage System Communicator (MSSC): The MSSC includes Mass Storage Volume Control (MSVC) functions to assist users of the 3850 MSS to control and manage the use of mass storage volumes. MSVC centers around a new system data set, Usercat.MSVI, which is a keyed sequential VSAM data set containing space and activity information about mass storage volumes and groups of mass storage volumes. It is created, initialized, and maintained by the user via the Access Method Services functions for creating a VSAM data set and for the manipulation of mass storage volumes. Usercat.MSVI is used by MVS for the allocation of mass storage volumes to satisfy non-specific volume requests for new data sets. An Access Method Services function which produces a report of the status of mass storage volumes and groups of mass storage volumes is available. Access Method Services also list information concerning cartridges similar to the information listed concerning volumes. Included are two commands which enable the user to list or scratch and uncatalog non-VSAM data sets according to his specified criteria (e.g., creation date, expiration date or name qualifier). It is an installation responsibility to analyze these reports to determine the extent of space utilization on mass storage volumes and then to initiate the appropriate utility functions to scratch or copy inactive data sets.

Data Management Support: BSAM, QSAM, BPAM, BDAM, VSAM, EXCP, and XDAP may be used for data sets contained on mass storage volumes. The staging of such data sets is initiated at OPEN. ISAM data sets can be contained on mass storage volumes. However, staging for ISAM data sets is not initiated at OPEN, but rather, at the time a data record is accessed. One cylinder at a time is staged as requested by the "cylinder fault" mode of operation. The Direct Access Device Space Management (DADSM) facilities are applicable to mass storage volumes as well as to real direct access volumes. All of the catalog facilities of VS2 can be used for data sets contained on mass storage volumes.

Data Sharing: The components of the 3850 MSS can be shared by a maximum of four S/370s and 3033 Processor complexes. The catalog, user program libraries, and user data sets can be accessed by any Processor. If 3333s are shared between hosts, the 3330V devices with paths to the shared 3330 drives may be SYSGENed as shared or unshared at user option.

Data Security: The password protection data security facilities of VS2 can be used to control access to MSC tables and data sets contained on mass storage volumes.

Data Set Utility Programs: All non-stand-alone VS2 Data Set Utilities can be used with data sets contained on mass storage volumes.

System Utility Programs: All non-stand-alone VS2 System Utility Programs except IEHDASDR and IEHATLAS can be used on mass storage volumes.

IEHDASDR Utility Function: VS2 System Utility Program IEHDASDR provides support for formatting the DASD volumes as staging volumes. This utility function can only be performed external to the MSS.

Access Method Services Functions: Access Method Services provides mass storage volume commands which allow a user to initialize, modify, copy, and scratch mass storage volumes, to add and remove mass storage volumes from the 3850 MSS, and to convert real 3336 mdl 1 and 11 Disk Packs to mass storage volumes and back again. There are commands which allow a user to create, modify and scratch groups of mass storage volumes in usercat.MSVI, and to list the contents of usercat.MSVI.

Additional commands allow the user to copy, swap and compare his Mass Storage tables, to dump portions of the MSC or Staging Adapter storage, to dump the MSC tables, to audit cartridge locations within the Mass Storage Facility and to check the consistency of the MSC tables, Staging Adapter tables and Mass Storage Volume Inventory data set.

JES3: JES3 data and device management of the 3850 MSS is available in JES 3 Release 3. This support is described in the JES3 section under *Device, Volume and Data Set Management*.

VIRTUAL TELECOMMUNICATIONS ACCESS METHOD - VTAM

(SVS Release 1.7 and MVS Release 3) (Also refer to the Program Products section for licensed options provided for VTAM).

A functionally superior alternative to BTAM, VTAM provides telecommunication support for the 3704/3705 in network control mode and for locally attached 3270s, 3730s and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM is supported in SVS Release 1.7, but is not supported in SVS Release 1.0 or 1.6. VTAM is supported in MVS Release 3 and all subsequent MVS releases, but is not supported in MVS Release 2.

VTAM provides for the direct transmission of messages between application programs and terminals. Using NCP/VS, it makes the lines

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and communications controllers transparent to the application program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM initially supports switched and nonswitched lines. A switched line connection requires system operator assistance. Manual dial service is supported. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. VTAM subsequently supports SDLC terminals in switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upward compatible for the three virtual storage operating systems (DOS/VS, OS/VS1 and OS/VS2). It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer DB/DC systems. In MVS Release 3, TCAM application programs can use certain VTAM facilities through the TCAM Message Control Program.

Network operator control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored VS2 RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a 3790 Installation Guide, is provided to facilitate installation of 3790 Communication Systems and the host communications subsystem. The 3790-SNA System Installation package supports the 8100/DPCX Information System.

To aid in installing the 8100 Information System with DPPX or DPPX/SP, the Host Command Facility licensed program, with a 3270 display station running under VTAM or TCAM, can be used to:

- Remotely operate an 8100/DPPX or 8100/DPPX/SP system from a 3270 display station.
- Run 8100/DPPX or 8100/DPPX/SP checkout routines remotely.
- Verify the operation of a connection between S/370 and 8100/DPPX or 8100/DPPX/SP.
- Modify DPPX or DPPX/SP network profiles.

Teleprocessing Online Test Executive Program - TOLTEP: TOLTEP is a component of VTAM and is designed to control the selection, loading and execution of teleprocessing online terminal tests (OLTTS) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting, and remote test requests. TOLTEP performs control services, device accessing, and configuration-update functions for teleprocessing OLTTS of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTS concurrently with other processing programs, with VTAM and the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, TOTE and OLTEP are still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTTS data set.

VTAM System Requirements: VTAM operates on all S/370 models supported by SVS Release 1.7 or MVS Release 3.

See *VTAM, TCAM and BTAM Terminals Supported* for a list of devices supported by VTAM with VS2.

TELECOMMUNICATIONS ACCESS METHOD - TCAM

(Also refer to the Program Products section for licensed options provided for NCP/VS).

The Telecommunications Access Method (TCAM) is a teleprocessing support program which may execute in conjunction with VTAM or as a separate access method. It provides:

- A regionalized, general-purpose TP access method providing facilities that permit exchange of data between a central S/370 and remote terminals.
- A control program designed to optimize the allocation and scheduling of a computer's resources in a real-time teleprocessing environment. Resources optimized include Processor time, real-storage space and I/O paths (lines and channels).
- A high-level language composed of macro instructions designed specifically to facilitate the construction of a TP message control program.

Please refer to the *Terminal Support Chart(s)* in this section for specific terminals and how supported.

TCAM provides unified management of terminal devices, local and remote, including BSC and SDLC devices, through a single Message Control Program. The TCAM application-program interface has been defined to provide maximum compatibility with BSAM (READ/WRITE level) and QSAM (GET/PUT level), yet provide the ability to identify or specify source and destination of terminal I/O. Network control functions may be provided in an application program able to issue TCAM operator control commands.

Teleprocessing applications using TCAM are constructed by providing a Message Control Program and one or more TCAM application programs.

TCAM does not provide emulation of the QTAM interface.

TCAM Message Control Program: The TCAM Message Control Program (MCP) serves as an interface between remote terminals, user-written application programs and secondary storage devices on which messages are queued until their destinations are available to receive them. The MCP's job is to control the flow of messages to and from these terminals, application programs, and queuing media, in a manner that optimizes allocation and scheduling of the computer's resources.

By handling all line control and scheduling of I/O operations for remote terminals, the TCAM MCP insulates user-written application programs from the complex device-dependent considerations inherent in a TP environment.

In TCAM, messages entered by remote terminals or application programs are queued by destination. Queuing by destination permits overlap of line usage in I/O operations; messages having a common destination may be received simultaneously from more than one source, even while the destination itself is busy sending or receiving a message. Disk queuing permits a high volume of concurrent terminal operations to proceed without requiring excessive real storage for buffering. TCAM destination queues may be located in main storage or on disk.

A TCAM MCP contains one or more message handlers. These are user-coded sets of routines that process messages as they enter and leave the TCAM MCP. Message handler functions are included by the selection and coding of TCAM supplied macros; among these functions are the following: message editing ... validity checking ... message routing ... record keeping ... error handling ... system control.

Special message-handler facilities are furnished for inquiry and conversational applications. The path of a message through a message handler may be varied dynamically based on the source or destination of the message, or on the presence or absence of certain character strings in the message header. To supplement TCAM-provided functions, the user may code open or closed subroutines consisting of assembler and macro instructions and include these in his message handlers. The TCAM MCP is just another problem program to the operating system. Assembly, linkage-editing, and execution of the MCP is similar to that for any other problem program. For performance reasons, the MCP is usually executed as the highest priority user task in the system, but this is not a requirement.

TCAM Application Programs: TCAM permits the user to code one or more application programs and interface these with the MCP. Application programmers are insulated from the TP environment; they issue ordinary GETs and PUTs or READs and WRITEs to move data between the MCP and application program work areas.

TCAM application programs can be SAM compatible, and may be debugged in a non-TP environment using BSAM or QSAM as the access method, and a tape, card-reader, disk, card punch, printer, etc., as I/O devices. Once debugged, many application programs can be plugged into TCAM without reassembly by changing a single job-control statement. The user can specify that either messages or user-defined records be transferred when he issues his GET/READ or PUT/WRITE macros.

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TCAM application programs can be attached dynamically during execution by the MCP.

TCAM Service Facilities: TCAM offers an extensive set of service facilities. Among these are:

- A set of operator commands allowing the user to determine the status of his TP system and alter, activate, or deactivate portions of that system by entering appropriate commands from the system console, remote terminals, or application programs. An MCP may be referred to by its MCP name, and SNA entities are allowed as operands where applicable.
- A checkpoint/restart facility which allows the user to specify that his MCP environment be restored following system failure or closedown.
- A facility for selectively logging incoming or outgoing messages or message segments.
- Comprehensive debugging aids, including error-recovery and event-recording facilities, and utilities which permit debugging information to be dumped to tape or disk and then printed out.
- An online test facility (TOTE) that allows the user to test transmission control units (270X and 3704/3705) and remote terminals without closing down the MCP or deallocating the device being tested. In MVS Release 3 when TCAM uses VTAM, TOLTEP provides testing facilities for the VTAM network.

TCAM MFT, MVT/VS Compatibility: OS TCAM Message Control Programs must be reassembled to run in the OS/VS environment. This reassembly allows the MCPs to benefit from the virtual storage capability of OS/VS. Under OS/VS, TCAM runs as a subsystem in a virtual region. Certain TCAM elements, such as the buffer pool, I/O appendages, control blocks, and tables are fixed in main storage for the duration of the TCAM task.

TCAM/VTAM Relationship in MVS: TCAM users may elect to use VTAM to control the portion of their communications network attached to 3704/3705 operating with the Network Control Program/Virtual Storage (NCP/VS). When this option is chosen, VTAM controls the telecommunications environment that includes 3704/3705s in network control mode and, optionally for TCAM, locally attached 3270s. VTAM permits sharing of this telecommunications network among different applications including those applications which used TCAM 3704/3705 NCP/VS support in previous releases of the operating system. When the TCAM Message Control Program schedules a read or write operation for a station in the TCAM/VTAM network, the I/O request is routed to VTAM. To the TCAM applications, the message looks as if it were handled only by TCAM.

If a TCAM application program or a TCAM terminal operator issues TCAM 3704/3705 control commands, a unique return code and a response message is provided. This code and message indicate the command has been intercepted and cannot be executed. TCAM now shares this network with VTAM and is no longer the sole "owner" of the telecommunications network.

The installation can provide an interface to the terminal user similar to the TCAM interface by using the "simulated logon" capability of VTAM. However, to use the full sharing capabilities of VTAM, the installation instructs the terminal user to enter an installation-defined sequence requesting logon to TCAM and includes in the system the VTAM facility to monitor logons. This facility provides the capability to interpret the sequence entered by the terminal user and to route the interpreted logon request to the appropriate VTAM application (e.g., TCAM).

BASIC TELECOMMUNICATIONS ACCESS METHOD - BTAM

The facilities of the Basic Telecommunications Access Method (BTAM) are designed chiefly to provide the basic tools required to write a telecommunications program. These include facilities for creating terminal lists and for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Code translation ... Retransmitting messages which are received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

The support of Binary Synchronous Communications combined with that of the various start/stop devices gives BTAM a wide range of applicability and flexibility. BTAM supports low, medium, and high speed devices.

BTAM supports Binary Synchronous Communication over nonswitched (leased or private direct connection) and switched (dial) networks in a S/360 to S/370 and S/370 to terminal communication.

All terminals (except Binary Synchronous Communication) on a multipoint nonswitched line must be the same type. Terminals may be mixed within the same problem program.

Further information on terminal support is provided by Terminal Support Charts 1 and 2.

Optional communication serviceability facilities are available in BTAM including error recovery procedures, diagnostic error information, error counts and online terminal tests. It is strongly recommended that these facilities be included since they increase system availability.

VS2 BTAM supports the same functions as OS BTAM and, therefore, requires no additional programmer training. The user is cautioned regarding any internal changes that he may have made to OS BTAM.

Graphic Programming Services: Graphic Programming Services consists of the functions necessary to handle graphic input/output, and a set of macro instructions and problem oriented routines that can be used as building blocks in the construction of graphic processing programs. These services support the 3250 Graphic Display System, the 2250 Display Unit mdl 1 and 3, and the 2260 direct attachment (local). This access method includes: Macro instructions ... Data handling aids ... Problem oriented routines ... Graphic Data Generation Subroutine to generate data ... Light-Pen Tracking Subroutine ... The Graphics Access Method (GAM) includes: Read/Write level macro instructions ... buffer management facilities ... optional routines that facilitate man-machine communication ... Graphic Subroutine Package.

Graphic Subroutine Package: The Graphics Subroutine Package provides support for graphic programs written in Assembler Language or for the following compilers:

FORTRAN IV E, G or H
 PL/I (F)
 FORTRAN IV H - Extended or G1 (program products)
 PL/I Optimizing or Checkout Compilers (program products)

These services consist of subroutines and functions that enable a programmer to create a display on one or more 3251 Display Stations or 2250 Display Units (mdl 1 and 3) under OS/VS2. The displays produced consist of any figures that can be constructed with points, lines, or characters, including charts, circles, arcs, rectangles etc. The subroutines are requested through the use of CALL statements in a sequence that produces desired characters or graphic forms on the 3251 or 2250 screen, and that provides two-way communication between the user's program and the 3250 or 2250 operator (if desired). In producing the desired displays, the subroutines automatically:

- Generate the necessary display buffer orders and data for the displays.
- Transfer the generated orders and data to the 3255 or 2840 display buffer for execution, relocating them as necessary.
- Allocate, control, and protect sections of virtual storage and of the 3255 or 2840 display buffer as required by the user's application program.
- Diagnose asynchronous errors and accomplish necessary error handling.

Highlights include:

- Two levels of display buffer order and data grouping each of which can be referenced as an entity: (1) an element - all orders and data produced as one call to a GSP subroutine, and (2) sequences of orders and data produced by several calls to GSP subroutines.
- Acceptance of input data in any two-dimensional rectangular coordinate system; the data is scaled as appropriate for use by the graphic subroutine package.
- Provision for temporarily removing an image from a display while retaining its associated orders and data in the display buffer, and later redisplaying the image.
- Modification of display buffer orders and data produced by a single call wherever they are located (in S/370 virtual storage or in a display buffer) by another call to the same subroutine.
- Display of alphameric characters using either the character generator or the 3250 or 2250 or, a series of lines called strokes.
- Capability to read information from the display buffer into S/370 virtual storage.
- Capability to locate the position of the light pen on the screen even if the light pen is pointed at a blank portion of that screen.
- Capability to place a tracking symbol on the screen and follow its motion as it is moved by a 3250 or 2250 operator with the light pen (restricted to 3250, or 2250 mdl 3).
- Allowance for display buffer subroutines that can be repeatedly invoked through display buffer order linkage, without recourse to the S/370 (restricted to 3250, or 2250 mdl 3).
- Ability to check the status of the program while it is being processed.
- Single and multiple queuing of attention information, and in-line processing of that information
- Access to the enhanced features of the 3250 Graphics Display System, including: 4 character sizes, character-string rotation

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through 90 degrees counterclockwise, 4 line types, 8 intensity levels, and entity blinking.

Shared DASD: A pool of direct access storage devices may be shared by up to four S/370 Processors. Devices supported are 2314/2319, 3330/3333, 3340, 3344, 3375, 3380 and 3350. Two Processors may share a pool of 2305 direct access storage devices. The catalog, program libraries, and user data sets may be accessed by any Processor. Advantages are reduced file maintenance, improved operational flexibility, and reduced disk space requirements. Exclusive access for all other data sets can be controlled by using the **RESERVE** and **DEQ** macro instructions. VSAM user catalogs may be shared among OS/VS1, SVS, and MVS. OS control volume catalogs may be shared among the above plus the OS/MFT and OS/MVT systems. While VSAM user catalogs may be shared, reference to specific entry types (e.g., GDG) created by MVS may be accessed only by MVS. The master catalog cannot be shared. Program libraries and other system or user data sets may be shared on a read-only basis. The system does not automatically provide exclusive control of records, or prevent concurrent update or extensions to these data sets. Such data sets should be shared on a read-only basis until safeguards are instituted by each installation.

