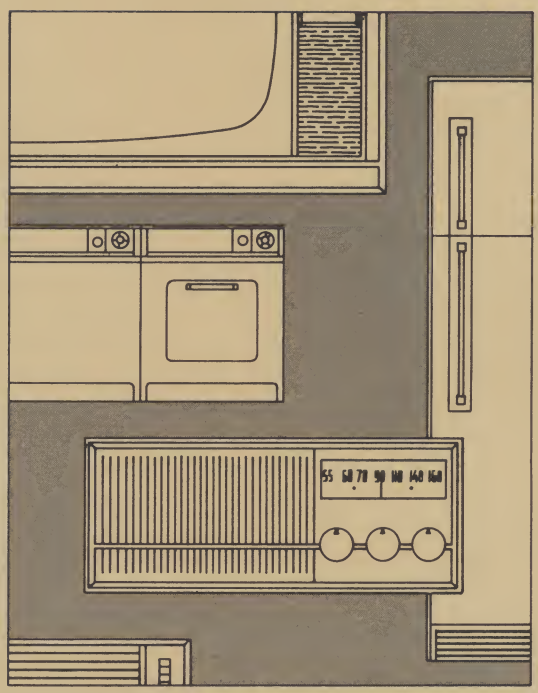
TELETYPE



GENERAL ELECTRIC USES TELETYPEWRITERS

to solve research problems
in real-time
via time-sharing computer

TELETYPE

case history:

General Electric Company's Appliance Park facility had long used computers in its research and design work. But because the engineers and scientists did not have direct access to the computer, there was considerable delay in processing data.

But now, as a result of Teletype Model 33 and 35 ASR (automatic send-receive) sets linked to a time-sharing computer, they can determine immediately the feasibility of ideas, new designs and engineering changes.

The story of how GE uses time-sharing to get real-time answers to problems is detailed here and in recent issues of several leading publications.

For information about leased services featuring Teletype equipment, consult your local telephone or telegraph company. To purchase equipment, contact us at our general offices address on the back cover.

When ordering input-output terminals for your data processing system, be sure to specify Teletype equipment—your vital communications link.

GENERAL ELECTRIC COMPANY
APPLIANCE PARK
LOUISVILLE, KENTUCKY

Appliance Park, world's largest major appliance manufacturing facility, Louisville, Ky. houses offices and manufacturing facilities for G.E. clothes washers and dryers, electric ranges, dishwashers, Disposalls, refrigerators, freezers and room air conditioners.

ENGINEERS, SCIENTISTS AT G. E.'S APPLIANCE PARK LINKED TO TIME-SHARE COMPUTER VIA TELETYPEWRITERS

SYSTEM OFFERS REAL-TIME ANSWERS TO PROBLEMS

By permitting engineers and scientists at Appliance Park to access a time-sharing computer via teletypewriters, General Electric Company is adding new dimensions to individual creativity and problem-solving skills.

Researchers and mathematicians are finding it possible to determine immediately the feasibility of ideas and designs. They are also able to check out modified products rapidly to establish the technical worth of engineering changes.

Appliance Park is the name given by General Electric to its manufacturing facility in the Louisville, Ky. area. Here, G.E.'s major appliances—ranges and ventilating hoods, refrigerators, freezers, automatic clothes washers and dryers, dishwashers, garbage disposal units and room air-conditioners—are produced.

Other General Electric major appliance and Hotpoint plants are located in Chicago, Illinois; Milwaukee, Wisconsin; Trenton, New Jersey; Tyler, Texas and Bloomington, Illinois.

COMPUTERS USED FOR SOME TIME

The Louisville facility has for some time made individual use of various types of computers.

"Because our engineers and researchers did not have direct access to these computers, however, we were faced until recently with considerable delays in processing data," states Ernest Bianco, manager of the Division's Applied Mathematics Laboratory.*

"But now," Bianco points out, "thanks to time-sharing computer service with teletypewriter links to the computer, we are able to do everything in one big gulp. And, because we are able to 'debug' programs before going on-line to the computer, we have virtually eliminated delays occasioned by errors."

