SCHLUMBERGER 1981 ANNUAL REPORT

Schlumberger
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COVER

A geological map of an oil field, based on wireline logging data; the map was produced on an Applicon four-color plotter.

SCHLUMBERGER LIMITED

IN BRIEF	1981	1980	1979
REVENUE	$5,977,938,000	$5,137,115,000	$3,641,438,000
NET INCOME	$1,265,975,000	$ 994,347,000	$ 658,936,000
NET INCOME PER SHARE	$4.37	$3.47	$2.30
DIVIDENDS DECLARED PER SHARE	$0.77	$0.63	$0.49

In 1981, net income crossed the billion dollar line. Quite a different order of magnitude from the figure I remember when I joined Schlumberger some thirty years ago. Luck, circumstances, hard work, a bit of everything, I suppose, made it happen.

Net income for the year was $1.27 billion, up 37% over the previous year, if one excludes the nonrecurring profit on the sale of the Rowan shares in the last quarter of 1980. Revenues of almost $6 billion show an increase of 19%, on a comparable basis.

Quarter by quarter, the year started strong and finished strong. Net income improvement was 42% for the first quarter, 27% for the second, 36% for the third and 44% for the last quarter (excluding the Rowan profit).

As the year unfolded, the fundamental trends did not change appreciably.

Oilfield activity was very strong, throughout the year, throughout the world. Canada was probably the only exception to a global picture of intense exploration and development of gas and oil fields, by national companies as well as by private companies. The wireline, or logging business, had the most spectacular growth but was followed closely by all the other oilfield services.

Fairchild lost money during the year. Not a spectacular amount, but nevertheless lost money. We have to go back quite a few years to see a major unit of Schlumberger in the red. It is not surprising. The semiconductor business is in the doldrums, and yet we accelerated the investment program, the Research & Engineering budget, the strengthening of management.

Measurement & Control units were profitable, although the business environment was affected in the United States by the economic slowdown and in Europe by the wide fluctuations of currencies.

To a lesser extent, two other factors, lower taxes and higher interest income, contributed to this record year. Overall effective tax rate was down 3 points, compared to the previous year. This reduction results from a lower proportion of income from high tax countries and from tax credits in the United States and in the United Kingdom. The second factor is the increased liquidity generating higher interest income. In 1981, fixed assets additions were over a billion dollars, another record. Yet, liquidity increased almost by a quarter of a billion dollars. At year-end, $1.66 billion were invested in short-term securities.

A stockholder wrote me recently: "The better your results, the higher your earnings, the lower your stock. Please explain." I am not a stock market expert, nor do I always understand the movements of Wall Street. However, I believe that the public has two main worries concerning the future.

What will happen to the price of crude oil?

What will happen to the economy in the United States?

It is not so long ago that the media were predicting the end of our industrial civilization because the world was running out of oil. Today, the same media are full of the oil glut. There is a very short time lag between too much and too little, between scarcity and surplus. Two years ago, almost to the day, I wrote: "Thirty years in the oil industry have taught me a simple conviction. If you want to find oil, you have to look for it; if you look, you find oil. The search has started and the finds are coming in." So goes the world, in cycles. There is no doubt that the steep and repeated increases in the price of oil have brought about significant discoveries and a noticeable reduction in the demand for hydrocarbons. The slowdown of the world economy has accelerated the process. Will this result in the price of crude oil tumbling down, playing havoc with the cash flow of oil operators and cutting down exploration programs. The risk exists and it scares the stock market. How serious, how threatening is this risk. Obviously, I do not have the answer but years of experience might help.

— At the present world price of oil, drilling for oil in the United States is very profitable. It would take a major drop in price to make it unprofitable.

— Ten years ago, outside North America, the list of our ten top customers were the nine largest publicly held oil companies and one national oil company. Last year, the same list showed nine national oil companies and only one private company. It would take a major decline in the price of crude for the national companies to change drastically their exploration programs. Many countries are fighting for their energy autonomy as they fought for their political independence. They will do it even if there is a temporary surplus of oil.

— Saudi Arabia had a determining role in stabilizing the price of crude when many experts were expecting $40 or $50 per barrel. I believe that Saudi Arabia has the means and the will to play the same role when the price is under pressure.

It is always easier to be gregarious. It is always dramatic to announce the most pessimistic scenario. I do not think that the price of crude oil will tumble.

I am more concerned by the state of affairs in the United States than I am about the oil glut. The year 1981 was for many sectors, including our electronic business, a year of organized retrenchment. The downturn was more serious for semiconductors because a price erosion of great amplitude accompanied the reduction in orders and shipments. But there was no fear or panic. In January and February, the climate has changed. Business people are running scared. There is a simple reason. Except for short periods, the United States economy cannot function with rates of interest at 15% or above. Something has to give.

There again, it is a simplification to become a Cassandra. The worst will not happen, neither for the price of crude oil, nor will a major depression entrench itself in the United States. But 1982 will be difficult.

Meanwhile, life goes on. Three developments are currently requiring our efforts and should be reported.

■ The Wireline or logging business is still today our largest and most profitable business (45% of 1981 operating revenue), our fastest growing business (revenue increased worldwide 38% in 1981). We decided last autumn to reorganize our basic Wireline structure. This is the way it was announced:

> "The organization of the Wireline has not changed appreciably in the last thirty years. It has grown, it has been decentralized, but the basic structure has not changed: two major centers, Houston and Paris, and one central research lab in Ridgefield, Connecticut.
>
> To meet the growing demand for Wireline services, to decentralize further the field operations, to benefit from the technical and industrial progress outside of Europe and North America, a new center will be established in Japan. This third center, as the two others, will have engineering and manufacturing facilities and will provide technical coordination of field operations.
>
> The new Wireline organization is:
>
> — Wireline North America: the United States and Canada, manufacturing facilities in Houston, engineering facilities in Houston and Austin, Texas,
>
> — Wireline Atlantic: Europe, Latin America and Africa, engineering and manufacturing facilities in Clamart, France,
>
> — Wireline Asia: Middle East, Far East, Australia. Engineering and manufacturing facilities will be established in Japan,
>
> — Schlumberger Doll Research, Ridgefield, Connecticut, responsible for research."

This is an important step for the Wireline. But it has further implications. It represents a pattern of management and structure that we will implement gradually over the next decade for our major product lines: drilling and production services, semiconductors, automatic test equipment, computer aided systems, electricity management....As we grow, for each major product line or service, a small core of people will provide, on a world basis, direction, long term orientation, coordination of research, financial control.

■ This month, nine Schlumberger men lost their lives when the Ocean Ranger capsized offshore Newfoundland. The oldest was 31 years of age, the youngest was 24. We have known for years that exploration for oil and gas is dangerous. Wells do blow out, offshore units do capsize in tempests. On land, driving is a hazard. Our engineers and operators drive many miles to reach the well sites. They are young, they are enthusiastic, they have no fear. Safety is a remote worry. We are undertaking a major safety campaign.