SYSTEM SUPPORT PROGRAMS

Linkage Editor: The Linkage Editor combines separately compiled or assembled object modules into one or more load modules that are in a format suitable for loading by the control program and for subsequent execution. It also combines previously edited load modules with each other or with object modules.

Features: Although linking or combining of program modules is its primary function, the linkage editor also:

- Provides CSECT ordering and page boundary alignment facilities to allow the user to improve paging characteristics of his programs.
- Incorporates modules from data sets other than those in its primary input, either automatically or upon request.
- Aids program modification by replacing and deleting control sections as directed by linkage editor control statements.
- Defines the storage requirements for the common control sections generated by the assembler and by FORTRAN compilers, and the static external areas generated by PL/I compilers.
- Provides processing options and logs diagnostic error messages.
- Maintains an audit trail of compilation, linkage editing dates and levels and modifications on a CSECT basis within a load module via the identification record (IDR).
- Provides a service aid feature to allow for expansion of modules to provide maintenance space.
- Processes a control card and parameter permitting the user to supply his authorization level for APF.

Loader: The Loader provides improved performance in a compile-load-go environment, compared to a normal compile link-edit, execution sequence. The Loader combines the basic editing and loading functions of the linkage editor with program loading (fetch) in the job step. It loads object modules provided by the compilers and load modules produced by the linkage editor directly into virtual storage.

VS2 Assembler: The VS2 Assembler allows users to write programs in S/370 Assembler Language. Assembler Language gives the user access to equipment functions and permits the user to obtain a balance between real storage usage and execution time of his program. Programs written in Assembler language normally require more coding effort than if written in a higher level language. The Assembler allows the user to generate and maintain VS2. Among the features supported by this assembler are:

- **Macro instructions** - The macro capability provided by the assembler is a powerful programming tool providing interfaces to the VS2 Input/Output Supervisor by means of Data Management macros, access to the complete VS2 capabilities through the use of Supervisor macros, and the ability to include programmer defined macros in assembler programs for special applications.
- **Conditional Assembly Statements** - Conditional assembly statements are used to alter the sequence in which statements are processed, or to specify selective assembly of instructions. The conditional assembler mechanism is a key element in the macro feature.
- **Private Libraries** - A private library may contain assembler language statements. These can be macro definitions or code that is to be inserted into the program by the **COPY** statement.
- **Dynamic Work Areas** - The assembler provides a mechanism for establishing addressability to independently allocated storage areas.

The VS2 Assembler is a compatible subset of the Assembler H Program Product, 5734-AS1, which is available under VS2.

Assembler System Requirements: The VS2 System Assembler uses the S/370 Standard Instruction Set. This assembler is designed to run more efficiently in 128K of virtual storage, and requires a minimum of 64K bytes of virtual storage. In addition to the standard VS2 requirements, the System Assembler requires space in auxiliary storage for system input data sets and three intermediate data sets for work storage. In MVS, virtual I/O may be used.

Depending on program requirements, additional data sets may be needed for Macro Definition library, print output, object module output, and punch output.

The VS2 Assembler provides extensions not found in OS/360 Assembler F such as: ... **SETC** values and character relation terms may be up to 255 characters in length (the old limit was 8 characters) ... Relaxed restrictions and extended functions for conditional assembler statements ... Three additional system variable symbols (**&SYSPARM**, **&SYSTEM**, and **&SYSDATE**) ... Extended mnemonics for RR-type branch instructions ... Improved diagnostics and debugging facilities ... Mnemonics for relocate and multiprocessing instructions.

System Utilities: These programs are used to maintain system control data at an organizational or system level to operate in pageable storage. The following functions are performed by the system utility programs.

IEHPROGM - modifies system control data and maintains data sets at an organizational level, scratch, rename, catalog data, etc.†

IEHMOVE - moves or copies logical collections of data.†

IEHLIST - lists system control data such as directory entries of partitioned data sets and VTOC entries.†

IEHDASDR - Initializes direct access volumes for use with the operating system and dumps data from and restores data to these volumes. Central and local service were discontinued January 22, 1981.

IEHINITT - Writes volume label sets in EBCDIC, in BCD, or in ASCII code on magnetic tapes.

IEHATLAS - Locates and assigns an alternate track to replace a defective track and copies usage records from the defective track to alternate track.

IFHSTATR - Selects, formats, and writes information from Type 21 (error statistics by volume) records.

Device Support Facilities - Initializes direct access storage volumes for use with the operating system, inspects count-key data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged defective, and analyzes the operational status of the 3350, 3375, 3380 and 3344 drives and the data and control paths. For the IBM 3340, 3344, 3350, 3375 and 3380, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. This aids the user in determining whether an error situation is drive or media related so the appropriate recovery procedures can be initiated. This utility is used to create a VTOC index when a volume is initialized on count-key-data devices. The building of an index over existing VTOCs may be done via this utility on systems that have the Data Facility/Device Support program product installed.

† Because the SVS system catalog is replaced by a VSAM master catalog in MVS, some IEHPROGM, IEHMOVE, and IEHLIST functions are replaced by Access Method Services or no longer supported.

With MVS, IEHUCAT provides the capability of updating an OS/MFT, MVT, VS1 and SVS catalog from a record of changes made to the MVS catalog. This program may be executed under SVS, OS/MVT, OS/MFT or VS1.

Access Method Services - The access method services multifunction service program for VSAM data sets is used to: Define a VSAM data set or catalog ... Convert a sequential or an indexed sequential data set to the VSAM format ... List VSAM catalog entries or records of a data set ... Copy a data set for reorganization ... Create a backup copy of a data set ... Make a data set portable from one operating system to another.

It can be invoked through an input job stream containing an Access Method Services command, by a processing program that passes it a command statement, or from a timesharing terminal.

In MVS, Access Method Services provides additional functions. It is also used to: Define and delete aliases for catalog names and non-VSAM data set names ... Support generation data groups (GDGs) ... Define and format paging data sets ... Convert an OS/MFT, MVT, VS1 and SVS catalog to an MVS catalog ... Move or copy a VSAM catalog ... Create the pointers in the master catalog to the OS control volume catalogs.

System Data Set Utilities: These programs reorganize, change or compare data at the data set and/or record level, and are required for the proper generation and maintenance of the system control program. The following general functions are performed by these utilities for non-VSAM data sets:

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

IEBCOPY - Copies, compresses, merges, loads, and unloads partitioned data sets.

IEBGENER - Copies a sequential data set or members of a partitioned data set, or converts a data set from sequential to partitioned organization.

IEBPTPCH - Prints or punches records residing in a sequential or partitioned data set.

IEBUPDTE - Updates a symbolic library

IEBEDIT - Produces an edited input job-stream data set from a master input job-stream data set

IEBTCRIN - Constructs records from input read from the 2495 Tape Cartridge Reader. Generation of a 2495 is required for the inclusion of the IEBTCRIN utility into the operating system.

IEBDG - Can create output data sets either with internally generated test data or externally supplied input. These data sets can be sequential, indexed sequential, or partitioned.

IEBCOMPR - Compares two identically organized sequential or partitioned data sets at the logical record level.

IEBISAM - Can copy, print, reorganize, load, or unload an indexed sequential data set.

IEBIMAGE - New 3800 Utility provides means for the user to create or modify and to store in **SYS1.IMAGELIB** Forms Control Buffer records, Copy Modification records, Graphic Character Modification Records, and Character Arrangement tables. Input to the Utility consists of simple control statements. User can specify for FCB records forms sizes, number of lines at each vertical spacing, and line positions for simulated channel control punches. For Copy Modification, control statements include the text and its position within each copy of the pages of a data set. Existing Copy Modification records can also be modified. Graphic Character Modification statements provide means for combining and naming groups of graphic characters, including any characters already in **SYS1.IMAGELIB**, and to assist in storing in the system new graphic characters of user's own design. Character Arrangement tables can be created or modified to print with different character sets, to include Graphic Character Modifications, and to assign data codes to graphics or to change existing assignments.

Independent Utilities: The following independent utilities do not operate with the VS2 control program, but they support VS2 with the following services:

IBCDASDI - Initializes Direct Access Volumes for use with VS2. Central and local service were discontinued on January 22, 1981.

ICAPRTBL - Performs stand-alone buffer loading for the IBM 3211 printer.

IBCDMPRS - Performs unloading and loading of data between DASD and a removable volume.

Device Support Facilities - Initializes direct access storage volumes for use with the operating system, inspects count-key data DASD volumes for defective tracks, conditionally reclaims tracks previously flagged defective, and analyzes the operational status of the 3344, 3350, 3375 and 3380 drives and the data and control paths. For the IBM 3340, 3344, 3375 and 3380, Device Support Facilities utilizes the skip displacement bytes in an attempt to recover a defective track before assigning an alternate. This utility is used to create a VTOC index when a volume is initialized on count-key-data devices. Device Support Facilities will utilize the SKIP Displacement bytes in an attempt to recover a defective track before assigning an alternate track for the IBM 3375 and IBM 3380 users. The MSS 3330 virtual volumes are supported by the **BUILDIX** command.

These independent utilities are not supported for the 3066 console.

Online Test Executive Program - OLTEP: The Online Test Executive Program (OLTEP) is a function designed to direct the selection, loading, and execution of the Online Test sections (OLT's) within the VS2 environment.

OLTEP with the related OLTs is designed to allow the testing of Input/Output Hardware components of a system, concurrent with the running of customer jobs.

The OLTEP/OLT system is designed for: Providing an interface with **RETAIN/370** ... Diagnosing I/O errors ... Verifying I/O hardware repairs and Engineering Changes ... Exercising a device requiring dynamic adjustments ... Checking I/O hardware ... Preserving integrity of customer data while testing.

As a job under VS2, it is called by standard Job Control Language and is under the control of the operating system at all times. It uses the facilities of VS2 to accomplish the testing and competes with other jobs in the system for use of these facilities when running in a multiprogramming environment.

Definition of test to be run can be entered via console or non-console devices.

Field Engineering supplies the OLTs and device configuration information to the customer on magnetic tape or cards. The Field Engineer reformats and link edits the OLTs into a partitioned data set so that they can be used under the operating system. Device configuration information is required for each device to be tested by OLTEP/OLTs.

The OLTEP interface to **RETAIN/370** provides the ability to transfer Diagnostic Test results to the **RETAIN/370** center and allows the **RETAIN/370** center to modify Diagnostic Test requests and options. The **RETAIN/370** interface is provided in OLTEP via the console.

OLTEP must normally be executed as a V=R job. The Logout Analysis program operates in virtual storage. Since use of OLTEP is now restricted by APF, all OLTEP programs must be online in protected system libraries.

OLTEP must normally be executed in a minimum of 76K bytes in MVS and 64K bytes in SVS as a V=R job. The logout analysis program will operate in the paged virtual storage.

Teleprocessing Online Test Executive Program - TOLTEP: (MVS Release 3)

An online test facility is provided for telecommunications networks under VTAM. See description in sales manual pages of the Virtual Telecommunications Access Method (VTAM) for information on TOLTEP.

SERVICE AIDS

Dynamic Support System (DSS) is no longer supported on OS/VS2 MVS and is deleted from the OS/VS2 MVS Release 3.8 distribution libraries.

Generalized Trace Facility (GTF) is a standard feature in the VS2 system. It is a program service that assists users in performing problem determination and diagnosis by tracing system events, user events, or both. GTF consists of two major functions, the Generalized Trace function and the Trace Edit function.

The Generalized Trace function is a system service that can be optionally started from the master console. It executes as a system task in a region. When the Generalized Trace function is started, the user also has the option of tracing internally in the GTF region or externally to a data set on an auxiliary device.

The GTF internal trace mode has been enhanced in MVS to include the full tracing selectivity and capability that previously existed only for external trace mode. Additionally, all GTF records may now be optionally formatted as part of an **ABEND/SNAP** dump. Dumps produced by **AMDSADMP** or other system dumping facilities also contain GTF trace data. Several types of system trace records have been added to support function in MVS.

The Trace Edit function is a feature of the **AMDPRDMP** service aid and provides the user with a selective data reduction capability for the trace data set or formats GTF trace data from a storage dump produced by **AMDSADMP** or the **SYS1.DUMP** data set. It runs as a problem program and can be invoked via JCL.

AMAPTFL - This program aids in the application of a PTF to the system by producing the JCL statements that are required for the proper application of the temporary fix. When a PTF is to be applied to a module, the user supplies distribution library module name and status and level information for each CSECT being modified. The program then either produces the necessary Job Control Language statements for application of the PTF; or, if specified, dynamically invokes the linkage editor to update the operating system. The program executes in the paged section of processor storage.

AMBLIST - This Linkage Editor service aid program produces various formatted listings which may be used for system serviceability and diagnostic purposes. Depending on options specified on **AMBLIST** control statements, the following listings may be produced:

- Formatted load module listings.
- Formatted object module listing.
- Map of System link pack area.
- Load module map and cross-reference listings.
- Map and cross-reference listings of the system nucleus.
- The data stored in the CSECT Identification records of load modules.
- Load module map and cross-reference listings showing addresses relocated relative to a user-supplied address.
- Load module summary data including entry point address, APF access code, module attributes, and the contents of the module's System Status Index.
- Program modifications to a load module library.

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

The minimum virtual storage requirement for AMBLIST is 64K bytes.

AMASPZAP - This service aid program assists authorized personnel to:

Inspect and modify instructions and data in any load module that exists as a member of a partitioned data set.

Inspect and modify data in a specific data record that exists in a direct access data set.

Dump an entire data set, a specific member of a partitioned data set, or any portion of a data set residing on a direct access device.

AMDSADMP - This service aid is a macro instruction that allows the user to generate a stand-alone dump program that is specifically tailored to his needs. AMDSADMP can generate two types of dump programs: one high-speed, the other low-speed. The high-speed version can write the control registers, contents of real storage, and selected portions of paged out storage onto a tape volume in large blocks. The low-speed version can write the control registers and the contents of real storage to a printer or tape volume in unblocked, printable format.

AMDPRDMP - This service aid program formats and prints dump data sets produced by AMDSADMP and other system programs. The dump data sets may contain dumped real or virtual storage.

Selective printing and formatting of the dump data sets is completely controlled by the user of AMDPRDMP via control statements. The **SUMMARY** control statement in MVS may be used to obtain the following: A synopsis of the storage ranges contained in the dump data set ... A summary of the status of the system as the dump data set shows it.

The user may use this information to determine what further formatting is required and he proceeds to get the required formatting by selecting the proper AMDPRDMP control statements.

An interface is provided whereby the user may write formatting modules to do additional (user tailored) formatting during AMDPRDMP execution.

In MVS Release 3, the Fast Dump Scan facility is added which allows the user to scan a storage dump (SVC Dump or Standalone Dump) from any TSO terminal (via the **CALL** subcommand) or the master console.

To use fast dump scan, the user executes AMDPRDMP. A new verb, **DISPLAY** (and subverbs **LIST**, **HARDCOPY**, **EQUATE**, **COMMENT**, **RETURN**), is used to display up to 256 storage locations starting at a specified hex or symbolic virtual storage address.

IMCOSJQD - This service aid produces a formatted copy of the contents of the job queue data set. This program operates as a problem program under the SVS control program. It is not supported in MVS. The stand-alone job queue dump program (IMCJQDMP) is not supported in VS2.

IFCEREPO - Edits and lists error environment records including software records with MVS.

IFCDIPOO - Reinitializes the system data set, **SYS1.LOGREC**.

HMASMP - This program is used for the application of Program Temporary Fixes (PTFs) prepared in the new Systems Modification Program format. It is designed to improve the quality and reliability of the support process by recording the status of the system so that modifications will not be applied where inappropriate. Also, updating will be easier since libraries, modules, macros, and PTFs can all be updated and applied via one programming procedure.

Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DASD error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to **SYSPRINT**.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system. Central and local service were discontinued on January 22, 1981.

Display Exception Monitoring Facility: The Display Exception Monitoring Facility (DEMF), Selectable Unit (SU) 68 for MVS, component release UY99958 for SVS, is a serviceability aid which offers users of 3270 Information Display System in local or BSC mode assistance in locating a hardware problem in a communication network. In remote mode, the 3270 must communicate through a 270X or 370X in EP mode.

DEMF is logically composed of two tasks: a logging function and a display function. The logging function runs as a system task under SVS or MVS. It is passed communication error records created for the **SYS1.LOGREC** data set. The display function is a component that runs under **TCAM**, **CICS/VS**, or **IMS/VS**. It presents a structured display of errors accumulated by the logging function at the user request.

