permit us to continue using the existing 1401 programs, running in compatibility mode, to print the reports from these files. In this way, we can devote our time to converting more 7074 programs without having to analyze the editing and processing functions performed by several hundred 1401 programs. Later, when more sophisticated report-writing features are available in our COBOL processor, we will write the report images directly from the converted programs.

Since we expect a major upheaval in our machine operating techniques, we are planning to expand a model 30 to a configuration equivalent to the model 65 a few months in advance of the bigger systems' delivery. This will enable us to explore the Job Control procedure and the various Operating System features and routines (especially the data conversion subroutines), at the same time that we are testing the converted programs. In this way, we expect to be much better prepared for immediate cutover to the model 65 when it arrives.

Library conversion may be our toughest problem to solve successfully. Each 7-track file to be read under 7074 emulation must be duplicated to 9-track 1600 bpi after its last use on the 7074. This is not difficult for monthly and semi-monthly files, but can become critical for weekly, daily, and special files. Out of more than 5000 library tapes, we anticipate that about 600 will have to be duplicated in a 50-hour period during the first week of operation of the 360/65.

To help ease this burden, we are going to keep the 7074 in operation for one month after startup of the model 65. This additional security will permit some slack in our duplication schedule, which is especially important in the case where a given tape is used as input to the 7074 during the peak-load duplication period, or in the event that the model 65 does not become operative as soon as expected. In a few instances, it may be necessary to save the original 7-track tape until after the 9-track copy is actually used; large master files or input tapes to critical runs would be included in this group.

summary

The importance of an early analysis of your conversion load cannot be overemphazised. The number of alternative plans from which you can choose decreases as the day of delivery approaches, until finally, only a brute force, crash program remains, leaving chaos in its wake.

"Plan your change, and change your plan" will be a recurring theme during conversion. Nevertheless, planning is a prerequisite to getting the job done. And the sooner the job is done, the sooner we can start using those "new generation" data processing techniques we have been promised. ∎

TRAINING FOR CONVERSION

ge goes ge

by MARIO V. FARINA

In May, 1965, the first GE-625 computer was delivered to the huge Schenectady plant of the General Electric Company. The large-scale computer was to replace five other computers of various sizes and makes. This article describes the training program set up to help in converting old programs to the GE-625 and to help computer users plan important new programs.

the environment

In order to understand the tremendous problems of transition, something should be said about the organization of the Schenectady plant. In an area of about 730 acres are located about 25 separate company components, which are semi-autonomous businesses. These range from small-scale, employing several hundred people, to very large-scale, employing thousands.

Most, if not all, of these businesses use computers, some having used them for over 10 years. Historically, each business obtained and operated its own computer. A few years back, all the major computers in this plant were placed under the control of a new organization called Telecommunications and Information Processing Operation (TIPO). Computers, for the most part, remained at widely scattered locations, but their control was centralized. The users of computers became internal customers of TIPO. With the advent of the GE-625, plans were made to phase out the older computers.

how conversions are being made

Many Schenectady computer users began to plan for conversion a year or more before the new computer ar-

Mr. Farina has been an educational specialist at GE Schenectady since 1964 and for the preceding five years was a scientific techniques programmer with GE. He has written 30 training texts in carrying out his responsibilities of preparing and teaching computer courses.

rived. The conversion plans are almost as varied as the businesses involved.

One large product department is an example. As one of the earliest computer users in Schenectady, many of its original programs were written in machine language. Later it developed its own compiler language called TASMIN. For several years, programs for the department were written almost exclusively in that language. Management decided that a feasible way to solve many of that department's conversion problems was for TASMIN to be implemented on the GE-625. This implementation was undertaken by TIPO. The people of the department are also learning how to write COBOL, FORTRAN IV, and GE-625 machine language for possible programming use.

Another example of how conversion problems are being met in Schenectady is illustrated by a second department. This department is responsible for company-wide accounting functions. In connection with these functions, it maintains almost 700 programs and many master files. Its files often contain hundreds of thousands of records.

For many years the computer used by this department has been a dependable old-timer. Although more than adequate in its day, it is now ready for retirement. Conversion to the GE-625 computer is taking two forms: one, by rewriting programs in COBOL; the other, through interim use of a simulator. The simulator was written by TIPO personnel and is now beginning to see service.

A third example of how conversion problems are being handled is illustrated by the plans of a third large product department. This department consists of three operating components, each of which is semi-independent. Complete new systems are being designed by them. The new computer will permit the department, in three to four years, to complete sophisticated real-time systems, using remote terminals, time-sharing equipment and elaborate display devices.

