2 mf

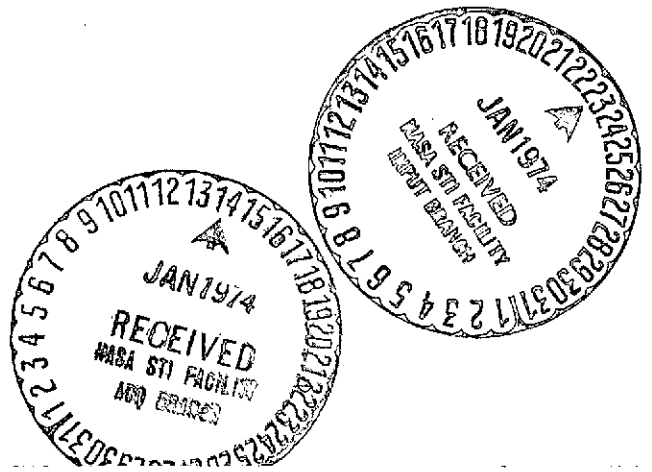
October 1, 1973
KSC - GP-421 F

SQT

JOHN F. KENNEDY SPACE CENTER

[redacted]

ANNUAL ADP PLANNING DOCUMENT



(NASA-TM-X-69298) ANNUAL ADP PLANNING DOCUMENT (NASA) ~~39~~ 40 p HC $4.00 CSCL 05A

N74-14695

Unclas
G3/34 26524

DIRECTOR INFORMATION SYSTEMS

October 1, 1973
GP-421 F

JOHN F. KENNEDY SPACE CENTER

ANNUAL ADP PLANNING DOCUMENT

For additional copies of this document or for additional information, please contact:

Dr. Rudolf H. Bruns, Chief
Computer Systems Division, IN-CSD
John F. Kennedy Space Center, NASA
Kennedy Space Center, Florida 32899

ORIGINATOR: M. Mogilevsky

M. Mogilevsky
Computer Systems Division

APPROVAL: R. Bruns

Dr. Rudolf H. Bruns, Chief
Computer Systems Division

APPROVAL: K Sendler

Karl Sendler, Director
Information Systems

APPROVAL: Peter A. Minderman

Peter A. Minderman
Director of Technical
Support

GP-421 F

JOHN F. KENNEDY SPACE CENTER

ANNUAL ADP PLANNING DOCUMENT

DIRECTOR INFORMATION SYSTEMS

October 1, 1973

CONTENTS

TABLES

SUMMARY

//Division A of this document describes the Category A computer systems at KSC (A1 and A2) which perform scientific and business/administrative operations. //Since the consolidation of the Data Systems Division and the Automatic Data Processing Division in 1972, both A1 and A2 systems are under the Chief, Computer Systems Division (IN-CSD). This Division is responsible for scientific requirements supporting Saturn, Atlas/Centaur, Titan/Centaur, Titan III, and Delta vehicles, and includes real-time functions, quick-look data reduction, and systems analysis on such programs as Skylab, The Apollo-Soyuz Test Project (ASTP), and the Space Shuttle. The work is performed chiefly on the GEL-635 (A1) system located in the Central Instrumentation Facility (CIF). The A1 system can perform computations and process data in three modes: (1) real-time critical mode; (2) real-time batch mode; and (3) batch mode. The Division's IBM-360/50 (A2) system, also at the CIF, performs business/administrative data processing such as personnel, procurement, reliability, financial management and payroll, real-time inventory management, GSE accounting, preventive maintenance, and integrated launch vehicle modification status.

Contractor personnel now on-board (Federal Electric Corporation and New World Services, Inc.) involved in computation and data processing total the following in terms of manyears:

Contractor Manyears

	FY-73	FY-74	FY-75
R & D	147	139	130
R & PM	166	163	148
Total	313	302	278

The appropriations for contractor services in terms of obligations (as of August 16, 1973) are as follows:

(Thousands of Dollars)

	FY-73	FY-74	FY-75
R & D	$3,228	$3,182	$2,962
R & PM	$2,359	$2,156	$2,535
Total	$5,587	$5,338	$5,497

The figures include ADPE maintenance and other related costs, and are an adjustment in FY 74 and FY 75 that includes $11K each year for additional ADPE maintenance not previously reported.

The number of government ADP personnel ranging in grade from GS-2 through GS-16 remains at 68 for PY (FY-73), CY (FY-74), and BY (FY-75).

There are two category A computer systems and 23 operational category B systems.

