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PHOENIX OPERATIONS – HONEYWELL INFORMATION SYSTEMS

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TO Distribution

FROM Jim Wilt

OMPONENT XDS Product Marketing

SUBJECT CP-6 PFS Version A01

Distribution:

R. Cossman	S. Klee
R. Forzani	D. Manzer
H. Haugland	E. Vance
R. Keeler	L. Wilkinson

Attached is the CP-6 PFS updated to reflect the agreements made at the review meeting held on September 16. This meeting was attended by R. Keeler, W. Estfan, L. Wilkinson, S. Klee, L. Osborne, H. Haugland, T. Beatson, A. Pensiero, R. Hesser, and J. Wilt. At the conclusion of this meeting, everyone concurred that they would approve the PFS when the agreed-to changes were made. These changes are indicated in the PFS by a vertical bar.

I will be contacting you on November 9 with the approval sheet for your signed approval.

Jim

Jim Wilt
Manager, Software Systems
XDS Product Marketing

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Attachment

HONEYWELL CONTROL PROGRAM 6

PRODUCT FUNCTIONAL SPECIFICATION

VERSION A01

XDS PRODUCT MARKETING

OCTOBER 27, 1977

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1.0 Introduction

This Product Functional Specification (PFS) represents a consolidation of the extant requirements for the first three releases of Honeywell Control Program-6 (CP-6).

The CP-6 effort is a major part of a general business strategy directed at concurrently maximizing the revenue and profit derived from the Xerox PARC and effecting a migration of the Xerox Control Program-Five (CP-V) PARC to Level 66, beginning in 1979. CP-6 is intended to be as compatible as possible with CP-V, while reflecting those enhancements necessary to insure a highly competitive offering during the 1979-82 time frame. Many of the enhancements will be derivative of the Level 66 NSA decor or will be obtained from the implementation of those areas of CP-V design that cannot be clearly converted to Level 66 because of Sigma/Level 66 architectural differences.

Since the principal design concepts of CP-6 are embodied in CP-V, it is not the intention of this PFS to re-state topics that are adequately documented elsewhere. This PFS is intended to provide a general description of the objectives and limitations of the program, and to emphasize and define areas of particular importance or difference from CP-V.

At the inception of the CP-6 program, it was assumed that a CP-6 to GCOS 66 migration would be effected during 1982 and beyond. This assumption was based on the then current understanding of GCOS 66 functionality and is valid to the extent that GCOS 66 is in fact a superset of CP-6 functionality and performance.

Additionally, the rapid change in the competitive arena, suggested by the announcement of the IBM 370/148 and 3033, and consequently the potential market beyond 1982, provides for a significant risk associated with naively adhering to rigid assumptions concerning our product directions.

It seems clear that the highest priority activities are those directed at retaining and expanding the GCOS PARC. The Xerox opportunity presents a methodology through which a substancial increase in large systems market share can be obtained at minimum cost and risk. It would be counter productive to artificially constrain the evolution of GCOS 66 or the CP-6 implementation in order to be consistent with rigid assumptions concerning the 1982 market place. Conversely, it would be equally non-productive to ignore opportunities to enhance the synergism of these products, or to allow the migration from one to the other to be unduly difficult.

Within this general framework, it is specifically required to order CP-6 priorities as follows:

1) The suitability of CP-6 as a vehicle for migration of the Xerox PARC is the highest priority concern. The product capabilities required to achieve this migration are described in this PFS.

2) Consistent with the preceding, every opportunity to maximize conversion ease from CP-6 to GCOS 66 must be taken.

3) In those limited areas where CP-6 must necessarily diverge from GCOS 66 compatibility, the design and implementation of CP-6 must provide for a manageable and rational extensibility to achieve requisite compatibility. "Requisite compatibility" is intended to mean that conversion from CP-6 to GCOS 66 will be approximately the same level of effort as converting from UTS CØ1 to CP-V EØ2.

2.0 Applicable Documents

Among the documents applicable to the CP-6 project are the following:

Xerox Liberator Business Plan

CP-V Concepts and Facilities (LADC 0036)

CP-6 Concepts and Facilities - Preliminary Draft

CP-6 Architecture File

CP-6 Project Plan

CP-6 BASIC EPS-1

CP-6 APL EPS-1

CP-6 COBOL 74 EPS

CP-6 PL-6 Handbook

CP-V ANS COBOL Language Reference Manual (XJ78)

CP-V ANS COBOL Operations Reference Manual (XJ80)

CP-V COBOL On-Line Debugger (XQ22)

CP-V ANS FORTRAN Language Reference Manual (XU03)

CP-V ANS FORTRAN Operations Reference Manual (XU04)

CP-V META-SYMBOL Language/Operations Reference Manual (XG48)

CP-V APL Reference Manual (XM51)

530 RPG-II Language/Operations Reference Manual (XM16)

CP-V BASIC Language/Operations Reference Manual (XK14)

CP-V TEXT Language/Operations Reference Manual (XM23)

CP-V EDMS Reference Manual (XP82)

CP-V EDMS User's Guide (XP98)

CP-V Sort/Merge Reference Manual (XS37)

CP-V MANAGE Reference Manual (XQ63)

CP-V Systems Programming Reference Manual (XQ63)

CP-V Operations Reference Manual (XL23)

CP-V Systems Management Reference Manual (XL21)

CP-V Time Sharing Reference Manual (XG15)

CP-V Time Sharing User°s Guide (XL34)

CP-V EASY Language/Operations Reference Manual (XM29)

CP-V Transaction Processing Reference Manual (XQ61)

CP-V Batch Processing Reference Manual (XL89)

CP-V Remote Processing Reference Manual (XP94)

PL/1 Language Reference Manual (GD33-0009-3)

Macro Assembler Program (GMAP) (DD08)

COBOL Reference Manual (DE01)

I-D-S/II COBOL 74 Programmer°s Guide (DE09)

I-D-S/II Data Base Administrator°s Guide (DE10)

CP-R Real-Time Batch Processing Reference Manual (XQ40)

CP-R Users Guide (XQ42)

CP-R Operations Manual (XQ41)

3.0 Marketing and Business Objectives

The CP-6 project, combined with in-place programs to extend the life of the Sigma/500 Series PARC, is intended to retain the installed CP-V PARC and subsequently to migrate these users to Level 66 systems. Results to third quarter 1977 indicate that the strategies defined in the "Xerox Liberator" business plan are meeting and exceeding assigned goals.

3.1 Existing Markets and Commitments

The CP-6 primary target market is the Xerox CP-V PARC. This is augmented by BPM/BTM, CP-R and large RBM sites.

The number of CP-V systems in North America that are migration candidates has grown from 118 to 152 since the incepetion of the CP-6 program. This growth is a result of:

1) A decision by the Xerox Corporation to retain their 15 CP-V systems, expand them, and eventually move them to CP-6. All assumptions concerning a Xerox Corporation migration from CP-V to CP-6 were specifically excluded from the original business plan.

2) The installation of Sigma 9°s, 560°s and Sigma 6°s as new CP-V sites. This has occurred in the process of depleting the inventory.

3) Strategies designed to upgrade BPM/BTM, CP-R and large RBM sites becoming effective.

By the end of 1978, it is anticipated that between 175 and 200 CP-V sites will be in place serving as the CP-6 target market.

Nearly one-third of the installed PARC is in education, most of the rest are in industrial environments. A few sites are federal government and a few are service bureaus.

Data indicates that the pattern of CP-V system use does not vary significantly as a function of the type of account in which it is installed. Although initially devoted primarily to conversational time sharing, most CP-V systems use approximately 50% of available resources for batch data processing within two to five years after installation. Program language utilization is generally 80-85% higher level languages. EDMS and MANAGE use is widespread, as is APL. In non-real-time environments, assembly level coding

appears to average 10-15%. The actual percentage of assembly language may exceed this due to the use of assembly subroutines supporting COBOL applications and the use of in-line symbolic coding in older FORTRAN programs. In real-time systems, the usage of assembly language is considerably higher. The actual quantity of assembly code in use probably will not be known by most users until they begin conversion.

Transaction processing (TP) and real-time applications are found in approximately one third of the accounts and typically are on large systems. Growth in the use of TP has been restricted to date due to the lack of improved communications hardware and the newness of CP-V TP. Due to Honeywell's commitment to CP-6 and the availability of a communications front end processor on CP-V, additional users are planning to implement TP applications between now and 1980.

The user community expects CP-6 to provide the following:

- Function and ease of use equivalent or superior to CP-V
- Efficiency and performance equal to or better than CP-V
- Throughput expansion to at least 2 times a fully expanded CP-V Sigma 9 configuration
- Minimal conversion efforts
- Personality and user interface closely compatible with CP-V

3.2 Product Migration Strategy

The overall CP-6 strategy consists of the following elements:

3.2.1 Stabilization of the PARC

The requirement in this area is to assure users of the continued viability of their systems and to build their confidence in Honeywell. Engineering contributions to this effort are centered around on-going product support and enhancement.

3.2.2 Provide Continuity of Field Support

Responsibilities in this area are primarily FED and Marketing.

3.2.3 Provide Continued Near Term Growth

The ease of use and modularity of CP-V systems has contributed to system usage increases of nearly 30% per year. In order to provide the hardware capacity to sustain such growth, a variety of Sigma life extension products have been announced. Many of these products are HIS technology that is compatible with Level 66, and allow users to begin to make an early investment in HIS products.

3.2.4 Provide for Future Growth

As the next generation CP-V system, CP-6 is the central element in the Xerox CP-V migration strategy. During the 1979-1980 period, most Sigma CP-V sites will be populated with HIS memory and mass storage devices. Beginning in early 1979 central systems hardware will be replaceable by CP-6 and Level 66. Essentially we can begin now to surround the Xerox CPU°s with HIS technology, and eventually replace the CPU°s.

3.3 Expected Competitive Environment

Trends, particularly based on recent IBM actions, indicate that credible alternatives to CP-V will be available by 1979. Of particular significance is the extent to which the IBM pricing actions have impacted traditional price/performance relationships. It is likely that CP-6 hardware systems will be priced equal to IBM offerings. It is, therefore, essential that CP-6 software perform in a manner consistent with its CP-V heritage; i.e., offering superior performance.

It is expected that Burroughs, IBM and DEC will be placing emphasis on networking capabilities. This has a number of negative implications for many interactive users. Only DEC is expected to offer, in addition to networking support, high quality directly connected interactive facilities. CDC and Univac are not expected to be major factors in the CP-V base.

3.4 Price and Cost Goals

Marketing anticipates that system pricing will be targeted at IBM. Given the price erosion acceleration introduced this year, this will likely mean that a CP-6 system will be priced equivalent to the CP-V system it displaces and will be required to generate approximately 50% more performance. Consequently, in order to attain profitability goals, it is essential that opportunities to reduce hardware product cost and maximize software performance be aggressively pursued. From an additional product cost perspective, it is a goal that the semiconductor memories, used in lieu of a high speed swapping device, be available at costs of no more than two cents per word by 1981.

3.5 Uptime Goals

System availability is to be greater than 99%. The mean time between a software induced interruption is to be greater than 150 hours. The maximum duration for such an interruption will be five minutes. System recovery facilities are to be as comprehensive and as rapid as experienced with CP-V. The design goal is to minimize (1) the number of users that have to be reinitialized and (2) the occurrence of losing a user's file.

3.6 Performance Goals/Measurement

At a minimum CP-6 performance is to be equivalent to CP-V. Given equivalent system resources and CPU speeds, CP-6 must generate throughput at least equal to that obtained on a CP-V configuration. Throughput will be measured by a benchmark stream provided by Marketing and agreed to by LADC.

Maximum load parameters will be at least 500 time sharing and/or batch users and 2000 transaction processing users. The design point load will be for 250 time sharing users, 20 batch streams and 800 transaction processing users.

Assuming an available instruction rate equivalent to that available from a Level 66/60P, the design point load, a program service call rate of 250/second, a user activation rate of 6/second, and a CPU load of 90%, then 90% of the average user responses are to be less than one second with 99.9% of the responses occurring within 2 seconds. As used here, response time is defined as the time between last character typed and first character printed for a trivial command (i.e., no I/O and negligable CPU usage). The

minimum acceptable performance level in the first release for this load is for 90% of the user responses to be in less than two seconds with 99.9% of the responses to be within five seconds. As defined in CP-V, no more than 15% of the available CPU cycles will be utilized for system overhead.

3.7 Software Modularity/Pricing Options

A general software pricing strategy is under development. For planning purposes, the flexibility to separately price CP-6 access modes (transaction processing, real-time, etc.), features, higher level languages and service processors is essential. Additionally, a "transactional billing" type of accounting system for use by Honeywell to charge the customer for use of the computer system as a function of the load placed on the system will be required.

3.8 Software Distribution and Documentation Requirements

Software distribution methodologies will be impacted by the software pricing actions eventually taken. It is intended that source code will be distributed.

The following documentation is required for CP-6. Manuals will be available with release of the product except for the Concepts and Facilities manual which will be available 2Q78 and the CP-V/CP-6 Conversion Reference Manual which will be available July, 1978.

- CP-6 Concepts and Facilities - a general overview of the CP-6 operating system.
- CP-6 User's Guide - a tutorial on the use of the CP-6 system for the casual user. Extensive practical examples will be included.
- CP-6 Programmer's Reference Manual - a description of the time sharing and batch features of CP-6.
- CP-6 Transaction Processing Reference Manual - a description of the transaction processing facilities under CP-6 and an explanation of how to use them to implement a TP system.
- CP-6 Remote Processing Reference Manual - a description of CP-6 remote processing facilities and examples of how to use them.

- CP-6 Real-Time Reference Manual - a description of the real-time features of CP-6 including the host resident software factory and real-time processors (RTPs). Extensive practical examples will be included.

- CP-6 Operations Reference Manual - a description of the system from an operator's point of view.

- CP-6 System Management User's Guide - a user's guide for the system manager including user authorization, maintenance of the file system, system tuning, and other system management functions. Extensive practical examples will be included.

- CP-6 System Programmer's Reference Manual - a description of features that are designed to aid the system programmer in the development, maintenance, and modification of the CP-6 system.

