

JULY, 1964

50 CENTS



# PHOTOFACT REPORTER

including **Electronic Servicing**

 **ELECTRONICS AT THE FAIR**



**SPECIAL ISSUE**

**PLUS  
COMMUNICATIONS  
SUPPLEMENT**

IA 3E 375 466  
S. KOSKY  
KOSKYS ELECT. RESEARCH  
14690 ROBERT DRIVE  
CLEVELAND 30, OHIO

**publisher**  
Howard W. Sams  
**editor**  
Forest H. Belt  
**managing editor**  
George F. Corne, Jr.

**associate editors**  
James M. Moore  
Allen B. Smith  
Stuart N. Soll  
Norman D. Tanner

**consulting editors**  
William E. Burke  
Joe A. Groves  
C. P. Oliphant

**production manager**  
Robert N. Rippy

**circulation manager**  
J. A. Vitt

**circulation fulfillment**  
Pat Tidd, Mgr.  
Katherine Krise, Asst.  
Cara La Von Willard, Asst.

**art directors**  
Gene La Rue  
Robert W. Reest

**advertising & editorial assistants**  
Hazel Boyer  
Rebecca Clingerman

**photography**  
Paul Cornelius, Jr.

**advertising sales offices**  
Dave Milling, advertising sales manager

**midwestern**  
Hugh Wallace  
PF REPORTER  
4300 West 62nd Street,  
Indianapolis 6, Ind.  
AXminster 1-3100

**eastern**  
Gregory C. Masfield  
Howard W. Sams & Co., Inc.  
3 West 57th Street,  
New York, N. Y.  
MUrray Hill 8-4350

**western**  
The Maurice A. Kimball Co., Inc.  
2550 Beverly Blvd., Los Angeles 57, Calif.  
DUinkirk 8-6178; and 580 Market Street,  
Room 400, San Francisco 4, Calif. EXbrock 2-3365

Address all correspondence to  
PF REPORTER, 4300 W. 62nd Street,  
Indianapolis 6, Indiana



Copyright© 1964 by Howard W. Sams & Co., Inc.  
PF REPORTER is a trademark of Howard W. Sams  
& Co., Inc. No part of PF REPORTER may be  
reproduced without written permission. No patent  
liability is assumed with respect to use of  
information herein. Acceptance of advertising does  
not in any manner signify the products, policies  
and services advertised have been approved,  
endorsed or recommended by this magazine.  
Subscription Prices: 1 year—\$5.00, 2 years—\$8.00,  
3 years—\$10.00, in the U.S.A., its possessions and Canada.  
All other foreign countries: 1 year—\$6.00, 2 years—  
\$10.00, 3 years—\$13.00. Single copy 50¢; back copies 65¢.

Indexed in *Lectrodes*.  
Printed by the Waldemar Press Div.  
of Howard W. Sams & Co., Inc.



# PF REPORTER

## including Electronic Servicing

VOLUME 14, No. 7

JULY, 1964

### CONTENTS

#### SPECIAL COMMUNICATIONS SUPPLEMENT

- |  |    |
|--|----|
| <b>Transistorized Mikes for Mobiles</b>  | 66 |
| A report with servicing hints on the construction and use of amplified mikes.                        |    |
| <b>Removing the Mystery from Modulators</b>  | 68 |
| Edward M. Noll<br>This article will aid your understanding of modulators and modulation techniques.  |    |
| <b>Radio Paging</b>  | 72 |
| Leo G. Sands<br>A discussion of equipment and methods used in this rapidly expanding public service. |    |

- |  |                         |
|--|-------------------------|
| <b>Heigh Ho . . . Come to the Fair!</b>  | 1                       |
| Forest H. Belt<br>Book Section—Our industry is on display at the World's Fair  |                         |
| <b>Letters to the Editor</b>   | 12                      |
| <b>The Electronic Scanner</b>  | 15                      |
| <b>The Troubleshooter</b>  | 21                      |
| <b>Symfact: Horizontal AFC</b>   | 25                      |
| (Synchroguide) See what happens to voltages and waveforms when troubles occur.   |                         |
| <b>Key to Stereo Alignment</b>   | 30                      |
| Norman D. Tanner<br>Your multiplex customer deserves top performance; here's how to give it to him.  |                         |
| <b>Shortcuts That Waste Time</b>   | 32                      |
| Allan F. Kinckner<br>Shop Talk—That next "timesaver" you try may cost you money!   |                         |
| <b>Foreign TV Systems</b>  | 34                      |
| A handy guide to specifications and broadcasting standards overseas.   |                         |
| <b>Aerosols in Servicing Chemicals</b>   | 36                      |
| Quicker Servicing—A roundup of handy chemical servicing aids that may save you many a headache.  |                         |
| <b>The High Cost of Employee Theft</b>   | 42                      |
| Dale Morey<br>Dollar and Sense Servicing—Shop owners are often victimized by dishonest employees. Are you?   |                         |
| <b>Notes on Test Equipment</b>   | 46                      |
| Stephen Kirk<br>Lab reports on EICO 3" Model 430 Oscilloscope, Heath Model IT-12 Signal Tracer, and Mercury Model 301 Combination VOM-Tube Tester-Rejuvenator. |                         |
| <b>Product Report</b>  | 60                      |
| <b>Free Catalog &amp; Literature Service</b>   | 64                      |
| <b>Monthly Index</b>   | on free literature card |

#### ABOUT THE COVER

The Biggest Show on Earth this year is probably the New York World's Fair. Organized to provide a showplace for products of the world's markets, the Fair has much to interest all who make their living in the expanding field of electronics. The Book Section in this issue is devoted to the part our industry plays at the Fair.



