FVE
UE

~~CONFIDENTIAL~~

5 November 1958

REPORT ON HARVEST PLANNING

By MPRO-03

~~CONFIDENTIAL~~

5 November 1959

Discussion on HARVEST Planning

I. INTRODUCTION

A. This discussion concerning the HARVEST System which is scheduled for arrival in September, 1960, was prepared for the purpose of aiding MPRO in its planning for Fiscal Years 1960-61. It is apparent that the installation of this system will greatly affect the processing capabilities of MPRO due to the tremendous increase in processing speeds and techniques which will be made possible using this system. This increase in processing capability will greatly affect the need of the continued operation of certain rental equipment and Agency-owned equipment.

B. Briefly, the following discussion supports the elimination of the EDPM 704 and 709 equipment from the rental budget and the retirement of the ATLAS I and ATLAS II equipment and other equipment such as CICERO, MILLIE, DEMONS, ETC. The personnel (programming, operating and engineering) released as a result of cancellation and retirement of equipment will be sufficient to sustain the HARVEST System.

C. An equipment planning calendar is provided at the end of this report for providing clarity to the discussion and for use as a guide in planning for effective utilization of Agency equipment.

D. The considerations which follow have been divided into two parts -- (1) Equipment and Fiscal Planning and (2) Personnel Planning.

II. EQUIPMENT AND FISCAL PLANNING

A. Present Processing Requirement

1. The following statements concerning production statistics are presented to clarify the conclusion reached in estimating HARVEST efficiency to absorb our current workload.

a. The EDPM 705's have been operating as follows (based on a 6-wk period):

(1).	Production	67%
(2).	Checkout	12%
(3).	Lost Time	17%
(4).	Maintenance	4%
(5).	Idle	0%
(6).	Overtime	0%

b. The production processing time for four EDPM 705's was computed to be 84% of a 480 hour week. This yields 404 production hours per week.

c. The production problems for the EDPM 705 were estimated as follows:

(1). 50% on sorting @ 50,000 records per hour.

(2). 50% on other tape bound problems @ 150,000 records per hour.

d. The EDPM 704's have been operating as follows (based on a 10-wk period):

(1).	Production	82.4%
(2).	Checkout	19.4%
(3).	Lost Time	4.2%
(4).	Maintenance	3.5%
(5).	Idle	8.4%
(6).	Overtime	(25% of weekend time)

e. The production processing time of the three EDPM 704's was computed to be 66.7% of a 350 hour week plus 25% of 144 available weekend hours. This yields 260 hours of production processing per week.

f. The ATLAS equipment has been operating as follows;
(based on a 10-month period)

	ATLAS I	ATLAS II
(1). Production	59.3%	78.6%
(2). Checkout	3.4%	6.4%
(3). Lost Time	12.6%	5.0%
(4). Maintenance	16.6%	10.0%
(5). Idle	3.1%	0.0%

g. ATLAS I production processing time was computed to be 75% of a 160 hour week or 120 production hours per week.

h. ATLAS II production processing time was computed to be 83.0% of a 240 hour week or 201 production hours per week.

i. An estimate of HARVEST versus ATLAS II processing ability is 100 to 1. Versus ATLAS I, 300 to 1.

j. A conservative estimate of HARVEST versus EDPM 704 processing ability is 80 to 1.

k. The input requirement for HARVEST was taken from current card-to-tape and TAMPA operating statistics. The current card input is a 1.5 million cards per week. The current TAMPA conversion is a .3 million 160 position records per week.

1. The amount of intermediate processing performed was determined by subtracting output results from possible processing volume.

m. The output requirement was determined from printer and punch use figures. The current printer output is 6.814 million printed items per week. The current punch output is .054 million cards per week.

n. The record size used in computing times was 80 positions except on TAMPA where a 100 position record size was used.

2. The amount of HARVEST time necessary to absorb the current EDPM 704, EDPM 709 and ATLAS equipment processing based on the above statements would be 37.0 hours per week.

The time breaks down in detail as follows:

a. 3.6 hours to read 1.3 million card-to-tape and TAMPA records.

b. 20.3 hours to write 6.9 million punch and printer items per week.

c. 3.6 hours to sort 10 million records.

d. 1.0 hours to process 40 million intermediate records using the TRACTOR Tape System.

e. 3.5 hours to complete EDPM 704 type processing.

f. .4 hours to complete ATLAS I processing.

g. 2.0 hours to complete the ATLAS II processing.