What Bianco and his group are striving for is the use of computers to permit "management by exception"—*i.e.*, using the computer to instantly uncover exceptional or unexpected data of any kind. Admittedly, such usage is still some time away.

"We're looking ahead toward direct-inquiry, even individual use, of the computer memory banks," Bianco says. Thus, a department manager, for example, could ask the computer what has changed—and receive in a moment information on what is significantly different from the traditional.

"Management too often equates data with information," says Bianco. "They are not synonymous, and there is too much of the former."

Appliance Park's early experience with time-sharing was via Bell System telephone lines to General Electric Information Processing Centers (IPC's) in New York, Phoenix and Valley Forge, Pa.

Then, early in 1966, the Louisville plant began to use exclusively the service of G.E.'s Information Processing Center in Chicago. It will continue to use these facilities until it has augmented its own computer complex.

*Title at time this article was prepared. Bianco is now manager of new ventures planning at Appliance Park.

Engineers and scientists in the Applied Mathematics Laboratory at General Electric's Appliance Park are responsible for developing the computer programs for use in research activities. Here, statistician, Robert D. Mohr (right) works out a program with the aid of Robert B. Hadeler (left), a time-share mathematician.

100-WPM TELETYPEWRITERS USED

Twelve Teletype Model 33 and 35 ASR (automatic send-receive) sets are employed at Appliance Park to communicate with the G.E. service center in Chicago via Bell System Data-Phone Service. Embodied within these machines are a keyboard send-receive page printer, a paper tape punch, and a paper tape reader, which can be used in different combinations. Both sets operate at 100 words per minute (10 characters per second) and use the U.S.A. Standard Code for Information Interchange (ASCII).

Each of the teletypewriters is connected to voice-quality phone lines through the Bell System's "Common Control Switching Arrangement" (CCSA, which G.E. internally calls its "Dial Comm" system). In fact, this gives the company its own direct-dial telephone network.

Users of the service at Appliance Park, most of whom are engineers, have been schooled in "BASIC" computer language—an acronym for Beginners All-Purpose Symbolic Instruction Code developed by Dartmouth College with General Electric. This language is taught in a short course given by Appliance Park personnel and available to all time-sharing service users from all G.E. centers.

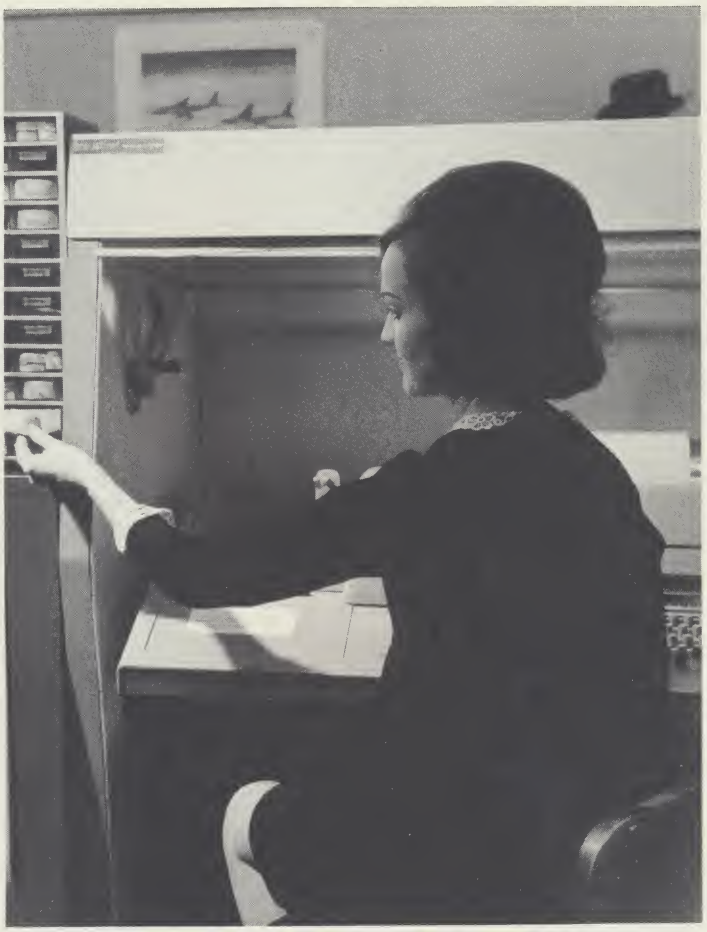
The curriculum of the course includes familiarization with system commands; the start-up and calling sequence; the use of Teletype equipment in context with a computer; the "library" program (*i.e.*, what programs are "on file" with the computer); the BASIC language, and finally, file editing (modification or alteration of programs already on punched tape).