Program Products: There are a large number of program products which may be ordered to support OS/VS. The program product section of the sales manual should be referenced for more information and ordering instructions.

Current System Programs (CSP) Under OS/VS: Type I CSPs, such as Sort and the Language Compilers, are not distributed as part of the OS/VS SCP. Those wishing to continue using them may transfer them over from their OS Release 21.8 or later system. If the CSP is on a DASD device accessible to a VS system, then the VS systems **SYS1.PROCLIB** need only be updated to include the CSPs cataloged procedures. These procedures should contain a **JOBLIB** or **STEPLIB DD** card referencing the data set containing the CSP. If the CSPs reside on a DASD device not accessible to VS, then they should be copied to one with the IBM Utility **IEBCOPY**. The VS System's **SYS1.PROCLIB** should be updated accordingly.

Those customers not on OS Release 21.8 must order this or a later release of the OS DLIBs. They would then perform a processor only **SYSGEN** as described in the *OS System Generation Guide* (GC28-6554). In so doing, the CSP target library and the procedural library should be one accessible by the VS system.

Ordering instructions for the Release 21.8 DLIBs are the same as for Release 21.7, which are available in the Release 21.7 Guide (GC28-6730)

Please note that the following programs and program products which were announced for SVS are not supported on MVS (i.e., APARS against these programs running on MVS will not be accepted).

Program Name	Program Number
	360A-CX-42X,
CALL/OS	44X,45X,46X
COBOL F	360S-CB-524
COBOL F Library	360S-LM-525
Full ANS COBOL V2	360S-CB-545
Full ANS COBOL V2 Library	360S-LM-546
FORTRAN G	360S-FO-520
FORTRAN H	360S-FO-500
FORTRAN G & H Library	360S-LM-501
PL/I F	360S-NL-511
PL/I F Library	360S-LM-512
PL/I F Syntax Checker	360S-PL-552
Sort/Merge	360S-SM-023

Even though the above Type I language compilers are not supported under MVS, generated object code for customers programs using any of these higher-level Type I languages, together with the relevant library modules, will operate on the current release of MVS subject to the constraints outlined in the *Introduction to OS/VS2 Release 2* (GC28-0661). Further, if that object code (with relevant object modules) runs on MVT Release 21.8 or a previous release of VS2 but does not function with the current release of MVS, an APAR will be accepted against MVS. Verification of the defect is the responsibility of the local CE programming systems representative, who will submit the APAR to the SCP location.

SPECIFIED OPERATING ENVIRONMENT

HARDWARE REQUIREMENTS

System Configuration: SVS supports S/370 mdls 145, 158, 168, 155II, and 165II and the 3031, 3032 and 3033 Processors. The 158MP and 168MP processors are supported in uniprocessor mode (8 megabyte maximum). Real storage requirements for SVS are:

384K	Minimum concurrent batch and reader/writer.
512K	Minimum concurrent batch, reader/writer, and TSO or Minimum ASP Support Processor.
768K	Normally considered for concurrent batch, TSO, HASP.
1,024K	Normally considered for ASP Support Processor with local main.

MVS supports S/370 mdls 145, 158, 168, 155II, 165II, 158AP, 168AP, 158MP, and 168MP and the 3031, 3031AP, 3032 and 3033 Processors. Real storage requirements for MVS are:

768K	JES2 design entry - not a production system.
1,024K	JES3 design entry - not a production system.
2,048K	Normally considered for a batch production system.
3,072K	Normally considered for a batch and TSO or batch and IMS/VS production system.
4,096K	Normally considered for a batch, TSO and IMS/VS production system.

The recommended storage requirements for MVS production systems are guidelines only. Benchmarks or customer performance evaluation runs should be utilized as required.

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

MINIMUM VS2 CONFIGURATION

The minimum configuration required for VS2 operation or SYSGEN is:

- S/370 3145, 3155II, 3158, 3158AP, 3158MP, 3165II, 3168, 3168AP, 3168MP, 3031, 3031AP, 3032, or 3033 Processor. The 3145 requires the clock comparator and Processor timer feature (#2001), the advanced control program support feature (#001) and floating point feature (#3910).
- 384K bytes of available real storage for SVS or 768K bytes of available real storage for MVS.
- A multiplexer channel.
- A selector or byte multiplexer channel.
- SVS; Three 3330/3333, three 3340, (with 3348 mdl 70 Data Modules) or four 3340 (with 3348 mdl 35 Data Modules) DASD spindles plus any additional online DASD capacity necessary to meet customers operational needs.
- MVS; Five 3340 (with mdl 70 Data Modules) or four 3330/3333 DASD spindles plus any additional online DASD capacity necessary to meet customers operational needs. The minimum spindle requirement for 3330/3333 mdl 11 is four. The 3340 requirements may be satisfied by 3344 volumes if the starter system address requirements are met. The 3330/3333 requirements (all models) may be satisfied by 3350 spindles in the equivalent compatibility mode. Starter system and library tapes which restore to the 3350 in native mode or 2314 are not provided. The user with 3350 DASD only must satisfy the 3330/3333 requirements above with 3350 spindles in 3330 compatibility mode with one exception. The target device for the new system being generated may be a 3350 in native mode if the starter system address requirement for 3350 is met.
- A SYSIN device (card reader or tape).
- A SYSOUT printer (printer or tape).
- A SYSOUT punch (punch or tape).
- A console
- A 9-track 1600 bpi tape drive.*

* Distribution of the SCP, component releases, emulator SCPs and PTFs are made on a 9-track 1600 bpi tape; therefore, a 9-track tape on the system or access to another system meeting the minimum configuration requirements and having a 9-track tape at the customer installation is required for system generation and maintenance. Note - a tape drive is also recommended for the output from a high speed stand-alone dump program (AMDSADMP). This may be the same drive used for generation and maintenance.

If TCAM/VTAM/BTAM is specified, at least one transmission control unit or communications controller is required for operation of remote terminals (VTAM requires a 3704/3705-I/3705-II in network control mode).

SYSTEM GENERATION

This is the process of preparing a specially tailored operating system to match the machine configuration and operating system options selected by the user. This process uses either the VS2 starter system or the user's current operational VS2 system (assuming the system generation is for the same release as the operational VS2 system) and requires the following programs: Control Program ... Data Management, Date Set Control, BSAM, QSAM, BPAM ... Assembler ... Linkage Editor ... Utilities.

PID distributes on 9-track 1600 bpi tape for 2314/2319 (Not available for MVS) or 3330/3333 mdl 11, or 3340 residence the required libraries (Partitioned Data Sets) which contain the Operating System modules the system generation macro instructions need for the system generation process when VS2 is ordered. The inclusion of JES into VS2 is accomplished via an additional generation phase which requires a card reader. The same system requirements are required for maintenance as for generation since some changes may require a full or partial system generation.

Tables showing the device supported, the system functions for which they may be used, and the three character address assigned to each of the units for the Starter System can be found in:

OS/VS2 System Generation Reference GC26-3792
OS/VS2 Release 2 Guide GC28-0671

Feature Support: The following features are supported by VS2. Other features, not listed, have no specific programming support; their existence is ignored by the control program. Attempts to use VS2 with unsupported features may cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device.

OPTIONAL PROCESSOR FEATURES SUPPORTED

Feature	S/370					
	145	148	155II	158	165II	168
Advanced Control Program Support	1001	STD	STD	STD	STD	STD
Conditional Swapping	1051	**	STD	STD	STD	STD
Block Multiplexer Channel	1421-4	STD	1433-5	1433-5	N/A	N/A
Buffer Expansion Channel-to-Channel	N/A	N/A	N/A	N/A	1432	1435
Clock Comparator and processor Timer	1850	1850	1850	1850	N/A	N/A
Direct Control	2001	STD	STD	STD	STD	STD
Extended Precision Floating Point	3274	3274	3274	3274	N/A	N/A
Extended Channels	3910	STD	3700	3700	STD	STD
1401/1440/1460 Compatibility	N/A	N/A	N/A	N/A	3850	3855
1401,1410/7010 Compatibility	4457	4457	3950	3950	N/A	N/A
High Speed Multiply	4458	4458	3950	3950	N/A	N/A
Integrated Storage Controls	N/A	N/A	N/A	N/A	4520	4525
Multiplexer Subchannels, Additional	4660*†	4660	N/A	4650	N/A	4650
2nd Byte Multiplexer Channel	4951-4	4953	N/A	N/A	N/A	N/A
OS/DOS Compatibility	N/A	N/A	4990	4990	N/A	N/A
Selector Channel 7070/7074	STD	STD	5450	5450	N/A	N/A
Compatibility 7080	6982-4	N/A	N/A	N/A	N/A	N/A
Compatibility 709/7090/7094II	N/A	N/A	7117	7117	7117	7127
Staging Adapter for ISC	N/A	N/A	N/A	N/A	7118	7128
3213 Printer Attachment	N/A	N/A	N/A	7840	N/A	N/A
3210 Adapter	7844-5	N/A	7844-5	N/A	N/A	N/A
3215 Adapter	7855	N/A	7855	N/A	N/A	N/A
Two Channel Switch for ISC	8100*	8100	N/A	7905	N/A	7905
Word Buffer	8810	STD	N/A	N/A	N/A	N/A

* 3345 mdls 3, 4, 5 available on the 145.

** This instruction is part of Advanced Program Control Support.

† Supported only with SVS.

3031, 3032 and 3033 Processors

Feature	3031	3032	3033
Block Multiplexer Channel	STD	STD	STD
Extended Precision Floating Point	STD	STD	STD
Multiplexor Subchannels	STD	STD	STD
Two-byte Interface	N/A	7850	7850
Extended Channels	N/A	3850	3850*
Channel-to Channel (First)	1850	1850	1850
Clock Comparator	STD	STD	STD
Adv. Control Processor Support	STD	STD	STD

* 3851 on 3033 Processor Model Group N and 3033 Processor Model Group S

I/O FEATURES

1052 Printer - Keyboard (see VTAM, TCAM and BTAM Terminals Supported)

1275 Optical Reader Sorter (mdls 1, 2, 4):
Required: #2925 - Expanded Capability
#9185 - Dual Address

1287 Optical Reader (mdls 1,2,3,4,5):
Supported: #3850 - Expanded Symbol Set
#3945 - Farrington 7B Font
#4470 - 1428 and ANSCS OCR Font
#5300 - NCR Optical Type Font (mdls 2, 4 only)

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

	#5370 - Numeric Handwriting	Not Supported:	More than 2 paths to a device from one Processor with MVS Release 2.
	#5479 - Optical Mark Reading		
1288 Optical Page Reader (mdl 1):		2860 Selector Channel (mdls 1,2,3):	
Supported:	#5370 - Numeric Handwriting	Supported:	#1850 - Channel-to-Channel Adapter (Available with MVS; for SVS support, see ASP)
	#5479 - Optical Mark Reading		
1403 Printer (mdls 2,3,7,N1):		2870 Multiplexer Channel:	
Supported:	#8640 - Universal Character Set	Not Supported:	Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer subchannel. Magnetic tapes are supported on the selector subchannels.
	#8641 - Universal Character Set		Cross channel devices (2804 Tape Control, 2816 Switching Unit, 3803 Tape Control with communicator feature and either 2-control switch 3-control switch or 4-control switch, 3803 Tape Control with 8100 Two-Channel Switch) attached between any 2780 selector subchannel and any other selector channel or between any 2780 selector subchannel and a selector subchannel of a different 2870.
1419 Magnetic Character Reader (mdl 1):			
Supported:	#1445 - Batch Numbering (requires 3800 Expanded Capability and 7730 Dual Address)		
	#5739,5741 - Program Control for Pocket Lights		
1443 Printer (mdl N1):			
Supported:	#5558 - 24 Additional Print Positions.		
2150 Console			
2250 Display Unit (mdls 1, 3)			
2260 Display Station (see VTAM, TCAM and BTAM Terminals Supported)			
2305 Fixed Head Storage (mdls 1,2):		2880 Block Multiplexer Channel (mdls 1, 2):	
Required:	#2835 Storage Control	Supported:	#7850, #7851 - Two-Byte Interface
2314 Direct Access Storage Facility (mdl A1):		3036 Console	
Supported:	#8170 - Two-Channel Switch	3066 System Console (mdl 1)	
2319 Disk Storage		3088 Multisystem Channel Communication Unit (mdls 1, 2)	
2400 Magnetic Tape Unit and Control:		3158 Console Function	
Required:	#2803 Tape Control (mdl 2)	3210 Console Function	
Supported:	#3471, 3472 - Dual Density (800 - 1600 bpi)	3211 Printer (mdl 1):	
2401 Magnetic Tape Unit (mdls 1,2,3,4,5,6)		Required:	3811 Printer Control Unit
2420 Magnetic Tape Unit (mdls 5,7)		Supported:	#5554 - 18 Additional Print Positions
2495 Tape Cartridge Reader			
2501 Card Reader (mdls B1,B2):		3213 Console Printer	
Supported:	#1531 - Card Image	3215 Console Printer-Keyboard	
2520 Card Read Punch (mdls A1,B1):		3262 Printer (mdl 5) (supported as a 4248)	
Supported:	#1531 - Card Image	3275 Display Station (mdls 1, 2) (See VTAM, TCAM and BTAM Terminals Supported)	
2520 Card Punch (mdls A2,A3,B2,B3):		3284 Printer (mdls 1, 2)	
Supported:	#1531 - Card Image	3286 Printer (mdls 1, 2)	
2540 Card Read Punch (mdl 1):		3288 Printer (mdl 2) (supported as a 3286-2)	
Supported:	#1531 - Card Image	3277 Display Station (mdls 1, 2) (see VTAM, TCAM and BTAM Terminals Supported)	
2671 Paper Tape Reader		3330 Disk Storage (mdls 1,2,11):	
2803 Tape Control (mdls 1, 2, 3):		Required:	3333 Disk Storage and Control, or 3830 Storage Control
Required:	#3228 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended)		
Supported:	#7125,7127,7135 - 7-track Compatibility	3333 Disk Storage and Control (mdls 1,11):	
	#7185 - 16 Drive Addressing	Supported:	#8150 - String Switch
	#7900 - 2420 Attachment (2803 mdl 2 only)	3340 Direct Access Storage (mdls A2,B1,B2):	
		Required:	3340 mdl A2
		Supported:	#6201,6202 - Rotational Position Sensing
			#8150 - String Switch
2804 Tape Control (mdls 1, 2, 3):		3344 Direct Access Storage (mdls B2,B2F)	
Required:	#3236 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended)	3350 Direct Access Storage Facility (mdls A2,A2F,B2,B2F,C2,C2F):	
Supported:	#7126,7128,7136 - 7-track compatibility	Supported:	#8150 - String Switch
2816 Switching Unit (mdl 1):		3375 Direct Access Storage (mdls A1, B1)	
Supported:	1050-1052,1055,2285,2286,4455,6392,6393 - Additional Switching	Supported:	#8150 - String Switch
		Required:	3880 Storage Control mdl 1 or 2
2821 Control Unit (mdls 1,2,3,5,6):		3380 Direct Access Storage (mdls A4,AA4,and B4.	
Supported:	#1990 - Column Binary (for problem program use only)	Supported:	#8150 - String Switch
	#8637-#8639 - Universal Character Set Adapter	Required:	3880 Storage Control mdl 2 or 3
2844 Auxiliary Storage Control:		3410 Magnetic Tape Unit (mdls 1,2,3):	
Supported:	#8171 - Two Channel Switch	Supported:	#3211 - Single Density
			#3221 - Dual Density
			#6550 - Seven-Track Tape Unit
			#7360 - S/360/370 Attachment
		3411 Magnetic Tape Unit and Control (mdls 1,2,3):	
		Supported:	#3211 - Single Density
			#3221 - Dual Density
			#6550 - Seven-Track Tape Unit
			#7360 - S/370 Attachment

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

3420 Magnetic Tape Unit (mdls 3,5,7):
 Supported: #3550 - Dual Density
 #6407 - 7-track
 #6631 - Single Density

3420 Magnetic Tape Unit (mdls 4,6,8):
 Supported: #6420 - 6250 Density
 #6425 - 6250/1600 Density

3505 Card Reader (mdls B1,B2):
 Supported: #5450 - Optical Mark Read
 #6555 - Selective Stacker

3525 Card Punch (mdls P1,P2,P3):
 Supported: #1533 - Card Read
 #5272 - Multiple Card Print
 #8338 - Two-Line Card Print

3540 Diskette Input/Output Unit (mdls B1, B2)

3800 Printing Subsystem (mdl 1):
 Supported: #1490 - Burster-TrimmedStacker
 #5401 - 127 Character Generation
 Storage Positions
 #8170 - Two Channel Switch

3803 Tape Control (mdl 1):
 Supported: #1792 - Two-Control Switch
 #1793 - Three-Control Switch
 #1794 - Four-Control Switch
 #3551 - Dual Density
 #6408 - Seven-Track
 #9071 - Communicator 1-2
 #9073 - Communicator 3-4

3803 Tape Control (mdl 2):
 Supported: #1792 - Two-Control Switch
 #1793 - Three-Control Switch
 #1794 - Four-Control Switch
 #5310 - Nine-Track NRZI
 #6320 - Seven-Track NRZI
 #8100 - Two-Channel Switch
 #9071 - Communicator 1-2
 #9073 - Communicator 3-4

3811 Printer Control Unit (mdls 1,2):
 Supported: #5553 - Additional (18) Print Positions

3830 Storage Control (mdls 1,2):
 Supported: #8170 - Two-Channel Switch
 #8171 - Two-Channel Switch,
 Additional
 Not Supported: More than 2 paths to a device from
 one Processor with MVS Release 2

3830 Storage Control (mdl 3):
 Supported: #8170 - Two-Channel Switch
 #8171 - Two-Channel Switch,
 Additional

3851 Mass Storage Facility (mdls A1,A2,A3,A4,B1,B2,B3,B4):
 Supported: #8171,8172 - Two Channel switch,
 additional
 #4901,4902 - MSC Port

3880 Storage Control (mdls 1, 2, 3)
 Supported: #8170 - Two-Channel Switch Pair
 #8171 - Two-Channel Switch Pair,
 Additional
 #8172 - Eight-Channel Switch feature
 (requires #8170 and #8171)
 #6550 - Speed Matching Buffer for
 3380
 #6560 - Speed Matching Buffer for
 3375
 Not Supported: More than 2 paths to a device from
 one Processor with MVS Release 2.