■ On January 12, 1982, Applicon became part of Schlumberger. Applicon is one of the leading companies in the field of Computer Aided Design – CAD. This follows the acquisition a year earlier of MDSI, a pioneer in the field of Computer Aided Manufacturing – CAM. We are putting both companies under a single management. They will be part of a new Schlumberger unit, called "Computer Aided Systems – CAS".

The long term future of Schlumberger has not changed. The temporary oil surplus or the recession in the United States economy does not alter our plans. We will be around for years to come as the best oilfield service company. We will put back Fairchild as one of the creative forces in the semiconductor business. We will be innovative and develop new products in the Measurement & Control units. We will be one of the leaders in the Computer Aided Systems technology.

February 26, 1982

Jean Riboud
Chairman and President

BUSINESS REVIEW

Wireline Services: measurements of physical properties of underground formations to help locate and define oil and gas reservoirs and assist in the completion, development and production phases of oil wells. Measurements are made by lowering electronic instruments in the wells at the end of an electric cable called the "wireline." Operations are conducted in 78 countries.

Wireline revenue worldwide was 38% higher than in 1980.

In North America, Wireline revenue increased 42%, reflecting the high level of drilling in the United States—the U.S. rig count increased 36% to 4530 by year-end. The areas of highest activity were the Anadarko Basin in Oklahoma, the Williston Basin in the eastern Rockies, the Austin Chalk trend in Texas and the eastern part of offshore Gulf of Mexico. The strong growth in North American activity was achieved in spite of a significant slowdown in Canadian operations as a result of the National Energy Program; in 1981, 214 rigs left the country and moved to the United States while the number of wells drilled declined 25%.

In the Eastern Hemisphere and Latin America, Wireline revenue was up 35%. Areas showing the best gains were the Far East, up 43%, and the Middle East, up 44%. The countries with the largest increases were Abu Dhabi, Indonesia, Saudi Arabia, Mexico, Egypt, Italy and Brazil.

■ Computed log interpretation activity worldwide grew 50% in 1981. This result was due to the continuing strong investment in log interpretation facilities, locating new centers closer to the clients, and from the broader range of Answer Products now available.

■ The conversion of field logging units to the computerized Cyber Service Units continued at a rapid pace, as 394 new units were added. In 1981, 83% of all open hole jobs were performed with a CSU unit.

■ A new engineering center was opened in Austin, Texas in 1981. This center will be responsible for the development of surface instrumentation, cable telemetry and data communication. Once the transfer is complete in 1982, the center will employ over 100 engineers and support people. Plans are under way for the construction of a permanent, $10 million facility to house this group.

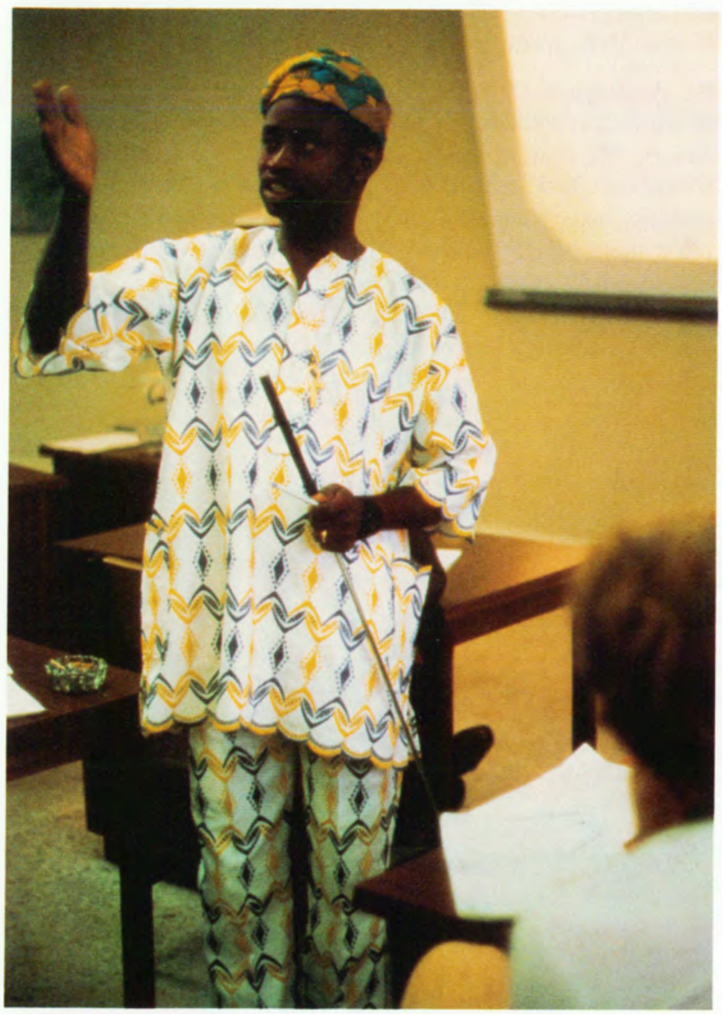
■ A shaped-charge perforating development and manufacturing center was opened in 1981 at Rosharon, Texas, 30 miles south of Houston. This facility will focus on developing and producing high technology, proprietary shaped charges for perforating casing to allow oil and gas to flow into the well bore. Scheduled production of over 800,000 charges in 1982 will be twice the 1981 rate. This center will have an engineering and manufacturing work force of about 150 people.

A wireline logging operation in Nigeria. A logging downhole tool is being pulled out of the well.