- CP-6 Library Routines - a description of the routines used in the CP-6 libraries and examples of their use.

- CP-6 Pocket Guide - a booklet containing most frequently used commands of the CP-6 processors.

- CP-6 Common Index - an index for all of the manuals.

- CP-V/CP-6 Conversion Reference Manual - a description of the conversion process for CP-V users to provide an orderly transition to CP-6.

- CP-6 Data Base Technical Manual - a description of internal CP-6 tables.

- CP-6 COBOL Language Reference Manual - a description of the CP-6 IBM compatible COBOL language.

- CP-6 COBOL User's Guide - a description of the use and operational characteristics of CP-6 COBOL.

- CP-6 ANS COBOL Language Reference Manual - a description of the CP-6 ANS COBOL language.

- CP-6 ANS COBOL User's Guide - a description of the use and operational characteristics of CP-6 ANS COBOL.

- CP-6 I-D-S/II User's Guide - a tutorial on the use of the data base management system with examples.

- CP-6 I-D-S/II Reference Manual - a description of the data base management system.

- CP-6 IDP User°s Guide - a tutorial on the use of IDP for the casual user. Extensive practical examples will be included.

- CP-6 IDP Language/Operations Reference Manual - a description of the langage and operational characteristics of CP-6 IDP.

- CP-6 Sort/Merge Reference Manual - a description of the commands and operational characteristics of the CP-6 Sort/Merge Processor.

- CP-6 FORTRAN Language Reference Manual - a description of the CP-6 FORTRAN language.

- CP-6 FORTRAN User°s Guide - a description of the use and operational characteristics of CP-6 FORTRAN.

- CP-6 APL Language/Operations Reference Manual - a description of the language and operational characteristics of CP-6 APL.

- CP-6 BASIC Language/Operations Reference Manual - a description of the language and operational characteristics of CP-6 BASIC.

- CP-6 TEXT User°s Guide - a tutorial on the use of TEXT for the non-computer user. Extensive practical examples will be included.

- CP-6 TEXT Language/Operations Reference Manual - a description of the language and operational characteristics of CP-6 TEXT.

- CP-6 RPG-II Language/Operations Reference Manual - a description of the language and operational characteristics of CP-6 RPG-II.

- CP-6 PL-6 Language Reference Manual - a description of the CP-6 PL-6 language.

- CP-6 PL-6 User°s Guide - a description of the use and operational characteristics of CP-6 PL-6.

- CP-6 PL/1 Language Reference Manual - description of the CP-6 PL/1 language.

- CP-6 PL/1 User°s Guide - a description of the use and operational characteristics of CP-6 PL/1.

- CP-6 Meta Assembler Language/Operations Reference Manual - a description of the language and operational characteristics of the CP-6 Meta Assembler.

- CP-6 GMAP Language/Operations Reference Manual - a description of the language and operational characteristics of the CP-6 GMAP assembler.

- CP-6 Debugger User's Guide - a tutorial on the use of the CP-6 debugger for the applications programmer. Extensive practical examples will be included.

- CP-6 Debugger Reference Manual - a description of the CP-6 debugger and its operational characteristics.

- CP-6 Language Processor Cards - a card for each language processor listing their most used features and operational characteristics.

- Level 66 Hardware Reference Manual - a description of the Level 66 hardware system including the basic and EIS instruction sets, and NSA hardware.

- Level 6 Hardware Reference Manual - a description of the Level 6 hardware system including its instruction set and the memory management unit.

- Level 66 and Level 6 Peripheral Reference Manuals - a description of all peripheral devices available on CP-6 systems including MPC programming where applicable.

- CP-6 On-Line Diagnostics - a description of the on-line hardware diagnostic facilities and the error logging function available with CP-6.

4.0 Functional Requirements

4.1 Priorities/Release Schedule

This PFS covers features to be included in the first three releases of CP-6. Appendix A contains a list of features not currently funded in the LISD LRP. Funding for these items will be provided through execution of a Change Proposal. The goal is to define a product that is closely compatible and equal in function to CP-V, release F00, that also includes a sufficient set of enhancements to insure a competitive offering during 1979 and beyond.

The first release of CP-6 will be available 1Q79 and must, as a minimum, contain:

- CP-6 Basic System including Batch, Time Sharing and Remote Batch
- ANS COBOL
- FORTRAN
- APL (Without I-D-S/II interface)
- BASIC
- PL-6 (Available but unsupported)
- RPG-II
- Meta Assembler
- GMAP
- I-D-S/II
- IDP (Without MANAGE like facility)
- TEXT
- Sort/Merge
- Full RMA Features Including On-Line Diagnostics and Remote Access
- CP-V Conversion Aids

The second release of CP-6 will be available no more than one year after the first release and must, as a minimum, contain:

- Transaction Processing
- Real-Time
- APL (With I-D-S/II interface)
- PL-6 (Supported)
- IDP (With MANAGE like facility)
- ✓ - COBOL (IBM compatible)
- ✓ - PL/1
- Remote Front End Communications Processors
- ✓ - SNA Terminal Support
- 6250 BPI Tape and 600 MB Disk Support
- Performance/Size Improvements

The third release of CP-6 will be available no more than two years after the first release and must, as a minimum, contain:

- ? - 66/85 and/or 6XXX Support
- ✓ - SNA Batch Job Exchange
- ✓ - SNA Data Exchange
- ✓ - HDNA Support
- Performance/Size Improvements

4.2 CP-V/CP-6 Conversion

Conversion is a critical issue in CP-6. The goal is to insure that conversion to CP-6 is significantly (approximately 50%) less difficult, and as a result less costly, than that required to go to other vendors.

The following is a description of conversion tools necessary to convert from CP-V to CP-6:

4.2.1 Job Control Language(JCL) Converter

A JCL converter will be necessary to convert commands from CP-V to equivalent CP-6 common command language statements. This converter will include the capability to convert processor commands (SUPER,PCL,etc) encountered in the input stream to their CP-6 equivalent. The capability to eliminate, reposition and insert new JCL commands will also be available. Where CP-V statements are encountered, for which no CP-6 equivalent exists, an informative error message will be printed. The JCL converter will run on CP-V and CP-6 systems in both batch and time sharing modes.

4.2.2 Data Conversion

A data conversion package will be provided to convert data files in CP-V internal formats to CP-6/Level 66 internal formats. The data conversion package will consist of a data file converter utility and a set of callable data conversion subroutines. The data conversion package will run on both CP-V and CP-6. The data file converter utility will accept a CP-V tape or disk file and produce an equivalent CP-6 file, converting the data as specified by the user. Provisions will be made to handle files that contain more than one record type. Also, it will be possible to reposition or eliminate data fields as the file is being converted.

It is a goal that the above data file converter utility will be able to convert the majority of user data files. For data files that cannot be converted by the data file converter utility, data conversion subroutines will be provided. These data conversion subroutines will be callable from COBOL, ANS COBOL, FORTRAN, PL-6 and assembly language programs, on CP-V and CP-6 systems. The user will write his own conversion program using the appropriate data conversion subroutines to convert the data fields.

4.2.3 APL Conversion

An APL workspace converter will be provided to convert CP-V APL workspaces to CP-6 APL workspaces. The converter will provide at least 90% correct translation to minimize conversion time and will run on CP-V systems. An APL data file converter will convert CP-V APL component files and APL indexed files to their CP-6 equivalents. Data which cannot be represented correctly in the Level 66 internal formats will be printed with appropriate error messages.

4.2.4 COBOL Conversion

A XEROX ANS COBOL 68 to CP-6 ANS COBOL translator will be provided. The translator will provide at least 90% correct translation. The user will be able to specify a control card file which the translator will read and use to override translator defaults. The translator will run on CP-V and CP-6 systems.

4.2.5 FORTRAN Conversion

Of the three FORTRAN compilers available on CP-V (FLAG, Extended FORTRAN IV, and ANS FORTRAN), only ANS FORTRAN will be supported in CP-6.

The conversion approach is to encourage CP-V users to convert to ANS FORTRAN under CP-V. Then, when moving to a CP-6 system, their FORTRAN source programs will be compatible with CP-6 FORTRAN.

4.2.6 BASIC Conversion

CP-V BASIC will be replaced by a new BASIC on CP-6 which conforms to the latest standards and is functionally equivalent to Dartmouth BASIC. The BASIC translator will provide at least 70% correct translation. The translator will run on CP-V and CP-6 systems. Appropriate diagnostic messages will be provided for statements that cannot be translated correctly or where the possibility of ambiguity exists. Any ambiguity between the semantics of CP-V and CP-6 BASIC should be documented in the Conversion Reference Manual.

4.2.7 RPG Conversion

CP-V RPG is being replaced by a newly developed RPG-II compiler on CP-6. The CP-6 RPG-II compiler will be identical in functionality to the Xerox 530 RPG-II compiler. Since the CP-6 RPG-II compiler is a superset of the CP-V RPG compiler, it should not present conversion problems at the source level.

4.2.8 EDMS Conversion

EDMS will not be converted to CP-6. It is being replaced by the Honeywell I-D-S/II data base management system. Although major similarities exist between the two data base

management systems, programming aids will be available to minimize user conversion. A schema converter will read an EDMS schema and create equivalent I-D-S/II schema and subschema statements. The converter should provide at least a 95% correct conversion of the schema.

It is a goal to provide a data base converter to move CP-V EDMS data bases to the equivalent CP-6 Level 66 I-D-S/II data base. This converter will convert the data fields in the data base as the new data base is being created by using information derived from the schema.

4.2.9 ASSEMBLER Conversion

No assembly language converter will be provided. PL-6 will be provided for current CP-V users permitting some conversion before the delivery of CP-6 systems. Additionally, the availability of a Meta Assembler on CP-6 will assist some users in converting their assembler code from CP-V.

4.2.10 Conversion Documentation

A users manual will be written to describe the conversion process. The manual will describe the use of all conversion tools, suggestions for creating additional specialized conversion tools, and techniques to expedite testing of converted programs. Tables will be provided showing language processor differences at a clause level wherever feasible. Suggestions for overcoming incompatibilities the translator aids cannot solve will also be included. Additionally, the conversion manual will include conversion planning guidelines for estimating required manpower and computer time based upon the experience of the Honeywell Conversion group in Phoenix.

4.3 Coresidence

CP-6 will coreside with at least three other types of systems:

- Xerox CP-V Systems
- OS/VS, SVS and MVS Systems
- Honeywell GCOS systems

Coresidence with GCOS systems is not expected to be of significance in the early years of the CP-6 project. CP-V coresidence is described in the conversion section of this document.

The reasons for making special consideration for supporting IBM coresidence in CP-6 are:

- A number of CP-V to CP-6 migration prospects also have IBM equipment installed.

- Based on past experience, the coresidence environment results in larger than average installation growth rates.

The following IBM coresidence facilities will be provided in CP-6:

- HASP Support

  CP-6 will support communication with IBM hosts using the HASP multileaving protocol.

- SNA Terminal Support

  An interactive terminal connected to CP-6 will be able to connect to an IBM system through a SNA network. Also, an interactive terminal on the SNA network will be able to connect to CP-6 using existing SNA network facilities up to the CP-6 connection point. The terminal will be able to access all CP-6 services including those provided in local and remote front end communications processors.

- SNA Batch Job Exchange

  CP-6 will support connections to IBM host processors via SNA network facilities for the purpose of exchanging batch jobs and the resulting spooled output.

- SNA Data Exchange

  CP-6 will support record and file transmission to and from IBM host processors via the SNA network. In order to accomplish data translation, it may be necessary for the user to supply parameterized record layouts specifying data types and lengths.

- High Level Language Compatibility

  The evolution of CP-6 language processors (particularly COBOL, PL/1, RPG II, APL and FORTRAN) will be towards providing maximum IBM compatibility at the source level.

- APL File Converters

  CP-6 will have a utility for conversion of IBM APL workspaces and files.

- Command Processors

  TSO and VSPC command simulators will be provided for on-line usage.

4.4 System Functions

4.4.1 Scheduling and Resource Management

4.4.1.1 Scheduling

The objectives of the CP-6 scheduler are as follows:

- Maintain the performance characteristics of the CP-V scheduler. The high responsiveness of the CP-V system is the result of a very efficient and reliable scheduling technique. The same techniques will be used in the design of the CP-6 scheduler. No changes will be made to the CP-V scheduler technique that would compromise the responsiveness of the CP-6 system.

- The current memory management strategy in CP-6 eliminates the swapping function. However, the CP-6 scheduler will be designed with the consideration that beyond the third release of CP-6, it may be necessary to use a high performance serial device for swapping (CCD, bubble memories or disk).

- The system tuning function that is available in CP-V will also be made available in CP-6. The CP-6 user will have the capability of tuning the system via appropriate parameters to adjust system throughput.

- The CP-V multiprocessing (MP) implementation technique (Primary/Secondary - a modified

Master/Slave technique) will be used in the CP-6 multiprocessing design. CP-6 will have at least the functionality of CP-V MP available in version F00 of CP-V.

4.4.1.2 Resource Management

A resource is defined as any portion of the CP-6 installation that is to be shared by users in a manner such that a user requiring the resource is allocated exclusive use of the resource. Tape drives and memory are common types of resources. Devices for which input or output is spooled are not resources since they are never reserved for the exclusive use of one user.

CP-6 resource management functions will include the following:

- To maintain the basic design of the CP-V resource management function.
- The pseudo-resource concept of CP-V will be implemented in CP-6.
- Logically addressable peripheral units (APU) will be allocatable as resources (see section 4.4.4.1).
- A user will be able to allocate a group of resources by a single resource name. A resource may belong to more than one resource group.
- A resource may be allocated by more than one resource name.
- Maximum user program size will be at least 224K words. Data areas may be expanded by an additional 128K words.
- Functionality equivalent to the following CP-V resource management tools will be available in CP-6:

- SYSGEN PASS2	- Maintain equivalent CP-V functionality
- CONTROL	- Maintain equivalent CP-V functionality
- SUPER	- Maintain equivalent CP-V functionality plus provide the capability to include

the peripherals and terminals associated with front end communications processors and real-time processors (both local and remote)

- SYSCON - Maintain equivalent CP-V functionality

. A systems management tool will be provided to dynamically define and modify the various elements in the CP-6 communications network.