# Heigh Ho... COME TO THE FAIR!



## A revealing look at modern electronics the world over

by Forest H. Bait

On April 22, 1964, in a large ex-swamp called Flushing Meadow near New York City, an exposition began that, for sheer complexity, almost overwhelms the imagination. The opening of the New York World's Fair, a gigantic international exchange of culture and technology, introduced an electronic era of trade and cooperation unknown in the annals of history. The Fair's deep commitment to electronics is affecting the lives and thinking of consumers, manufacturers, distributors, and those responsible for maintenance and servicing all over the world. Significant are the varied electronic devices being used in some of the most impressive exhibits on Flushing

ing Meadow. The Fair has a futuristic format, and everywhere the visitor turns he finds applications of electronic skills and techniques.

He sees, however, only a comparatively small part of the total electronics picture. Hidden from his eyes are thousands of electronically controlled devices doing jobs that until recently have been suggested only in science fiction.

On display and behind the scenes, this 1964-65 World's Fair has an impressive collection of many electronic miracles of this exciting age. To examine every electronic application at the Fair would require compilation of a large book, but the ingenuity revealed in that book would be a tribute to the cumulative efforts of some of today's most talented electronics engineers. Furthermore, keeping these hundreds of electronic "gadgets" in operation 12 hours a day, 7 days a week, demands the abilities of some of the best troubleshooting experts in the world.

Your PF REPORTER editors recently visited the Fair to bring you a first-hand report. We saw electronics on display, electronics being used to activate and control other displays, and electronics at work in the complex administration of this 646-acre tract where thousands of people move in every direction, from pavilion to pavilion, in a continuous throng. We were awed by the apparently limitless ways in which the use of electronics is making the 1964-65 New York World's Fair more impressive. Come along with us now, and we'll

take you on a word-and-picture tour of the Big Fair, pointing out those features of particular interest to the electronics-minded visitor.

## Color TV Center

Gate 1, the main entrance for most Fairgoers, opens directly in front of the RCA Color TV Communications Center, as you can see from Fig. 1. RCA plays a many-faceted part, providing dozens of services for the overall operation of the Fair and widespread facilities for broadcasts originating within the giant Fairground. The ultramodern RCA building is laid out in the shape of three large cylinders on a 30,000-square-foot plot.

In the part of the exhibit that comprises the first cylinder, the visitor can stand in front of a live color television camera and see himself in both front and side views. For the 600 persons-per-hour who visit the RCA exhibit, however, the principal attraction is a guided tour of an operating TV-broadcasting studio and control room, contained in the other two cylindrical sections of the building. The studio and control room are surrounded by a glassed-in elevated walkway that completely encircles the extensive facilities. Through the glass, visitors can see action in both the studio and control room. They can watch every move of the directors, producers, and control operators, observe cameramen dollying in and out, and view, on several monitors, the results of those activities. They can also see how shows are taped, played back, retaped, and edited. All programs can be viewed on monitors located throughout the building.

Programming in the circular studio includes interviews with famous personalities visiting the Fair, style and fashion shows, cooking demonstrations by world-famous chefs, and special performances. Some programs are developed expressly for the entertainment of Fair visitors; some are also rebroadcast over WNYC-TV, New York.

To serve the Fair itself, the studio and control-room facilities will soon become part of the world's largest CCTV system consisting of 300 color receivers situated throughout the Fairground. Features of this system will include an-



Fig. 1. Main gate entrance to World's Fair.



Fig. 2. Demonstration of education methods.



Fig. 3. "Floating wing" of the Bell System.

nouncement of VIP arrivals, short segments concerning history of the Fair, details of important exhibits, spot news developments from various points on the premises (picked up remotely by a complete mobile color-TV studio), aid in locating lost articles, suggestions on how to travel around the Fairground, where to dine, and many other helpful highlights.

The RCA color CCTV facilities are also used, in cooperation with the Pinkerton police who patrol the Fair, to restore missing children to teachers or parents. Lost children are brought by uniformed Pinkerton men to the color studio where their picture is broadcast over the Fairgrounds system with instructions for reclaiming them.

An impressive array of television station equipment fills the racks and panels of the control room. Three video tape recorders stand ready to record any of the program material for rebroadcast at any time, and elaborate video- and audio-control consoles permit broadcasting or recording any form of AM, FM, or TV show. In the circular studio, illumination is provided by the very latest *Klrig* lighting equipment. Thus, color-sensitive electronic eyes serve the Fair from the most modern color-TV center ever built.

### Computers on Parade

Our next stop is the *National Cash Register* pavilion located in the Industrial area of the Fair where it faces the Court of the Moon. As you may suppose, electronic computer systems play an important part in this exhibit, with the Model 395 all-transistor system receiving the spotlight. To demonstrate their feature computer, NCR hosts ask visitors to choose any number, which the computer immediately expands into a 25-place square of 5 columns and 5 rows. Figures in both the columns and the rows can be totaled in any direction to equal the number initially chosen. A diagonally totaled number also equals the starting figure.

An NCR information-retrieval exhibit supplies automatically teletyped answers to questions selected by visitors from a prepared chart. When a button that corresponds to the question is pressed by the visitor, the readout typewriter types out the answer.

National Cash Register has also done other research, some of special interest to the television industry. For example, the NCR display demonstrates—through a magnifier—a TV picture displayed on a 1/16" television screen. This is, of



Fig. 4. Voice patterns are on video monitors.

course, a bit too small for even the tiniest portable imaginable, but the precision required, in the phosphor coating and in the sweep system, to achieve a clear image on so tiny a surface is impressive. No doubt this CRT will open up important advances in high-resolution TV receivers.

Walking toward the Pool of Industry, we arrive at the pavilion of *International Business Machines* and join a group waiting to assemble on the "People Wall" beneath the 90-foot-high "egg" theater.