3880 Storage Control (mdls B13, D13)
 Supported: #8170 - Two-Channel Switch Pair
 #8171 - Two-Channel Switch Pair,
 Additional

3880 Storage Control (mdl D11)
 Supported: #8170 - Two-Channel Switch Pair
 #8171 - Two-Channel Switch Pair,
 Additional

3886 Optical Character Reader (mdl 1):
 Supported: #3210 - Additional Data Storage
 #4610 - Additional Instruction
 Storage
 #4720 - Line Marking
 #5360 - Numeric Handprinting
 #6450 - Serial Numbering

Not Supported: The 3886 is not supported by SVS.

3890 Document Processor (mdls A1,A2,A3,A4,A5,A6):
 Supported: #5111 - Microfilming
 #4666 - Item Number/Endorsing

4245 Printer mdl 1

4248 Printer mdl 001
 Supported: #3157 - Additional (36) Print Positions

SVS DEVICE SUPPORT

The SVS Device Support Chart shows all devices that are supported by SVS for systems functions and/or non-TP access methods. (For other telecommunications devices see VTAM, TCAM and BTAM Terminals Supported). The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under SVS and their existence is not recognized by the control program.

Notes:

- 1) BSAM (device-dependent only).
- 2) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
- 3) The Selective Tape Listing feature is not supported.
- 4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
- 5) DIDOCS supported.
- 6) Multiple Requesting supported.
- 7) File Scan not supported.
- 8) Rotational Position Sensing support (optional feature on 3340).
- 9) For message queues under TCAM.
- 10) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
- 11) Supported for read or punch, but not both simultaneously.
- 12) For use with the VS2 Output Writer; not for system messages.
- 13) Punch Feed Read is not supported.
- 14) The 3540 is supported by the VS2 Diskette Copy Programming Support.
- 15) QSAM (device-dependent only).

Legend:

- C = Console
- G = Graphic Programming Support
- S = Sequential Access Method
- I = Indexed Sequential Access Method
- P = Basic Partitioned Access Method
- D = Basic Direct Access Method
- A = Virtual Storage Access Method
- X = Function Supported



SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

MVS DEVICE SUPPORT CHART

I/O Unit Support: The following units to a maximum of 1,023 devices are supported at the MVS Release 3.7 level and a maximum of 1,917 devices are supported at the MVS Release 3.8 level by the Operating System, for the indicated function:

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1275 Optical Reader								X1	
1287 Optical Reader								X2	
1288 Optical Page Reader								X1	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X1	
1443 Printer						X4		X	
2305-1 Fixed Head Storage (Notes 6, 7, 20)	X8	X8,9		X	X8			X8	X8
2305-2 Fixed Head Storage (Notes 6,7)	X8	X8,9		X	X8			X8	X8
2314 Direct Access Storage Facility (Notes 7,10)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2501 Card Reader						X4		X	
2520 Card Read Punch	X12		X12,13			X4		X12	
2520 Card Punch			X13			X4		X	
2540 Card Read Punch	X14		X13,14			X4		X	
3036 Console						X5			
3066 System Console						X5			
3158 Console Function						X5			
3203-5 Printer (Note 21)			X			X4		X	
3210 Console Printer-Keyboard						X			
3211 Printer			X			X4		X	
3213 Console Printer						X			
3215 Console Printer-Keyboard						X			
3251 Display Station (Note 24)						X5	X		
3262-5 Printer			X			X4		X	
3275 Display Station	X					X5			
3276 (Supported as a 3277)	X					X5			
3277 Display Station	X					X5			
3278 (Supported as a 3277)	X					X5			
3284 Printer						X4			
3286 Printer						X4			
3288 Line Printer						X4			
3330 Disk Storage (Notes 7,10)	X8	X8		X8	X			X8	X8
3333 Disk Storage and Control (Notes 7,10)	X8	X8		X8	X			X8	X8
3340 Direct Access Storage Facility (Notes 7,10)	X8	X8		X8	X8			X8	X8
3344 Direct Access Storage (Notes 7,10)	X8	X8		X8	X8			X8	X8
3350 Direct Access Storage (Notes 7,10)	X8	X8		X8	X8			X8	X8
3375 Direct Access Storage (Notes 7, 22, 23)	X8	X8		X8	X8			X8	X8
3380 Direct Access Storage (Notes 7, 22, 23)	X8	X8		X8	X8			X8	X8
3410 Magnetic Tape Unit	X		X						
3411 Magnetic Tape Unit and Control	X		X						
3420 Magnetic Tape Unit	X		X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X12		X12,13			X4		X	
3800 Printing Subsystem			X					X	
3838 Array Processor (Note 25)		X							
3851 Mass Storage Facility (Note 16)	X17				X17,18			X17	X17
3886 Optical Character Reader								X1	
3890 Document Processor								X19	
4245 Printer			X			X4		X	
4248 Printer			X			X4		X	

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

MVS Device Support: The *MVS Device Support Chart* shows all devices that are supported by MVS for systems functions and/or non-TP access methods. For additional devices supported for system functions and/or non-TP access methods, see *MVS/370 Data Facility Product (5665-295)* program product. (For other telecommunications devices see *VTAM, TCAM and BTAM Terminals Supported*). The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under MVS and their existence is not recognized by the control program.

Notes

- 1) BSAM (device-dependent only).
- 2) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
- 3) The Selective Tape Listing feature is not supported.
- 4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
- 5) DIDOCS supported.
- 6) Multiple Requesting supported.
- 7) File Scan not supported.
- 8) Rotational Position Sensing support (optional feature on 3340).
- 9) Not supported by JES3.
- 10) For message queues under TCAM.
- 11) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
- 12) Supported for read or punch, but not both simultaneously.
- 13) For use with the VS2 Output Writer; not for system messages.
- 14) Punch Feed Read is not supported.
- 15) The 3540 is supported by the VS2 Diskette Copy Programming Support. SYSIN/SYSOUT support is provided by the Diskette Reader program and Diskette Writer program with JES2/JES3.
- 16) Support shown is for 3330s or 3333s as virtual device types. If real 3330/3333s are included as part of 3851, see the 3330/3333 lines above.
- 17) With 3330/3333 as staging device, Rotational Position Sensing supported.
- 18) User Program Libraries only.
- 19) QSAM (device-dependent only).
- 20) Supported on Models 165II, 168 and the 3033 Processor only.
- 21) Supported on Release 3.8.
- 22) Requires OS/VS2 MVS Data Facility/Device Support program product (5740-AM7).
- 23) For message queues under TCAM, requires the ACF/TCAM Version 2 Release 3 program product (5735-RC3).
- 24) Must be SYSGENed as 2250-3.
- 25) Requires Vector Processing Subsystem (VPSS) (5744-CK1).

Legend:

- C = Console
- G = Graphic Programming Support
- S = Sequential Access Method
- I = Indexed Sequential Access Method
- P = Basic Partitioned Access Method
- D = Basic Direct Access Method
- A = Virtual Storage Access Method
- X = Function Supported

VTAM, TCAM and BTAM TERMINALS SUPPORTED

VTAM, TCAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, TCAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does(do) support the terminal/feature is(are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by VTAM, TCAM or BTAM may also function satisfactorily with VTAM, TCAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact

that any changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT

Terminals and Terminal Features

SS LINES:

IBM TERMINALS

- 1030 Data Collection System on nonswitched lines: (TCAM,BTAM)
 - 1031 Input Station (mdls A1,A2,A3,A4,A5,A6,A7):
 - Supported: Attachment of 1031,1033,1034, 1035
 - 1031 Input Station (mdls B1,B2,B3,B4,B5,B6,B7):
 - Supported: Attachment of 1035
 - 1035 Badge Reader
 - 1033 Printer
 - 1034 Card Punch
 - 1035 Badge Reader
- 1050 Data Communication System on switched or nonswitched lines:
 - 1051 Control Unit (mdls 1,2):
 - Supported: Attachment of 1052,1053,1054, 1055,1056,1057,1058,1092, 1093
 - #1313 - Automatic EOB
 - #4795 - Line Correction
 - #4796 - Line Correction Release
 - #5465 - Open Line Detection
 - #6100 - Receive Interrupt
 - #9698 - Text Time-Out Suppression
 - #9700 - Transmit Interrupt
 - 1052 Printer-Keyboard (mdls 1,2):
 - Supported: #1313 - Automatic EOB
 - 9567,9597 - PTTC/BCD Code
 - #9571,#9591 - PTTC/EBCD Code
 - 1053 Printer (mdl 1):
 - Supported: #9567,9597 - PTTC/BCD Code
 - #9571,9591 - PTTC/EBCD Code
 - 1054 Paper Tape Reader (mdl 1)
 - 1055 Paper Tape Punch (mdl 1)
 - 1056 Card Reader (mdls 1,3)
 - 1057 Card Punch (mdl 1)
 - 1058 Printing Card Punch (mdls 1,2)
- 2848 Display Control (mdls 1,2,3) on nonswitched lines: (TCAM,BTAM)
 - Supported: Attachment of 2260,1053
 - #3901 - Extended Cursor Control
 - #4787 - Line Addressing
 - #5340 - Non-Destructive Cursor
 - #5341 - Non-Destructive Cursor Adapter
 - Not Supported: Attachment of 1053 (TCAM)
 - 2260 Display Station (mdls 1,2):
 - Supported: #3606 - Extended Cursor Control
 - Alphameric Keyboard
 - #4766 - Alphameric Keyboard
 - Tab feature of 3606
 - Not Supported: Attachment of 1053 (TCAM)
 - 1053 Printer (mdl 4): (BTAM)
 - Supported: #9567,#9597 - PTTC/BCD Code
 - #9571,#9591 - PTTC/EBCD Code
- 2845 Display Control (mdl 1) on nonswitched lines: (TCAM,BTAM)
 - Supported: Attachment of 2265,1053
 - #3301 - Destructive Cursor
 - #4801 - Line Addressing
 - Attachment of 1053 (TCAM)
 - #7801 - Tab
 - Not Supported
 - 2265 Display Station (mdl 1):
 - Supported: #4766 - Alphameric Keyboard
 - 1053 Printer (mdl 4): (BTAM)
 - Supported: #9567,#9597 - PTTC/BCD Code
 - #9571,#9591 - PTTC/EBCD Code
- 2740 Communication Terminal (mdl 1) on switched or nonswitched lines:
 - Supported: #3255 - Dial Up
 - #6114 - Record Checking
 - #7479 - Station Control
 - #8028 - Transmit Control
 - #8301 - 2760 Attachment (TCAM, BTAM)
 - #9567,#9597 - PTTC/BCD Code
 - #9571,9591 - PTTC/EBCD Code
 - Correspondence Code

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

2740 Communication Terminal (mdl 2) on nonswitched lines:
 Supported: #1495,1496 - Buffer Expansion
 #1499 - Buffer Receive
 #6114 - Record Checking
 #9571, #9591 - PTTC/EBCD Code

2741 Communication Terminal (mdl 1) on switched or nonswitched lines:
 Supported: #3255 - Dial Up
 #4708 - Receive Interrupt
 #7900 - Transmit Interrupt
 #9567, #9597 - PTTC/BCD Code
 #9571, #9591 - PTTC/EBCD Code
 Correspondence Code

2760 Optical Image Unit (mdl 1) on switched or nonswitched lines (TCAM, BTAM)
 Required: In the 2740-1: #6114 Record Checking and 8301 - 2760 Attachment

3100 Display Terminal (mdls 10, 12, 13, 20, 23) on switched lines 110-1200 bps: (TCAM, VTAM)

3232 Keyboard Printer (mdl 51) on switched or nonswitched lines.

3767 Communication Terminal (mdls 1,2) (supported as a 2740-1) on switched or nonswitched lines:
 Required: #7111 - 2740-1 Start/Stop
 Supported: #9560 - Station Control

3767 Communication Terminal (mdls 1,2,3) (supported as a 2740-2) on nonswitched lines:
 Required: #7112 - 2740-2 Start/Stop

3767 Communication Terminal (mdls 1,2) (supported as a 2741) on switched or nonswitched lines:
 Required: #7113 - 2741 Start/Stop

5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines:
 Required: #1525 - Communications Adapter

6733 Typewriter Communication Module (supported as a CPT-TWX 33/35) on switched and nonswitched lines at 110, 150, 300, and 1200 bps (BTAM, ACF/TCAM, ACF/VTAM)

CMCST (Communicating Magnetic Card Selectric® Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:
 Supported: The CMCST is functionally equivalent to a 2741 with Dial UP, Receive Interrupt and Transmit Interrupt

IBM PROCESSORS AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

System/7 (supported as a 2740-1 with checking) on switched or nonswitched lines:
 Required: #1610 - Asynchronous Communication Control

Non-IBM TERMINALS

AT&T 83B3 Line Control Type on nonswitched lines

CPT-TWX (mdl 33/35) Line Control Type on switched lines

World Trade Telegraph on nonswitched lines

WU 115A Line Control Type on nonswitched lines

BSC LINES:

IBM TERMINALS

2790 Data Communication System on switched or nonswitched lines: (TCAM, BTAM)

2715 Transmission Control Unit (mdl 1 and 2):
 Required: 2740
 Supported: Attachment of 2798, 1035, 1053, 2740
 #3801 - Expanded Capability
 #4850 - Local 2740 Adapter
 #9401 - Point-to-point Nonswitched
 #9402 - Point-to-point Switched
 #9403 - Multipoint Nonswitched

2740 Communication Terminal (mdl 1)
 2798 Guidance Display Unit (mdl 1)

1035 Badge Reader (mdl 1)
 1053 Printer (mdl 1)

2770 Data Communication System on switched or nonswitched lines:
 2772 Multipurpose Control Unit:

Required: #5010 - Multipoint Data Link Control (VTAM)
 Supported: Attachment of 0050, 0545, 1017, 1018, 1053, 1255, 2203, 2213, 2265, - 2502, 5496
 #1340 - Automatic Answering
 #1490 - Buffer Expansion (256 bytes)
 #1491 - Buffer Expansion Additional (512 bytes)
 #1910 - Conversational Mode
 #3250 - Display Format Control
 #3650 - EBCDIC Transparency
 #3860 - 144 Character Print Line
 #4610 - Identification
 #4690 - Keyboard Correction
 #5010 - Multipoint Data Link Control (TCAM, BTAM)
 #5890 - Horizontal Format Control
 #6555 - Space Compression/Expansion
 #7705 - Synchronous Clock
 #7950 - Transmit-Receive-MonitorPrint
 #9140 - Extended Re-Entry
 #9402 - Line Termination - 2-wire
 #9761 - Transmission Code EBCDIC
 #9762 - Transmission Code ASCII
 #9936 - Immediate WACK

0050 Magnetic Data Inscrber
 0545 Output Punch (mdls 3,4)
 1017 Paper Tape Reader (mdls 1,2)
 1018 Paper Tape Punch (mdl 1)
 1053 Printer (mdl 1)
 1255 Magnetic Character Reader
 2203 Printer (mdls A1,A2):
 Supported: #5558 - Print Positions, 24 Additional
 2213 Printer (mdls 1,2)
 2265 Display Station (mdl 2)
 2502 Card Reader (mdls A1,A2)
 5496 Data Recorder