4.4.2 File Management

As in CP-V, the user always accesses files through the system, never directly. The CP-V file organizations will be carried over into CP-6. Extensions will be made to support those file organizations required by the GCOS processors supported by CP-6. Beyond the third release, an extension will be made to support IBM°s VSAM file organization. The file system in CP-6 will be optimized for accessing small records (less than 100 bytes), small to medium size keyed files and medium to large data base files. The file system should also be optimized to contain a large number of files. Enhancements to file integrity (RMA) will be made wherever feasible.

The file organizations (consecutive, keyed and random) and access methods (direct and sequential) that are available in CP-V will be supported in an equivalent fashion in CP-6. Those file organizations required by CP-6 processors converted from GCOS will be supported in a logically similar fashion. Compatibility between the files written by the various processors will be provided; e.g., files written by COBOL can be read/updated by FORTRAN.

Permanent files within CP-6 normally reside on disk or tape storage. Beyond the third release, extensions will be made for files to be stored on a Mass Data File for archiving purposes. In this case, a file will have to be returned to disk or tape storage before being accessed.

Disk storage will be logically divided into system storage and dismountable pack sets. System storage are those disk packs that must always be mounted during CP-6 operation. They will contain items, such as the operating system image, spooling files, language processor images, operating system files, master catalogs, etc. A dismountable pack set is a collection of disk pack(s) that may contain files from more

than one account which needs to be mounted only when user(s) desire access to files on the pack set. More than one pack set may be mounted at the same time and the packs may be mounted on any available drive. A user may request exclusive use of a pack set to prevent other users from accessing that pack set until he has released it.

A mechanism will be provided to avoid requiring a user to know explicitly which of his pack sets contains a file when he references the file name and account.

A facility to allow a user access to multiple file directories will be provided. Both control commands and monitor services will be provided to change the default directory for referencing files. It will be possible for two different users to have the same default directory. It will be permissable to specify which logon accounts can list and create files in a directory.

Each pack set will be an independent entity so that it may be physically moved from one CP-6 system to another without changing its character.

Information associated with a file will include creation and expiration dates; last access date; last modified date; accounts authorized to read, update, expand, delete, execute, etc; content type (COBOL, ANS COBOL, FORTRAN, etc. source; object or run unit; APL workspace; I-D-S/II data base; etc.); and archive information. An optional facility for automatically providing generations of selected files will be provided.

In addition to providing functionally equivalent security features from CP-V, a set of optional (possibly separately priced) security enhancements will be available in CP-6. These enhancements will provide the following facilities:

- Logging all unsuccessful attempts to access a file (optional by file, file directory or installation).
- Logging all accesses to a file (optional by file, file directory or installation).
- Clearing (scrubbing) any granule released from a file (optional by file, file directory or installation).
- Multi-level encryption. For example, compressing the records, encrypting the compression-keys, encrypting the data, encrypting both the encrypted compresion-keys and the encrypted data.

A unified file backup/archiving procedure will be provided that allows automatic and/or user specified files to be stored on disk or tape. In the future, an on-line Mass Data File will be used for archiving purposes as mentioned earlier. The user will be able to access a file without knowing the pack set name from which it was archived or is stored on. In backing up files to disk, options for either a dual image of the pack set or an "updated file" only copy should be provided. It should be possible to have more than one archive mounted on the system concurrently for retrieving files.

4.4.3 Input/Output Management

The logical I/O structure of CP-V provides users one of the most flexible and easy to use I/O systems available. The design of the CP-6 I/O Management system will provide the functionality and personality of the CP-V I/O system. CP-6 will provide all I/O services through a common set of routines. Programs may be written without the need for explicit knowledge of the file or device to which I/O will actually take place. Selection of the files or devices can be done internally to a program or externally via control commands. A set of default device assignments will be provided which make nominally appropriate device selections for batch or on-line jobs. The design of the CP-6 I/O system will strive to minimize the difference between the CP-V and CP-6 I/O system as seen by the programmer. The I/O system will include support for the following distributed functions:

- Front end communications processors and associated peripheral devices (both local and remote)
- Real time processors (both local and remote)

4.4.3.1 Spooling Subsystem

The CP-V symbiont processing features should be enhanced in the CP-6 spooling subsystem in the following manner:

- The spooling files will be standard CP-6 files.
- The operator will have the capability to prioritize the spooling output by job-ID.
- The user/operator will be able to transfer spooling files stored in the spooling file area to a magnetic tape or another disk pack for processing at a later

time. Once transferred, the original spooling file space can be released. A simple operator command should automatically re-insert the file into the spooling subsystem for processing when the tape or disk containing the file is remounted.

- The user will be able to specify the number of columns in an output line.

- A command will be provided for specifying a code indicating a class of peripherals on which the report is to be printed.

- A report may be sent to multiple sites and/or multiple devices.

- Page alignment functions will be enhanced to enable the operator to request printing of a specific number of lines for test purposes and request as many repeats of the test lines as desired. Single line print options available on certain output listing devices should be recognized by the spooling system if appropriate.

- Output restart due to paper jams or device malfunctions can be specified at the page level by the operator.

- Forms positioning will be provided to allow the operator to backspace or forward space a spooling file.

4.4.4 Communications Management

The design objectives for communications management are three-fold:

1) Maintain maximum functional compatibility with CP-V.

2) Maintain the performance, characteristics, and personality of CP-V, especially high responsiveness.

3) Respond to market requirements by improving functionality where CP-V is deficient (e.g., front end communication processor (FECP) support, extension of logical I/O management to terminal devices, and making SNA network connections available).

4.4.4.1 General Description

In order to maintain CP-V compatibility, the identical complement of terminal devices will be supported (with the exception of VISTA 2, IBM 2741 and DCT 2000 terminals). Also, the terminal interaction and response characteristics will be equivalent. The following terminal characteristics are considered important in maintaining CP-V terminal "personality":

1) Type-ahead ordering.

   All terminal output will appear to the user in the logical sequence of terminal input followed by the corresponding terminal output. If the terminal operator types input while output is still being received from previous commands, the type-ahead input will not be echoed until responses to previous commands have been completed.

2) Degree of interaction.

   The terminal interaction characteristics will be designed to support the CP-V time sharing environment. Emphasis will be placed on response to short messages. One statistical sample of CP-V time sharing messages shows that 50% of the input lines are less than 5 characters in length, and 23% of the output lines are less than 5 characters.

   For this environment, immediate response will be given to input edit functions (like backspace and delete a character, or retype input line). At the same time, quick turnaround must be available even if only short messages are involved.

   Long output sequences will appear without noticeable time delays between data blocks received at the terminal.

3) Response versus efficiency.

   CP-6 is intended to maximize people productivity. Therefore, interactive response will take precedence over communications line throughput. As an example, output messages for terminals will be sent immediately without waiting for the formation of a line efficient transmission block.

CP-V supports a class of terminals for batch job transmission. CP-6 will support the same terminals (IBM

2780, 3780 and 360/20 HASP compatible devices). Since CP-V emulates the 360/20 HASP terminal, this will provide a facility for submitting jobs and transferring files between CP-V and CP-6 systems.

A CP-6 enhancement over CP-V functionality will be the support of logically addressable peripheral units (APU) as an extension of the I/O facility (see figure 4.4.4-1). Each APU corresponds to a logical device associated with a front end communications processor (FECP), a CP-6 host or a real-time processor (RTP). FECPs are described in section 4.4.4.2 and RTPs are described in section 4.4.8.5.1.

Each APU will be accessible from CP-6 applications programs by using the APU name. Certain classes of APU's may be accessed only from applications programs with specific authorization or privilege to do so. An integral part of this concept is the capability of applications programs to converse with local/remote terminals/peripherals and other applications programs in different Level 66 host systems or RTPs without being aware of physical characteristics and protocols for peripherals or communication circuits.

An APU is allocated to an applications program or a CP-6 system function by CP-6 resource management. The resource management function shall allow the existence of a pool of APUs, out of which individual logical units may be assigned to different CP-6 host systems.

4.4.4.2 Front End Communications Processors

CP-6 will support both local and remote front end communications processors (FECPs). The function of a FECP is to distribute the communications processing to smaller systems (Level 6/43 or larger) which can operate independently of Level 66 hosts. This will result in a reduction of software overhead on the host system and improve the availability of CP-6 systems. This will also reduce the net communications cost for the user. The FECP will also provide connections between the native CP-6 communication facility and IBM SNA networks and HDNA networks.

The main difference between a local and a remote FECP will be the hardware connection to the host. The local FECP will communicate to the host via a Level 66 DIA channel facility. The remote FECP will communicate to CP-6 host systems via a serial data communication circuit through a local FECP or another remote FECP. At least four local FECPs may be connected to a Level 66 host. At least three levels of

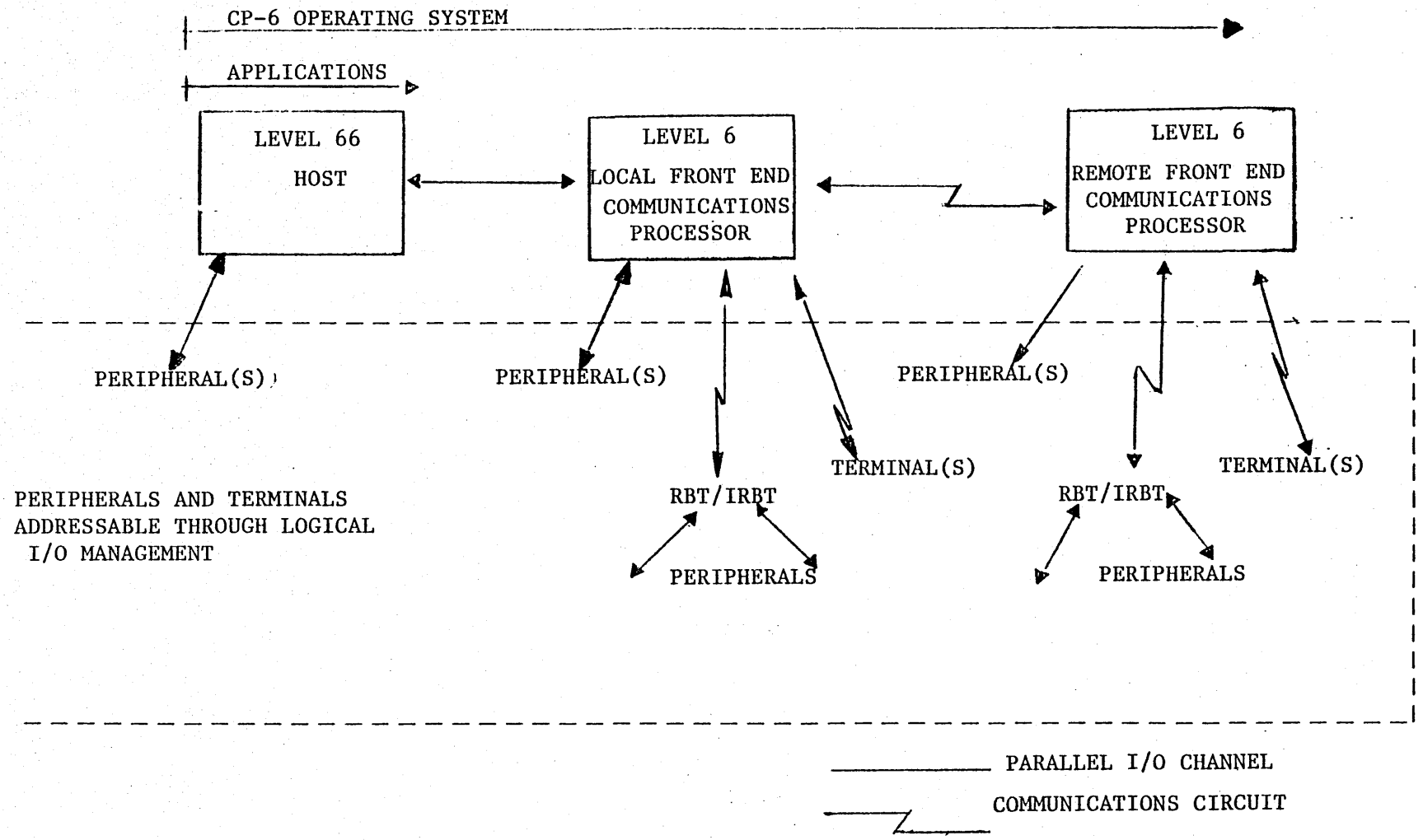

FIGURE 4.4.4.-1 HOST ADDRESSABLE PERIPHERAL UNITS

remote FECPs will be supported. A FECP which is local to one host system may be remote to other CP-6 hosts. A remote FECP may be concurrently connected to more than one host. A terminal connected to a FECP may logon to any of the hosts to which the FECP is connected. Figure 4.4.4-2 illustrates FECP connectability.

The communications software for the FECP will be designed such that CP-6 real-time programs executing in a real-time processor (RTP) can use a subset of the communications functions to exchange data with programs residing in the Level 66 host systems.

FECPs will provide the following facilities:

- Autobaud detection.
- Input and output message formatting similar to the transaction format descriptor (TFD) facility provided in CP-V. TFDs will be applicable to all interactive terminals and all processing modes.
- Reserve devices/dial-up line positions for host initiated applications or specific accounts.
- Interrogate status on any specific or of all APUs in the system.
- Reassign logical device addresses between functionally compatible APUs.
- Report traffic load (peaks and averages) by communications circuit.
- Interrogate status and display cumulative error counts of a line.
- Permit broadcast of messages from an operator. The broadcast may be directed to all terminals connected to a specific host or to a specified group of terminals.
- Produce accounting information enabling billing by communication circuit used.
- Permit an operator at a host system to log off a remote terminal.
- Down-line load remote FECPs from local FECPs.