The IBM exhibit was designed to give the average Fairgoer an insight into complex computer operations. Short plays, puppet shows, and films shown in the pavilion are used to dramatize the story of computer development. The 45' "Wall" lifts us into the theater where we are shown nine films devoted to man's thought process and how he has developed computers to do certain portions of his thinking. The concepts established in the films are then reinforced by several mechanized puppet shows, staged on the floor below, that dramatically demonstrate the logic of computers in a most entertaining manner.

### Electronics for Learning

As we walk around the Promenade of Industry, our next stop is the Hall of Education. Housed in a 50,000-square-foot building facing the Pool of Industry, this enormous exhibition hall contains dozens of booths and display cabinets showing present trends in education and presenting futuristic concepts of what



Fig. 5. Anechoic chamber in the Bell exhibit.

schools, classrooms, and teachers will be like a few years hence. Interest in the Hall seems to center around the recently completed Communications Demonstration Center (Fig. 2), symbolized by the catchword "Educom." Coordinating the installation and operation of the complex electronic system in this exhibit is *Visual Electronics Corp.*, New York manufacturer and distributor of broadcast and communications systems and equipment.

Many of the audio and visual teaching techniques we see demonstrated here are already being used in classrooms around the country, while others soon will be. A few are in the experimental or advanced-planning stages, but all are technologically feasible; their usefulness and practicality are being tested in actual classroom and home-teaching situations.

Obviously, an undertaking of this size requires the efforts and products of many companies. The Communication Center's electronic equipment utilizes audio devices built by *KRS Electronics*, *McCurdy Radio Industries*, *Comrex*, *Electro-Voice*, and *Harmon-Kardon*. Video equipment includes that of *Visual Electronics Corp.*, *Conrac Div.* of *Giannini Controls*, *GPL Div.* of *General Precision Instruments*, *TeleMatron, Inc.*, and *Jerrold Electronics*. Film and slide equipment comes from *Fairchild Camera & Instrument*, *Graflex*, *Bell & Howell*, *Bodde Screen and Projector Co.*, *Radiant Mfg. Co.*, and *Spindler & Sauppe*; studio equipment from *Machronics*, *Century Lighting*, *E. J. Baughman Co.*, and *Emcor*; and test equipment from *Harmon-Kardon* and *Tektronix*. This impressive list of manufacturers illustrates how important electronics will be in the classroom of the future. Electronic teaching aids include a special programmed-learning student-response system produced by *Edex Corp.*, a dial-controlled learning system from *Chester Electronics*, and a "Language Master" teaching machine from *Bell & Howell*. *WNYC-TV* has provided facilities for the radio and television studio. In all, the Center is a real tribute to the cooperation of participating manufacturers.

In addition to classroom demonstrations, visitors to the Center will see how education and instruction can be extended into the home or into multiple classrooms via special pushbutton automation. Employing a device called the "StudySphere," an individual student can receive highly personalized instruction at home. Furthermore, a single student (or several) can receive personalized instruction through television—closed-circuit or aired. With ETW stations springing up all over the country, such programs not only are possible, they are actually in use. Some are received and studied at home, and some at school; many can be studied both places.

### A Study in Communications

Another pavilion of interest for its electronics is that of the *Bell System*. Dominated by a 140' microwave tower, the "floating wing" structure (Fig. 3) sits on a 2½-acre plot facing the Pool of Industry. At the base of the tower, a glass enclosure permits passersby to inspect racks that contain microwave

relay equipment used to transmit Fair-originated TV programs into New York City. The Bell microwave tower and control-room facilities serve both the RCA and Hall of Education exhibits when live shows are relayed to New York for taping or rebroadcasting.

A "ride" in the Bell exhibit takes the visitor past some 50 scenes from the history of communications. A separate taped-sound system in each of the 1000 continuously moving chairs is piped to the passenger via adjustable earphones built into the chair. Each playback machine is synchronized to provide the visitor with a commentary on each scene as he passes by.

Of far greater interest to the electronics-minded Fairgoer is the exhibition hall in the lower level of the Bell building. Bell has developed some unusual ways to demonstrate various phenomena associated with electronics—devices such as the "visible speech" demonstration (Fig. 4), a combination of graphic displays that show various effects that can be produced by the voice of the demonstrator. We enter this lower hall through an acoustical lock (Fig. 5) that demonstrates how an anechoic chamber deadens sound by eliminating all reverberation.

A real crowd-stopper in the hall is a group of booths where the visitor can actually use one of the experimental "Picturephone" systems—Fig. 6. The unit shown also contains "Touch-Tone" dialing (a feature incorporated in all telephones at the Fairground) and the hands-free "Speakerphone."

The "Picturephone" contains only two tubes—a 1" vidicon camera tube and the 6" CRT picture screen. Transistors handle all the rest of the work inside this miniature CCTV system. The vidicon has an f/1.9 lens with a focus range of 29" to 48", covering a field 12" x 16". The receiver section displays a reasonably defined picture, scanned "on end" at 275 lines per frame, 30 frames per second. The system requires a three-pair cable with a bandwidth capability of about .5 mc—not bad considering the definition; one pair is used for audio transmission and two pairs for video.

Other Bell exhibits include: demonstrations depicting lasers and masers, solar batteries, satellites, computers, transistor development and manufacturing, logic and memory games in which the visitor can participate, testing and quality-control devices for telephone manufacturing, a special wave-behavior exhibit, and underseas cables that use time-diversity techniques for increasing the number of simultaneous messages that can be handled by one cable. A colorfully lighted display reveals the complexities of telephone networks to the nontechnical visitor.

### Electrical Progress

Another short walk around the crescent-shaped Promenade of Industry, which partially encircles the Pool of Industry, brings the visitor to another giant electronics exhibit, that of the General Electric Co. Their building alone is noteworthy—a self-supporting 80' dome (Fig. 7) that uses, for the first



Fig. 6. "Picturephone" communication system.

time, special "curvilinear lamella" construction techniques. At night, colored lights on the dome blink on and off in a tape-programmed sequence that gives an observer the impression that the entire dome is revolving.

