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HISTORY and FACILITIES

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HISTORY and FACILITIES

Electro-Mechanical Research, inc.

EXECUTIVE OFFICES
SARASOTA, FLORIDA

ASCOP DIVISION
PRINCETON, NEW JERSEY

INTRODUCTION

Since its inception in 1941, Electro-Mechanical Research, Inc. (EMR) has maintained a position of technical leadership, through self-sponsored research and development, organizational flexibility, and effective management by engineers and scientists.

In 1959, EMR acquired the Applied Science Corporation of Princeton, which has since operated as the ASCOP Division of Electro-Mechanical Research, Inc.

The following pages give a brief account of the growth, methods of operation, products and services, and personnel of EMR and the ASCOP Division.

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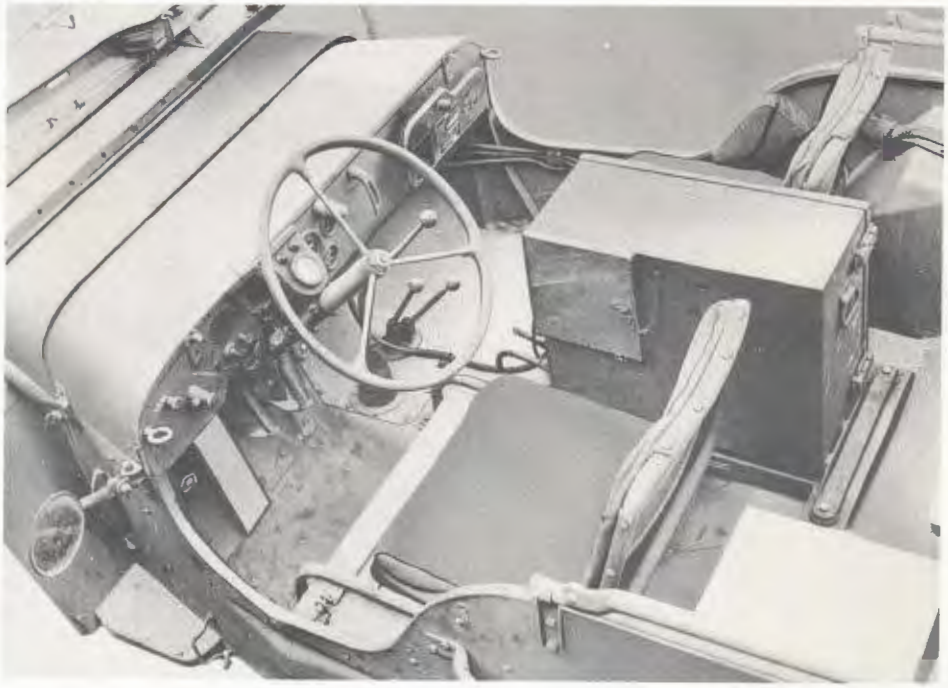
HISTORY

EMR ORGANIZED IN 1941

EMR was founded in the spring of 1941, as a non-profit corporation, by the Schlumberger Well Surveying Corporation of Houston. The primary purpose of the new organization was to conduct research and development for the military establishments, making use of the Schlumberger firm's experience, specialized knowledge, and unique geophysical detection techniques, as a direct contribution to the war effort. EMR activities were initially conducted in the extensive shop and laboratory facilities of the Schlumberger organization.

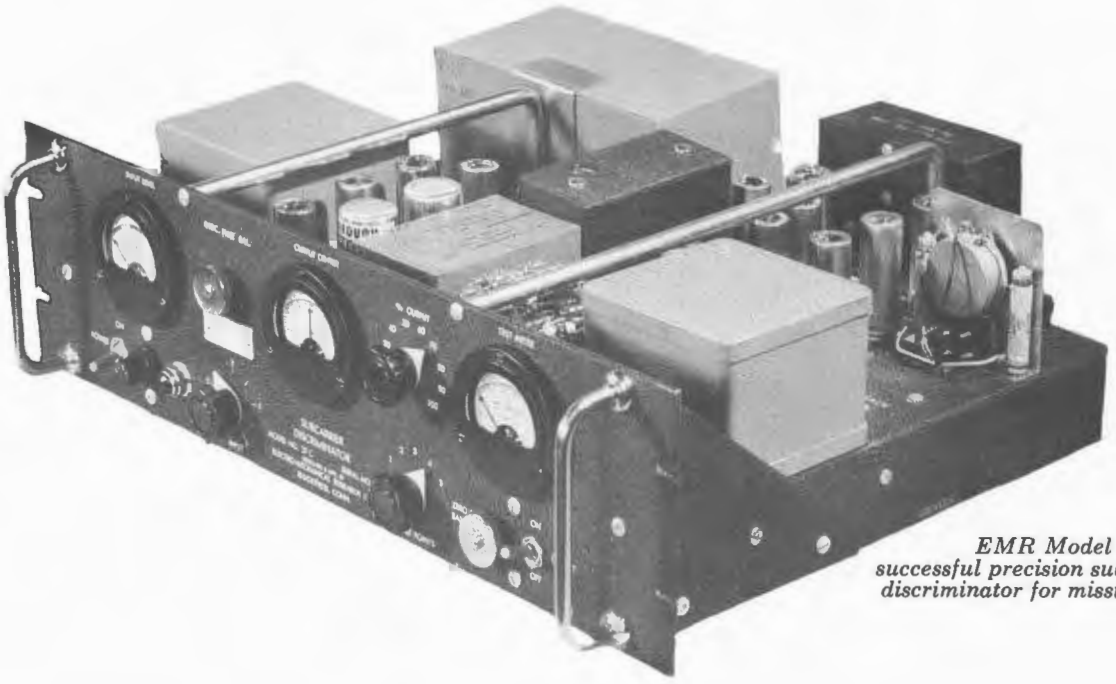


Automatic braking system built by EMR for World War II jeeps.

WORLD WAR II CONTRIBUTIONS

During World War II, company-financed research and development resulted in products used by the armed forces. EMR engineering was responsible for many land and underwater mine detectors as well as pioneer work in infrared detection. A system that automatically stopped jeeps and tanks when they approached land mines was successfully developed by EMR for the Army Corps of Engineers.

HISTORY



EMR Model 27, first successful precision subcarrier discriminator for missile tests.

TELEMETRY LEADERSHIP ESTABLISHED

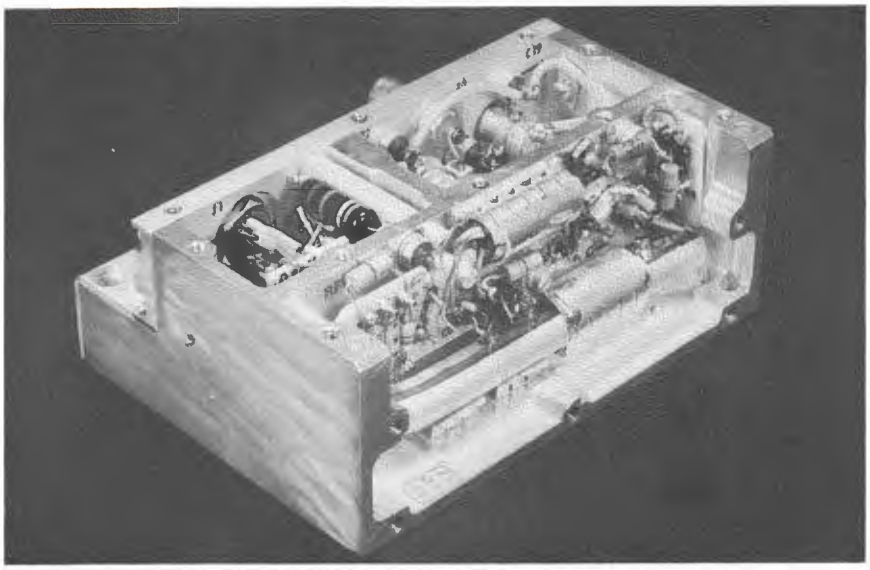
In 1946, following the war, EMR initiated diversified R and D programs in the field of research instrumentation. Notable developments during this period include highly sensitive galvanometers, accurate and stable strain-gage amplifiers, and precision signal generators. Improved degaussing equipment was developed by EMR for the Department of the Navy.

In 1948 the Applied Physics Laboratory of The Johns Hopkins University, which had conducted much of the World War II research in radio telemetry, contracted with EMR to develop a new subcarrier discriminator. Not long after the first design was completed, sample orders were received from other organizations. Evaluation tests proved highly successful, and EMR has been furnishing subcarrier discriminators in ever-increasing numbers since that time. By expanding its product line to include other telemetry equipment, EMR rapidly obtained a strong competitive position. By 1956 the company was employing over 350 persons, and by 1960, over 800.

COMPANY RELOCATES

In January of 1957, EMR began to transfer its operations to Sarasota, Florida. By February 1958 transfer was completed, the new facility was occupied, and employment was higher than it had ever been before.

HISTORY



Unique quartz-line-controlled EMR FM transmitter.

EMR DEVELOPS VHF/UHF EQUIPMENT

Early in 1959 the decision was made to extend EMR operations into the field of VHF and UHF communications. This decision was primarily based upon the successful development —through company-financed research—of new techniques for frequency stabilization. Today, financing its own research and development provides EMR with a stable basis for continued growth and customer service.

EMR ACQUIRES ASCOP

Also in 1959, EMR purchased the Applied Science Corporation of Princeton. For many years, ASCOP has been a major supplier of time-division telemetry. The union of these two companies, with ASCOP operating as a Division of EMR, insures the provision of more comprehensive coverage of over-all telemetry than any other company in the industry. EMR is thus capable of assuming prime responsibility for all phases of large telemetry systems, or supplying individual components of telemetry systems of both the FM/FM and time-division types.

HISTORY

ASCOP Ground Station Equipment used in the Missile and Space Vehicle Department of General Electric.

