MEETING OR CONTACT REPORT

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Organization & Location: North American Aviation Incorporated Los Angeles, California	Date: April 21, 22, 27, 28, 1959 Reported By: E. G. Law
Project: 7000X Applications	Department: 749 Follow-up Date:

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This report actually covers six separate meetings. For the sake of brevity all will be reported here together. All of the personnel shown as participating were not present at each of the six meetings.

At present North American Aviation has in use 3 709's, 2 704's, and 2 705's. Usage projections indicate that they will run out of available 704-709 time early in December of this year. Their first 7090 is scheduled for delivery in April of 1960 followed by a second 7090 in May and a third in June. The third machine may be postponed until September. They are making arrangements to buy 709 time between December and April. There is at least one 305 RAMAC on order for the Rocketdyne division. Eight different groups at the Rocketdyne division feel that they each have justification for a separate RAMAC. There is a similar desire in several areas of the Los Angeles Division for the random accessing abilities of a RAMAC. The 7070 was considered for a time because of its ability to include disk processing. The pressure for disks at the Los Angeles Division is being held off by management until the Rocketdyne division situation is clarified. In addition, there are several very large

integrated applications which are now in the system study stage. When these are fully mechanized, they will probably account for more machine time than all of the applications presently on the equipment. On top of all of this, there are applications areas which haven't even been scratched yet.

If one considers applications only, there is no question but that this customer is a prime candidate for at least one STRETCH machine. However, North American's data processing management has always avoided having all of their eggs in one basket. They are very much afraid of a "one of a kind" situation. Even if the new technology is extremely reliable, it is still possible to have a disaster, such as fire, which will put the equipment out of operation for an extended period. This feeling is reinforced by certain elements at the Rocketdyne Division who don't care to see all of their processing done on a single machine which would probably be located at the Los Angeles Division. This customer's experience with stored program equipment began with 701's in 1953. They fully realize and desire the lower unit cost of processing which usually goes along with larger machines. But they don't want to use so large a machine that they can have only one of them. They would prefer a pair with one located at the Los Angeles Division and one located at the Rocketdyne Division. There is reasonably general agreement that they will eventually require two large STRETCH's. They would much prefer to arrive at this state through two small STRETCH's rather than through one large STRETCH. This assumes complete program compatability between the large and the small configuration of course. Backup by another machine not under their control is a possibility which they are willing to consider, but which they feel would not be as satisfactory.

North American management has a long standing desire to process both commercial and computing work on the same machine. Exhaustive studies were made toward this end on first the 701 and then the 704 before the 705's were put on order. Flexibility in the assignment and use of available machine capacity is the major goal. North American also feels that important savings could be made on their work by doing this.

There is a desire on the part of this customer to enter the next machine family as early as possible before any more applications are committed to the existing machine family. An important difference of opinion exists on this point, however, between those who already have a large investment in programs for current equipment and those who are just beginning to put applications on the equipment. There seems to be reasonably general recognition, however, that if the switch is to be made eventually to a new machine family, it would be in the company's interest to make that switch at the earliest possible time. Like most customers this customer is weary of the necessity for reprogramming in order to take advantage of improvements in technology. They have expressed the hope that STRETCH logic is sufficiently broad to last for an extended period of time, certainly longer than the 704-709 logic has lasted. Some think that it would be better for even the new applications to experiment with pilot models on existing equipment prior to programming the full systems for a new line of equipment. The argument is that changes are always desired after the first attempt on a machine. A pilot model period would enable those people with a large investment in present programs to realize a little more from those programs prior to having to reprogram for a new family of machines.

