SUMMARY

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NASCOM SYSTEM PROGRAMMING

Before beginning with my presentation, I would like to express my appreciation for having this opportunity to present the programming portion of the NASCOM System.

In building an organization to perform the programming for the NASCOM Network, four things of major concern had to be taken into consideration: The time frame involved, education, record keeping and the future capability of the system.

The first and foremost consideration involved the time frame, which was an uncontrollable item dictated by the speed in growth of the NASCOM Network. The amount of satellites being launched and new tracking stations necessary for their support made it imperative that the system be operational within eight months or additional equipment be purchased for the system being utilized at that time.

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In order to meet the time requirements, initial program de-bugging was done on the Univac 490 at IMCC, Houston, Texas. Following the installation and hardware check-out of the Goddard Systems, "ROUND-THE-CLOCK" de-bugging was implemented.

Our second major consideration existed with education in that our communications personnel, although experts in the application, had to learn the 490 real time system and the Univac personnel assigned to the project had to learn the application.

A decision was made, which has proved beneficial to utilize a combination of both experienced programmers and experienced communications personnel with programming ability.

With the caliber of personnel selected, it was possible to utilize an accelerated training program. Univac provided formal class room training for NASA's communicators and NASA in turn provided an on-the-job training program for the Univac personnel assigned to the project.

This method of approach proved to be very successful and solved the problem of educ[redacted]

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Record keeping can be harmful at either the extreme of too many records or too few. To alleviate this possible problem, both the communications project group and the Univac project group were merged under the management of one individual who could both expedite and control the necessary record keeping and documentation.

Our last consideration was insuring that all known future requirements were built into the system. This was assured by having the individuals most intimately involved with our future requirements to monitor all parameters set within the system.

Now that we had our primary considerations under control, we were ready to begin the programming design, coding and implementation.

Fundamental concepts in consideration of design were:

System would always be ready to receive input on all circuits.

Store and forward method of operation would not be used.

Output would be an independent operation on all circuits. Messages would be stored on drum for a period of 24 hours for immediate recall and on magnetic tape permanently for future recall.

Both hard copy and magnetic tape journal records would be produced for all messages transmitted and received.

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With the foregoing concepts in mind, programming on the main chain began.

INPUT

In order to provide a simple straightforward system which makes good use of the queueing capabilities of the high speed drum, the input program runs independently of other programs. The input program can handle simultaneous input on all circuits. This is accomplished by dedicating a core module to each input circuit. This module contains all necessary information about an individual circuit and message. The interrupt analysis program passes control to the input program with the module base address in an index register. The program modifies its instructions by this index register and functions without knowing which circuit is being processed.

The input program receives traffic into two alternating 6-character buffers of each circuit. As each internal interrupt occurs, it packs the characters (6 per word) into a pack area. When the pack area is full the program writes it on the drum. There are 66 characters in the first pack area and 90 in subsequent areas. They are chained together by a drum continuation address in the last word of each pack area. The last word of the message contains a special indicator and word count. The beginning drum address of the message is placed on the validation queue and on the magnetic tape queue. If the count of entries on either queue is zero, the program will also be scheduled so that it will get control.

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The input program performs a number of other functions such as discarding leading letters prior to SOM, discarding blanks anywhere in the message looking for EOM, timing message breaks, discarding line hits and sending special advisory messages such as INVALID EOM, blanks, excessive message breaks, etc.

All input traffic is immediately recorded on magnetic tape by the WRTIT program which functions simply as a drum to tape utility program.

VALIDATION

The validation program which is scheduled by the input program checks for a valid start of message, input number, precedence, and routing indicators. It permits a great deal of flexibility in format and can tolerate operator errors to a great extent. It will send erroneous messages to the service area but will forward the message, if possible. If not possible, the message is intercepted at the service area. A message may have an unlimited number of routing indicators and may also have collective routing indicators which specify a large group of stations. A message may have five levels of precedence, including one (urgent) which can interrupt a non urgent message presently in progress.

After obtaining all routing indicators, the validation program puts the beginning drum address of the message on the proper precedence output queue for each addressee. Then, it schedules the output program for each circuit which is available.

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The circuit status is determined by checking indicators within the module for each circuit. The circuit is checked to see that it is not already busy, that the station is open, and that the circuit is in commission. It is also checked to insure that it is not in conference or alt-routed. If all conditions are properly met, output is started.

The output program generates a standard SOM, an output number, and starts transmitting. It then reads the message from the drum, unpacks it into a twelve character output buffer and transmits it. It also supplies a standard EOM at the end of the message.

After an output number is assigned and output started, the output program makes an entry on the Recall Directory and on the journal queue.

JOURNAL

The journal program, when it gets control, will generate and transmit a journal record to a 28 RO. It will also schedule the journal record to be written on magnetic tape by the WRTIT program. The journal record contains source, destination, input and output numbers, input and output times tape search identifier, message drum address, and the heading of the message.

The journal record on magnetic tape is cross checked with the input message on magnetic tape at the end of each day to insure that all messages have been delivered. This is a backstop procedure which backs up other procedures which function all day long with the same goal.

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RECALL

The recall directory is used to locate a message on the drum when a station requests retransmission within 24 to 32 hours of the original transmission. The CP generates a supplementary heading and transmits it, followed by the original message. If a message is no longer on the drum, the recall request goes to the service area. They obtain the proper day's tape from storage and mount it to be searched. When found, it is transferred to the drum and transmitted with a supplementary heading to the requesting station.

SUMMARY:

The key to the system is the high speed drum which allows all parts of the program to operate independently and control can be passed to other parts of the program by means of entries on queues. The INPUT program packs messages, puts them on the drum, and queues them for WRTIT and VALIDATION. VALIDATION reads from the drum one message at a time and queues it for output on all indicated circuits. Output reads the message from the drum once for each circuit to which it is to be sent. OUTPUT writes the Recall Directory and the Journal Queue Entry on the drum. WRTIT reads the message from the drum and writes it on magnetic tape. Subsequently, it will read the Journal Record from the drum and write it on tape.

The queueing concept allows a program to handle events one at a time even though they may have happened simultaneously, or nearly so. It permits automatic compensation for speed differences between input and output and eliminates any need for coordinating output to different circuits.

That briefly, is the programming portion of the NASCOM System.

Thank you.