SCHLUMBERGER

1963 ANNUAL REPORT

SCHLUMBERGER IS MEASUREMENT SCHLUMBERGER IS MEASUREMENT SCHLUMBERGER IS MEASUREMENT SCHLUMBERGER IS MEASUREMENT

CONTENTS

SCHLUMBERGER LIMITED

1900 Southwest Tower, Houston, Texas, 77002

BOARD OF DIRECTORS

H. G. DOLL
Chairman

ROBERT G. COWAN
Chairman, National Newark & Essex Bank
Newark

W. J. GILLINGHAM
Vice President
President, Schlumberger Well Surveying Corp.
Houston

J. C. HUTCHESON, III
Partner, Baker, Botts, Shepherd & Coates
Houston

PAUL A. LEPERCQ*
President, Istel, Lepercq & Co., Inc.
New York

CLINTON S. LUTKINS
Senior Partner, R. W. Pressprich & Company
New York

AMEDEE MARATIER
President, Forages et Exploitations Petrolieres
Paris, France

JOHN DE MENIL*
Chairman of the Executive Committee

JOHN B. MONTGOMERY
Vice President
President, Daystrom, Incorporated
Murray Hill

CHARLES C. PARLIN
Partner, Shearman & Sterling
New York

JEAN RIBOUD*
Executive Vice President
President, Schlumberger Overseas and
Societe de Prospection Electrique Schlumberger
Paris, France

MAURICE SCHLUMBERGER
Director Emeritus

PIERRE SCHLUMBERGER*
President and Chief Executive

RENE SEYDOUX
Chairman, Schlumberger Overseas and
Societe de Prospection Electrique Schlumberger
Paris, France

AME VENNEMA*
Executive Vice President

E. M. VOORHEES
Director and Member Executive and Finance
Committees, United States Steel Corporation
New York

* *Member Executive Committee*

OFFICERS

H. G. DOLL
Chairman of the Board

PIERRE SCHLUMBERGER
President and Chief Executive

JOHN DE MENIL
Chairman of the Executive Committee

JEAN RIBOUD
Executive Vice President

AME VENNEMA
Executive Vice President

W. J. GILLINGHAM
Vice President

JOHN B. MONTGOMERY
Vice President

CARL NEUREUTHER
Vice President Control and Finance

EVERETT F. STRATTON
Vice President

EDWIN N. WEST
Secretary and General Counsel

J. E. RHODES
Controller

WILLIAM NILES
Treasurer

H. L. PLATTER
Assistant Secretary

SCHLUMBERGER LIMITED

1900 Southwest Tower, Houston, Texas, 77002

SUBSIDIARIES AND DIVISIONS (CONSOLIDATED)

SCHLUMBERGER WELL SURVEYING CORPORATION
5000 Gulf Freeway, Houston, Texas

JOHNSTON TESTERS
Sugar Land, Texas

SCHLUMBERGER OF CANADA
1780 Elveden House, Calgary, Alberta, Canada

VECTOR CABLE COMPANY
5616 Lawndale, Houston, Texas

SCHLUMBERGER SURENCO
Apartado 1608, Caracas, Venezuela

ELECTRO-MECHANICAL RESEARCH
1900 Main Street, Sarasota, Florida

DAYSTROM, INCORPORATED
430 Mountain Avenue, Murray Hill, New Jersey

WESTON INSTRUMENTS AND ELECTRONICS
614 Frelinghuysen, Newark, New Jersey

DAYSTROM TRANSICOIL
Worcester, Pennsylvania

DAYSTROM ELECTRIC
Manchester Rd., Poughkeepsie, New York

HEATH COMPANY
Benton Harbor, Michigan

DAYSTROM FURNITURE
Sinai Road, South Boston, Virginia

VIRTUE FURNITURE
5701 West Century Blvd., Inglewood, California

SOCIETE DE PROSPECTION ELECTRIQUE SCHLUMBERGER
42 Rue Saint Dominique, Paris, France

SCHLUMBERGER OVERSEAS
26 Berners, London W. 1, England

FORAGES ET EXPLOITATIONS PETROLIERES
35 Rue Saint Dominique, Paris, France

SOCIETE D'INSTRUMENTATION SCHLUMBERGER
42 Rue Saint Dominique, Paris, France

SOLARTRON ELECTRONIC GROUP
Farnborough, Hampshire, England

ASSOCIATED COMPANY (NOT CONSOLIDATED)

DOWELL SCHLUMBERGER
26 Berners, London W. 1, England

STOCK TRANSFER OFFICES

First National City Bank, New York
Bank of the Southwest, Houston

REGISTRARS

Morgan Guaranty Trust Company, New York
First City National Bank, Houston

TO THE SHAREHOLDERS:

With the close of the year 1963, we report the following over-all financial results:

	1963	*1962*
Operating revenues	$302,967,000	$266,544,000
Operating income	$ 40,822,000	$ 35,729,000
Taxes on income	$ 19,763,000	$ 15,783,000
Net income	$ 21,831,000	$ 22,240,000
Net income per share	$4.09	$4.17

The increase in operating revenues is largely attributable to the inclusion of Forages et Exploitations Petrolieres (Forex) in the consolidated financial statements from January 1, 1963 — when the interest in that company was increased to majority ownership — and to greater sales of electronic equipment by Electro-Mechanical Research. Oil field services accounted for slightly more than half of 1963 total operating revenues. Approximately two-thirds of the total revenues were from United States and Canadian sources.

Operating income reflects a more efficient level of operation of our United States oil field services, together with increased drilling activity in the Eastern Hemisphere and the contribution of Electro-Mechanical Research. Higher taxes were incurred, in part because of the inclusion of Forex, and retroactive increases of Algeria tax rates. Also, 1962 benefited from the carry-forward for tax purposes of unused operating losses incurred in earlier years by a United States subsidiary. Approximately half of the net income was derived from United States and Canadian sources.

Significant efforts were made in 1963 toward consolidation of our position in the electronic industry, and the following actions were taken:

Remaining minority interests in the Solartron Electronic Group, England, and in Lie Belin, a French subsidiary of Societe d'Instrumentation Schlumberger, were acquired, making each of the companies a wholly owned Schlumberger subsidiary.

The business and assets of Advanced Scientific Instruments, Minneapolis, were acquired and its activities were continued as an operating division of Electro-Mechanical Research.

Control Systems Division of Daystrom at La Jolla, California, was sold to Control Data Corporation in exchange for 26,247 shares of common stock of that company.

Several operating activities of Daystrom were transferred to the Weston Instruments and Electronics Division of Daystrom at Newark, New Jersey, to consolidate these activities with Weston activities for better control.

Early in the year, Electro-Mechanical Research started to supply telemetry for the Gemini Project. EMR also began scheduled deliveries around mid-year of ground station equipment for the NASA World Wide Range. In December, the Department of Defense announced the long-anticipated cancellation of the Air Force Dyna-Soar Program. EMR had completed a major amount of its telemetry contract for this Program, and its engineering and manufacturing activity was realigned to handle expanding effort in other programs.

Capital additions during 1963 aggregating $21,719,000 were principally for offshore surveying equipment and other oil field service equipment. When the new manufacturing plant now being constructed in Los Angeles is occupied by Virtue later this year, both of the furniture divisions will have modern facilities for efficient manufacturing.

Regular quarterly dividends of twenty-five cents per share were paid during the year. At December 31, 1963, the company held 30,370 shares of Schlumberger Limited common stock purchased on the New York Stock Exchange for delivery to key employees upon exercise of their stock options. The company is continuing to make such purchases for this and other corporate purposes. Trading of Schlumberger Limited common stock on the Stock Exchange, London, England, began on April 29, 1963.

The United States Treasury Department advised the New York Stock Exchange that it would exclude the stock of foreign corporations traded on a national securities exchange from the proposed Interest Equalization Tax if the trading on the exchange constituted the principal market of such stock during 1962, and if more than 50 percent of the stock was held by United States persons. Schlumberger Limited meets the tests of exclusion. The stock was withdrawn on January 6, 1964, from the New York Stock Exchange list of issues affected by the proposed tax.

Management changes included the promotion of Jean Riboud to Executive Vice President in addition to his other duties. The Schlumberger companies with head offices in the Eastern Hemisphere report directly to Mr. Riboud and he will continue to make his headquarters in Paris, France.

Ame Vennema, Executive Vice President, was elected a Director and member of the Executive Committee. The Schlumberger companies with headquarters in the Western Hemisphere report directly to Mr. Vennema at the Schlumberger Limited headquarters in Houston, Texas.

W. J. Gillingham, President of Schlumberger Well Surveying Corporation, and J. B. Montgomery, President of Daystrom, Incorporated, were elected Vice Presidents of Schlumberger Limited in addition to their other duties. E. F. Stratton, former Executive Vice President of Schlumberger Well Surveying Corporation, transferred to Schlumberger Limited and was promoted to Vice President. William Niles transferred from Schlumberger Surenco, Caracas, to Schlumberger Limited, Houston, and was elected Treasurer.

