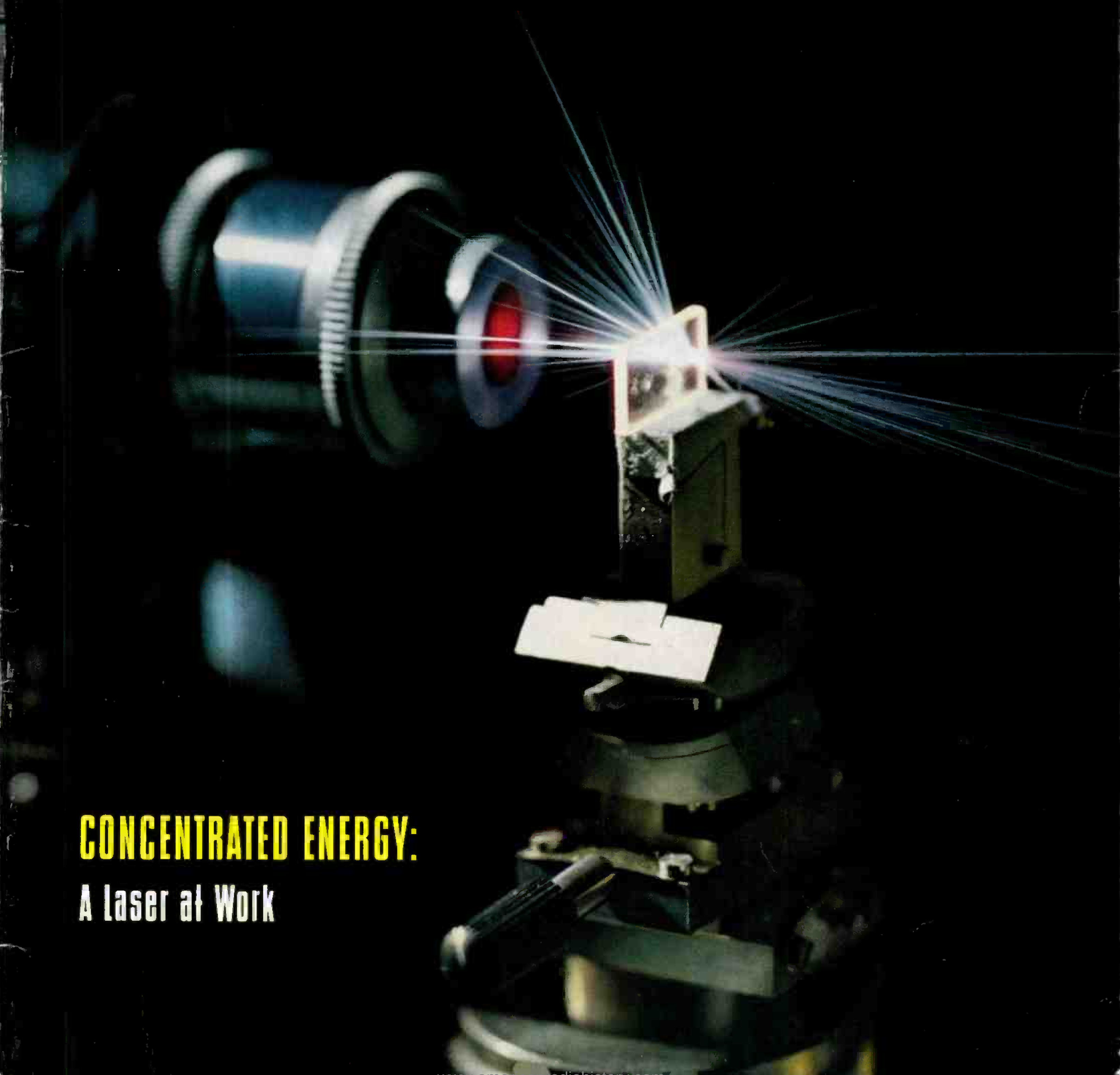
RCA

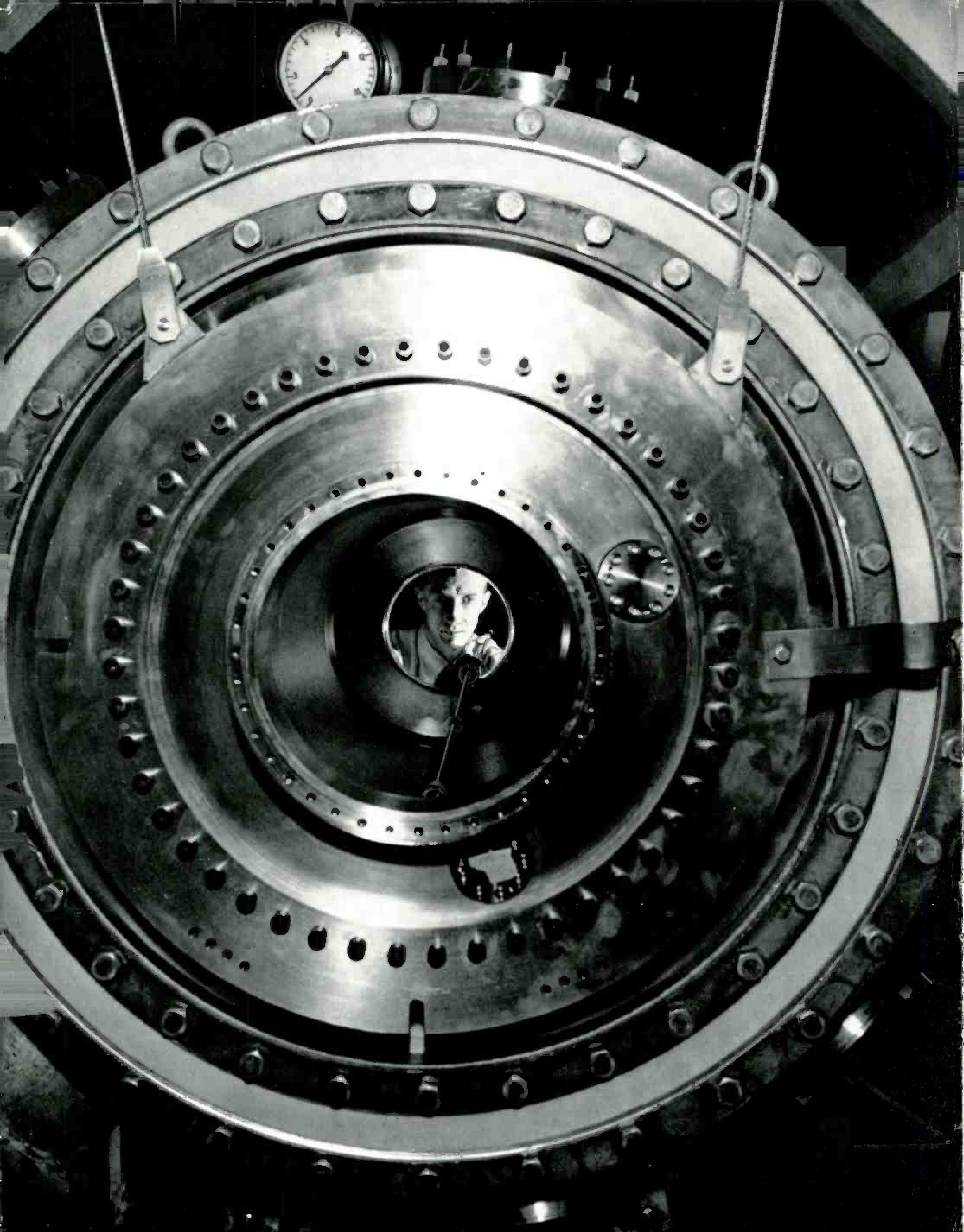
SUMMER 1962

electronic age



CONCENTRATED ENERGY:

A Laser at Work



RCA electronic age

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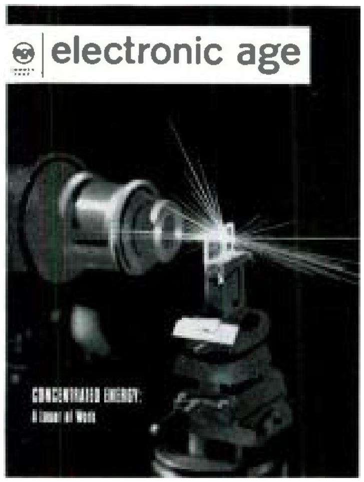

COVER: *Pulsed ruby laser pierces a sapphire crystal at the RCA Laboratories in Princeton, N. J. The laser's energy is so intense that it can bore a sixteenth-of-an-inch hole in a thousandth of a second and generate a heat of at least 2800° on surface of the sapphire.* *See Lasers: New Power from Light, page 8.*

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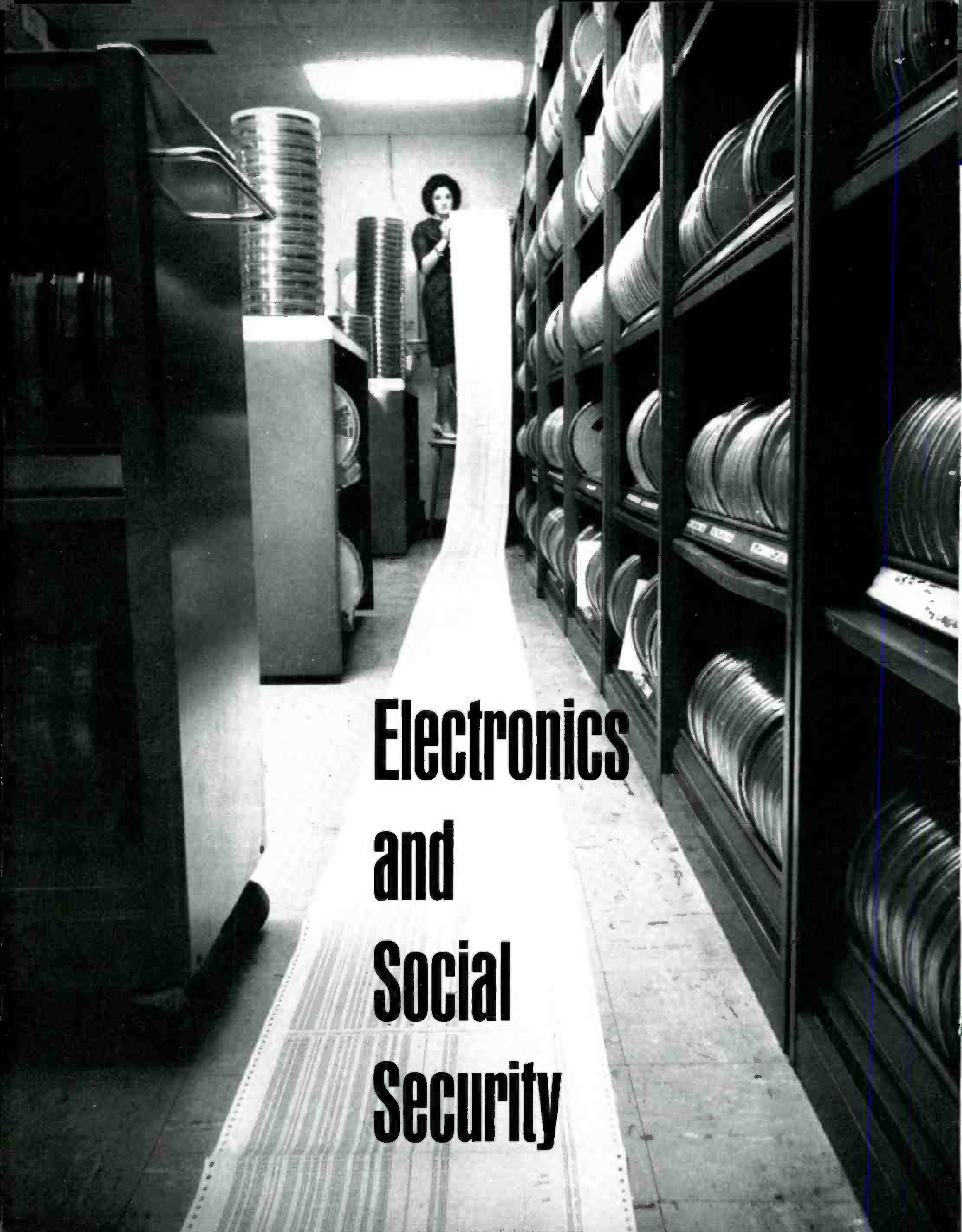
Measuring magnetic field inside unit of the C Stellarator's heating system. *See page 26*



Electronics and Social Security

THE MIRACLE OF MODERN ELECTRONICS MAKES POSSIBLE COORDINATION OF THE COMPLEX RECORDS OF MILLIONS WHO BENEFIT FROM SOCIAL SECURITY

by **VICTOR CHRISTGAU**

National Director, Bureau of Old-Age and Survivors Insurance, Social Security Administration

Secure accurate records of all covered wages and self-employment income in a way which makes it easy as possible for the public to do what is required— from "Statement of Bureau of Old-Age and Survivors Insurance Objectives"

THE CONGRESS OF THE UNITED STATES has given the Bureau of Old-Age and Survivors Insurance of the Social Security Administration the legal responsibility for administering a social insurance program with benefits payable to each worker and his dependents, geared to the individual's covered employment. In general, those who worked more would get more in benefits. This approach, reflecting as it does traditional American values in providing protection against losses of income brought about by retirement, disability, or death, has necessarily made for a big job of gathering, recording, assessing, and acting upon a mountainous mass of data each working day of the year. And the cumulative weight of this data, collection of which began on January 1, 1937, could by now have reached Mount Everest proportions if ways hadn't been found early in the Bureau's history to record it accurately and efficiently, and with that measure of economy that would see the greatest possible number of Trust Fund dollars paid in benefits and not as overhead charges.

From the very beginning BOASI officials looked for possible mechanical and electronic means of handling present and anticipated workloads. Many of the exciting things that they saw were still on drawing boards. Later a war intervened to delay civilian applications of the new electronic discoveries. But they persisted — until today electronic data processing methods of record-keeping and controls are in use, or being installed, in every phase of the BOASI record-keeping and claims processes.

It would not do justice to any part of the EDP applications to attempt to cover all in a single brief article. Therefore, I will restrict myself here to the recording of earnings information. This is our biggest job — one we have had well in hand by timely introduction of the latest and most advanced mechanical and electronic aids. And one that has brought countless domestic and foreign visitors to our Baltimore headquarters to study the applications for possible adaptation to their own record-keeping operations.

The framers of the original Social Security Act strongly recommended an earnings-related system for establishing both entitlement and rate of benefits, with financing of the program through special tax contributions from employer and employee. The original coverage groups were those employed in commerce and industry. Account numbers had to be issued for these groups in the short lead time afforded between the signing of the Act on August 14, 1935, and January 1937, the month designated for employers to begin keeping wage records with these numbers. And meanwhile, an entire organization had to be set up from scratch to pioneer this new field of American administration.

In the first year of wage reporting, there were 23 million active accounts. Judged by today's statistics, this was a mere handful — today we have over 85 million active accounts. An "active" account is currently defined as one in which the record reflects fairly regular work activity after 1950. Total account numbers outstanding amount to about 140 million.