Inside, the visitor is treated first to a ride in G-E's "Carousel of Progress." The "Carousel" is a huge circular auditorium, divided into six 250-seat sections, that revolves around five stages. The first stage, the loading area, contains a gaily lighted screen that changes color in time with music. Once everyone is seated, a process that takes approximately four minutes, the huge merry-go-round whisks around to the second stage to the tune of the "Progressland" theme song—"There's a Great, Big, Beautiful Tomorrow!" A four-minute show portrays living conditions during the 1880's, prior to the development of regular uses for electricity. The play is acted out by amazingly lifelike figures, created by Walt Disney and called "audio-animatronic" people. The figures are deceptively realistic—their eyes blink, lips move as they talk, fingers twitch occasionally, heads turn, feet tap out musical time; "mother" irons, and the dog even raises his head and growls.

To the accompaniment of the theme tune, sung by Rex Allen, whose voice is also heard as "father's," we are transported around the remaining third, fourth, and fifth stages, stopping four minutes at each to view the electrical side of life in the 1920's, 1940's, and finally the mid-1960's. At the sixth stop, we all disembark and are carried up a moving "time tube," to walk along a hall where kaleidoscopic mirror effects (also arranged by Disney) show over 100 photo-scenes relating to research being carried on by G-E scientists.

The mirrored hall leads to a darkened area where we lean back to watch the "Skydome Spectacular," a show projected on the domed ceiling of the build-

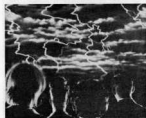


Fig. 8. Realistic storm projected on dome.



Fig. 7. Lighted dome seems to spin at night.

ing. The effects created are spectacular: lightning flashes, thunder rumbles and then crackles startlingly; the crowd actually shivers as a storm that seems to stretch as far as the eye can see is unleashed on the screen (Fig. 8). The storm is replaced by the searing flames of the sun, and the flames give way to spinning atoms that move across the "sky"; the narrator explains the tremendous power unleashed by nature and suggests that man has learned to do the same.

Then, to see proof of the point, we are lead down a ramp to witness an actual demonstration of the controlled fusion of deuterium atoms. To produce the reaction, a bank of capacitors is charged to 60 kv, and deuterium gas in special quartz enclosures is preheated to a dull glow. Following a dramatic countdown, the capacitors are discharged through two coils positioned around the quartz tubes. The pulse sends about one million amps through the coils for part of a microsecond. We involuntarily jump at the sudden sharp report and the blinding flash as the deuterium atoms fuse at temperatures as high as 100,000,000°F. The fusion reaction itself takes about six microseconds, too short to be dangerous but long enough to release significant and measurable neutron energy.

Downstairs, in a model all-electric community called "Medallion City," visitors can see: "Steinmetz High School," where CCTV and audiotape (language-lab-type) teaching machines tutor students in an electronically climate-controlled classroom; "City Hall," where two-way radio, CCTV, automated traffic control, and automated highspeed transit systems make city life safer; "Coolidge Hospital," where medical electronics, X-ray, and two-way and CCTV communications networks are saving lives; and modern homes where electronics is contributing to greater leisure.



Fig. 9. Video switching panel for GE CCTV.



Fig. 10. Fountain of Planets erupts to music.

While the "show" at G-E is meaningful, the real electronics spectacular is behind the scenes, where some of the most advanced techniques are at work. The heart of the giant "Progressland" display is a GE-225 computer that programs the proper sequence of up to 1400 separate actions. Four tape machines, built by Precision Instruments Corp., handle automation for the audio-animatronic figures and for the "Skydome Spectacular." Using 1" magnetic tape, preprogrammed with 32 tracks per tape, two of these machines alternate in operating the entire "Carousel" system. When the first machine finishes the sequence contained on one tape, an automatic switchover sensor places the other machine in operation while the first rewinds.

Some of the 32 magnetic tracks contain the recorded voices of the audio-animatronic figures and other sound effects, including the theme song and the growling dog. Other tracks contain audio-frequency impulses used to actuate pneumatic and hydraulic valves in the figures; flexible tubes and other mechanical devices expand and contract as fluid and air are sent into and out of them, causing lifelike movements and changes of facial expression. Similar recorded tape pulses control lighting, movement of the carousel theaters, and scenery changes on the



Fig. 11. As music changes, so do fountains.

stages, thus providing control of the entire six-step "show" from one tape. The other two 32-track tape machines alternate with one another to control the projectors and provide sound effects for the "Skydome Spectacular."

All this would seem like enough electronics for one exhibitor, but there is more. A 20-camera closed-circuit TV system keeps an electronic eye on various entrance ramps and areas in the "Progressland" pavilion. Video switching panels and monitors in key spots (Fig. 9) show one monitoring console) enable G-E personnel to keep track of what's going on. In the event of trouble with the huge carousel theater, the system would facilitate orderly control and evacuation of the crowds.

At various exits and entrances to the giant dome, Pinkerton security guards are equipped with tiny hand-held walkie-talkies. Just another use for electronics at the Fair. . . .

### Musical Showers

Leaving the giant dome of G-E "Progressland," we discover that darkness has fallen. As we step out along the Promenade of Industry, huge fountains in the Pool of Industry suddenly erupt, sending colored sprays of water high into the air

—Fig. 10. Thus begins another breathtaking display of the "Fountain of the Planets," a musical ballet of colored fountains (Fig. 11) accented by periodic showers of fireworks.

This colorful performance of the largest fountain ever built is totally automated. The music, the changing spray patterns, the changing colors (including a true flame color achieved by using actual flames), the fireworks, are all controlled by tone pulses on one track of a two-track RCA audio tape machine. More than 500 separate effects are turned off and on several times during the 30-minute performance. The other tape track contains a half-hour medley of well-known tunes specially recorded for the display by a 60-piece orchestra.