3. The above represents the worst case for the HARVEST System. The input-output time wasn't assumed to overlap. There was no reduction given for the ability to program jobs rather than steps as is now done on EDPM 705 type processing. The internal supervisory system will have the ability of controlling the HARVEST System so that more than a single problem can be in the state of processing within the same period of time. Programs will be written to multiplex the input-output operations, so that this time can be reduced considerably.

4. The HARVEST System will give us a minimum of 4 times our present EDPM 704 and 705 computing capacity if we can learn to use it correctly.

B. Fiscal Year 1960 Requirements

1. The estimated computer hours for processing the Analytic Offices' requirements for 1960 is 13,303 EDPM 704 hours and 25,432 EDPM 705 hours. This represents a 31% increase over the available five-day week EDPM 704 time and a 21% increase over the EDPM 705 time. These same estimates are to be used for Fiscal Year 1961.

C. On-line Rental Equipment Requirement

1. The following list contains the estimated amount of on-line rental equipment which is required for the HARVEST System in Fiscal Year 1961. The prices are best guesses based on present prices and equipment improvements.

No.	Name		Primary Shift	Total 3 Shifts
1	Card Reader - 1000 CPM	@	$1800	$3240
1	Card Reader Control	@	1000	1800
1	Printer - 600 LPM	@	1500	2700
1	Printer Control	@	1000	1800
1	Inquiry	@	300	540
12	729-III Dual Density	@	1100	23760
8	Tape Control Unit	@	2350	33840
1	Punch - 250 CPM	@	600	1080
1	Punch Control	@	1000	1800
				$70560

The rental for the on-line equipment would be for three-quarters of FY 1961 since HARVEST is scheduled for September 1960.

D. Off-line Rental Equipment Requirement

1. The HARVEST System will require less peripheral equipment than exists at present to meet Fiscal Year 1961 requirements. We are presently printing at 66% capacity, punching at 11% capacity and loading cards-to-tape at 37% capacity. These figures are based on 100 available hours (three-shift operation) per week for each peripheral unit. The card loading and punching functions can be performed on-line on the HARVEST System. These equipments should be released with the EDPM 705 Systems.

2. Some of the present low-speed printing units should be replaced by an equivalent capacity of high speed printers. Facility for handling low volume printing jobs would still be required.

E. TRACTOR Tapes

1. The six storage units in the TRACTOR Tape System have a minimum capacity of 240 TRACTOR tape cartridges. A proposed schedule for delivery of these cartridges follows:

   a. 50 cartridges on delivery of the HARVEST System in September, 1960.

   b. 30 cartridges per month for the remainder of Fiscal Year 1961.

2. The above figures would give us full minimum capacity seven months after delivery of the System and a total of 320 cartridges by the end of Fiscal Year 61.

3. IBM has not given any estimate of the price of one TRACTOR tape cartridge. R/D has estimated the cost at $800 per cartridge. At this price, our TRACTOR tape budget for Fiscal Year 1961 would be $216,000. TRACTOR tape budget for Fiscal Year 1960 is $40,000.

4. One fully loaded TRACTOR tape (1800 feet) could hold 1,281,024 eighty-position records using a block size of 2048 words. This is equivalent to forty 729-III tapes with a reel capacity of 32,000 records each. The bookkeeping on the TRACTOR Tape System would prohibit us from packing this number of reels on a single TRACTOR cartridge. In actual processing we could expect approximately 10 jobs per cartridge which represents jobs requiring 15 reels of 727 tape. We could expect at least a 200 reel per month reduction in our 1/2 inch tape requirement. Our present monthly level of the 1/2 inch magnetic tapes is 600 reels per month.

F. Funding Recommendations

1. The O/M funds in the FARMER Fiscal Program dated 8 May 1958 should be revised in accordance with the following:

a. Item 5b, Data Conversion Equipment, on the Fiscal Program should be deleted. The cost of this conversion is exorbitant for the operation performed. It will require 5 minutes on the 729-III as compared to 3 seconds on the TRACTOR tape drive for the conversion of one reel of 729-III tape. It is doubtful that normal processing would require the full weight of the Basic Exchange. The conversion can be performed on-line without seriously affecting the efficient utilization of the HARVEST System. These funds should be held in reserve for additional components which might be required. The addition of a high speed disk unit, low speed exchange, and possibly Swift tape drives should be considered. The first two components could absorb the 650 operation as well as strengthening the entire HARVEST System. These units will be studied and estimated prices will be obtained from IBM. Also the addition of three automatic cartridge handling units to the TRACTOR Tape System in Fiscal Year 1962 should be considered. This would require $250,000.