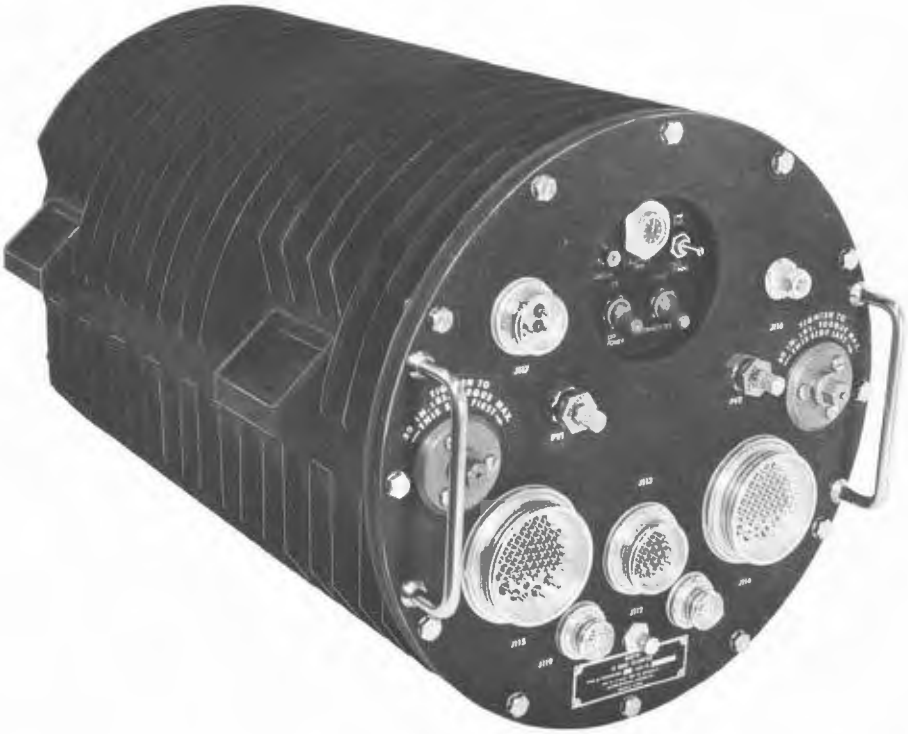
ASCOP HISTORY

ASCOP was founded in 1946 by a research group from Princeton University, which recognized the need to continue important work in telemetry begun at the University during World War II.

In 1947 ASCOP collaborated with the Applied Physics Laboratory of The Johns Hopkins University to conduct an extensive study program, encompassing the entire field of missile telemetry, for the Navy Bureau of Ordnance. As a consequence of this study, which continued until 1953, ASCOP pioneered airborne and ground equipment to exploit the relatively untried techniques of time-division multiplexing.

ASCOP pulse-duration-modulation (PDM) telemetry instruments won quick recognition for consistent performance in a wide range of applications, and ASCOP has since been the chief proponent of time-division-multiplex telemetry. In this period it also designed and delivered one of the first high-speed digital data-handling systems for use at the White Sands Proving Grounds.

HISTORY



The complete FM, PDM telemetry package used by The Martin Company in testing the USAF Titan Missile. The pressurized package contains FM subcarrier oscillators, solid state commutator, keyer and transmitting equipment.

SYSTEMS DIVISION FORMED

The systems' concept has naturally evolved from the continual expansion of EMR's product line to encompass the complete breadth of the telemetry and data processing fields. Integration of EMR equipment with other manufacturer's standard peripheral equipment to form a cohesive system is now a major portion of the company's activities.

In 1960, elements of the Company working principally on systems, and the highly trained systems engineers of the Systems Engineering Department were formally established as the nucleus of a new Systems Division. Divisional objectives were to solidify and strengthen the well-established work in telemetry systems, data processing systems, satellite systems, and similar systems, while building a core of advanced systems specialists of diverse experience for exploring and establishing new areas.

Advanced capabilities of the Division embrace the fields of communications, optics, infrared and ultraviolet techniques, information theory, digital techniques, instrumentation, speech analysis, and guidance and control. The Division handles all systems work of any nature in the Company.

GENERAL INFORMATION

THE COMPANY: ITS LOCALE, POLICIES, PRODUCTS

Electro-Mechanical Research, Inc. has two major facilities. The headquarters of the company, the EMR Division, and the Systems Division, are located in Sarasota, Florida. The ASCOP Division is located in Princeton, New Jersey. Field engineering offices are situated in strategic points throughout the United States.

A young, expanding organization, EMR has already attained an exceptionally sound operating position. This may be attributed to the outstanding accomplishments of our engineering staff and supporting personnel. Engineering is both the point of departure and the underlying foundation of all EMR operations. Continued emphasis on this engineering approach is ensured by initiating within the company the major portion of all research and development, by guaranteeing the excellence of products through comprehensive inspection and testing, and by placing engineers in key positions throughout the organization. This fundamental policy has proved eminently successful in the service it enables EMR to provide.

EMR has a broad base of self-engineered products. More than three-quarters of all sales consist of equipment which is in standard production. The future of EMR is based on a continuation of a policy of technical excellence and product diversification.

Included in the company catalog line are: subcarrier oscillators and discriminators; dc and subcarrier amplifiers; rf equipment; tape-speed-compensation and automatic-calibration subsystems, and electronic commutators. The company offers many other devices and systems for digital, PCM/FM/FM, PAM/FM/FM, PDM/FM and PDM/FM/FM telemetry. The company also produces a diversified group of telemetry and control equipment for industrial applications. Other products include photomultiplier tubes and pressure transducers. Digital transducers — shaft-position encoders — complete the line. More advanced concepts are being applied to the development of equipment for the Space Age.

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ORGANIZATION

Since EMR primarily produces equipments for the acquisition and processing of performance data, its organization is research oriented. The officers and all key personnel have had formal technical training and many years of research and engineering experience. Responsibilities are divided among several divisions and departments, but organizational flexibility is maintained to provide complete coverage and integration of all activities required of a supplier in the field of instrumentation.

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CORPORATE ORGANIZATION – EMR

Electro-Mechanical Research, Inc. is a closely held corporation, wholly owned by the Schlumberger Well Surveying Corporation of Houston, Texas. It is incorporated under the laws of the State of Connecticut. EMR maintains "secret" facility clearance and is a qualified Department of Defense contractor.

GORDON S. SLOUGHTER
President and Chief Executive Officer

The Officers of the Company are:

ENDERS M. VOORHEES
Chairman of the Board

GORDON S. SLOUGHTER
President

THOMAS E. STEWART, JR.
Vice President

JOSEPH C. HUTCHESON, III
Secretary

DR. GLENN E. TISDALE
Assistant Secretary

SEYMOUR D. HOLMES
Treasurer and Controller

The Members of the Board of Directors are:

ENDERS M. VOORHEES, Chairman
14 East 68th Street
New York, New York

MAJOR GENERAL ERNEST M. BRANNON
U. S. Army, Retired
3612 Ingomar Place N.W.
Washington, D. C.

HENRI GEORGES DOLL
Schlumberger Well Surveying Corporation
Ridgefield, Connecticut

JOSEPH C. HUTCHESON, III
Baker, Botts, Andrews and Shepherd
Esperson Building
Houston, Texas

PAUL A. LEPERCQ
Istel, Lepercq and Co., Inc.
63 Wall Street
New York, New York

GORDON S. SLOUGHTER
Electro-Mechanical Research, Inc.
Sarasota, Florida

THOMAS E. STEWART, JR.
Electro-Mechanical Research, Inc.
Sarasota, Florida

EARLE W. WALLICK, JR.
Schlumberger Limited
Houston, Texas

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CONTRACT ADMINISTRATION AND FIELD ENGINEERING

THOMAS E. STEWART
Vice President

A typical aircraft installation

ORGANIZED FOR SERVICE

EMR's Contract Administration and Field Engineering Department has but one objective: service to the customer. This department acts for the company as a single agency equipped to serve the interests of both customer and company.

This objective is realized through a nationwide organization that comprises the home office and field engineering offices in Washington, D. C., El Paso, and Houston, Texas, Los Angeles, Calif., Dayton, Ohio, Denver, Colo., Princeton, N. J., and Huntsville, Ala. All offices are staffed by graduate engineers thoroughly experienced in telemetry and instrumentation. Rapid, accurate servicing of inquiries and purchase orders is effected by means of streamlined procedures and close liaison between the field and Sarasota or Princeton.

The Contract Administration and Field Engineering Department works in close co-operation with the Systems, Production, and Research and Engineering Departments in the preparation of quotations and proposals. It also expedites items returned for major repair or replacement under EMR'S standard 30-day warranty policy. The preparation and distribution of literature descriptive of company products is also a function of this department.

The Titan

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SYSTEMS DIVISION

DONALD M. POWERS
Systems Division Manager

SYSTEMS FOR EVERY REQUIREMENT

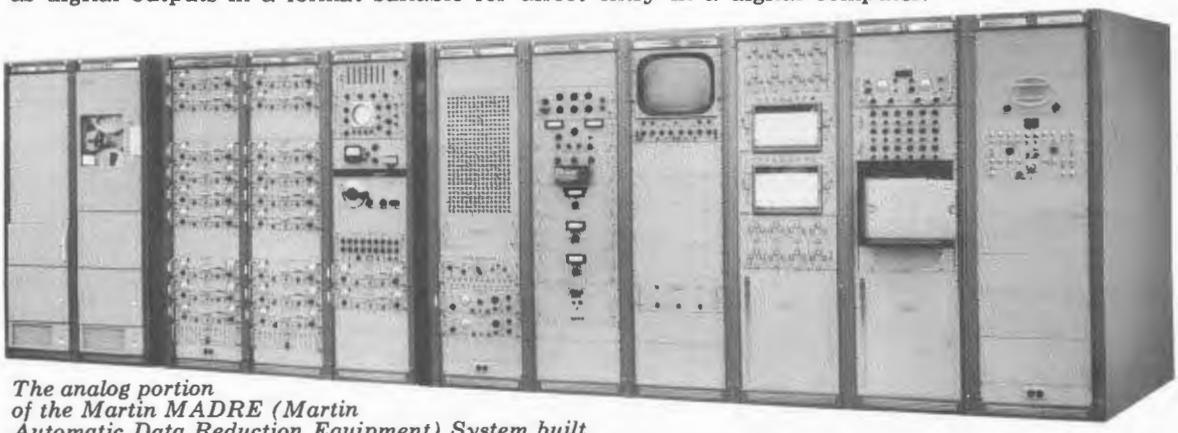
The Company has supplied telemetry and data reduction systems to most of this country's major aircraft and missile manufacturers, to all armed services, to many Government agencies, and to foreign user groups. Ground stations supplied by EMR can be found at practically every missile range in the U.S.