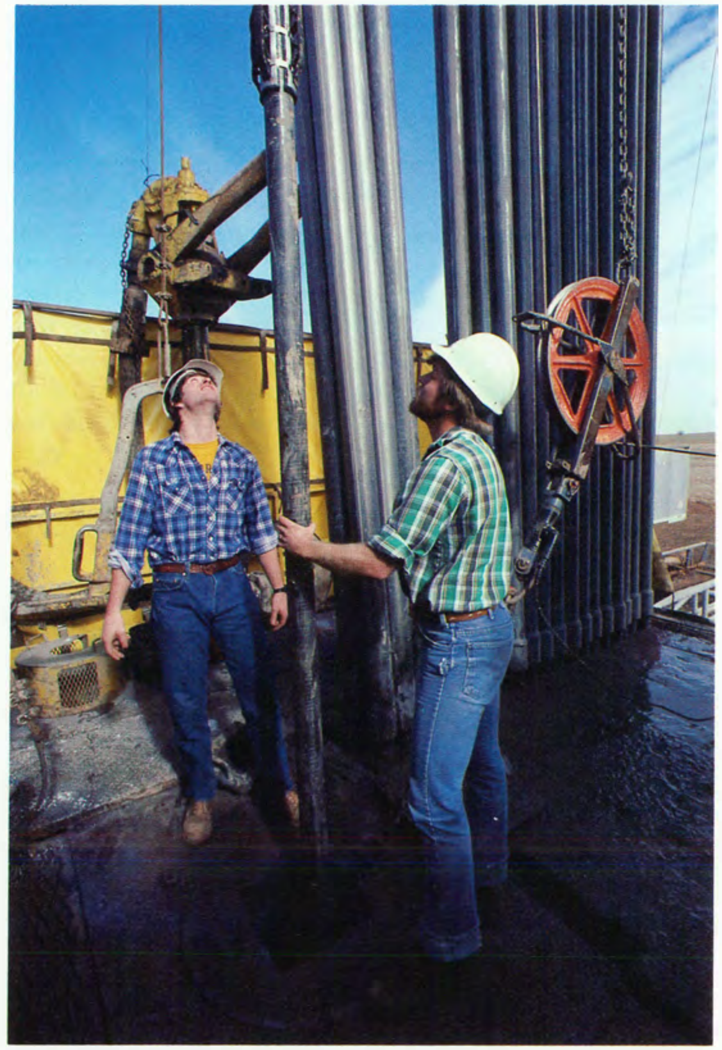
RECRUITING THE WIRELINE FIELD ENGINEER

Schlumberger's Oilfield Wireline revenue has doubled every three years for the past decade. Revenue in 1981 was 38% higher. Sustaining this growth rate depends on recruiting and training new groups of field engineers every year to run wireline services in oil wells. At a time when demand for engineering graduates exceeds the supply, Schlumberger hired approximately 1,300 wireline field engineers in 1981, and will be seeking over 1,450 in 1982. Consequently, recruiting is a major, ongoing concern at Schlumberger.

The job of Wireline engineer is not to everyone's taste. A new engineer faces three years of demanding study and training. He is on the job wherever oil wells are drilled, often in difficult and remote locations. At the well, the Wireline engineer represents Schlumberger so he must be outgoing and communicative, as well as technically capable. Once he starts to log a well, it is his job alone from start to finish, even if it means 48 hours without sleep. Obviously, a sense of responsibility, initiative and adaptability are necessary qualities. The individuals who fit this mold are rare. So, the task of finding such people makes the recruiter's job in Wireline a difficult one.



Matthew Ikpoku instructs a class of trainees at the Wireline training center in Port Harcourt, Nigeria.



Near Covington, Oklahoma, Dennis Jones, senior field engineer (right) explains wireline logging to Ed Mollett, a job candidate.

To meet this demand, Schlumberger Wireline has 24 recruiters working full time worldwide. They are not professional recruiters but are selected from the top group of young field engineers with three to four years seniority. They can discuss the job objectively and convincingly from first-hand experience, and they represent the type of candidate they want to recruit. Their recruiting effort takes them several times a year to nearly 300 universities worldwide. Among students who meet academic standards, the Schlumberger recruiter typically interviews eight to find two qualified, and in the end hires one.

As often as possible during the year, the recruiters are accompanied by a Wireline field manager to visit campuses and meet with professors and placement directors. In turn, members of the academic community are invited to visit Wireline field and engineering facilities where the latest technology is demonstrated. Additionally, Schlumberger works with the local universities by providing literature about new developments, and in some cases, guest lecturers.

In addition to meeting faculty and administrative groups, the recruiters address seminars and speak at meetings of student engineering societies. Through a summer trainee program, some 100 students beginning their final year of college are given a chance to work alongside Wireline engineers in oil fields worldwide. This gives these students a taste of the field life and work, and helps make Schlumberger better known in the universities.

Wireline services are provided in more than 78 countries. This presents an added challenge to the Wireline recruiter, for it is Schlumberger's policy to recruit in these 78 countries. In line with this policy, 40% of the engineers recruited in 1980 and 1981 for assignment outside of North America came from developing countries. To date 24% of all field engineers in these assignments come from these countries; there were only 10% in 1975.

These results have not come easily. Problems of language, cultural and educational differences had to be overcome. To solve these problems, Schlumberger has based a number of recruiters in developing nations, and assigned others to search for engineers from these nations studying at European and U.S. universities. Once employed, the new engineer attends one of the 18 training centers placed around the globe. Outside of North America, one-third of the teaching staff also comes from developing countries. This has helped establish the communication and understanding needed by new employees in the critical early days in a new environment.

The field engineer is the backbone of the Wireline. To maintain its position, Schlumberger must continue to recruit the best engineers from around the world. It is through these engineers, the Schumberger leaders of tomorrow, that the company acquires the flexibility to adapt to a fast changing and diverse world.

Recruiting at the University of Texas. Oftentimes a Schlumberger Cyber Service Unit (CSU) mobile laboratory is parked on a campus to show students the technology. A logging tool is resting on the sawhorses.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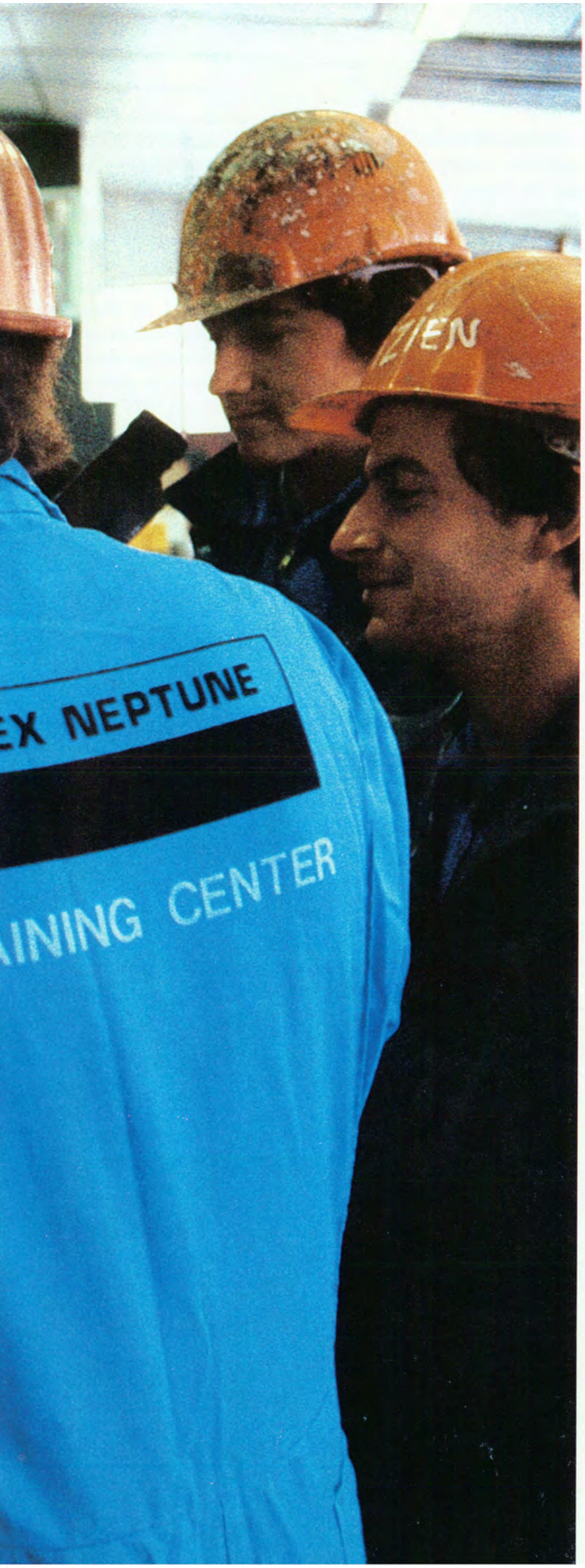