The data on ADP personnel, equipment, and resources in the new revised formats is presented in this prefatory section of the plan.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Table A-1

CATEGORY A SYSTEMS FUNDING DATA

(Each Category A system – Dollars in Thousands)

SYSTEM UNIT AND ID DESIGNATOR: 7601 A1

DATE SUBMITTED: October 1, 1973

OPERATIONS – CATEGORY A		PY 1973	CY 1974	BY 1975	BY + 1 1976
CAPITAL INVESTMENT	PURCHASE *(New ADPE)*	150	530*	230	230
	PURCHASE *(Leased ADPE)*	0	0	0	0
	PURCHASE *(Other Equipment)*	0	0	0	0
	SITE PREPARATION	0	0	0	0
IN-HOUSE OPERATIONS	CIVILIAN SALARIES/MIL. PAY **	–	–	–	–
	ADPE RENTALS	21	25	25	25
	TELECOMMUNICATIONS	24	24	24	24
	SUPPLIES & MISC. COSTS	115	115	115	115
CONTRACTOR SERVICES	ADPE TIME AND RELATED SERVICES	0	0	0	0
	SYSTEMS ANALYSTS/ PROGRAMMERS	1975	1940	1762	1762
	ADPE MAINTENANCE	816	813***	813***	813***
	OTHER MISC. SERVICES	437	429	387	387
INTER-AGENCY COSTS	PAYMENT – OTHER GOVT. AGENCIES	0	0	0	0
	RECEIPTS – OTHER GOVT. AGENCIES	(0)	(0)	(0)	(0)
TOTAL OBLIGATIONS ▶		3538	3876	3356	3356
NO. OF MANYEARS FOR THIS SYSTEM		**	**	**	**

REMARKS *(Include Major Funding Highlights; significant Increases/Decreases)*

*Includes $300K budgeted for purchase of Datanet 355 and DSS-180 Disk Storage Subsystem.

**Both A1(R&D) and A2(R&PM) personnel are in one Division.

This entry is, therefore, combined under A2(R&PM).

***Includes $11K for Datanet 355 maintenance.

NASA FORM T-28 AUG 73

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Table A-2

CATEGORY A SYSTEMS FUNDING DATA

(Each Category A system – Dollars in Thousands)

SYSTEM UNIT AND ID DESIGNATOR	DATE SUBMITTED
7601 A2	October 1, 1973

OPERATIONS – CATEGORY A		PY 1973	CY 1974	BY 1975	BY + 1 1976
CAPITAL INVESTMENT	PURCHASE *(New ADPE)*	24	10	10	10
	PURCHASE *(Leased ADPE)*	0	0	0	0
	PURCHASE *(Other Equipment)*	0	0	0	0
	SITE PREPARATION	0	0	0	0
IN-HOUSE OPERATIONS	CIVILIAN SALARIES/MIL. PAY	1230	1255	1281	1352
	ADPE RENTALS	14	15	15	15
	TELECOMMUNICATIONS *	-	-	-	-
	SUPPLIES & MISC. COSTS **	128	135	135	135
CONTRACTOR SERVICES	ADPE TIME AND RELATED SERVICES	0	0	0	0
	SYSTEMS ANALYSTS/ PROGRAMMERS	1797	1982	1834	1834
	ADPE MAINTENANCE	102	108	108	108
	OTHER MISC. SERVICES	460	66	593	593
INTER-AGENCY COSTS	PAYMENT – OTHER GOVT. AGENCIES	0	0	0	0
	RECEIPTS – OTHER GOVT. AGENCIES	(0)	(0)	(0)	(0)
TOTAL OBLIGATIONS ▶		3755	3571	3976	4047
NO. OF MANYEARS FOR THIS SYSTEM		68	68	68	68

REMARKS *(Include Major Funding Highlights; significant Increases/Decreases)*

* These are entered under A1 (R&D).
** These show the new "fringe benefits" figures (A-83).

NASA FORM T-28 AUG 73

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ANNUAL ADP PLAN FUNDING DATA – CATEGORY A ONLY

(Dollars in Thousands)

INSTALLATION: KSC

Table A-3

DATE SUBMITTED: October 1, 1973

OBLIGATIONS – CATEGORY A		PY 19 73	CY 19 74	BY 19 75	*GROUP SUMMARY TOTALS ONLY – NO DETAIL REQUIRED* BY + 1 19 76	BY + 2 19 77	BY + 3 19 78	BY + 4 19 79
CAPITAL INVESTMENT	PURCHASE *(New ADP)*	174	540*	240	240	240	240	240
	PURCHASE *(Leased ADP)*	0	0	0				
	PURCHASE *(Other Equipment)*	0	0	0				
	SITE PREPARATION	0	0	0				
IN-HOUSE OPERATIONS	CIVILIAN SALARIES/ MILITARY PAY	1230	1255	1281	1666*	1740*	1818*	1901*
	ADPE RENTALS	35	40	40				
	TELECOMMUNICATIONS	24	24	24				
	SUPPLIES & MISC. COSTS	243*	250*	250*				
CONTRACTOR SERVICES	ADPE TIME & RELATED SERVICES	0	0	0	5497	5497	5497	5497
	SYSTEMS ANALYSTS/ PROGRAMMERS	3772	3922	3596				
	ADPE MAINTENANCE	918	921**	921**				
	OTHER MISC. SERVICES	897	495	980				
INTER-AGENCY COSTS	PAYMENTS – OTHER GOVT. AGENCIES	0	0	0	0	0	0	0
	RECEIPTS – OTHER GOVT. AGENCIES	(0)	(0)	(0)				
TOTAL OBLIGATIONS ▷		7293	7447	7332	7403	7477	7555	7638

*$128K for FY-73 and $135K for FY-74 and beyond as "fringe benefits." ** See Forms T-28(A1).