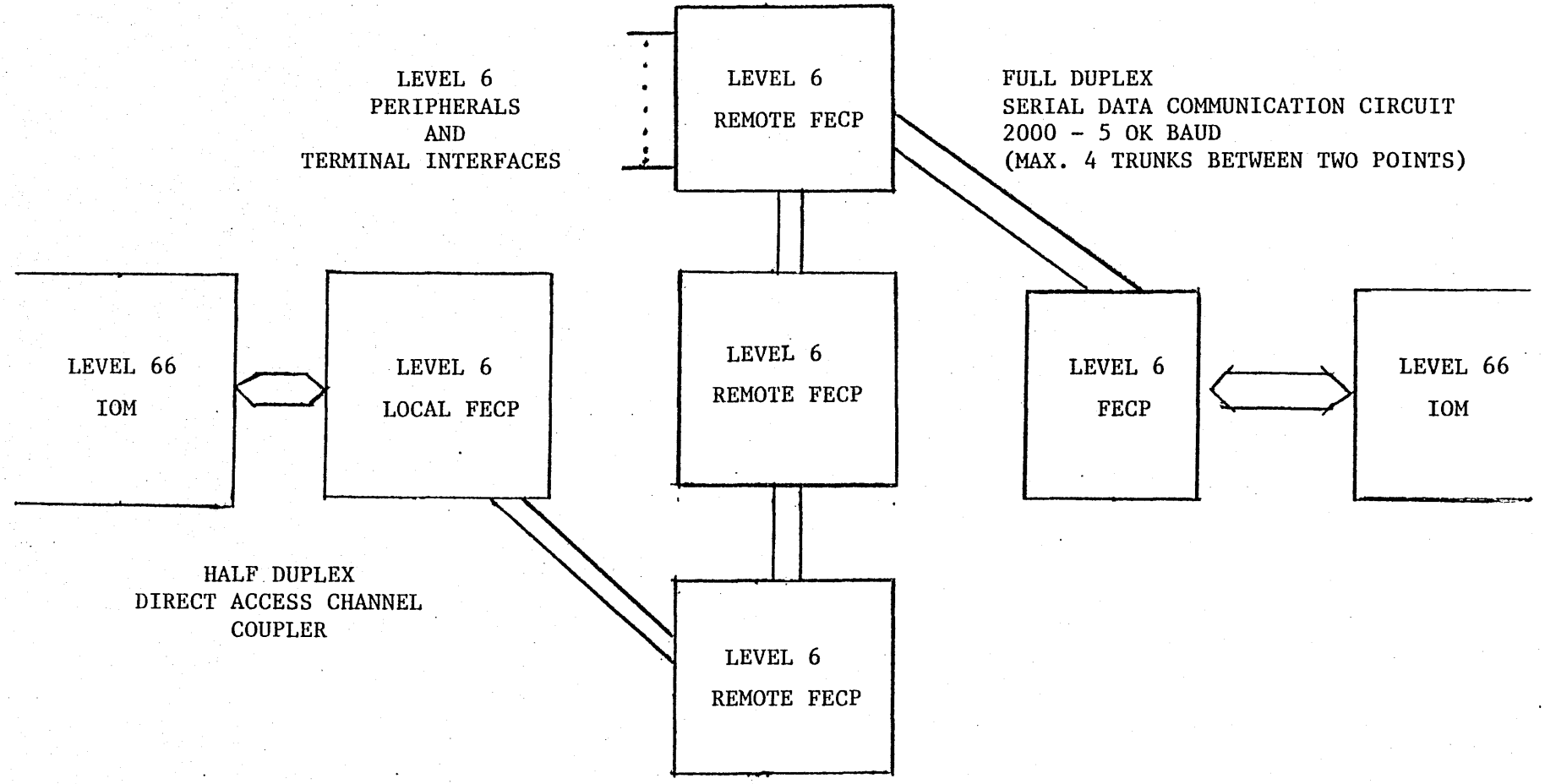

FIGURE 4.4.4.-2 FRONT END COMMUNICATIONS PROCESSORS

4.4.4.3 Device Support

Communications management will support a range of different terminal and peripheral types through specialized software handlers. Different classes of terminals or peripherals may have different priorities on service and resources in the FECP. The priority scheme will be set up to deliver best service to interactive devices.

The terminals supported will include:

1) Teletype 33, 35 and 37.

2) Dataspeed 40 terminals (Models 1, 2, and 4).

3) IBM 3270 and compatible terminals using BISYNC protocols (multi-drop line, polled terminal support).

4) Tektronix 4010 and 4013 (or other suitable graphics terminal).

5) IBM 2780 and 3780 or compatible terminals.

6) HASP multileaving 360/20 mode compatible devices including other CP-6 systems, CP-V systems, the Level 6 HASP IRBT package and XEROX 530 XSP systems.

7) Honeywell VIP series model 7100, 7105, 7200, 7205, 7700, 7705, 7760 and 7800 display terminals.

8) Terminals compatible with the above.

The FECP software will be designed to allow easy user implementation of new terminal handlers.

The peripherals supported on the FECP will include the following peripherals or their successor/replacements:

1) CRT keyboard console (DKU 9101/9102).

2) Keyboard typewriter console (TWU 9104/9106).

3) Diskette (DIU 9101/9102).

4) Serial character printer (PRU 9101/9102).

5) Line printer (PRU 9103/9104/9105/9106).

6) 9-track magnetic tape (MTU 9104 and MTU 9105 plus equivalent phase-encoded devices when announced).

7) Cartridge disk unit (CDU 9101/9102/9103/9104).

8) Card reader (CRU 9101/9102/9103/9104).

The nature of the terminal/peripheral (hereafter called device) support will, where possible, be such as to allow CP-6 applications programs to access the devices without recognizing the physical characteristics of the device. However, an option will exist to allow programs to obtain physical device characteristics and drive the device at the physical level (transparent data exchange).

4.4.4.4 Network Support

The local/remote FECPs in the CP-6 system will use a common "native mode" CP-6 protocol to exchange data. This protocol will accommodate the requirements outlined in section 4.4.4.1. It also will allow a common message format which is independent of the physical devices involved at the end points in the communications path.

The CP-6 protocol will allow support of IBM SNA and Honeywell HDNA protocols without affecting performance of CP-6 interactive terminal support. The following functions must be provided for supporting SNA:

1) Allow a CP-6 connected terminal to have interactive processing performed on a SNA host system.

2) Allow a terminal connected to the SNA network to have interactive processing performed in a CP-6 host.

3) Submit a batch job from CP-6 to an IBM host in a SNA network.

4) Accept a batch job into CP-6 from the SNA network.

5) Exchange output print files with the SNA network.

6) Exchange data files with the SNA network.

7) Exchange records of a data file with the SNA network.

It is anticipated that the following additional protocols may be required to be supported in the future:

1) Telenet (X.25)

2) Datapac (Bell of Canada, X.25)

4.4.4.5 Recovery/Back-Up/Redundancy

A design goal for the Level 6 FECP interconnect scheme will be to minimize the effect on overall system operation when a Level 6 mainframe is inoperative. To meet this goal, options will be provided to support multiple local FECPs and multiple trunk lines (communication circuits) between remote and local FECPs.

A FECP will be capable of responding to a terminal dial-in activity even if its host is not operational. The minimum response will be a notification of the host condition. An installation option will be to let the FECP log appropriate input transactions (Level 6 peripheral required) for processing when the host becomes available.

CP-6 communication management will have access to a journaling facility which will store selected messages for reprocessing in case of hardware/software failure.

4.4.4.6 Performance

A local FECP will be connected to its CP-6 host system via a half-duplex DIA channel coupler supporting data transfers of up to 1 MB/second. At least four local FECPs may be connected to a Level 66 host.

Remote FECPs may be connected to local FECPs or other remote FECPs via communication circuits supporting 50K baud full duplex transmission.

The FECP will support asynchronous transmission speeds of up to 19.2K baud and synchronous transmission up to 50K baud.

A FECP will be able to sustain character throughput rates of at least 15K bytes/second (worst case circumstances including logging of communications traffic)

4.4.5 System Service Processors

4.4.5.1 Accounting

CP-6 accounting will provide a superset of the CP-V accounting capability. Enhancements to CP-V accounting are described below.

4.4.5.1.1 Storage Accounting

CP-6 will allow computer installations to charge users at rates consistent with the CP-6 pack set and file archiving strategies.

4.4.5.1.2 Budget Accounting

A mechanism will be provided to control inter-session computer usage, based on budgets allocated to accounts.

An installation will be able to allocate funds for users and have the amounts retained by the system. Optionally, it will be possible to establish a tree structure for a hierarchy of budget centers. When logging on a user, CP-6 will optionally check for a positive budget value before allowing the user access to further system services.

Session charges will be calculated via the :RATES file or via installation supplied routines and will be deducted from the user°s budget at logoff time. An installation option will be provided to check a user°s budget after each job step and terminate the user if his budget has been exceeded. This can be selected on a user basis.

Installation management will also have the option to permit "bankrupt" users or groups of users on the system.

4.4.5.1.3 RATES

The RATES system will be expanded to include more items in the charge unit calculations, to enable users to communicate with the processor in more familiar terms, to generate charge rate tables which will give the user a charge expressed in dollars and cents, and to provide greater flexibility for installation specific charging. Among these enhancements are:

- All "chargeable" items in the accounting record will be capable of having their rate expressed individually in the RATE file.
- Fractional arithmetic will be provided by the RATES processor to alleviate tedious rate calculations by installations. For example, installations will be able to specify the cost per minute of CPU time in dollars and cents. The user will also be provided with a currency multiplier to be applied to the charge units before they are output to the user or

accounting record. This could be used to convert charge units to dollars if the installation chose to think of the two separately, or to convert units to other forms of currency.

- A large number of rate tables will be permitted.
- A capability will exist to give discounts to second or third shift users.
- Schedule and rate table records for proprietary software and special forms will be provided.
- The RATES processor will provide a mechanism for creating a new rate table using a skeleton rate table as a base.

4.4.5.1.4 Forms Accounting

Due to the many different types of forms (cards) and their varied costs, installations will be provided a means to charge based upon page count of each type of form used.

The total charge for forms will be included in the user's accumulated charges in his accounting record and also deducted from the user's budget. The form name and the number of pages utilized will be included on the user's accounting printout.

4.4.5.1.5 Compiler Charging

A method will be provided to charge for installation selected processors or programs in any account. A method for accumulating statistics for selected chargeable items will be provided.

The rate for specified processor usage will be established by the installation manager via the RATES system. The total charges for compilers will be included in the user's accumulated charges and deducted from his budget.

4.4.5.1.6 Job Step Accounting

Job step accounting will consist of the following:

- Job step accounting records written to the accounting file.

- Job step accounting statistics written to the listing device.

The generation of the job step accounting records will be controlled by the installation manager and will not be subject to user control. The printing of job step accounting statistics will be at the discretion of the user and controlled via Command Processor instructions.

4.4.5.1.7 FECP and RTP Accounting

Local and remote FECPs and RTPs will generate appropriate accounting information on their use. This information will be provided to the appropriate hosts to which they are connected.

4.4.5.1.8 Termination Accounting Printout

The accounting printout for batch jobs will be expanded to reflect the additional accounting information to be included in the termination accounting record, forms accounting record and the processor accounting record.

Accumulated charges for all users will be output in dollars and cents.

4.4.5.1.9 Recovery Accounting

All calculations performed by logoff or by installation-supplied accounting routines will also be performed during recovery.

4.4.5.1.10 Ghost Job Accounting

Accounting information will be kept for installation selected ghost jobs.

4.4.5.2 Performance Monitoring and Control

CP-6 will have the complete CP-V capability in the areas of the following processors:

- STATS
- CONTROL

. SUMMARY

The STATS facility will be enhanced to monitor, collect and analyze additional data related to CP-6 operational performance. This data will be used by customers and Honeywell field personnel in evaluating configuration expansion alternatives. The data will indicate the effect on system throughput of each alternative. Among the configuration alternatives and upgrades which will be directly evaluatable using the collected data are:

- Single versus dual channel disk access
- Single versus dual channel magnetic tape access
- Central processor upgrades
- Multiprocessor expansions
- Memory capacity expansions
- Increased performance and/or number of peripheral devices

Also, CP-6 will allow the easy incorporation of a dynamic system performance graphic display package.

4.5.3 Authorization

CP-6 will have the equivalent CP-V capability for logon and job authorization plus extensions in the areas of file management, APUs, and budget accounting. A template facility for generating user authorization records will be provided.

4.4.5.4 Operator Communication

CP-6 will retain the complete CP-V capability in the area of operator communication. Enhancements will include:

- Operator commands/messages will be divided into classes.
- A privileged command will be provided to allow any supported terminal device to receive/transmit one or more classes of operator console communication messages to/from it.
- CP-6 will not require IOM-connected consoles.

- An option will be provided for logging operator console I/O to a disk or tape file.

4.4.5.5 Honeywell Transactional Billing

CP-6 will provide a "transactional billing" type of accounting system for use by Honeywell to charge the customer for use of the computer system as a function of the load placed on the system. This is currently being further defined by LADC and Marketing.

4.4.6 User Services

4.4.6.1 System Call Services

System call services are the mechanism by which a user program requests CP-6 to perform a privileged operation while the program is executing. CP-6 services will provide equivalent functionality and results as their corresponding CP-V service. Higher level languages (FORTRAN, COBOL, PL/1, PL-6) will provide library routines to obtain system services from a user program. New system services will be provided for multitasking, intertask communication and other functions that are being added to CP-6.

Multitasking is defined to be the ability of a job (the "parent" task) to spawn off one or more additional tasks (jobs) which are to be executed concurrently with the parent task. This implies real concurrency in a multiprocessing environment and apparent (logical) concurrency in a single processor environment.

WHAT IS THIS - NOT BATCH OR LOAD AND LINK.

System services will be provided to allow a task to create (spawn) another task (sub-task). Either a run unit or a cataloged procedure may be spawned. A system service also will be provided to allow a task to abnormally terminate one of its sub-tasks.

A means for passing data between tasks also will be provided by system services. The sending and receiving of data will be asynchronous operations. Facilities will be provided to allow multiple streams of data to be passed between tasks and to time-out message sending or receiving. A facility such as shared data segments or "memory" files will be provided to pass large amounts of data with little or no system overhead.