The earnings reports submitted quarterly by employers (through Internal Revenue Service, where the tax was collectible) were punched to eighty-column cards, one to an employee, by electrical accounting machines. However, as time went on, and as succeeding amendments to the law made additional entries necessary for future benefit determination purposes, it was seen that the single card would have to be supplemented by additional cards. Besides rendering the accounting operation more complex, and far more costly, multiple punched cards for each individual would aggravate a storage and handling problem that was already acute.

The Bureau's records are stored on magnetic tape and easily can be produced in print when the information is needed.

As early as 1945 (one year after the first true computer anywhere went into operation at Harvard University) BOASI began studying the possibility of using EDP methods for processing earnings information. But the early studies established that the equipment then available was not adaptable to the maintenance of a summary of earnings information, which was what we were looking for. It was designed rather to solve king-sized mathematical and scientific problems, with a low rate of input and output on punched cards.

While still concerned about the coming necessity to supplement a second card for each worker, the Bureau added accounting machinery capable of making a determination which, if left in the hands of Bureau earnings record certification clerks, would have been extremely time consuming. This was the determination, made mandatory by the 1950 Amendments to the Social Security Act, as to whether including earnings prior to 1951, and not just those after 1950, would yield the claimant a higher benefit. This machine was capable of rendering one hundred decisions a minute, but it did not solve the then emerging multiple summary record card problem.

It was foreseen that the space on the single eighty-column card for each worker would be exhausted by July 1, 1956. A study launched in 1954 led to the conclusion that EDP equipment recently developed, which used magnetic tape for both input and output, could be adapted to our needs – and not only could it maintain lengthy records on magnetic tape, the new equipment could also be programmed to take over the benefit-computation function.

In May 1955, a decision was made to acquire EDP equipment for use in three earnings information operations: posting, the reinstating of incorrectly reported earnings items, and the computation of benefits based on the posted earnings. In addition, it could be used for statistical work to be derived from the summary items, which, given the magnitude of the record, was prohibitively expensive by manual methods, and still costly when using electrical accounting machinery.

Proposals were sent out to manufacturers then active in the digital computer field and capable of supplying the type of equipment we needed. The medium-size data processing system that went to work for the Bureau in March 1956 provided a timely solution to the multiple summary record card problem, and began taking over practically all of the major accounting operations that followed the initial punching of earnings reports into cards. And there were exceptions even to the manual punching of earnings cards as we worked out arrangements with some large employers to send their reports in on magnetic tape.

But the Bureau's needs for EDP equipment to carry the brunt of its record-keeping responsibility was far from being solved for all time. Hardly would one EDP system be installed and put into operation when the systems people in the Bureau would begin looking around for more powerful and sophisticated hardware to cope with increasing workloads. To illustrate this,

Electronic Data Processing aids the Bureau in its service to 140 million citizens, through its 604 district offices across the country.

1956 was the year in which the beneficiary rolls passed the 8 million mark. In early 1962, this number was doubled, with supporting operations along the line correspondingly increased.

As things stand at this writing, BOASI has three large computers at its Baltimore accounting center and seven smaller computers used largely to carry out less complex off-line operations.

Over 70 million earnings items are received from about 5 million employers for their employees each quarter. And over 9 million self-employed individuals report their earnings annually. In addition to these, 300,000 farm workers are reported by their employers annually. Thirty large employers now regularly report on magnetic tape the earnings of their workers. For the remainder who report in the more usual manner — by lists — each earnings item must be punched into a card, converted to magnetic tape and balanced against the incoming reports. After this has been done, the tape record is merged with another tape that contains corrections in workers' accounts, plus information as to whether the individual has become a beneficiary since the last updating. This tape is then used to post the items to the proper account on the master earnings record tapes. While this appears a comparatively simple operation, the establishment and maintenance of earnings records requires close to 200 computer programs and a multitude of clerical processes.

Now that the worker's earnings are on the tape, with the prospect of being updated periodically during the balance of his working life, doesn't this become a somewhat sterile operation, considering nothing will be done with the record until that day, far in the future, when he decides to retire?

Not at all. In addition to the retirement feature of the program, social security also means survivorship and disability protection for those it covers, the need for which can develop at any age. And the Social Security Administration encourages all workers to check their accounts at least every three years. This permits corrections to be made of errors in earnings postings before the trail gets cold, and saves the expense of investigations of earnings when an application on the account is eventually filed. A post card for this purpose can be obtained at any social security office. The same purpose may be served by addressing a brief letter to "Social Security Administration, P.O. Box 57, Baltimore 3, Md." In addition to requesting the current status of your account, you should include your social security account number and date of birth.

The extraction of information from the master account tape for account status requests is accomplished electronically. The request for an individual's earnings record, occasioned by the taking of a claim for benefits, is a combination of electronic extraction of information and a number of clerical procedures, which involve searching part of the detailed record on microfilm, and a certification of the correctness of the record by an employee with this delegated authority.

On May 24, 1962, the Bureau activated the final section of its National Data Transmission System, a new linkage by telecommunications of its 604 district offices, seven payment centers, and the earnings records center, for the purpose of transmitting claims data from workstation to workstation. One of the principal early uses of this system is the transmittal of requests for certified records of earnings needed in claims development. An application is filed today, say, in the social security district office on Golden Gate Avenue in San Francisco. Before the close of business of that office, the pertinent information in the claim will be keyed in machine language on punched paper tape. It will then be transmitted to the system's Western States Communications Control Center on Market Street of the same city. Here the earnings record request will be transmitted again from punched paper to the telecommunications terminal in the headquarters building in Baltimore, where it will be received in magnetic tape form. The taped request — along with thousands of others — is then fed directly into a computer process for the production of an earnings record. The earnings record thus produced could be readily returned over the telecommunications system, but as it requires, at this early stage of our development of this system, considerable clerical scrutiny and a certification before it may be used as a basis for benefits, re-keying would be required, which would result in a net loss of return time against airmail deliveries.

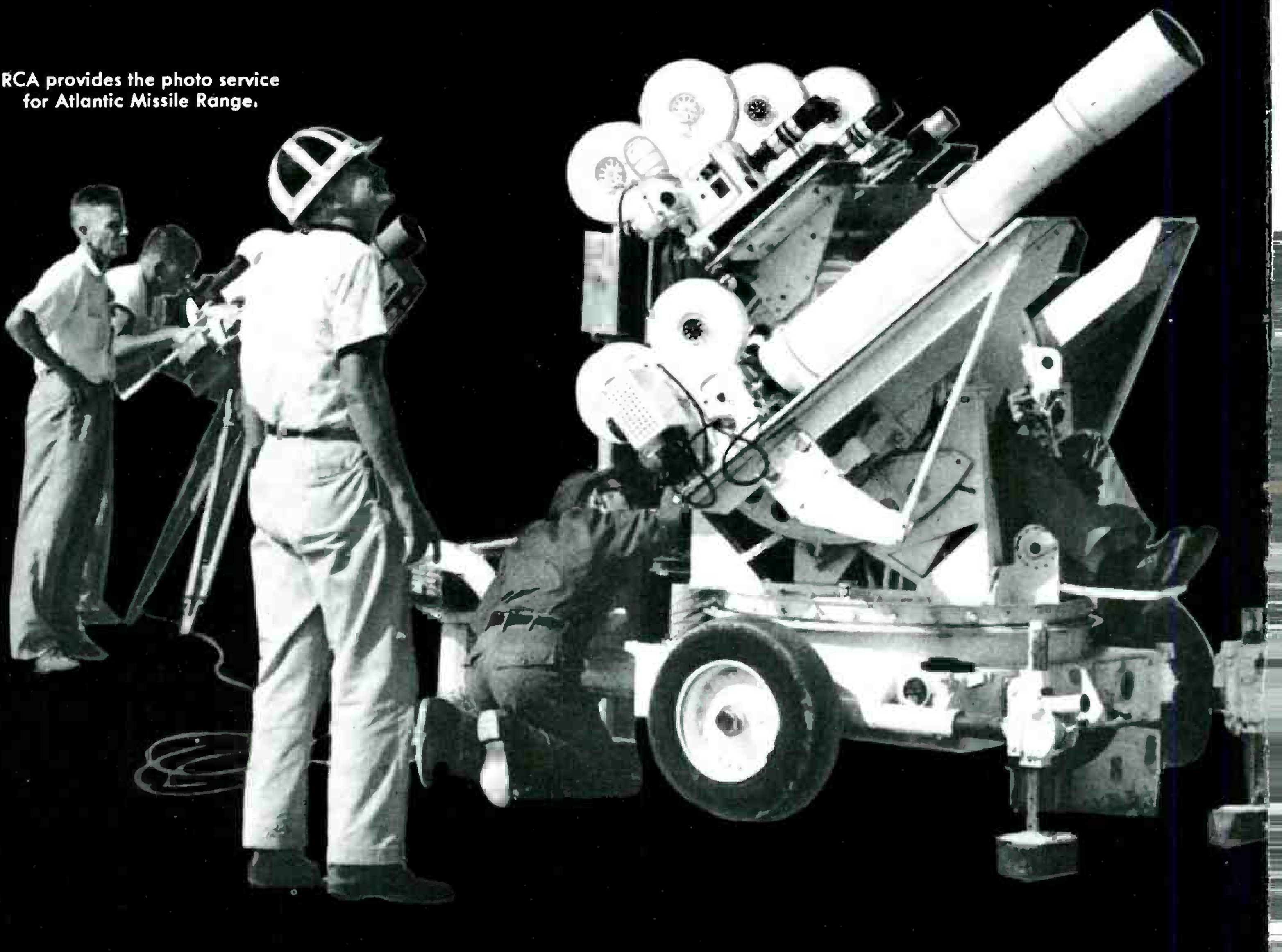
Social security paperwork processes are far from, and will never be, wholly automated. There are many steps in the claims process that can never be accomplished automatically. These are in the area of judgmental decisions which are necessary at various points in the total process. But a boldly planned scheme of Integrated Data Processing is under way in BOASI, which gives promise of substantial future payoffs in better service and reduced costs.

Given the dynamic program of Old-Age, Survivors, and Disability Insurance, and the constantly growing numbers of those brought under its protection, we necessarily look to electronics as our most useful tool in cutting through the mountains of paperwork that might otherwise reach unmanageable proportions at some future date. We will continue working to achieve even better methods of using electronics to do the job we need to do — for better claims service at less cost to the Trust Funds out of which benefits are paid. ■

CANAVERAL BIRD WATCHERS

With a thunderous roar and a blinding flash, a missile ponderously lifts off its pad and, gathering power, streaks out of sight. Later, officials at Cape Canaveral will examine not only data provided by electronic tracking equipment but photographs of the lift-off, of the missile in flight—far out of man's range of vision—and the fiery nose cone as it plunges into the ocean 5,000 miles from its launching site. This exhaustive documentation is provided by photographers of the RCA Service Company under subcontract to Pan American World Airways. Using a bewildering variety of motion picture and still photo equipment, the photographers produce a massive volume of film for processing by RCA in the range laboratory.

RCA provides the photo service for Atlantic Missile Range.



Almost 1 million feet of movie film are processed monthly.

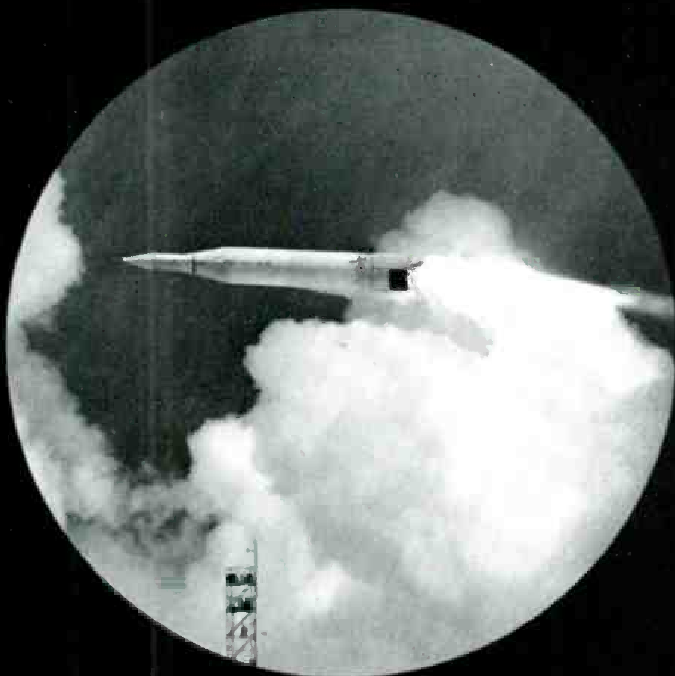
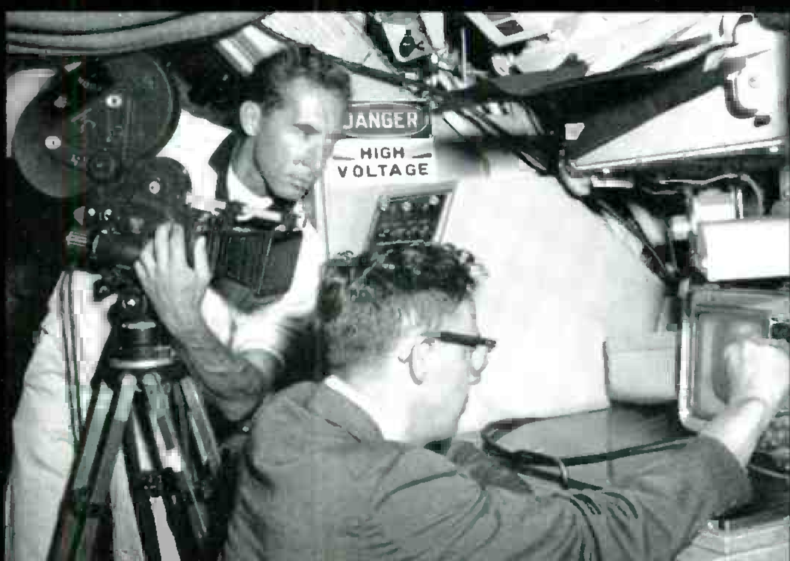
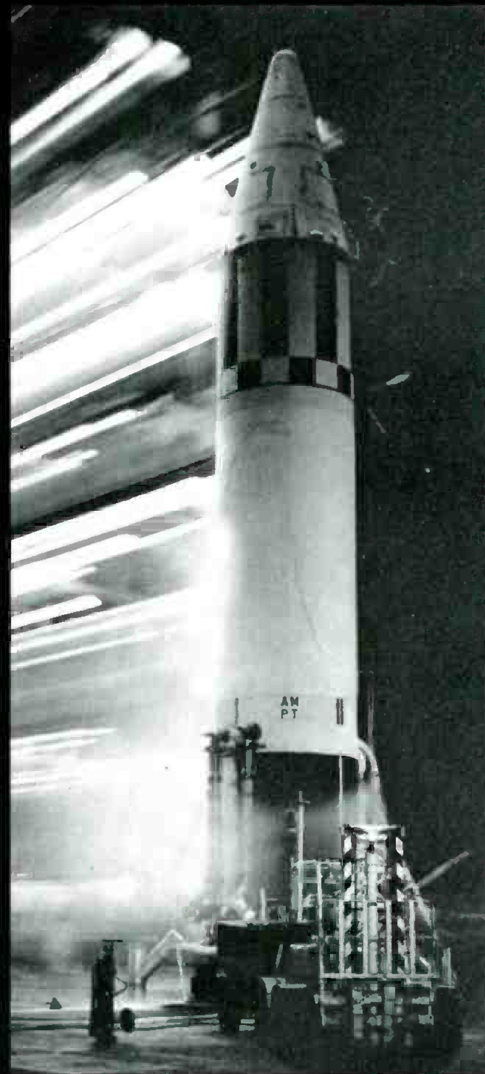