COMPUTER SYSTEMS/CPU'S/MANYEARS – CATEGORY A							
NO. OF COMPUTER SYSTEMS/CPU's	2/6	2/6	2/6	2/6	2/6	2/6	2/6
NO. OF MANYEARS	68	68	68	68	68	68	68

NASA FORM T29 AUG 73

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ANNUAL ADP PLAN HARDWARE FUNDING DATA – BY APPROPRIATION

(In Thousands of Dollars)

INSTALLATION		DATE SUBMITTED
KSC	Table A-4	October 1, 1973

INSTRUCTIONS

GENERAL. This form is used for the presentation of financial data encompassing the hardware aspects of ADPE *(i.e., lease, maintenance, purchase)* by the appropriate category of equipment and the appropriation from which it is funded.

FUNDING DATA. List the total lease, maintenance, and/or purchase costs of all ADPE equipment at the installation. Funds for the past year *(PY)* should be readily reconcilable to the official accounting records at the installation. Funds listed for the current and budget years *(CY and BY)* should be consistent with the latest approved financial operating plan, POP's, WAD's, PAD's, etc.

NOTE: Use reverse for continuations.

APPROPRIATION		PY 19 73			CY 19 74			BY 19 75		
		LEASE	MAINT.	PURCH.	LEASE	MAINT.	PURCH.	LEASE	MAINT.	PURCH.
CATEGORY A	R&D	21	816	150	25	813*	530*	25	813	230
	R&PM	14	102	24	15	108	10	15	108	10
	C O F F	0	0	0	0	0	0	0	0	0
	TOTAL	35	918	174	40	921	540	40	921	240
CATEGORY B	R&D	0	33**	288**	0	36	0	0	36	0
	R&PM	0	0	0	0	0	0	0	0	0
	C O F F	0	0	0	0	0	0	0	0	0
	TOTAL	0	33	288	0	36	0	0	36	0
ALL EQUIPMENT	R&D	21	849	438	25	849	530	25	849	230
	R&PM	14	102	24	15	108	10	15	108	10
	C O F F	0	0	0	0	0	0	0	0	0
	TOTAL	35	951	462	40	957	540	40	957	240

REMARKS *(Include major funding highlights)*

*Includes $300 K budgeted for purchase of Datanet 355 and DSS-180 Disk Storage Subsystem and $11K for maintenance.

**Shows mini computers purchased in FY-73 and $19 K for maintenance.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CATEGORY A SYSTEMS – UTILIZATION

(Hours per year)

INSTALLATION: KSC 7601 Series Table A-5

DATE SUBMITTED: October 1, 1973

A-83 SYSTEM ID NO.	SCIENT./ENGR. APPLICATIONS			DATA REDUCTION			MISSION CONTROL			SIMULATION			ADMINISTRATIVE APPLICATIONS			TOTAL		
	PY	CY	BY	PY	CY	BY	PY	CY	BY	PY	CY	BY	PY	CY	BY	PY	CY	BY
A1	6445	7405	6528				4153	3560	3072				3724	3275	3200	14322	14240	12800
A2													7015	6950	7000	7015	6950	7000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CATEGORY B EQUIPMENT – SYSTEMS SUMMARY

INSTALLATION: KSC 7602 Series Table A-6

DATE SUBMITTED: October 1, 1973

A-83 SYSTEM ID No.	CPU TYPES	APPL. CODES	CPU'S INSTALLED			PROGRAM SUPPORTED	FUNCTION PERFORMED
			PY	CY	BY		
B1	PDP-8*	13	1	1	1	Skylab	Vehicle Vibration Launch Analysis
B2	XDS-930	12	2	2	2	Skylab	Launch Data System
B3	RAY-703*	11	1	1	1	Delta/Centaur	Unmanned Launch Vehicle TLM Checkout
B4	EMR-6130	12	1	1	1	Skylab	Quick-Look Data System
B5	SEL-810*	12	1	1	1	Skylab	TLM Data Comparator
B6	HPC-2116B*	12	1	1	1	Skylab	Auto.(RF)Frequency Analysis System
B7	PDP-8	12	1	2	2	Unmanned Launch(WTR)	TLM Universal Decommutator System
B8	HPC-2100A*	15	1	1	1	Shuttle	Design Verification Simulator
B9	HPC-2114B*	12	1	1	1	Skylab	Transient Signal Measuring Device
C1	XDS-910	11	1	1	1	Skylab/ASTP	Utility Processing and Training
C2	XDS-910	11	1	1	0	Apollo	Launch Vehicle Subsystems Data Display
C3	XDS-910	11	1	1	0	Apollo	Launch Vehicle Subsystems Data Display
C4	XDS-910	11	1	1	1	Skylab/ASTP	Launch Vehicle Subsystems Data Display
C5	XDS-910	11	1	1	1	Skylab/ASTP	Launch Vehicle Subsystems Data Display
D1	XDS-910	11	1	0	0	Apollo	Launch Vehicle Subsystems Data Display
D2	PDP-11/40*	12	0	1	1	Shuttle	Launch Processing System
D3	DSI 120*	12	0	1	1	Shuttle	Launch Processing System
D4	PDP-11/40*	12	1	1	1	Shuttle	Launch Processing System
D5	PDP-11/45*	12	1	1	1	Shuttle	Launch Processing System
E1	XDS-930	11	3	3	3	Skylab/ASTP	Launch Vehicle Subsystem Data Proc.
E2	XDS-930	11	3	3	3	Skylab/ASTP	Launch Vehicle Subsystem Data Proc.
E3	XDS-930	11	3	3	3	Skylab/ASTP	Launch Vehicle Subsystem Data Proc.
E4	XDS-930	15	1	1	1	Skylab/ASTP	Simulator Tester/Trainer
Z5	PDP-8/S*	19	1	1	1	Skylab/ASTP	Engineering Calculations