4.4.6.2 Utility Processors

4.6.2.1 Edit

CP-6 Edit will provide the full complement of CP-V Edit capabilities. In addition, CP-6 Edit will have a macro capability. The macro of Edit commands can then be called as a single Edit command with parameter substitution.

WHAT IS THIS - IF IT IS TO BE DONE THEN WE NEED MUCH BETTER DEFINITION OF WHAT SORT OF CAPABILITY IS DESIRED. COMMAND STREAMS CAN PROVIDE PSEUDO-MACRO CAPABILITY.

4.4.6.2.2 PCL

CP-6 PCL will provide the full complement of CP-V PCL capabilities.

Additionally, CP-6 PCL will provide the user the ability to read and write "free form" (i.e., non-standard) tape formats.

4.4.6.2.3 Linker

The CP-6 Linker will provide the full complement of CP-V LYNX capabilities.

4.4.6.2.4 HELP

There will be a standard method by which CP-6 processors will provide information and assistance to on-line users. The processors will answer questions about their functions and explain usage errors. The user will be able to enter the HELP command at any prompt. Options will be provided to:

- Cause the processor to output a brief description of its function and operation including a list of commands and their purpose.
- Cause the processor to output detailed description of a command including its function and syntax. A facility for having all commands described in detail will also be provided.

If the user inputs a command which causes an error condition, the processor will respond with an error message to the user. If the user requires further assistance, he may query the processor for further information. Each time the user responds to an error message, he will receive a more complete explanation based on an interpretation of his input.

4.4.6.5 Debugging Facility

CP-6 will provide a comprehensive debugging facility functionally equivalent to the CP-V debugging facilities.

The features of the CP-6 debugger include:

- The debugger will be external. Language processors, in cooperation with the Linker, will be capable of producing a program schema in a standard form. The debugger can service a target program regardless of the source language and without requiring the generation of special code in the users program.

- The debugger will be multi-lingual. The debugger will deal with any target program regardless of the source language (or mixture of languages) from whence it came.

- The debugger will operate in batch and on-line. Batch variations include:

  - No prompt

  - No execution pause/resumption

- The debug command language will be easy to learn and use, will be appropriate for any source language, and will have an abbreviated form for terseness.

- The debugger will operate with or without a program schema.

Additionally a debugging facility will be provided for Level 6 programs created in the host resident software factory.

4.4.7 Command Processors

The Command Processor (CP) for CP-6 will be a replacement for TEL and CCI in CP-V and will be applicable to all modes of CP-6. It will contain the full functionality of both CCI and TEL but have the personality and syntax of TEL. It must be possible to add additional command processors easily to the system for providing a different personality for CP-6 (e.g., subsets of TSO, GE Mark II or III, GCOS 66).

In addition to the functions provided by CCI and TEL, the CP will provide the following capabilities:

- Adjust file attributes (? - seems a PCL function)
- Denote a file for archival backup
- Pre-scan job commands for syntax errors before submitting them to the system for processing
- Spawning tasks (forking) and waiting until all spawned tasks have been completed (joining). A command file may be spawned.

AGAIN - THIS IS THE FIRST I HAVE HEARD OF THIS

- Switch a terminal between time sharing and transaction processing
- Invoke compilation and/or Linker if a source file or object unit file is invoked in a program execution command

not currently planned for first release

- Invoke the HELP facility
- Change the file directory used for the default accessing of files

The current CP-V BATCH processor facility used to submit control command files to the spooling system for scheduling and execution of batch jobs will retain a similar personality in CP-6. Of particular importance is the retention of the easy to use parameter substitution capability and the EXEC facility which allows command files to call other command files or data files. EXEC → XEQ; function retained

In concert with CP-6's goal of minimizing operator intervention and improving throughput, the following additional features will be supported:

1. Ability to automatically insert the serial numbers of removable volumes (disk or tape) into the appropriate control commands for files when only the file name and desired generation are specified.
2. Ability to merge parts of a command file with another command file.
3. Global parameter substitution will be provided. For example, an execution of a job may require the use of a different file than is in the command file. It will be possible to use a single parameter to substitute the new file name for the one referenced in the command file.

4. Syntactical validation of the complete control command file prior to submission to the spooling system. This validation should occur after all requested command files have been merged and serial numbers and user parameter substitution has been completed. The expanded control command file will optionally be saved for correcting errors using Edit.

5. This facility can be invoked from a local or remote input device or from a time sharing terminal.

For competitive reasons, this facility should be referred to as Cataloged Procedures.

4.4.8 Processing Modes

4.4.8.1 Time Sharing

The services provided by CP-6 time sharing will continue the industry leadership role pioneered by CP-V time sharing. No design considerations will be made in any part of CP-6 (scheduler, communication, file management, etc.) that will compromise the responsiveness of CP-6 time sharing services.

CP-6 will provide the full complement of time sharing capabilities as described in the CP-V Concepts and Facilities Manual. Major enhancements will be provided to time sharing users by the communications enhancements included in CP-6 (see section 4.4.4).

Functional equivalents of the services offered by the CP-V Terminal Executive Language (TEL) in CP-V will be available in CP-6. Additionally, terminal coupling will be implemented for all types of interactive terminals supported in CP-6.

4.4.8.2 Batch

The objectives for batch processing in CP-6 are two-fold:

1) Maintain compatibility with CP-V.

2) Enhance the batch functionality to meet the on-going requirements of the CP-V base.

This latter requirement is due to the increased data processing usage of CP-V as the product has matured and has

been installed in environments where CP-V coresides with IBM systems. The commercial and business-oriented facilities must be enhanced in CP-6 to continue to meet this growing demand by our CP-V customers.

The underlying theme of these enhancements is to minimize operator and programmer intervention, simplify job submission by automating control command changes for production jobs, provide an easier to understand and use interface for the operator, and to provide facilities for the programmer or operator to easily correct problems and restart processing when errors are detected. It is desirable to have these enhancements be system options so they can be packaged for separate pricing.

These enhancements will include:

- Support for multiple operators consoles.
- Installation options to control which operator messages are to be sent to each operator console.
- A facility for an installation to dynamically alter CPU scheduling to provide better throughput of a class of batch jobs.
- Control command options for specifying that a job should not be scheduled until a specified date and time or until a specified ammount of time has elapsed.
- Providing a facility to allow more than one series of jobs to be order dependent from the same account.
- Provide switches which are kept over job steps and can be set and tested under program control. Control commands will also be able to test them to decide if the next job step is to be executed. Additionally, up to 4 words of data can be passed from one job step to another under program control.
- An operator key-in will be provided to display the resources and serial numbers of disk packs and tapes that a job in the spooling queue will require for execution.

4.4.8.3 Remote Batch

The CP-6 remote batch capability is a logically compatible extension of the current CP-V facility. Devices supported will include the following:

- HASP multileaving 360/20 mode compatible devices including other CP-6 systems, CP-V systems, the Level 6 HASP IRBT package, and Xerox 530 XSP systems

- IBM 2780 and 3780 or compatible terminals

Extensions to include the treatment of remote batch terminals as addressable peripheral units (APUs) will be made. This extension will include the ability to address resource groups by a single resource name as defined in section 4.4.1.2.

Operator and job control commands will be a functional superset of CP-V. Capabilities will include the ability to retransmit a spooling stream by a control command or the operator at a specified page or line position. Spooling files will optionally be held until the successful transmission or receipt of data streams is acknowledged. Requests for multiple destinations for output will be allowed. Host-located or remote operations personnel will be able to redirect output to an alternate destination device or to hold the spooling files. Error recovery will be improved over CP-V.

IRBT operator console commands will enable communication with other IRBT stations that are connected to the system.

In addition to HASP protocol support, SNA support (discussed in section 4.4.4) will become an important superset of the CP-6 computer to computer communications capability.

The equivalent of the ISCL/RATLER inter-CP-V file transfer service will be supported under CP-6. Also, the ability to transmit sequential and keyed files from/to IBM systems using SNA will be provided. Format conversions between ASCII and EBCDIC will be performed automatically. A similar capability, including format conversion, will be available to transfer files between CP-V and CP-6 systems.

4.4.8.4 Transaction Processing

The transaction processing facilities (TP) in CP-6 will form a functional superset of the equivalent facilities in CP-V. CP-6 TP should provide for concurrent processing of multiple transactions of the same or different type. Programs processing these transactions will be able to share files and other system resources using appropriate CP-6 services. User programs designated as reusable or shared will not have to be reloaded from disk for each transaction. Facilities will be provided to assist in debugging TP

programs. Additionally, all services available to the TP application program will also be available to it when it is executed in the batch or timesharing mode.

The major services provided by transaction processing are:

- Communication services
- Journalization
- File management services
- TP control and performance monitoring
- Recovery

These facilities are described in more detail below:

Communications Services

The communication services system transmits requests to the TP application and distributes the output. The TP application program will not need to recognize the protocols involved in communicating with CP-6 supported terminals. Any terminal supported by CP-6 communications management will be usable by TP.

Message routing and terminal formatting of input and output is handled by communications management. In addition, message integrity may be enhanced by using an optional journalization facility.

It will also be possible to specify terminal input and output message formatting by using terminal format descriptions (TFDs), as in CP-V.

Input and output messages may be queued in memory and disk resident queues. TP will receive messages from these queues in a user selected order of priority. Output messages will be transmitted to the receiving terminals in a user selected order of priority as well. It will be possible to designate receiving devices other than those used for input of transactions.

Multiple page reports transmitted to CRT terminal devices will be presented to the terminal operator a page at a time. The operator at the receiving terminal will also be able to request retransmission of previous pages in the current output report. However, the installation will have an option to inhibit retransmission for certain report classifications.

Journalization

The TP system will journalize several types of information, including:

a) Input transactions

b) Output reports

c) Data base recovery information

d) Application program specified information

The journal media (tape or disk) will be managed to minimize overhead for transaction processing. Multiple devices may be used concurrently for journalization. Installation parameters will be available to control the allocation of resources for journalization including the ability to pre-mount journal tapes to avoid waiting time when tape volumes are switched.

File Management Services

All standard file management services including I-D-S/II facilities will be available to TP application programs. Installation selectable options will be available to optimize for the TP environment. I/O caching facilities will be used to increase throughput for frequently used files.

TP Control and Performance Monitoring

The TP system will be designed to support uninterrupted 24 hours per day, 7 days per week operation. Since transaction volume and throughput requirements may vary while TP is operating, it will be possible to monitor performance and processing rates from designated TP master terminal(s). Additionally, the master terminal will be able to regulate the flow and priorities involved in the processing of transactions. The master terminal(s) will also have the ability to allocate or de-allocate resources used to support TP operation or to shut down TP operation.

The master terminal facility will be implemented to allow the system to continue operation even if the master terminal(s) are temporarily disconnected.

Recovery

The design goal for the recovery facility will be to guarantee the integrity of the data base(s) used in TP and

also to guarantee processing and proper response for all transactions accepted from TP associated terminals.

In addition, the recovery facility will allow recovery to proceed in parallel with entering new transactions into the system for processing after the recovery has been completed. This will avoid the appearance of lengthy "down-time" requirements and will serve to reduce processing bottlenecks when the system becomes operational.

4.4.8.5 Real-Time

4.4.8.5.1 Overview

The inclusion of a comprehensive real-time capability for CP-6 will be required to sustain and migrate both CP-R and CP-V real-time users to CP-6. This marketing goal requires that the following facilities be provided:

- A distributed, multitasking real-time processing facility, incorporating both Level 66 host and Level 6 real-time processors (RTP), both local and remote, that is highly responsive and utilizes the total processing capabilities of CP-6.

- Host and RTP real-time services that provide the logical equivalent of CP-R and CP-V real-time services.

- A host resident software factory for RTP program development, down-line loading, and up-line dumping.

- RTP interfaces to Xerox Direct I/O (DIO) and Multiplexing I/O Processor (MIOP) interfaced real-time equipment, as well as a new state-of-the-art line of digital and analog equipment.

The following definitions will be used throughout this subsection.

- Real-time job (subsequently referred to in this section as "job"). -- A program that is scheduled (entered into a prioritized event queue) upon the occurrence of a real-time event (interrupt, time of day, or period) and dispatched (the highest priority program entry in the scheduling queues is determined and control is passed to that program) for execution. Jobs residing on the host are always

centrally connected (software dispatched) and tasks residing on the RTPs may be centrally connected or directly connected (hardware dispatched).

- Real-time job set (subsequently referred to in this section as "job set"). -- A job set consists of one or more related jobs distributed among the host and RTPs. Therefore, distributed, multitasking, real-time processing exists for each job set in the system. Each job set in the system may exclusively share system resources related to the operation of its jobs.

4.4.8.5.2 Distributed Multitasking Real-Time Processing

The hardware and software employed to provide distributed, multitasking, real-time processing will be built upon the generalized CP-6 multitasking facility, as described in section 4.4.6.1.

As a minimum, RTP connectability will be as follows:

- Four local RTPs per Level 66 IOM.
- Four remote RTPs per local RTP or FECP.
- Three levels of remote RTPs.

There will be a data path between Level 66 IOM/DIA interfaces and the local RTPs. This path will allow direct memory access (DMA) transfers up to approximately 1 million bytes/second in half duplex mode with up to 75 foot separation. The link between local and remote RTPs will use an HDLC protocol supporting rates up to at least 50K baud. Remote RTPs will be down-line loaded from local RTPs or FECPs. RTPs will be based on Level 6/43 computers or future Level 6 systems of greater capability.

System software to support the distributed real-time system will be integrated to utilize the CP-6 concepts of logical I/O, job priority, prioritized I/O, and addressable peripheral units (APUs) (see section 4.4.4). CP-6 will permit any job to communicate with any other job of the same job set (host job to host job, RTP job to RTP job, and host job to/from RTP job). This multitasking communication will be synchronized via real-time services detailed in 4.4.8.5.3 of this subsection.