An outstanding example of the versatility of EMR systems is the airborne telemeter originally developed for The Martin Company's Titan ICBM. Evolutionary changes have resulted in advanced versions of this system used in the "second generation" Titan, in the NASA Project Mercury space capsule, and in other test programs of a classified nature.

Unclassified and declassified programs, for which complete or partial systems have been supplied, include: Bomarc, Hound Dog, Redstone, Jupiter, B-58, Atlas, Talos, Terrier, Matador, Pershing, X-15, Navaho, Snark, and Firebee; also, Thor, Lacrosse, Sparrow II, Viking, Bumblebee, Project Vanguard (Earth Satellite Program), Project Score (Atlas Talking Satellite), Project Mercury (Man-in-Space), Minuteman, Polaris, and Tiros.

The Company has also designed and installed many large data-processing systems, such as the telemetry and digital data transmission portions of the huge electronic scoreboard at Eglin Gulf Test Range in Florida. This high-accuracy system permits simultaneous test and evaluation of as many as three remotely piloted drones and three missiles over the giant range.

Another large, complex, combined analog and digital system is the MADRE (Martin Automatic Data Reduction Equipment) system supplied to The Martin Company, Orlando, Florida. This system, installed in a data-reduction center in Martin's Orlando facility, processes telemetry data from test missiles such as the "Pershing". The MADRE system provides analog outputs as well as digital outputs in a format suitable for direct entry in a digital computer.



The analog portion of the Martin MADRE (Martin Automatic Data Reduction Equipment) System built by the EMR Systems Division. The EMR equipment feeds telemetry data to a high-speed digital acquisition and computing system for computation of missile test results.

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RESEARCH AND ENGINEERING

KENNETH M. UGLOW
Director of Research and Engineering EMR, Sarasota

Director of Research and Engineering meets regularly with his section heads for examination of departmental problems and progress.

SELF-SPONSORED RESEARCH RESULTS IN RECOGNIZED LEADERSHIP

The pre-eminent position which the company has established in telemetry is, to a large extent, due to the company-sponsored research programs conducted by the Research and Engineering Department. With but few exceptions, the catalog line consists of units, the development of which was initiated and wholly financed by the company. Typical research and development programs include the following:

- Evaluation of FM signal detection techniques leading to highly sophisticated advanced designs;
- Analysis of digital encoding, programming, and synchronization for use in airborne and ground PCM telemetry systems;
- Statistical data analysis as applied to bandwidth reduction;
- Circuit design applying new components and techniques to basic improvements in present products and development of new products;
- Study of physical properties of mechanical switching leading to completely new mechanical switching concepts.

These are representative samples of important projects currently under development by the company.

Modern, well-lighted, air-conditioned laboratories and offices, the availability of the most up-to-date equipment, an atmosphere of freedom for independent research, plus recognition of individual effort and achievement contribute to a high morale among professional employees. This results in an extremely low turnover rate, continuity of effort by project teams, and a high quality of all end products.

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PLANT OPERATIONS

WESLEY D. PECK
Plant Operations Manager
EMR, Sarasota

STREAMLINED ORGANIZATION FOR FAST COMPLETION OF ORDERS

More than half of all EMR personnel are associated with Plant Operations Department, which has the responsibility for all phases of the manufacturing process — from procurement of basic components to shipment of final products This department, with its many operational sections, occupies plant areas totaling some 160,000 square feet.

The diversification of production functions among a number of specialized groups results in an operation which makes possible a production run — from receipt of the customer's order to shipment on schedule — in a minimum period of time.

Well lighted, air-conditioned assembly rooms help insure high efficiency.

Orders are shipped out on schedule.

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RELIABILITY & QUALITY ASSURANCE

Incoming Inspection area where all purchased material is tested prior to use in EMR products.

The temperature and humidity controlled Standards Laboratory has a full complement of certified mechanical and electrical primary standards for periodically calibrating all measuring equipment used in EMR product acceptance tests.

YOUR ASSURANCE OF QUALITY

The Reliability and Quality Assurance Department has authority commensurate with its full responsibility for the quality of all EMR products. This department reports directly to the Plant Operations Manager.

Throughout the entire company, the quality of all products is monitored by this Department and its Standards Laboratory, which have complete facilities and manpower for inspecting incoming material, in-process products and finished goods. All instruments are calibrated periodically by the Standards Laboratory.

The Reliability and Quality Assurance Department proposes and maintains exacting quality-control procedures, which it rigorously enforces, to assure highest possible product and performance. The Department also prepares and coordinates reliability programs to fulfill engineering reliability objectives on new equipment as well as systems.

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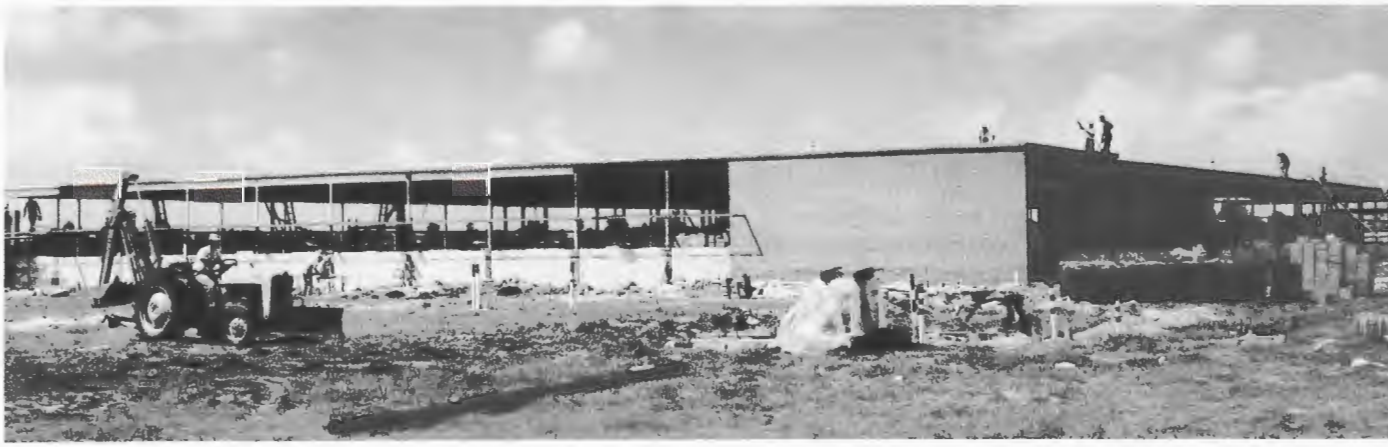
PERSONNEL AND SERVICES

DAVID A. EBERLY
Director of Personnel and Services

PROVIDING A CLIMATE FOR CO-OPERATIVE EFFORT

The company's record of leadership in the industry is due in large measure to the Personnel Department's success in attracting highly qualified individuals to the company's service. Also important to achievement of company goals is the fact that in co-operation with line managers the Personnel Department formulates company policies and procedures which help create an effective and co-operative work force.

Excellence in engineering environment attracts applications from many of country's top electronic design engineers.



In addition to personnel administration, this department is responsible for industrial security, facility construction, communication services, and building maintenance.

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ACCOUNTING

SEYMOUR D. HOLMES
Treasurer and Controller

Operating data, generated in EMR's Accounting Department, plays a vital role in management decisions.

MAJOR CONTRIBUTION TO CUSTOMER SERVICE

In addition to its routine functions and responsibilities, EMR's Accounting Department compiles and disseminates vital operating data to management, interested department heads, and field offices.

The Accounting Department uses the most modern systems, established with the aid of consulting firms. Wherever practicable, punch cards facilitate the collection and daily recording of vast amounts of pertinent data, including detailed descriptions of all company products, manufacturing costs, inventories, sales orders, negotiations, and quotations.

Thus, the Accounting Department is in position to supply immediate and accurate data — as well as analyses of costs and other operational problems — enabling management to make sound decisions and prompt and reliable quotations to customers.

The ready availability of such important information through the Accounting Department is a significant contribution to EMR's efficient, economical, and successful operation.

FACILITIES

Excellent facilities for research, engineering development, test, and production contribute toward EMR's position of leadership. Effective implementation of company programs is achieved through the use of the finest, most advanced equipment available.

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PHYSICAL PLANT

EMR – Sarasota, Florida

ASCOP Division – Princeton, N.J.

MODERN BUILDINGS DESIGNED FOR EXPANSION

EMR's Florida plant occupies buildings constructed since 1957 on a 90-acre rectangular plot in the Sarasota area.

A 67,500-square-foot, one-story building houses all personnel and equipment of the Production and the Reliability and Quality Assurance Departments. A 14,000-square-foot building is occupied by the Systems Division. A two-story building, comprising 31,000 square feet, houses the offices and laboratories for all other departments and activities. There is ample room for expansion within the existing plant.

All the Sarasota buildings are of modern steel, masonry, and glass construction, completely air-conditioned and specially designed for the Florida climate. The setting for these buildings is enhanced by a small lake which is particularly enjoyed by lunch-hour anglers.

Sarasota, located on U.S. Routes 301 and 41 (the Tamiami Trail), is serviced by the Sarasota-Bradenton airport, the Seaboard Air Line Railroad, and the Atlantic Coast Line Railroad.