* Minicomputers

NASA FORM T32 AUG 73

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AUTOMATIC DATA PROCESSING EQUIPMENT FUNDING DATA

(In Thousands of Dollars)

1

INSTALLATION	CATEGORY	APPROPRIATION	DATE OF REPORT
KSC Table A-7	☐ A ☒ B	☐ R & PM ☒ R & D ☐ C OF F	October 1, 1973

A-83				PY 19 73			CY 19 74			BY 19 75		
LOC CODE	ID	SYSTEM DESCRIPTION	UPN	LEASE	MAINT.	PURCH.	LEASE	MAINT.	PURCH.	LEASE	MAINT.	PURCH.
7602	B1	PDP-8	954		2			2			2	
7602	B2	XDS-930	954		11			11			11	
7602	B3	RAY-703	492									
7602	B4	EMR-6130	953		38			38			38	
7602	B5	SEL-810	954		1			1			1	
7602	B6	HPC-2116B	954									
7602	B7	PDP-8 (WTR)	492			25						
7602	B8	HPC-2100A	987		18	24		18			18	
7602	B9	HPC-2114B	954									
7602	C1	XDS-910	966		10			10			10	
7602	C2	XDS-910	-		9							
7602	C3	XDS-910	-		15							
7602	C4	XDS-910	966		15			15			15	
7602	C5	XDS-910	966		10			10			10	
7602	D2	PDP-11/40	987		4	50		4			4	
7602	D3	DSI-120	987			11						
7602	D4	PDP-11/40	987		4	39		4			4	

x1

NASA FORM 1415 SEP 69

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AUTOMATIC DATA PROCESSING EQUIPMENT FUNDING DATA

(In Thousands of Dollars)

INSTALLATION: KSC — Table A-7 (continued)

CATEGORY: ☐ A ☒ B

APPROPRIATION: ☐ R & PM ☒ R & D ☐ C OF F

DATE OF REPORT: October 1, 1973

A-83 LOC CODE	A-83 ID	SYSTEM DESCRIPTION	UPN	PY 19 73			CY 19 74			BY 19 75		
				LEASE	MAINT.	PURCH.	LEASE	MAINT.	PURCH.	LEASE	MAINT.	PURCH.
7602	D5	PDP-11/45	987		11	104		11			11	
7602	E1	XDS-930	966		42			42			42	
7602	E2	XDS-930	966		42			42			42	
7602	E3	XDS-930	966		42			42			42	
7602	E4	XDS-930	966		22			22			22	
7602	Z5	PDP-8/S	953		2			2			2	

NASA FORM 1415 SEP 69

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AUTOMATIC DATA PROCESSING PERSONNEL SUMMARY DATA

INSTALLATION: KSC

Table A-8

DATE OF REPORT: October 1, 1973

GRADE	MANAGEMENT			ANALYSTS AND PROGRAMMERS			OPERATORS (*Clerical, keypunch, etc.*)			OTHER PERSONNEL			TOTAL		
	PY 73	CY 74	BY 75	PY 73	CY 74	BY 75	PY 73	CY 74	BY 75	PY 73	CY 74	BY 75	PY 73	CY 74	BY 75
EXCEPTED AND GS-16	1	1	1										1	1	1
GS-13 THRU GS-15	19	19	19	22	22	22							41	41	41
GS-9 THRU GS-12				16	16	16							16	16	16
GS-5 THRU GS-8				4	4	4				5	5	5	9	9	9
GS-1 THRU GS-4										1	1	1	1	1	1
TOTAL	20	20	20	42	42	42				6	6	6	68	68	68

REMARKS

NASA FORM 1416 SEP 69

DIVISION A

CATEGORY A COMPUTER OPERATIONS

I. GENERAL INFORMATION

The Kennedy Space Center Central Computation Complex performs scientific and technical/administrative data processing in support of prelaunch, launch, and postlaunch checkout and operations, as well as engineering and management systems analysis amd data processing within the technical/administrative area of responsibility. In November 1972, the Data Systems Division and the ADP Division were merged into the Computer Systems Division (IN-CSD). In addition to the responsibility of managing the operation of KSC's category A equipment, Division personnel also represent KSC in contacts with NASA Headquarters in the planning, acquisition, utilization reporting, and special hardware and software studies of computer and related equipment. These responsibilities are specified in such documents as the OMB Circular A-83, and A-83, Revised, "Management of ADP in the Federal Government," OMB Circular A-44, Revised, "Management Review and Improvement Program," and all other requirements as listed in NHB 2410.1A, "Management Procedures for Automatic Data Processing Equipment."

Computer operations are performed under the cognizance of KSC government personnel by two support service contractors - the Federal Electric Corporation (FEC) and New World Services, Inc. (NWSI).