Arithmetic data formats between the Level 66 and Level 6 processors will be made compatible for transmission and

processing between the host and RTPs. This will be done in the hardware interface to minimize conversion overhead. At a minimum, formats to be converted bidirectionally include:

Level 6	Level 66
Integer Word	Integer Halfword
Integer Word	Integer Word
Two Integer Words	Integer Word
Bytes (packed)	Bytes (packed)
Bit Stream (packed)	Bit Stream (packed)
Floating Point, Single Precision	Floating Point, Single Precision
Floating Point, Double Precision	Floating Point, Double Precision

The most critical real-time interrupt response requirements will be handled at the RTPs with jobs directly connected to interrupts. Directly connected jobs (as defined in CP-R) will respond to interrupts, best case, in less than 100 microseconds. Centrally connected RTP jobs (similar to those in CP-R) will respond to interrupts, best case, in less than 500 microseconds. Any interrupt inhibit times will be additional to the above times.

Less time critical real-time processing will be done on the Level 66 host and will be dispatched by CP-6. Under best case conditions, initiated host jobs will be dispatched for execution in response to scheduling events within three milliseconds. Data transfer initiation times across the RTP/IOM link will be similar (not exceeding those of host real-time job scheduling).

Host real time jobs will have their own parameters to provide real-time system tuning.

4.4.8.5.3 Real-Time Services

The host and RTPs will provide real-time services that will accommodate both CP-R and CP-V real-time users at the functional level. This means that CP-R or CP-V real-time users will be able to logically distribute their real-time applications over the distributed real-time system host and RTPs. To accomplish this, any job will be able to

communicate with any other job in the same job set and to access appropriate real-time services. These real-time services, to be provided by both the host and RTPs, include (parenthetical mnemonics are CP-V equivalent services):

- Initialize or prepare a job for immediate or deferred dispatching and execution at a given priority.
- Start an initialized job running from the beginning or from where it was last stopped.
- Stop a job from running until it is initialized or started again.
- Schedule a job to be initialized upon the occurrence of an event (interrupt, time of day, period).
- Level 6 interrupt control services: connect/disconnect, arm/disarm, enable/disable, and trigger (or hardware-dependent equivalents). Multitasking facilities will provide equivalent capabilities on the Level 66.
- Request job and interrupt status: (Initialized, started, stopped, scheduled, and state of interrupts).
- Poll or request data from another job.
- Signal or send data to another job.
- Post the completion of data sent to a sending job.
- Job no-wait I/O services: Check for completion of a specific no-wait request, wait for completion of all no-wait requests, wait for completion of any no-wait request, test for the completion of any no-wait request, and delete a specific no-wait request.
- Simulate that an event took place for a given task (for example: BREAK or error (M:RUE)).
- Shared, programmed data segments, not restricted as to type (for example: public library, processor, data, subroutine, and labeled common), declared by the user but managed by CP-6.
- Prevent the execution interruption of the calling task by any higher priority task (M:INHIBIT).

- Acquire and release items controlled by real-time operations, such as devices, files, and tables. This service will be a user responsibility (not automatic), items may be declared for either private or shared use among tasks of the same job or among multiple jobs, and will be based on the enqueue/dequeue facility.

- Read calendar and high resolution clock time.

- Trap service that has the option to override an abort condition.

- In the RTPs, return from processing a centrally connected interrupt or clock pulse directly (without M:EXIT) to the point in the task that was previously running (M:INTRTN).

- In the RTPs, suspend execution while awaiting interrupts or clock pulses of higher priority than the current task (M:QFI).

- In the RTPs, acquire and release disk space by directly addressing the disk granules(M:GDG/M:RDG).

Users will be permitted to construct their own real-time services and trap handling routines on both the host and RTPs. For example, users will be able to write special routines for host or RTP power fail conditions or custom trap handlers for host or RTP real-time device faults.

4.4.8.5.4 Host Resident Software Factory

The host will provide all development tools necessary for RTP resident programs. These tools will be accessible on-line via interactive host terminals. RTPs will not require any local devices or local interfaces for the development of RTP programs. The host resident software factory will consist of:

- A FORTRAN compiler capable of generating host and RTP programs.

- A PL-6 compiler capable of generating host and RTP programs.

- A Level 6 assembly language cross-assembler.

- A linker to associate the common run-time elements of a given RTP task or tasks.

- A loader to down-line load run units to RTPs.

- An up-line dump capability from RTPs to the host.

- A debugger for programs written in FORTRAN, PL-6 or Level 6 assembly language that operates on Level 6 programs. It will have a subset of the capabilities of the standard CP-6 debugger and will run on the host.

- A simulator for RTP programs that will provide an RTP simulated environment, including run time services, on the host. For example, simulated RTP program run times will be reported and RTP interrupts will be simulated on the host.

- A performance monitor for real-time programs that runs on the host for host real-time programs and an equivalent capability that can be down-line loaded with RTP real-time programs to run on the RTPs. The performance monitor will record the occurrences of real-time events, such as the number of times interrupts are triggered, the real-time services used, I/O traffic among host and RTPs, as well as job execution time measurements.

4.4.8.5.5 RTP Interfaces

RTP hardware interfaces and software handlers for Xerox DIO and MIOP interfaced real-time equipment will be provided. Using these interfaces users of Xerox real-time equipment have the option of migrating to CP-6 real-time processing without reinvesting in new digital and analog equipment.

RTP hardware interfaces and software handlers for a new, state-of-the-art line of digital and analog equipment also will be provided. Whether or not Honeywell manufactured, this equipment will be eligible for Honeywell maintenance. These interfaces will be via Level 6 DMA channels and serial communication links. The new line of real-time equipment will have the following specifications:

- Analog input (low-level) subsystem
  +5mV to +1000mV ranges
  12 bit resolution
  at least 8KC per second (A/D conversion + data transfer)

- Analog input (high-level) subsystem
  +4V, +5V, +10V ranges

12, 13, 14, 15 bit resolution
at least 20KC per second (A/D conversion + data transfer)

- Analog output (D/A) subsystem
  +5V, +10V, 0 to + 5V, 0 to + 10V ranges
  2.5mV, 5mV, 1.25mV, 2.5mV per bit resolutions respectively
  10 to 50 m seconds settling time
  at least 20KC per second

- Analog output (sample and hold) subsystem
  +5V, +10V ranges
  2.5mV, 5mV per bit resolutions respectively
  at least 20KC per second

- Digital input card
  16 bits
  DTL or TTL compatible source input
  4-50V source input and current sink/contact sense input
  12V source (via power supply) and current sink/contact sense input

- Digital output card
  16 bits
  DTL and TTL compatible
  Current sink/interrupt logic
  Switch up to 50V
  Pulsed output

- AC output card
  8 isolated 117V AC switches

- AC input card
  8 117V AC input signals
  interrupt logic

- Optically isolated input card
  8 or 16 bit
  5V, 12V, 24V, 48V inputs
  Interrupt logic

- Relay output card
  16 bit
  mercury-wetted or dry reeds
  28VA 1 AMP, 10VA .5AMP respectively

- Interrupt card
  8 priortized levels of input
  enable/disable

Compatible with digital input

- Real-time clock card
  - 10K Hz or 60 Hz
  - Count down interrupt
  - Watchdog timer

- Time of day clock card
  - 60 Hz
  - Computer programmable

- Pulse counter card
  - Apply to serial input line

- Frequency counter card
  - Determine rate of pulses applied to serial input line
  - .1 Hz, 1 Hz, 10 Hz

- Serial communication interface card
  - EIA RS 232C, MIL-STD-188C, CCITTV24
  - Modem or current loop
  - Up to 2400 baud
  - Interrupt logic
  - Via analog and/or digital controller unit
  - Local and remote applications

- Custom interface card
  - I/O transfer and interrupt logic provided for designing custom circuits

In addition, hardware interfaces will be provided for the following standards for instrument bus interfaces:

- IEEE Standard Digital Interface for Programmable Instrumentation (IEEE Std. 488-1975/ANSI MC 1.1-75).

- IEEE Standard Modular Instrumentation and Digital Interface System (CAMAC: Computer Automated Measurement and Control) (IEEE Std. 583-1975).

Also a programmable real-time clock with clock rates up to 1 MHZ will be provided.

4.4.9 Language Processors

All CP-6 language processors will conform to the following overall standards:

- All language processors will be competitive with IBM on a feature comparison basis

- All will be structured to minimize conversion effort for current CP-V users while at the same time striving for compatibility with IBM and ANS.

- CP-6 language processors may be accessed uniformly by all program development access modes and will interact with a common, integrated file system

- All CP-6 language processors (except GMAP), the object code they generate and their libraries will be shareable. The object code generated for the Level 6 by the PL-6 and FORTRAN compilers will also be re-entrant.

- Object units from the different compilers may be combined by the Linker into a run unit

- All language processors will (except BASIC, APL) support compressed source input/output with an update capability

- All language processors, except RPG-II and BASIC, will support an interface to I-D-S/II

- The generation of special program code to use the debugger will not be required

- Subroutines generated by one compiler will be callable from a main program or subroutine generated by a different compiler

- Library routines will be provided for all languages to allow access to system services

4.4.9.1 COBOL

Both an ANS compatible and an IBM compatible COBOL compiler will be provided on CP-6. Both compilers will be available from either batch or time sharing, producing code executable in any mode. Both compilers will be shareable, generate shareable object code and produce a debug schema. It is anticipated that the IBM compatible COBOL can be derived from the GCOS 66 (ACOS) offering.

Features to be included in the COBOL compilers include:

- Compatibility with IBM OS/VS COBOL (IBM compatible COBOL only)

- Compatibility with ANSI COBOL-74 standards and FIPS pub 21-1 including the communications facility (ANS COBOL only)
- Support for decimal floating point
- Support of relative and indexed I/O
- Diagnostic aids at least as extensive as those of CP-V COBOL-68
- Interface to I-D-S/II and translation of DML (Data Manipulation Language) statements
- Capability to read/write a file in all standard system organizations except RANDOM
- Support of commands enabling a programmer to use the shared file facility of CP-6

4.4.9.2 FORTRAN

CP-6 FORTRAN will be based upon the CP-V ANS FORTRAN which is a superset of the current ANS FORTRAN standard. It will additionally be competitive with the FORTRAN of other vendors, such as IBM, DEC, CDC and UNIVAC. The compiler will be capable of generating object code for the Level 66 host or a Level 6 RTP. The compiler will generate locally optimized object code to minimize memory and execution time requirements.

Significant features include:

- IF-THEN-ELSE statement
- CHARACTER variables
- Expanded I/O capabilities with OPEN, CLOSE, and INQUIRE statements
- Real time features include the CONNECT, BUFFIN, BUFFOUT and ICHECK statements and, for Level 6 object code, an option to generate reentrant object programs and the optional use of a reentrant library
- Line by line syntax checking capability for the conversational time sharing user
- Load and go option

- Generalized DO loop
- N-dimensional arrays with generalized bounds
- Virtual arrays
- Expressions in input/output lists
- Global variables
- Generalized DATA and REPEAT statements
- Automatic double precision
- Compound statements
- Global statement labels
- Direct I/O (DEFINE FILE)
- IBM compatible NAMELIST
- Boolean functions for bit manipulation
- Single and double precision binary and decimal floating point

4.9.3 APL

CP-6 APL will be a superset of Xerox CP-V APL. In addition to the current CP-V functionality, it will have features comparable to IBM's APLSV. CP-6 APL will have shared variables, full I/O capabilities and an I-D-S/II interface, similar to the current APL-EDMS capability A facility for directing APL to obtain commands (function definition, global variables, etc.) from an edit-type file will also be provided. Additionally, CP-6 APL will be competitive and compatible with the I. P. Sharp and Comshare Ltd. APL processors.

4.4.9.4 BASIC

CP-6 BASIC will combine a superset of the features of CP-V BASIC, as well as the features of competitive versions, especially the Dartmouth BASIC and Tymshare SuperBASIC. Any feature of the ANS standards for minimal BASIC not included in any of the above will also be in CP-6 BASIC.

Using CP-V BASIC as the model, the following enhancements will be in CP-6 BASIC:

- ASCII and binary file I/O.
- Interactive capabilities while compiling or executing.
- Debugging features, such as breakpoint and trace, available within a program.
- Dynamic, run time array allocation.
- Similar on-line and batch execution environments.
- Standard CP-6 file I/O.
- Execute only mode for proprietary software.
- Time-outs on terminal read operations.
- Single and double precision binary and decimal floating point.

4.4.9.5 PL-6

The system programming language for CP-6 will be PL-6. It will provide basic PL/1-like statements and will be capable of handling data structures, bit and byte data, decimal and binary floating point. Storage classes include STATIC, AUTOMATIC, and BASED. CASE and DO-CASE statements will be implemented to facilitate the writing of more readable and structured programs. PL-6 will have the capability to include source records from files (INCLUDE statement), string substitution, and MACRO expansion. An alternate return address may be specified on subroutine calls to provide an error return.

PL-6 will operate as a shared processor under CP-6 and will generate efficient object code for either the Level 66 host or a Level 6 RTP. PL-6 will also produce concordance, source, and assembly language listings of the generated code.

4.4.9.6 RPG-II

The objectives of the CP-6 RPG design are as follows:

- CP-6 RPG-II will be a superset of CP-V RPG

- CP-6 RPG-II language will be equal to or a superset of IBM System 3 RPG-II. The only acceptable incompatibilities are those caused by "system conflicts" where the guideline is the requirements of the CP-6 system.

- For the same (or equivalent) language elements, an RPG-II object program operating on CP-6 will functionally perform the same as on System 3

- If a program compiles (with or without warning diagnostics) and executes under System 3 RPG-II, it will compile and execute in the same way under CP-6 RPG-II. If a warning diagnostic requires that an assumption be made, CP-6 RPG-II will make the same assumption as System 3.

- In the case of a program which is diagnosed by System 3 RPG-II to contain fatal errors, compatibility need not be guaranteed between CP-6 RPG-II and System 3 RPG-II. However, in general, the implementation will be designed to minimize possible incompatibilities.

- CP-6 will not be implemented in such a manner to preclude further extensions to make it compatible with IBM OS/VS RPG-II.

