MEMO ROUTING SLIP

NEVER USE FOR APPROVALS, DISAPPROVALS, CONCURRENCES, OR SIMILAR ACTIONS

	NAME OR TITLE / ORGANIZATION AND LOCATION	INITIALS / DATE	
1	MPRO-41	EOB 7/8	CIRCULATE
			COORDINATION
2	MPRO-42	WE	FILE
			INFORMATION ✓
3	MPRO-43	IAJ	NECESSARY ACTION
			NOTE AND RETURN
4	MPRO-44	CCH	SEE ME
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REMARKS

FROM NAME OR TITLE: F. V. COSTANZA	DATE: 26 AUG 58
ORGANIZATION AND LOCATION: MPRO-4	TELEPHONE: 5182

DD FORM 1 FEB 50 95 Replaces DA AGO Form 895, 1 Apr 48, and AFHQ Form 12, 10 Nov 47, which may be used.

16—48487-4 GPO

Harvest File

MPRO

26 August 1958

MPRO-4

HARVEST Maintenance Requirement

The inclosed paper is the first of a series of reports by Mr. E. J. Sumpter the MPRO-4 project engineer assigned to HARVEST.

F. V. COSTANZA
Major, USMC
Chief, MPRO-4

cc: MPRO-03
MPRO-45

AUG 2 2 1958

EARLY OBSERVATIONS ON MAINTENANCE REQUIREMENTS AND RELIABILITY FACTORS FOR FARMER

The estimated time schedule for the delivery of the FARMER equipment is listed below.

1957	1958	1959	1960 1/4	2/4	3/4
Study program gather information - talk to consumers make speed comparisons - etc.	Paper work phase AC, DC studies design details set up manufacturing facilities compute wiring layouts - junction wiring paths- etc	Construct pilot models - test components for speed, reliability modify circuits if test results so indicate	Test basic comp. test HARVEST comp.	Mem. to HARVEST basic & high speed exchange to comp.	Tractor to HARVEST

The above is basically optimistic but considered possible.

The HARVEST Task Group of which I am a member consists of twelve (12) people of which three (3) are supervising personnel - Mr. Lane, Mr. Rickerson and Mr. Snyder are in overall charge of the training and supervision of the group with Mr. Willard. Included in the group are engineers from various parts of ANEQ and ENGR, Programmers from the ANEQ Program group and myself as representative of the MPRO-45 Engineering Group. The engineers are divided roughly by assignment as follows: Input-Output Equipment and Exchange (2), Memory (2), Basic Exchange & Comp. (3), Logical Design (3), Reliability and Maintainability (1). Training of the group is being carried out by means of lectures on the various sections of the system and by study of the various reports submitted by IBM on the development of the various parts of the project.

Fundamentally the power that is being designed into the FARMER system should make it an extremely valuable tool in the Agency's work. The instruction code includes all of the mathematical and manipulative capabilities normally found in a general purpose system, but in addition some very powerful additions to this instruction code have made the statistical analysis approach which is the Agency's traditional approach to its problems more effective.

The system itself will be transistorized. At present it is planned to use direct coupled logic in the circuit design which will cut down tremendously capacitor-resistor population in the machines. The logical designs that I have seen so far do not involve any radical departures from the standard designs. The implementation of these logical circuits with the drift transistors under development at the research labs at Poughkeepsi, New York, will help to make the tremendous speed (20 musecs loss per stage) possible, while instruction overlap and look ahead operations with a separate index arithmetic operation complete the basic speed up approach. While this machine is not very different from some machines already in operation in MPRO, these new ideas will provide unique controls which will make this type of manipulation terrifically fast.

Overall power and air conditioning requirements for the system cannot be computed at this time but will be forthcoming as soon as this information is available or at least some information, which could be computed. Space requirements seem to be pretty firm but may change, dependant on the amount of input-output equipment finally required by PROD.

Many new techniques of construction are being used by IBM in the fabrication of this system. Non-soldered connections using the solderless wrapped connection is used throughout the back-board wiring of the machine with a maximum of three connections per post. Maintenance-wise, this may lead to difficulty in future modifications but for reliable connection in initial construction this seems to be a satisfactory type of connection. (Monograph 2065 by McRae, Mallinia, et al. of Bell Telephone System presents a thorough going engineering analysis of this type of connection and an adequate comparison with screw, crimp and soldered connections.) Changes in wiring required for future modifications will probably have to be soldered if the connection being changed is the bottom or next to the bottom one on the post. Bell Labs have concluded after extensive testing that re-use of a post for a new wrapped connection is permissable but re-use of wire previously used in a wrapped connection is not recommended.

Because of the complexity of the FARMER system, logical modifications for expanded capabilities should not be undertaken for at least one or two years after delivery. The only modifications that should be performed would be for reliability, maintainability or correction of circuitry.

Manpower requirements for FARMER maintenance responsibility are estimated below. Time to train the men listed below will vary from one year to six (6) months. Special maintenance tools and equipment are also listed although whether these will be supplied by the manufacturer, purchased by the Task group or procurred by MPRO, I don't know.

ENGINEERS	TIME	AREA OF PRIME RESPONSIBILITY
1	1 year	1) HIGH SPEED EXCHANGE - Tape transports tape magazine storage, tape control buss, tape amplifiers system, error detection and correction, marginal checking system
1	1 year	2) SLOW SPEED EXCHANGE - Narrow magnetic tape machines (729-3) thirty-two of them, high speed card readers, high speed printer, high speed punch card and tape, remot input-output system, error detection and correction system, marginal checking system
1	1 year	3) BASIC COMPUTER-HARVEST Computer Programming transistor dir. coup. logic, look ahead, instruction overlap, modifications, marginal checking provisions, routines for maintenance utilizations of double error detection and single error correction

1	1 year	4) MEMORY - High speed memory, main memory, exchange memory, memory buss-multiplexing, time sharing priority

All of the above should receive as much training as possible in programming, transistors (both drift and surface barrier types) and in all of the newer techniques of instruction sequencing incorporated in this machine. They also should be required to have knowledge of high velocity heat exchange equipment, hydraulic mechanical devices and be familiar with parity checking systems and the Hamming Systems. Engineers, even though assigned to one area of prime responsibility, should become familiar with the entire system.

In addition to the above requirements, ten technicians should be available for six months to a year for training on the various peculiarities of the system. This is necessary because off-line testing of components for replacement will involve new techniques and the use of new test equipment. Also potential use of this system and the enormous amount of work designed for it will preclude any large segments of time alloted to maintenance. Extensive off-machine testing and replacing of components will be necessary.

The below list indicates some special equipment that will be required to perform maintenance. (See paper on maintenance techniques.)

Electrically driven wrap tools for solderless connections.
Minaturized hand tools for work in the densely packaged circuits.
Signal generators and measuring devices for test set up capable of reliable operation in the 30 to 100 MC range.
Accurate meters in the range of micro-amps and micro-volts.
A library of up-to-date transistors characteristics and provisions for weekly or even daily additions to the manuals.
Test equipment capable of faithfully reproducing machine conditions for test purposes.
An adequate and assured supply of drift transistors meeting the stringent requirements of the FARMER system.

E. J. SUMPTER
MPRO-45

file - HARVEST

AUG 2 2 1958

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AND
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