BUSINESS REVIEW

Drilling & Production Services revenue increased 28% over the preceding year. Each operating division showed improved results as the oilfield activity continued to be strong worldwide.

DRILLING SERVICES

Forex Neptune: drilling on land and offshore.

■ Revenue was 28% higher than last year. At the end of 1981, the Forex Neptune group owned and operated 56 land rigs and 17 offshore units. Under contract, the group operated ten drilling rigs owned by other companies. Over-all, land and offshore rig utilization averaged 92%. Three jack-up rigs, Tridents 6, 7 and 8, went into service during the year. A new offshore jack-up rig, Trident 9, will be delivered in March 1982. Five more land rigs are on order. Drilling operations were started in the United States in May, 1981; at present, four rigs are in service.

The Analysts: well site computer analysis of surface and downhole drilling data, gathered while drilling.

■ Revenue was 42% higher than in 1980. The significant growth areas were in the Eastern Hemisphere and Latin America. In October, a new surface system (Total Concept III) was introduced, which provides greater flexibility in presenting well-site data. In December, MWD operations were in progress offshore in the Gulf of Mexico, the North Sea, Spain and the Ivory Coast.

TESTING AND COMPLETION SERVICES

Flopetrol: well testing; pressure measurements; production and workover services — in the Eastern Hemisphere and Latin America.

■ Revenue increased 27%, with the largest gains in the Far East, Middle East, Mediterranean area, Venezuela and Mexico. High accuracy pressure measurements, well testing and PVT laboratory services made significant contributions to the results.

Johnston-Macco: well testing; pressure measurements; production and workover services; drilling tool rentals — in the U.S. and Canada.

At the drilling school in Pau in southwest France, instructor Christian Mallé explains how to repair a mud pump to a group of trainees. From the left are Bruce Hamilton, Doug Kapps, Alain Boucher, Jacques Leblay and Gilbert Bizien.

■ Revenue was 42% higher than in 1980. Significant improvements were made in testing services and drilling tool rentals.

PUMPING SERVICES

Dowell Schlumberger (50% owned): cementing; well stimulation; directional drilling—in the Eastern Hemisphere and Latin America.

■ Revenue increased 23% with the Far East, Middle East and Africa showing the largest gains. Two additional stimulation vessels, The Normand Providence and Bigorange 17, were commissioned in 1981, one for the North Sea and the other for offshore Brazil. A new training center was opened at Sharjah, in the United Arab Emirates.

SCHOOL TO TRAIN DRILLERS AND DRILLING ENGINEERS

The Forex Neptune Group, which owns and operates 73 rigs, is one of the world's largest drilling service companies. Business has expanded rapidly and the company puts a great deal of attention on recruiting and training people. An important training school is located at Pau, in southwest France. In 1981, some 210 recruits, including 182 future drillers and 28 engineers, attended this school.

Forex Neptune recruits young men without experience and teaches them drilling, starting from the fundamentals. The training school is staffed by professionals who have had years of field experience.

The Pau school, with 8,600 square feet of building space, includes some $3 million worth of equipment. Facilities comprise two complete rigs, and a training well 4,300 feet deep which is equipped with air injection allowing realistic simulation of blowouts. Other drilling simulators, in classrooms, can reproduce many of the mishaps which may occur only a few times in a driller's career. Recruits are exposed to real life-size equipment, the exact type they will operate in the field. This direct exposure has led to safer operating habits. Statistics have shown a reduction in the number of accidents for all categories of personnel who have been trained in the school.

New recruits go through a four-week course during which they must learn all the duties of a rig crew, the safety rules, and the proper way to use and maintain the equipment. After a successful test, the recruits are sent into the field as "roughnecks" where they will perform all the jobs of the drilling crew. One year later, they are sent back to the school for two weeks; after two more years in the field, they take another five-week course to qualify as driller. Selected drillers eventually will attend other sessions in Pau to be trained as tool pushers. In the course of their career, drillers and tool pushers go back to school periodically to become familiar with the more recent techniques.

The training of engineers, which lasts 18 months altogether, includes five months spent in the Pau school; engineers also take all the courses given to the technicians. Another Forex Neptune training center is located in Warri, Nigeria; instruction is given by Nigerians. The 15 Forex Neptune rigs in this country are operated by Nigerian employees, including tool pushers and chief mechanics.

As the company grows, more training facilities soon will be required. Two additional centers are planned for the Far East and the West Africa coast.

SAMPLING AND ANALYSIS OF RESERVOIRS

Testing is a way of life in the oil fields. Wells are tested periodically from the time a hole is drilled to locate oil or gas, later to follow the production performance of the well, and finally, when production declines, to diagnose its ills and define what can be done to extend its useful life. Testing is a major part of Schlumberger Oilfield Services.

An important stage in the life of an oil or gas reservoir is the time between drilling a discovery well and the installation of surface production facilities. This is the time when engineering studies are performed to estimate the reserves, to predict the recovery factor, to design the well completion and to engineer the production equipment. Some of the essential data required for these studies are derived from a series of laboratory measurements performed on samples of reservoir fluids. These measurements are called PVT, for pressure, volume, temperature. Flopetrol operates PVT laboratories in France, Nigeria, the United Arab Emirates and Singapore.

Fluid samples usually are collected in the well at the depth of the producing formation by means of a special bottom-hole sampler run into the well on a nonconductor cable. The fluids collected in the sampler are under pressure and must be transferred into special containers for shipping to the PVT laboratory. Samples of oil and gas also can be taken at the production separator during a well test and later recombined in the laboratory to yield the initial reservoir fluid. Both Johnston-Macco in North America and Flopetrol in the Eastern Hemisphere and Latin America offer bottom-hole and separator sampling services to their clients.