H. G. Doll
Chairman of the Board

P. Schlumberger
President

Houston, Texas
March 4, 1964

SCHLUMBERGER LIMITED

(Schlumberger N. V., Incorporated in the Netherlands Antilles)
AND SUBSIDIARY COMPANIES

CONSOLIDATED STATEMENT OF INCOME

	Year Ended December 31, 1963	1962
	(Stated in thousands)	
OPERATING REVENUES	$302,967	$266,544
OPERATING EXPENSES		
Direct operating	197,403	168,839
Research and engineering	13,059	13,510
Profit sharing and other employee benefit plans	7,318	6,987
General	44,365	41,479
Total operating expenses	262,145	230,815
Operating income	40,822	35,729
INTEREST AND OTHER INCOME — NET	1,489	1,930
Income before taxes on income	42,311	37,659
PROVISION FOR TAXES ON INCOME	19,763	15,783
Income before minority interest	22,548	21,876
MINORITY INTEREST in net income (loss) of subsidiaries	717	(364)
NET INCOME	$ 21,831	$ 22,240
NET INCOME PER SHARE	$ 4.09	$ 4.17

Expenses include $20,092,000 and $14,491,000 depreciation of fixed assets, and $1,768,000 and $1,320,000 amortization of intangible assets

INCOME RETAINED FOR USE IN BUSINESS

Balance at beginning of the year	$161,272	$142,856
Net income	21,831	22,240
Dividends declared	(5,323)	(3,824)
Balance at end of the year	$177,780	$161,272

See notes to financial statements

SCHLUMBERGER LIMITED

(Schlumberger N. V., Incorporated in the Netherlands Antilles)

AND SUBSIDIARY COMPANIES

CONSOLIDATED BALANCE SHEET

ASSETS	December 31, 1963	1962
	(Stated in thousands)	
CURRENT ASSETS		
Cash	$ 32,312	$ 28,690
Marketable securities, at cost (approximately market)	57,467	41,251
Receivables, less allowances for doubtful accounts	67,198	57,627
Inventories, at cost or less	49,048	48,466
Other current assets	1,396	1,359
	207,421	177,393
INVESTMENTS AND LONG TERM RECEIVABLES, at cost	13,553	20,169
FIXED ASSETS		
Plant and equipment, at cost	191,139	152,586
Less depreciation to date	107,736	77,868
	83,403	74,718
INTANGIBLE ASSETS, less amortization to date	13,388	10,775
OTHER ASSETS	3,720	2,737
	$321,485	$285,792

LIABILITIES AND STOCKHOLDERS EQUITY

CURRENT LIABILITIES		
Accounts payable and accrued liabilities	$ 44,094	$ 35,493
Estimated liability for taxes on income	18,852	13,714
Dividend payable	1,332	1,332
Portion of long term debt due within one year	2,046	807
	66,324	51,346
LONG TERM DEBT	14,717	17,606
OTHER LIABILITIES	5,475	4,262
MINORITY INTEREST IN SUBSIDIARIES	7,189	1,306
	93,705	74,520
STOCKHOLDERS EQUITY		
Common stock — $1 par value Authorized — 6,000,000 shares Issued — 5,333,587 shares	50,000	50,000
Income retained for use in business	177,780	161,272
	227,780	211,272
	$321,485	$285,792

See notes to financial statements

SCHLUMBERGER LIMITED

(Schlumberger N. V., Incorporated in the Netherlands Antilles)

AND SUBSIDIARY COMPANIES

NOTES TO FINANCIAL STATEMENTS

PRINCIPLES OF CONSOLIDATION

The consolidated financial statements include all majority owned operating subsidiaries in the United States and other countries. Forages et Exploitations Petrolieres (Forex) has been included in the consolidated statements from January 1, 1963 when the interest in that company was increased to majority ownership.

The financial statements show the consolidated results of operations and financial position after elimination of intercompany transactions and providing for minority interests. Fixed assets and investments recorded in other currencies have been translated to United States dollars at historical rates and other items have been translated at current rates.

LONG TERM DEBT

Long term debt consists of $9.1 million Daystrom 5¼% sinking fund debentures due 1980 and $5.6 million other debt payable mainly to banks and insurance companies. All amounts payable in 1964 are included in current liabilities. The indenture covering the debentures provides for annual sinking fund redemptions and contains certain restrictive provisions pertaining to payment of dividends.

INTANGIBLE ASSETS

Research and development costs are charged to operating expenses currently. Intangible assets, representing primarily the portions of investments in consolidated subsidiaries not attributable to tangible assets, are being amortized over periods of five or ten years.

PROFIT SHARING AND OTHER EMPLOYEE BENEFIT PLANS

There are various employee benefit plans in many countries providing for profit sharing, pensions, or other benefits in lieu of pensions, established in prior years in conformity with local conditions and regulations. Except for relatively small amounts, provision has been recorded for all benefits arising from prior service and the funds for the plans have been deposited under trust agreements.

STOCK OPTIONS

Options granted in prior years to key employees to purchase 144,915 shares of common stock at prices ranging from $30 to $83 per share were outstanding at December 31, 1963. The options are for ten-year periods and for the most part are exercisable for one-fifth of the shares in each of the first five years. Options to purchase 91,215 of the shares were exercisable at December 31, 1963. During the year options for 12,640 shares were exercised at prices of $30 to $49 per share and options for 10,450 shares terminated. Investments include $1.9 million cost of 30,370 shares held by the company for options and other corporate purposes.

SUPPLEMENTARY BALANCE SHEET INFORMATION

Cash includes $12.7 million interest-bearing time deposits. Marketable securities comprise mainly United States dollar securities of the International Bank and of governments of the United States and other countries.

Inventories are stated at cost less allowances for obsolescence, with cost determined primarily by the moving average or standard cost methods. Operating material and supplies for oil field services amount to $16.9 million, and inventories for manufacture and sale of electronic equipment and other products are $32.1 million.

Investments include 50% ownership of Dowell Schlumberger stated at cost of $6.1 million, compared to approximately $7 million equity in the net assets of that company at December 31, 1963.

Fixed assets include $137.6 million field technical and other equipment, $46.3 million buildings and building improvements, and $7.2 million land and land improvements. Depreciation is recorded by the declining balance method or the straight line method over the estimated useful lives of the assets.

COMMITMENTS AND CONTINGENCIES

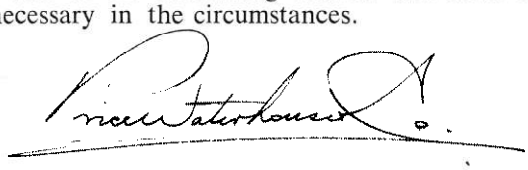
There were no commitments or contingencies other than in the ordinary course of business, except for several lawsuits which on the basis of presently available information are not expected to result in any liability. Renegotiation refunds, if any, are not expected to be material.

PRICE WATERHOUSE & CO.

ESPERSON BUILDINGS
HOUSTON 77002
February 14, 1964

TO THE BOARD OF DIRECTORS OF
SCHLUMBERGER LIMITED:

In our opinion, the accompanying statements present fairly the consolidated financial position of Schlumberger Limited and its subsidiaries at December 31, 1963 and the results of their operations for the year, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year. Our examination of these statements was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.



OUR TECHNICAL society, in its scientific, industrial, and military phases, as well as in the pursuits of the consuming public, depends on the integrity of measurement. The growth of Schlumberger, from its beginning to its present diversity, has been through the achievement of more precise measurements.

Schlumberger's many products and techniques set the standard for reliable, accurate measurement in environments ranging from the earth's interior to outer space. In oil fields throughout the free world, at missile launch sites and distant monitor stations, in the facilities of the electronic and aerospace industries, in the defense establishment of the free world, in laboratories, schools, and homes, instruments designed by Schlumberger are in daily use.

Instruments developed for measurements in subterranean formations, through which wells are drilled in search for oil and gas, are adapted to measuring similar parameters found in satellite and missile technology. Creative interplay in the solution of measurement problems in widespread and dissimilar fields has led to greater inventive resources and a stronger technical position. The unification under a single corporate structure of a broad technical complex is advantageous to company and customer alike.

MEASUREMENT IN THE EARTH

Measurements made within the earth itself find application principally in that phase of the petroleum industry devoted to exploration for deposits of oil and gas and their ultimate recovery. Measuring equipment lowered into boreholes provides continuous readings on such parameters as formation electrical conductivity or resistivity, spontaneously generated potentials, nuclear radiation, sonic velocity and attenuation, electron density and proton (hydrogen) content, temperature, pressure, and fluid flow rates. The data are telemetered to the surface through multiconductor cables, recorded as a permanent log of the well on film, and often times on magnetic tape. Computation and analysis of these data are performed at the well site to assist the geologist or petroleum engineer in arriving at decisions with regard to the completion of the well.

Schlumberger was the originator and pioneer of electrical logging and auxiliary wireline service, and invests annually substantial amounts in research and engineering. As a result, new services and measuring techniques are constantly being introduced by the company to assist the petroleum industry in the discovery and evaluation of oil and gas reservoirs.

Measurements are obtained while the well is being drilled, and later, after it has been lined with steel casing. Electrical, sonic, and radioactivity logging instruments are employed to record formation characteristics to discover at what depth oil or gas zones have been encountered in the borehole. The various types of Schlumberger log-

ging services complement one another to increase the amount and reliability of information and the precision of measurements obtained under varying borehole conditions.

Electrical logging relies on a contrast of electrical conductivity to distinguish between oil or gas and water-bearing formations and to determine the thickness and productivity of formations. The Induction-Electric log, or Induction-Laterolog, is used generally to make precise measurement of formation resistivity. There also may be well conditions where the Laterolog alone is more effective in defining the formation resistivity.

The Proximity log, the Microlog, and the Microlaterolog are used to determine changes in formation conductivity across small depth intervals, less than one inch for example, as well as to determine the conductivity of small formation volumes near the well bore. The microdevices are systems where the electrodes are pad mounted and are pressed against the wall of the hole.

The Continuous Dipmeter provides the customer with an accurate record of the direction and amount of dip of the subsurface formations. These data are used to determine the location of additional productive wells or even to indicate the position of a possible new oil or gas field. Recently, Schlumberger has been recording Dipmeter logging data in digital form on magnetic tape, using an electronic computer to determine the azimuth and magnitude of the dip and to print-out the results automatically.

Sonic logging relies on contrasts in transmission time of sound energy to determine how much fluid — oil, water, or gas — the formations may contain. The Sonic log, with travel time measured to an accuracy of a millionth of a second, provides the geologist, engineer, and geophysicist with necessary information for development and exploratory activities.