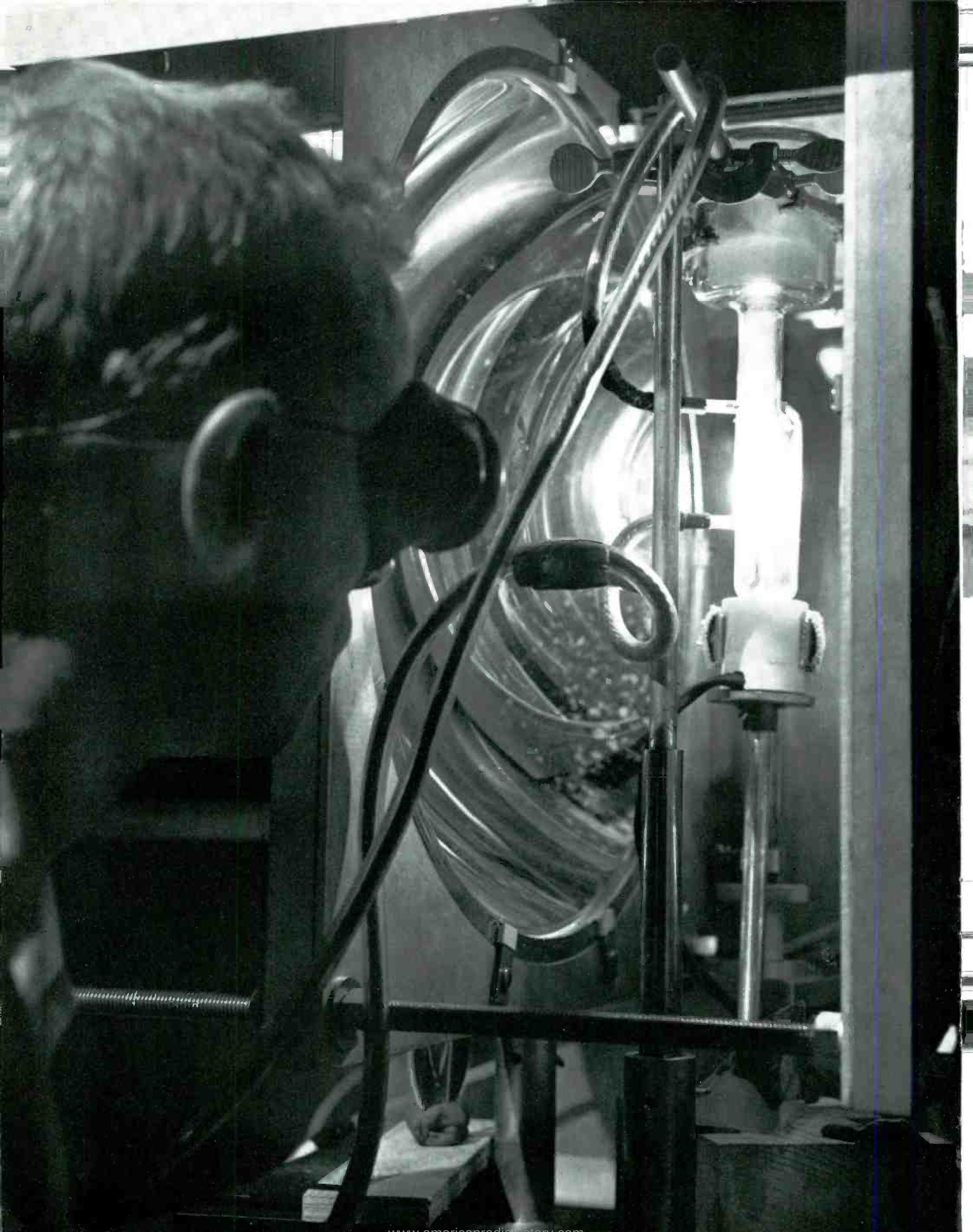
Photo coverage includes even Polaris submarines.





Still photo output is 50,000 a month.

High power cameras film missiles 100 miles away.



by **BRUCE SHORE**

On May 9, of this year, a team of research scientists at the Massachusetts Institute of Technology in Cambridge, Mass., made final adjustments to a complex of optical and electronic instruments set up on the campus grounds. They checked their watches and waited, eyeing the half-moon that cast a pale glow over the scene.

At last, the word came. One of the scientists touched a button and, instantly, a flash of intense red light shot upward, briefly etching its path in a layer of unsuspected haze as it raced towards the moon.

Three seconds later, it had burst on the lunar surface southeast of the crater Albategnius and been reflected back to M.I.T. where its return was duly noted in the sensitive photomultipliers of a telescopic receiver. For the first time in history, man had built a light strong enough to illuminate a celestial body.

Far brighter than the sun, the light beam that made this unprecedented 478,000-mile round trip was emitted from a six-inch ruby rod, no thicker than a lead pencil. This ruby comprised the heart of a new electronic device that is called a laser.

Able to amplify light waves just as radio waves are amplified, lasers already foreshadow an era in which light beams may be used to guide space vehicles, communicate between planets, perform delicate eye and brain surgery, weld and machine difficult metals, destroy hostile missiles in flight, and detect enemy submarines on the ocean floor.

Right now, for example, scientists in RCA Laboratories and manufacturing divisions are perfecting a laser radar for battlefield use, a laser tracking system for monitoring the flight performance of U.S. missiles, and a laser computer which may operate, literally, at the speed of light.

Also, RCA scientists are deeply engaged in developing a laser communications system which, in theory, could use a beam of light to carry all the radio, television and telephone broadcasts currently transmitted throughout the world.

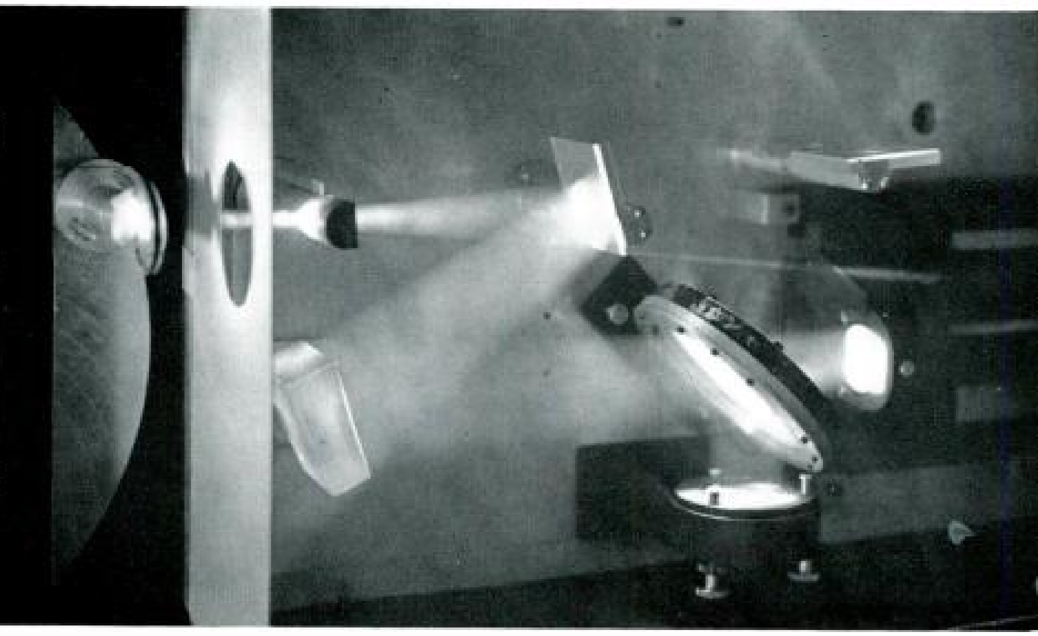
The word laser is derived from a phrase that describes the device's function: Light Amplification by Stimulated Emission of Radiation. Ideally, lasers amplify light in the same way that a great river, such as the Mississippi, can be said to amplify its many tributaries into one immensely powerful body of water. Ordinary light is composed of the colors in the visible and near-visible spectrum. Lasers convert these components of ordinary light to a single, powerful frequency whose purity contrasts with the mixture of frequencies in conventional light.

One mechanism by which this conversion is accomplished is a semi-transparent crystal containing atoms that can be made to fluoresce. Chromium or the so-called "rare earths" are examples of such atoms.

When the crystal is exposed to an intense light source, certain electrons orbiting the nuclei of these atoms gain enough energy to jump into a higher orbit. Here, they are unstable, however, and fall back to their original orbit giving up their newly acquired energy primarily in the form of light.

Essentially, all fluorescent materials work this way but, in the laser, this process is rigidly controlled so that most of the electrons emit light of exactly the

LASERS: NEW POWER FROM LIGHT



Scientist inspects RCA's new continuous-wave laser which is ten times more efficient than any solid-state laser previously developed.

same energy and frequency. Therefore, these independent emissions add together to form a coherent beam so intense that, when focused, it will melt any known material instantly.

Because of this coherence, incidentally, laser beams travel in straight lines over enormous distances without spreading appreciably. This explains why M.I.T. was able to perform its historic moon experiment.

It was in 1958 that the first proposal for constructing a solid-state laser was made in a scientific paper published by Dr. Charles H. Townes, of Columbia University, and Dr. Arthur L. Schawlow, of Bell Laboratories. Both men held that electrons, in the proper environment, could be made to emit light in a predictable and controllable way.

That electrons can emit light was not new. Certain crystals exposed to ultraviolet radiation, fluorescent lamps, even television screens give off electron-emitted light. What was new in this proposal was that such light might be controlled.

In April 1960, the RCA Laboratories prepared an engineering report recommending that the potential uses of laser light be thoroughly explored. This recommendation led eventually to a large laser research program supported, in part, by the U.S. Air Force. Other laboratories in the nation began similar programs.

It was not until June 1960, however, that the Hughes Aircraft Company announced achievement of a working solid-state laser consisting of a ruby crystal containing atoms of chromium. The unit worked like a gun, firing pulses of intense red light when the crystal was activated by a brilliant xenon flash lamp. Unfortunately, these pulses were extremely brief – only a thousandth of a second long – and their great power could not be sustained long enough to do much useful work.

In October 1960, Dr. William M. Webster, Director of the RCA Laboratories' Electronic Research Program, set up a unit known as the Quantum Electronics Group and gave its members a charter calling for a complete investigation into all aspects of laser technology. A young, energetic physicist, Dr. Henry R. Lewis, was put in charge.

By November, this group succeeded in building a laser along the lines of that announced by Hughes. Today, this and similar instruments are being used in efforts to generate harmonics from red light, to achieve light beams of unbelievable energy and to study the very nature of light itself.

In December, International Business Machines, Inc., reported building a laser similar to the Hughes device but using a calcium fluoride crystal containing atoms of uranium.

In February 1961, the Bell Telephone Laboratories in Murray Hill, N. J., announced a totally new kind of laser – one that used gases instead of solids. Even more important, it emitted light *continuously* instead of in pulses. Its power, however, was rather limited.

In this heady atmosphere, Dr. Lewis and his team began to expand their research. Proceeding from their newly developed ruby laser, they began searching for ways to make improved types. The expanded program enlisted the help of an RCA materials research group directed by Dr. Simon Larach.

In October 1961, the first break-through occurred. Dr. Larach and his associates succeeded in pioneering an advanced method for growing calcium fluoride crystals of high optical quality.

The next big hurdle was to find a fluorescent material to use in these crystals. The need was for a substance that would absorb all the wave lengths of visible light and then fluoresce in only one color – the purer the better. The rare earths suggested themselves immediately. However, there are fourteen such elements, and the question arose as to which ones would make the best lasers.

In the absence of a clear-cut answer, Dr. Larach's group began the herculean task of preparing calcium fluoride crystals individually diffused with all fourteen rare earths, with the exception of promethium, which is radioactive.

In the meantime, Dr. Lewis sought a better understanding of laser action and a more precise knowledge of the forces at work within laser crystals. In this pursuit, he turned to a co-worker, Dr. Donald McClure, a specialist in atomic and electronic interactions in crystals. Dr. McClure provided the key that led to a second break-through.

In Dr. McClure's view, the more promising fluorescent materials to use were not simply rare earths, but *divalent* rare earths – rare earth atoms lacking two electrons in their outer orbits.

Divalent rare earths, he reasoned, would not only absorb more incoming light energy in the visible range but, by their nature, could also be expected to emit far more light.

The importance of this hypothesis can be appreciated when it is realized that lasers reported up to this time had many serious drawbacks.

They were notoriously inefficient. Only one one-thousandth of the total energy poured into them was being converted to light. The rest was going into heat.

Furthermore, enormous energy was required to make them work. The flash lamps used to trigger them had to radiate thousands of watts. The reason was the inability of the reported lasers to use all of the light frequencies available to them from the lamps. To derive sufficient energy from the few they were

John McCormack prepares to analyze the frequencies of a laser beam with a new interferometer built by RCA scientists in Princeton.

using, therefore, it was necessary to raise the incoming frequencies to as high a power as practicable.

Dr. McClure's suggestion seemed to offer a solution to both difficulties, and Dr. Lewis set out to see if it was practical.

Subsequent studies of the rare earths showed that two – thulium and dysprosium – offered, in divalent form, the best combination of fluorescent, thermal and structural features needed for laser action. Unfortunately, both were trivalent in their natural state – that is, they were lacking three rather than two electrons in their outer orbit.

Putting an electron back into this orbit was the next challenge. The problem was one of chemistry, and Dr. Larach was again consulted. After several months of unsuccessful experiments, his group found a solution. By January 1962, the Quantum Electronics Group had all the ingredients for a new RCA laser.

At this juncture, Bell Laboratories announced development of a solid-state laser that generated coherent infrared light continuously. The device used a calcium tungstate crystal containing atoms of the rare earth, neodymium. Bell had also departed from the use of a xenon flash lamp light source, but used instead an equally powerful mercury lamp, shining continuously.

In the first week of April 1962, RCA reported its new laser – a calcium fluoride crystal containing divalent dysprosium that generated infrared light in intense pulses. Shortly thereafter, using a mercury lamp, it was made to operate continuously and proved to be far more efficient than any laser previously reported. In addition, it required ten times less energy to activate.

"In a relatively short time," Dr. Lewis states, "we expect this device to operate continuously, activated only by a 100-watt bulb."

Achievement of the new laser had taken nearly two years of intense, unmitigated research. It had involved countless frustrations and setbacks. Nevertheless, its realization was a milestone in a new technology which may one day revolutionize our lives. ■

by **STAN WALKER**

Cover Story

EVERY RECORD ALBUM MUST HAVE A NEW AND UNIQUE COVER... A BIG ORDER FOR "CONSTANT CREATIVITY"

In the nineteenth century, William Pater, a critic, essayist and novelist, observed that "all art constantly aspires towards the conditions of music."