A bank of RCA amplifiers drives one of the most unusual speakers ever built. Weighing 3½ tons, this giant 16' speaker radiates some 10,000 watts of audio power upward and outward to accompany the dancing fountain. The speaker is shaped like two huge metal saucers joined bottom-to-bottom by three circular tiers. Each tier contains 16 cast-aluminum horn sections with separate drivers. The 48 horns in this unusual design radiate sound in a powerful vertical "mushroom" that enables listeners to hear almost as well at 600 feet as at 300 feet.

### Satellites

After a night's rest, we start another day by entering Gale No. 3, the Peter Stuyvesant Gate. The first display we encounter contains several types of earth satellites (Fig. 12): communications satellites Echo II, Telstar, Syncom, Relay, and the weather satellite Tiros. Of particular interest are the solar cells used to power these electronic denizens of outer space.

### Behind the Scenes

A short walk up the Avenue of Science brings us to the Ford Motor Co. exhibit. In the lobby, visitors file past Ford's ten "International Gardens" displays, tiny replicas of communities in different countries. In each, the theme song of the Ford display can be heard—in perfect harmony with all other "countries," except that the music is being played with instruments in the style of that particular country. As in many exhibits at the Fair, the electronic devices in this pavilion are mainly behind the scenes; instead of being on display, they control the special effects to dramatize other facets of the past, present, and future world.

Upstairs in Ford's electronics control room, we find two Precision Instrument Co. recorders (left side of Fig. 13), similar to those being used in the Disney audio-animatronic display at G-E. The units here are of 14-track configuration, threaded with "Scotch"-brand 1" magnetic tapes, and are used to provide synchronized sound for the "International Gardens." Two units are used alternately for continuous operation; a blank spot at the end of each tape automatically triggers the changeover

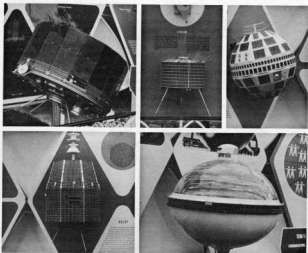


Fig. 12. Communications and weather satellites form a very modern electronics display.





Fig. 13. Amplifiers and 14-track tape units.

switch on the standby tape machine and allows the first to rewind. Banks of 70-watt RCA amplifiers (Fig. 13) provide sound power for all the systems in the building, including the audio-animatronic figures in scenes along the Ford "ride."

The visitor rides through this display in a driverless brand-new Ford-built convertible, which is pulled along a guide track. Narration for each segment of the exhibit is prerecorded on continuous-loop cartridge tapes; a playback machine is mounted in the trunk of each auto (Fig. 14). These playback units are "Wayfarer" machines, built by Taiko, and are similar in appearance to Viking units. They have been specially converted to four-track playback by Paul Colosimo of City Animation Co., Detroit. Tapes are wound in *Fidelipak* cartridges, with the narrative on each of the four tape tracks recorded in a different language—English, French, German, and Spanish—to accommodate the international audiences. Passengers in each convertible, by depressing the appropriate pushbutton on the car "radio," can choose whichever track (language) they understand best. As the visitor rides past a scene, the tape machine runs to the end of the narration about that scene and stops. When the next scene is approached, a microswitch beneath the car passes over a trigger, actuates the machine, and the next recorded sequence begins.



Fig. 14. Narration is from cartridge tape.

The diorama contain audio-animatronic figures that are not quite so lively as those at the G-E pavilion, but are certainly realistic. Their sounds, and those of various prehistoric animals that accompany them, are recorded on four-track cartridge tapes. They are played back on KRS "Stact" tape machines (upper right, Fig. 13), amplified in RCA amplifiers, and fed to speakers in the various scenes via 70-volt distribution lines.

### Below the Surface

In the next exhibit we visit, electronics plays secondary but admittedly important roles. The Underground Home, built and operated by *Underground World Home Corp.*, is exactly what its name implies—a complete dwelling beneath the ground. In almost every room we see G-E television receivers, including a color set in the living-room entertainment center. TV signals are picked up by a *Channel Master* antenna mounted above ground, amplified by *Channel Master* and *Winegard* amplifiers, and distributed among the six rooms by *Viking* RF tapoffs. The living-room entertainment center also contains complete stereo tape, stereo phono, and AM-FM-Stereo receiving equipment built into the wall and covered by folding doors. An electronic organ built by *Thomas Organ Co.* is but one more piece of electronic equipment the service technician will find in this home of the future. Connecting various rooms of the house is an intercom system, with the master unit mounted beside the kitchen TV set.

A most unusual lighting system offers some very realistic lighting arrangements; silicon-controlled rectifiers are used in the controls. From the master panel, "outside" patio lighting can be made to simulate bright daylight, comfortable twilight, or nighttime—with or without stars and moon. An interesting lighting effect is used in the kitchen ceiling—a "skylight" (Fig. 15) that is actually 15 feet below the earth's surface; an SCR control adjusts the amount of "daylight."

Electronic controls maintain an even climate in this all-electric home the year around. The insulating qualities of the surrounding earth help keep heating and cooling bills well within reason. This home of tomorrow provides further evidence that the technician of the future is going to find plenty of new equipment to maintain and service; he'd better keep up-to-date with advancements like these.

### Leave the Driving . . .

Moving on around the Avenue of Transportation, we next encounter the *Socony-Mobil* pavilion where visitors can test their driving skill in a simulated "Economy Run." Thirty-six test units, complete with bucket seats, steering wheels, accelerators, brakes, and speedometers, allow drivers to test their reaction to several driving hazards during a four-minute test run. Most visitors, however, fail to realize the amount of electronics equipment that makes the test possible. A few statistics: the system contains over 4200 light bulbs, 2500



Fig. 15. "Skylight" is SCR-controlled lights.

transistors, 100,000 feet of wire, and over 600 rheostats, relays, and micro-switches. The units were designed and built by *Dramaturgy, Inc.* of Cleveland, and *Dage Television Co.* of Michigan City, Ind.