Nuclear techniques provide the basis for several logging services. Gamma Ray logging, for example, measures the natural radioactivity of the formations. Neutron logging, on the other hand, measures secondary effects due to the bombardment of formations by neutrons. The measurement is an indication of the total amount of fluid contained in the permeable formations. Both Gamma Ray and Neutron logging can be performed either in wells which have been completed with a steel casing or in the open hole before any steel casing has been placed in the well.

The Formation Density log is a relatively recent and very successful service. It measures one of certain secondary effects which occur when a formation is bombarded with gamma rays. The measurement furnishes information on the density of the formation which, in turn, is very significant in the evaluation of productive potential.

The Cement Bond log is a cased well service. It is a measure of the energy loss which occurs when acoustic energy is sent through a steel casing. This reveals whether the casing is properly cemented or if remedial work should be undertaken. Proper cement-

ing of the casing is important to avoid unwanted communication in the borehole between oil-bearing and water-bearing formations.

The Formation Tester and Sidewall Coring Tool are two other wireline services used to secure important formation data. These are used to recover fluid or rock samples from any formation in the well. The Formation Tester has a unique capability of obtaining a one to five-gallon sample of formation fluid under the extremes of subsurface pressure and temperature and to measure flowing pressure of the formation. When the well is cased a shaped charge is fired to make a hole in the casing. Pressure measurements are made, the fluid sample recovered, and the hole is then closed with a cement plug.

In the usual completion of a well by perforating with Bazooka-like shaped charges, the importance of measurement lies in the accurate placement of holes in the steel well lining at the proper depth opposite the formation to be produced. Automatic cable measurement and magnetic depth marks on the cable have been developed by Schlumberger to obtain a depth measurement accuracy of one foot in 10,000 feet. The shaped charges, too, are designed to give a uniform depth of penetration and entrance hole size in the formation.

Gamma radiation patterns may be employed to orient the direction of perforations. Company development of such orienting techniques has made possible the production of oil from several different depths in one well by use of parallel strings of pipe in the borehole.

Mobile laboratory units, equipped with ruggedized climate-proof control and recording instrumentation, provide accurate measuring services at well sites in any climate or terrain throughout the free world. Schlumberger truck units are used on land and may be seen on the roads in and around any oil field.

A marine unit, equipped with a recorder cab which has been sealed against salt spray and with diesel engine power, is used for work at offshore wells. An airborne unit complete with cable, which weighs approximately 17,000 pounds, has been constructed for use on exploratory wells in inaccessible terrain. It is designed to fit in a cargo plane or for airlifting by helicopter. The unit can be dismantled so that the heaviest component weighs less than 4,000 pounds.

Motor vessels equipped with Schlumberger logging units and tools navigate the inland waterways of coastal states to provide service for wells drilled in shallow bays and marshy areas.

Continual improvement of existing logging methods and the successful development of new techniques increase the use of our service by customers. Schlumberger, for example, has developed a technique for electronic computation of logs in the field through the use of computers carried as standard equipment in the truck laboratories. Log data, computed and plotted automatically as it is recorded, provides a Formation Analysis log to help determine possible productivity. The importance of this information,

and the speed with which it can be provided, has proven of particular interest to customers.

The Formation Analysis log was introduced in 1963. An Induction-Electrical log and a Sonic log are each recorded simultaneously on film and in digital form on punched paper tape. As the tape is fed to a computer, the logs are automatically merged and analyzed to produce the Formation Analysis log. Measurement and comparison of parameters relating to formation resistivity and sonic transmission time permit a quick, accurate assessment of the productive capacity of the well. The computer is used to analyze the recorded measurements in the well from bottom to top so that possible oil or gas zones will not be overlooked.

Though well logging tools are designed especially for use in the petroleum industry, they do find application in earth science research. During the drilling of the Mohole, Schlumberger equipment will be used to measure the properties of rocks at depths perhaps to as much as 40,000 feet below sea level. The Mohole is a project of the National Science Foundation to acquire greater knowledge of the earth's crust.

Other measurements in the field of oil and gas exploration and production are carried out by *Johnston Testers*. A *Johnston* testing tool, lowered into a well at the end of drill pipe, permits the testing of a formation under closely controlled and metered conditions, approximating those which will be encountered after the well has been completed and placed on production. The information is essential for proper evaluation of the productive potential of the well.

Vector Cable Company manufactures electric cables complementing the measuring process. The cables, employed in seismic exploration for oil and gas reservoirs, in oceanographic research, and in well logging and completion, are used to transmit data from sensing to recording devices. *Vector* cables are designed for high precision measurements under the most severe environmental conditions.

MEASUREMENT ON EARTH

Schlumberger companies are engaged in the design and manufacture of electrical, electronic, and electromechanical devices employed in the measurement and display of many physical phenomena.

Weston Instruments and Electronics manufactures high precision voltmeters, ammeters, and wattmeters which are standards in laboratories and in industry. The company has developed instrumentation for the measurement of temperature, fluid flow, light intensity, rotational motion, and other physical parameters. *Weston* produces, in addition to precision meters, electronic test equipment, calibration standards, X-ray and infrared gauges, and display devices. *Weston* developed the first aircraft engine performance indicating instruments and subsequently has designed and produced a complete line of modern aircraft instruments. *Weston* meter relays are in use in monitoring systems for atomic reactors, in go-no-go systems, and in other detection and control system applications where dependability and sensitivity are essen-

tial. Perfection of the Photronic® non-physical contact-type relay is a recent development. *Weston* also designs and manufactures precision resistors and potentiometers.

A *Weston* installation completed in 1963 for one of the major steel companies included an optical gauge system to increase production and improve quality in centerless grinding of close tolerance steel rods. The gauge is used to continuously measure rod diameter after the rod leaves the grinder. It detects variations as small as 0.0001 inch in the size of the rod as it passes through a light beam. If the variation exceeds a predetermined tolerance range, the gauge transmits a corrective signal to the grinder. The previous method required an operator to spot check rods with a micrometer and manually adjust the grinder. The new method increased rod production by 20%.

Another *Weston* product, familiar to photographers throughout the world, is the Weston Exposure Meter. A new model, the Master V, marketed in 1963, offers improvements in dial and scale design with a positive film speed lock. Sensitive selenium photoelectric cells and precision meter movements provide reliable measurement under any usable light conditions without the use of boosters or batteries.

The *Electric Division* at Poughkeepsie, New York, has performed research in underwater acoustics for the United States Navy. Development of a submarine detection system called JULIE incorporates a detection technique known as explosive echo ranging. The *Electric Division* developed and produces a number of specialized ordnance devices and fuzes, including the Mark 59 Underwater Sound Signal. A new depth indicator, designed by the *Electric Division* in 1963, permits highly accurate depth measurement on ocean-going vessels. The shipboard unit is equipped with three underwater pressure transducers, for various depth ranges, and provides reliable and rapid depth measurement in the selected range.

Transicoil at Worcester, Pennsylvania, has been a designer and producer of servo systems and components for approximately two decades. *Transicoil's* ability in developmental engineering is illustrated by its many advances in the art, such as the smallest practical motor generator yet designed, gear trains, miniaturized solid-state amplifiers, and other servo system improvements. It also manufactures tachometers, induction potentiometers, brakes, and temperature compensated devices.

The *Heath Company* has developed a wide range of measuring instruments for use in homes, schools, service shops, and laboratories. Its HEATHKIT® catalog lists such measuring and recording devices as oscilloscopes, direction finders, depth sounders, vacuum tube voltmeters, signal generators, signal tracers, and audio generators, packaged for home assembly or sold in assembled form. Other items in kit form include amateur radio and stereo/hi-fi equipment, automotive and industrial test devices and instrumentation, black and white and color television sets, an electronic organ, and electronic kits for science education.

A broad band of measuring instru-

ments are manufactured in France by subsidiary companies of *Societe d'Instrumentation Schlumberger*. The *SIS* group of seven companies manufactures sensors, regulators, magnetic recorders, test equipment, and radio and television broadcasting equipment.

Ateliers de Construction de Bagneux (ACB) manufactures galvanometers, recorders, and transducers on a large scale for aeronautical and industrial usage.

Les Laboratoires de Physique Appliquee (LEGPA) produces precision potentiometers for aerial navigation and industrial usage as well as certain specialized measuring instrumentation with application in the atomic energy field and in automobile manufacturing.

Laboratoire Industriel d'Electronique Belin (LIE BELIN) makes phototelegraphic instruments used the world over, audio tape recorders, audio amplifying and control equipment for television and radio, scintillation counters, and special transformers.

Quentin & Cie manufactures regulated power supplies, high voltage test equipment, precision temperature controllers, and capacitance bridges.

Rochar Electronique produces electronic counters, digital voltmeters, frequency meters, and other general measuring instruments.

Societe d'Electronique-Materiel Automatique-Controle (SEMAC) designs and manufactures gas analyzers and process control systems for industries ranging from sugar refineries to brickworks.

Tolana, S. A. manufactures audio and digital data tape recorders.

The *Solartron Electronic Group, Ltd. (SEG)* in Great Britain is a designer and manufacturer of dynamic analysis equipment, digital instruments, oscilloscopes, analog computers, digital data logging equipment, radar simulators, power supplies, and a wide range of general instruments. Their two modern plants employing some 1,400 people, one in Farnborough, Hampshire, and the other in Chessington, Surrey, have over 250,000 square feet of floor space for manufacturing, research and engineering laboratories, and offices.

Solartron oscilloscopes have been adopted as standard interservice equipment for the British Armed Forces and are approved as NATO standard equipment. Their Transfer Function Analyzer has established an international reputation in the design and testing of servo systems used in industrial process control measurement systems and in missile and aircraft control systems. *Solartron* is a supplier of high accuracy Digital Voltmeters.