The Central Computation Complex receives requirements for computer operations and data reduction from three basic sources: (1) local KSC requirements; (2) other NASA Centers; and/or (3) The Office of Manned Space Flight (OMSF). Local KSC business requirements are processed in accordance with KMI 2410.2A, "Management Automatic Data Processing (ADP) Support." Scientific computation requirements are processed in accordance with KMI 2410.3/TS, "Management Procedures for Automatic Data Processing Equipment." Test data requirements follow the management instructions of KMI 8660.2A/TS, "KSC Support Documentation System." The requirements from OMSF or other NASA Centers are processed in accordance with NASA-recognized requirements documents. Stage contractor requirements are accepted after validation by the appropriate technical manager, and are evaluated by government computer personnel, who submit the appropriate recommendations to the requestors for the services.

II. SCIENTIFIC COMPUTATION EQUIPMENT AND OPERATIONS

A. Requirements

The following computation and quick-look data reduction activities are among those being performed by the GEL-635 (A1) System in support of NASA and NASA contractor activities at KSC and Cape Kennedy:

- Preflight data reduction
- Scientific planning and analysis
- Preflight simulation and subsystem evaluation
- Prelaunch test support
- Real-time telemetry and ground support equipment data monitoring using the CIF Data Core Subsystem
- Postflight quick-look data reduction
- Recording of Air Force Eastern Test Range (AFETR) tracking data in real time

The GEL-635 (A1) system can operate in three multiprogramming modes.

1. Real-Time Critical Mode

During prelaunch testing, countdown, and launch operations, each half of the system operates in real time. Its functions consist of storage, retrieval and processing of up to 5,000 telemetry measurements per vehicle. The system accepts data from the ground station at the nominal transfer rate of 432,000 bits per second and can refresh 30 independent CRT display devices within one second.

2. Real-Time Batch Mode

In this mode the A1 System performs general-

purpose scientific computing and data reduction and display functions.

3. Batch Mode

When in this mode, the system processes general-purpose scientific and administrative data in a multiprogramming environment.

Some of the real-time scientific applications listed below are for launch vehicle and spacecraft ground support in general, such as the Saturn Vehicle, the Atlas Centaur, Delta, Titan/Centaur, Titan III, Skylab, ASTP, and the Shuttle Program:

- General Launch Vehicle and Spacecraft Ground Support
- Capture of Meteorological Radar Data
- Special Eastern Test Range Impact Predictor Data
- Space Vehicle Telemetry Data
- Launch Vehicle Guidance Data
- Preflight Simulation
- Data Communication with other NASA Centers
- Atlas/Centaur, Titan/Centaur, and Titan III (Medium Launch Vehicles) Guidance Computer Reduction
- Medium Launch Vehicle Computer Laboratory Tape Reduction, Parameter Computation, Event Data Processing, and Landline Analog Parameters
- Major Launch Vehicle Prelaunch Countdown Testing, and Real-time and orbital requirements

Quick-look data requirements pertain to all projects and will indicate the number of telemetry measurements to be reduced. The requirements include:

a. Quick-look telemetry reduction to convert all measurements to engineering units versus time.

b. Detailed guidance computer data reduction.

c. Weather data calculation.

d. Quick-look orbital elements. (The input parameters are provided by the AFETR immediately after orbital insertion (Saturn). Orbital elements are also required by Project Centaur with input from the guidance computer data.)

e. Telemetry calibrations (Saturn).

f. Reduction of all measurements to volts (Remote Automatic Calibration System).

g. Discrete history.

h. Reduction of all measurements to percentage figures (Information Bandwidth Centaur).

i. Time edit (comparison of on-board time to Greenwich Mean Time).

j. Formatting all reduced engineering units for transmittal to MSFC (Project LIEF).

k. Facilities and environmental measurement reduction.

There are seven data acquisition systems which require reduction to quick-look engineering units. The number of measurements to be reduced varies from 400 to 600 with a point frequency of 30 to 40 per second.

The following are representative of the general non-real-time scientific applications and requirements:

- Preflight Data Requirements
- Planning and Analysis
- Contractor Requirements
- Postflight quick-look data reduction
- Recording of Air Force Eastern Test Range (AFETR) tracking data in real time

Table 1 shows PY (FY-73), CY (FY-74), and BY (FY-75) major computing requirements performed by the A1 system:

Table 1

GEL-635 (A1) Computation Requirements

	PY (FY-73)	CY (FY-74)	BY (FY-75)
Mission Test and Support			
Heavy Launch Vehicles	3581	2563	1280
Medium Launch Vehicles	573	997	1792
Shuttle	143	143	512
Scientific Support	1575	1424	1280
TSS	4726	5838	4736
Business Applications	3724	3275	3200
Total Hours	14,322	14,240*	12,800*

*Estimated

B. Major Accomplishments

During PY (FY-73), the scientific computation A1 system was used in support of the manned missions (Apollo and Skylab) and the medium launch vehicles. This work continues into CY (FY-74) and BY (FY-75), as work on the Apollo-Soyuz Test Project progresses. In addition, scientific and engineering program development on the Shuttle requirements continues.

During the Skylab 1 and 2 prelaunch and launch phases, a computer program was developed to permit the continuous processing of real-time data from both vehicles, a major accomplishment.