4.4.9.7 Assembler

Both a sophisticated Meta Assembler and an extended GMAP assembler will be available on CP-6. Both assemblers will support the EIS and NSA instruction sets in addition to the basic Level 66 instruction set. The object units produced by the assembler will be in standard CP-6 object language and will be capable of being combined with all other CP-6 compiler object units by the CP-6 Linker. The assemblers will also produce a symbol table and other related information for the CP-6 debugger. The Meta Assembler will be a functional superset of CP-V Meta-Symbol and feature sophisticated meta facilities, including recursive procedures, list definition and manipulation, conditional coding, and pseudo-ops (directives). The Meta Assembler will operate as a shared processor.

4.4.9.8 PL/1

PL/1 is a planned addition to the library of languages available under CP-6. The goal will be to modify either the existing ACOS, MULTICS or GCOS PL/1 compilers to interface to CP-6, as well as provide certain improvements. Enhancements will be made to make the PL/1 compiler consistent with the implementation philosophy of the other language processors that will be available under CP-6. These enhancements include:

- Producing tables necessary to operate the interactive debugging facility
- Producing optional symbol cross-reference listings
- Providing an optional °syntax check only° mode
- Implementing PL/1 as a shared processor
- Generating shared object code
- Provide compatibility with IBM OS/VS PL/1
- Providing for the subsequent implementation of a code optimizing feature

4.4.9.9 Integrated Data Store/II (I-D-S/II)

The design objectives for the data base management system under CP-6 are as follows:

- To maintain maximum functional and operational compatibility with EDMS (and with CODASYL standards)
- To provide enhancements in terms of host language support and analysis tools
- To provide a comprehensive framework for incorporation of additional file management structures under control of a data base administrator

I-D-S/II has evolved to represent a comprehensive data base management system based on the latest CODASYL standards. As such, I-D-S/II will be used as the vehicle to provide a data base system for CP-6.

The features of CP-6 I-D-S/II are listed below:

- Data Structure

Provides an environment which uses a single, uniform schema Data Definition Language for describing the information in a data base.

- Integrated Files

  These are structured files with built in record-to-record relationships established by pointers. There are five main types of structures: hierarchy, tree, network, cycle and inverted. Secondary indexes containing key(s) other than the primary key allow records to be related on the basis of a common characteristic and can be used to create inverted files.

- Other File Organization

  In order to provide a general, comprehensive capability for defining and accessing all data elements in a user environment, the DBMS must include the capability to use indexed and random file organizations.

- Data Definition

  A Data Definition Language (DDL) provides for the logical description of the data base -- record content, structure, set relationships, access modes, privacy levels, etc. The DDL is used to derive a schema -- an independent file containing the data base description.

  A subschema DDL is used to logically subdivide the data base into portions in order to limit the access of individuals to only those sections with which the application is concerned. The subschema file also is independent of the object program.

  A Device Media Control Language (DMCL) is used to relate the data base definition to actual physical disk storage characteristics. The DMCL is used to define such attributes as area content and size, page size, and number of records per page.

- Data Base Control

  The features of privacy and security are discussed in a later section. At this point, it is sufficient to say that the schema and subschema files are provided with password locks. The schema files also contain the system locks and keys applicable at various levels in the data base.

Provision is made for determining that the subschema is clean by a validation process.

Provision also is made for cross reference lists of the following:

- All subschemas and dates translated against the schema.
- All subschemas that reference each set, area, or record of a schema.
- All programs and dates compiled against a subschema.

. Language Processor Support

To provide compatibility with EDMS, interfaces to I-D-S/II by COBOL (IBM compatible), ANS COBOL, FORTRAN, Meta Assembler, GMAP, PL-6, APL and PL/1 will be provided. The COBOL, ANS COBOL, and FORTRAN interfaces will use appropriate verbs for data base manipulation.

. Data Manipulation Language Verbs

A comprehensive set of Data Manipulation Language (DML) verbs will be available to the I-D-S/II programmer.

. System Interface

The data base control system and any libraries will be implemented as shared processors.

The current (last accessed) records on a set, area, and program basis will be made available to the user program in a user work area.

Shared access and update of the data base will be provided including detection and notification to user programs of a deadlock condition.

The DML verbs will be made available to the timesharing user to provide interactive access to I-D-S/II.

. Data Base Utilities

General Utilities will include provisions for:

- Statistical analysis of the data base.

- Dumping to tape and/or printing all or part of the data base.

- Initialization of page control and space inventory processing information in data base pages.

- Simulating the placement of CALC type (random) records in the data base.

- Printing of specified portions of a journal including capabilities for record selection, sorting, and merging.

- Loading and/or printing pages of the data base.

- Restructuring of a data base to provide for increasing size, adding new relationships, new passwords, new record types, etc.

- Recovery of a data base using a backed-up copy of a data base and the journal(s).

Data Base Integrity

Integrity means protection against damage to a file or its contents due to willful or inadvertant programmer action or to software or hardware problems.

Short-term recovery/restart within a program will be provided including recovery/restart from deadlock conditions.

Long-term or system recovery following hardware or software problems will be provided for by journal disk/tape files of data base activity. The data base reload utility using the data base back up and journal(s) will assist with a site's disaster prevention procedures.

As a result of a single user abort or system recovery, the recovery process will automatically recover the data base using the in memory buffers and, if necessary, the journal(s). All data elements and sets in the data base will be provided with password locks/keys to prevent unauthorized access and/or update. Capability for enciphering data with a user supplied mask before writing and after reading will also be provided.

4.4.9.10 Interactive Database Processor (IDP)

This section describes the functional requirements of a self-contained, non-computer user oriented, interactive capability for inquiry, maintenance, and report generation against data files. The overall objectives of IDP are:

- Provide an enhanced, integrated equivalent of CP-V processors MANAGE and IDP
- Provide commands that are easy to learn and use for users without knowledge of programming or computers
- Provide a comprehensive capability -- using the data definition language of I-D-S/II -- for describing, retrieving, maintaining, and displaying information

The functional requirements of IDP are as follows:

- Data Description

  Provide user access to a pre-defined subschema description of the data to which he is privileged to access. Contained in the subschema are the necessary locks and keys to control access and insure privacy. The data files may be organized as integrated, keyed, indexed, relative or sequential.

- File Retrieval

  Provide a command language based upon MANAGE retrieval functionality to permit:

  - Retrieval qualified by boolean criteria
  - Retrieval contingent on the results of the previous retrieval statement
  - Computations on the data retrieved
  - Sorting retrieved data on one or more data items retrieved and/or computed in ascending, descending, or mixed order

- Report Generation

  Provide a command language and high level editing capability for:

  - Displaying of one or more single/multilevel reports with page layout, headings, subtotals, totals, and data element editing control.

- Directing output to the user terminal or a local or remote APU.

On-line sessions are to be interactive and provide for syntax checking. User error handling options will be provided for no record or no data found conditions. A set of commands will be capable of being cataloged as a procedure for on-line or batch execution.

4.4.9.11 TEXT

UPDATE REQ'D IN NEXT PFS VERSION

CP-6 TEXT will be a superset of CP-V TEXT. Additional capabilities to be included in CP-6 TEXT are as follows:

. Multiple Columns

  Causes subsequent printout to be formatted into one or more columns.

. Footnote Definition Command

  Defines a footnote and associates a name by which it can be referenced.

. Footnote Reference Command

  This command causes a footnote reference to be inserted at the point of the command and causes the footnote itself to be placed at the bottom of the page.

. BREAK Key on Input

  On TTY-compatible terminals, the BREAK key can be used as a substitute for the ATTN (Control D) key.

. Command Acknowledgement

  TEXT will acknowledge the receipt of most commands by writing a space-backspace sequence to the terminal.

. Allow/Inhibit Command Acknowledgement

  Allows or inhibits the acknowledgement of commands. The standard acknowledgement is a space-backspace sequence.

. Flagging Changes in the Updated Version

TEXT will allow the user to put a specified character in the right or left hand column of each input line that has been updated.

The following CP-V TEXT capabilities will be enhanced in CP-6 TEXT:

- Block Callout Command

  A new version of the block callout command will be defined. It will cause the named block to be inserted at this point if enough space is left on the current page; otherwise, the current page will continue printing and the named block will print at the top of the next page.

- Unconditional Skip to Next Page

  Causes unconditional skip to next page when performing multiple column formatting.

The following features of CP-V TEXT will not be included in CP-6 TEXT:

- OMRON 8025 Display-Oriented Editing.

- Xerox Graphics Printer (XGP) Support.

4.4.9.12 Sort/Merge

The goal of CP-6 Sort/Merge is to retain user interface personality as similar to CP-V as possible while providing a competitive offering.

Sort/Merge will be callable from any terminal or job input peripheral. In addition, Sort/Merge will be callable from any processor or user program. A co-resident Sort facility will also be provided.

Constraints associated with device independence in any phase of the Sort/Merge process will be minimized.

Transliteration of character sets will be available for input and/or output files. Collating sequence will be able to be designated at the individual field level within a file. The collating sequence can specify ascending and descending, as well as character set sequence.

Fixed and variable length, blocked and unblocked, single and multi-volume files may be specified for input and output.

Linkages to allow execution of user own-code interfaces will be available on the Sort/Merge input and output phases.

4.4.10 Application Processors, Packages and Libraries

A profile of the application processors, packages and libraries used in the CP-V PARC is currently being developed by Marketing. This information will be combined with the results of a similar study being undertaken by EXCHANGE, the Xerox Computers Users Group, to develop an overall position. The priorities and detailed requirements for key "packages" will then be developed. The following limited information provides a sampling of application software shipped to users of 32-bit Xerox computers.

The number of requests for processors was accumulated from October, 1975, to the present. Tabulated request data prior to October, 1975, is not available. Other assumptions include that each request was by a CP-V site, that no site made more than one request per processor, and that the requested processor is now in use by that site.

Based on this limited data, there will be a need to provide the following processors. The processors are listed in the order of the most requested first:

- XPL Compiler
- Extended ALGOL 60
- LISP 1.5
- SNOBOL4 V3.7
- Simulation-Oriented Language (SOL)
- SL-1
- GASP-II

The the following application packages and libraries are listed in descending request frequency:

- Execution Analyzer Program
- SIGMA Project Management System (SPMS)
- Vanderbilt Statistical Package VUL2
- GPDS

- Interactive Critical Path Method
- BIO-MEDICAL Statistical Package - BMD (UCLA)
- Electronic Circuit Analysis Program (ECAP)
- CIRC-TRANSIENT
- BIO-MEDICAL (Regular and X Series)
- CIRC-DC
- CIRC-AC

4.5 Hardware Support and Configuration Requirements

4.5.1 Level 66

The basic 6000 instruction set plus the EIS and NSA extensions will be supported by CP-6. The maximum configuration will include four central processors, four Input/Output Multiplexors (IOM) and as much unit record equipment, magnetic tapes, disk devices, mass storage devices, communication front end processors, and real time processors as is configurable by hardware. The minimum memory configured for CP-6, supporting approximately 25 users, will be no more than 1 megaword. Memory increments will be no greater than 512K words and the maximum memory will be at least 16 megawords. The peripherals to be supported by CP-6 are defined in subsequent sections. The following memory systems, currently being marketed on Sigma 6 and 9, will be field modifiable to operate on Level 66:

XPF 6850 and 9850	MOS memory subsystem including 128KW starter unit
XMM 6610 and 9610	64KW memory unit
XMM 6611 and 9611	128KW memory unit
XMM 9612	Second system controller including 128KW starter unit
XMF 6650 and 9650	Battery backup option

The hardware factoring strategy for CP-6 will be defined subsequently in the CP-6 Pricing Plan.

4.5.2 Unit Record Devices

The following is a list, by current model number, of the devices and features to be supported by CP-6. If any of the following devices are superseded in the Level 66 product line prior to CP-6 release, the most recent devices will be supported by CP-6.

URP 0600/0601/0602	Unit Record Processor (inclusion of appropriate device adapters is assumed)
URF 0041	Dual Switched Channel
CRU 1050	1050 Card Reader
CRF 0003	51 Column Read
CRF 0005	Mark Sense
PCU 0120	100-400 cpm Card Punch
PRU 1100	1100 lpm Line Printer
PRU 1200	1200 lpm Line Printer
PRU 1600	1600 lpm Line Printer
PRB 0513	64 Character ASCII Belt
PRB 0524	64 Character OCR A/B Belt
PRB 0600	96 Character ASCII Belt
PRF 0022	160 Column Option

Additionally, plotter support equivalent to Calcomp 563/565 plotters will be provided.

4.5.3 Magnetic Tape

The following is a list by model number of the devices and features to be supported by CP-6:

MTP 0601	Magnetic Tape Processor (inclusion of appropriate adapters

	is assumed)
MTF 1042	Dual Simultaneous Channel
MTF 1047	IBM EBCDIC to ASCII Conversion
MTU 0410/0411/0412	75 ips Tape Drive, 9T, 800/1600 bpi
MTU 0610/MTF 0605	125 ips Tape Drive, 9T, 800/1600 bpi
MTU 0610/MTF 0607	200 ips Tape Drive, 9T, 800/1600 bpi
XTP 9310	Magnetic Tape Processor
XTU 9312	75 ips Tape Drive, 9T, 800/1600 bpi
XTU 9313	125 ips Tape Drive, 9T, 800/1600 bpi
XTU 9314	200 ips Tape Drive, 9T, 800/1600 bpi

Additionally, the GCR (6250 bpi) tape controller and drives will be supported when they are announced. MTU 0610 and XTU 9313 and 9314 transports will be field-upgradeable to GCR operation.

Dual access, cross barring and all permissible intermixing of MTU types on a single controller will be supported.

4.5.4 Disk

The following is a list, by model number, of the devices and features to be supported by CP-6:

MSP 0600/0601/0602/0603	Mass Storage Processor (including device adapters as appropriate)
MSF 1019	Software Switchable Channel
MSF 1021	Dual Simultaneous MSP Channel
MSF 1031	Dual MSP Cross Barring Feature
MSF 0007	Rotational Position Sensing (mandatory option)
MSF 1026	Software Switchable Channel
MSF 1036	Dual MSP Cross Barring Feature

MSF 0011	Dual Access Feature
MSU 0402	100 MB (unformatted) Removable Storage Unit
MSU 0451	200 MB (unformatted) Removable Storage Unit
MSU 0500	2x600 MB (unformatted) Non-Removable Storage Units
XSP 9210	Mass Storage Processor Plus 4-200 MB (unformatted) Removable Storage Units
XSP 9211	200 MB (unformatted) Removable Storage Unit
XSF 9250	Second Mass Storage Processor for Dual Access
XSF 9251	Dual Access for 200 MB (unformatted) Removable Storage Unit

CP-6 will support dual access and intermixing (on either one or two MSP°s and crossbarring (on two MSP°s) of MSU 0402°s, 0451°s and 0500°s devices.