Transducers have been designed and are manufactured by *SEG* for a range of applications from physiological and opthalmological pressure measurement in the medical field, to pressure instrumentation on experimental nuclear reactors, and in high temperature pressure measurement in Rolls Royce aircraft engine testing.

Complementary to this is their digital data logging equipment, based on a series of standard modules, for gathering data such as temperature, pressure, strain, specific gravity, etc., from transducers and converting to digital

language. These data are then processed in the equipment and presented in a suitable form for transmission to a computer.

SEG builds a series of general purpose Analog Computers from those suitable for training and as a personal computer for research or development engineers to the new large computer system which may be used to provide capacity up to 400 amplifiers with compatible non-linear elements. Their computers have proven reliability and are used by industry and laboratories throughout Western Europe.

Solartron Simulator Systems are used for training radar controllers and operators, merchant marine officers, air traffic controllers, sonar teams and for other similar functions.

MEASUREMENT BEYOND THE EARTH

Electro-Mechanical Research is a supplier of telemetry equipment to the aerospace industry. *EMR* equipment is used for the acquisition, discrimination, recording, and display of data relating to the performance of space vehicles. The company develops and builds telemetry systems which set the standard for reliability and measurement accuracy.

Space projects in which *EMR* has participated are Mercury, the first United States manned satellite; Explorer satellites used in space research; OSO, an orbiting solar observatory; and in 1962, Telstar, private industry's communications satellite, for which *EMR* provided the ground station telemetry equipment.

EMR is engaged in supplying such instrumentation products as subcarrier oscillators, electronic commutators, digital encoders, subcarrier discriminators, VHF radio transmitters, digital decommutators, display equipment, and automatic telemetry checkout equipment. It has produced and delivered more than 10,000 FM subcarrier discriminators — more than the rest of the industry combined.

The *EMR* systems engineering activity currently includes programs in the areas of telemetry, data processing, range instrumentation, and data communication.

In designing and building the electro-optical equipment for the Smithsonian Astrophysical Observatory's Project Celescope, *EMR* is taking part in a most advanced satellite experiment. Project Celescope is an astronomical observatory which will orbit the earth. Among the techniques employed for the first time in a space environment will be digital television, a new ultraviolet television pickup tube, and the first practical space test of large, high precision optical equipment. Despite its complexity, the system is designed to operate for over one year in space without failure. The satellite equipment supplied by *EMR* consists of seven subsystems: UVicon cameras, camera controls, camera selector, analog data processing, digital data processing, command and program control, and power supplies. While the satellite is stabilized in space, four Schwarzchild telescopes will image an area of the sky on four UVicon TV camera pickup tubes. These will be

optically filtered to receive ultraviolet radiation from several different regions of the ultraviolet spectrum.

The equipment will also scan stars and nebulae, transmitting video information to the ground in analog and digital form. On the ground, digital data processing equipment will automatically print-out a star catalog of the 100,000 stars which are expected to be studied during the 12-month life of the satellite. This material is expected to provide astronomers with a wealth of information concerning the composition of interstellar matter, the theory of hot star atmosphere, a better understanding of nebulae, and understanding of the hot atmosphere of cool stars.

EMR will supply two ground support systems to Smithsonian to display Project Celescope data. One set of this equipment will be in portable form to be used in preliminary system checkout and during prelaunch and launch phases. The other will be installed at the Smithsonian Astrophysical Observatory for preliminary data evaluation. This ground equipment includes circuits to process digital and analog data in order to recreate the telemetered television scenes and two electronic systems: one to produce a photographic sky map; the other a storage tube on which a star-map image may be stored indefinitely for detailed observation.

Under another recent contract from NASA, *EMR* is manufacturing, testing, and installing Pulse Code Modulation telemetry ground stations for the NASA World Wide Range. Each of the stations consists of 11 racks of electronic equipment designed specifically to acquire PCM telemetry signals and to convert the signals into forms suitable for transmission, display, and computation.

The system can be programmed to accept any of the many PCM formats envisioned for future NASA long duration man-in-space flights. Its high degree of flexibility is evidenced by accepting variable word length data within a selected frame in any word pattern. Thus, various signal formats may be programmed and placed in standby and as a given signal requirement occurs, a new format may be selected and the station switched over to receive that signal within milliseconds after a command is given.

EMR has a small laboratory facility at College Park, Maryland, which provides for NASA satellite integration services including assembly, prelaunch checkout, and supervision of data collection during launch operations. The facility is fully equipped for calibration of satellite instrumentation including nuclear and cosmic radiation. The facility is conducting the development of space radiation-resistant telemetry equipment for use in satellite and spacecraft operating in regions of high radiation intensities.

EMR at the *Princeton Division* is a primary developer of time-division-multiplex telemetry widely used in missile programs; has branched into the fields of industrial instrumentation, transducers, electro-optics, and electron physics. Industrial instrumentation includes metal detection equipment for process industries and advanced state-of-the-art photomultiplier tubes characterized by high performance,

reliability, and ruggedness. This makes them ideal for use in space vehicle instrumentation as well as in industry. Transducers include shaft-position encoders incorporating company-developed magnetic coding techniques.

Advanced Scientific Instruments produces general-purpose digital computers and associated input/output equipment for engineering and scientific use. Computers presently in production by ASI are the 210 and 2100 small to medium-scale digital computers. The exceptionally high-speed and high input/output rate of these computers affords an unusually low cost-to-answer ratio for complex problems and on-line control and simulation. Several *ASI* computers are presently integrated into a real-time manned-spacecraft simulator. Other computers have found extensive use in nuclear research and for aerospace data reduction.