b. Item 5c, Additional Memories, needs some type of immediate action. This money was budgeted for Fiscal Year 1961 due to IBM's inability to deliver additional memories with the HARVEST System. Recently, AMEQ was informed that additional 2 microsecond memory

could be produced and installed before delivery of the HARVEST System. MPRO should firmly commit funds and contract for two additional 2 microsecond memories in Fiscal Year 1960. The price for each will be approximately $1,000,000.

c. Item 5d, TRACTOR Tape, in Fiscal Year 1961 should be increased to the amount previously indicated ($216,000) in this report. (See II.E.3 above)

III. PERSONNEL PLANNING

A. Personnel Requirements

1. The personnel requirement for putting HARVEST into operation can be broken into five functional parts--system's programming planning, production programming, data preparation, operations and engineering. The acquisition of the personnel for the staffing according to the above functional parts will be explained under III.B.

a. System's Planning. Initially, it will be necessary to establish a system's planning group to handle such problems as

(1) Automatic Coding

(2) Automatic Operations

(3) Tape Identification

(4) Memory Use

(5) TRACTOR Tape System Use

(6) Debugging Techniques (Simulation and Desk Checking)

(7) Multiprogramming

(8) Data Preparation and Handling

(9) Training

It is very necessary that solutions to the above problems be obtained in order that production type programming can be initiated at the appropriate time. It is extremely important that the selection of personnel be made from the most talented of the experienced MPRO programmers since effective utilization of HARVEST will depend for the most part on the solutions derived by the System's Planning Group.

This group will determine how programs will be written and how the HARVEST System will be utilized. It is estimated that 20 programmers will be required for this group.

b. Production Programming. The establishment of a Production Programming Group will be required to re-program for HARVEST those programs which are currently on existing equipment, that will be cancelled in the case of rental equipment and retired in the case of Agency-owned equipment. There will be a requirement for reprogramming those problems which can be sufficiently improved upon by being processed on HARVEST. It is expected too that many new problems will be planned and programmed for HARVEST processing prior to its arrival and that this effort will require considerable effort. This programming responsibility will be assumed by the Production Programming Group. This group should consist of 30-50 trained programmers who must be available at least one year in advance of the arrival of the HARVEST System. This group would continue to grow until a complement of 90 programmers is reached.

In order for this Group to properly assume its responsibilities, an up-to-date program priority list based on economic considerations and problem life should be prepared for their guidance. After the initial programming requirements have been fulfilled, it is expected that the size of the group can be

reduced because of the increased experience of the programmers, the improved programming system on HARVEST and the elimination or reduction of duplication of programming effort. The reduction of the group size could probably begin in Fiscal Year 1962.

c. Data Preparation. The HARVEST System will permit processing that is beyond the capabilities of existing equipment. The manual data preparation personnel requirement is going to be dependent on the improvements made by NSA in the fields of automatic recording, conversion and editing. The efficiency of the HARVEST System will depend on the automatic recording, conversion and editing devices. One type of equipment to date which treats this problem is the FLORIDA Series. The STORK project and other fielded format systems will greatly increase our data conversion capacity when they become a reality. The trend in communications towards automatic systems instead of manual systems will aid us in handling large volumes of data provided we keep up with the conversion problem.

At present, we have peaks and troughs in our keypunching workload. No continuing backlog exists. We are keypunching at 85% capability due to this uneven workload.

Fiscal Year 1960 requirements indicate a 27% increase in EDPM 705 processing and a 31% increase in EDPM 704 processing, over current production processing.

These figures are undoubtedly high but can probably be used as actual requirements for Fiscal Year 1961. No increase in manual preparation is anticipated. The increase in data to be processed will probably come from the field and through automatic conversion equipment.

d. Operations. It is felt that the programming for the operation of the HARVEST System should be the responsibility of a single division; however, it is recognized that certain organizational changes within MPRO would be required if this were to be the case. The operations personnel for the equipment in the system should consist of the following:

(1).	Operations Chief		1
(2).	Asst. Operations Chiefs		2
(3).	Production Control Specialists		7
(4).	Shift Personnel (One-shift)		
	Shift Supvr.	1	
	Main Frame Supvr.	1	
	Prod. Cont. Spec.	2	
	Main Frame Oper.	4	
	Peri. Equip. Oper.	3	11
			21 Total

e. Engineering. MPRO-45 has indicated that there will be a requirement for four engineers and ten technicians to perform the maintenance on the HARVEST System.