Armin Breitling, a Flopetrol engineer (right) directing a production test offshore Argentina on the Rio Colorado jack-up drilling for Total Austral. During such well tests, samples of produced oil and gas may be taken for laboratory PVT *analysis.*

The laboratory tests simulate the behavior of the fluid samples under varying reservoir conditions: from the early production stage, to a later time when the reservoir is depleted and pressure has declined. Also, the quality and grade of the hydrocarbons are measured to determine their commercial value.

Most of the laboratory measurements involve changing the pressure of the sample, which is at a preselected temperature, and observing how this change affects the volume of the liquid and gaseous phases. In addition, the chemical composition of the various phases is analyzed.

The fluid samples are placed inside high-pressure cells at a temperature and a pressure similar to those prevailing in the reservoir. Then, they are subjected to a certain number of tests to determine:

- The bubble point: This is the pressure at which natural gas, dissolved in the crude oil, begins to be released from the liquid.

- The volume of dissolved gas: Gas is released from the oil when the pressure drops below the bubble point and is gradually lowered to atmospheric pressure. This test, called a depletion study, simulates fluid behavior during the production phase of a reservoir.

- The volumes of natural gas and of stabilized crude oil that can be recovered when the initial reservoir fluid is flashed in a separator; this separation study simulates what takes place in the production separators in the field.

- The viscosity of the crude oil at reservoir pressure and temperature.

Chemical compositional analyses are also performed on the initial reservoir fluid as well as on the various gas and liquid phases encountered during the depletion and separation studies. As many as 600 different components may have to be identified.

BUSINESS REVIEW

Revenue of Measurement & Control-Europe, expressed in U.S. dollars, declined 4% in 1981. When expressed in national currencies, revenue improved 18%. This increase includes the revenue of Balteau International since May, 1981. Excluding Balteau, Measurement & Control-Europe revenue, expressed in national currencies, increased 13%.

Research & Engineering expenditures amounted to $43 million, while capital expenditures were $67 million.

In the following narrative, year to year comparisons of revenue are made in national currencies and not in U.S. dollars.

Enertec: meter and load management equipment for electricity distribution; relays and measuring transformers for electricity transmission; instruments and systems; data acquisition; magnetic tape recording.

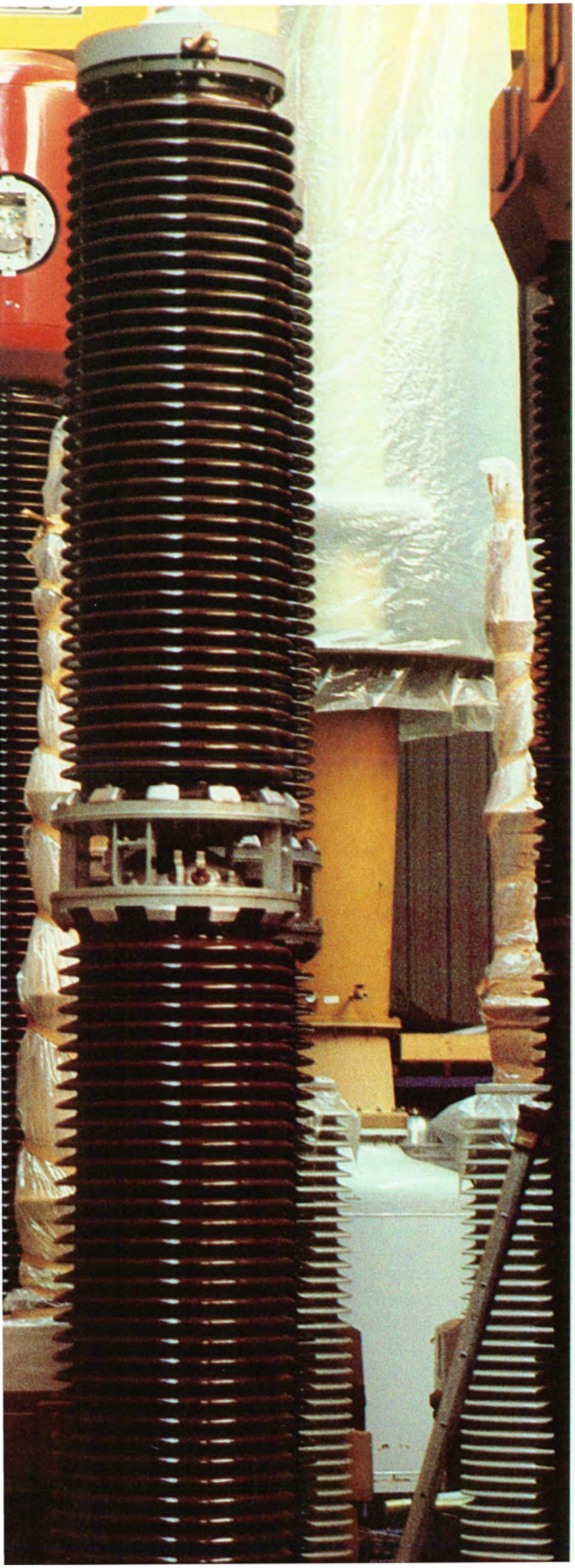
■ Revenue improved 32%; about half of the increase was due to the inclusion of Balteau's activities starting June 1, 1981. Balteau manufactures measuring transformers for electric utilities. Sales of magnetic tape recorders, automatic test equipment and electricity meters continued to grow.

Among the major products introduced in 1981 were a new electronic ripple-control relay and a new mechanical electricity meter.

Flonic: water meters and water distribution systems; gas meters and gas distribution products; high precision mechanical and plastic products; electronic payment systems.

■ Revenue increased 3%; depressed conditions in the building industry in Europe affected sales of water meters and valves.

Sales of gas equipment in France, Italy and Germany were down 12% as a result of reduced capital investment. This equipment consists of domestic and



industrial gas meters and gas expansion units for distribution networks.

An order was received from a group of French banks for a pilot series of the new electronic credit card developed by Flonic. This card is part of a system of fund transfer using offline equipment at points of sale.

Sereg: industrial control equipment; petroleum, nuclear and industrial valves.

■ Revenue increased 14% with the best growth in high-performance nuclear valves. Strong sales of petroleum valves also contributed to this gain.

Service Division: services related to water distribution and gas heaters; gasoline pumps; industrial piping.

■ Revenue increased 16% primarily due to activities related to water distribution and gas heater servicing. In addition, orders for the installation of industrial piping used in nuclear plants were up substantially.

International Division: electricity, water and gas meters and related systems in several countries in Europe (outside of France and the U.K.) and Latin America.

■ Revenue, expressed in U.S. dollars, was down 8% partly due to the appreciation of the dollar vis-à-vis most currencies. Demand for electricity and gas meters was generally good with the best progress in Spain and Austria. Two new plants were opened in 1981: one in Dordrecht, Netherlands and the other one in Campinas, Brazil.