2780 Data Transmission Terminal on switched or nonswitched lines:
 Supported: #1340 - Automatic Answering
 #1350 - Automatic Turnaround
 #3401 - Dual Communication Interface
 #5010 - Multiple Record Transmission
 #5020 - Multipoint Line Control
 #5820 - 120 Character Print Line
 #5821 - 144 Character Print Line
 #6400 - Selective Character Set
 #7850 - Terminal Identification
 #8030 - EBCDIC Transparency
 #9150 - Extended Retry Transmission
 #9761 - ASCII Transmission Code
 #9762 - EBCDIC Transmission Code

2980 General Banking System on nonswitched lines:
 2972 Station Control Unit (mdl 8 - RPO 858160, mdl 11 - RPO 858231)
 Supported: Attachment of 2980, 2971
 RPO 835503 - Buffer Expansion
 RPO 858165, 858182 - 96-Character Buffer
 2980 Teller Station (mdl 1 - RPO 835504, mdl 4 - RPO 858147)
 2980 Administrative Station (mdl 2 - RPO 835505)
 2971 Remote Control Unit (mdl 3 - RPO 858144)

3270 Information Display System on nonswitched lines:
 3271 Control Unit (mdls 1,2):
 Supported: Attachment of 3277, 3284, 3286, 3287
 3288
 #1550 - Copy
 #9761 - EBCDIC Code
 3274 Control Unit (mdl 1C) (Supported as a 3271)
 Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

3276 Control Unit Display Station (mdls 1,2,3,4) (Supported as a 3271)	Supported: Attachment of 3268, 3278, 3287 #6350 - Selector Light-Pen #9082 - EBCDIC Character Set	Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal
3277 Display Station (mdls 1,2):	Supported: #6350 - Selector Light-Pen #9089 - EBCDIC Character Set	3683 Point of Sale Terminal
3278 Display Station (mdls 1, 2, 3, 4) (Supported as a 3277)	Supported: #6350 Selector Light-Pen #9082 - EBCDIC Character Set	3735 Programmable Buffered Terminal (mdl 1) on switched or nonswitched lines:
3284 Printer (mdls 1,2):	Supported: #9089 - EBCDIC Character Set	Supported: Attachment of 5496,3286 #5010 - Multipoint Data Link Control #9761 - EBCDIC Code #9762 - ASCII Code
3286 Printer (mdls 1,2):	Supported: #9089 - EBCDIC Character Set	5496 Data Recorder (mdl 1) 3286 Printer (mdl 3)
3287 Printer (mdls 1, 2) (Supported as a 3284 or 3286 attached to a 3271-1 or -2)	Supported: #9082 - EBCDIC Character Set	3741 Data Station (mdl 2) on switched or nonswitched lines:
3288 Printer (mdl 2) (supported as a 3286-2):	Supported: #9089 - EBCDIC Character Set	Supported: Attachment of 0129,3713,3715, 3717 #1680 - Expanded Communications #1685 - Expanded Communications/ Multipoint Data Link Control #5450 - Operator Identification Card Reader #7850 - Terminal Identification
3289 Printer (mdls 1,2) (Supported as 3286-2)	Supported: #9089 - EBCDIC Character Set	0129 Card Data Recorder (mdl 2) 3713 Printer (mdl 1) 3715 Printer (mdls 1,2) 3717 Printer (mdl 1)
3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,TCAM,BTAM)		3741 Programmable Workstation (mdl 4) on switched or nonswitched lines:
3275 Display Station (mdls 1,2):	Supported: Attachment of 3284 #6350 - Selector Light-Pen #9089 - EBCDIC Character Set #9761 - EBCDIC Code	Supported: Attachment of 0129,3713, 3715 #1680 - Expanded Communications #1685 - Expanded Communications/ Multipoint Data Link Control #5450 - Operator Identification Card Reader #7850 - Terminal Identification
3284 Printer (mdl 3):	Supported: #9089 - EBCDIC Character Set	0129 Card Data Recorder (mdl 2) 3713 Printer (mdl 1) 3715 Printer (mdls 1,2)
3624 Consumer Transaction Facility (mdls 1, 2, 11, 12) (supported as a 2772) (BTAM):	Supported: Attached to a 3704/3705 via nonswitched lines only	3747 Data Converter (mdl 1) on switched or nonswitched lines:
3650 Programmable Store System (Supported as a System/3) on switched lines: (BTAM)		Supported: #1660 - Communications Adapter
3651 Store Controller (mdls A25, B25, A75, B75, C75, D75)	Supported: Attachment of 3275, 3657, 3659,3663, 3669 3683, 3784	3770 Data Communication System (supported as a 2770) on switched or nonswitched lines:
3653 Point of Sale Terminal (mdl 1 and 1P)		3771 Communication Terminal (mdls 1,2,3):
3683 Point of Sale Terminal (all models)		Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-point, or #1462 - BSC Multipoint Supported: #1201 - ASCII Code
3657 Ticker Unit (Not available on 3651 mdl A25 and B25)		3773 Communication Terminal (mdls 1,2,3,P1,P2,P3):
3663 Supermarket Terminal (mdls 1P, 2 and 3P)		Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-point, or #1462 - BSC Multipoint Supported: #1201 - ASCII Code
3275 Display Station (mdl 3)	Supported: Attachment of 3284	3774 Communication Terminal (mdls 1,2,P1,P2):
3284 Printer (mdl 3)		Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-point, or #1462 - BSC Multipoint Supported: #1201 - ASCII Code
3659 Remote Communication Unit (mdl 1)	Required: 2400 bps nonswitched line (Not available on 3651 mdls A25 and B25)	3775 Communication Terminal (mdls 1,P1):
3784 Printer (mdl 1) Not Available on 3651 mdls A25 and B25		Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-point, or #1462 - BSC Multipoint Supported: #1201 - ASCII Code
3669 Remote Communication Unit (mdl 1) Not Available on 3651 mdls A25 and B25		3776 Communication Terminal (mdls 1,2) (supported as a 2772/3780):
3660 Supermarket Scanning System (supported as a System/3) on switched lines: (BTAM)		Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-point, or #1462 - BSC Multipoint Supported: #1201 - ASCII Code
3651 Store Controller (mdls A60,B60):	Supported: Attachment of 3663,3669	3777 Communication Terminal (mdl 1) (supported as a 2772/3780):
3663 Supermarket Terminal (mdls 1,2):	Supported: Attachment of 3666	Required: #1460 - SDLC/BSC, Switch Control, or #1461 - BSC Point-to-point, or #1462 - BSC Multipoint Supported: #1201 - ASCII Code
3666 Checkout Scanner (mdl 1)		3777 Communication Terminal (mdl 2) (supported as a S/360-20 MULTI-LEAVING Workstation):
3669 Store Communications Unit (mdl 1)		Required: #3701 - EIA Interface
3660 Supermarket Key-Entry System (supported as a System/3) on switched lines: (BTAM)		
3661 Store Controller:	Supported: Attachment of 3663	
3663 Supermarket Terminal (mdls 1,2)		
3670 Brokerage Communication System on nonswitched lines: (TCAM)		
3671 Shared Terminal Control Unit (mdl 1):	Supported: Attachment of 3672,3673, 3674 #3250 - Display Expansion	
3672 Executive Console (mdl 1)		
3673 Data Display (mdl 1)		
3674 Printer-Keyboad (mdl 1)		
3680 Programmable Store System supported on switched and nonswitched lines: (BTAM)		
3684 Point of Sale - Control Unit (mdls 1, 2)		

SYSTEM CONTROL PROGRAMMING

OS/V52 (5752-VS2) (cont'd)

3780 Data Communications Terminal (mdl 1) (supported as a 2772 without component select) on switched or nonswitched lines:

- Supported:
- #3601 - EBCDIC Transparency
 - #5010 - Multipoint Data Link Control
 - #5701 - Print Positions, Additional
 - #9761 - EBCDIC Code
 - #9762 - ASCII Code

5110 Computer (supported as a 2772) on switched or nonswitched lines:

- Required: 2074 BSCA
Supported: Attachment of a 5103 Printer, 5106 Tape Cartridge and 5114 Diskette Unit.

The 5110 emulates the following 2772 features:

- Auto Answer, Buffer expansion additional (512), EBCDIC transparency, 144 character print line, identification, Multipoint Data Link Control (TCAM, BTAM), Horizontal Format Control, Space Compression/ expansion, Synchronous clock, Transmission code EBCDIC.

5265 Retail Communicating mdl (supported as 3741) point-to-point operation. (TCAM,BTAM).

- Required:
- #5500 - 1200 BPS Integrated Nonswitched Modem or
 - #5501 - 1200 BPS Integrated Switched Modem or
 - #3701 - EIA/CCITT Interface

5275 Direct Numerical Control Station (supported as a 3275 with EBCDIC code and EBCDIC Character Set) on switched lines (BTAM) or nonswitched lines (VTAM, TCAM, BTAM).

IBM PROCESSORS AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

1130 Computing System on switched or nonswitched lines: (TCAM,BTAM)

1131 Central Processing Unit:

- Required: #7690 - Synchronous Communications Adapter

1800 Data Acquisition and Control System on switched or nonswitched lines: (TCAM,BTAM)

1826 Data Adapter Unit:

- Required: #7550 - Communication Adapter

5280 Distributed Data System (supported as a 3271-2) on a non-switched line:

5285 and 5288 controllers:

- Required: Refer appropriate pages for required features and related programming

5280 Distributed Data System (supported as a 3741 or S/3 MRJE) on switched or nonswitched line:

5285 and 5288 Processor Units:

- Required: #2500 Communications Adapter

Series/1 (Supported as a S/3 on switched or nonswitched lines:) (BTAM)

4953 or 4955 Processor

- Required: #2074, 2075 or 2094 Binary Synchronous Communications Adapter

System/3 on switched or nonswitched lines:

5404, 5406, 5408, 5410, 5412 or 5415 Processing Unit:

- Required: #2074 - Binary Synchronous Communications Adapter

System/7 (supported as a System/3) on switched or nonswitched lines:

5010 Processor Module:

- Required: #2074 - Binary Synchronous Communications Adapter

System/32 (supported as a System/3) on switched or nonswitched lines:

5320 System Unit:

Required: #2074 - Binary Synchronous Communications Adapter

System/34 (supported as a System/3) on switched or nonswitched lines: 5340 System Unit:

Required: #2500, #3500 or #4500 Communications Adapter feature

System/34 (supported as a 3271 mdl 2) on a nonswitched line:

5340 System Unit:

Required: #2500, #3500, #4500 Communication Adapter feature
#4900 or #4901 Workstation Control Expansion A or B

System/36 (supported as a System/3) on switched or nonswitched lines:

5360 System Unit:

Required: #2500 or #4500 Communications Adapter feature

System/36 (supported as a S/360 mdl 25 and up) on switched or nonswitched lines:

5360 System Unit:

Required: #2500 or #4500 Communication Adapter feature

System/36 (supported as a 3271 mdl 2) on nonswitched lines:

5360 System Unit:

Required: #2500 or #4500 Communication Adapter feature
#4900 Workstation Control feature

System/38 (supported as a System/3) on switched or nonswitched lines:

5381 System Unit:

Required: #1501 or #1502 Communications Attachment Feature
#2001 or #2003 Communications Control Feature
#3200 Line Base Feature

S/38 (supported as a 3271 mdl 2) on a nonswitched line:

5381 System Unit:

Required: #1501, #1502 Communications Attachment
#2001, #2003 Communications Control

S/360 mdl 20 on switched or nonswitched lines: (TCAM,BTAM)

2020 Processing Unit:

Required: #2074 - Binary Synchronous Communications Adapter

S/360 mdls 25,30,40,50,65,65MP,67(65mode),75,85,91,195 on switched or nonswitched lines: (TCAM,BTAM)

Processing Unit:

Required: #4580 - Integrated Communications Attachment, or
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in emulation mode, or
3705-I Communications Controller in emulation mode, or
3705-II Communications Controller in emulation mode

All virtual storage S/370 Processors on switched or nonswitched lines:

Processing Unit:

Required: #4640 - Integrated Communications Adapter, or
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in network control or emulation mode, or
3705-I Communications Controller in network control or emulation mode, or
3705-II Communications Controller in network control or emulation mode

8100 with DPPX on nonswitched lines: (BTAM, TCAM, VTAM)

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

Required: Refer to 8100 pages for required features and for licensed programs supported.

8100 with DPPX/SP on nonswitched lines: (BTAM, TCAM, VTAM)
Required: Refer to 8100 pages for required features and for licensed programs supported.

SDLC LINES:

COMMUNICATIONS CONTROLLERS

3704 Communications Controller in network control mode (VTAM,TCAM)

3705 Communications Controller in network control mode (VTAM,TCAM)

IBM TERMINALS

3232-1 Keyboard Printer Terminal on switched or nonswitched lines (VTAM, TCAM).

3270 Information Display System on nonswitched lines: (VTAM,TCAM)

3271 Control Unit (mdls 11,12):
Supported: Attachment of 3277,3284,3286, 3287,3288
#1200 - ASCII Code
#1550 - Copy
#9761 - EBCDIC Code

3275 Display Station (mdls 11,12):
Supported: Attachment of 3284
#1200 - ASCII Code
#6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code

3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set

3284 Printer (mdls 1,2):
Supported: #9089 - EBCDIC Character Set

3284 Printer (mdl 3):
Supported: #9089 - EBCDIC Character Set

3286 Printer (mdls 1,2):
Supported: #9089 - EBCDIC Character Set

3287 Printer (mdls 1, 2) (Supported as a 3284 or 3286 attached to a 3271-11 or -12)
Supported: #9082 - EBCDIC Character Set

3288 Printer (mdl 2) (supported as a 3286-2):
Supported: #9089 - EBCDIC Character Set

3270 Information Display System on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM/NCP Direct) (Supported as a 3790 with Configuration Support 9165).

3276 Control Unit Display Station (mdls 11,12,13,14)
Supported: Attachment of 3268, 3278, 3287
#6350 - Selector Light-Pen
#9082 - EBCDIC Character Set

3278 Display Station (mdls 1,2,3,4) (Supported as a 3277)
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set

3268 Printer (mdl 2) [Supported as a 3286-2]
3287 Printer (mdls 1,2) (Supported as a 3284 or 3286)
Supported: #9082 - EBCDIC Character Set

3600 Finance Communication System on switched or nonswitched lines: (VTAM, TCAM)

3601 Controller (mdls 1,2A,2B,3A,3B):
Supported: Attachment of 3603,3604,3606, 3608,3610,3611,3612,3614, 3615, 3616,3618

3602 Controller (mdls 1A and 1B)
3603 Terminal Attachment Unit (mdls 1,2):
Supported: 3600 loop attachable devices.

3604 Keyboard Display (mdls 1,2,3,4,5,6,7)
3606 Financial Services Terminal (mdls 1,2)
3608 Printing Financial Services Terminal (mdls 1,2)
3610 Document Printer (mdls 1,2,3,4)
3611 Passbook Printer (mdls 1,2)
3612 Passbook and Document Printer (mdls 1,2,3)
3614 Consumer Transaction Facility (mdls 1,2,11,12):

Required: When attached to a 3601 or 3602, 3601 or 3602 application programs

Supported: Attachment to a 3704/3705 (via nonswitched lines only) or a 3601,- 3602.

3616 Passbook and Document Printer (mdl 1)
3618 Administrative Line Printer (mdl 1)
3615 Administrative Terminal Printer (mdls 1,2)
3694 Document Processing System

3630 Plant Communication System on switched or nonswitched lines (VTAM, TCAM)

3631 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642 3643, 3644, 3646, 3842, 7430 (RPQ)

3632 Controller (mdls 1A, 1B)
Supported: Attachment of 3604, 3641, 3642 3643, 3644, 3646, 3842, 7430 (RPQ)

3604 Keyboard Display (mdl 6)
3641 Reporting Terminal (mdls 1, 2)
3642 Encoder Printer (mdls 1, 2)
3643 Keyboard Display mdls 2, 3, 4
3644 Automatic Data Unit (mdl 1)
3646 Scanner Control Unit (mdl 1)
3647 Time and Attendance Terminal (mdl 1)
3842 Loop Control Unit (mdl 1)
7430 Document Printer (RPQ)

3650 Programmable Store System on switched or nonswitched lines: (VTAM, ACF/VTAM)

3651 Store Controller (mdls A25, B25, A75, B75, C75, D75)
Supported: Attachment of 3275, 3653, 3657, 3659, 3663, 3669, 3683, 3784

3653 Point of Sale Terminal (mdl 1 and 1P)
3683 Point Of Sale Terminal (all models)
3663 Supermarket Terminal (mdl 1P, 2 and 3P)
3657 Ticket Unit (Not available on 3651 mdls A25 and B25)
3275 Display Station (mdl 3)

Supported: Attachment of 3284
3284 Printer (mdl 3)

3659 Remote Communications Unit (mdl 1)
Required: 2400 bps nonswitched line
3784 Printer (mdl 1) [not available on 3651 mdls A25 and B25]
3669 Remote Communication Unit (mdl 1) Not available on 3651 mdl A25 and B25.