Drivers view the road by means of Dage CCTV monitors placed at windshield level. On the screen, various filmed traffic situations are shown. Drivers react to such things as train gates, approaching cars weaving in and out of traffic, careless pedestrians, and stopped school buses. Potentiometers connected to the steering wheel, brake, and accelerator keep track of motions made by the test driver. These motions are factored in a computer to find an average score, which is shown to the driver as "miles per gallon."

In the control center, two Dage television camera film chains run in exact synchronism, one for the test and another for "crash scenes." If a driver in any situation exceeds certain limits of safety, a relay trips and his monitor is switched to a crash scene for that particular situation. Both films have optical sound tracks to provide realistic road noises, crash noises, etc. An additional magnetic track contains perfect-driver reference information that is compared, in the computer, with the actions and reactions of the test "driver." These "perfect" reactions were prerecorded by an expert test driver under actual driving conditions over the course from which the filmed scenes were taken.

### Future Living

Since we couldn't brag about our scores to "drivers" waiting to take the test, we crossed the Avenue of the United Nations to the *General Motors* pavilion (Fig. 16)—a huge structure that in profile looks like a jet airliner.

The theme of GM's exhibition is "Futurama," and the visitor transport system



Fig. 16. "Futurama" pavilion lit up at night.



Fig. 17. Color set is converged with mirrors.

takes the Fairgoer through a series of imaginative but plausible "cities of the future." Men at work on the moon, a community in Antarctica, a gigantic roadbuilder in the jungle, ultramodern cities within cities under a single roof, a continent-wide system of ultraspeed highways, a complete series of settlements on the bottom of the ocean—are all shown in amazing detail. The "tour of the future" utilizes an endless loop of seats, three abreast, continuously moving past three-dimensional scenes. The narration is recorded on tape, and the playback machines each serve about nine seats. As with displays visited earlier, the tape playback is synchronized with the movement of the seats past each scene. The sound comes from speakers built into the "wrap-around" chairs, approximately at ear-level.

### From the Orient

A long walk up the Avenue of the United Nations brings us to the Japan pavilion next to Eisenhower Promenade, near the Fountains of the Fairs. On the second floor of this building is the largest single visible display of electronics equipment at the Fair. Participating in this exposition that showcases nearly every facet of the Japanese electronic industry, we spot the following companies immediately: Sony Corp., Sanyo Electric, Inc., Nippon Electric Co., Hitachi, Tokyo Shibaura Electric Co., Ltd., Nivico (Victor Co. of Japan), Matsushita Electric Corp. of America, Mitsubishi Electric Corp., and Japan Electron Optics Laboratory Co., Ltd.

Attracting considerable attention in



Fig. 18. Sixteen-inch rectangular color set.

the Mitsubishi booth was a small-screen color TV receiver (Fig. 17). Most small-screen color sets aren't too unusual, but the approach to color used in this set is. Three CRT's with filters are used, one for each of the three basic colors—green, blue, and red. Dichroic mirrors superimpose the three images in the same plane, and the viewer sees only a single image converged on the viewing reflector. The interior is not displayed so we can't see just how convergence is accomplished, but it would seem slightly complicated; vertical and horizontal size and linearity must be precisely the same on all three CRT's, and mechanical positioning of the mirrors would seem quite critical. The converged image is recessed in the unit, as you can see from the photo of Fig. 17, thus narrowing the viewing angle from which the image can be seen.

Behind us, as we watch the small color set, other visitors are watching a wall of tiny receivers—a bank of 6" portables of the type being marketed in the U.S. by Singer Corp. Most of the sets we see in this display are equipped for UHF reception in accordance with the recent All-Channel Law. Apparently the Japanese have been preparing for the April deadline the same as have U.S. manufacturers. The UHF tuner is attached to the bottom of the set.

Mitsubishi has other electronic products on display: transistor AM, FM, AM-FM, shortwave, longwave, and multi-band receivers—both portable and home-type—and several models of CB receivers and transceivers.

Moving again, we spot several other color receivers (Figs. 18, 19) of the 16" rectangular variety being introduced to the U.S. market by Japanese manufacturers. Some of them could not be inspected internally, but they all seem to be similar except for cabinet design. We stop for an inside look (Fig. 20) at the one made by Victor Co. of Japan (JVC or Nivico). Several points are noteworthy: The controls are arranged similarly to those in American sets; even the convergence panel looks familiar (upper left in Fig. 20). There are three screen and two drive controls for the three-gun CRT, and a service switch for setting up. Three convergence magnets and coils are arranged around the CRT neck, and we notice the blue gun is at the bottom instead of on top as in the U.S.-made sets.

Some Japanese manufacturers tell us these sets are not ready for market yet, but certain U.S. importers have announced their intentions of selling them by late this summer. We see no evidence of a set using the two-gun Chromatron picture tube; apparently it isn't at the Fair yet.

Another interesting device at the Nivico booth is the video tape recorder shown in Fig. 21. Very little information about the unit is available, but its size is relatively small compared to the units we saw in the Communications Center. We can't see it in operation, so it is difficult to appraise its capabilities.

Further along the aisle, Hitachi displays (Fig. 22) a wide variety of elec-



Fig. 19. Except for size, appears like ours.

tronic parts, especially transistors and tubes. In addition to semiconductors for almost every application, we see several nuvotrons built by them, and klystrons and vidicons for industrial electronics. Some vidicons are of broadcast quality.

The Toshiba (Tokyo Shibaura) booth includes another of the 16" color receivers, some black-and-white sets (suspended on pipes from the ceiling), and several transistor stereo radio and phono sets. Along the walls, a display of parts built by Toshiba features a storage tube whose phosphor can hold a still picture for several hours and then feed it into a TV set for as long as 30 minutes. The unit resembles an image orthicon tube. A small transistorized television camera, auto radios, tape recorders, and some small electrical appliances round out the Toshiba exhibit.