United Kingdom Division: electricity meters and relays; aircraft and industrial instruments; electronic instruments; training systems; transducers; automatic test equipment.

■ Revenue increased 6%, in spite of a continuing recession in the United Kingdom. Membrain's automatic test equipment and the transducer business of Weston continued to grow substantially. Orders received increased by 40% with significant export orders at Solartron training systems and Membrain.

Measuring transformers in the high-voltage assembly shop in Liège, Belgium. André Gossin, on the ladder (left) is working on an 800 KV voltage transformer for Edelca, Venezuela. In the middle are 800 KV current transformers for Hydro-Quebec, Canada, and, on the right, 400 KV voltage transformers for Electricité de France.

MEASURING TRANSFORMERS FOR POWER SYSTEMS

The Instrument Transformers and Control division, including Balteau, acquired by Schlumberger in May 1981, is now a leading manufacturer of measuring transformers. Balteau has plants in Belgium, the U.K., the U.S., Mexico and Brazil; the division also includes the transformer plant at Gentilly, near Paris.

Measuring transformers are used throughout an electrical power system: at the generator, on the transmission lines and at the distribution level. They are attached to power lines to measure the currents and voltages that are being carried on these lines. The transformers accurately reduce these parameters to levels that can be handled safely by measuring instruments. The slightest deviation from normal may signal an electrical network problem, so the transformers must be capable of following precisely any voltage or current variations. The measuring instruments are part of a network protection system which is designed to interrupt the flow of power as soon as it detects a problem. The measuring transformer is an especially critical element in network protection. Since it is the interface between the power line and the instruments, it is almost impossible to protect against the failure of the transformer itself. Consequently, measuring transformers have to be built to operate trouble free for 20 years in the worst environment that might be expected.

The division produces a wide range of measuring transformers, from the 600 volt minitransformer weighing about a pound, up to the large 765,000 volt units weighing several tons.

The larger transformers are used in countries such as the U.S., Canada and Brazil where very high voltages permit electrical power to be transmitted over long distances with as little power loss as possible.

There are various types of measuring transformers: current transformers, voltage transformers and combination transformers which measure both current and voltage. Three types of installations are used in electrical networks:

LOW VOLTAGE. Domestic electricity distribution networks, less than 1,000 volts, require large numbers of current transformers.

MEDIUM VOLTAGE. Generator and domestic distribution networks, between 3,000 and 60,000 volts; both use current and voltage measuring transformers; transformers are located outdoors or in specially built indoor cabinets.

HIGH VOLTAGE. used exclusively in power transmission networks. Many more high voltage networks are being constructed due to an increased number of power generating plants located far away from users. Current and voltage transformers with capacities up to 800,000 volts are provided along with transformers having combined current and voltage measuring capabilities up to 230,000 volts.

Through research and development, transformers have been designed to meet special requirements such as resistance to temperatures as low as −40°C, or resistance to earthquakes. Over the last ten years, there has been an increased interest in gas-insulated substations in which the station equipment, isolated by an inert gas for additional safety, is housed in an armored enclosure. Balteau manufactures several types of transformers for these applications.

FLIGHT TEST DATA SYSTEMS

An airline passenger looking through the aircraft window during bad weather may notice that the tips of the wings flex several inches. This raises questions: Is this normal? Is the aircraft designed to survive under these conditions?

The reply lies partly in the theoretical design calculations but, above all, in flight testing the prototype aircraft. In fact, from the design stage until it is put into service, any new aircraft or helicopter undergoes numerous tests designed to determine its flight performance and assess its characteristics. After tests on prototypes, testing is also performed at each alteration to the structure, and whenever new equipment is introduced or when special operations are contemplated such as landing on offshore platforms or aircraft carriers.

The Acquisition and Recording Division of Enertec supplies complete flight-test systems.

Generally speaking, most tests are carried out on engines, avionics, electrical systems, flight controls and main structures. For structural tests, numerous strain and vibration transducers are installed throughout the aircraft in order to analyze its reaction to natural stresses such as take-off, bad weather, and extreme flight conditions, or to artificial stresses generated by external stimulation equipment attached to the structure.

Due to the over-all high cost of flight testing, the main concern is to obtain high quality test results in the shortest possible time. There are two practical solutions to this problem: the first is to transmit all the

This Enertec flight-data recorder, being installed in a Mirage jet fighter at the Brétigny Flight Test Center in France, stores information on the aircraft performance during missions.

test data to a ground station, using telemetry; the other is to record the test data on board using a magnetic tape recorder for later analysis on the ground.

Transmitting the data to the ground by telemetry has numerous advantages: the on-board equipment is compact and light, and processing can be carried out immediately on the ground upon reception of the data, or stored on magnetic tape for later processing. However, telemetry has some limitations: the transmission passband can be insufficient for certain very high frequency parameters such as vibration and radar, and there could be a risk of transmission loss in the most critical test phases such as relatively rapid movement of the aircraft in relation to the receiving station, masking by a tree or hangar during landing. Certain remote tests under arctic or desert conditions may be too far away from ground stations, thus eliminating the possibility of using telemetry. For all these reasons, the usual procedure is to use both techniques: transmission of data by telemetry whenever possible, complemented by on-board magnetic tape recording.

Enertec supplies complete on-board data acquisition systems: the sensors, the data concentration and formatting equipment, the radio transmission link and magnetic tape recording equipment.

The magnetic tape recorders used for these applications are specifically designed to withstand the special environmental stresses which may be encountered. Recorders must withstand vibration and impact, acceleration of up to 10 times that of gravity, apron storage temperature of −40°C or bay operation temperature of +70°C. Because on-board space is limited, recorders must use the latest miniature electronics, as well as stacked magnetic tape reels. Enertec flight-test equipment records up to 28 channels, each having a capacity of up to four million bits per second for high-density numerical recording.

On the ground, the received signal may be attenuated or even drowned in noise, depending on the distance and direction of the aircraft from the ground station. Bit and formatting synchronizers and selector switches extract the information required from the signal; then, this information may be either recorded or processed in real time in order to correlate the measurement with the actual physical parameter. When this is done, the parameters selected by the test engineer can be displayed on a TV screen. If required, the engineer can then instruct the pilot by radio to alter his flight plan.

A tape player on the ground can read both the tapes recorded on board, or those recorded on the ground from a telemetry output. The results of the computer processing are available to the test engineer in various forms: print-outs, histograms, trajectory reconstitution, flight envelope limits are typically displayed.

In addition to airborne test systems, Enertec supplies complete ground recording, processing and interpretation systems, including software.