Important segments in this customer's data processing management have no desire to be pioneers in the use of new equipment, expecially equipment as expensive as STRETCH. They tend to discount the prestige value which will be associated with such use. This is true even when one basis on which the Air Force now lets contracts is computing ability. This attitude is based on a very hard headed and realistic evaluation of the cost of being a pioneer. They feel that this cost is greater than the benefits which are to be derived. This fear could be greatly reduced with management and Applied Programming assurance of a first rate system to be delivered on time. Related to this lack of desire to be a pioneer in the use of a new machine is a dislike for the special contract arrangement. One of the reasons this customer has always been such a good IBM customer and has ordered so little equipment from competitors is that the competitive arrangements ordinarily required special contracts. There is no question but that the STRETCH machine will have more appeal to this customer after it is a regularly announced commercial product. They like the standard commercial arrangement which they have had in the past.

A general discussion of equipment needs at North American brought out the following four main points: The first concerns the need for lower elapsed time on certain very high priority problems. These are usually large engineering problems, the results of which are needed even before the data is presented. Very often, extremely expensive test equipment waits until the results are available. Usually the nature of the problem is such that it cannot be split up for processing on several machines. The fastest possible CPU is needed to process this type of problem in absolute minimum time. The high cost of the waiting test equipment will often artificially justify very high cost machine processing. In fact, separate installations are sometimes set up to process nothing but the priority problem. They stand by the remainder of the time just so they will be available when needed. This is seldom the best solution because a standby machine is rarely the most powerful available. A better solution for everyone concerned is a direct wire to the most powerful machine that the company can afford. All of the power of this machine is made available whenever the priority need is indicated. In the meantime the machine is turning out all of the other hundreds of jobs which the company has. A very large, fast, and powerful CPU can perhaps process no more work than the equivalent power in smaller machines, but it can produce dramatically lower elapsed time on priority problems such as those mentioned above.

The second need is related to the first. It concerns extremely fast passing of raw data. Several of the very high priority problems mentioned above are data reduction problems. One of these is expected to yield two hundred million data points per day for analysis. The vast majority of these points will only enter into simple comparisons for the sake of determining those areas needing further analysis. The ability to subject the points to simple comparisons while they are being read in at an extremely high rate is needed. Very high speed communication links were also discussed as part of this point.

The third general need discussed was for very large random access memory. The high level of interest in disk memory at North American was mentioned earlier in this report. The discussion actually brought out the need for a variety of random access memories to serve different needs. There are at least three of these. The difference is one of emphasis. The first type is needed as an extension of main memory. The emphasis in this case is on extremely high instantaneous transfer rate. Large capacity is assumed, of course. Data can be transferred to and from memory in large blocks,

therefore, the access time is not as important as the transfer rate. This need is satisfied very well by the parallel disk presently planned for STRETCH. A second slightly different need is felt for a random access device with faster access time. In this case the instantaneous transfer rate can be sacrificed somewhat in order to obtain a faster access time. A larger number of much smaller records are involved here. Low access time is important. The third type needed puts the emphasis on very low cost per word of storage. Extremely high capacity is also assumed. Both access time and transfer rate can be sacrificed for the sake of low cost and high capacity. All three of these types could be used on the same machine for different purposes.

The fourth general need discussed is related to both the first and the third need mentioned above. It is for a good general interrupt system. When a high priority problem is ready for processing it can be put in ahead of any backlog which exists without any trouble. But without a good interrupt system which will save all of the work done up to any point of interruption, it cannot be put on the machine immediately without losing whatever job is on the machine at that time. As soon as the priority problem has been processed, the machine must return to the interrupted problem with a minimum of lost time. This situation calls for completely general interrupt system not available prior to the STRETCH machine.

The largest part of the desire for very large random access memories by this customer relates to inquiry type access rather than to an extension of main memory. This customer is quite excited about the possibility of having very large files of information available both for inquiry and also for processing and updating by a machine with more than fundamental computing ability. This is recognition of the fact that the interrupt facilities can make large amounts of information available for inquiry without hampering the machine's ability to process large amounts of normal work. This customer already has in mind several different files, all of which would be available for inquiry at any given time. Present STRETCH design comes far closer to satisfying this need than any previous machine. But a little more attention is probably deserved by the following areas: First, the definition of the low speed exchange to serve a large number of inquiry stations should be put in final form. Second, absolutely minimum cost inquiry stations should