If this is true, then the twentieth century art directors, painters, designers, photographers, illustrators, graphic artists, sculptors and typographers who yearly create thousands of album covers for the various record companies, are working in the perfect art form. For the real purpose of album cover art is to convey to the buying public the true "condition" of the music available within its package.

Robert M. Jones, art director of RCA Victor Records for the past nine years, believes that to be successful an album cover must accomplish three objectives: it must interest, inform and influence.

"The first two objectives are entirely dependent on the art concept and typography," he says, "but while the album art influences to an extent, the buyer's major concern in his purchase is the recording artist and the repertoire produced."

The concept of album cover art is primarily the responsibility of the art director and the A & R (Artist and Repertoire) man producing the particular album. When the latter has determined the musical content of the recording, the art director is called in to discuss its particular objective and how this goal best can be realized on the cover.

"The art director must always keep in mind the relation of both aesthetics and sales potential," states Jones. For the final criteria of the success of an album cover is how well the product actually sells. With this as the prime consideration, the art director and his staff make a series of thumbnail sketches to decide whether to commission a painter, illustrator, photographer or graphic designer.

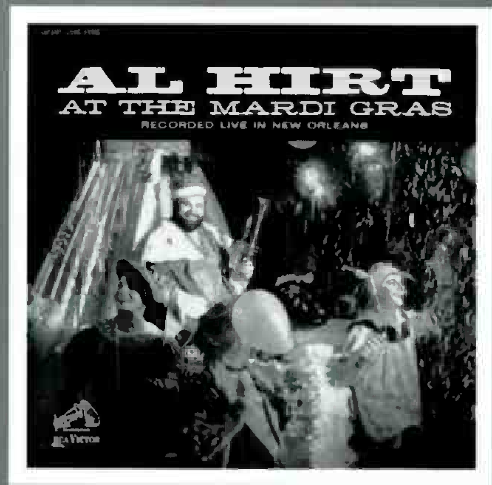
Mainly these small sketches are intended to suggest only the situations and mood of the planned cover art. However, attention is also given to such particulars as the period of furniture or clothing to be used.

Classical recordings give the serious creative artist or photographer considerably more inventive freedom than those in the Pop field. With a new recording of Schubert's famous "Unfinished Symphony," for example, Jones sought to create a cover that depicted an "unfinished" event. Since it was an orchestral work, he wasn't restricted to a photograph of an individual personality. The final cover was a beautiful photograph of a bird's nest filled with unhatched eggs. "To me, this symbolized an unfinished, incomplete experience," reveals Jones.

On a trip to Nassau not too long ago, Jones happened to come across a beautiful yellow flower which so fascinated him that he photographed it. Recently, RCA Victor made a recording of Beethoven's "Pastoral Symphony," and this same yellow bud now graces the cover as a perfect expression of the mood of the album.

On the other hand, when working on covers for albums by such well-known personalities as Artur Rubinstein, Van Cliburn or Jascha Heifetz, Jones and his department usually work around a photograph or likeness of the performer. These artists, like most of the Popular recording artists, have star status and their likeness is often more important than an art interpretation of the recorded repertoire.

When pianist Peter Nero made his first record for RCA Victor, he was comparatively unknown. In order to establish strongly his name and the album contents, the RCA Victor art department decided the best device was to use strong boldface type in a handsome and graphic fashion. Against a solid black background, the



big white letters sang out: "Piano Forte – Peter Nero." In place of the usual back-cover liner notes, the art department, for double effect, elected to use a striking black and white photograph of Nero. But the cover had only type.

Several albums later, Nero, now an established and recognizable performer, could be treated differently. Since his face has become an important sales commodity, his latest album cover finds the same black background and boldface type – but with Peter Nero sitting at the piano.

From a well-known performer to a seldom-heard orchestral work, every kind of recording demands a new and unique album cover. RCA Victor's art department, consisting of Jones, a creative staff of five and several production personnel, completes over thirty covers a month, in addition to other promotional material such as window streamers, in-store displays, mailing pieces, sleeves for the countless number of 45 r.p.m. single records and tape covers.

Seventy-five per cent of the album covers produced today make use of photographs, with four-color photography the most prominent form of cover art, according to Jones. "This is because photography is a universal language; it generates instant recognition and makes its point immediately," he says.

RCA Victor's art department has its own photographic studio and employs one full time staff photographer, Dave Hecht. Fifty per cent of RCA Victor's covers are photographed in this studio, but for various assignments, Jones also hires free lance photographers around the world.

"While the photographer or artist is guided by our thumbnail sketches, we never try to lock him into a format," states Jones. "Too many spontaneous things can happen – moments of truth, dramatic events which cannot be planned to occur, give a dimension we could never envision."

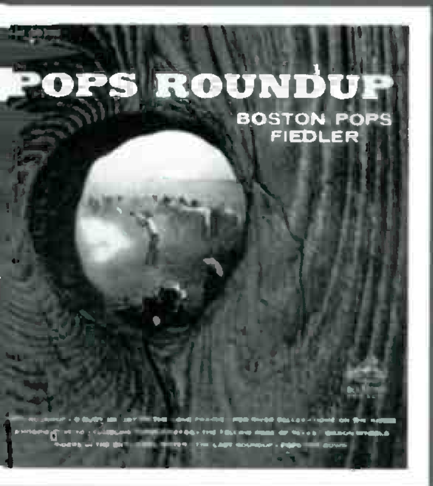
A recent incident is typical of these unexpected moments. A free lance photographer was photographing conductor George Melachrino against the Tower of London along the Thames River. As the pictures were being taken, a flock of pigeons flew down – right into the carefully planned setting.

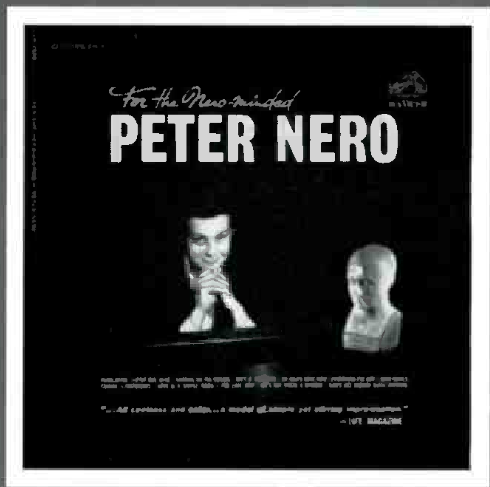
"You couldn't rent a flock of pigeons to sit on the bridge of the Thames River – but because of them, we got a cover shot that was much more interesting and dramatic," says Jones.

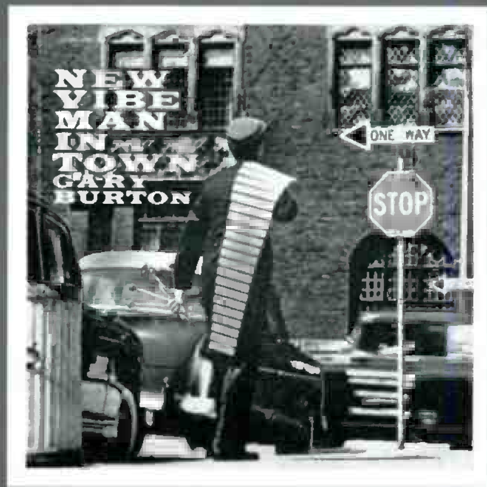
Even though these experiences are few and far between, it is up to the art department constantly to deliver the right kind of artistic – yet salable – cover. And more often than not, this has to be done before the recording is actually made. "In order to produce a cover in time for the release date, we work on a six-month cycle compared with the three to four months that the A & R department has to produce the album,"

Since the album was planned as a May 1962, release, the cover had to be completed well in advance of Mardi Gras time. Realizing that he would have to create his own "Mardi Gras," Jones arranged for Hirt to come to New York the first week in November. He took Hirt and several members of his band to a costume company and had them outfitted in Mardi Gras costumes. At the studio, the art department staff built a float for Hirt and his group to ride "through the festivities." Standing on step ladders around the studio, the staff threw balloons, confetti and Fourth of July sparklers over the float to capture perfectly the excitement of the event.

When the brilliant young vibes player, Gary Burton,







says Jones. "And that means that we usually have only a tentative title and repertoire with which to work."

Three weeks is about average for the complete design of the cover art, with the time factor playing an important part in the selection of the technique to be used for the cover work.

Last October, trumpeter Al Hirt informed RCA Victor that he would be appearing at the March 1962, Mardi Gras in New Orleans. Since Hirt is closely associated with New Orleans, the company decided that it would record his live concert for a new album to be titled, "Al Hirt At The Mardi Gras." Naturally, the ideal cover would be a photograph of Hirt and his band at the colorful event.

recently recorded his first RCA Victor album, the main concern was to establish his name to the record-buying public. With the title, "New Vibe Man In Town," the art department decided on Gramercy Park in New York City for the setting of the picture. A last minute schedule change forced the artist to cancel the planned photographic session, and with time a major factor, Jones hired a model to stand-in for Burton and photographed him from the back so that his face was not visible.

Such efforts to produce artistic covers for record albums have blossomed especially in the past fifteen years, although record companies first became conscious of cover art around 1938. Before then, covers consisted primarily of gold stamping on solid colored stock, giving only the title and artist information.

RCA Victor pioneered in the use of decorative album covers. Skeets Rundle, RCA Victor's art director at the time, adapted full color store displays for album covers. One of the most historic covers, a painting by Rundle, showed Papa Brahms walking through sun-flecked woods — a dramatic scene for a cover of a classical recording, and a far cry from what had been done up to that time. Seeing the ensuing promotional and sales benefits, the other record companies quickly followed.

In the late 1940's, technological advances in color photography and faster and better color films went hand in hand with the development of high speed off-set lithography. This combination made it more economical to produce the covers and along with the need for fast-selling, competitive techniques, brought about the extensive use of four-color photography.

But photography is not the only technique that will accomplish the album cover's objectives. In an article in the November 1960, issue of *American Artist*, Bob Jones said: "Album cover art must be primarily in the poster tradition. Artists and photographers are commissioned to interpret and visually sell *all* of the forms of music. They must translate for the eye and impress upon the consumer the glamour, beauty and excitement of the opera house, Broadway theater, the concert and dance hall, the night club and the motion picture. No industry in the United States offers a wider range of expression and artistic technique . . ."

The techniques employed can run the gamut from mosaic to cartoon, from sculpture to line drawing, from abstract forms to oil paintings. Sometimes the art director interweaves them for a special effect.

A recently released album of Western favorites by the Boston Pops, titled "Pops Roundup," consists of an old wooden fence with a big knothole, a roundup scene visible through the knothole. Actually, the cover consists of two separate photographs superimposed to create the desired effect. The fence was photographed by Dave Hecht at Atlantic Beach on Long Island, where one of the art department staff had recalled a series of old fences with large knotholes. Since there weren't any roundups taking place nearby, Jones contacted various photographic services and in their files found just what he was looking for — a roundup scene which had been photographed by a freelancer in Arizona.

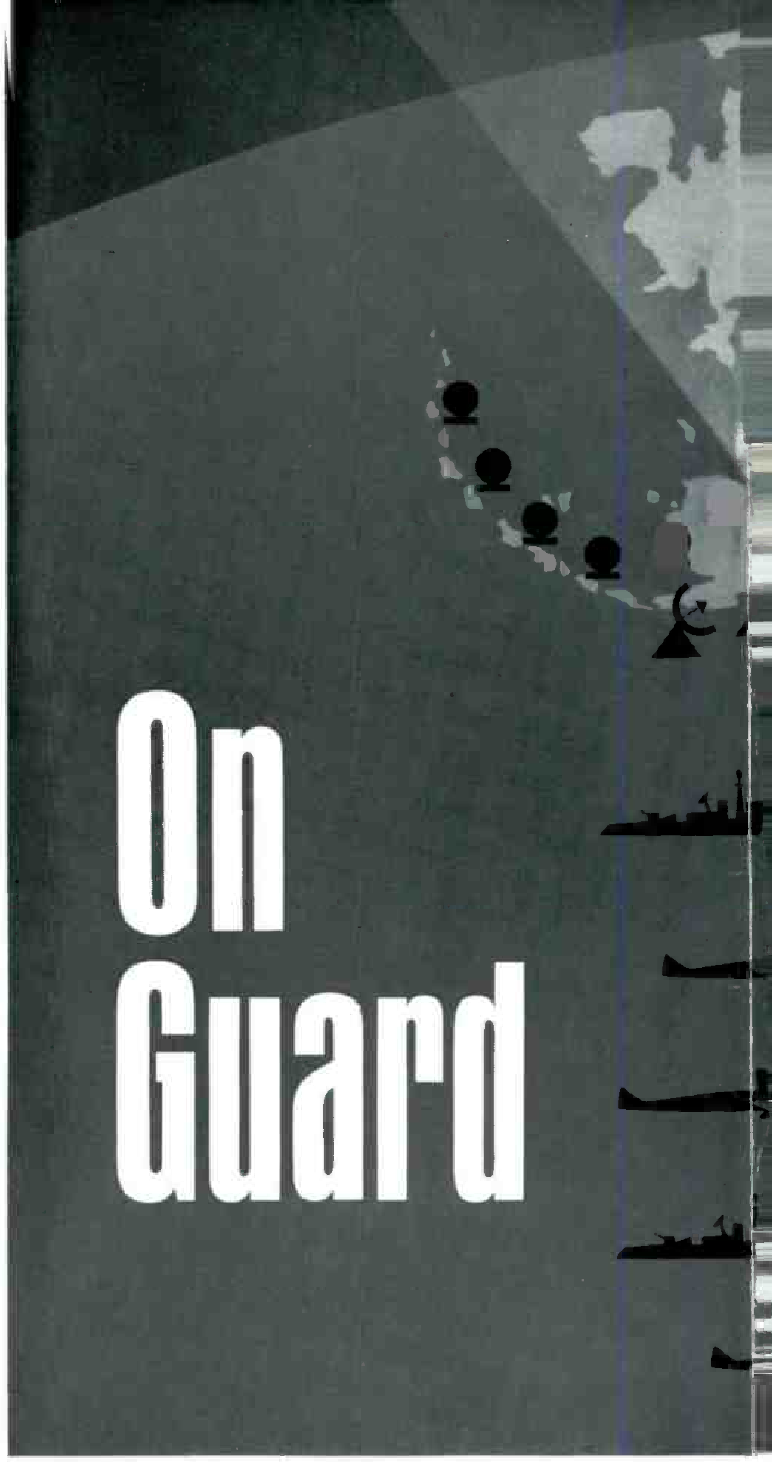
Paintings have been extremely effective for particular albums, says Jones. RCA Victor's recently released special collection, "Summer Festival," features a double-cover, four-color painting of an outdoor summer concert by the well-known artist Mozelle Thompson.

When Metropolitan Opera star Leontyne Price was named "Musician of the Year" by *Musical America*, the magazine commissioned a special painting of Miss Price for its cover. Jones decided that the painting was in keeping with the mood of a forthcoming album of spirituals by Miss Price. He reproduced the painting, complete with frame, for the album cover.