B. Personnel Acquisition

1. Since one of the purposes for the acquisition of the HARVEST System was to reduce the rental budget for Agency processing equipment, it is reasonable to assume that the personnel can be obtained through reassignment of MPRO programming and operating personnel. The phasing-out of the taking-off-rental of non-Agency equipment and the retirement of some Agency-owned equipment should permit a reasonably smooth transition to HARVEST. Although it is expected that HARVEST programmers will be selected from all MPRO programmers, the current strength of only EDPM 704 and 705 personnel is sufficient to staff the System's Planning Group, the Production Programming Group and the Operation Group (assuming a three-shift operation).

	EDPM 704	EDPM 705	Totals
Programming Supervisors	7	4	11
Programmers	53	62	120
Operations Supervisors	2	4	6
Main Frame Operators	12	39	51
Peripheral Equipment Operators	0	17	17
Production Control	1	5	6
			201

C. Personnel Training

1. The establishment of a large training program to run for a two-year period will be required to train the personnel for the System's Planning Group, the Production Programming Group and the Operations Group. It is estimated that a three-month period would be required to develop the training program. (This could be a joint MPRO/R&D project.) Each training course would last four months except for the first two sessions which would last only three months. An additional month will be required for the later sessions due to the additional material to be covered which would be available at that time. Not more than four hours per day should be devoted to the HARVEST programmer training until such time as the writing of test programs starts.

2. Assuming that the two-year period for training could commence on 1 November 1958, the training schedule would appear as follows:

Session	Date	Length	Hours/Day	Number of Trainees
*1.	Nov 58 - Jan 59	3 mo.	3	0
2.	Feb 59 - Apr 59	3 mo.	4	20
3.	May 59 - Jul 59	3 mo.	4	30
4.	Aug 59 - Nov 59	4 mo.	4	30
5.	Dec 59 - Mar 60	4 mo.	4	30
6.	Apr 60 - Jul 60	4 mo.	4	30
7.	Aug 60 - Nov 60	4 mo.	4	30

*This session is set aside for the development of the training program.

3. This training schedule would reflect on the EDPM 704, EDPM 705 and HARVEST Groups as indicated in the table below. There was an assumption in arriving at these figures that an equal number of programmers from the EDPM 704 and EDPM 705 Groups were in each of the training sessions and that an equal number of each type were selected for the HARVEST Group. The figures below indicate, there will be personnel trained for HARVEST programming in addition to those from the EDPM 704 and 705 groups.

Date	HARVEST Group Size	EDPM 704 Group Size	EDPM 705 Group Size	Programmers Trained
Feb 59	0	65	66	0
May 59	10	60	61	20
Aug 59	30	50	51	50
Dec 59	50	40	41	80
Apr 60	70	30	31	110
Aug 60	90	20	21	140
Dec 60	110	10	11	170

4. The programming training would be provided by two MPRO instructors. There would be a requirement for one classroom from 1 February 1959 through 30 April 1959 and two classrooms for the duration of the program.

5. The data preparation personnel would not require any special HARVEST training.

6. The establishment of a three-month training period for all operations personnel would be necessary and the training should commence in May 1960. This would be a four-hour/day training class to acquaint the operations personnel with the programming system and the operational aspects of the HARVEST components. (Supervisory personnel would be given programming training as well as operational training.) Approximately one-third of the operational personnel must be available by September 1960 for single-shift operation, one-third by January 1961 for two-shift operation and one-third by June 1961 for three-shift operation.

7. MPRO-4 has indicated that the training of the four engineers and ten technicians to perform maintenance on the HARVEST System would occur prior to the delivery of the system and partially at the contractor's site. The engineers would require one year of training and the technicians would require from six months to one year's training. Any additional maintenance personnel would be trained during the six-months contractor maintenance period at NSA.

IV. CONCLUSION

The goal of the plan advanced in this discussion is to put into operation a system which is capable of absorbing the workload placed on MPRO by the Analytic Officies at the earliest possible date. In addition to satisfying the workload requirement, HARVEST will provide additional capacity to meet future workload increases and will reduce the MPRO EDPM rental budget. The estimated savings is $3,318,996 based upon Fiscal Years 1959-1962 comparison as shown in the attached budget estimates.

Close cooperation and support of MPRO organizations and the Analytic Offices is necessary for the successful realization of the goal set.