TIPO'S education function

The complexities and varieties of transition problems made it apparent to TIPO management even before the GE-625 computer arrived that a computer training program should be initiated in TIPO.

Organizationally, TIPO's education and training function is one of the responsibilities of the Software Systems and Techniques Unit. I have been a member of this unit for two years and am responsible for the education and training function. It is my responsibility to ascertain customer training requirements, plan computer courses, and teach. Qualified people often are used from both within and without TIPO to conduct some of the planned courses.

The goals of the TIPO education function are two-fold: first, to enable programmers to cope with the immediate difficulties of conversion; second, to better prepare Schenectady computer users for the challenges of the future.

The GE-625, being a large-scale binary computer, is different from those computers most Schenectady programmers had been used to. For example, many of the programmers had used only character-oriented machines and had no idea what "bits" were. Other programmers had lived with computers of small 2000-word memories.

There was little question, therefore, whether an education and training program should be begun, but rather how intensive it should be; TIPO decided to undertake an intensive program since it had a vital interest in how efficiently the new computer was used. Their approach to the training requirement was to offer a steady stream of computer courses, repeating them as often as there was demand for them.

And demand there was! The stream of courses became a torrent. Many different computer subjects were covered. Classes were usually large; in some cases, very large. Forty and 50 students per class was not unusual. In one case, a FORTRAN IV course was given to over 100 engineers. The largest available classroom was booked, a room which is actually an auditorium. Except for a somewhat more formal lecture approach than usual and the use of a lapel mike, the course was essentially the same as that used in classes containing fewer people. Despite some initial misgivings, the course was a success, and a small army of engineers began "speaking" FORTRAN.

Courses are announced through 110 Schenectady-area education specialists. These specialists, who are responsible for education functions in their own components, circulate announcements among managers and collect the names of persons wanting to take TIPO computer courses.

courses offered

Courses offered are not only the familiar standbys—FORTRAN IV, COBOL, TASMIN, and machine language, but also a basic computer course for managers, an introduction to computers (for technicians), FORTRAN IV for engineers and basic courses in data communications.

The TASMIN and FORTRAN courses are 32-hour courses spread over 8 weeks, two 2-hour meetings per week; COBOL is a 40-hour course given over ten weeks. The other courses mentioned are shorter, varying from 12 to 20 hours each. All of these courses are also conducted in the evening, one session per week. Evening courses are, therefore, spread over a longer period of time. Courses require textbook study, homework problems, and lab work in the form of actual programs on computers.

Response to course offerings, even after two years, is enthusiastic. In many instances courses are oversubscribed, causing TIPO to open additional sections. No opportunity for giving users computer knowledge is overlooked. In some cases, small groups of users have requested specialized training and have been given crash courses.

Since mid-1964, when this intensive education and training program was initiated, almost 2,000 people have received some form of computer training in over 100 completed courses or seminars.

correspondence courses, too

Particularly successful has been a correspondence course in FORTRAN IV. This course was originally written in 33 lessons in 1964 and was offered to a small group of individuals who couldn't attend regular classes. Students read text material and mailed lessons to TIPO for correction proceeding at their own pace. The course required that students write and actually debug four programs on a computer. Though I seldom met the students personally, I got to know them from correspondence and phone conversations.

This correspondence course has been rewritten several times using actual experiences with it as a guide to improvements, and has evolved into an informal, easy-to-read text, avoiding much of the rigorous language found in some publications. It exists currently as a 40-lesson course in bound form. Early this year a version of the book was made available internally to General Electric plants.

courses for managers

To acquaint leaders in the Schenectady plant with computer challenges of the future, courses for managers were developed. One of these is Basic Computers for Managers. Its purpose is to acquaint managers with what computers are, how they are programmed, and their applications.

The course is offered frequently and is always filled quickly. To date over 300 managers have gone through the six evening sessions required for this course. Written lectures for this course include such subjects as "What Is A Computer and What Can It Do Well?", "The Nature Of Computer Applications" and "Is There A Computer In Your Future?" Documenting the managers' course has proven valuable because managers are not always able to attend every session of a course. However, they are able to read while on planes, or during odd moments. They can thereby keep up with the rest of the class.

In 1965, another course for managers was designed. This one was called "Computers In Action For Managers." It was set up for those managers who had completed the Basic Computers course and who wanted to know more about how computers are used in Schenectady and elsewhere. Each week for six weeks a different expert speaks to this class.