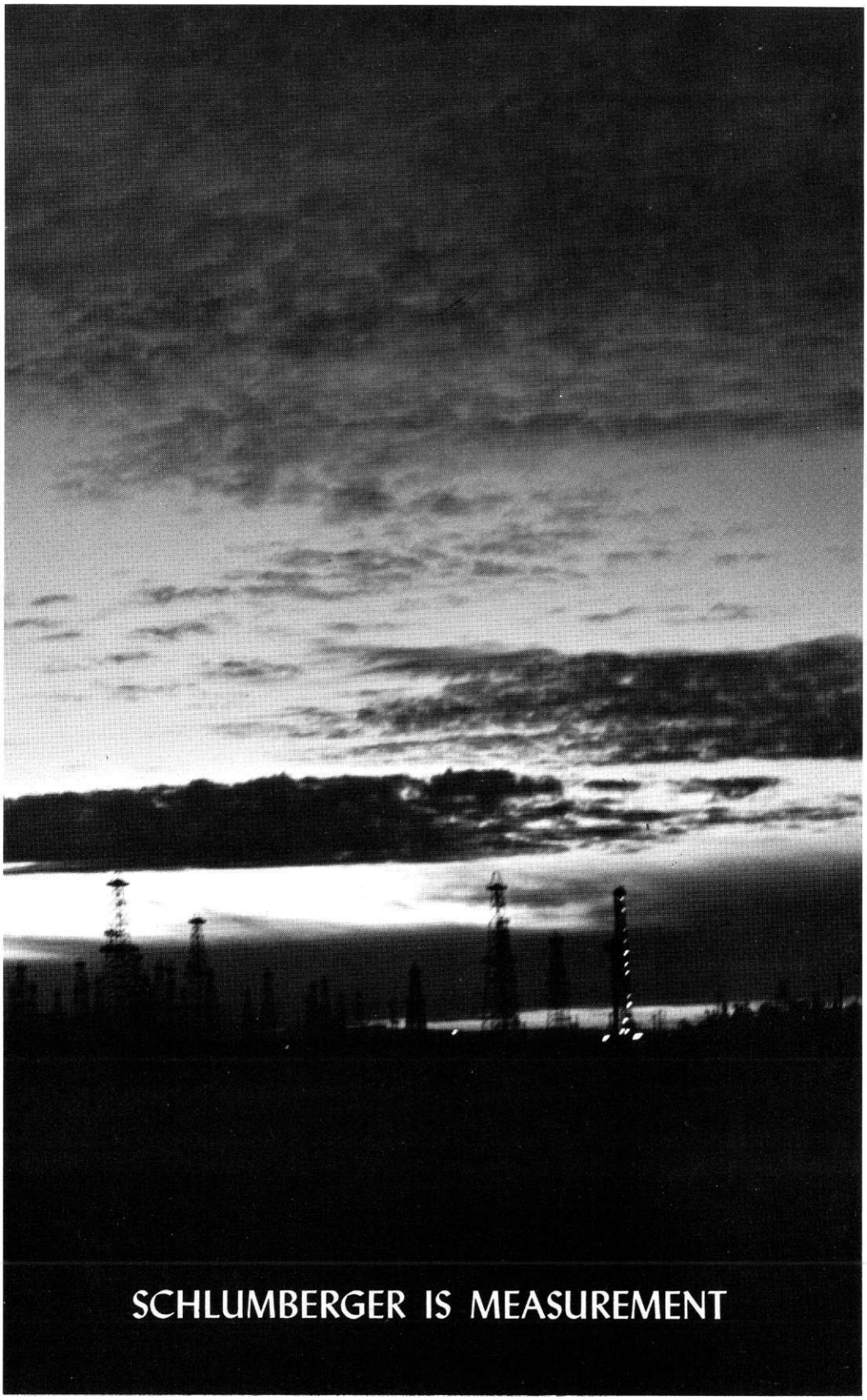
OTHER SCHLUMBERGER ACTIVITIES

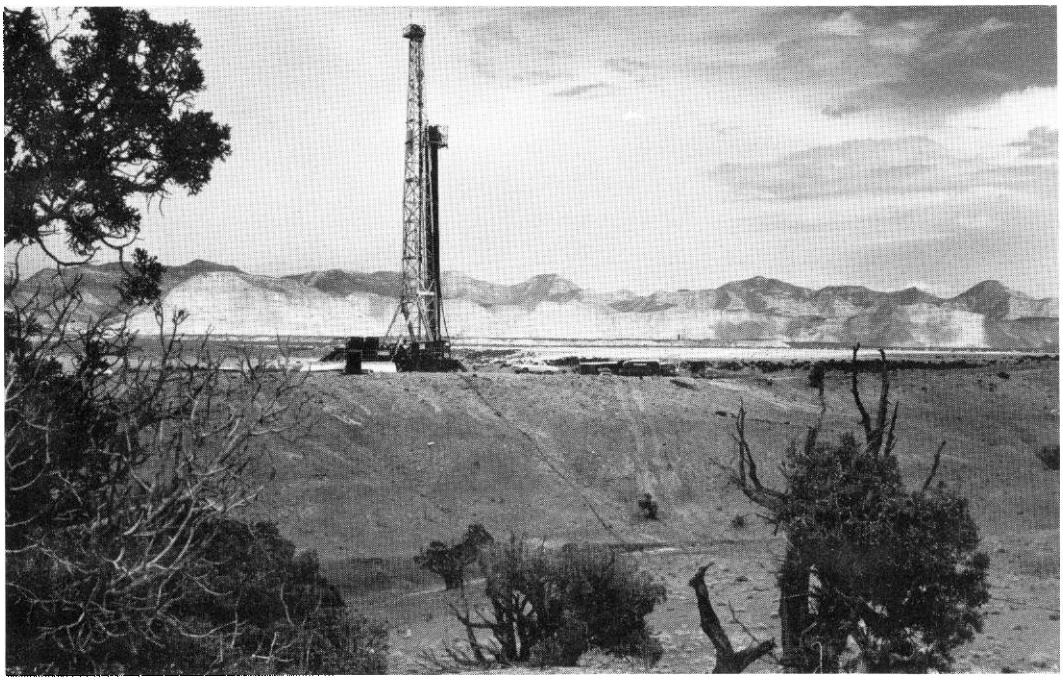
Daystrom Furniture and *Virtue Furniture* are primarily engaged in the manufacture of kitchen and dinette sets for home use and commercial furniture for hotels, restaurants, and offices. *Daystrom Furniture,* operating in a modern plant at South Boston, Virginia, occupied in 1962, distributes its products generally in the east, midwest, and south. *Virtue* distributes primarily in the western states. Schlumberger recently purchased a 20-acre site in the Los Angeles area for the erection of a new *Virtue* plant in order to improve manufacturing efficiency and to supply increased sales requirements. Construction of the 375,000 square foot, single story, steel and concrete building is presently underway and is scheduled for completion in the fall of 1964.

Forages et Exploitations Petrolieres (Forex) is a contract drilling company in which Schlumberger has slightly more than a fifty percent ownership. *Forex* operates some forty-five drilling rigs serving major oil companies in Africa and Europe. These rigs range in size from small, truck-mounted units used in drilling shallow seismic shot holes for geophysical prospecting to large rigs capable of drilling to any depth. The company also contracts the operation of customers' drilling rigs and is presently engaged in offshore drilling in this capacity.

Dowell Schlumberger, which Schlumberger owns in equal partnership with Dow Chemical Company, provides oil well cementing, acidizing, and fracturing services in Europe, Africa, the Middle East, and Latin America. Well cementing, performed to seal well casing in place, requires specialized mobile pumping equipment. Acidizing and fracturing services, using similar equipment, are employed to treat productive formations in order to initiate or increase their output.

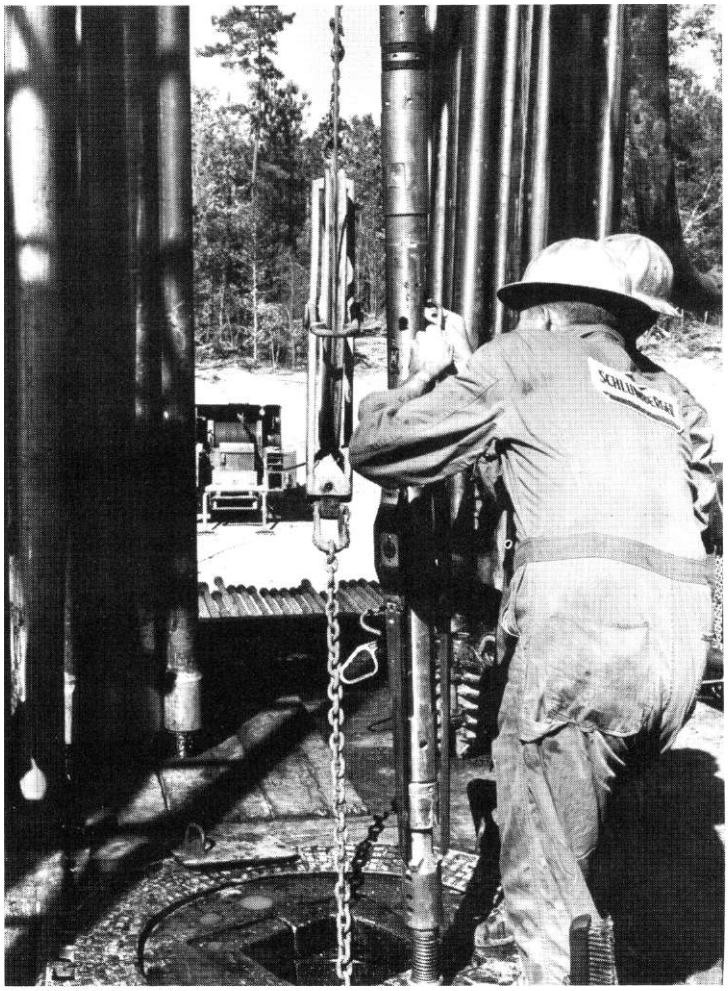
SCHLUMBERGER technical achievements are possible only through the coordinated efforts and ability of talented people. Schlumberger has some 17,000 of them throughout the free world. *These people are Schlumberger and Schlumberger is measurement.*


SCHLUMBERGER IS MEASUREMENT



Schlumberger crew on location logging a well.

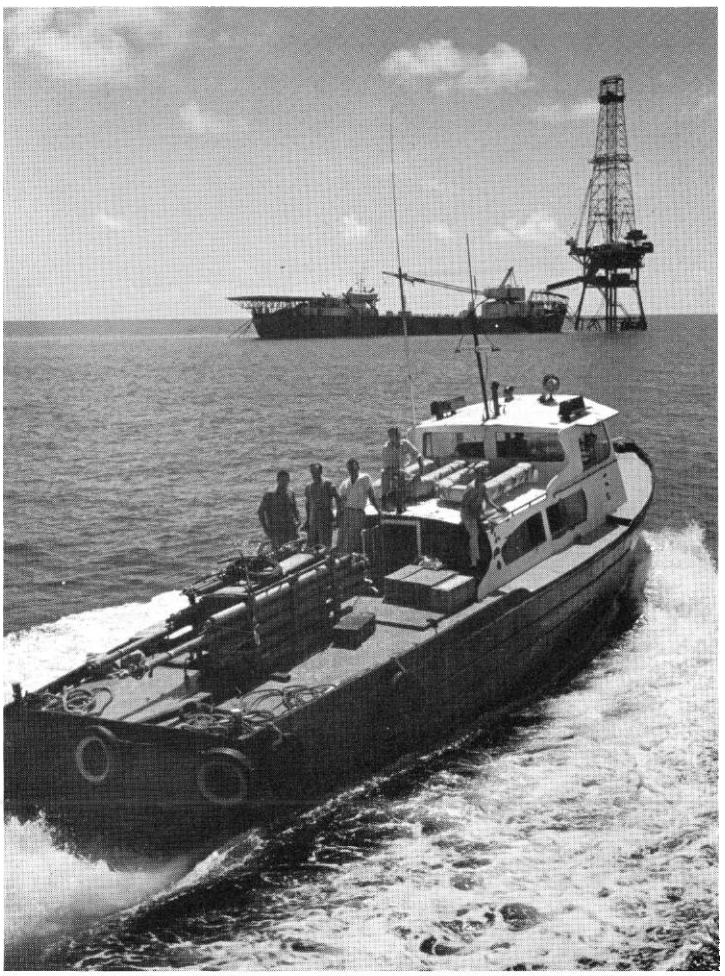
Oil well drilling activity in the United States was at a somewhat lower rate than in 1962, although offshore drilling remained at the same high level attained in 1962. Increased drilling activity in the last half of the year tended to offset the rather slow start which occurred during the first six months period. The drilling in Canada showed a slight improvement over 1962. Drilling activity in South and Central America was close to the 1962 rate, except in Argentina, where there was a substantial decline. In the Eastern Hemisphere drilling increased approximately ten per cent.



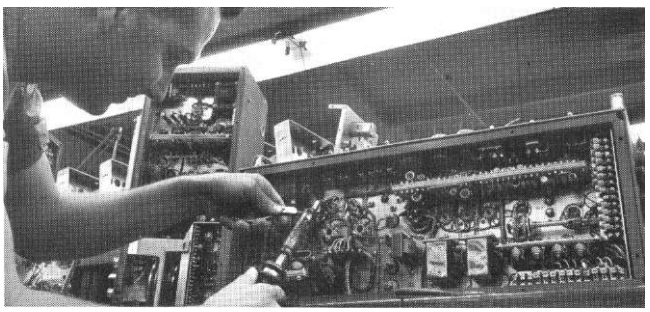
Preparing to run a Continuous Dipmeter survey.

Drilling in the Adriatic Sea off the Italian coast.