~~CONFIDENTIAL~~

EQUIPMENT PLANNING CALENDAR

	APPROX. MONTHLY RENTAL	FY 1959 J A S O N D	FY 1960 J F M A M J J A S O N D	FY 1961 J F M A M J J A S O N D	FY 1962 J F M A M J J A S O N D
SLED II	$19,548	**********	**********	**********	
IRDOCK BLUEPLATE		**********	**********	**********	
650	21,655	**********	**********	**********	
ATLAS I SER 1		**********	**********	**********	
ATLAS I SER 2		**********	**********	**********	
ROB ROY	5,940	**********	**********	**********	
705-3	48,413	**********	**********	**********	
705-III	65,700	**********	**********	**********	
ATLAS II SER 1		**********	**********	**********	
MAIDEN FORM	6,880	**********	**********	**********	
MULE SKINNER	4,680	**********	**********	**********	
CLIP PIN		**********	**********	**********	
ATLAS II SER 2		**********	**********	**********	
HARVEST	70,560	**********	**********	**********	
704-1	39,798	**********	**********	**********	
705-2	51,816	**********	**********	**********	
704-2 (32K)	57,608	**********	**********	**********	
705-1	61,876	**********	**********	**********	
704-3 (32K)	68,598	**********	**********	**********	
705-4 (40K)	56,879	**********	**********	**********	

~~CONFIDENTIAL~~

CONFIDENTIAL

ESTIMATED EDPM RENTAL BUDGET

	APPROX MONTHLY RENTAL	FY 1959	FY 1960	FY 1961	FY 1962
SLED II	$20,290	$ 182,610	$ 243,480	$ 243,480	$ 243,480
650	21,655	129,930	259,860	259,860	259,860
ROB ROY	5,940	23,760	71,280	71,280	71,280
705-3	48,413	580,956	96,826		
705-III	65,700		591,300	788,400	197,100
MAIDEN FORM	6,880		41,280	82,560	82,560
CLIP PIN	4,680		18,720	56,160	56,160
HARVEST	70,560			705,600	846,720
704-1	39,798	477,576	477,576	238,788	
705-2	51,816	621,792	621,792	310,896	
704-2	67,608	811,296	811,296	608,472	
705-1	61,876	742,512	742,512	556,884	
704-3	68,598	823,176	823,176	823,176	
705-4	56,879	682,548	682,548	682,548	
	Totals	$5,076,156	$5,481,646	$5,428,104	$1,757,160

CONFIDENTIAL

~~NFIDENTIAL~~

Tentative Fiscal Program - FARNER System

	1958		1959		1960		1961		Total - (1958-61)	
	R/D	O/M	R/D	O/M	R/D	O/M	R/D	O/M	R/D	O/M
HARVEST Basic Computer	$ ---	$4,166,000	$ ---	$ ---	$ ---	$ ---	$ ---	$ ---	$ ---	$ 4,166,000
HARVEST Additional Computer	1,200,000	---	1,100,000	---	1,600,000	---	---	---	3,900,000	---
TRACTOR Tape System	---	---	200,000	1,466,000	600,000	---	---	---	800,000	1,466,000
Total - HARVEST Complex	$1,200,000	$4,166,000	$1,300,000	$1,466,000	$2,200,000	$ ---	$ ---	$ ---	$4,700,000	$ 5,632,000
FARNER Study	$ ---	$ ---	$ 200,000	$ ---	$ 500,000	$ ---	$ 300,000	---	$1,000,000	$ ---
FARNER Support:										
a. Special Purpose Units										
(1) Circuit Experimentation	---	---	45,000	---	---	---	---	---	45,000	---
(2) Data Flow Models	---	---	---	---	105,000	---	---	---	105,000	---
(3) Special Purpose Unit Constr.	---	---	---	---	545,000	---	600,000	---	1,145,000	---
b. Data Conversion Equipment (729 to TRACTOR Tape and Reverse)	---	---	---	---	---	1,150,000	---	---	---	1,150,000
c. Additional Memories	---	---	---	---	---	---	---	4,000,000	---	4,000,000
d. TRACTOR Tape	---	---	---	---	---	40,000	---	---	---	40,000
e. Spare Parts	---	---	---	---	---	600,000	---	---	---	600,000
f. Test Equipment	---	---	---	---	---	60,000	---	---	---	60,000
g. Training	---	---	---	---	---	150,000	---	---	---	150,000
Total - FARNER Support	$ ---	$ ---	$ 45,000	$ ---	$ 650,000	$2,000,000	$ 600,000	$4,000,000	$1,295,000	$ 6,000,000
Contingency	$ ---	$ ---	$ ---	$ ---	$ ---	$ ---	$1,000,000	$ 500,000	$1,000,000	$ 500,000
Total - FARNER System	$1,200,000	$4,166,000	$1,545,000	$ 1,466,000	$3,350,000	$2,000,000	$1,900,000	$4,500,000	$7,995,000	$12,132,000
									$20,127,000	

~~CONFIDENTIAL~~