In addition to the color receiver shown in Fig. 18, Matsushita Electric is displaying several models of tape recorders, stereo hi-fi units, radios, and black-and-white TV sets, including their "Mitey-9" transistor portable TV. Under the brand-name "Panasonic," electronic products by Matsushita are being distributed all over the U.S., particularly in the Midwest.

Across the aisle, Sanyo Electric, Inc. is displaying a variety of home-entertainment products that encompasses electronic organs, advanced-design portable radio-phonos, auto radios, stereo sets, kitchen appliances, and transistor radios. Also prominent in the booth is a placard by Channel Master of Ellenville, N. Y., displaying a couple of the transistor portable radios built by Sanyo and distributed by Channel Master in this country.

Undoubtedly the largest electronics booth in the Japanese pavilion is that of Nippon Electric Co., a giant electronics company of Japan. A small part of the booth can be seen in Fig. 23.

In addition to the usual transistor-radio products (which are strangely incon-



Fig. 20. Inside of 16" Japanese color TV set.





Fig. 21. Video tape recorder with controls.

spacious in the exhibit), NEC builds electronics equipment of a most exotic nature. In the background at the right of Fig. 23 can be seen a large computer; telephone equipment is displayed along the front table. A tiny TV camera (Fig. 24) permits the passerby to see himself on a closed-circuit monitor at the rear wall. Also on display (Fig. 25) are several unusual medical-electronic devices, among which are: a heart-rate telemeter that can be strapped directly on an athlete while a receiver reports his exact heartbeat to the trainer or physician; an echo-type encephalograph, a device for measuring brain condition; special telemetry capsules that can be swallowed by a patient, after which a data receiver records temperature, acidity, and other body functions transmitted by the capsules.

Literature available at the NEC exhibit tells of microwave, broadcast, coaxial cable, power-line carrier, shortwave, mediumwave, and longwave equipment NEC has in operation all over the world. The company is also taking an active part in research relative to space communications, computer technology, and other modern electronic developments.

Sony Corp. features its new "Video-corder," a lightweight video tape recorder that they hope will open up the field of home video recording. It is designed to be used with its own camera to record video information directly, much as the home recordist tapes audio sequences with a microphone; or it can be used to record video programs received from other sources. At a speed of 5 1/4 ips, a 7" reel of 2" video tape will hold one hour of television picture and sound. Two recording heads are used to record on the 2" magnetic tape.

Another item of interest is a 30,000-power electron microscope. This advanced research device, being displayed by Japan Electron Optics Laboratory Co.,



Fig. 22. Semiconductors, tubes from Japan.

Ltd., combines the arts of optics, electronics, and photography to accomplish an almost fantastic degree of magnification. The microscope is contained in a cabinet that takes little more space than an ordinary office desk and weighs only 390 lb.

## Electronics Everywhere

Even the most casual visitor to the New York World's Fair will find electronics at work all over the Fairground. In addition to the many huge exhibits we've already described, you will find electronics in the most unexpected places. For example:

Ten tower-mounted clocks located over the Meadow will keep Fairgoers informed of the time and serve as easily found meeting places. These aren't ordinary clocks, however; they are slaves to a highly accurate crystal-controlled master clock similar to those used in broadcast stations all over the country. These at the Fair are part of a *Favag* system, installed by *Visual Electronics Corp.* From the master clock in the Timing Center at the Swiss pavilion, timing pulses are sent to the ten slave clocks, keeping them accurate within microseconds.

In the Billy Graham pavilion, Fairgoers can hear evangelist Graham's message in any one of six languages. Pushbuttons in the armrests of the seats select the desired language—truly an international place of worship.

In the Illinois pavilion, another of Disney's audio-animatronic creations, a lifelike figure of Abraham Lincoln, delivers a moving speech on Liberty. Stereo music, tape-controlled lighting, and the tape-controlled figure are all electronically activated—as is the closing and opening of the theater doors.

In the U.S. pavilion, a point of interest is the Audiovisual Learning Center (Fig. 26). In a "Study Station" booth (pictured at left), a student can be seated facing a control panel and TV screen. Programmed study courses are projected on the screen and through speakers in the booth. The student responds via the control panel, and computers test his answers and accept or reject them and offer remedial supplementary instruction, if required. In short, the "Study Station" system can do almost everything a teacher can do.

TV technicians will probably recognize the *B & K* Model 1076 TV Analyst in the equipment rack at the right, which is used to transmit the video from slides for the Study Station. Video tape recorders by *Ampex Corp.*, video monitors by *Minatrel Electronics, Inc.*, video distribution panels by *Anzac Electronics, Inc.*, scopes from *Tektronix, Inc.*, video and audio tapes from *Minnesota Mining & Mfg. Co. (3M)*, and various other equipment from *Maryland Telecommunications, Inc.*, *North Atlantic Industries, Inc.*, *Pendar, Inc.*, and *Temple Sound Equipment*—are all incorporated in this working exhibit of the most advanced audiovisual teaching methods. Electronics all the way!

A modern library in the same pavilion



Fig. 23. A portion of the NEC exhibit booth.

uses computer techniques, similar to those we saw at the NCR pavilion, to show how easily information can be found. Books, trained librarians, and a *Univac* information-retrieval system offer a ready reference service to World's Fair visitors. Some 2000 standard reference books have been used to compile information in the computer storage system. If a system like this were programmed centrally with all knowledge that presently exists on any particular subject, "branch" readout systems located at colleges and libraries all over the country could have research information available almost instantaneously. Something to think about . . .

## Everybody's In the Act

As the host country, we might seem to dominate the Fair. Such is not the case. Dozens of countries and companies are participating, and many are showing electronic products.