Offshore drilling, which has been associated with the Gulf of Mexico, became of increasing world-wide significance in 1963. Since offshore wells are more expensive and hazardous to drill, the operator needs to have all possible data on the hole and on the rock formations encountered. Such wells generally produce increased service revenues per foot drilled as compared to wells which are drilled on land. Greater client acceptance of our newer measuring techniques and services results in more technical services being performed per well drilled.



Schlumberger crew and equipment on the way to an offshore well.

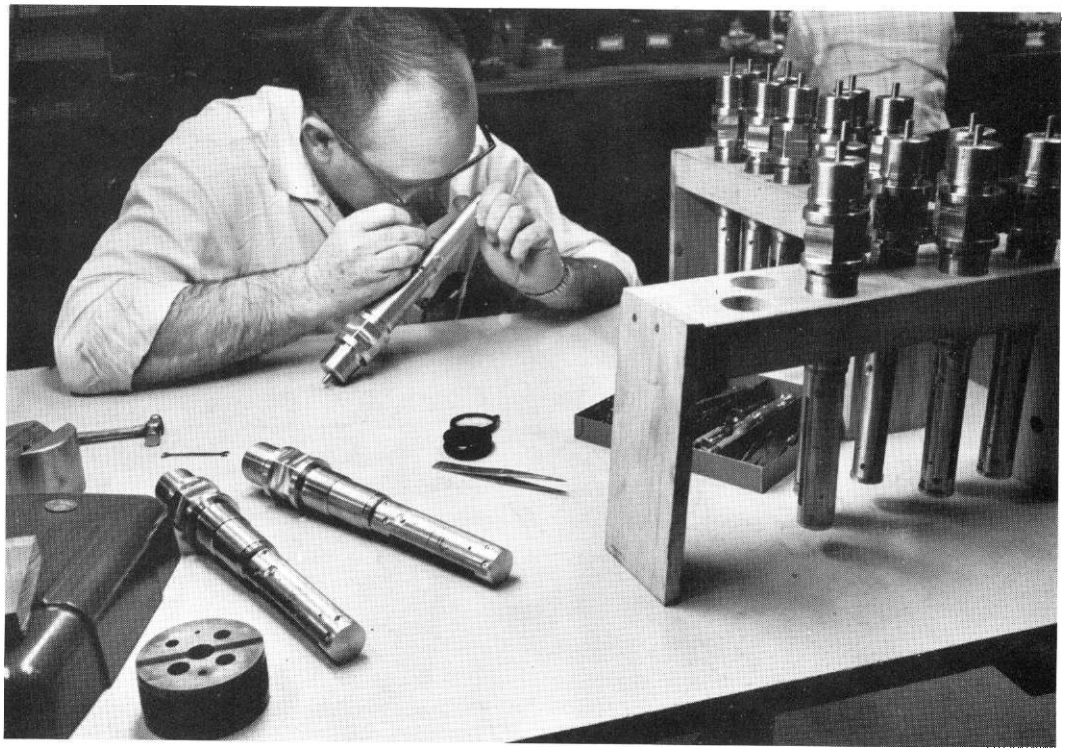


The manufacturing and assembly shops of Schlumberger Well Surveying Corporation, Vector Cable Company, Johnston Testers, and of Societe de Prospection Electrique Schlumberger, produced more than $20 million worth of materials in 1963. The equipment and material were placed in service in oil fields throughout the free world. Export shipments were made to Schlumberger field locations in more than 60 countries.

Above: Assembly of electronic control panel.

Left: Assembly of electronic logging sondes.

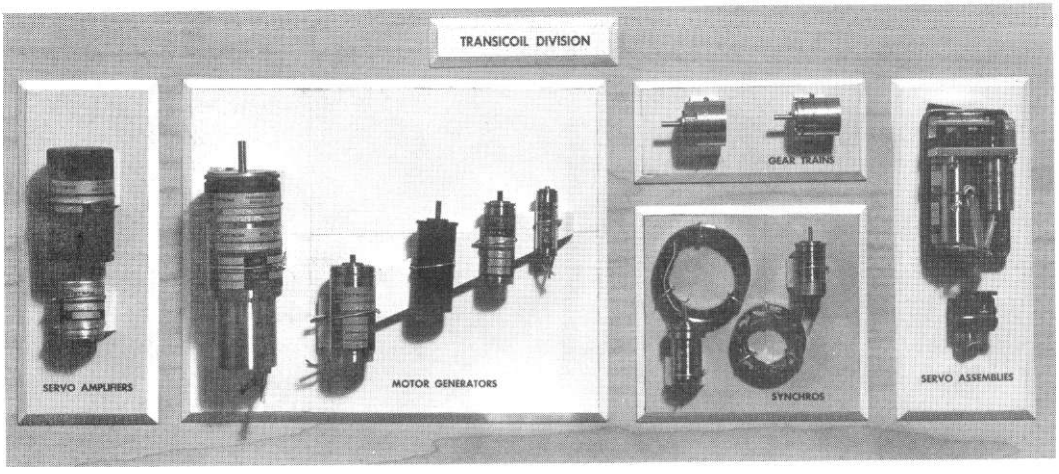
Below: Oil well service equipment for export.



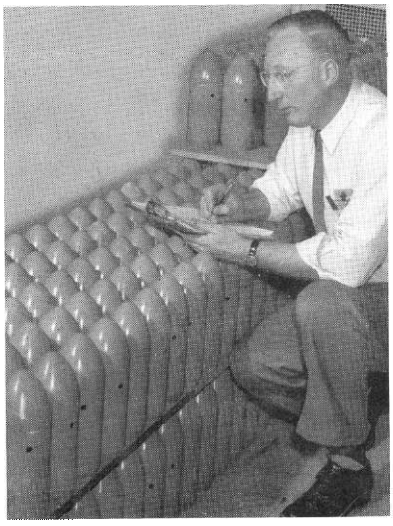
Pressure measuring and recording instruments being checked at Johnston Testers.

The continuing annual expenditure of about $8 million for research and development resulted in significant advances in oil field service measuring techniques. An important new effort in the research program is intended to provide a Formation Analysis log at the well site. A Continuous Dipmeter log adapted to computer analysis of formation dip measurements was one of the results of our research. Another important development of the year was the design of a new borehole-compensated Sonic Logging tool that produces superior logs under adverse borehole conditions. The high reliability of equipment is maintained through an extensive engineering program of testing at and above design specifications.

Electronic measuring cartridge for a Dipmeter sonde gets a final inspection.



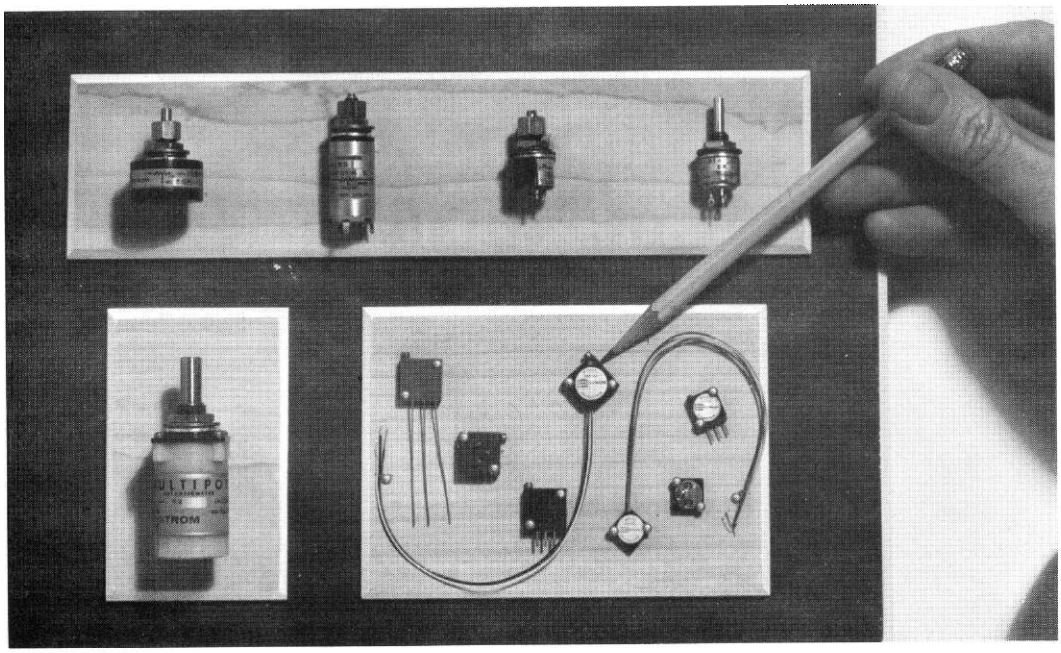
Servo mechanisms manufactured by Transicoil.



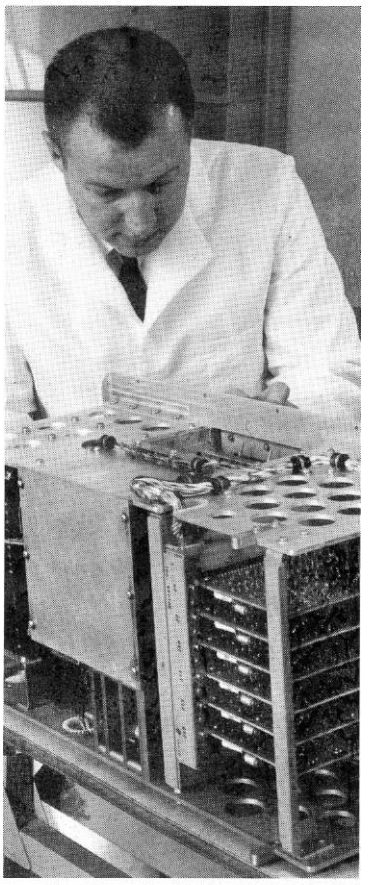
Transicoil designs and manufactures servo mechanisms, servomotors, servo amplifiers, generators and motor generators utilized in missile systems, aircraft, radar, and commercial applications. The Electric Division continued to deliver Anti-Submarine Warfare components to the United States Navy. During the year, the Division also developed products for use in oceanographic investigations. Weston, originator of the square trimming potentiometer, samples of which are shown below, offers more than 1700 types of Squaretrims® as shelf items.