3650 Retail Store System on switched or nonswitched lines: (VTAM,ACF/VTAM)

3651 Store Controller (mdls A50,B50):
Supported: Attachment of 3653,3657,3275, 3659,3784

3653 Point of Sale Terminal (mdl 1 and 1P)
3657 Ticket Unit
3275 Display Station (mdl 3):
Supported: Attachment of 3284

3284 Printer (mdl 3)
3659 Remote Communications Unit (mdl 1)
3784 Printer (mdl 1)

3660 Supermarket Scanning System on switched lines: (VTAM)

3651 Store Controller (mdls A60,B60):
Supported: Attachment of 3663,3669
3663 Supermarket Terminal (mdls 1,2):
Supported: Attachment of 3666

3666 Checkout Scanner
3669 Store Communication Unit (mdl 1)

3660 Supermarket Key-Entry System on switched lines: (VTAM)

3661 Store Controller:
Supported: Attachment of 3663
3663 Supermarket Terminal (mdls 1,2)

3730 Distributed Office Communication System on switched or nonswitched lines (VTAM and TCAM/NCP Direct)

3791 Controller, mdl 11C, 12A, or 12B with SDLC with Clock (#6301) or SDLC without Clock (#6302 or #6303), and required modem
3732 Text Display Station
3736 Printer

3680 Programmable Store System supported on switched and nonswitched lines: (VTAM)

3684 Point of Sale - Control Unit (mdls 1, 2)
Supported: 3684 mdl 2: Attachment of 3683 Point of Sale Terminal

SYSTEM CONTROL PROGRAMMING

OS/V52 (5752-VS2) (cont'd)

3767 Communication Terminal (mdls 1,2,3) on switched or non-switched lines: (VTAM,TCAM)
Supported: SDLC adapter provided unless one of the Start/Stop features are specified
#1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines: (VTAM,TCAM)

3771 Communication Terminal (mdls 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3773 Communication Terminal (mdls 1,2,3,P1,P2,P3):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3774 Communication Terminal (mdls 1,2,P1,P2):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3775 Communication Terminal (mdls 1,P1):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3776 Communication Terminal (mdls 1,2):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3776 Communication Terminal (mdl 3,4) (VTAM):
Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 1):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3777 Communication Terminal (mdl 3) (VTAM):
Supported: #1201 - ASCII Code

3790 Communication System on switched or nonswitched lines: (VTAM,TCAM)

4730 Personal Banking Machine on nonswitched lines: (VTAM, ACF/VTAM, TCAM)

6670 Information Distributor on switched or nonswitched lines (ACF/VTAM, ACF/TCAM V2 R2)

8100/DPCX Information System on switched and nonswitched lines: (VTAM, TCAM)

8815 Scanmaster I on switched or nonswitched lines (VTAM)

IBM PROCESSORS AS TERMINALS

5280 Distributed Data System (supported as a 3274-1C) on switched and nonswitched lines (TCAM, VTAM):

5285 and 5288 Controllers:
Required: Refer to sales manual for required features and related programming

5280 Distributed Data System (supported as a 3770) on switched or nonswitched lines:

5285 and 5288 Processor Units:
Required: #2500 Communications Adapter

System/32 (supported as a 3770) on switched or nonswitched lines: (VTAM,TCAM)

5320 System Unit:
Required: #1005 - Additional Storage (minimum of one)
#6301 - Synchronous Data Link Control

System/34 (supported as a 3770 or 3791) on switched or nonswitched lines (VTAM, TCAM):

5340 System Unit:
Required: #2500, #3500, or #4500 Communications Adapter feature

System/34 (supported as a 3274 mdl 1C) on a nonswitched line (VTAM):

5340 System Unit
Required: #2500, #3500 or #4500 Communications Adapter feature
#4900 or #4901 Workstation Control Expansion A or B

System/36 (supported as a 3770 or 3791) on switched or nonswitched lines:

5360 System Unit:
Required: #2500 or #4500 Communications Adapter feature

System/36 (supported as a 3274 mdl 1C) on switched or nonswitched lines:

5360 System Unit
Required: #2500 or #4500 Communications Adapter feature
#4900 Workstation Control feature

System/36 on nonswitched lines (VTAM) (supported as a 3274):

5360 System Unit:
Required: #2500 or #4500 Communications Adapter feature
#4900 Workstation Control feature

System/38 (supported as a 3770) on switched or nonswitched line:

5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2000, #2001, #2002, or #2003 Communications Control feature
#3200 Line Base feature

System/38 (supported as a 3274) on switched or nonswitched line (VTAM, TCAM):

5381 System Unit:
Required: #1501 or #1502 Communications Attachment feature
#2000, #2001, #2002 or #2003 Communications Control feature
#3200 Line Base feature

8100 with DPPX on switched or nonswitched lines: (TCAM, VTAM)
Required: Refer to 8100 pages for required programs and for Licensed Programs supported.

8100 with DPPX/SP on switched or nonswitched lines: (TCAM, VTAM)
Required: Refer to 8100 sales pages for required programs and for licensed programs supported.

LOCAL ATTACHMENT

Transmission Control Units and Communications Controllers

2701 Data Adapter Unit on local channel: (TCAM,BTAM)
Supported: #1302, #1303, #1314 - Autocall
#3455 - Dual Code
#3463-3465 - Dual Communication Interface
#8029 - Transparency
#9060 - EBCDIC Code
#9061 - ASCII Code
#9062 - 6-bit Transcode

2702 Transmission Control Unit on local channel: (TCAM,BTAM)
Supported: #1290 - Autocall
#1319 - Autopoll
#8055 - 2741 Break

2703 Transmission Control Unit on local channel: (TCAM,BTAM)
Supported: #1340,1341 - Autocall
#7715 - EBCDIC Code
#7716 - ASCII Code
#7717 - 6-bit Transcode
#8055 - 2741 Break
#9100 - Transparency for ASCII

2715 Transmission Control Unit (mdl 1) on local channel: (TCAM,BTAM)

Supported: See "2790" under Local Terminals

3704/3705-I/3705-II Communications Controller on local channel:

SYSTEM CONTROL PROGRAMMING

OS/V S2 (5752-VS2) (cont'd)

Supported: EBCDIC Code, ASCII Code, Autopoll and EBCDIC Transparency do not have special feature codes in the 3704/3705
EP/VS (TCAM,BTAM)
NCP/VS (VTAM,TCAM)
PEP
#8002 - Two-Channel Switch (VTAM,TCAM)

LOCAL TERMINALS

2848 Display Control (mdls 1,2,3) on local channel: (TCAM)
Supported: Attachment of 2260, 1053
#3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053
2260 Display Station (mdls 1,2):
Supported: 3606 - Extended Cursor Control, Alphameric Keyboard
Not Supported: Tab feature of 3606
2790 Data Communication System on local channel: (TCAM,BTAM)
2715 Transmission Control Unit (mdl 1):
Supported: Attachment of 2740, 2791, 2793
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
#8110 - Two Processor Switch
Not Supported:
2740 Communication Terminal (mdl 1)
2791 Area Station (mdls 1,2):
Supported: Attachment of 1035, 2795, 2796, 2797, 2798, 1053
1035 Badge Reader (mdl 1)
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)
2793 Area Station (mdl 1):
Supported: Attachment of 2795, 2796, 2797, 2798, 1053
2795 Data Entry Unit (mdl 1)
2796 Data Entry Unit (mdl 1)
2797 Data Entry Unit (mdl 1)
2798 Guidance Display Unit (mdl 1)
1053 Printer (mdl 1)

3270 Information Display System on local channel:
3272 Control Unit (mdls 1,2):
Supported: Attachment of 3277, 3284, 3286, 3287, 3288
3277 Display Station (mdls 1,2):
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3284 Printer (mdls 1,2):
Supported: #9089 - EBCDIC Character Set
3286 Printer (mdls 1,2):
Supported: #9089 - EBCDIC Character Set
3287 Printer (mdls 1, 2) (Supported as a 3284 or 3286 attached to 3272-1 or -2)
Supported: #9082 - EBCDIC Character Set
3288 Printer (mdl 2) (supported as a 3286-2):
Supported: #9089 - EBCDIC Character Set
3270 Information Display System on Local Channel: (Supported as a 3272)
3274 Control Unit (mdl 1B)
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station mdls 1,2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3278 Display Station (mdls 1, 2, 3, 4) (Supported as a 3277)
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as a 3286-2]
3284 Printer (mdls 1, 2)
Supported: #9089 - EBCDIC Character Set
3286 Printer (mdls 1, 2)
Supported: #9089 - EBCDIC Character Set
3287 Printer (mdls 1,2)(Supported as a 3284 or 3286)

Supported: #9082 - EBCDIC Character Set
3288 Printer (mdl 2) (Supported as a 3286-2)
Supported: #9089 - EBCDIC Character Set
3289 Printer (mdls 1,2)(Supported as a 3286-2)
3270 Information Display System on Local Channel: (VTAM, TCAM through VTAM) (Supported as a 3790 with Configuration Support)
3274 Control Unit (mdl 1A)
Supported: Attachment of 3268, 3277, 3278, 3284, 3286, 3287, 3288, 3289
3277 Display Station (mdls 1,2)
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
3278 Display Station (mdls 1,2,3,4)
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
3268 Printer (mdl 2) [Supported as 3286-2]
3284 Printer (mdls 1,2)
Supported: #9089 - EBCDIC Character Set
3286 Printer (mdls 1,2)
Supported: #9089 - EBCDIC Character Set
3287 Printer (mdls 1,2)(Supported as a 3284 or 3286)
Supported: #9082 - EBCDIC Character Set
3288 Printer (mdl 2)(Supported as a 3286-2)
Supported: #9089 - EBCDIC Character Set
3289 Printer (mdls 1,2)(Supported as a 3286-2)
3730 Office Communication System on local channel (VTAM)
3791 Controller, mdl 11C, 12A or 12B with: Local Channel Attachment (#1515)
3732 Text Display Station
3736 Printer

3790 Communication System on local channel: (VTAM,TCAM through VTAM) See appropriate sales pages for description of configuration and access methods supported.

7770 Audio Response Unit (mdl 3) on local channel (TCAM)

Legend:

(VTAM) = VTAM only
(TCAM) = TCAM only
(BTAM) = BTAM only

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

SVS TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM	TCAM	TCAM or BTAM		TSO	TSO
	via NCP/VS	via NCP/VS	via EP/VS (d)	via 270X (e)	via TCAM, NCP/VS	via TCAM, EP/VS
SS Lines:						
1031			X	1,2,3		
1051	X	X	X	1,2,3	X	X
2260			X	1		X
2265			X	1		X
2740-1,-2	X	X	X	1,2,3		
2741	X	X	X	1,2,3	X	X
2760			X	1,2,3		
3101	X	X	X		X	X
3232-51	X	X	X		X	X
3767-1,-2 (2740-1)	X	X	X			
3767-1,-2,-3 (2740-2)	X	X	X	1		
3767-1,-2 (2741)	X	X	X		X	X
5100 (2741)	X	X	X		X	X
CMCST (2741)	X	X	X	1,2,3		
System/7 (2740-1)	X	X	X	1,2,3		
AT&T 83B3 or WU 115A						
Line Control Type	X	X	X	1,2,3		
CPT-TWX (M33/35)	X	X	X	1,2,3	X	X
WT Telegraph	X	X	X	1,2,3		
6733 (CPT-TWX 33/35)	X	X	X	-	X	X
BSC Lines:						
2715-2		X	X	1,3		
2772	X	X	X	1,3		
2780	X	X	X	1,3		
2972-8,-11	X	X	X (B)	1,3 (B)		
3271-1,-2	X	X	X	1,3	X	X
3274-1C (3271-1,2)	X	X	X	1,3	X	X
3275-1,-2	X	X	X	1,3	X	X
3276 (3271-1,2)	X	X	X	1,3	X	X
3651-A60,-B60 (S/3)			X (B)			
3661 (System/3)			X (B)			
3670			X (T)	1,3 (T)		
3684			X			
3735	X	X	X	1,3		
3741-2,4	X	X	X	1,3		
3747	X	X	X	1,3		
3771-1,-2,-3 (2772)	X	X	X	1		
3773-1,-2,-3,-P1, -P2,-P3 (2772)	X	X	X	1		
3774-1,-2,-P1,-P2, (2772)	X	X	X	1		
3775-1,-P1, (2772)	X	X	X	1		
3776-1,-2 (2772/3780)	X	X	X	1		
3777-1 (2772/3780)	X	X	X	1		
3780 (2772)	X	X	X	1,3		
1131		X	X	1,3		
1826		X	X (B)	1,3 (B)		
System/3	X	X	X	1,3		
System/7 (System/3)	X	X	X	1,3		
System/32 (System/3)	X	X	X	1,3		
System/34 (System/3)	X	X	X	1,3		
System/34 (3271)	X		X (B)	1,3 (B)		
System/36 (System/3)	X	X	X	1,3		
System/36 (S/360 (b)) (mdls 25 and up)		X	X	1,3		
System/36 (3271)	X		X (B)	1,3 (B)		
System/38 (3271)	X	X		1,3 (B)		
System/38 (3770)	X	X	X	1,3		
S/360-20		X	X	1,3		
S/360 (b)		X	X	1,3		
S/370 (b)	X	X	X	1,3		
5265 (3741)		X	X			

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

SVS Terminal Support Chart 1 - cont'd

	VTAM via NCP/VS	TCAM via NCP/VS		TSO via TCAM
SDLC Lines:				
3271-11,-12	X	X		
3274-1C(3271-1,2)	X	X		
3275-11,-12	X	X		
3276(3791)	X	X		
3601	X	X		
3602	X	X		
3614	X	X		
3624	X			
3631	X	X		
3632	X	X		
3684	X			
3767-1,-2,-3	X	X		
3771-1,-2,-3	X	X		
3773-1,-2,-3	X	X		
3773-P1,-P2,-P3	X	X		
3774-1,-2,-P1,-P2	X	X		
3775-1,-P1	X	X		
3776-1,-2	X	X		
3776-3,-4	X			
3777-1	X	X		
3777-3	X			
3791	X	X(f)		
8130 DPCX-A21,-A23	X	X		
8140 DPCX-A31, -A33,-A51,-A53	X	X		
S/32 (3770)	X			
S/34 (3770)	X			
S/34 (3791)	X			
S/34 (3274)	X			
S/36 (3770)	X			
S/36 (3790)	X			
S/36 (3274)	X			
S/38 (3770)	X			
Local Channel Attach				
TCUs, Local Communications				
Controllers:				
2701		X	X	
2702		X	X	
2703		X	X	
2715-1		X	X	
3704 (EP/VS)		X	X	
3704 (NCP/VS)	X	X		
3705-1 (EP/VS)		X	X	
3705-I (NCP/VS)	X	X		
3705-II (EP/VS)		X	X	
3705-II (NCP/VS)	X	X		
Local Terminals:				
2260		X		
3272-1,-2	X	X	X	X
3274-1A(3791)	X			
3274-1B(3272-2)	X	X	X	X
3791	X(c)			
7770-3		X		

Legend:

- SS = Start/Stop
- BSC = Binary Synchronous Communication
- SDLC = Synchronous Data Link Control
- X = supported now
- (date) = date when support will be available

Notes:

- (B) BTAM only.
- (T) TCAM only.
- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "System/7 (2740-1)" means "the System/7 is supported as a 2740-1".
- (b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1, or OS/VS2.
- (c) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s, and precludes concurrent operation of 3704/3705 or 3272 controllers through VTAM.
- (d) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.
- (e) 270X = 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.
- (f) Does not apply to versions earlier than Version 6 of the 3791 Controller.