As of August 1, 1973, approximately 450 persons were enrolled in or have completed courses in software training such as time-sharing programming (BASIC and FORTRAN languages), Open-shop FORTRAN, COBOL, and Numerical Analysis, since such training was first offered in 1971.

C. Resources and Expenditures

The Hardware Funding Data (NASA form T30) indicates $300,000 budgeted in CY (FY-74) for the purchase of the Datanet 355 system to augment present remote processing services. With implementation of this amount, $11,000 a year is to be provided for maintenance costs.

D. System Description

The scientific and real-time computer system (A1) is composed of two GEL-635 CPUs and two ancillary UNI-1005 CPUs.

The Executive System for A1 is a modified version of the General Comprehensive Operating Supervisor (GCOS III), interfaced with an in-house developed real-time supervisor called the Dual Operating Supervisor. The current version of GCOS being used at this installation is Software Release Six.

Major programming languages used on GCOS and the percentage of the total workload using each language is given below:

COBOL	10%
FORTRAN	30%
GMAP	58%
TSS BASIC	2%

Jobs performed on the A1 system are accounted for on an activity-by-activity basis. Each job may contain one or more activity. The time charged against each activity is determined by the following factors:

1. Processor Time. This is actual execution time but not core resident time.
2. The amount of core memory used.
3. Input/Output (I/O) time used on the associated I/O controller channels.

The use of performance monitors for the GEL-635 is being considered.

The 1970 Gibson Mix index for the GEL-635 showed 334,447 instructions per second for the raw computing power of this equipment. However, the figure is valid only in a uni-programming environment, while the KSC GEL-635 is a multiprogramming system. The memory cycle time for A1 is one microsecond, and data transfer occurs in groups of 72 bits in parallel. The percentage of workload distribution is given in table 2 below in terms of actual programs supported.

Table 2

Percentage Workload Distribution, A1 System

Major Program	PY (FY-73)	CY (FY-74)	BY (FY-75)
Mission Test and Support			
Heavy Launch Vehicles	25%	18%	10%
Medium Launch Vehicles	4%	7%	14%
Shuttle	1%	1%	4%
Scientific Support	11%	10%	10%

Table 2. Percentage Workload Distribution, Al System Continued -

Major Program	PY (FY-73)	CY (FY-74)	BY (FY-75)
TSS	33%	41%	37%
Business Applications	26%	23%	25%

E. Future Plans

1. The Launch Processing System (LPS)

With the end of the Apollo/Skylab era of launch activities at KSC, a new approach in keeping with Space Shuttle operations is being developed. In order for the ground operations to be compatible with vehicle operations, projected launch and turnaround rates, as well as to meet program economy objectives, new launch data processing techniques are needed. The LPS will provide a flexible, reliable, and cost-effective method of performing systems testing, launch operations control, status monitoring of the vehicle, GSE, and facilities during ground operations, and checkout of line-replaceable units (LRUs). Automation of testing and operations will be emphasized to assure repeatability, minimize ground time, and to provide test results in real time. In addition, the LPS will provide data file capability and recovery of operational information to support the landing and launch sequence.

To this end, a grouping of KSC elements has been formed. The personnel of the LPS Task Group are now developing hardware, software, and accompanying operations procedures and techniques needed for the Shuttle activities of the coming decade.

The LPS consists of two related but somewhat separable systems:

a. A monitor and control system for testing, checkout, safing, and operating the vehicle and ground systems during Shuttle ground operations.

b. A technical data management system for providing supplementary data services.

The major LPS elements consist of display and control consoles, computers, a data transmission system (data bus, data handling equipment), computer programs, and interface units to facility end items.

A Central Data System (CDS) of computers, storage, and communication devices will perform the technical data management functions, simulations for application program checkout and launch team training, real-time test data history retrieval, and other services such as program compilation, program loading, and configuration management for the console computer.

2. Acquisition of the Datanet 355 Front-End Communications Processor for the GEL-635 (A1) System

A special-purpose front-end communications processor, the Datanet 355, will be acquired in FY-74 to augment the A1 system. This interfacing unit will extend the existing remote processing functions of the A1 system.

Currently, a DN-30 network processor attached to the A1 System is servicing, buffering, and pre-processing data from 29 low-speed lines (110 bps, 134.5 bps) and two medium-speed lines (2,000 - 2,400 band). The unit is fully expanded. Also, although the DN-30 is switchable to either half of the A1

system, only one of the Al CPUs can be used for remote data processing.

The DN-355 will accomplish the following:

a. Additional line service will be provided for medium-speed and high-speed line requirements.

b. There will be considerably improved computer utilization by the sharing of the remote workload between the Al CPUs.

c. In the KSC efforts to use existing hardware/software systems to the maximum, the Al system will be functionally utilized to provide a software development facility. It will also be used to develop a portion of the prototype configuration for software development and design analysis for data base applications and communications to launch processing console equipment. To this end, special-purpose software and hardware interfaces will be developed for the DN-355 to provide launch-critical computer support for Shuttle data processing.