Left: Underwater sound signal components.

Below: Weston potentiometers.



Color Television HEATHKIT®.



Weston Signal Data Recorder.

Schlumberger electronic products incorporate solid-state technology in transistorized and miniaturized components. Schlumberger companies continued to improve and broaden their product lines. Weston manufactures and sells many different types of electrical and electronic measuring instruments and components. The Heath Company lists in its catalog 200 HEATHKITS®. The most important addition in 1963 was a color television.

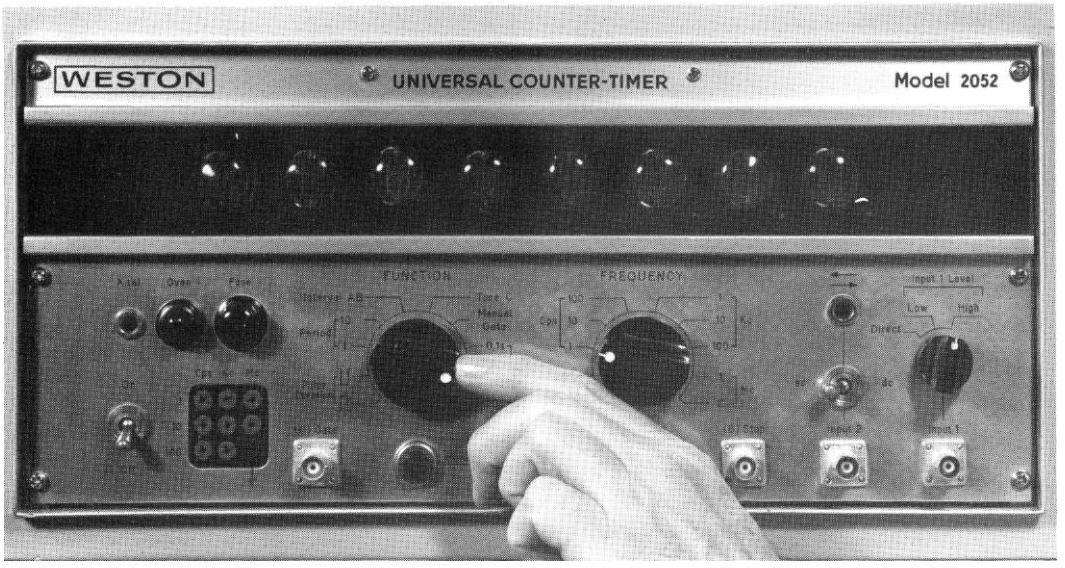
Weston products on display at Schlumberger Limited headquarters.

Electronics industry exposition in Paris, France.

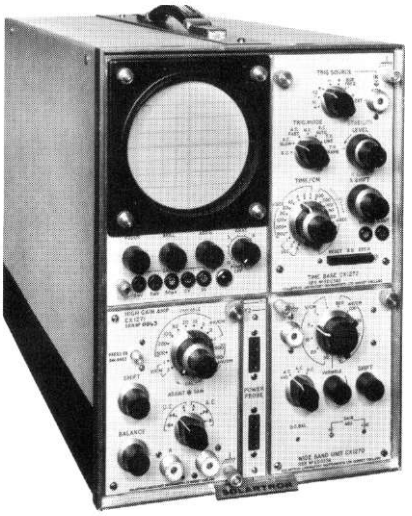
The marketing effort for Schlumberger electronic products in the Eastern Hemisphere was reorganized and enlarged. The sales increased about ten per cent. Efforts are presently being directed toward an improved management control, more efficient manufacturing, and greater investment in research and new product development.

The electronic counter pictured below was designed and developed by Rochar Electronique, one of the subsidiaries of Societe d'Instrumentation Schlumberger. It is the first product from the Schlumberger European electronics companies selected by Weston to be marketed in the United States.

Rochar electronic counter marketed by Weston.



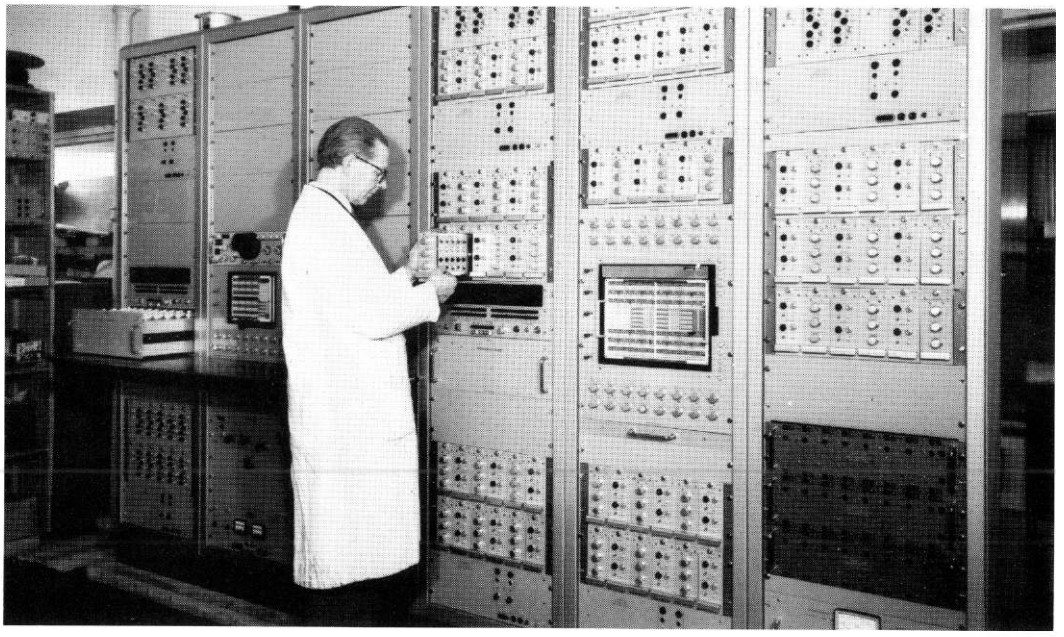
The Solartron Electronic Group in Great Britain has its head office and a plant at Farnborough and another plant at Chessington. Through reduction of operating expenses, a substantial improvement of financial results was achieved in 1963. Sales showed some improvement over 1962. A new high accuracy digital voltmeter was developed while the performance characteristics of the company's oscilloscopes were improved. An analog computer for training purposes was designed to meet the special requirements of educational institutions. Several transistorized radar simulators were sold during the year for use in aircraft pilot training.

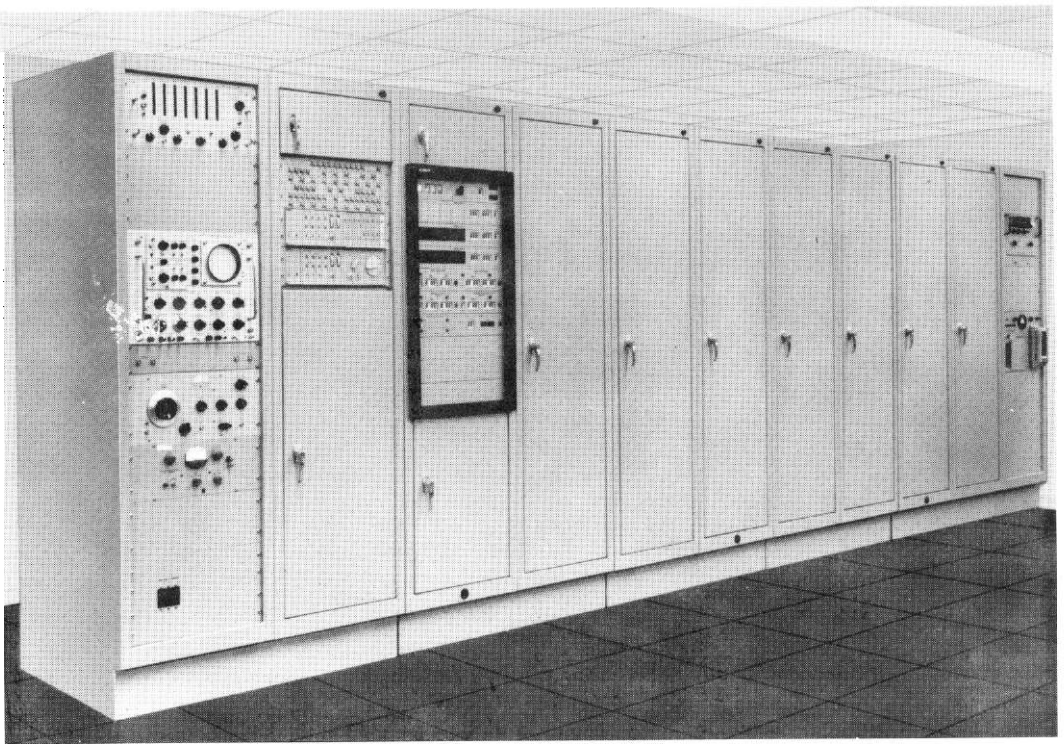


Above: Solartron Pulse Generator.

Left: Solartron Oscilloscope.