Jones and other executives at RCA Victor are always on the lookout for paintings for future albums. Often, the paintings are purchased from art galleries, but sometimes they are found in unexpected places.

Recently, Robert L. Yorke, Vice President, Artist and Repertoire, for RCA Victor, was visiting a friend who is an executive at a leading New York advertising agency. A painting hanging in his friend's office intrigued Yorke. Dramatically capturing the emotions of a tormented man, hands on top of his bowed head, the painting brought to Yorke's mind Richard Strauss' intense and haunting work, "Also Sprach Zarathustra," which RCA Victor had just recorded.

Such a marriage of fine art and fine music is a double reward for today's discerning record-buying public. According to Bob Jones, "There is evidence that the record buyer's taste is maturing. He demands sophisticated, enlightened art work, and we feel gratified to have more of an opportunity to give this to him on our album covers." ■



On Guard

LESS THAN A DOZEN MILES from the site of an ancient watchtower that guarded England's shores in the fourth century, another watchtower is being built to guard the Free World against a modern day threat from across the sea. The place is Fylingdales Moor and the new warning post is the third radar base of the *Ballistic Missile Early Warning System* (BMEWS). This gigantic base, which will go into operation early in 1963, is but one segment of a complex system intended to deter attack by providing the West with sufficient warning to mount a crippling blow against the attacker.

In the first decade of the Cold War, the most formidable military threat to the United States and Canada was the manned bomber. To counter this threat, radar fences were built across North America. At the top of the world, stretching across the Arctic from the Aleutians in the west across Greenland in the east, is the *Distant Early Warning System,* commonly called the Dew Line.

Some 600 miles to the south is the *Mid-Canada Line,* another fence of radar posts to track invading aircraft and plot their courses. Just north of the United States-Canada border is the *Pinetree Line* which can serve not only to warn of attack but also to control intercepting fighter planes and missiles.

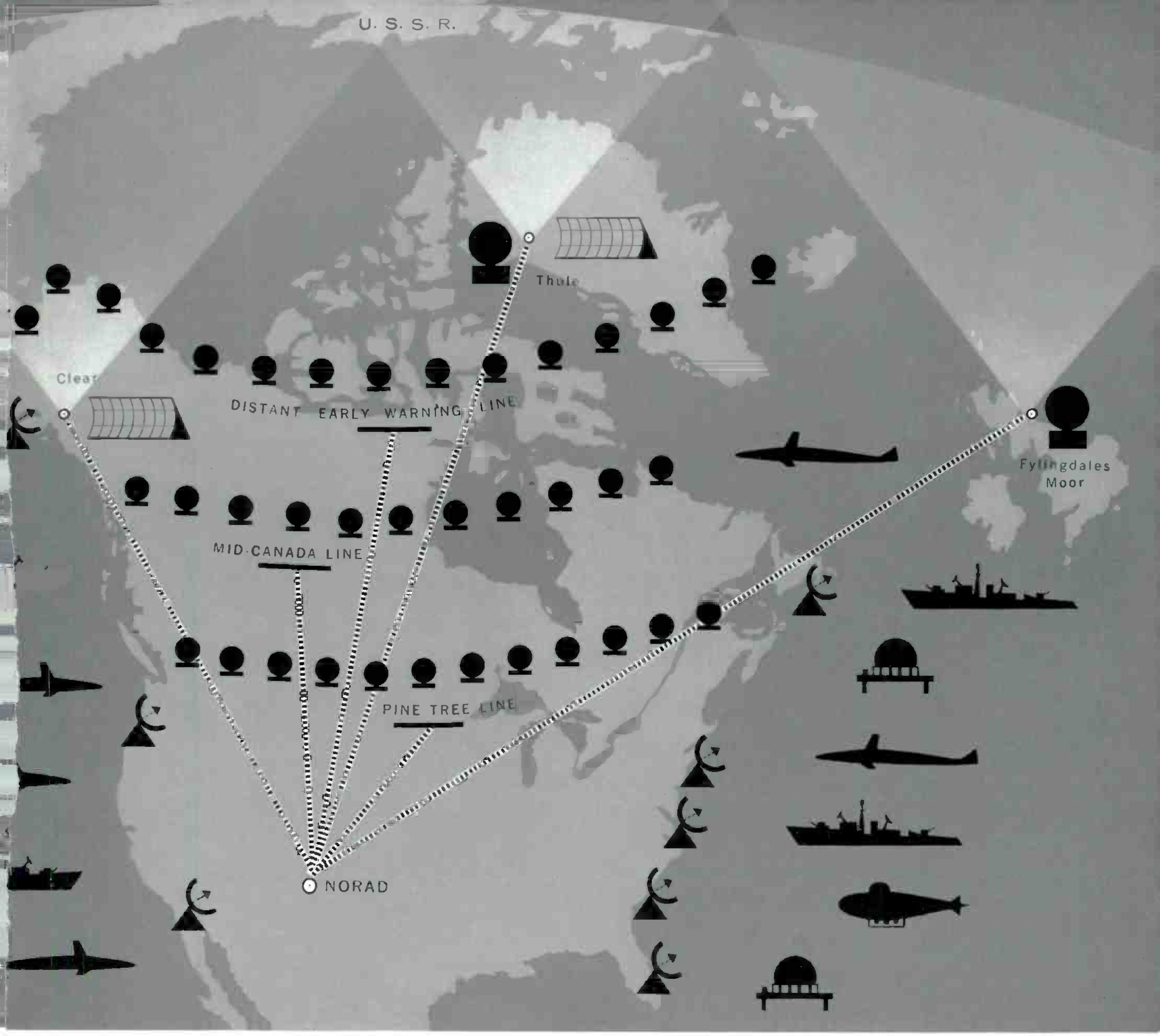
Protecting the flanks over the Atlantic and Pacific are still other radar systems – Navy picket ships, Air Force radar planes and the Air Force "Texas Towers," huge platforms built on pilings, one hundred miles off the East Coast.

In the mid-1950's, the new threat of attack by intercontinental ballistic missiles prompted the Air Force, with RCA as prime contractor, to start construction of BMEWS, made up of three huge bases at Clear, Alaska; Thule, Greenland; and Fylingdales Moor. The Greenland and Alaska bases already are providing a large measure of protection, their radar beams fanning out across most of the Eurasian land mass to detect any missiles launched within a range of 3,000 miles.

The readings from all of these radar systems are flashed to one central place – a concrete two-story building at Ent Air Force Base, Colorado, the combat operations center of the North American Air Defense Command. Here, twenty-four hours a day, 365 days a year, American and Canadian officers keep watch on plexiglass maps of North America and Eurasia.

On the map of the continent appears a constant flow of electronic signals giving this combined United States-Canadian team pertinent information about what is happening in the air and sea lanes of North America – the location of unidentified planes, usually international carriers a few minutes or miles off flight plan; foreign trawlers, usually Russian vessels off Nova Scotia or Greenland; SAC planes on special missions within the continental boundaries.

On the adjacent map, tests created on magnetic tape show how missiles launched in Soviet territory would be detected seconds after launch. For each launch area shown on the BMEWS map, an impact area appears on the continental map, its location computed instantly by data processing machines. These tests, prepared by RCA Service Company engineers at Colorado Springs and at Riverton, N.J., train the NORAD teams for split-second performance if ever the dreaded moment should come.



From the NORAD combat operation center, communications lines go out to the Strategic Air Command at Omaha, the Royal Canadian Air Force at Ottawa, the Royal Air Force in Britain, as well as the Pentagon and the White House.

In its present exposed quarters, NORAD's COC is vulnerable not only to bomb or missile attack but also to a few strategically lobbed hand grenades. That is now being remedied.

One thousand feet inside the granite of Cheyenne Mountain, six miles from NORAD, men and machines are toiling today to build a new control center safe from anything but a direct hit by an atomic bomb. Three tunnels will lead to a three-story building inside the mountain, to be completed by 1965 at a cost of some $66 million. It will house as many as 700 men, though only 350 are needed to operate it, and it will contain food and supplies, utilities and other services, to sustain them for long periods of time if cut off from the outside world.

This would be the command post for any Battle of North America — a battle which the West's strategists hope will never come to pass because of the very existence of our warning systems. ■

THE NEW BANKERS

ONE OF THE NATION'S LARGEST BANKS HAS FOUND AN IMPORTANT ROLE FOR COMPUTERS AND COMPUTER MEN

ONLY A FEW YEARS AGO two young college graduates were working on inertial guidance systems for the Atlas intercontinental ballistic missile. Today, at 35, Robert J. O'Keefe and Charles Block are Wall Street bankers.

Computers caused them to switch. Banks are faced with mountains of paperwork which only electronic data processing can handle efficiently and EDP specialists O'Keefe and Block came to Wall Street to harness computers for the Chase Manhattan Bank.

"I don't always think of myself as a banker," says Mr. O'Keefe, an assistant vice president of the Chase Manhattan Bank, the nation's second largest.

"That's because I never really changed professions," he explains. "Computers are the common denominator of progress in so many fields."

Banker Block, also a computer expert, heads the Customer Services and Electronic Research team of Chase Manhattan. This team designed the programs for the bank's Electronic Check Processing Depart-

ment — the largest centralized computer installation of its type in the world and an example of one of the many areas in which EDP has come into the traditional field of banking.

Nine computers — two RCA 501's and seven RCA 301's — now process between 200,000 and 250,000 checks daily for seventy-two of the bank's 115 metropolitan branches. This is a 24-hour-a-day job, five days a week, involving everything from account entries to delivery of canceled checks to customers. Full conversion of all branches to the new computer system is scheduled for March 1963, nearly a year ahead of the target date planned by Mr. O'Keefe in October 1960.

Full conversion will mean processing 1 million checks daily. By that time, two additional RCA 301's will be required. Other equipment in the system will include a total of eight Burroughs check sorters and one hundred Burroughs proof machine encoders. The value of this equipment, including the computers, will approximate $7 million.

"About a year after the bank has converted all branches to the new system, all installation and conversion costs will have been recovered," Mr. O'Keefe says. "Centralized electronic check processing is proving less expensive than traditional check processing procedures at the individual branches — despite today's enormous increase in check volume."

When Bob O'Keefe graduated from Boston College with an A.B. in mathematics in 1951, only a few experimental computers existed. And Bob didn't consider entering banking. His qualifications seemed to point his career elsewhere.

He joined M.I.T.'s famed Instrumentation Laboratory and there met another new hand, Charlie Block. Charlie had also majored in mathematics at college. At the Lab, Bob and Charlie did research on ballistics, setting up the Lab's first digital computer and working on inertial guidance for the Atlas missile.

In 1955, Bob and Charlie were recruited as electronic data processing specialists by a management consultant firm.

"We were then in the business of finding useful *commercial* applications for computers," Charlie explains. "In 1957, Chase Manhattan asked the firm for an evaluation of EDP."

Bob headed the survey. He later reported that check handling was the bank's largest and most critical data cost problem. EDP could cut processing expenses substantially, he asserted, and so avoid any need to increase check charges to customers.

The bank management was so impressed by the report they hired Bob, established a Systems Planning Division, and gave him the assignment of setting up Chase Manhattan's first "electronic team."

At the bank, mathematician O'Keefe met career banker John B. Sleight and machine accounting expert Edward Kahn. John had a detailed knowledge of branch procedures, while Ed had specialized in tabulating equipment in the manufacturing and retailing fields.

In August 1958, Bob O'Keefe along with operating and other systems people was named to a new committee on check handling. Ed Kahn was appointed to head the group's task force on methods for the proposed EDP installation. The results of their work included: an analysis of check handling volume by branch and type of account; development of a ten-digit Magnetic Ink Character Recognition (MICR) account numbering system; and a plan for installing a centralized electronic check processing system at the head office which took advantage of the American Bankers Association's MICR common language.

At that time, each branch did its own check processing or it was done for them in small local units. Under the new plan, batches of checks were to be delivered during each day to the new Electronic Check Processing Department.

By October 1960, the bank's top management had approved the committee's recommendation, including a detailed conversion schedule. The new bankers were ready to move fast.

A thirty-three member conversion team, headed by John Sleight, was charged with converting the branches to the new system.

"The new check processing system ties the branches closer to the head office," John points out. "Normally, a branch is practically the community bank in its neighborhood of the city. The manager's job is to serve his area, and the new computer system helps him do this by relieving him of the record-keeping chores but maintaining for him important information on each of his accounts."

John and his team provide the initial contact between the branch and this new system. As a result of his responsibilities, John now knows all 115 branch managers. The managers of branches already converted keep in touch, and the managers of other branches want to discover all they can about the new procedure.

Members of the conversion team report to a branch either singly or in groups of two or three. There are never more than three assigned to any branch at one time and they remain on the assignment up to six weeks. By that time the branch is fully converted.

Bob O'Keefe emphasizes that the success of the schedule depends greatly on the conversion team.

"The members of this team are all enthusiastic, interested, and hardworking," he says. "When they

New bankers Charles Block, John Sleight and Robert O'Keefe, left to right, in Electronic Check Processing Department.

started their assignments, the branch managers were so impressed they tried to recruit them for their own operations. Now the word is out that they can't be recruited — because that would disrupt our schedule.

"The turnover rate for the team is close to zero. That's a solid indication of the kind of people we have working on this project. They prefer EDP and they stick with it."

"Of course," John says, "they have to be mentally and physically equipped to do their jobs because the pace is rough. Youth is definitely no handicap. Take Elizabeth Urban. She's only 20, but she does a fine job. I think many people in banking find EDP has opened an exciting new horizon."

The youngest member of the conversion team is Mark Icabuzio, 19, who has been with the bank three years. The oldest, Michael Bartolomeo, 58, has thirty-nine years' service. Most are in their twenties, and nineteen of the thirty-three are women. Most are clerks or bookkeepers familiar with branch procedures.

Have there been any protests about the new EDP system?

"I don't know of any," John replies. "But there is the story about the lady who wrote in to say that she had had a very fine pen for many years. She did not intend to ruin it, she declared, by using magnetic ink." Fortunately, customers do not write their signatures in magnetic ink. Only the bank uses the ink for identification numbers.

The numbering system devised by Chase Manhattan uses ten digits to describe each account's identity in terms of area, branch, account sequence position, and type. This system enables the head office Electronic Check Processing Department to process the checks drawn on Chase Manhattan, or so-called "on us" checks, for all of the bank's domestic branches.

When the batches of checks are first delivered they are "proved" by the Burroughs proof machine encoders in the Incoming Clearings Department, and the dollar amount is inscribed on each check in magnetic ink.

Then each check is read by a Burroughs sorter and the information is fed to an RCA 301 for conversion to magnetic tape. Deposits and other transactions are handled similarly. This taped information is put into the RCA 501 systems in random order to be sorted and put on a new tape according to branch, in account number sequence. This tape, which contains all the transactions for the day, is used by the 501 to produce an up-dated master balance tape. A 301 then prints out new balance sheets and other important data for each account at each branch.

The branches receive these reports daily. The computer also prints monthly statements, a copy of which, along with the canceled checks on which the customer signatures have been checked, is mailed to the customer by his branch.

When the bank's Electronic Check Processing Department became operational in March 1961, Ed Kahn became its manager. Today he has 165 people working for him on three shifts daily. The staff operates the computers, the check sorters, and other associated machine equipment.