III. BUSINESS/ADMINISTRATIVE EQUIPMENT AND OPERATIONS

A. Requirements

The IBM 360/50 (A2) system under the management of the Computer Systems Division is assigned the business/administrative applications at KSC. The A2 system processes workloads in the areas of business applications, technical support, and administrative applications. These range from small (10-page) reports to large-volume detailed reports for summary data, as in the case of historical analyses of vehicle or spacecraft parts. The business application work consists of payroll, general accounting, financial management reports, supply reports, and procurement and contract reports. In the area of technical support, the Division responds to requirements and requests for quality assurance and countdown information, engineering documentation, reliability information retrieval (failure analysis), preventive maintenance reports of control vehicle components and ground support equipment (GSE). It also supports the KSC Library's NASA Selective Dissemination of Information (SDI) program by providing time on its computers for literature and bibliographic searches using the KSC Library's NASA magnetic tapes. Administrative applications handled by the ADP Division consist of contract surveillance (including operational control reports for NASA, KSC support, and mission contracts) in support of all Directorates, personnel status reports for the Personnel Office, and security reports for the NASA KSC Security Office.

The following is a list of requirements processed by the A2 system:

1. Reliability (KSC and Stage Contractors) System
    a. Failure Data System
    b. Customer Quality Inspection System
    c. Manned Spacecraft Center Quality Control System
    d. Equipment Data System
    e. Time and Cycle System
2. Procurement System
    a. Procurement System
    b. Vendor System
    c. Purchase Order System
3. Financial Management System
    a. Daily Commitment System
    b. Cost Accounting System
    c. Travel Accounting System
    d. Contracts and Grants System
    e. Monthly Accounting Report System
    f. Payroll System
    g. Labor System
4. Pre-post Inventory Management System
5. Calibration System
6. Preventive Maintenance System
7. Personnel System
8. Contract Surveillance System
9. Work Order Control System
10. Security System

11. Countdown System

12. Integrated Uprated Change Tracking Status System

13. Rockwell International Engineering Order Configuration System

14. IBM Administrative Terminal System (ATS) for Operational Checkout Procedures (OCP)

15. KSC Work Order Cost System

16. Contractor Data Processing System

17. Remote File Inquiry System

The independent Remote File Inquiry (RFI) System was developed by this Division. It requires approximately 70,000 units of core memory and a minimum of two IBM-2314 direct-access storage facilities (disk storage drive units). Although some modification may be required for certain file structures, essentially any file can be loaded on disks through a Generalized File-Build Program. The data may then be accessed through use of any teletype-compatible input-output (I/O) device.

The system is designed to employ user-oriented inquiry data sets which can be easily generated into a File Dictionary in accordance with the requirements of the user. The RFI system will reduce batch reporting requirements by an anticipated 35 to 40 percent and appreciably improve the system's management information capability.

18. KSC Resources Planning and Tracking System

The Planning and Tracking System provides management with comprehensive reports for monitoring the effectiveness of their Resources Management Programs, conducting internal reviews and the preparation of reports to higher authorities. It presents planned obligations and cost, as well as actual commitments,

obligations, and costs incurred in the execution of plans. Reports are prepared on a weekly and monthly schedule. This system was developed to replace the Program Operating Plan (POP) System.

19. Design Engineering Project and Scheduling System

This system maintains the schedules and status of all projects under the responsibility of the Design Engineering Directorate. This system schedules reports and tracks all projects from time of initiation to final work closeout.

20. Launch Preparation Document (LPD) System

The system is designed to generate Launch Preparation Documents for the Delta program, with compatibility of the three Delta areas: KSC Eastern Test Range, Western Test Range, and the McDonnell Douglas plant at Huntington Beach, California.

The system consists of four major modules:

a. LPD Task Modules

b. Test Requirements & Description Modules

c. Flight Hardware Requirements & Description Modules

d. Nonflight Hardware Requirements & Description Modules

The LPD System produces such reports as:

a. Test Requirement Documents Usage Report

b. Test Requirement Documents Mismatches

c. LPD/TRD Index

d. Critical Data Appendix Loadsheet

e. TRD Trend Data

f. Field Station Installation Usage Reports

g. FSI Verification

h. FSI Mismatches

i. Total Nonflight Hardware Documentation

j. Countdown Complete Board - Blockhouse Nonflight Hardware

k. CDCB - Pad Nonflight Hardware

l. Noncritical Nonflight Hardware

The A2 system utilization figures are shown in Table 3.

Table 3

IBM-360/50 (A2) Computation Requirements

Major System Application	PY (FY-73)	CY (FY-74)	BY (FY-75)
Administrative Support	1579	1564	1575
Launch Operations Technical Support	1834	1817	1500
Installation Support	1610	1595	1750
Technical Support	916	908	925
Design Engineering Support	353	350	450
System Maintenance & Other	723	716	800
Total Hours	7015	6950*	7000*

*Estimated

B. Major Accomplishments

In conformance to current NASA budget restrictions and the mandatory need for lowering operating costs, two significant transfers of data systems previously processed on contractor computer equipment have been accomplished.

The Boeing Financial System became operational at KSC in October 1972. The transfer effort involved 125 programs in production on the IBM-360/65 computer at the Boeing, Huntsville, Alabama, Facility. Program modifications and job control language (JCL) changes were required to meet KSC equipment and production standards. The system is comprised of non-labor accounting information such as Accounts Payable and Purchase Order; Timekeeping and Attendance Reporting; Labor Distribution; and Integrated Personnel System.