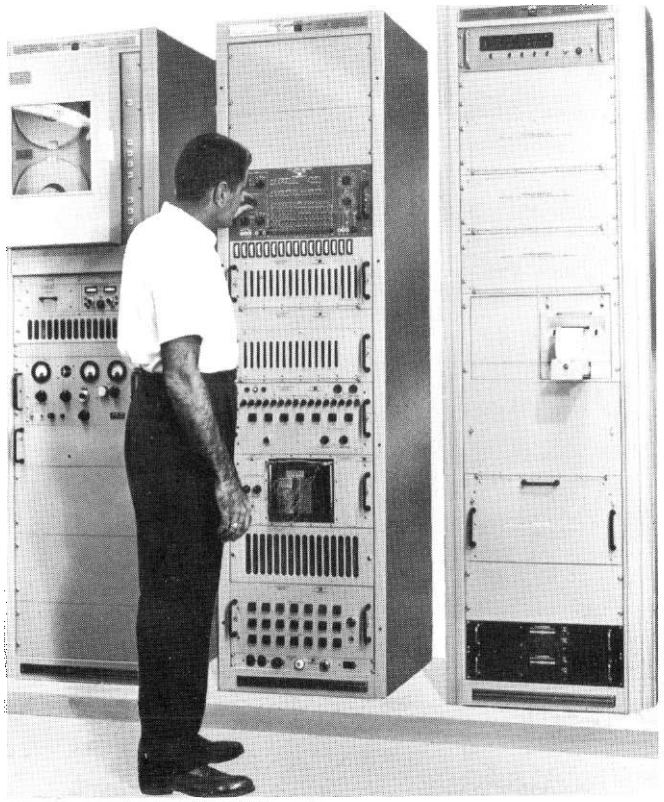
Below: Solartron Analog Computer.



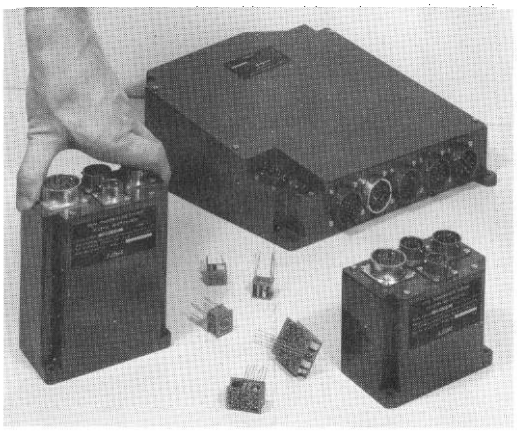


EMR telemetry ground station equipment for a NASA World Wide Range station.

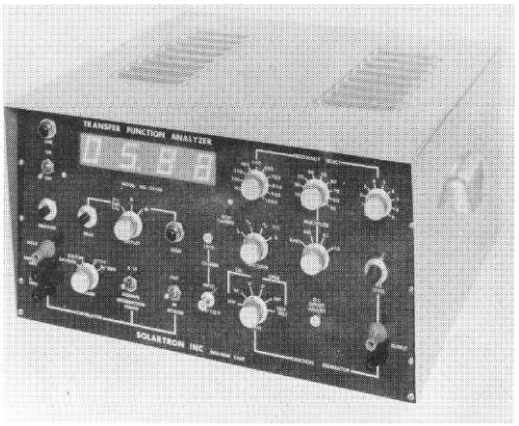
EMR ground station for use with Telstar.



Sales of Electro-Mechanical Research of Sarasota, Florida, increased by more than 68 per cent. Together with this substantial growth, a corresponding improvement in net income was accomplished. EMR is an important supplier of airborne telemetry and systems to the aerospace and missile programs of the United States Government. Production and installation was started on Pulse Code Modulation telemetry ground station equipment for NASA locations around the world. These stations will be used in tracking future manned space flights. Telemetry ground station equipment was also supplied Bell Telephone Laboratories for use with Telstar, the communications satellite.



Miniaturized space borne components.

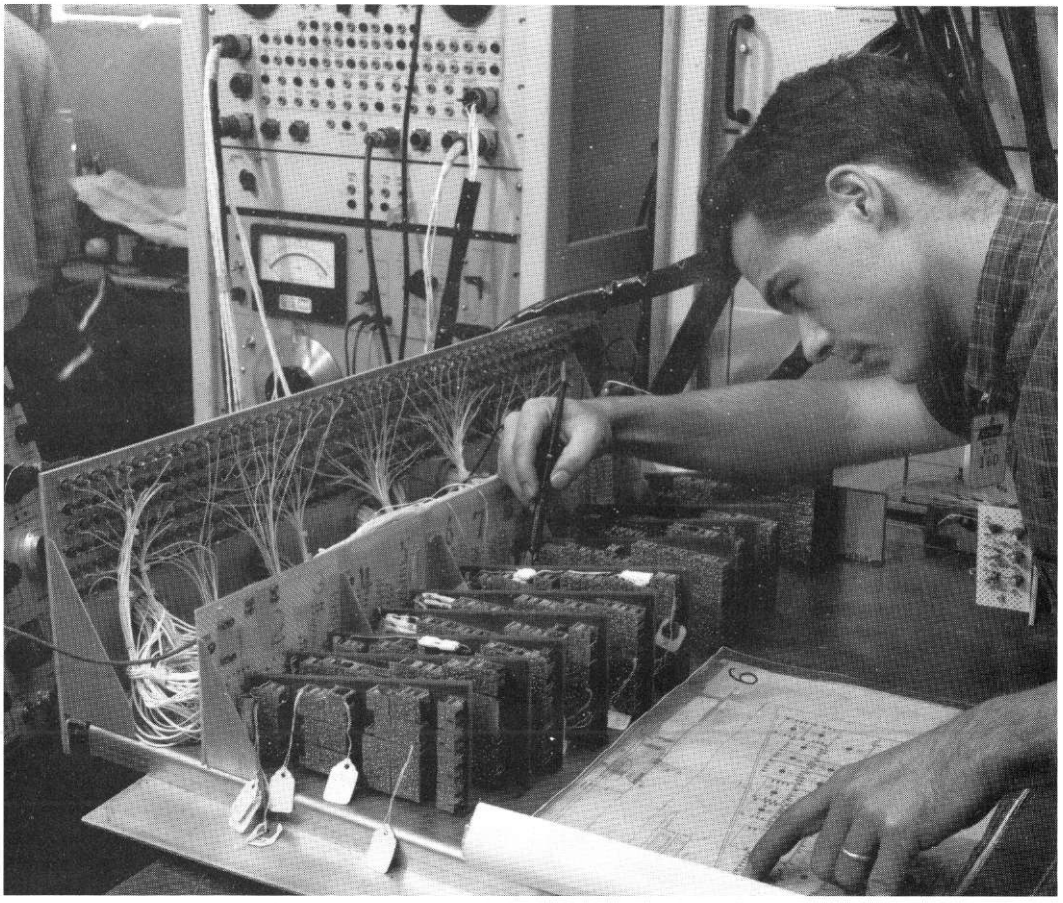


Solid-state transfer function analyzer for servo analysis.

EMR contracted to design and build the airborne data transmission and test equipment for the Gemini manned spacecraft program.

EMR also designed and built special test equipment which can be programmed to check out a complete spacecraft data system automatically.

Gemini data transmission system components being checked out.

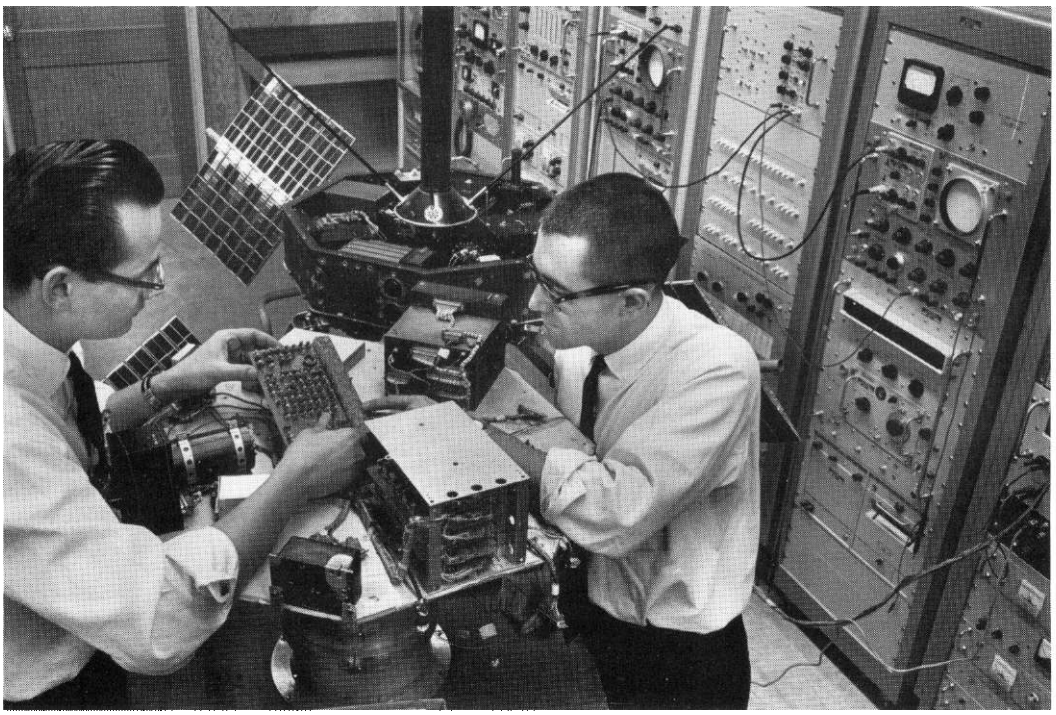


Electronics package constructed for NASA Project Celescope.

The electronics package shown in the picture above being tested, contains more than 6200 transistors. It is for Project Celescope, the NASA orbiting astronomical observatory satellite.

At College Park, Maryland, EMR has a small laboratory where satellites are assembled and are thoroughly checked and tested for functional reliability.

Checking satellite assembly at College Park.



SCHLUMBERGER LIMITED • 1900 SOUTHWEST TOWER • HOUSTON, TEXAS, U.S.A. 77002