It was not difficult to find experts from the many various businesses in the Schenectady area. On occasion lecturers from outside the company have been invited to participate, such as a professor from a local university and the data processing manager of a near-by airline.

Courses for managers have been so successful that another course called "FORTRAN IV for Managers" is being initiated. This is a greatly abbreviated version of the standard FORTRAN IV course. The idea behind it is to give managers a quick look at FORTRAN IV so that they can learn to use computers more effectively. The course requires managers to write and debug one simple program.

This new course is not intended to teach managers to program, but simply to give them an insight into programming problems. The FORTRAN IV language was selected because it is simple to use and is representative of other compiler languages. It is expected that managers will benefit from the course even though their people use COBOL, TASMIN, or other languages. Managers should be
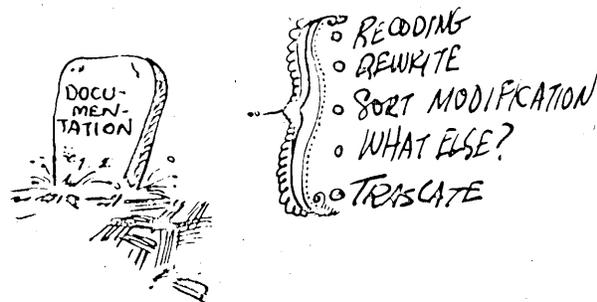
able to communicate better with programmers regardless of programming language used. In addition, managers should be better prepared to ascertain the feasibility of contemplated computer applications, to estimate their costs and to determine how soon the applications could be implemented.

operator training

An important facet of the program is the training of TIPO computer operators. The GE-625 is a versatile machine and requires highly skilled operating personnel. To help provide a supply of such personnel, the General Electric Computer Equipment Department gave a pilot operators' course in 1965 to a group of six skilled GE-225 computer operators. Some of these operators were selected by management to prepare and to teach additional GE-625 operators' courses. I conferred with the selected men and offered advice on how to prepare effective sessions. These men willingly took over the responsibility of preparing lectures and gave creditable performances. The operators' courses have been successful and I believe that operators

training themselves is an optimum way to meet this critical need.

teaching methods

The TIPO training specialists are encouraged to document courses because a lecture once written satisfies many needs. For example, those who cannot attend formal classes can learn by studying the written material. Furthermore, if a person misses a class for some unavoidable reason, he can make it up easily by outside reading.

The publications generated by TIPO instructors include complete courses in FORTRAN IV, COBOL, and machine-language programming. Instructors have also written scores of shorter pamphlets on such computer subjects as binary arithmetic, how computers work, what computer languages are and what techniques are used in computer programming. These documents are offered to TIPO users and are widely accepted. Some of the publications are published as technical reports and are offered to computer users throughout the company. In 1965 over 1800 copies of such publications were distributed, not only in the United States, but also in Canada, Mexico and France. One of these publications was recently translated into Spanish by GE personnel and is being used in Mexico at a field office.

Education techniques in the classroom have included experimental use of recorded lectures. The FORTRAN IV lectures were recorded on tape and were played in the classroom. A clerk operated the recorder and, at preplanned times, mounted for display the poster-size exhibits associated with the lectures.

Results have been mixed. Experience has shown that recordings must be carefully planned to obviate unanticipated questions and to provide pauses now and then for student reflection.

Work is continuing on the development of recorded lectures in the hope that some courses can be taught without the presence of an instructor. If such lectures can be successfully developed, instructors would, of course, be free to perform other tasks. Further, students could take courses at hours convenient to them.

Most of the TIPO people who teach computer subjects are not primarily teachers, but programmers. Typically, such programmers have attended pilot courses conducted in Schenectady by the General Electric Computer Equipment Department. Now, on a part-time basis, they teach the subjects which they have learned. Those who teach have discovered that one never learns a subject so well as when he has to teach it himself. Therefore, they usually welcome the opportunity to learn by teaching. The Computer Equipment Department is always available, of course should training requirements exceed those which can be handled by TIPO personnel.

summary

The problems of transition are being solved by TIPO users in a variety of ways. Users are free to make their own conversion plans but TIPO helps them by providing assistance such as computer simulators and the implementation of compilers. It is also helping them make conversions by supplying the computer education and training they require.

In the area of computer education, TIPO plans to continue offering basic and specialized courses. The emphasis will shift from training for conversion to training to meet the challenges of a computer-oriented future. Several avenues for providing support will be maintained. Computer courses will be offered both during the day and in the evening. Self-teaching texts, correspondence courses and pamphlets will be available. Experiments to find effective ways to teach will be continued. ■