4.5.5 Mass Data File

CP-6 will support the CDC Mass Data File when it becomes a Level 66 product. The Mass Data File will be used as tertiary storage for archiving files.

4.5.6 Level 6

The Level 6/43 processor (or larger) will be used as front end communications processors (FECPs) and real-time processors (RTPs) in CP-6. An unattended bootstrap loader, to support initialization via a down-line load, will be added to these devices. At least 16 MLCP°s with individual line speeds up to 50K baud will be supported. A capability to attach IBM SDLC lines will also be provided. Minimum memory requirements will be determined during implementation.

The following Level 6 peripherals will be supported by CP-6 FECPs and RTPs. This support will be for both local and

remote processors. If any of the following devices are superseded before CP-6 release, the successor devices will be supported by CP-6.

DKU 9101/9102	CRT Keyboard Console
TWU 9104/9106	Keyboard Typewriter Console
DIU 9101/9102	Diskette
PRU 9101/9102	Serial Character Printer
PRU 9103/9104/9105/9106	Line Printer
MTU 9104/9105	9-Track Magnetic Tape
CDU 9101/9102/9103/9104	Cartridge Disk Unit
CRU 9101/9102/9103/9104	Card Reader

4.5.7 Minimum Configuration

The minimum CP-6 configuration will be as follows:

1 Level 66B Central Processor w/IOM and SCU

1 MW Memory

2 Disk Spindles and controller (attached to the IOM)

1 Front End Communications Processor with one Honeywell ASCII EIA RS232B terminal for use as a host operators console

1 Binary input device on either a local Level 6 or on the Level 66 for loading diagnostics (see section 4.7.3)

For the initial release of CP-6, it will be permissable to require, in addition to the above minimum configuration, a card reader, a line printer, and a magnetic tape unit attached to the Level 66.

4.6 System Definition and Recovery

4.6.1 System Definition

The overall philosphy of the CP-6 system definition process will be simplicity. Complex procedures will be simplified, eliminated or performed at a central location by Honeywell personnel and then distributed to the user. Among the features of CP-6 system definition are:

- The CP-6 system definition process will interact with the user. Command inputs may be assigned to come from a terminal, card reader, magnetic tape or a disk file.

- The system definition process will be able to determine what equipment (peripherals, memory, etc.) is installed on the system on which it is working and to select appropriate software handlers. This capability will extend to FECPs and RTPs connected to the system.

- The CP-6 system definition process can be directed to ignore equipment or to make provision for additional equipment.

- Boot time configuration of peripherals and symbolic patching of CP-6 modules will be possible at least as complete as in CP-V.

- The system definition process will allow users to easily interface modifications to the standard system.

- The CP-6 system definition files will be distributable on disk pack media to eliminate the magnetic tape requirement for system definition purposes. The system definition material will include procedures, CP-6 object modules, CP-6 load modules, test programs, and any necessary patches.

- The CP-6 system definition process will be compatible with pricing strategies which may include separately priced access modes (transaction processing, real time, etc.), features, higher level languages, or service processors.

4.6.2 Recovery

CP-6 recovery will retain the philosophy of CP-V recovery. Emphasis will be placed on recovery speed and minimizing loss of user program and data. Highlights are:

- A comprehensive dump will be produced by the recovery process for analysis by systems personnel
- The recovery process will require a minimum of operator intervention
- Batch jobs which were running when the system crash occurred will be optionally restarted
- System failures in the FECP(s) or RTP(s) will cause no loss of batch jobs being processed on the Level 66 host
- Terminal input will not be suspended when the Level 66 is down but, in appropriate circumstances, will be buffered to an FECP disk or tape unit if available
- Rollback of data bases after a system crash will be as automated as is feasible and allow for the user to provide routines to assist in recovery of the data base.
- A memory error in the user's address space will cause, at worst case, a single user abort.

4.7 Reliability/Maintainability/Availability

4.7.1 Error Detection, Logging and Retry

CP-6 will make comprehensive use of the error detection features of the Level 66/Level 6 hardware hosts. Additional software-related detection facilities also will be provided for those areas of the system where hardware error detection lacks comprehensiveness or cannot be applied. CP-6 will provide a comprehensive log of detected errors and corresponding retry events. Appropriate software modules will initiate hardware retry or software retry for all errors that lend themselves to retry. Errors from all hardware processing elements, memory units, and addressable peripheral units will be uniformly integrated in the CP-6 error logging facility. The CP-6 error logging facility will be equivalent to the Honeywell HEALS product or its successor product. Files will be in a format that affords a high level of commonality between the GCOS and CP-6 error log analyzers.

A number of installation management options will be included in the CP-6 error logging facility including:

- Optional logging of successful hardware-initiated error-correction retries.

- Optional number of software-initiated retries to overcome a given error type.

- Thresholding will be provided to notify the operator when system elements exceed given error rates.

- Optional suspension of all error logging functions during, for example, critical real-time processing operations.

- Utilization of a comprehensive set of user-access points permitting further extension and customizing of error management facilities.

The CP-6 error detection, logging and retry facilities will not require configurations which include models CSU6001 or CSU6002 operator's console.

4.7.2 Fail-Soft/Reconfigurability

CP-6 will successfully recover from the failure of any isolatable hardware element, including but not limited to:

- Any addressible peripheral device (APU) for which an assignable alternate device is available.

- Any operator's console.

- Any disk track (except possibly those containing a single copy of non-resident system services).

- Any memory page -- recoveries will minimize the loss of user programs and data.

Other hardware reconfiguration options permitted by CP-6 include (on the Level 66 host):

- Memory address change, port inhibit and interleave alteration.

- Central processor and IOM addition/deletion.

- FECP and RTP addition/deletion.

- MCP addition/deletion (if an alternate path exists).

Reloading activities may be required for some of these operations although the goal is to permit changes to occur dynamically during system operation. The system definition process should not be required. CP-6 will support dual-access disk and magnetic tape, as well as permit use of statically-switched unit record, local FECP, local RTP and Level 66 cross-barring capabilities. Such dual-path capability may encompass one or two IOMs and may be utilized without requiring reload or system definition operations. Operator interaction may be required during reconfiguration operations. However user program receivers will be provided permitting customer implementation of automatic fail over systems. In addition, CP-6 will be designed to readily permit the future implementation of automatic reconfiguration capabillties as standard features.

4.7.3 On-Line Diagnostics

CP-6 on-line hardware diagnostics will be based on the Honeywell TOLTS system. The TOLTS user interface will be retained to minimize FED retraining requirements. CP-6 TOLTS will be enhanced, if necessary, to provide functional equivalency to the CP-V OLTEST capability.

The goal of CP-6 TOLTS is to permit rapid, straightforward detection of hardware malfunctions in isolatable units of the Level 66 system. These isolatable units include, but are not limited to, all peripheral devices (both local and remote),disk pack tracks, physical memory pages, secondary central processors, and IOMs.

CP-6 TOLTS will provide a straightforward user interface permitting complete use of TOLTS by an installation's operation staff.

CP-6 TOLTS may be run with complete functionality from any CP-6 terminal and will not require configurations which include models CSU6001 or CSU6002 operators console.

A comprehensive on-line diagnostic capability will be provided for CP-6 FECPs and RTPs, both local and remote. Closed loop line/terminal tests will be provided for supported terminal devices which incorporate such facilities. These tests will be initiated and controlled by the Level 66 host system.

4.7.4 Off-Line Diagnostics

Off-line hardware diagnostics for the Level 66 will include the capability to test all Level 66 features and peripherals. Diagnostics will also be provided for comprehensive testing of local and remote Level 6 FECPs and RTPs. A binary input device (magnetic tape, diskette or disk) must be available on either a local Level 6 or the Level 66 for loading diagnostics for both Level 6's and the Level 66. Model CSU6001 or CSU6002 operators console will not be required by Level 66 diagnostics. Level 6 diagnostics will not require processor control panels or local peripherals (with the exception of a binary input device if one is not available on the Level 66). Appropriately configured Level 6 systems may run local diagnostics autonomously of the Level 66 host.

The diagnostic strategies will be consistent with the Honeywell repair policy for each system unit. Level 66 diagnostics, combined with the on-site board tester, will be oriented to on-site integrated circuit replacement. Level 6 diagnostics will be oriented toward board swapping.

On a tandem system, it will be possible to partition the system into a CP-6 on-line subset and a simultaneously operating off-line diagnostic subset.

4.7.5 Error Log Analysis

An Error Log Analyzer will be provided on CP-6 to list, summarize and analyze the error log. The Error Log Analyzer will have at least the functionality of CP-V ELLA and Honeywell's HEALS II. It will be designed in a manner that allows easy incorporation of future HEALS II enhancements. The user interface will retain a high degree of commonality to the GCOS HEALS II interface to minimize FED retraining requirements. Its output will be human engineered to enable customer participation (i.e., non-cryptic printouts) and will provide self-prompting reports.

4.7.6 Software Failure Analysis

CP-6 ANLZ will provide the full complement of CP-V ANLZ capabilities to analyze host, FECP or RTP crash dumps or to inspect the current running system. Appropriate extensions will be made for architectural changes in CP-6. Additionally, an Executive Delta (XDELTA) facility will be provided to debug the host, FECP or RTP systems software. Both ANLZ and XDELTA will have user interfaces similar to their CP-V counterparts to minimize retraining of FED and customer analysts.

4.7.7 Remote Access

Remote access for on-line diagnostic operation, performance monitoring, and operations consultation will be included in CP-6. This capability will be provided by standard CP-6 facilities. Among the CP-6 remote access specifications are:

- Site dial-out only
- Standard terminals used
- CP-6 system security invoked
- Site-specified local terminal coupling with remote access terminals

In addition, off line diagnostics will have a remote access capability. Since there is no CSU6001/2 console, the Level 6 will incorporate the remote assist capability.

4.7.8 Source Power Failsafe

CP-6 will include an integrated hardware/software power failsafe system. Power failsafe for this specification is defined as the ability to sense an impending source power outage at the host site and upon such a detection, to bring the system to an orderly shutdown state; subsequently, to detect the corresponding steady state restoration of source power and then to restore at least all "critical system hardware" and at least all "on-line software activity", using appropriate power sequencing, to the processing state immediately succeeding the point of interruption. All of the above functions should be performed entirely without manual intervention. "Critical system hardware" is defined to include at least all mainframe electronics, all local and remote FECPs and RTPs, all interactive terminal devices, all operator's consoles, and all disk storage subsystems. "On-line functions" include all program activities initiated in the time sharing and transaction processing modes.

Exceptions to the integrated power failsafe capability are:

- Source power failures involving interactive terminal devices.
- Source power failures involving common carrier communications equipment or "foreign" value added network equipment.

- Remote Level 6 equipment to the extent that the Level 6 specific power failsafe logic fails, after power restoration, to initiate appropriate down-line load requests.

Additional power failsafe features include:

- The ability to detect and notify the operator of the expiration of the battery backup memory content retention facility.

- The provision of "user hooks" in the power failsafe routines permitting the addition of user created instruction sequences (for example, in support of real-time processing).

Memory content retention will be provided on all Level 66 and Level 6 main memories. The extent of this duration will be not less than four minutes. This capability, based on constantly charged batteries, will recharge to 90% after depletion within two hours or less.

CP-6 power failsafe routines will be designed for hardware configurations which do not include as a standard item motor generator/alternator sets or equivalent capabilities. Such equipment will be installed on a site specific exception or customer option basis.

4.7.9 Software Distribution

The CP-6 products, as well as associated updates and corrections, will be distributed in a manner at least as timely and convenient as the CP-V equivalents. Specific features include:

- Distribution on both magnetic tape and disk pack media.

- Distribution of source and object-code versions of CP-6 with the exception of program modules related to implementation of a transactional billing system.

- Distribution, at least at the object level, of the PL-6 system language.

- Distribution of "patches" and other software updates at the source level to accommodate customer-modified CP-6 systems.

- Provision for a symbolic patch capability to "patch" the system at load time without requiring any system recompile or relink activities.

- Provisions to allow an installation to edit, add, and delete entries in the patch file.

APPENDIX A

1. All facilities relating to SNA and SDLC support of connection.
2. All facilities relating to HDNA support or connection.
3. All facilities relating to X.25, DATAPAC, and Telenet support or connection.
4. IBM compatibility in any of the language processors (particularly COBOL) and IBM VSAM in the file system.
5. Command language compatibility with TSO and VSPC.
6. All items in the PFS labeled "beyond third release."
7. Multitasking except spawning of jobs (no join) for execution in parallel in multiple CPUs.
8. A monitor for performance evaluation on either Level 6 or Level 66.
9. A Level 6 FORTRAN cross compiler.
10. A Level 6 PL-6 cross compiler.
11. Interactive I-D-S II.
12. Support for the mass data file.
13. Full implementation of APUs.
14. Generation data sets.
15. Certain of the file security options in Section 4.4.2.
16. Support of Dataspeed 40 Model 4.
17. Macros of EDIT commands.
18. STATS enhancements in Section 4.4.5.2.
19. Serial number insertion in control command files to replace file name and generation, Section 4.4.7.
20. Automatic compiler invokation on request to execute compiler source.
21. Floating point facilities in PL-6.

22. Single and double precision decimal floating point in FORTRAN.

23. Secondary indicies for CP-6 file managed file records.

24. Meta Assembler.

25. PL/1.

26. IBM compatible COBOL.

27. Hardware reference manuals, Section 3.8.

28. Real time data acquisition hardware.

29. Conversion coupler for Level 6/Level 66 data transfer.

30. Programmable real time clock (1 MHZ) for Level 6.

31. Power failsafe and power sequencing.

32. Plotter interface hardware.