Charlie Block's Customer Services and Electronic Research team, composed of programmers, systems analysts, and tabulating specialists, reports to Bob, who now has the title of manager of Equipment Research. In that post Bob is responsible for all the bank's office equipment from typewriters to computers and has four teams in addition to Charlie's.

Modern rectangular Chase Manhattan building, in heart of Wall Street area, beckons new bankers and new electronic banking methods.

Currently, the check processing computer system which is only one of three major computer installations at the bank uses twenty-eight tape stations, twenty-one for the two RCA 501's and one each for the seven RCA 301's. Two additional tape stations will be in-

An electronic check sorter, one of seven, reads each check and feeds information to RCA 301 systems for conversion to magnetic tape.

cluded with the two RCA 301's yet to be incorporated in the system. Over 2,000 tapes are required at present. Between 3,000 and 4,000 tapes will be employed when all branches are converted.

To keep ahead of today's boom in banking, the new bankers were forced to an extremely tight schedule, one that required close cooperation between the people at Chase Manhattan and with RCA's Electronic Data Processing Division. On March 1, 1961, the first two RCA computers were delivered at the bank's new sixty-story building. On March 17, the Electronic Check Processing Department was formally opened two months before the new building itself.

"We've been ahead of schedule ever since management approved the recommendations for the EDP system," Bob notes. "We have always assumed a 'foul up rate,' but there have been very few foulups."

The project is a landmark development for RCA's Electronic Data Processing Division, as well as for the bank. The first RCA 301 to be installed anywhere was one of the two computers originally delivered to the bank on March 1, 1961. This was only eleven months after the 301 computer system had been announced by RCA, a record for the computer manufacturing industry.

Moreover, the third RCA 301 to be delivered to the bank was the first 301 to come off the production line at RCA's new computer plant at Palm Beach Gardens, Florida. Chase Manhattan Chairman George Champion personally accepted delivery of this machine on May 25, 1961 – two months ahead of schedule.

"The RCA 301 has since proved itself in a great variety of commercial installations throughout the country," says E. S. McCollister, RCA's EDP Marketing vice president. "We are proud of that, but we are especially proud of the machine's performance at Chase Manhattan. There, it met its first critical test and came through with flying colors."

This elaborate, carefully tailored, cost-cutting complex of electronic equipment and techniques has taken the computer experts three years to design and install. It is the first computer-centered check processing installation to become operational in New York City, the financial capital of America.

The prime significance of Chase Manhattan's achievement is, however, that it was conceived and realized by a new breed of banker, the EDP specialist. EDP was the only introduction to Wall Street that Bob O'Keefe and Charlie Block had – or needed. ■

"Now  What,

by **HOWARD VANDERMEULEN**

THE CHUBBY, balding man was grateful that the crew of the passing police car was looking the other way. Otherwise, he might have had to explain why he was standing in his back yard in his bathrobe and shouting into a telephone at five o'clock in the morning. At the moment he had enough problems.

The man was NBC News producer Chet Hagan. He was asleep when the NBC newsroom phoned to tell him the launch of astronaut Virgil Grissom was "go." Hagan heard the ring but couldn't find the phone. He groped through his home, becoming more frenzied with each ring, until he remembered the barbecue the night before and the call he had made from a portable phone at the pit.

Once alerted that the often-postponed space attempt was finally going to happen, Hagan set the wheels in motion for its coverage, before dashing to the studio. Another "instant special" was in the making.

Hagan heads a small, fast-moving unit that has become particularly adept at this new kind of electronic journalism — the instant news special. A modern version of the newspaper "extra," this is a program planned on short notice to cover an event which is dominating the headlines, in order to present the story clearly, completely and effectively. No one remembers who coined the phrase "instant special." One day there was a sign on the wall of Hagan's office, "Home of the Instant Special," and the name stuck.

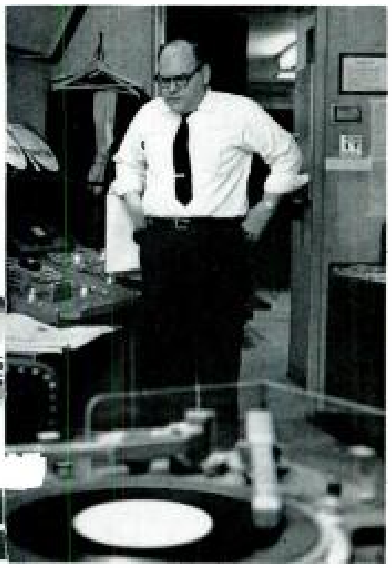
The voice and face of the unit, the man the viewing public identifies with this type of NBC-TV programming, is NBC News correspondent Frank McGee. A New York television critic once said that McGee's "voice and manner equip him perfectly for the bedside vigil at any crisis. 'I've abandoned hope myself,' he seems to be saying, 'but I don't want you folks out there to be alarmed . . .' "

The third member of the triumvirate that guides the unit is director Robert Priaulx, as cool a man under fire as they come, filling a job that demands iron nerves. Priaulx does not confine his efforts to his directorial duties, but tries to help wherever he can. When an instant special was planned on the seizure of the Portuguese cruise ship *Santa Maria*, Priaulx, on his way to NBC from his New Rochelle home, picked up an armful of books on piracy at the local library. By the time his train reached Grand Central Station he was becoming an expert on Blackbeard, Lafitte and the legal niceties of piracy on the high seas.

The subjects of instant specials have run the gamut from the completely unexpected to events which have been foreseen but contain an element of unpredictability. At one end of the scale have been air crashes, the sinking of the Texas radar tower, the hijacking of a jetliner. Less out-of-the-blue but still surprising have been crises in Cuba, Algiers, Laos. Sometimes the subject has been an extraordinary new development within the context of a planned event as, for example, the collapse of the Summit meeting in the spring of 1960.

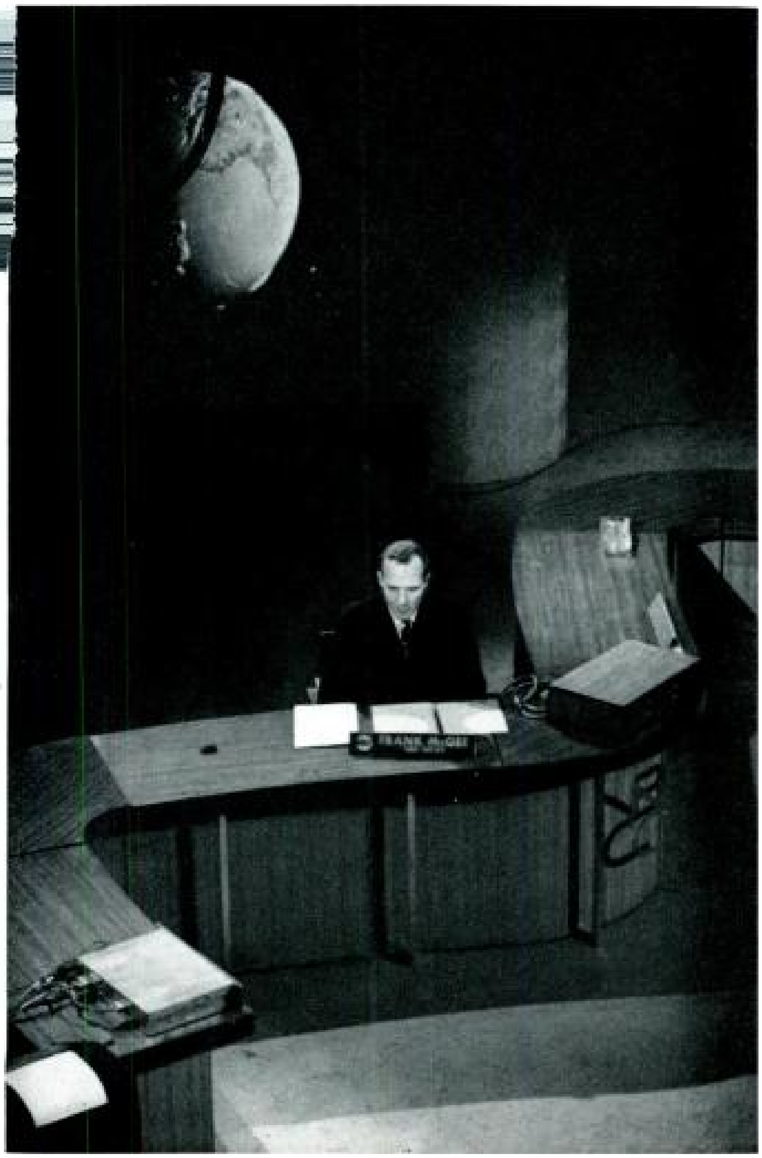
An important part of this programming has been coverage of the major space flights. One reason why such flights fall into the category of the instant special

Frank McGee, the voice and face of the team, serves as anchorman for a Project Mercury instant news special.



McGee?"

THE "INSTANT TEAM" IS READY FOR ALMOST ANYTHING IN THE FAST-MOVING WORLD OF TELEVISION NEWS



is that the day and time of a launching remain uncertain to the last moment. Another is that emergency situations may arise once the flight is underway. The Hagan group has the flexibility and know-how to handle such sudden developments.

Presentation time for instant specials has ranged from fifteen minutes, as in the case of the program on the Texas Tower disaster, to eleven and a half hours of continuous coverage of the Glenn orbital flight. Most programs have been a full hour or a half hour.

The material that goes into an instant special is equally varied. A program is shaped not only by its subject but also by the materials readily available and the arrangements that can be made for special coverage in the brief period – usually only a few hours – between assignment and air time. The principal ingredients are film, live or taped remote pickups, studio originations and radio circuit reports, supplemented at times by still photos, maps, graphs and sketches.

An extreme example of the speed with which the group must move was a special about the break in diplomatic relations with Cuba. The decision to do this show was made at 6:30 one night. The program went on the air at 7:30 – one hour later. A secretary recalls seeing McGee running down a hall, a partial script and a sheaf of notes in hand, shouting, "Which studio? Which studio?"

Although the production unit is small, Hagan can draw upon the vast resources of NBC News, including its correspondents around the world. For reaction from a high government official or the man in the

Members of the "instant team," Robert Priaulx, foreground. and Chet Hagan, third from left, during a tense moment in the control room.

street, for vital background information, for up-to-the-minute developments and for expert analysis of a situation, these newsmen can be depended upon to move quickly in a crisis.

Another reason why an instant special can be assembled within hours after an event is that the unit anticipates most of the major news breaks. What they call their "instant shelf" contains "bits and pieces," as Hagan calls them, for thirty to forty shows at any given time. These materials include stock film footage, special film, taped interviews, background reports from correspondents, photographs, books, maps and newspaper and magazine clippings.

When the nuclear test ban talks in Geneva collapsed, Hagan had an ace in the hole. Foreseeing this possibility, he had asked NBC News correspondent Robert Kroon to interview Arthur H. Dean, chief U. S. negotiator, about the problems of dealing with the Russians. It was agreed that the filmed interview would not be used until the negotiations were broken off, if indeed they were. The film was held for six weeks. When the special which featured the interview went on the air, Dean was on his way to Washington to confer with President Kennedy about the crisis.

The need for good visual materials makes the television news special much more difficult to do than its parent, the radio news special. When film coverage can be obtained, or live or taped remotes arranged, the problem is easily solved. But what does a producer do when the story is unfolding on a ship at sea, its whereabouts unknown? This was the perplexing situation in which Hagan found himself when he had to cover a bizarre story of modern piracy in the Caribbean early last year.

The assignment: a half-hour special on the seizure of the cruise ship *Santa Maria* by a band of political exiles from Portugal. Production time: twelve hours. Film of the *Santa Maria:* none.

Hagan, after rounding up his staff, briefed production assistants Marion Eiskamp and Barbara Mueller on his plans for the program and set them to work on research. Within the next eight hours they made more than 150 phone calls to libraries, universities, travel agencies and other sources, gathering maps, photos, film and background data. One of their most prized discoveries was a rare old pirate map of the area where the *Santa Maria* was seized.

Meanwhile, Hagan called artist Jacques Barosin and outlined the known facts to him. Six hours later Barosin appeared at NBC with three realistic artist's sketches of events in the strange story.

With film editor Robert Sorenson, Hagan screened film selected from the network's own laboratories and a dozen outside sources. The footage chosen included the political background of the incident at sea and some colorful scenes of Curacao where the exiles had boarded the *Santa Maria.*

If improvisation was needed in the area of visual effects, such was not the case, however, with the spoken word. Interviews with key figures in the story and an array of new and illuminating facts were provided by NBC News correspondents Wilson Hall, recently back from the Caribbean; Peter Hackes at the Pentagon; William T. Richards in Lisbon; and Kenneth Bernstein in South America.

"Piracy in the Caribbean," as the show was called, stands out in Hagan's mind as his favorite special because of the way ingenuity and imagination successfully met the unique challenge.

The space flights present other kinds of challenges. One of the most difficult is the task of filling in the many gaps in information, the pauses between announcements from Mercury Control during orbits, and the longer wait between landing and recovery.

During the eleven and a half hours of coverage of Glenn's flight, McGee, who was anchorman, had one minute of written script. All of his other information came from his all-extensive knowledge of space flights. While he was speaking, he was being fed switching cues by Hagan through the small earphone he wears. For example, Hagan might say, "We're going to Jim Hurlbut's in New Concord for an interview with a neighbor of Glenn's parents." McGee had to absorb this information so that he could make the announcement without interrupting the pace and flow of what he was saying at the moment.

"Imagine trying to explain something as complicated as the abort sensing implementation system and hearing that Mercury Control will make an announcement in twenty-five seconds," McGee said. "You not only have to keep in mind that the coverage will switch to Mercury Control, but you have to compress your explanation into the few remaining seconds."

The Hagan-to-McGee communications setup made McGee break up at one point, and viewers must have wondered why he suddenly burst out laughing. McGee had been filling in a lull with small talk and finally ran out of gas with the phrase, "And now . . ."

Equally out of gas, Hagan spoke to McGee's earphone, "Now WHAT, McGee?"

The assignment that McGee says put the most emotional strain on him was the interspersing of two instant specials – coverage of the ticker tape parade in New York for Glenn and the crash of a jet airliner in Jamaica Bay the same day. These two events of a violently contrasting nature were separated by place and time, but they were presented on television back to back. It was McGee's job to help the audience make

the emotional shift from the gruesome scene of the disaster to the festivity of Glenn's welcome and back again – repeatedly – and still strike a balance between the two things, so one would not destroy the other.

The hard core of the instant specials unit – Hagan, McGee, Priaulx, production assistant Marion Eiskamp and film editors Sorenson and Clay Cassell – have been together since their first show of this kind, coverage of an Explorer missile firing January 30, 1958. It was their only instant special that year, but it was enough to win a Sylvania Award. In 1959 they turned out twenty-two programs including the "Journey to Understanding" series of President Eisenhower's travels abroad, which also received a Sylvania Award.

The number of instant specials grew to forty-three in 1960, forty-two were produced in 1961, and nineteen have been done so far this year, for a total of 127. Late in 1960 a unique sponsorship agreement was signed. The Gulf Oil Corporation, in a precedent-setting move, purchased a series of instant specials throughout the following year. The number and length of the programs, called "NBC Special News Reports," was to be determined by the news as it broke. No company ever before had been willing to sponsor fast-breaking, unscheduled news events.