"The BASIC language and the ubiquitous teletypewriter have helped establish a true man-machine interaction," states Bianco. "Empathy exists because of the high accessibility rate and the conversational mode used. Our engineers and scientists now have a real chance to express themselves analytically."

PROGRAMS PUNCHED INTO PAPER TAPE

To date, scores of different programs have been developed by the personnel at the Applied Mathematics Laboratory. Each has been punched into paper tape and is stored at a central location within the department. When an engineer desires to make use of a particular program, he merely inserts the program tape into the tape reader

Each computer program developed at the Applied Mathematics Laboratory is punched into paper tape by the operator of a Teletype Model 35 ASR (automatic send-receive) set, as demonstrated by Mrs. Betty Hall, computer programmer. Tapes are then stored until an engineer or scientist has application for a particular one, at which time the tape is inserted into the ASR set's tape reader and transmitted to the computer.



Computer program tapes are stored at a central location within the Applied Mathematics Laboratory. When a particular one is to be used, it is transmitted to the computer via a teletypewriter, as Mrs. Betty Hall, computer programmer, demonstrates.

of a Model 33 ASR set, which in most cases is near his desk.

Once the tape has been transmitted to the computer, the engineer is ready to begin asking predetermined questions to elicit analytical data. The entire "conversation" between man and computer is recorded as page copy on the ASR unit. If desired, a paper tape can be punched simultaneously to duplicate page copy; the tape is made whenever information will be processed through the computer at some future time.

The greatest use of G.E.'s Teletype machines in the current time-sharing program is for analysis—as opposed to cybernetic use, or the batch-processing of data in large amounts. A current example is a Refrigeration Department study that transmits to the computer test data on the engineering performance of experimental models, comparing this data to that on file for the latest models in production.

Another use is for statistical analysis—dealing with tests of an inferential nature and utilizing the probability theory (*i.e.*, given a complete set of circumstances or criteria, the computer will provide answers of the "this course of action is better than that" sort). The computer also is accessed for simulation studies by engineers—most recently of a mathematical building "model" to justify a suggested plant expansion.

ENGINEERS GIVEN FREE REIN

Bianco, who terms time-sharing "without doubt the greatest single achievement in the computer business today," underscores the fact that he does not supervise use of the Teletype computer-access equipment in the strict sense of the word.

"We watch only for excessive on-line time that indicates the user of the Teletype equipment has not done his 'homework' before going on-line," Bianco states. " 'Heavy-handed' restrictions would negate all we have striven for in our present data communications setup."