SYSTEM CONTROL PROGRAMMING

OS/V52 (5752-VS2) (cont'd)

MVS TERMINAL SUPPORT CHART 1

	VTAM via NCP/V5 (c)	TCAM via VTAM (c)	TCAM via NCP/V5 (f)	TCAM or BTAM via EP/V5 (g)	270X via (h)	TSO via TCAM, NCP/V5	TSO via TCAM, EP/V5	TSO via VTAM	JES2 via RTAM	JES3 via RTAM
Remote Attach (a)										
SS Lines:										
1031				X	1,2,3					
1051	X	X	X	X	1,2,3	X	X			
2260				X	1		X			
2265				X	1		X			
3101	X	-	X	X	1	X	X (o)			
2740-1,-2	X	X	X	X	1,2,3					
2741	X	X	X	X	1,2,3	X	X			
2760				X	1,2,3					
3232-51	X	X	X	X		X	X			
3767-1,-2 (2740-1)	X	X	X	X						
3767-1,-2,-3 (2740-2)	X	X	X	X	1					
3767-1,-2 (2741)	X	X	X	X		X	X			
5100 (2741)	X	X	X	X		X	X			
5110 (2741)	X	X	X	X		X				
CMCST (2741)	X	X	X	X	1,2,3					
S/7 (2740-1)	X	X	X	X	1,2,3					
AT&T 83B3 or WU 115A										
Line Control										
Type	X	X	X	X	1,2,3					
CPT-TWX (M33/35)										
Line Control										
Type	X	X	X	X	1,2,3	X	X			
WT Telegraph	X	X	X	X	1,2,3					
6733 (CPT-TWX 33/35)	X	X	X	X	-	X	X	X		
BSC Lines:										
2715-2	X	X	X	X	1,3				X	X
2772	X	X	X	X	1,3				X	X
2780	X	X	X	X	1,3					
2972-8,-11	X	X	X	X (B)	1,3 (B)					
3271-1,-2	X	X	X	X	1,3	X	X	X		
3274-1C(3271-1,2)	X	X	X	X	1,3	X	X	X		
3275-1,-2	X	X	X	X	1,3	X	X	X		
3276 (3271-1,2)	X	X	X	X	1,3	X	X	X		
3624-1,-2,-11,-12 (2772)				X(B)						
3651-A25,B25,A75 B75,C75,D75 (S/3)				X (B)						
3651-A60,-B60 (S/3)				X (B)						
3661 (S/3)				X (B)						
3670				X (T)	1,3 (T)					
3684				X (B)						
3735	X	X	X	X	1,3					
3741-2,-4	X	X	X	X	1,3					
3747	X	X	X	X	1,3					
3771-1,-2,-3 (2772)	X	X	X	X	1				X	X
3773-1,-2,-3 (2772)	X	X	X	X	1				X	X
3773-P1, -P2,P3 (2772)	X	X	X	X	1				X	X
3774-1,2 (2772)	X	X	X	X	1				X(k)	X
3774-P1,-P2 (2772)	X	X	X	X	1				X(k)	X
3775-1 (2772)	X	X	X	X	1				X	X
3775-P1 (2772)	X	X	X	X	1				X	X
3776-1,-2 (2772/3780)	X	X	X	X	1				X	X
3777-1 (2772/3780)	X	X	X	X	1				X	X
3777-2 (S/360-20)	X	X	X	X	1,3				X	X
3780 (2772)			X	X		X	X			
5110 (2772)			X	X						
5265 (3741)			X	X						
5275 (3275-1,-2)	X	X	X	X	1					
5285/5288 (3271)	X	X	X	X	1,3			X		
5285/5288 (3741)	X	X	X	X (B)	1,3(B)					
5285/5288 (S/3)									X	X
1131			X	X	1,3				X	X
1826			X	X (B)	1,3 (B)					



SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

MVS Terminal Support Chart 1 - Cont'd. (1)

	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (f)	TCAM or BTAM via EP/VS (g)	270X via (h)	TSO via TCAM, NCP/VS	TSO via TCAM, EP/VS	TSO via VTAM	JES2 via RTAM	JES3 via RTAM
Remote Attach (a)										
SS Lines:										
Series/1				X (B)	1(B)					
System/3	X	X	X	X	1,3				X	X
System/7 (System/3)	X	X	X	X	1,3				X	X
System/32 (System/3)	X	X	X	X	1,3				X	X
System/34 (System/3)	X	X	X	X	1,3				X	X
System/34 (3271)	X		X	X (B)	1,3 (B)			X		
System/36 (System/3)	X	X	X	X	1,3				X	X
System/36 (3271)	X		X	X (B)	1,3 (B)			X		
System/36 (S/360) (mdls 25 up)			X	X	1,3				X	X
System/38 (System/3)	X	X	X	X	1,3				X	X
System/38 (3271)	X		X	X	1,3 (B)			X		
S/360-20			X	X	1,3				X	X
S/360 (b)			X	X	1,3				X	X
S/370 (b)	X	X	X	X	1,3				X	X
8100/DPPX (j)	X		X	X	1,3	X	X	X	X	X
8100/DPPX/SP (j)	X		X	X	1,3	X	X	X	X	X

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

MVS Terminal Support Chart 1 - Cont'd. (2)

	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS	TSO via VTAM	JES2 via VTAM	JES3 via VTAM		
SDLC Lines:								
3232-1	X	X	X	X	X	-		
3271-11,-12	X	X	X	X				
3274-1C(3791)	X	X	X	X				
3275-11,-12	X	X	X	X				
3276(3791)	X	X	X	X				
3601	X	X	X					
3602	X	X	X					
3614	X	X	X					
3624	X							
3631	X	X	X					
3632	X	X	X					
3651-A25,B25,A75 B75,C75,D75(S/3)		X	X					
3651-A50,-B50	X	X						
3651-A60,-B60	X							
3661	X							
3684	X							
3694	X	X	X	-	X (p)	X (p)		
3767-1,-2,-3	X	X	X	X				
3771-1,-2,-3	X	X	X	X	X	X		
3773-1,-2,-3	X	X	X	X	X	X		
3773-P1,-P2,-P3	X	X	X					
3774-1,-2	X	X	X	X	X	X		
3774-P1,-P2	X	X	X					
3775-1	X	X	X	X	X	X		
3775-P1	X	X	X					
3776-1,-2	X	X	X		X	X		
3776-3,-4	X				X	X		
3777-1	X	X	X		X	X		
3777-3	X				X	X		
3791	X	X (e)	X (e)		X	X		
3791 (for 3730)	X				X (m)	X (m)		
5285/5288 (3274-1C)	X	X	X	X				
5285/5288 (3770)	X				X	X		
8130/DPCX-A21,-A23	X	X	X	X	X	X		
8140/DPCX-A31, -A33,-A51,-A53	X	X	X	X	X	X		
System/32 (3770)	X				X			
System/34 (3770)	X							
System/34 (3791)	X	X	X		X	X		
System/34 (3274)	X				X			
System/36 (3770)	X							
System/36 (3791)	X	X	X		X	X		
System/36 (3274)	X				X			
System/38 (3770)	X							
6670	X		X		X (n)	X (n)		
8100/DPPX(j)	X		X	X	X	X		
8100/DPPX/SP(j)	X		X	X	X	X		
Local Channel Attach	VTAM (c)	TCAM via VTAM (c)	TCAM	BTAM	TSO via TCAM	TSO via VTAM	JES2 via VTAM	JES3 via VTAM
TCU's Local Communications Controllers:								
27011			X	X				
2702			X	X				
2703			X	X				
3704 (EP/VS)			X	X				
3704 (NCP/VS)	X	X	X					
3705-1 (EP/VS)			X	X				
3705-1 (NCP/VS)	X	X	X					
3705II (EP/VS)			X	X				
3705-II (NCP/VS)	X	X	X					
Local Terminals:								
2260			X					
2715-1			X	X				
3272-1,-2	X	X	X	X	X	X		
3274-1A(3791)	X	X						
3274-1B (3272-2)	X	X	X	X	X	X		
3791	X(d)	X(e)					X	X
3791 (for 3730)	X							
7770-3			X					

Legend:

- SS = Start/Stop
- BSC = Binary Synchronous Communication
- SDLC = Synchronous Data Link Control
- X = supported now
- (date) = date when support will be available

Notes:

- (B) BTAM only.
- (T) TCAM only.

(a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7(2740-1)" means "the S/7 is supported as a 2740-1"

(b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.

(c) MVS Release 3.0 or later.

SYSTEM CONTROL PROGRAMMING

OS/VSS2 (5752-VS2) (cont'd)

- (d) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration, using 3760s. This support precludes concurrent operation of 3704/3705 or 3272 controllers through VTAM or TCAM through VTAM.
- (e) Does not apply to versions earlier than Version 6 of the 3791 Controller.
- (f) MVS Release 2.0 only.
- (g) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.
- (h) 270X 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.
- (i) Supported as a 2780.
- (k) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).
- (l) Dependent on SU 26 availability.
- (m) Concurrent 3730-3790 systems only.
- (n) Supported through the MVS/Information Distribution Workstation Support (program product 5740-AMA) with ACF/VTAM on 3/80, and with ACF/TCAM on 4/80.
- (o) Installation of Network Terminal Option required.
- (p) JES2 and JES3 support for the 3602 and 3694 is limited to users of program product CHX/3694 (5748-F53).

MVS TERMINAL SUPPORT CHART 2

SS Lines:	Communications Code		ASCII		Communication Network		
	EBCDIC norm	trans	norm	tran	sw PTP	nonsw PTP	MP
1031	-	-	-	-	-	-	X
1051	-	-	-	-	X	-	X
2260	-	-	-	-	-	-	X
2265	-	-	-	-	-	-	X
2740-1	-	-	-	-	X	X	X
2740-2	-	-	-	-	-	-	X
2741	-	-	-	-	X	X	-
2760	-	-	-	-	X	X	-
3101	-	-	X	-	X	-	-
3232-51	-	-	X	-	X	X	-
3767-1,-2	-	-	-	-	-	-	-
(2740-1)	-	-	-	-	X	X	X
3767-1,-2,-3	-	-	-	-	-	-	-
(2740-2)	-	-	-	-	-	-	X
3767-1,-2	-	-	-	-	-	-	-
(2741)	-	-	-	-	X	X	-
5100 (2741)	-	-	-	-	X	X	-
5110 (2741)	-	-	-	-	X	X	-
CMCST (2741)	-	-	-	-	X	X	-
System/7 (2740-1)	-	-	-	-	X	X	X
AT&T 83B3	-	-	-	-	-	-	-
WLU 315A	-	-	-	-	-	-	X
CPT-TWX	-	-	-	-	-	-	-
(M33/35)	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	X	-
6733 (CPT-TWX 33/35)	-	-	X	-	X	X	-
BSC Lines:							
2715-2	-	X	-	-	S	X	M
2772	X	X	X	-	S	X	M
2780	X	X	X	-	S	X	M
2972-8,-11	X	-	-	-	-	-	M
3271-1,-2	X	-	X	-	-	-	M
3274-1C	-	-	-	-	-	-	-
(3271-1,2)	X	-	X	-	-	-	M
3275-1,-2	X	-	X	-	S	-	M
3276	-	-	-	-	-	-	-
(3271-1,2)	X	-	X	-	-	-	M
3624-1,-2,-11,-12	-	X	-	-	-	-	M
(2772)	-	X	-	-	-	-	M
3651-A25,B25	-	-	-	-	-	-	-
A75,B75,C75	-	-	-	-	-	-	-
D75(System/3)	-	X	-	-	X	-	-
3651-A60,-B60	-	-	-	-	-	-	-
(System/3)	-	X	-	-	X	-	-
3661 (System/3)	-	X	-	-	X	-	-
3670	X	-	-	-	-	-	M
3694	X	X	-	-	-	-	-
3735	X	X	X	-	-	-	M
3741-2,-4	X	X	X	-	S(d)	X	-
3747	X	X	-	-	S(d)	X	-
3771,3773,3774,	X	X	X	-	S	X	M
3775 (2772)	X	X	X	-	S	X	M
3776,3777-1	X	X	X	-	S	X	M
(2772/3780)	X	X	X	-	S	X	M
3777-2	X	X	X	X	S	X	M
(S/360-20)	X	X	X	X	S	X	M
3780 (2772)	X	X	X	-	S	X	M
5110 (2772)	X	X	-	-	S	X	M
5265	-	-	-	-	-	-	-
Communicating Model (3741)	X	-	-	-	X	X	-
5725 (3275-1,-2)	X	-	-	-	S(e)	-	M
1131	X	X	-	-	S	X	M
1826	X	X	X	-	S	X	M
5285/5288	X	-	-	-	-	-	M
(3271-2)	X	-	-	-	-	-	M
5285/5288	X	X	X	-	S	X	M
(3741)	X	X	X	-	S	X	M
5285/5288	X	X	X	-	S	X	M
(System/3)	X	X	X	-	S	X	M
System/3	X	X	X	-	S	X	M
System/7 (System/3)	X	X	X	-	S	X	M
System/32 (System/3)	X	X	X	-	S	X	M
System/34 (System/3)	X	X	X	-	S	X	M
System/34 (3271)	X	X	X	-	S	X	M
System/36 (System/3)	X	X	X	-	S	X	M
System/36 (S/360(b))	X	X	X	-	S	X	M
System/36 (3271)	X	X	X	-	S	X	M
System/38 (System/3)	X	X	X	-	S	X	M
System/38 (3271)	X	X	X	-	S	X	M
S/360-20	X	X	X	X	S	X	M
S/360 (b)	X	X	X	X	S	X	M
S/370 (b)	X	X	X	X	S	X	M
5265 (3741)	X	X	X	X	S	X	M
8100/DPPX	-	-	-	-	-	-	-
DPPX/DSC	X	-	-	-	-	X	X
DPPX/RJE	X	X	-	-	-	X	X
8100/DPPX/SP	-	-	-	-	-	-	-
DPPX/SP/DSC	X	-	-	-	-	X	X
SDLC Lines:							
3232-1	-	-	-	-	X	X	N
3271-11,-12	-	-	-	-	-	-	N
3274-1C(3791)	-	-	-	-	-	X	N
3275-11,-12	-	-	-	-	-	-	N
3276(3791)	-	-	-	-	-	X	N
3601	-	-	-	-	D	X	N
3602	-	-	-	-	X	X	N

SDLC is insensitive to data interchange codes.



SYSTEM CONTROL PROGRAMMING

OS/V52 (5752-VS2) (cont'd)

TERMINAL SUPPORT CHART 2 (cont'd)

	Communications Code				Communication Network		
	EBCDIC		ASCII		sw	nonsw	MP
	norm	trans	norm	tran	PTP	PTP	MP
3614					-	X	N
3624					-	X	N
3631					X	X	N
3632					X	X	N
3651-A25,B25,A75							
B75,C75,D75					D(e)	X	N
3651-A50,-B50					D(e)	X	-
3651-A60,-B60					D	-	-
3661					D	-	-
3684					D	X	N
3694					X	X	X
3767-1,-2,-3					D	X	N
3771,3773,3774							
3775,3776,3777-1,3					D	X	N
3791 (c)					D(e)	X	N
4730-F01,-F02,-R01,-R02					-	X	N
5285/5288 (3274-1C)					D	X	N
5285/5288 (3770)					D	X	N
6670					D	X	N
System/32 (3770)					D	X	N
System/34 (3770)					D	X	N
System/34 (3790)					D	X	N
System/34 (3274)					D	X	N
System/36 (3770)					D	X	N
System/36 (3790)					D	X	N
System/36 (3274)					D	X	N
System/38 (3274)					D	X	N
8130/DPCX-A21,-A23					D(e)	X	N
8140/DPCX-A31					D	X	N
-A33,-A51,-A53							
8815					D	X	N
SS Lines:							
Local Channel Attach:							
8100/DPPX					D	X	N
8100/DPPX/SP					D	X	N
2260							
2715-1			X	-			
3272-1,-2	X		-	-			
3274-1A(3791)	X		-	-			
3274-1B(3272-2)	X		-	-			
3791 (c)							3791 local attachment is code insensitive
7770-3							

Legend:

- SS = Start/Stop
- BSC = Binary Synchronous Communication
- SDLC = Synchronous Data Link Control
- X = Supported
- = Not supported
- D Group of terminals which can communicate over the public switched telephone network to the same SDLC line appearance on a 3704 or 3705 attached to a S/370. All DTEs so communicating must be operating with the same clocking source (either modem or business machine) and at the same transmission speed.
- M Group of terminals which can operate on same BSC MP line and same line speed.
- N Group of terminals which can operate on same SDLC MP line and same line speed.
- S Group of terminals which can share the same phone number(s).

Notes:

- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7 (2740-1)" means "the S/7 is supported as a 2740-1"
- (b) S/360 mdls 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.
- (c) The 3791 Controller, as part of the 3790 Communication System/Data Entry Configuration, does not support ASCII code.
- (d) The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, NCP/VS requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.
- (e) Terminal operates on switched line using manual dial/manual and/or auto answer procedures and nonswitched VTAM-NCP/VS programming support. The 3651-A50,-B50 uses manual answer and the 3791 uses manual or auto answer procedures. These manual dial procedures will not be required when switched VTAM-NCP/VS support is available.
- (f) IPL of S/7 is not supported in this network configuration.
- (g) 1750 BSCA does not support MODEM Autoanswer function.

SYSTEM CONTROL PROGRAMMING

OS/VS2 (5752-VS2) (cont'd)

ASP - ASYMMETRIC MULTIPROCESSING SYSTEM (360A-CX-15X)
For description, see IBM.

HASP-II VERSION 4 (370H-TX-001) (SVS)

HASP II Version 4 is not System Control Programming (SCP). It is optionally available to replace SVS readers and writers. It provides the remote job entry (RJE) support for SVS. Installation remains the responsibility of the user. Programming service classification is A.