The ASCOP Division offices, laboratories, and production facilities are located at Princeton Junction, New Jersey, only a short distance from major traffic arteries, including the New Jersey Turnpike. This facility is adjacent to the Pennsylvania Railroad station, on that railroad's main line between New York City and Philadelphia. Because of its proximity to New York, Newark, and Philadelphia, the ASCOP Division is within easy reach of four major airports.

The activities of the ASCOP Division occupy more than 53,000 square feet. Production, engineering, and most administrative functions are concentrated primarily in one building. Two smaller, adjacent buildings house subsidiary functions.

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ENGINEERING LABORATORIES

FINEST AND MOST MODERN EQUIPMENT

The company's Research and Engineering Departments maintain numerous laboratories occupying approximately 30,000 square feet. These laboratories contain the latest test equipment and research tools for use by the company's highly trained and skilled personnel in developing, evaluating, and improving EMR products. All electrical, electronic, and environmental test equipment is periodically checked and calibrated against rigid standards.

A *A printed circuit laboratory enables EMR to exercise complete control over a critical phase of engineering development.*

B *EMR's spacious, well lighted engineering laboratories provide proper environment for exacting work of research technicians.*

C *EMR development technician running a temperature stability test on prototype of FM transmitter.*

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PRODUCTS

In addition to catalogued products for data acquisition, transmission, and processing, the company develops and constructs complete instrumentation and data-reduction systems.

Detailed specifications and performance data on standard products and complete systems are available in the general catalog or directly from the EMR Contract Administration and Field Engineering Department.

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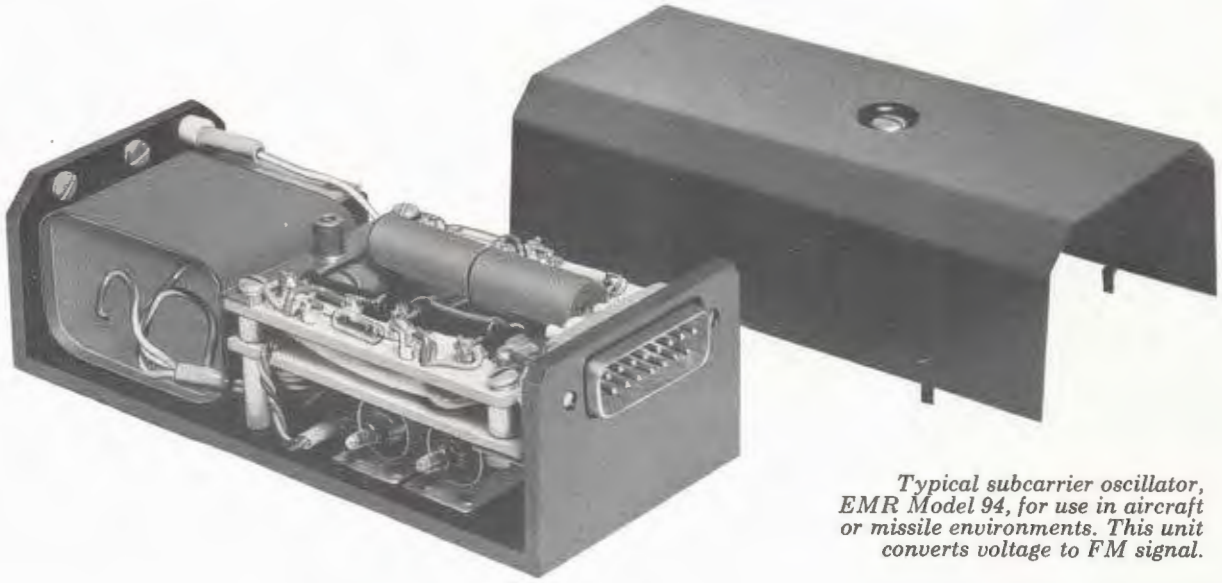
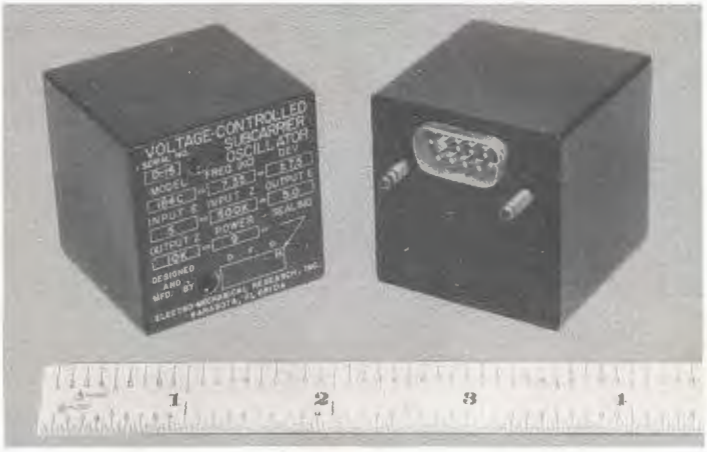
AIRBORNE EQUIPMENT

EMR manufactures telemetry equipment for airborne data collection and transmission. Typical products in this area are shown on this and the following pages:



Typical subcarrier oscillator, EMR Model 94, for use in aircraft or missile environments. This unit converts voltage to FM signal.



The Model 184C, a completely transistorized FM subcarrier oscillator packaged in a 1½" cube, developed by Electro-Mechanical Research, Inc. specifically for aircraft and missile telemetering systems.

SUBCARRIER OSCILLATORS

In scheduled production and easily available are all categories of subcarrier oscillators, including voltage-, strain-gage-, and reactance-controlled types. In the strain-gage-controlled oscillator, application of EMR proprietary techniques in phase-selective metal detectors has resulted in an inherently stable subcarrier component.

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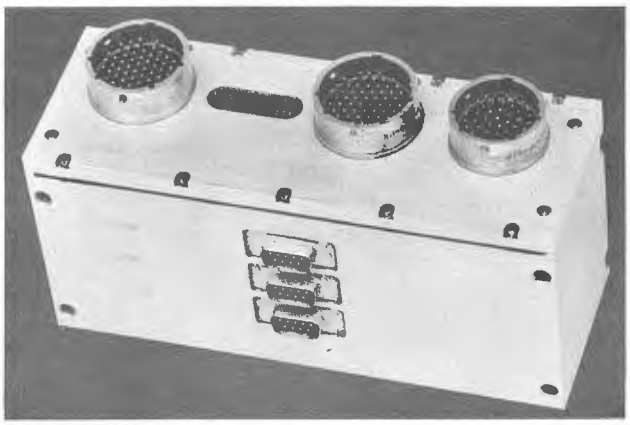
AIRBORNE EQUIPMENT

Solid-state commutator-multiplexer samples data at rates as high as 10,000 channels per second in PAM or PDM telemetering systems.

An EMR modular electro-mechanical commutator. This unit handles 45 mixed high and low level channels. Each channel is sampled 20 times per second.



ELECTRONIC AND ELECTROMECHANICAL COMMUTATORS

Bandwidth restrictions limit the amount of data which can be continuously transmitted. Therefore, it is necessary to use commutators when more information channels are required than are available in a single FM/FM link. Miniaturized, low-power electronic or electromechanical commutators — which enable very large quantities of data to be carried over a single restricted-bandwidth communications link — are an essential part of every time-division-multiplex system used in missile or aircraft telemetry.

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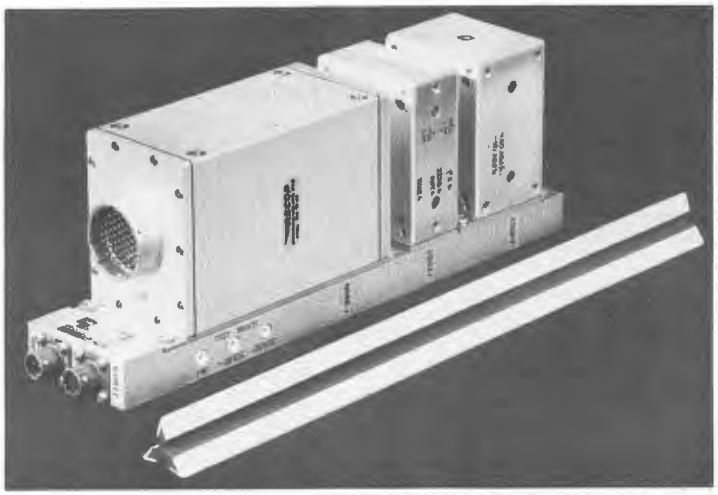
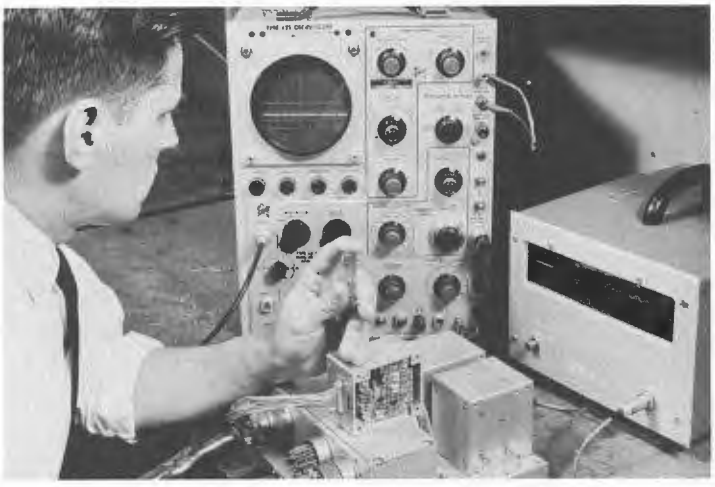
AIRBORNE EQUIPMENT

A typical modular PDM multiplex telemetering system for high performance in extreme airborne environments. "Building block" design allows many systems configurations.



Engineer checking out PDM telemetry system.