After careful evaluation of the results of that first year's programming, Gulf renewed the contract with an even larger budget for 1962. Since the arrangement went into effect, forty-six of the sixty-one instant specials presented have been sponsored by Gulf.

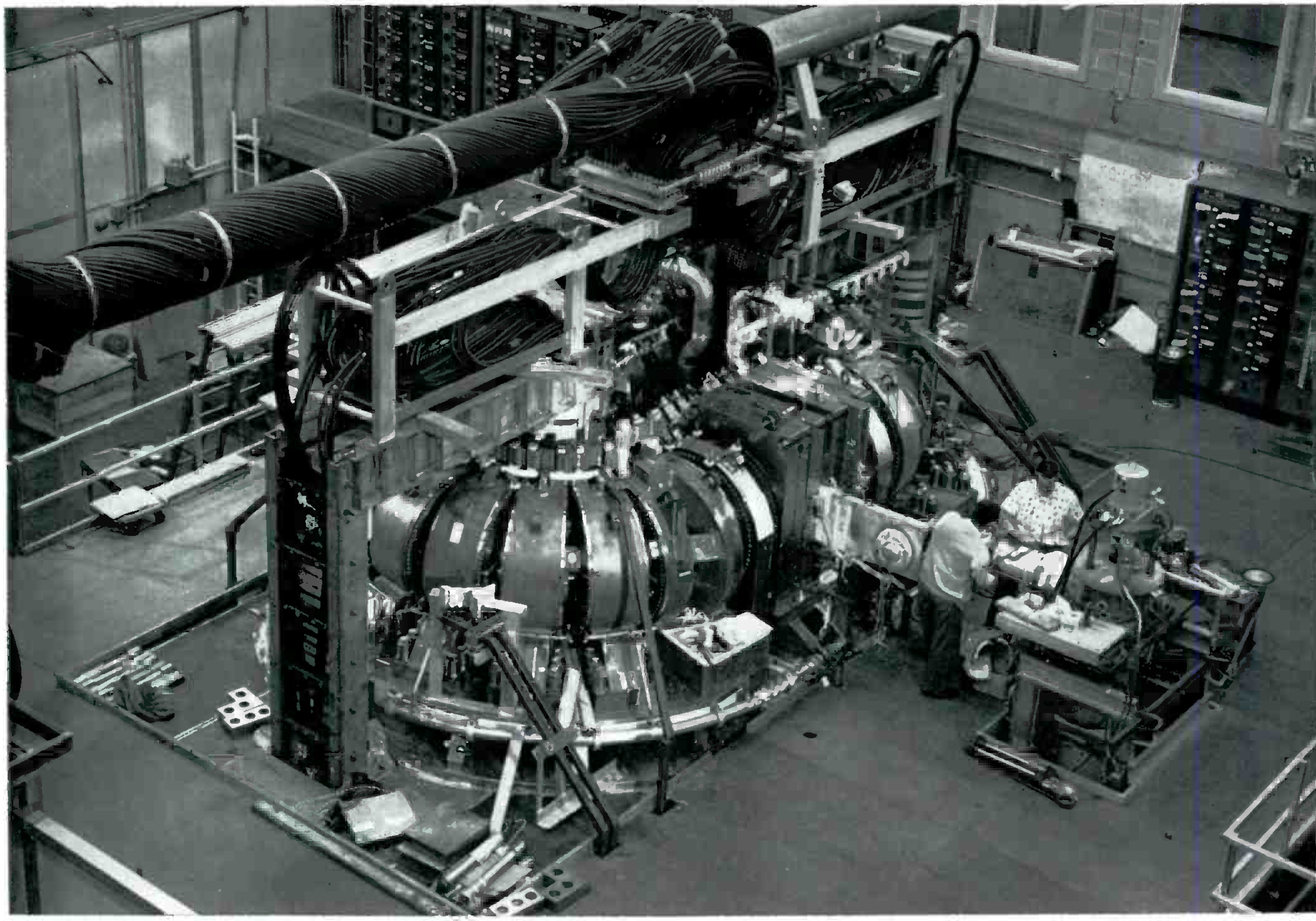
The Hagan unit is about twice its original size now, but it is still a tightly knit, smoothly functioning organization. "We've developed a verbal shorthand," as McGee puts it, "that enables us to go our separate ways and be out of touch for hours, yet still know what the others are doing."

Hagan, who sets the pace, was at one time the publicist for Joie Chitwood's Hell Drivers, and it may be that some of this racing speed rubbed off on him. McGee is an extremely fast writer. He spends most of the preparatory time gathering his facts and often doesn't begin work on his script until an hour or two before air time. As he writes he fortifies himself with a bowl of soup and two double-thick milk shakes. He shaves while Hagan edits the script.

At the end of one exhausting day, a bone-tired McGee talked with his son-in-law in Boston and learned that whenever he appeared on the TV screen, his one-year-old granddaughter tottered over to the set and patted his face affectionately.

"I was delighted," McGee said, "but then she does the same thing whenever she sees Walter Cronkite." ■

Toward Limitless Energy



The Model C Stellarator

ELECTRONICS AND ELECTRICAL TECHNOLOGY
FORGE A GREAT NEW INSTRUMENT
FOR FUSION RESEARCH AT PRINCETON

A CLUSTER OF LARGE, angular buildings, placed like oversized boxes in the wooded landscape of central New Jersey, is the focal point of a major scientific thrust that could lead one day to all but inexhaustible sources of energy for mankind.

Housed within the building complex is an oval-shaped 180-ton assembly of stainless steel tubing and immense magnets forming a unique research machine known as the Model C Stellarator — a "stellar generator" designed to raise ionized hydrogen gas to temperatures approaching those that exist inside the sun and other stars.

The C Stellarator and the massive electronic and electric power systems that surround and feed it, represent an outstanding achievement in university-industry-government cooperation to forge what is probably the most powerful single instrument for probing a vastly challenging frontier of modern science — the quest for means of achieving controlled thermonuclear fusion for the production of power.

The Stellarator — designated Model C to indicate the third and by far the most powerful variant in a series — was conceived and is now operated by Princeton University scientists in a broad research program sponsored by the U.S. Atomic Energy Commission. The machine and its extensive supporting facilities were designed and built for the University and the AEC by the Radio Corporation of America and the Allis-Chalmers Manufacturing Company in a five-year engineering team effort drawing upon new and advanced concepts of electronics and electrical technology.

The mission of the C Stellarator is to explore basic scientific problem areas in which solutions may open the way to controlled thermonuclear fusion. Success in achieving this long-range goal could tap an energy source of unbelievable scope, capable of supplying all human wants for a billion years to come, at a consumption level perhaps 1,000 times greater than the total of world power requirements today.

Thermonuclear fusion is the energy-producing process that occurs in the sun and stars. In its simplest terms, it results from the collision of atomic nuclei with such force that they fuse to form nuclei of greater mass. In each case, the mass of the new nucleus is somewhat less than the combined masses of those which fused to form it. The leftover mass is radiated in the form of energy.

The fuel for the process is heavy hydrogen, an atomic variant of normal hydrogen, which is found in virtually unlimited quantity in all of the oceans of the world. But while the fuel is plentiful, the means for employing it are so far non-existent. Creating the environment for controlled fusion is an immensely complicated task which science has yet to prove possible of achievement. The incentives are so great, however, that hundreds of millions of dollars are being invested in fusion research programs that occupy an imposing array of scientific talents in the United States and other leading nations, including Russia.

The formidable nature of the problem is evident in the conditions that must be created in order to generate and sustain the fusion process. The required environment is a vacuum vessel containing a heated plasma — a gas so hot that all of its electrons are torn away from its atomic nuclei to form what science now recognizes as a fourth state of matter that differs basically from liquid, solid, or gaseous states.

The plasma must then be heated to tens of millions of degrees in order to impart sufficient energy to cause high-velocity collisions among the nuclei. At the same time, the superheated plasma must be contained in a limited space for a long enough time to permit an appreciable portion of the nuclei to fuse together. Containers of solid material are useless for this purpose, because the plasma would lose so much heat by contact with the walls that the reaction would be quenched. Instead, scientists are experimenting with extremely strong magnetic confining fields to compress the plasma within the center of the vacuum vessel, away from the walls.

These procedures are based upon well developed theory for which direct proof is so far in short supply. For example, it is not yet certain whether the intensely hot plasma can be confined by a magnetic field long enough to sustain a fusion reaction. Furthermore, it is equally uncertain whether presently contemplated techniques can provide high enough temperatures or sufficiently pure heavy hydrogen plasma.

With the great new C Stellarator, the scientists of Princeton University's Plasma Physics Laboratory hope to obtain at least some of the answers to these basic questions. To this end, the machine is intended to create a laboratory environment in which the problems of purity, heating, and magnetic field confinement can be studied at first hand.

The *raison d'etre* of the powerful instrument is described this way by Dr. Lyman Spitzer, Jr., originator of the stellarator concept and Chairman of the Executive Committee of the Princeton Plasma Physics Laboratory:

"Smaller devices at Princeton have shown promising results, but plasma on a small scale cannot be heated sufficiently nor confined for a long enough time to carry out research on conditions most relevant to a thermonuclear reactor. The Model C Stellarator, with a diameter four times larger than most of our smaller stellarators, should produce plasmas more similar to those required in a power-producing device.

Moreover, the auxiliary supporting facilities, including such systems as direct current generators for producing the confining magnetic field and radio-frequency power sources for heating the plasma, will make possible an experimental program on a number of large devices of which the present C Stellarator is the first."

The electronic aspects of the Stellarator underscore the major role to be played by advanced electronic technology in the quest for — and, hopefully, the eventual use of — controlled thermonuclear fusion. In meeting the unprecedented requirements of vacuum and heat, RCA's development program drew heavily upon long-established skills in electron tube technology, high-power broadcast equipment engineering, and electronic data processing and control systems. Participating in the work at various stages of the five-year effort were specialists of the RCA Electron Tube, Electronic Data Processing, and Broadcast and Communications Divisions, as well as scientists of RCA Laboratories. RCA Laboratories administered the company's portion of the project, and engineers and

Array of RCA superpower tubes provides heat for C Stellarator.

technicians of the RCA Service Company were involved in the installation and testing of the system.

The heart of the Stellarator is an extremely large ultra-high-vacuum vessel — a stainless steel tube eight inches in diameter and forty feet long, closed on itself to form an oval resembling a race track. The great tube is almost entirely hidden within the array of large magnetic coils which create the strong confining field to hold the heated plasma away from the tube walls. The associated high-speed pumping system can evacuate the interior of the tube to a vacuum equivalent to the near-vacuum of space several hundred miles out from the earth's surface — about 10 trillion times below the pressure of the atmosphere at sea level.

To heat the plasma to the immensely high stellar temperatures needed in experiments, RCA specialists have designed two types of electronic systems. The first is the largest electronic power supply of its type ever installed — an assembly of six to ten RCA superpower tubes with an output of up to 500,000 watts each. Pulses from the tube assembly generate an extremely strong electrical field around the vacuum chamber, and the plasma inside the tube becomes hot as a result of its electrical resistance. Using this process, the researchers can raise the plasma temperature to approximately 1 million degrees.

To carry the heat upward to the temperature levels of the sun and stars, another type of process has been developed, using large banks of capacitors which store energy for release in bursts of up to 50 million watts. This immense energy is transmitted to the plasma by means of coils around one section of the tube. Its absorption by the ions in the plasma should result in a further sharp rise in the plasma temperature so the heavy hydrogen nuclei may collide and fuse.

To control the operation of the Stellarator, RCA engineers developed an Equipment Action Sequence Timer (EAST), a sophisticated relative of the electronic equipment used in various industrial control applications. The system may be thought of in terms of eighty persons with stop watches, all synchronized with one another to a precision of a fraction of a millionth of a second. Twenty-five of the eighty are used for switching on and off the major apparatus, such as the heating systems. The others provide trigger pulses for the instrumentation used to observe and measure experiments.

Already, research with the great machine has started to provide vitally needed information by its ability to confine the heated plasma for far longer periods than had been possible with the earlier small machines used by the Princeton scientists.

"The engineering program has been brought to an outstandingly successful conclusion with the completion of the C device, together with the many intricate subsystems and supporting facilities," says Dr. Spitzer. "It seems clear that the C Stellarator will be an important research tool in the controlled fusion program." ■

THE STORY OF A

MULTI-BILLION DOLLAR INDUSTRY

THAT'S ONLY FIVE YEARS OLD

The Boom in Space

AN OVERHEAD CRANE gingerly lowers the prototype space satellite into a yawning opening. As the crane moves away, a massive steel cover, twenty-six feet across, rumbles down supporting rails to seal the chamber, and vacuum pumps begin the tedious task of exhausting air from the enclosed area.

Another test has begun in one of the world's most advanced thermal vacuum chambers, a structure of spectacular proportions, more than four stories tall, with a test space so big that a truck of moderate size could be placed in it. Within twenty-four hours, the satellite will be subjected to the same dead, airless cold that it would encounter in orbit ninety miles above the surface of the earth. The thermal vacuum chamber and other advanced testing equipment comprise the heart of the Space Environmental Test Center near Princeton, N.J., recently completed by the Astro-Electronics Division of the Radio Corporation of America.

The Space Center, along with similar facilities of other aerospace contractors, is used by the National Aeronautics and Space Administration and by the Armed Forces in the nation's broad assault on the problems of outer space. It typifies the arrival, with startling suddenness, of an entirely new industry; an industry which has developed so rapidly that it has had to create new techniques, new capacities, even new words as it goes along.

Five years ago, for example, the word "Astrolog" would have been quite meaningless, even to the handful of research scientists then working on long-range studies that eventually would lead man into outer space. Today, "Astrolog" is recognized as a periodic summary of space projects published monthly by a leading technical magazine.

Each month new projects are added, but the current list includes fifty-seven missile projects, thirty-three projects involving satellites and spacecraft, a dozen different space vehicles, and nearly fifty satellites presently orbiting the earth.

Together, these projects represent a multi-billion-dollar industry, involving more than one hundred major contractors, employing hundreds of thousands of men and women, and requiring manufacturing facilities of incredible complexity. Yet, scarcely five years ago, this entire industry did not exist.

The "Gee, whiz!" quality of this expansion is reflected in the money allocated by the U.S. Government over a period of three years. Defense Department research and development in astronautics only cost $500 million in Fiscal 1961, $700 million in Fiscal 1962, and is expected to require $1 billion in Fiscal 1963.

Scientific investigation of space, including manned space flights and satellite projects, by the National Aeronautics and Space Administration cost $192 millions in Fiscal 1961, $450 million in Fiscal 1962, and is expected to cost $998 million in Fiscal 1963.

The eventual cost of putting American astronauts on the moon, and perhaps sending manned space probes to the nearest planets, will involve additional billions of dollars which cannot be even estimated yet.

The RCA Space Center, which almost might be called "*Spacetown, U.S.A.*" is an example, in microcosm, of this mushrooming growth of a new industry.

Six years ago, there was no plant here; only a few engineering theoreticians hopefully trying to sell the Army Ballistic Missile Agency on the idea of using satellites for reconnaisance. No one had yet put a satellite in orbit. Even the first Soviet "Sputnik" still was in the future.