BUSINESS REVIEW

Sangamo Weston 1981 revenue increased 8%. Gains were recorded in residential and industrial electricity meters, electro-optical equipment and camera systems. In the U.S. and Canada, the economic slowdown in the commercial and industrial sectors affected most operating units. Rixon was affected the most as new orders for their telecommunications products dropped over 50% from the 1980 level. Over-all orders remained flat and backlog at year end was only 7% higher than a year ago.

Electricity Management: electricity meters and equipment for electric power distribution systems.

■ Revenue increased 1%. Sales of both domestic and industrial electricity meters were up somewhat, despite a substantial decline in housing starts and industrial construction. Shipments of electric power recording systems were significantly lower than in 1980. Sales of load and rate control equipment remained below expectations.

Fairchild Weston Systems: optical and electro-optical data acquisition equipment and signal processing systems for aerospace and defense applications; also controls for nuclear power systems.

■ Revenue gained 25%. Imaging systems which include cockpit television cameras and reconnaissance equipment had sales growth of about 40%. Backlog on these two products increased 55% over 1980.

Data Systems: data acquisition and telemetry systems; supervisory control systems; magnetic tape data recorders.

■ Sales of telemetry equipment increased 9%. Sales of data recorders decreased sharply as the order level remained weak throughout the year. Orders at year end declined in all product lines.

Instruments: scientific and aerospace instruments; vehicle performance recorders; photoelectric devices.

■ Revenue was flat. Aerospace and analog instruments manufactured by Weston Instruments had a satisfactory year. Performance at Engler remained level, despite continued softness in the trucking industry which buys both tachographs and hubodometers.

Rixon: modems—modulator/demodulator—and associated equipment used for data communication between computer terminals.

■ Revenue declined 9%. The most severe slowdown was experienced in high speed modems which were off 30%. Excess distributor inventories and changes caused by anticipated deregulation of the U.S. telephone industry affected both orders and revenue. Backlog by year end was down 46%.

Capacitor: capacitors for both electronic and electric power applications.

■ Revenue declined 4%. Sales of electronic capacitors, both mica and aluminum electrolytic, were affected by the recession in the electronic industry. Mica capacitors, which suffered the largest sales decline, were down 25%. Sales of power capacitors, which are sold to electric utilities, increased 35% as the changeover to more power efficient units continued. Orders for both electronic and power capacitors picked up in the latter part of the year.

At the Electricity Management plant in Oconee, South Carolina, a continuous conveyor holds completed subassemblies until they are needed for final assembly. Operator Faye Raines is removing a meter register.

AN OIL FIELD SUPERVISORY CONTROL SYSTEM

Under contract to a major oil company, the Data Systems division of Sangamo Weston in Sarasota, Florida has designed and developed an oil field supervisory control system to optimize oil production in an offshore oil field in the Arabian Gulf. The system will control 28 offshore platforms from two separate computing centers and will handle over 2,000 data points and 300 control functions.

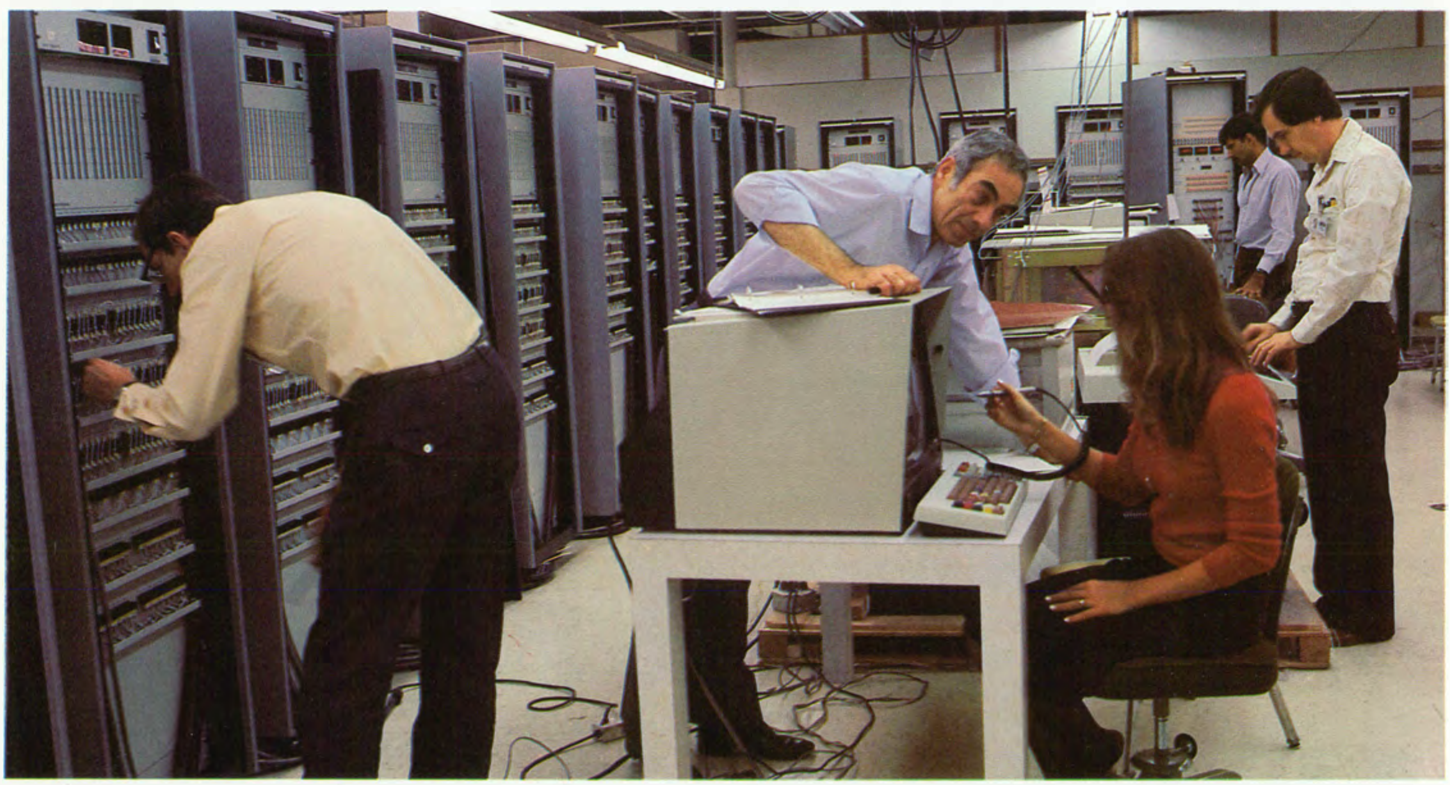
Secondary recovery techniques are employed to improve production. These techniques include both gas injection (gas lift) into each oil well and water injection into the reservoir. Gas lift consists of injecting gas in the well to reduce the weight of the fluid column and help produce the oil in reservoirs where formation pressure has declined. Injecting water in a reservoir to replace the void due to oil already produced limits the decline of the reservoir pressure. Both gas and water injection are regulated to optimize oil production based on the reservoir and well completion characteristics. The interaction of wells producing from the same reservoir, and sharing a common supply of injection gas, presents a complex control problem.