PDM-MULTIPLEX TELEMETRY SYSTEMS

The company's PDM-multiplex telemetry systems can handle large quantities of low-frequency data over a single restricted-bandwidth channel. Among the variety of system components offered as standard products is a line of high-performance, all-solid-state instruments for PDM telemetry which are packaged in modular form. With these components as basic building blocks, the user can formulate an accurate data system capable of withstanding rigorous airborne environments. The PDM equipment includes power supplies, keyers, low-level amplifiers, and commutators. Both high- and low-level inputs can be accommodated.

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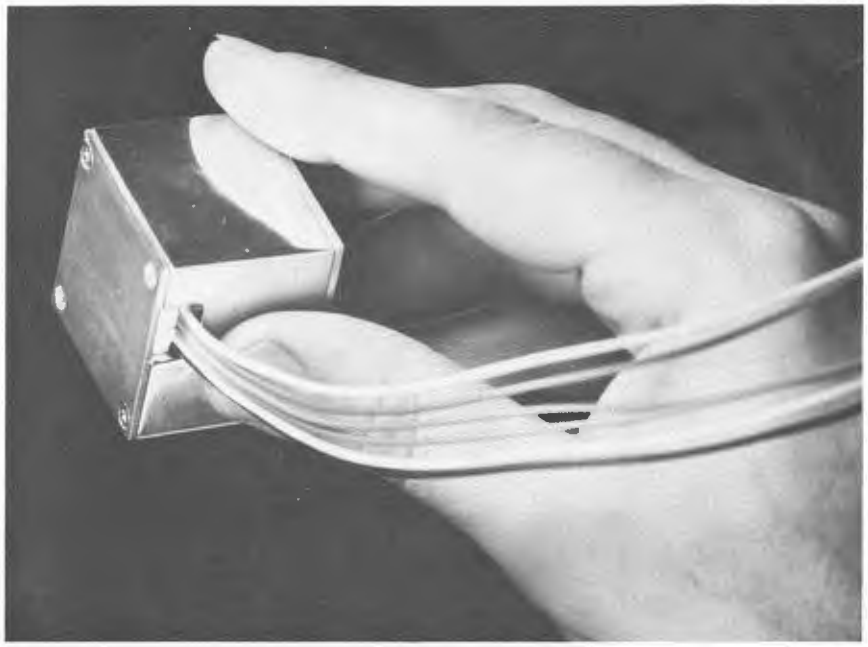
AIRBORNE EQUIPMENT



A tiny instrument, little bigger than an ice cube, uses statistical techniques to send exact time-of-occurrence over a restricted bandwidth channel.

STATISTICAL TELEMETRY AND DATA HANDLING

EMR has also taken the lead in developing compact, lightweight equipment for airborne reduction of data prior to transmission. Techniques of information theory and generalized harmonic analysis have been applied to hardware development. The result — statistical preanalysis — permits transmissions of high-frequency random-noise data in meaningful form at very low frequencies, saving bandwidth, power, and weight in the airborne equipment.

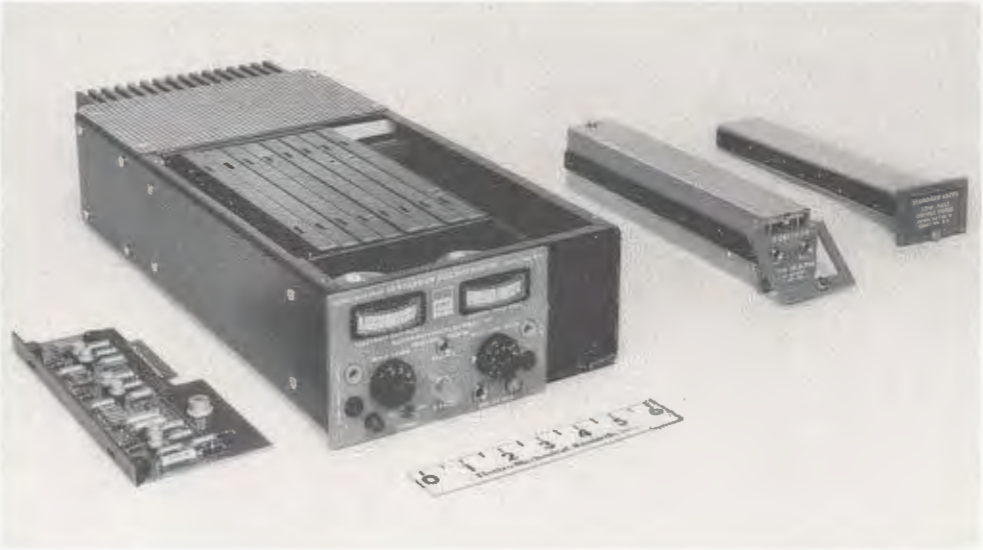
VHF RADIO TRANSMITTERS

The requirements imposed on radio transmitters flown in guided missiles and experimental aircraft for the purposes of transmitting telemetry data are extremely rigorous in terms of frequency stability and spurious radiation. Existing crystal-control techniques, utilizing crystal oscillators and frequency multipliers, are often unusable and generally unsatisfactory. EMR has developed a technique whereby fused quartz, coated with fired silver, is used as a tuned circuit operating at the transmitter output frequency. The stability exceeds that achievable with crystal oscillators. Spurious radiation, as a function of frequency multiplication, is eliminated.

The EMR Model 121 true-FM telemetry transmitter is frequency controlled by a quartz-line oscillator. The unit is designed to operate in the 215 to 260 megacycle IRIG band.

GROUND STATION EQUIPMENT

Phase-lock loop discriminator, the Model 165A, is a highly accurate instrument for precision FM telemetry ground stations.



Model 167A transistorized, phase-lock subcarrier discriminator features plug-in circuit cards and interchangeable channel selectors and output filters.

EMR currently markets a variety of equipment for use in telemetry data-reduction stations. The following are some of the major products in this area:

SUBCARRIER DISCRIMINATORS

The standard equipment used in all successful FM telemetry systems was developed by EMR, and the company's continuing self-sponsored engineering program has resulted in several improved models. The basic EMR discriminator is adaptable to all standard FM/FM telemetry channels through the use of plug-in tuning units and filters. In addition, a tunable discriminator is available as a standard catalog item.

GROUND STATION EQUIPMENT

EMR Model 185 digital decommutator accepts PAM, PDM or PCM inputs and supplies analog or digital outputs.

GROUND DECOMMUTATION EQUIPMENT

Equipment for the reduction of time-multiplexed telemetry data is the result of 14 years experience. A recent development is a solid-state digital decommutator. This versatile, accurate equipment handles PAM, PDM, or PCM signals and provides analog binary or BCD outputs. Because of its digital synchronization and correction circuitry, this decommutator has unequalled stability. Up to 100 channels can be handled at sampling rates as high as 4600 pps. EMR's M-Series ground decommutation equipment is an industry standard for analog decommutation. This versatile ground station decommutates either PAM or PDM signals from any signal source. Automatic correction circuits and the automatic-correction concept, both basic company patents, are incorporated in all standard decommutation equipment.

Console mounted telemetry monitor displays all channels of a PAM or PDM signal in bar-graph form.

ACCESSORIES — GROUND DECOMMUTATION

EMR has developed many useful accessory instruments for ground PAM and PDM decommutation stations. Among these are a signal simulator which tests a station in IRIG standards, a monitor scope which displays data in bar-graph form, and a variety of other devices.

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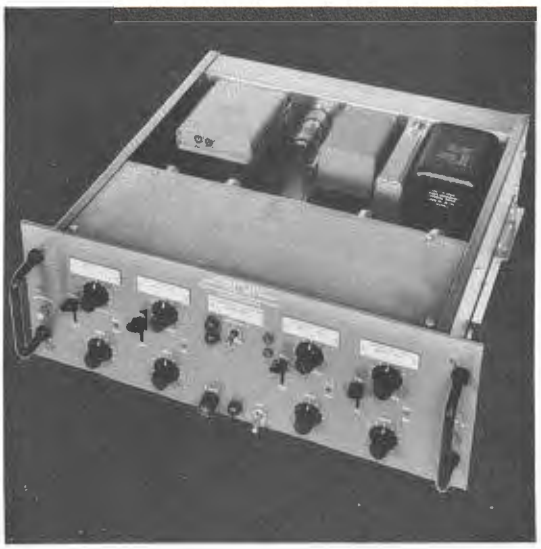
GROUND STATION EQUIPMENT

CHECKOUT EQUIPMENT

Telemetry ground stations periodically require alignment prior to use. EMR manufactures a number of extremely stable units designed to facilitate preflight checkout with a high degree of accuracy. Among these useful adjuncts to any telemetry data-gathering station are a band-switching voltage-controlled oscillator, a frequency calibrator, a signal simulator, and fixed-frequency VCO's.

The Model 146 band-switching voltage-controlled oscillator provides linear, stable signals for FM ground station alignment.

EMR ground-station calibration system provides data correction of a complete FM telemetry system.



AUTOMATIC CALIBRATION EQUIPMENT

The severe environmental conditions encountered during guided-missile and aircraft flights cause airborne telemetry equipment to drift. EMR offers airborne and ground-station components which automatically adjust the ground station to compensate for drift of the airborne equipment.

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SYSTEMS

THE EMR SYSTEMS DIVISION CONCENTRATES ITS ACTIVITIES IN TWO MAJOR AREAS

Small telemetry truck constructed for on-the-range testing at the Pacific Missile Range. A tracking antenna is mounted in operating position and the omni-directional two-way radio antenna is below it.

First, the Division proposes, designs and assembles airborne and ground telemetry systems, data processing and reduction systems, satellite systems, ground support equipment, automatic checkout equipment, and similar systems allied to the company's traditional experience. These systems incorporate equipment of standard company manufacture, commercially available equipment, and specially designed units.

In addition, the Division sponsors fundamental investigations into advanced electronic and electro-mechanical systems both for improving techniques in existing areas and for expansion and diversification into new areas. A team of specialists has been assembled for operating in advanced systems areas. Capabilities of this team are outstanding in the following areas:

OPTICAL SYSTEMS: Filters and optical modulation; optical spectrum scanning; optical measurements and correlation; television scanning and data link systems.

