

PRODUCT PLANNING & MARKET ANALYSIS DIVISION

MEETING OR CONTACT REPORT

70-6076-0

Project: Stretch	Date of Report: Feb. 1, 1957
Purpose of Meeting or Contact: Review progress on Stretch machine	Date of Meeting or Contact: 11/14-15/56
	Reported by: B. L. Sarahan
	Dept.: 749
Place of Meeting or Contact: <input type="checkbox"/> WHQ <input type="checkbox"/> Phone Other: Los Alamos	Follow-up Date:

List Personnel Participating

Give Report (including next action)

Indicate Distribution

	<u>IBM</u>	<u>Los Alamos</u>	
	J. Griffith	Bengt Carlson	E. Voorhees
	F. Beckman	H. Kolsky	W. Woolton
	D. Sweeney	R. Lazarus	T. Jordan
	B. Sarahan	D. Woods	I. Cherry
	F. Johnston	R. Frank	P. Harper

Dora Sweeney of IBM reviewed a proposal for a binary floating-point arithmetic system. This proposal in memo form was made available to all concerned. The following points were discussed:

1. It was recommended that, if possible, the overflow-underflow indicator on the exponent be made variable. With this feature an early warning under the control of the programmer would be available to allow changing the course of calculations to prevent actual overflow or underflow.
2. Several instructions in the presented paper were redundant, because of the particular notation used. This led to a consideration of a large vocabulary versus a small machine vocabulary.
3. Unnormalized arithmetic operations were not included in the proposed set of instructions in a way to permit full flexibility in this mode. It was agreed that if this is an acceptable mode of operation, then a full complement of instructions should be provided. Mr. Bengt Carlson agreed to provide a set of suggestions on this subject.
4. Any option for break-in should provide for all registers remaining in the resultant state unless the break-in has been specified as automatic. This allows the programmer complete freedom in determining and correcting the condition signalling a break-in.

5. Some members from Los Alamos objected to the approach taken to double and multiple precision operations. The proposal presented contained certain features to facilitate these operations. It was agreed that provisions for these features would not affect the speed of single precision operations, which must be considered the basic mode of operation.
6. It was suggested that it might be inefficient to clear the B and B' registers on add-type operations. If this were not done, it would be possible to use these registers as temporary storage under certain conditions. This will be studied.
7. Considerable discussion occurred on the subject of handling exception cases automatically. A much more complete system was devised during this discussion. It was agreed to study the requirements and make a decision at a later date. It was pointed out that a separate indicator for zero is necessary to designate starting values of zero, as opposed to the technique of using a very small number for such values.
8. It was suggested that, if possible, provision be made for detecting zero to several different points in the A and B registers. For example, in some cases, differencing of two numbers might result in several zeros in the high order part of the result. If provision is made then automatic break-in might occur whenever there are, for example, 16 zeros, 32 zeros, 48 zeros or 64 zeros--The particular setting being established by the programmer.
9. A suggestion was made that a bit in the instruction itself be used to indicate whether the machine break-in facility should be operative or not.
10. Frank Beckman felt that in all of these several comments a clear distinction should be made between facilities and aids to machine checking as opposed to devices to assist in problem logic.
11. It was agreed that a 12-bit exponent was less desirable than a 9-bit exponent with three program-assignable bits. A study should be made to determine how these program-assignable bits should be handled by the arithmetic element.

The above discussion resulted in an appreciation of the complexity of the problem. There was some question whether all of the automatic complexity was actually desirable. The remainder of the day was spent discussing the following subjects:

1. A suggestion was considered regarding provision for summary indicators for many exception conditions. The operation would be under the control of the programmer, that is, the programmer must interrogate the conditions of the indicators. This was a well-received suggestion and certainly should be considered seriously.

Some questions as to methods of truncating data to introduce a measure of significance were considered. There was a general feeling that a method of simply dropping the low-order eight bits would not be too valuable. This and other methods probably should be considered further.

Mr. Voorhees suggested that it might prove useful if some six bits of a data word could be capable of being added, under program control, to a base address. This would result in a method of being able to branch to different subroutines on the basis of the data being considered.

There was some feeling that decimal arithmetic would be desirable, providing that this arithmetic is not performed with a reduction in speed.

A divide by-pass instruction might be extremely useful.

Interest in some search order was expressed. It was agreed that IBM would investigate the orders which had been built into the UNIVAC by NYU.

During the second day of discussion the following points were made:

It was suggested that the ability of shifting be provided for the S register thus, numbers may be lined up with the accumulator without resorting to shifting during the transfer of numbers from one register to another. The effect of such operation unnormalized arithmetic might be to make those operations somewhat inefficient.

Mr. Lazarus returned to the subject of multiple precision. He noted that double precision required the B-register and the borrow-function. This implies additional equipment and the provision of such features should be considered carefully.

A rounded quotient operation should be provided.

The semi-two-address instruction was thought to be very worthwhile. The problem of going to full two-address operations was considered. The most serious disadvantage of such operations is the increased complexity of the decoder. A suggestion was made that certain instructions permit the extraction of two successive words from memory.

The suggested word length of 64 bits is considered to be too long by some of the Los Alamos representatives.

Mr. Kolsky presented a preliminary paper on the input-output equipment which would be an important portion of the system. The following points were made:

The speed of the 727 tapes is probably too slow for the system. The loading and unloading of the high-speed RAMAC should be done infrequently. The system operation should be error-free to the extent that dumping because of machine error should not be required any more than once every two or three hours. This is a minimum figure.

2. Punched cards are still useful for control and small data read-in operations involving something on the order of 1000 cards.
3. Interconnection and time considerations on overall performance are very serious problems.
4. The volume of input-output operations is much more difficult to evaluate than is the case of arithmetic operations. This statement is true because the I/O operations depend upon the philosophy of machine use.
5. Intercommunication between machines should be as fast as possible, but to human beings this link must be as clear as possible.
6. A typewriter should be available to keep a record of the use of the machine with respect to time. This would necessitate a real-time clock for the system.
7. A careful consideration of output data will be required. The need for more summarizing to reduce output is apparent. Graph plotting is extremely desirable.
8. In printing, the average rate over fairly long periods of time will amount to no more than a few pages per minute.
9. The need in magnetic tapes is for more reliability. The second need is for more logical ability. The third need in order of importance is for increased speed.

Some general consideration was given to the problems of operating the system. The methods of assembly, interlocking various parts of the machine, and multi-programming must be investigated fully. It was indicated that the most efficient system operation should occur on problems requiring two to three hours computing time.

Mr. Lazarus brought up the need for a graph plotter as opposed to the more generalized electronic printer. He estimated that the cost of the graph plotter might be an order of magnitude less than an electronic printer. He felt that the normal printing load could be handled by a mechanical printer. The operation of the plotter would be on-line, but would be off-line if faster tapes could be used.

Mr. Voorhees brought up the question of a typewriter capable of using many mathematical symbols to assist in the automatic coding program. The status of a submitted RPQ will be investigated by John Griffith.