The HASP System is an extension of SVS and provides support in the areas of job management, data management, task management, and remote job entry. HASP operates as a systems task and is formally interfaced to SVS. When HASP is used, it supplants the normal SVS functions of reader - printer - punch input/output services, SYSIN-SYSOUT spooling and job scheduling.

Features that may add to systems performance are a high performing SPOOL management routine and the HASP MULTI-LEAVING line manager. MULTI-LEAVING is employed with all Processor workstations and will tend to maximize line effectiveness and provide concurrent operation of all supported workstation devices.

HASP operation is a V=V mode. The minimal storage that must be fixed is 12K bytes. The requirement for fixed storage will be approximately 25% of the total storage generated for a HASP System.

The job input and output services provided for local peripheral devices along with a subset of the HASP operator commands capability are optionally extended to remote workstations, including both Processor and non-Processor terminals. Workstation programs for BSC S/360 mdl 20 or higher, BSC 1130, and BSC S/3 are generated as extensions to the central HASP System and operate in the workstation on a 'stand-alone' basis. The HASP RJE implementation for BSC Processor workstations is based upon the HASP MULTI-LEAVING philosophy which provides the capability for concurrent operation for all supported terminal job input, output, and console devices.

HASP Description: HASP is a specialized program which operates in the same Processor with SVS to perform the peripheral functions associated with batch job processing.

HASP is loaded as a systems task. Control of all online unit record devices is assumed, the designated intermediate storage direct access device(s) are initialized and job processing begins.

HASP has three major processing stages which relate to its three major external functions. These are:

1. **INPUT STAGE** - This stage reads jobs simultaneously from an essentially unlimited number of various types of online card readers, tapes and remote terminals into the system. These jobs are then entered into a priority queue by job class to await processing by the next stage.
2. **EXECUTION STAGE** - This stage removes jobs based upon priority and class from the queue established by the Input State and passes those jobs to SVS for processing. Input cards are supplied as required to the executing program and print and punch records are received and written onto HASP intermediate storage. This stage can simultaneously control an essentially unlimited number of jobs being processed by SVS. At the completion of a job, it is placed in a queue to await processing by the next stage.
3. **OUTPUT STAGE** - One purpose of this stage is to transcribe the printed output generated by jobs in the previous stage to printers. An essentially unlimited number of various types of printers and remote terminals can be operated simultaneously. The output stage also transcribes the punch output generated by jobs in the execution phase to punches. An essentially unlimited number of various types of punches and remote terminals can be operated simultaneously.

All of these processes are controlled by reenterable code so that no additional code is required to support multiple, simultaneous functions. Since all of the above functions can occur simultaneously and asynchronously, a continuous flow of jobs may pass through the system.

Following are some of the more significant algorithms employed by HASP to improve function and performance:

Specialized Direct Access Storage Allocation: HASP, through the use of an allocation bit map in main storage, dynamically allocates space for intermediate storage on a record basis, within definable track groups, for jobs. The use of this technique offers the following advantages:

1. Disk-arm motion and interference is minimized by dynamically allocating space based upon the position of the access mechanism.
2. Disk area fragmentation is automatically eliminated by allocation of the smallest possible increment of space.

3. The data for a single data set can be spread across multiple direct access volumes. In addition to further optimizing arm motion, this capability allows for the simultaneous use of multiple selector channels to increase the data rate for a given job.
4. Space is allocated as required minimizing the loss of space as a result of over-estimated output requirements.
5. The release of previously used space is accomplished by a simple algorithm which requires no I/O operations.

Unit Record Device Command Chaining: While operating any reader, printer or punch, rather than handling each record separately, HASP constructs a chained sequence of channel command words to pass to the channel. Thus, instead of the overhead of the EXCP and the ensuing interrupts for each record transmitted, only one EXCP and associated interrupt is required for a series of records. For example, when reading a job into the system, HASP might chain 40 commands together to instruct a card reader. This would cause the next 40 cards to be read into storage without requiring the execution of any Processor instructions.

Transparent Blocking: All input, print and punch for every job is automatically blocked by HASP to improve performance. Since all deblocking is also done by HASP, any program, even if designed to operate with unblocked records can benefit from the blocking. Also, because all blocking and deblocking is done by HASP, program programs require buffers only the size of a single card or line. This can reduce a program's partition or region requirement by several thousand bytes over normal full track blocking.

Dynamic Buffer Pool: HASP maintains a dynamic area of storage which is allocated as required. This technique allows not only multiple data sets of a job but multiple jobs to share this area, thereby insuring optimum use of storage.

HASP Standard Features: The standard features of HASP are as follows:

Job input service provides for low overhead reading of job streams and storing of data on SPOOL volumes for later high speed retrieval for up to 99 concurrently active local card readers in any combination of devices as follows (one required): 2540 reader ... 2501 reader ... 3505 reader (80-column punched cards only).

Execution services provides for selection of jobs and execution monitoring for up to 63 concurrently executing jobs with services as follows: Selection of jobs based upon job class and initiator priority class list of up to 64 classes for each initiator ... automatic delaying of jobs with duplicate OS jobnames ... automatic deblocking and blocking of user SYSIN/SYSOUT data using the HASP dynamically shared buffer pool ... counting of lines, cards, and execution duration with optional operator notification and/or cancellation ... interface for SMF counting of SYSIN/SYSOUT data.

Execution services requires an OS Reader Interpreter to be active at all times.

Multiple SPOOL volume support provides for balanced utilization of up to 36 volumes for any combination of devices as follows (one required): 2314 ... 3330 ... 2305.

Warm start capability provides for checkpointing critical HASP information sufficient for: optionally restarting jobs which were executing ... restarting print at the last checkpoint ... restarting punch at the beginning of data set.

Job output print service provides for low overhead printing of job stream system message and user data print output for up to 99 concurrently active local printers in any combination of devices as follows (one required): 1403 Printer ... 3211 Printer.

Special forms feature provides for the routing of print (on a job or data set basis) and punch data (data set basis) to special forms output queues for output as directed by the operator.

Console Support provides for direct entry for HASP commands and HASP abbreviated reply to WTOR through SVS Operator Consoles.

HASP minimal System Message Block (SMB) output writer provides for retrieval of SMBs from the SYS1.SYSJOBQUE data set.

HASP interfaces directly with the SVS SMF writer.

HASP Optional Features: In addition to the standard features, the following optional features are available:

OS/VS2 (5752-VS2) (cont'd)

Internal Reader feature provides the ability for any nonswappable task within the system to submit jobs to HASP for batch execution as though entered from a HASP card reader.

Job output punching services provides for low overhead punching of job stream user punch output for up to 99 concurrently active local punches in any combination of devices as follows: 2520 punch ... 2540 punch ... 3525 punch.

Execution Batching feature provides the facility for passing jobs directly to a processing program such as a "one-step" monitor, reducing the overhead of OS scheduling and allocation of facilities for short running jobs requiring limited system facilities.

Priority aging feature provides for automatically increasing the HASP scheduling priority of jobs which have been in the system for extended periods of time.

Remote Job Entry feature provides for high speed communications with BSC batch workstations which may be used for job stream input and output as well as operator control of the devices and jobs associated with the remote (see HASP Remote Job Entry for features).

HASP RJE Features: Those features common to all HASP RJE configurations are listed as follows:

HASP RJE supports up to 99 remote workstations communicating over nonswitched (point-to-point) or switched lines.

HASP RJE provides for concurrent operations over up to 99 lines assigned to unique communication lines adapter addresses of the following types: SDA Type II on a 2701 for BSC ... Synchronous Base on a 2703 for BSC ... 3704/3705 providing 270X emulation.

Output routing control provides for print and punch output to be directed to the devices attached to the remote, to the central system, or to other remotes as designed by HASP generation parameters, by control card submitted with the job, or by operator command.

Remote operator control feature provides a subset of the HASP operator commands for display of information and control of jobs and devices associated with the remote.

Operator message output feature provides for transmission of messages and responses to remote operators with online MULTI-LEAVING workstations with consoles immediately and optionally saving of messages for all other remotes until the remote is online and has its primary printer available.

Workstation programs, when required, are supplied as extensions of HASP and are contained on the HASP distribution tape in source form.

Terminal support on the central system provides for communication with: 2770 (BSC) ... 2780 (BSC) ... 3780 (BSC) ... S/360 Models 20, 25, 30, 40, 50, 65, 75, 85, and 195 (MULTI-LEAVING) ... 1130 (MULTI-LEAVING) ... S/3 (MULTI-LEAVING) ... S/32 or S/34 (MULTI-LEAVING as a S/3).

The signon feature provides for remote identification and line security through line passwords.

Remote characteristics support utilizes the unique features on each remote as follows: full text transparency (required for object decks) ... text compression ... print line width ... buffer size and blocking capabilities.

Note: Multipoint or multidrop line features are prohibited.

Remote job priority adjustment provides for favoring or limiting the HASP scheduling priority of jobs submitted from each remote workstation.

Line restart feature provides for warm starting of print output after remote workstation or line failures.

Line error recovery provides for continuous retry until successful transmission.

HASP MULTI-LEAVING RJE Features: MULTI-LEAVING is a term which describes a computer-to-computer communication technique developed for use by the HASP System. In a gross sense, MULTI-LEAVING can be defined as the fully synchronized, pseudo-simultaneous, bi-directional transmission of a variable number of data streams between two or more computers utilizing binary synchronous communications facilities. Those features common to all HASP RJE

configurations are provided with MULTI-LEAVING configurations with additional features as follows:

Concurrent device operation feature provides for all supported devices to operate concurrently in accordance with the device characteristics, line speed, and characteristics of the data streams.

Dual reader/punch device support provides for use as both reader and punch under automatic or operator control.

Unit record error recovery provides a minimum of operator intervention and continued operations using unaffected devices on operator console configurations.

HASP/2770 RJE Workstation: The 2770 is supported by the HASP RJE features as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support of the 2772 provides for job stream input and output on the following devices: 2213 mdl 2 Printer ... 2203 Models A1 or A2 Printer ... 2502 Models A1 or A2 Card Reader ... 0545 mdl 3 or 4 Output Punch.

Note: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job stream input (a job stream must fit entirely within the 2772 buffer).

Extended support provides for special features: Buffer expansion and buffer expansion additional ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Horizontal Format Control ... 144 character print line (2203 only, requires Buffer Expansion) ... Space Compression/Expansion.

The Terminal ID and Security ID features may be present but are not supported by HASP.

Note: Other features not prohibited by HASP RJE and transparent to programming are permitted.

HASP/2780 RJE Workstation: The 2780 is supported by the HASP RJE feature as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support for job stream input and output on the following 2780 configurations: mdl 1 Printer and Reader ... mdl 2 Printer, Reader and Punch.

Extended support provides for special features: Multi-record transmission ... 120 and 144 character print line ... Horizontal Format Control ... EBCDIC or ASCII transmission codes ... Full text transparency for EBCDIC.

The Terminal ID and Security ID features may be present but will not be supported by HASP.

Note: Other features not prohibited by HASP RJE and transparent to programming are permitted.

HASP/3777-2 MULTI-LEAVING Workstation: The 3777 mdl 2 is supported as a S/360 mdl 20 Binary Synchronous MULTI-LEAVING Workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

The RMTM20 Workstation program is generated by HASP remote generation procedures for a S/360-20 Submodel 5 with 12K of main storage.

Device support provides concurrent operations on each reader, printer, punch and console device: 3203-3 Printer (required) (specify 1403) ... 2502 Reader (required) (specify 2501) ... 3521 Punch (optional) (specify 1442) ... Console Display (optional) (specify 2152).

HASP/3780 RJE Workstation: The 3780 is supported by the HASP RJE features as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support provides for job stream input and output on the following devices: Card Reader ... Line Printer.

Supported features are: 512 character buffer ... Variable length record ... Space Compression/Expansion ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Print positions (additional) for 144 character print line ... Horizontal Format Control.

The Terminal ID and Security ID features may be present but are not supported by HASP.

OS/VS2 (5752-VS2) (cont'd)

HASP/360-20 MULTI-LEAVING Workstation: The S/360 mdl 20 with BSC adapter and HASP provided workstation program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The RMTM20 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage on a mdl 20 submodels 2, 4, 5, and 6. Larger core (up to 32K) may be used for additional buffer storage is available.

Device support provides concurrent operations on one of each reader, printer, punch and console device: 2203 Printer or 1403 Printer (one required) ... 2501, 2520 or 2560 Reader device (one required) ... 1442, 2520 or 2560 Punch device (optional) ... 2152 Console (optional).

Dual 2520 device support provides automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Dual 2560 device support provides selection of functions by feed hopper as follows: Primary feed assigned to reader ... Secondary feed assigned to punch.

Unit record data checks which require operator intervention may be corrected without stopping other functions when the 2152 console is available.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) over all available BSC line speeds; however, speeds requiring the high speed feature (19.2K baud and above) are not recommended for the submodels 2 or 4.

HASP/360 MULTI-LEAVING Workstation: The S/360 mdls 25, 30, 40, 50, 65, 75, 85 and 195 with BSC adapter and HASP provided workstation programs are supported as BSC MULTI-LEAVING workstations for submission of jobs to the central HASP for OS processing and have the following features:

The RMT360 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to support single reader, printer, punch, and console device configurations. Larger storage (up to 32K) may be used as space for additional buffers and to support additional devices for up to seven readers, printers, punches (the number of printers when added to the number of punches must not exceed eight).

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch and Punch ... 2520 Reader/Punch and Punch ... 2540 Reader/Punch ... 1403 Printer ... 1052 Printer-Keyboard.

Notes: At least one reader and one printer along with the 1052 console required ... Each device (including communications adapter) must be on separate non-shared subchannels.

Dual reader/punch support for 1442 and 2520 provides for automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Note: 2540 reader/punch has two independent card paths which operate concurrently.

Communications adapter support on the workstation provides for EBCDIC transmission (transparency optional), via: SDA Type II on a 2701 ... Integrated BSC adapter on Model 25.

HASP/1130 MULTI-LEAVING Workstation: The 1130 Computing System with BSC adapter and HASP provided workstation program is supported as a BSC MUTLI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The RTP1130 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core (up to 32K) may be used for additional buffer storage.

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch or Punch ... 1132 Printer ... 1403 Printer ... Standard Printer-Keyboard.

Note: At least one reader required.

Dual reader/punch support for the 1442 provides for operator assignment of function.

Console output support provides for color-coded messages for separation of HASP messages from workstation messages and operator input.

Single 1403 printer configurations support 132 character lines (RPQ features required).

Note: This feature does not include support for UCS printers.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the standard BSC adapter attachable to the 1131.

HASP/System/3 MULTI-LEAVING Workstation: The System/3 with BSC adapter and HASP provided workstation program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The System/3 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to operate all supported devices currently. Larger core is utilized when available.

Device support provides for concurrent operations on each of the supported devices as follows: 5424 Reader/Punch ... 1442 Reader/Punch ... 5203 Printer ... 1403 Printer ... 5471 Printer-Keyboard (console) ... 5475 Data Entry Keyboard (in lieu of 5471).

Note: At least a card reader and printer required.

Dual reader/punch support for 1442 and 5424 provides for automatic determination of each card path as follows: Operator places blank cards in feed to designate punch ... Operator places job stream in feed to designate reader.

Each 96-column card punched is interpreted.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the BSC adapter.

Printer support provides for extra print positions and UCS images of LC and PN trains (PN recommended).

System/32 MULTI-LEAVING Workstation for HASP: The System/32 with Binary Synchronous Communications Adapter and its associated MRJE/WS System Utility Program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/32 must be specified as a System/3. The System/32 MRJE/WS System Utility Program is supplied as a component of the System/32 SCP.

Device support provides for concurrent operations on each of the supported facilities of the 5320 System Unit: Disk storage simulation of card I/O and/or printer data streams ... Line or serial printing ... Keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Binary Synchronous Communications Adapter.

System/34 MULTI-LEAVING Workstation for HASP: The System/34 with Communications Adapter in BSC mode and its associated MRJE System Utility Program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/34 must be specified as System/3. The System/34 MRJE System Utility Program is supplied as a component of the System/34 SSP.

Device support provides for concurrent operations on each of the supported features of the 5340 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console).

Communication adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Communications Adapter.

System/38 MULTI-LEAVING Workstation for HASP : The System/38 with Communications Attachment and Communications Controls Features and its associated RJEF Licensed Program is

OS/VS2 (5752-VS2) (cont'd)

supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/38 must be specified as a System/3 or as a S/360 Mdl 25 or greater when more than 3 readers/writers are to be supported. The System/38 Remote Job Entry Facility (RJE) is supplied as a Licensed Program.

Device support provides for concurrent operations on each of the supported facilities of the 5381 system unit: Disk storage simulation of card I/O and/or printer data streams...line or serial printing...keyboard/display (console)...direct output to user application program.

Communications adapter support on the workstation provides for EBCDIC code (Text transparency optional) at any speed available to the Communications Adapter.

SCP PROGRAMMING SERVICES: Class 1 SCP Category B.