DATA OR INFORMATION SYSTEMS: Modulation and encoding techniques; signal enhancement methods; short-range secure communication systems; speech-band-width-compression techniques; satellite communications; specialized information displays.

WEAPONS SYSTEMS: Low-cost, portable ground-warfare missiles; artillery support devices; tactical operations control; optical, infrared and electronic reconnaissance devices; simplified, compact guidance and control systems; acoustical detection and warning systems.

INDUSTRIAL SYSTEMS: Industrial process control systems; application of advanced systems to process control.

The Advanced Systems Department is backed up where necessary by the full resources of the Company's research and development engineers and scientists whose experience and capabilities in the areas of FM and pulse-type data transmission, telemetry and data processing are unsurpassed in the industry. Among the recent contracts undertaken by

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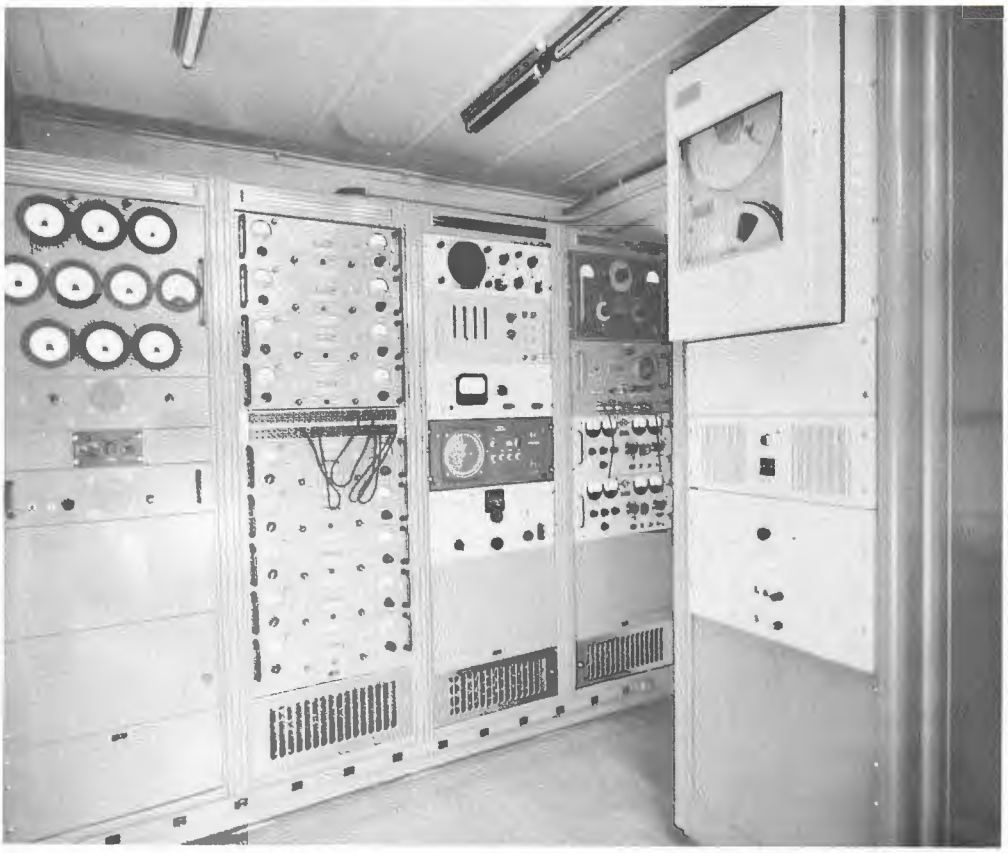


Inside view of the Pacific Missile Range telemetry truck shows FM discriminators, receivers, tape transport, test equipment, and aircraft-type instruments. The completely air-conditioned van has its own self-contained power supply.

Firebee Drone Telemetry Package.

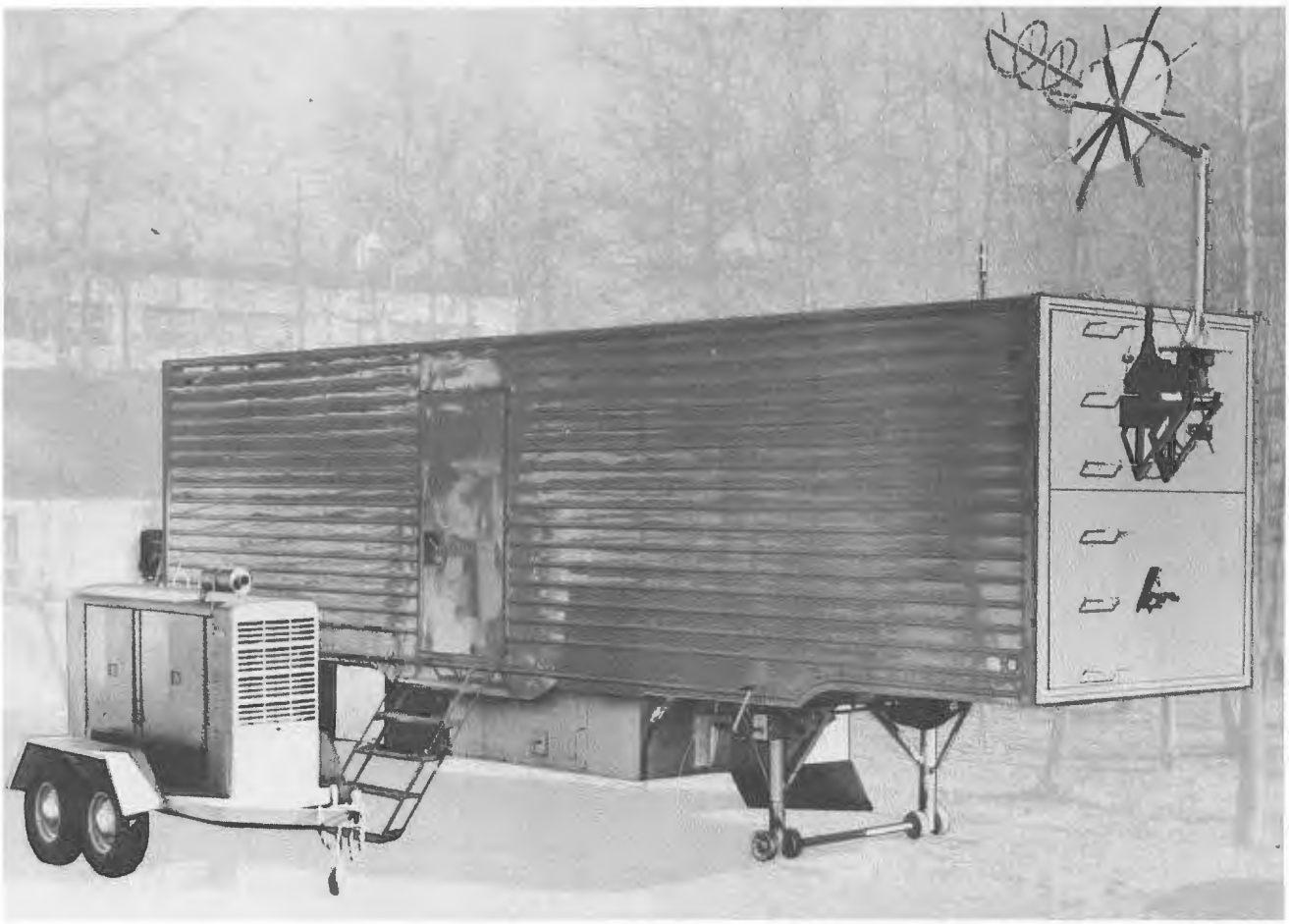
the Advanced Systems team are speech bandwidth compression for battlefield communications, and a study of modulation methods for data telemetering in future space-communications systems.

The Division maintains functions of Engineering, Manufacturing, Reliability and Quality Assurance, and Advanced Systems. These departments are staffed by experienced engineers, technicians, and assemblers whose activities are geared to meet the most demanding requirements of systems performance and accelerated delivery. Their ability to meet accelerated deadlines is exemplified by the delivery of the first telemetry package for the Firebee Drone only seven weeks after receipt of the request for proposal. Another achievement was the delivery of the prototype transmitting package for the NASA "Man-in-Space" Mercury capsule nine weeks from the receipt of the preliminary design information. The latter

Continued on next page

system was of unusual complexity and involved a unique design for telemetering millivolt grounded-thermocouple signals.

The Division has also produced complex data-handling systems. Notable are large, self-contained vans for remote mobile telemetry in the field and numerous ground decommutation stations, both digital and analog, supplied to virtually every major missile test and data-reduction center.



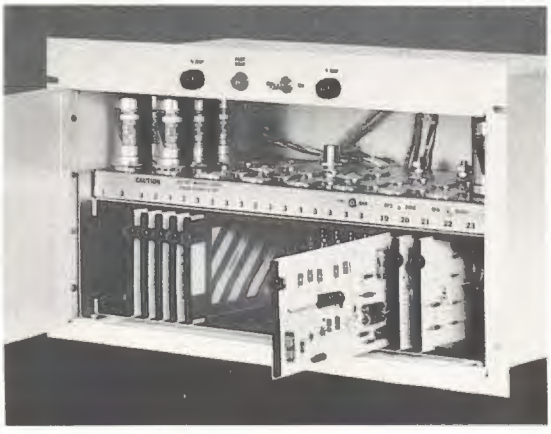
A complete telemetry ground instrumentation station is contained in this large instrumentation van constructed for NAS Patuxent.

INDUSTRIAL PRODUCTS

THE SCIENCE OF ELECTRONICS BRINGS NEW ECONOMIES TO INDUSTRY

EMR has developed new industrial products which permit one man or a small group of men to monitor and control commercial processes in a vast complex network from hundreds or thousands of miles away. These products are now in use in oil and gas pipelines, public utility companies, municipal utilities, and others. These new products include: (1) Supervisory Control, for the control and supervision of remote equipment through electrical signals; (2) Telemetering, for transmitting and observing measurements from remote processes to a master indicating panel, and (3) Fault Alarm Annunciator, for detecting alarm conditions at remote processes and transmitting them to a master station for identification.