In the Austrian pavilion, visitors can view Austrian electronic products mounted inside plastic bubbles. One company that is well known to American broadcasters—*AKG of Vienna*—has a display of their most popular microphones.

Sweden has a spectacular demonstration in their pavilion, showing effects that must be overcome in ultra-high-voltage power transmission, a system they have developed considerably. They also have on display telephone and communications equipment built by *Ericsson*, one of Sweden's largest electronics companies.

Mexico has one tier on their second floor devoted to an exhibit of electronic products from Mexico. In a nearby pavilion, India displays electronic meters



Fig. 24. Small camera amuses NEC visitors.



Fig. 25. Several medical electronics units.

and cables manufactured in their country. These exhibits are informative to the Fairgoer who isn't accustomed to thinking of these countries as having significant electronics industries. Faraway places of the world are getting closer to home all the time!

The Singer Co., although famous for its sewing machines, has only recently emerged as an electronics manufacturer and distributor. In their huge pavilion at the Fair, we see home entertainment products made by their recently purchased KHL Electronics Div. and some more of the small-screen transistor TV sets imported from Japan and marketed here by Singer. Several Sylvania Model 800 CCTV systems are also in evidence to allow visitors at the pavilion to witness sewing demonstrations. Other Sylvania cameras are placed so visitors can see themselves on TV—Singer TV, naturally.

The Travelers Insurance pavilion uses stage projection equipment and relay-controlled lighting—all controlled by magnetic tape—to present their "Triumph of Man" show, a 2½-million-year history of Man's progress. The magnetic-tape control system incorporates a four-track playback system; one track is used to key the projection and lighting equipment, while the other three carry sound for the show.

Pepsi-Cola Co. has what is probably one of the most intricate and colorful displays at the Fair. Designed by Disney, several hundred foot-high audio-animated doll-children (Fig. 27) represent virtually every country of the world. A

tribute to UNICEF, the exhibit's theme is "It's a Small, Small World." The hundreds of dolls, with changing expressions, flitting eyes, and in perfect harmony, sing the theme song in their respective languages. Passage through the exhibit, by boat, takes the visitor on a memorable simulated tour of the world to the lulling tune of "It's a Small World, After All," written especially for the exhibit. The electronic systems involved in the Pepsi-Cola display are very much the same as those described for other Disney exhibits, although an unusually large number of actions must be controlled; the science of audio-animatronics makes the tiny dolls behave almost like real children.

In the field of electronics, Eastman Kodak is displaying sound-track movie equipment for the home and professional photographer, and is showing a new line of sound tape for both the amateur hobbyist and the professional audio recordist.

### A Last Look Around

Yes, electronics is really in evidence at the Fair. Everywhere we turn, we see some familiar electronics company taking an active part. Some are participating in a big way behind the scenes; others are playing a more direct and equally important part.

As we learn more of what's happening at the Fair—in full view and beneath the surface—these are some of the other electronics participants we encounter: EICO Electronics Instrument Co., Inc., who (at the Pavilion of American Interiors) is demonstrating a special electronic color organ—the "Eicolortron"—that flashes multicolored lights in unison with music played on the instrument, and who has recorded for Fair visitors a cartridge-tape discussion of kit building; JFD Electronics, Inc., whose TV and FM antennas have been chosen for use at the House of Good Taste, Formica House, Eastman Kodak pavilion, State of Florida pavilion, and Hawaiian pavilion; Conrac Div. of Giannini Controls, whose weatherproof TV monitors we discover in some of the most unexpected places; RCA, who has supplied 550 small speak-



Fig. 27. Doll-children of world hail UNICEF.

ers for the World's Fair public-address system and has color TV sets spotted all over Flushing Meadow; Crown International, who has furnished stereo playback machines for several exhibits at the Fair, including some thirty-odd for the Bell Telephone display; Aitec Lansing Corp., who has developed sound systems for more than 15 separate pavilions and exhibits, and who has its own exhibit of stereo playback equipment in the House of Good Taste; Acoustic Research, Inc., (AR, Inc.), whose exhibit in the Better Living Center features their own turntable and speaker systems, along with a tuner, preamp, and amplifier from Dynaco of Philadelphia and cartridges by Shure Bros. of Evanston, Ill.; Reverend Sound Co., Inc., Div. of Reeves Industries, who has devoted much time, equipment, and talent to the development and operation of several exhibits—notably those of Bell Telephone, Eastman Kodak, General Cigar, General Motors, Ireland, S. C. Johnson, Travelers Insurance, United Airlines, and Electric Power and Light. Other electronics and acoustics companies have designed and equipped at least two large auditoriums at the Fair: one at the Texas pavilion and another in the band pavilion facing the Avenue of Progress. Throughout the many theaters involved in dozens of the exhibits, there has been a tremendous amount of acoustical design and consulting, as well as equipment engineering.

Overseeing the security and safety of the Fairgrounds exhibitors and visitors, the Pinkerton's National Detective Agency is using a \$250,000 communications system designed jointly by World's Fair Fire Chief Thomas P. O'Brien and Bell Telephone Co. engineers. In addition to the ordinary communications sets used by regular police and fire departments, the elaborate Pinkerton system has interconnections with public and private telephones all over the Fairgrounds. Special "nixie" lights show the operators and dispatchers the source of any call immediately. The network is one of the most elaborate ever developed for public safety purposes.

### Conclusion

There are probably countless other companies, large and small, taking part in or contributing to electronics at the Big Fair. We've brought you up-to-date on those we've seen so that, on your trip to the Fair, you can be watching and taking note; you'll probably see electronic feats that will surprise you. And you're bound to come away with a better appreciation of just how vast our field is and how effectively electronics is helping to shrink the boundaries of the modern world. ▲



Fig. 26. Study booths in Audiovisual Center give insight to future teaching techniques.