Four years ago, there was a modest engineering center employing about 250 persons, with an initial contract for the TIROS weather satellites. In all, the project occupied about 75,000 square feet of plant space.

Today, the original 75,000 square feet has grown to 200,000 square feet. Surrounding buildings, even an old carpet factory, have been taken over. Builders are rushing construction of a new building that will add yet another 130,000 square feet. Meanwhile, more than 1,700 workers are engaged in satellite and spacecraft projects; so many, in fact, that some draftsmen and engineers work at desks in hallways and corridors.

At this Astro-Electronics center alone, more than a dozen satellites and space vehicles will be turned out in a period of twelve months, averaging delivery of better than one a month. These include four new TIROS weather satellites, four Relay satellites for intercontinental telephone and television communication experiments, two SERT vehicles for testing electric rocket propulsion, and a number of classified projects for the Armed Services. In addition, the center is to provide this year the power supplies and television systems for several Nimbus satellites, the second-generation weather observers in space, and the large television mission packages to be crash-landed on the moon in forthcoming Ranger projects.

Although it is entirely correct to say that satellites now are being delivered by America's aerospace industry on a schedule that almost approaches assembly line speed, it would be wrong to say that satellites are produced on an assembly line basis — each one must be hand-crafted with infinite care. Hardware delivered by aerospace contractors has little in common with assembly line deliveries from suppliers of earthbound equipment. The latter may have tolerances for adjustment, or even for repairs if something goes wrong. In aerospace there can be no tolerances, because once a satellite is in orbit, adjustments and repairs obviously become impossible.

How do engineers and designers cope with the unusual problems of this new industry? They can determine much by mathematical calculations, but in the end, only physical testing of a prototype, in conditions resembling outer space, can give the final answer.

At the RCA Space Center the new environmental test installation can simulate most, although not all, conditions in outer space with controlled precision. Extreme heat and extreme cold, and hard vacuum, mechanical shocks and trans-sonic vibrations, even electromagnetic radiation, all can be directed toward testing the satellite in its eventual environment. Weightlessness, on the other hand, cannot be duplicated in the laboratory, nor is it possible to simulate nuclear, solar or Van Allen radiations, or the effect of comets, meteors or dust clouds.

Actually, a prototype never goes into orbit. It is tortured to three times the level of anything it conceivably would encounter in launching into space, only to end up as a museum piece. Three other semi-completed models also are tested: one in thermal tests, one in mechanical tests, and one in electrical tests. Only when all of these tests have been completed successfully are payload flight models put into production; then each of these is tested up to one and one half the expected environment before being sealed in a special container and sent to the launch site.

The result is an extraordinary level of reliability in the satellites which the United States has sent into space. The TIROS weather satellites are a good example. Five out of five have been successful.

Sometimes, the satellites astonish even the engineers who designed and built them. TIROS II, for instance, operated for more than a year and sent back 37,000 TV pictures before being switched off for good December 2, 1961. By then, it had been active 376 days — an all-time record for a complex system.

In May 1962, after TIROS III had been aloft 300 days and TIROS IV for ninety days, an electronic accident occurred. A signal intended for TIROS IV was intercepted also by TIROS II. And, to the unbounded

Completed spacecraft can be tested before flight in this large thermal vacuum chamber at RCA's new Space Environmental Test Center.

surprise of all concerned, the "dead" satellite briskly turned on for limited use.

What lies in the future is beyond the prediction of even the most knowledgeable engineers.

"We've been at this less than five years," said one of them, "and already it's changed our whole way of thinking. Imagine what lies ahead, in say fifty years! The mind boggles."

What kind of men and women form the work force of this new industry? Generally speaking, they are young and they are highly trained. Taking the RCA Space Center as a cross section of the industry, it is worth noting that nearly one third of all the employees are professional engineers, scientists and mathematicians. And more than half of these received their degrees within the last six years.

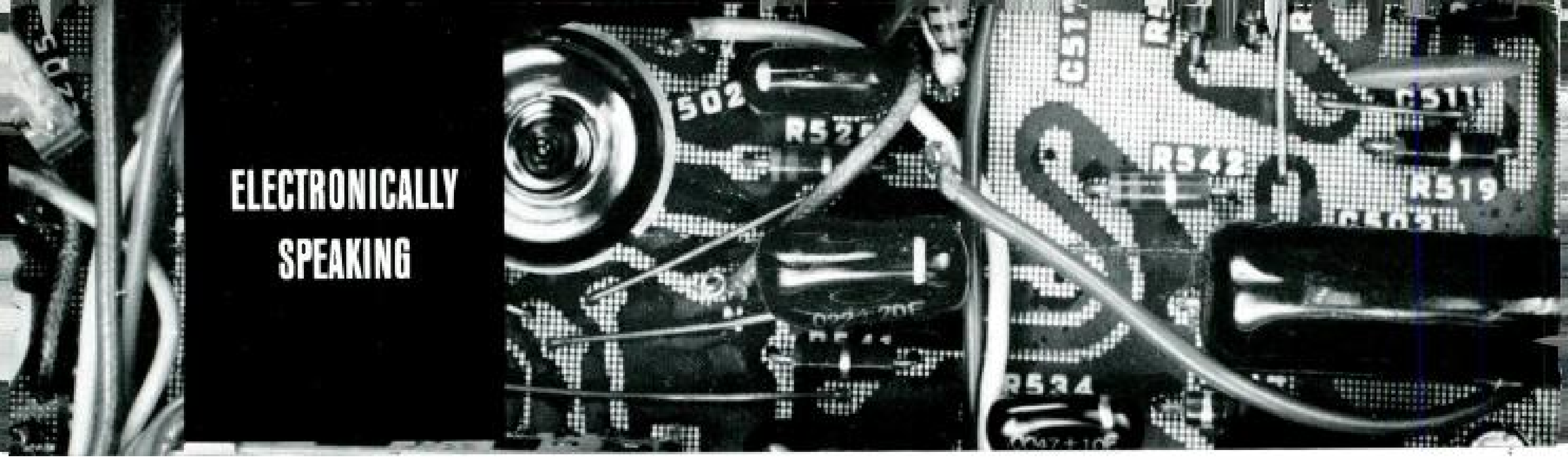
Nevertheless, an engineering degree, or a master's degree in mathematics, is hardly more than an entry ticket to such a pioneering field.

An RCA personnel executive explained: "It isn't easy, recruiting the skills you need for this new industry. You start, usually, with an engineering degree, but that's no handicap if the man is willing to learn after he gets on the job!"

Of the total number of 1,700 workers in the Astro-Electronics Division, the great majority are under thirty-five years of age. About 200 are women, including ten women who hold engineering degrees. All display conspicuous *elan* and a pride in being associated with the conquest of space.

Despite the relative youth of the engineering and production personnel, the Astro-Electronics Division has no fewer than thirty men with more than twenty-five years of management experience in the Radio Corporation of America.

Said one of them: "Here at the Space Center, every day is Judgment Day... and everyone has to use a lot of it." ■



ELECTRONICALLY SPEAKING

FIVE FOR FIVE

When the TIROS V weather satellite was rocketed into space on June 19, its performance fit into the pattern of unsurpassed reliability established by its four predecessors.

The 286-pound satellite contains forty complex subsystems made up of 550 transistors, some 4000 other electrical parts, about 4000 mechanical parts and 9200 solar cells. Failure of any small percentage of the electrical or mechanical parts could have meant failure of the entire satellite. But the new TIROS had been rigorously pretested at the Space Center of RCA's Astro-Electronics Division, where it was built under contract to NASA. It began televising cloud patterns immediately upon achieving orbit. This makes it five up and five successful in one of the nation's most important space programs.

SEA THE C

The big drawing card at the recent annual meeting of the Acoustical Society of America in New York was the experimental phonetic typewriter from RCA Laboratories. Just talk to the machine and it types what you say — as long as you use the one hundred or so words stored in its "memory." Change circuits, and your English words can be typed in another language.

Dr. Harry F. Olson, who directed its development, points out that the system lacks one important attribute of a good human typist. It spells by sound, not by word. For example, it cannot tell the difference between "see," "sea," or "c."

Where can it be used? The military has some ideas for useful application, and, with further development, it could produce readable notes and memos for office use.

HOW REAL?

Sometimes the people at the RCA Victor Record Division carry the quest for realism to new and wonderful extremes. During the recording of Victor's recently released album of "La Boheme," every effort was made to follow the opera's script exactly.

Richard Mohr, the Red Seal musical director who produced the album, was particularly insistent that Mimi sing her death scene while lying in bed, as prescribed. To suit the occasion, a bed was rolled onto the empty stage of the Rome Opera House where the recording was being made.

When Anna Moffo, the album's Mimi, dutifully took her place and began to sing, Mohr was working in a control room that had no view of the stage. Suddenly, he stopped the action with a loud cry "Anna, you're not lying in bed." And most certainly she wasn't, she was sitting *on* the bed, a fact that Mohr was actually able to *hear*.

BON VOYAGE

Going to Martinique? If so, do you know that it's not customary to tip a cab driver unless he performs an unusual service for you?

This and dozens of other handy facts on tipping, customs regulations and currency exchange are provided in a pocket-size booklet that has been published yearly by RCA Communications, Inc. since 1953. This finger-tip guide, covering thirty-five of the sixty-nine countries now served directly by RCAC telegraph, is available upon request to the Manager of Commercial Research, RCA Communications, Inc., 66 Broad Street, New York 4, N.Y. Happy traveling!

TAKING UP SPACE

Visitors to Rockefeller Center on a recent morning were astonished to find seven down-to-earth models of space vehicles parked in front of the RCA building. The models, on their way to a "Space Age Electronics" exhibit, represent space projects in which RCA is either the prime contractor or a contributor of key elements.

In the foreground, to the right, is a projected moon surface vehicle in a rocket nose cone. At its left is a Nimbus second-generation weather satellite. The other five vehicles, from left to right, are: a Ranger lunar impact vehicle with a six-camera television package for observing the moon's surface; a TIROS weather satellite; the 1958 SCORE communications satellite; a Relay experimental active communications satellite and a SERT vehicle for carrying electric propulsion engines into space for tests. ▶

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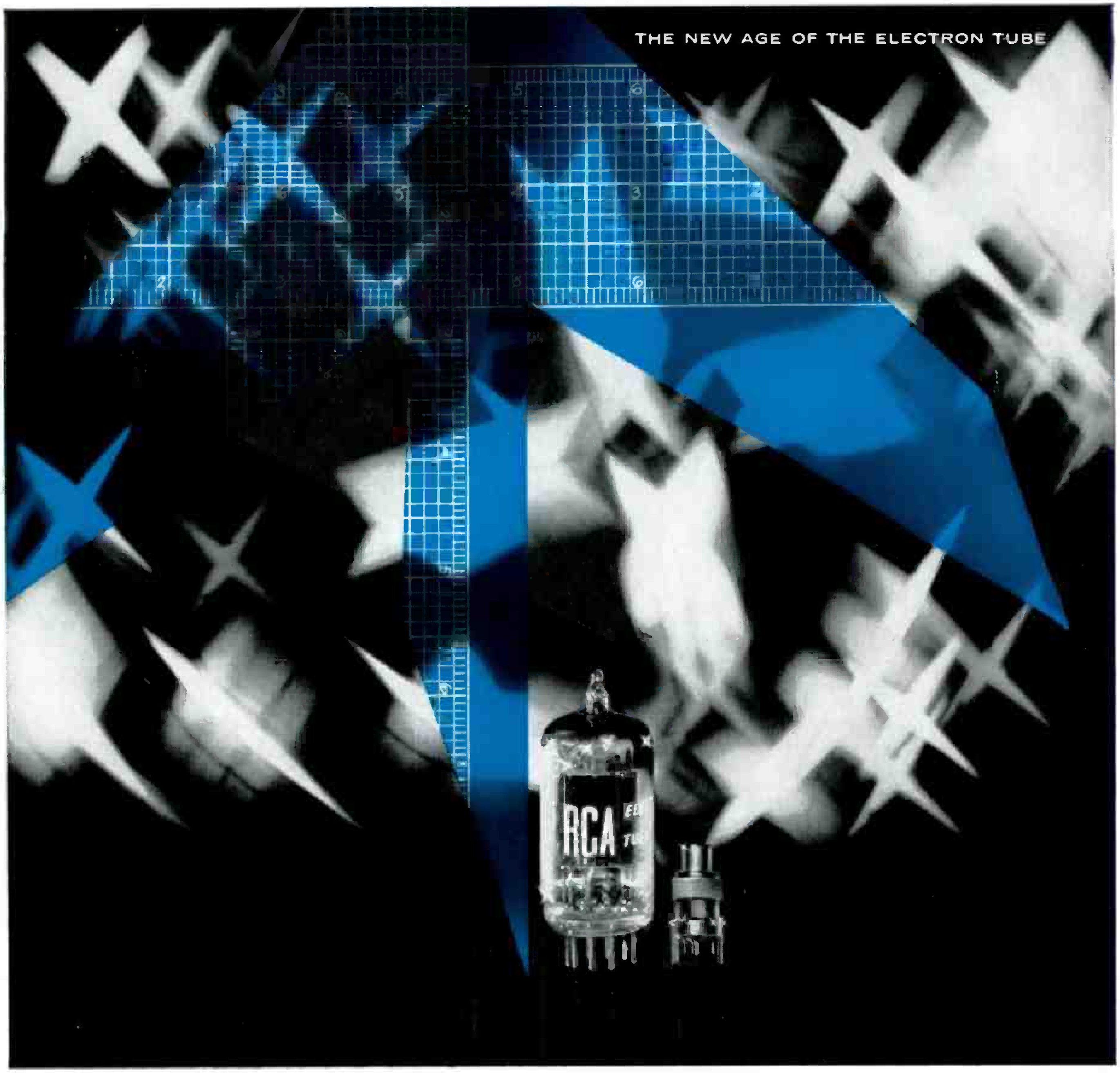
UNITED STATES



Sharpening the "Senses" of Defense

Unique in its ability to split time into infinitesimal intervals and compress space requirements into microscopic dimensions, the amazing electron tube is adding immense scope to the nation's electronic defense systems—in servo, missile-guidance, radar, bombing devices, navigational aids, sonar, intercontinental communications.

Consider a few of the basic advantages that make the electron tube virtually indispensable: *Sensitivity and speed of response*—to react to the most complex variations of signals at all frequencies throughout the usable radio spectrum; *Versatility*—to handle broad ranges of power to meet the military's most stringent demands; *Reliability*—to perform under extremes of temperature; *Mass reproducibility and unexcelled uniformity* from tube to tube.

Backed by the same bold planning that evolved the NUVISTOR—the revolutionary new concept in compact, high-efficiency tube design that is opening a new era in defense electronics, the RCA electron tube today is capable of rolling with the punch. It reflects the priceless experience gained in building millions of tubes for war and peace.

Explore the advantages of the RCA electron tube when you consider the parameters of your new design. Electron tube performance is predictable with certainty. Electron tube economy makes for pleasant reading on the balance sheet.

RCA ELECTRON TUBE DIVISION, Harrison, New Jersey

The Most Trusted Name in Electronics
RADIO CORPORATION OF AMERICA