A typical installation of supervisory control and fault alarm annunciator equipment at an electric utility. In this system a complete electric sub-station is remotely controlled and supervised from the master control panel shown. This particular installation contains 243 points of fault alarm annunciation and 13 points of supervisory control.



Plug-in cards and mercury-wetted relays permit easy field expansion or servicing of EMR industrial telemetering equipment.

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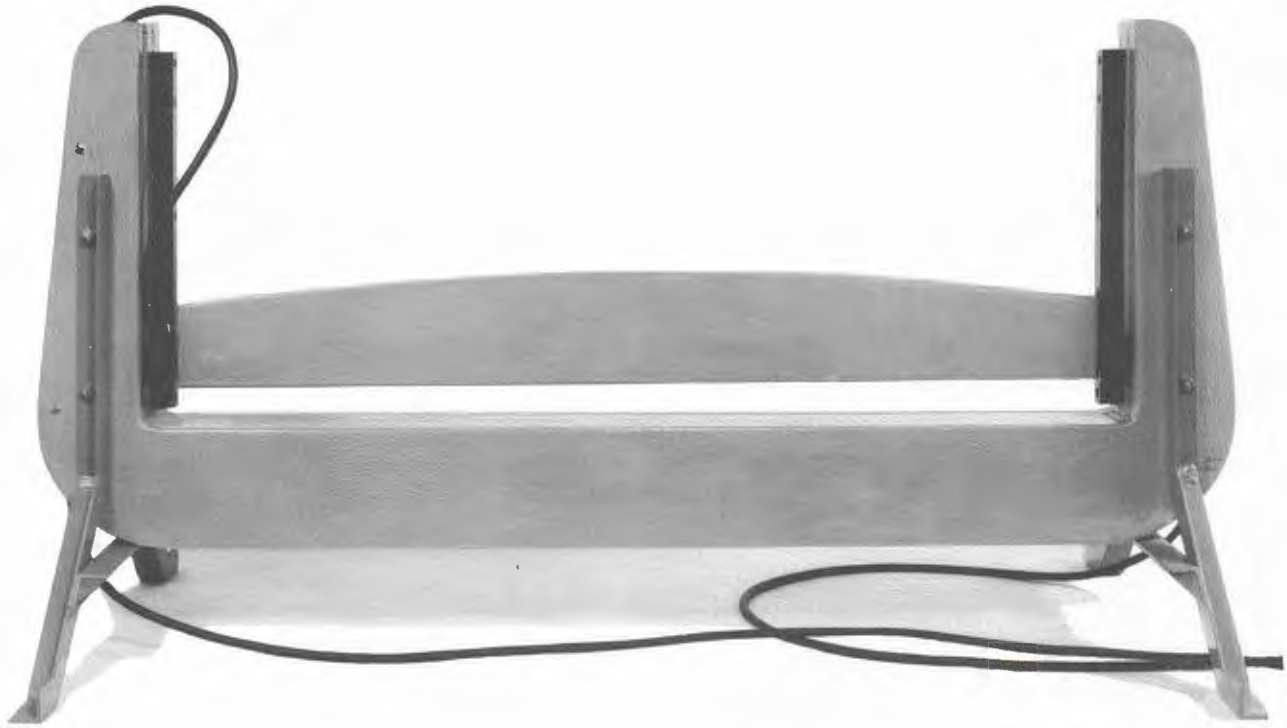
INDUSTRIAL PRODUCTS



Scanning Coil for use with Model 200A in metal detection on conveyor belt lines.

EMR supplies a specialized metal detector for industrial processes with patented features that permit operation over long periods of time without adjustment.

This detector is designed to locate ferrous or non-ferrous tramp metal in food, plastic sheet or film, plywood and wood products, or similar non-metallic products where the product is carried on a conveyor or is in sheet or board form.

EMR Model 200A Metal Detector electronic control unit.

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SPECIAL PRODUCTS

MODEL 506A:
13-bit natural binary output for 64 turns.

MODEL 504A:
8-bit Gray code binary, single turn.

MODEL 527A:
7-bit natural binary, one turn.

MODEL 505A:
equal increments, one turn, dual heads.

All Magnetic Shaft-Position Digital Encoders are ultra-reliable in operation, unaffected by extreme environments.

DIGITAL ENCODERS WITH WIDE APPLICATIONS

The company has also developed small electronic components which have found wide applications in industry, ranging from machine-tool control to weather forecasting. These new devices, shaft-position digital encoders, translate shaft rotation directly into numbers. An all-magnetic device, the new encoder is unaffected by environments; and for all practical purposes having unlimited life, it is also especially suitable to military needs. As computers play an increasingly important role in every part of industry, these digital encoders, which complement them, will be used in larger numbers.

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PERSONNEL

EMR's most important asset . . .

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PERSONNEL

GORDON S. SLOUGHTER
President and Chief Executive Officer

Mr. Sloughter was graduated by Cornell University as an Electrical Engineer. He was first employed by the International Business Machines Corporation and remained with them for eight years prior to his entry into the Armed Forces in 1942. Mr. Sloughter was assigned to the Corps of Engineers, Research and Development Laboratory, Fort Belvoir, Virginia, throughout the war. He was Chief of the Electronics Section, and later Deputy Chief of the Electronics Branch. He joined Electro-Mechanical Research upon leaving the Army in 1946.

His work with IBM included the development of automatic accounting machines employing high-speed electro-mechanical devices and industrial electronic circuits, medium-frequency transmitters, high-impedance sensing equipment, and training aids for the Armed Forces. His Army experience included development work on portable and vehicular mine detectors, remote radio control equipment for demolition, and electronic navigational equipment for vehicles.

Mr. Sloughter is responsible for the general direction and operation of Electro-Mechanical Research. His engineering contributions to EMR include many new types of metal and ore locators and the design of the most successful subcarrier discriminator developed to date for use in FM/FM telemetering systems, together with an automatic calibrator for system calibration. He has had experience with microwave FM equipment and computing and high temperature (351° F) electronic telemetering equipment for use in deep drill holes. He is a registered Professional Engineer.

PERSONNEL

THOMAS E. STEWART
Vice President

Mr. Stewart was graduated by Pratt Institute, School of Science and Technology, as a Mechanical Engineer. He was first employed as Research Engineer with the Sylvania Industrial Corporation until 1942. He then joined the staff at the Corps of Engineers, Research and Development Laboratories, Fort Belvoir, Virginia, until 1948. His last position was as Chief, Applied Geophysics Branch.

As Field Engineer in the Washington Area, Mr. Stewart represented Electro-Mechanical Research, Radio Receptor Company of New York, and the Technical Instrument Company of Houston, Texas, until June 1952, when he was appointed Sales Manager of EMR.

Mr. Stewart's work with Sylvania Corporation included the application of electronic controls to viscose process machinery. At Fort Belvoir his work included the development of several types of metallic and non-metallic mine detection systems, navigational equipment for land vehicles, underwater-obstacle location systems, and flight-test instrumentation equipment. His field-engineering work was in the development of communications and IFF equipment, airborne and shipboard fire-control computers, telemeter equipment, and metallic and non-metallic detection systems.

In 1955, Mr. Stewart was appointed Vice President of EMR, and was elected to the EMR Board of Directors in 1958.

PERSONNEL

SEYMOUR D. HOLMES
Treasurer and Controller

Mr. Holmes was graduated by Pace College with a B.B.A. degree, Accounting major. Prior to matriculation, he served with the Army of the United States as a major in the Ordnance Department.

Mr. Holmes' professional experience includes cost work with Blaw Knox Company, auditing with Sears Roebuck and Co., and public accounting.

For eight years he was associated with S. D. Leidesdorf & Co., Certified Public Accountants, as Senior Accountant. His duties were in the areas of general auditing and tax accounting in retail, manufacturing, and investment concerns. Later, Mr. Holmes was associated with Arthur Young and Co. as Senior Accountant responsible for balance sheet audits.

In addition to interim and year-end auditing procedures, Mr. Holmes acquired extensive experience in systems analysis, budget preparation and analysis, payroll procedures and capital account management.

Joining EMR in 1954, Mr. Holmes assumed responsibilities as Chief Accountant. In 1958 he was appointed Treasurer and Controller, and in addition directs the EMR Property Office.

PERSONNEL

MAX L. VAN DOREN
Manager, ASCOP Division

Mr. Van Doren received his Bachelor of Science degree in Electrical Engineering from Pacific States University in 1947. He continued at Pacific States, instructing in the undergraduate school until 1950 when he joined Douglas Aircraft as a research engineer. Here, he was subsequently made supervisor of the electronic design group for equipment development in the Testing Division. While with Douglas, Mr. Van Doren designed a number of electro-mechanical devices, one of which, a pulse integrator and reshaper, was subsequently released to Ampex for incorporation in their type 309 Recorder.

Joining EMR in 1955 as a field engineer. Mr. Van Doren assumed supervision of the West Coast Sales Office in Los Angeles. In 1958 Mr. Van Doren was appointed Eastern Area Manager. In this capacity, he was responsible for all sales in the eastern half of the United States.

In 1960 Mr. Van Doren was appointed Manager of the ASCOP Division of EMR. He directs the manufacturing, engineering, and research programs conducted by the ASCOP Division.

PERSONNEL

DONALD M. POWERS
Manager, Systems Division

Mr. Powers received his Bachelor of Science, Master of Science and professional degrees in Electrical Engineering from the Massachusetts Institute of Technology. He also taught and was a Research Associate, conducting research on FM transmission and varying frequency network theory. While he was obtaining his degrees, he was also a design engineer with the Raytheon Company and was associated with the Radiation Laboratory at MIT, working on radar systems and components. He later joined Melpar, Inc., where he conducted applied research in the areas of bandwidth compression, advanced radar, and applications of information theory. He later joined the Laboratory for Electronics as Manager, Commercial Products Division, with general responsibility for commercial products, including signal generators, oscilloscopes and microwave test equipment.