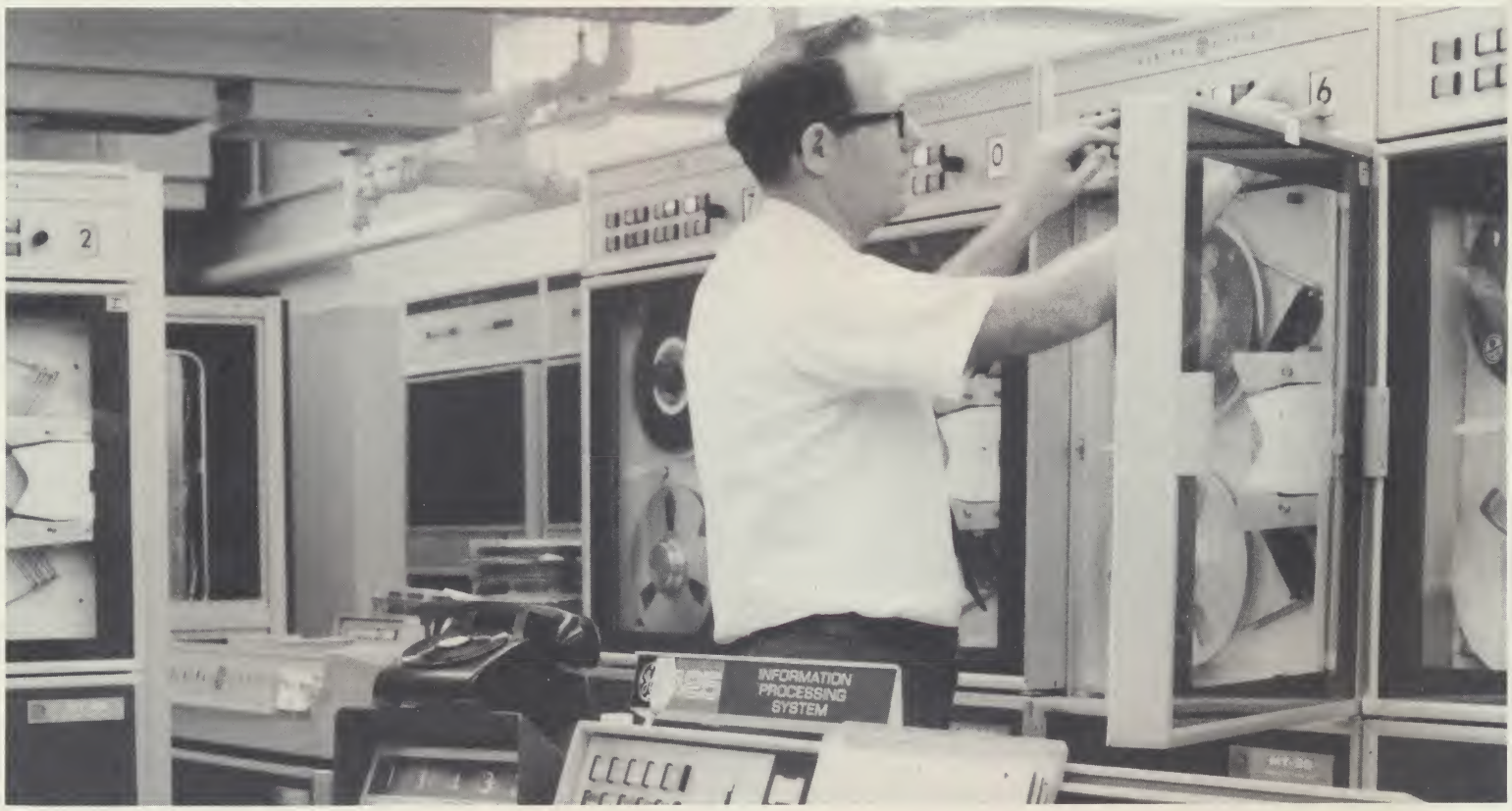
"Getting file information on just what you want is an immeasurable benefit," continues Bianco. "In the future, I'm almost sure we'll see a proliferation here of remote terminal devices. The number, in fact, should double—and just as importantly, our uses of them will double. We'll be in possession of *dynamic* information—of the sort that would be represented by daily sales forecasts, if that were our concern.

"And the factor of analytical expressiveness," Bianco concludes, "will also continue to grow."

Engineers and scientists at Appliance Park communicate directly with the computer via a Teletype Model 33 ASR (automatic send-receive) set. The "conversation" is recorded as page copy, but a paper tape can be punched simultaneously. Shown here is Stuart R. Kunz, Specialist Engineering, Merchandized Information Systems.

Traffic flow into and out of the computer in Chicago is controlled by a G. E. Datanet-30 communications processor similar to the unit above located at Appliance Park. By next year, the Laboratory's work will be phased out of the Chicago facility and onto the Appliance Park data processing system. At right is Wayne Kepley, specialist in telecommunications applications, discussing new programming with analyst M. R. Salsman.

Data processing facilities at Appliance Park used by the Applied Mathematics Laboratory with similar equipment in Chicago.



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