All Bendix technical and business data processing systems, with the exception of Bendix in-house corporate requirements, were transferred to the KSC A2 system computer on October 1, 1973. Eleven systems, totaling 104 programs, were included in the transfer. The majority of the programs are written in the Report Program Generator (RPG) Language, and are being installed with only minor modifications. A follow-on effort will be required to convert the systems to ANS COBOL and distribute the workload between the A2 and the A1 computers. The transfer of this workload enabled the turn-in of the IBM-360/20 computer located at the Bendix Facility in Titusville, Florida.

C. System Description

The A2 system is composed of one IBM-360/50 CPU and an ancillary UNI-1005. The system core memory is 768K bytes. The Executive System in use is the IBM 360 Operating System (OS), Release (version) 21.6.

The following are the programming languages used and the percentage distribution:

ANSI COBOL	90%
FORTRAN IV (G)	2%
IBM 360 Assembler	8%

The system uses the IBM OS System Management Facility (SMF), an OS option, for its internal machine accounting system. There are no hardware performance monitors used.

Currently, the basic methods to measure system throughput, raw computing power, and system efficiency values by using software monitors are being developed. They are estimated for completion by FY-75.

The following table shows the percentage workload distribution of the A2 system by major function performed.

Table 4

Percentage Workload Distribution, A2 System

Major Function	PY (FY-73)	CY (FY-74)	BY (FY-75)
Administrative Support	23%	23%	23%
Launch Operations Technical Support	26%	26%	21%
Installation Support	23%	23%	25%
Technical Support	13%	13%	13%
Design Engineering Support	5%	5%	6%
System Maintenance & Other	10%	10%	12%

The following is a capsule description of the telecommunications services at KSC:

a. Type of Service:

Text Editing (ATS) - Local

Remote File Inquiry (RFI) - Local

Base Supply System - Local

b. Equipment Used:

ATS - IBM-2741 Terminals, half-duplex

RFI - Teletype Terminals, half-duplex

Base Supply System - IBM-2740
IBM-1050 terminals,
half duplex

c. Service Provided By:

KSC - internal personnel

d. Maintenance:

Software: NASA

Communications Equipment: Equipment Vendor

Associated Computer Terminals and Hardware: Equipment Vendor

D. Future Plans

Approved requirements for using the Remote File Inquiry System (RFI) are approaching the allocated resource capabilities of the IBM 360/50 computer. The implemented RFI improvements such as asynchronous sorting, on-line update and data editing have allowed increased effectiveness of the total RFI application.

An increasing number of computer output products are being provided to users in the form of microfiche created on the Datagraphix Micromation Recorder. All supply catalog outputs have been converted to microfiche and are distributed

throughout KSC. The substitution of microfiche for hard copy products has resulted in substantial cost savings.

DIVISION B

CATEGORY B SYSTEMS

There are 23 Category B Systems in use at KSC, excluding those systems reportable by other Centers. They are reported on Forms T32 and 1415.

The changing trends at KSC, beginning with the close of the Apollo/Skylab/ASTP era and the development of the Shuttle design phase, will necessitate corresponding changes in the computer equipment being used. During the transition phase, small specialty ("mini") computers will be used to develop new programs and to perform simulated ("breadboard") design verifications for such systems as The Launch Processing System (LPS).

Among the new acquisitions, or older equipment retained for new applications, are the following:

A. Information Systems Directorate

1. HPC-2114B (B9) System

The Hewlett-Packard HPC-2114B is used primarily as an automated voltmeter to measure the transients on various signals and control lines. It is also used to develop programs for the Automatic Frequency Analysis System.

B. Launch Operations Directorate

1. DEQ PDP-8/S (Z5)

This system, a government-owned computer, was used by Stage Contractors during the Apollo Program. It is now used by this Directorate for special mathematical computations.

2. DDP-224 SUMC I/O System

Two DDP-224 systems, used as Flight Crew Training Simulators (LMS-2 system) during the Apollo Program, will be used as I/O processors. They will also be used as main memory storage devices for the KSC breadboard model of the Space Ultrareliable Modular Computer (SUMC). This system will be used for acquiring skills needed to keep abreast of the state of technology and for developing new methods of testing Shuttle era on-board computer systems. It can also be used to implement the Ground Operations Aerospace Language (GOAL) directly into microcode.

3. DDP-24 System

The DDP-24 system, originally located in the Flight Crew Training Building, was transferred to the Florida Institute of Technology (FIT) under an Air Force study grant. Its continued use by FIT is assured by a NASA study grant, which replaced the Air Force grant.

C. Design Engineering Directorate

Several new minicomputers have been acquired during this reporting period.

1. HPC-2100A (B8) System

The 9600 G Design Verification Simulator uses an HPC-2100A (B8) system. The simulator is used for data acquisition and control for the laboratory checkout, verification, and simulation of automated hardware functions.

2. PDP 11/40 (D2)

This computer is used as part of the Tektronix Intercomputer (IC) Tester System.

3. DSI-120(D3)

The Data General DSI-120 is part of a design development display system.

4. PDP 11/40 (D4)

This minicomputer is used in LPS development.

5. PDP 11/45 (D5)

This mimicomputer is also used in LPS development.