Before joining EMR in 1960 as Manager, Systems Division, Mr. Powers was associated with The Martin Company, Orlando, Florida, as Manager of the Airborne Electronics Department. At The Martin Company, he had full responsibility of management and technical direction of eight sections engaged in work on missile guidance and control systems, radar systems, and data acquisition and transmission.

Mr. Powers holds patents in the fields of microwave tubes and data transmission systems.

PERSONNEL

WESLEY D. PECK
General Manager, Sarasota Plant Operations

Mr. Peck has had extensive experience with military electronic apparatus as a result of his service with the Signal Corps. He attended many service schools of instruction for both airborne and ground communications equipment. He was previously employed by the Pilotless Plane Division of the Fairchild Engine and Airplane Corporation. While with Fairchild he gained experience in airborne control, servo-mechanisms, and telemetering instrumentation.

Since joining Electro-Mechanical Research in 1946, Mr. Peck has contributed greatly to the development of portable and vehicular metal detectors, photocell test equipment, and telemetering transmitting and receiving systems. He has made substantial contributions to the successful production of the Applied Physics Laboratory FM/FM subcarrier discriminators, three-point frequency calibrators, and all of the items more recently added to the EMR standard products list.

Mr. Peck now directs all EMR production functions. His direct experience in manufacturing, production engineering, and performance testing uniquely qualifies him for these responsibilities.

PERSONNEL

KENNETH M. UGLOW
Director of Research and Engineering

Mr. Uglow received his Bachelor of Science degree, with first honors, and his Master's degree from the University of Maryland. He also participated in the General Electric Company's Advanced Engineering Program, specializing in advanced mathematics and electro-magnetic theory. His first position was that of Radio Engineer with General Electric, where he did research, development and design work on microwave components and measurements. During World War II he was assigned by General Electric to the Radiation Laboratory at M.I.T. and participated in the development of airborne navigation and search radars.

Mr. Uglow spent several years with the Naval Research Laboratory, first as Project Engineer responsible for the development and design of electronic instrumentation and telemetering equipment and, later, as Electronics Consultant to branches of NRL dealing with upper-atmosphere and missile research and development. His responsibilities encompassed advisory, planning and analytical work concerned with multiplex radio telemetering equipment and systems; electronics for physical research; missile guidance; noise and communication system theory; HF, VHF, UHF and SHF antennas, receivers and transmitters.

From 1953 until he joined EMR in 1958, Mr. Uglow maintained a private engineering practice in Silver Spring, Maryland, dealing with commercial and military electronics, including radio, radar, communications and telemetering.

PERSONNEL

DAVID A. EBERLY
Director of Personnel and Services

Mr. Eberly received his Bachelor of Science and Master's Degrees from the Massachusetts Institute of Technology and taught in the graduate school while completing additional graduate studies. Part of his work was done on a Westinghouse Fellowship in Industrial Relations. Subsequent to this, Mr. Eberly was associated with the Industrial Relations Department of the Westinghouse Electric Corporation, with responsibility for union relations, and negotiations on wage and salary administration.

Returning to MIT for graduate work, Mr. Eberly was Personnel and Fiscal Officer of the Operations and Evaluation group of the Office of the Chief of Naval Operations on loan from the University. He later was made Staff Personnel Officer at Lincoln Laboratory and, after this, Personnel Officer, Division of Defense Laboratories, MIT. During this time, he also taught graduate courses in the Department of Economics and Social Science at MIT and Boston University, and conducted a private consulting business in industrial relations. Mr. Eberly then joined the General Electric Company as Supervisor, Technical Administration, responsible for engineering personnel and technical administration.

Joining EMR as Personnel Director in 1957, Mr. Eberly was assigned additional responsibilities in 1958 for industrial security, plant services, and new facility construction.

During World War II, Mr. Eberly served with the United States Marine Corps as an electronic technician, radar crew chief, and finally as NCO in charge of ground radar instruction at the USMC electronic school.

PERSONNEL

JOHN M. SHERMAN
Western Area Manager

Mr. Sherman received his Bachelor of Science degree in Electrical Engineering from Ohio State University. He worked as a laboratory technician for the Hobart Manufacturing Company while obtaining his degree and after graduation, served with them as a Research Engineer.

Mr. Sherman was Chief Engineer of Witco Manufacturing Company and Land-Air, Inc., prior to joining EMR as a Field Engineer in 1955.

In 1958 Mr. Sherman was promoted to Western Area Manager. In this capacity he is responsible for all sales in the western half of the United States and directs all actvities of the Denver, Colo., El Paso, Houston, Texas, and Los Angeles, Calif. offices.

PERSONNEL

H. R. WEISS
Eastern Area Manager

Mr. Weiss attended Washington University, St. Louis, Missouri, and gained broad electronic experience from 1941 to 1951 in various positions in industry and government. During this time, he was engaged in communication, sound recording, television and radar work. In 1951, Mr. Weiss accepted a position as an electronic engineer at the Air Force Missile Test Center, Patrick AFB, Florida, and until 1954, he worked for the Center and for the Radio Corporation of America on trajectory measurement systems associated with missile guidance and testing.

In 1954, Mr. Weiss joined Electro-Mechanical Research, Inc. as a sales engineer in the Eastern Field Office. Leaving EMR in 1958, Mr. Weiss worked for a short time with Epsco, Inc., rejoining EMR in 1959 as District Office Manager in charge of the EMR Washington Sales District Office. In 1960, Mr. Weiss was promoted to his present position as Eastern Area Manager. He is responsible for all sales in the Eastern half of the United States, directing activities of the offices in Washington, D. C., Princeton, N. J., Dayton, Ohio, and Huntsville, Ala.

ENGINEERING SUPPORT

Librarian locates source of desired information for EMR engineer.

AUXILIARY SERVICES

EMR devotes substantial areas to facilities that, though available to the whole company, primarily serve the Research and Engineering Departments. For example, the libraries contain technical and scientific books and periodicals, in addition to company documents and technical reports, available for easy reference and study in quiet enclosures.

Drafting Sections provide complete services for the rapid formulation and reproduction of drawings and specifications pertinent to EMR products.

The Model Shops are equipped to fabricate new and unusual metal parts and to construct special devices and precision mechanical equipment used in assembling some of the complex electromechanical devices produced by the company.

Drafting rooms are uncrowded, well lighted.

Machine shops have finest, most advanced equipment.

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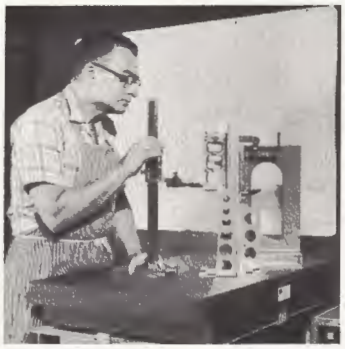
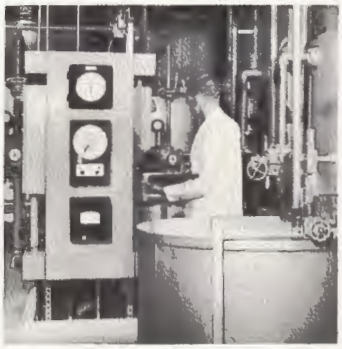
PRODUCTION

Markem Machine is used to imprint clear panel markings on EMR airborne equipment.



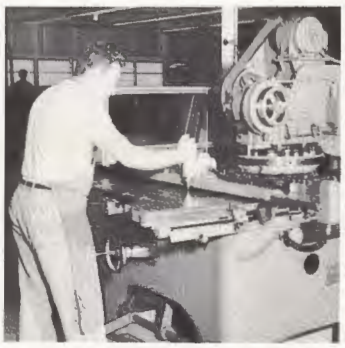
Granite-block surface plate and height gage is used by inspector to check part dimensions to close tolerances.



Section of water treatment plant used in plating process.

Spray-painted instrument parts are dried in a 6' x 6' x 8' sealed drying oven.

Front-panel silk screen process.



Wiedemann turret punch, operated from precision template, used in chassis hole and slot forming.

Ten-foot, heavy-duty, Wysong shear for precision shearing of large sheet metal.

Sixty-ton Niagara ten-foot press brake for heavy duty bending and forming.

A view of the three EMR plating lines equipped to handle virtually any type of plating on a production basis.

SPECIAL COST-SAVING OPERATIONS

Many operations that competitive manufacturers must subcontract to suppliers, with resulting increased costs ultimately reflected in product selling price, are performed by the company itself.

Labor costs are materially reduced by the use, wherever feasible, of modern, automatic machines, the latest-design hand tools, and other special devices that simplify the intricate assembly work characteristic of electronics manufacture.

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TEST

HIGH PERFORMANCE ASSURED

A *Fifty-hour temperature tests are performed automatically in this EMR test setup. Critical voltages, frequencies and currents are measured and the test stops itself automatically if one of these goes out of tolerance.*

B *TITAN telemeter package undergoing vibration test in EMR's environmental laboratory.*

C *Printed circuit cards for EMR digital decommutation equipment are given final precision check and adjustment for output voltage and waveform.*

Final adjustment and electrical and environmental qualification of all EMR products are effected by the Production Test Section.

An extensive complement of instrumentation, commercially available or specially designed and built by EMR, is assigned for exclusive use by this section.

Production Department testing is subject to final approval of the Reliability and Quality Assurance Department, which reports directly to the Plant Operations Manager. The latter department initiates and surveys test procedures and data sheets; it follows through on test rejects and maintains Production test equipment. A complete environmental test facility, under supervision of the Reliability and Quality Assurance Department, is available to the Production Test Section for product qualification.

The Sarasota and Princeton electrical and environmental test activities are augmented, when necessary, by facilities and personnel available at nearby commercial testing laboratories.

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