be designed. Any single inquiry station will almost certainly not be used for a very high proportion of the available time. It is difficult under these circumstances to justify a very high priced unit for the individual inquiry stations. If the cost of the inquiry unit forces concentration of inquiry stations and consequent batching of inquiries, a great deal of the gain to be made by the inquiry principle is lost. This same situation pertains in the data collection field. One of the biggest difficulties has been lowering the cost of the individual reporting station to a point where the entire system is made practical. Using the same adapter and typewriter from the console for separate inquiry stations is probably too expensive an approach. A less expensive one has to be found. Finally, the disk memory now planned for STRETCH must be supplemented by additional units which provide a different balance between cost, access time, and instantaneous information transmission rate. It seems evident that more thought should be given to slower very large random access devices for connection to the basic exchange of STRETCH rather than to the high speed exchange. These would in no way replace the various high speed disks, but instead would supplement them for that type of job where access time is more important than instantaneous information transfer rate, or where cost is more important than either access time or information transfer rate.

The applications which North American now has operating on the 704, 705 and 709 all follow fairly conventional forms. There has been only limited integration of previously separate systems. This is true in both the commercial and the engineering areas. There are some very large integrated applications in the planning stage, but none of these have as yet accounted for any large amount of machine time, even though they will eventually account for a large majority of it. Although the work to date has followed conventional forms, the amount of machine time being used is witness to the very high volume of this work. There are several applications presently in operation on the equipment which we might study in detail for purposes of comparing STRETCH operating time with the present operating time.

For purposes of measuring STRETCH performance on future very large integrated applications, there are the following jobs which are now in the systems study and early coding stages. In the engineering area there is the flight test instrumentation problem mentioned earlier in this report. It involves the reduction and analysis of two hundred million data points a day. Mr. Leeburg has calculated that this will require four to five hours of 7090 time per day. Telemetering of these

data points was considered at one time, but was given up because it was considered unfeasible to process the data at the high speeds at which it would be reported. There evidently would be considerable value in being able to do this if a fast enough CPU could be applied to the problem. Short of this, reduction and analysis of the data is needed as soon after the plane has landed as possible. Elapsed time is critical here because the nature of the next test is often dependent on the results of the preceeding test.

A second application from the engineering area is the simulation of completed electronic systems before the system itself is complete. Those components of the system which have not been delivered at any point are simulated in order to begin testing the entire system at an earlier point. The justification for the large amount of machine time required to do this is found in the need for minimum elapsed time in the availability of the entire system. This problem has been estimated as requiring four hours of 709 time a day.

In the manufacturing area, there is a spares documentation problem involving approximately 300,000 records of about 500 characters each which must be kept up to date and available for inquiry at any time. It would probably make a very good application study for permanent disk storage and a large inquiry network. A second application in the manufacturing area is a material transactions flow system. Portions of this are already being put on the 705's at North American. It will be considerably extended in the future and will form the foundation for a completely integrated system going all the way from the engineering drawing to the finished product. This application has several elements which would make it a very good subject for a STRETCH application study. It is the beginning of an area which this customer hopes to mechanize to a much larger extent in the future. But at the same time, enough work has been done on it to provide very reliable information as to the machine time required on present equipment. Good comparisons can therefore be made.

There is another very interesting application at the Rocketdyne Division. Part of its interest lies in the fact that it is the forerunner of a whole class of applications. It involves the logical retrieval and analysis of information from previous rocket engine firings. It yields information obtainable only when several different firings are studied together. It was programmed first for the 704 about two years ago.

It is now being redone and expanded considerably for the 709. It could probably be expanded even more on a more powerful machine. Its value is measured in terms of drawing additional information from extremely expensive static firings of rocket engines. In some cases it might even avoid the necessity for an entire firing. Whether the results are that dramatic, or whether they merely result in additional valuable information being gained from firings, the result is a very profitable application.

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