Studies by the oil companies showed that an automatic monitoring and control system could optimize the secondary recovery techniques. Typically, the desired oil production rate is obtained by adjusting the amount of gas injected into a well based on the current gas supply and injection pressure. Basic production data are collected at each offshore oil platform and transmitted to the onshore computer center for processing and display. The computer automatically adjusts the gas injection rates by transmitting control signals to valves at the well sites. Automatic emergency well shutdown, early detection of fire, gas leaks and general platform operation parameters also are provided.

Today, as offshore wells are regulated, the gas supply changes due to interaction among the wells and oil production rarely remains at the optimum rate. A lower flow rate means lost revenue while too high a rate can damage a well, requiring costly workover. The automated system can monitor the gas supply and continuously regulate all wells simultaneously.

Once the system is in place, it can provide additional cost benefits. For example, if gas supply is limited by a production or compressor failure, gas can be allocated automatically to wells with highest flow rates.

The Industrial Group at Data Systems configured the supervisory system specifically for the customer's requirements using standard products from the RECON III Series, a line of supervisory control equipment developed by Data Systems. This equipment is de-



Final checkout and acceptance tests of an oil field supervisory-control system at Data Systems in Sarasota, Florida. The system will help control oil and gas production offshore in the Arabian Gulf.

signed for reliability and performance in environments such as those experienced on offshore platforms.

Communications between the offshore platforms and the control centers are via a network of radios and undersea cables. All radios, antennas and communication equipment also are being provided by Data Systems.

IMPROVING PRODUCTIVITY THROUGH AUTOMATION

Two divisions of Sangamo Weston, Electricity Management in Oconee and Capacitor nearby in Pickens, South Carolina, have designed and installed automatic test and assembly equipment for speeding up their production. These are the early steps of a long-range program throughout Sangamo Weston to improve productivity through automation.

The Electricity Management division makes electricity meters for measuring power consumption by homes and industries. An important part of these meters is a mechanism of gears and counters, called the register, that is driven by the current flowing through the meter. The counter displays the power consumption. Assembly of these small parts was error prone and time consuming. So, the division designed an automatic assembly line that is integrated with manual assembly operations. The new set-up produces a complete meter subassembly every five to seven seconds and has improved the production rate for residential electricity meters by 100%.

There are fifteen automatic stations. Each station performs a specific function. Most stations are able to feed parts automatically, as needed, and include pick-and-place robots to place the parts in the subassembly. At each station, the location of parts is sensed electronically to insure that the preceding station has properly placed them. If a part is missing, the station automatically shuts down and a diagnostic message is issued to enable rapid start-up and recovery.

The Capacitor division had a different kind of problem. Their products are capacitors, devices that store electrical energy. Capacitors are important components of all electronic circuits, millions of them are used by electronic equipment manufacturers every year. The characteristics of every capacitor used in a circuit are precisely defined for that application, so each capacitor has to be tested thoroughly to assure that it meets all specifications. To speed up this step, the Capacitor division designed their own automatic test systems, one that can handle electrolytic capacitors, and another for mica capacitors.

Final test operator, Miranda Chapman, prepares a rack of electrolytic capacitors for automatic testing at the Capacitor division in Pickens, South Carolina.

The electrolytic capacitor test system consists of a cluster of four microprocessor-controlled stations. Each accepts a tray of 25 capacitors. The first station applies a sudden voltage pulse on each capacitor to ensure that it does not break down; the second applies a DC voltage to ensure that no current flows through the capacitor; and finally, the third station tests for the values of capacitance and resistance. If a capacitor fails any of the tests, it is automatically ejected into one of four compartments relating to the reason for failure. At a fourth station, the leads are cut to the proper length and capacitors are placed, 25 at a time, on a strip of tape for shipping.

The other test system, designed to check mica capacitors, tests for various electrical characteristics. This machine sorts the good capacitors into 10 categories, depending on the capacitance value and tolerance.

With these systems in place, the production rate of electrolytic capacitors has doubled and that of mica capacitors has increased five times.

BUSINESS REVIEW

Fairchild and the rest of the semiconductor industry were severely affected by the economic conditions in the United States and Europe, resulting in sharp price erosion and reduced demand.

Fairchild's 1981 revenue declined 12% compared to the preceding year. Orders fell 24% and the backlog at year end was considerably lower than at the end of 1980.

Despite adverse business conditions, the company continued its program of building for the future. Expenses for research and development amounted to $71 million, 44% ahead of the 1980 level; the investment in long-range research at the Palo Alto laboratories was doubled, continuing the effort of the prior year. Capital spending in 1981 reached $166 million, an increase of 75%.

SEMICONDUCTORS

Semiconductor revenue accounted for 74% of 1981 sales and decreased 18% as compared to the previous year. Although orders improved in the fourth quarter, recovery in 1982 is expected to be slow. The Semiconductors group comprises two divisions: Analog and Components, and LSI Products.

Analog and Components: discrete components such as transistors and diodes; linear circuits such as telecommunication products; optoelectronic devices such as fiber-optic couplers.

■ Revenue declined 9%. Orders were weak throughout the year, particularly for linear and optoelectronic products. Shipments of automotive ignition modules and voltage regulators from the Hybrids Division were up 30%.

LSI Products: large-scale integrated and very large scale integrated circuits such as microprocessors, memories, logic circuits, gate arrays and charge-coupled devices; using MOS, advanced bipolar and CMOS technologies.

■ Revenue declined 25%. Prices dropped throughout the year in all product areas, but particularly for MOS memory and for digital products. Order rates, while declining through most of the year, showed some improvement in the fourth quarter. By year end, billings continued to exceed new orders.

AUTOMATIC TEST EQUIPMENT

Automatic Test Equipment: computer based systems for testing semiconductors, printed-circuit boards and subassemblies.

■ Revenue rose 7% in 1981 with orders remaining at the same level as in 1980. Sales of component test systems for large-scale integrated circuits and memories declined 10% from last year's level due to spending curtailment by semiconductor manufacturers. Sales of printed-circuit board testers continued strong and grew 53% as compared to 1980.

Fairchild introduced several new products during 1981, one being the F9445 16-bit microprocessor. Later in the year, the U.S. Air Force contracted with Fairchild to develop an advanced bipolar microprocessor for the F-16 fighter plane.

In telecommunications, the Fairchild Research and Development Center has developed a family of telecommunication circuits including an electronic telephone circuit. These products are in the process of being produced and sold by the Linear Division.

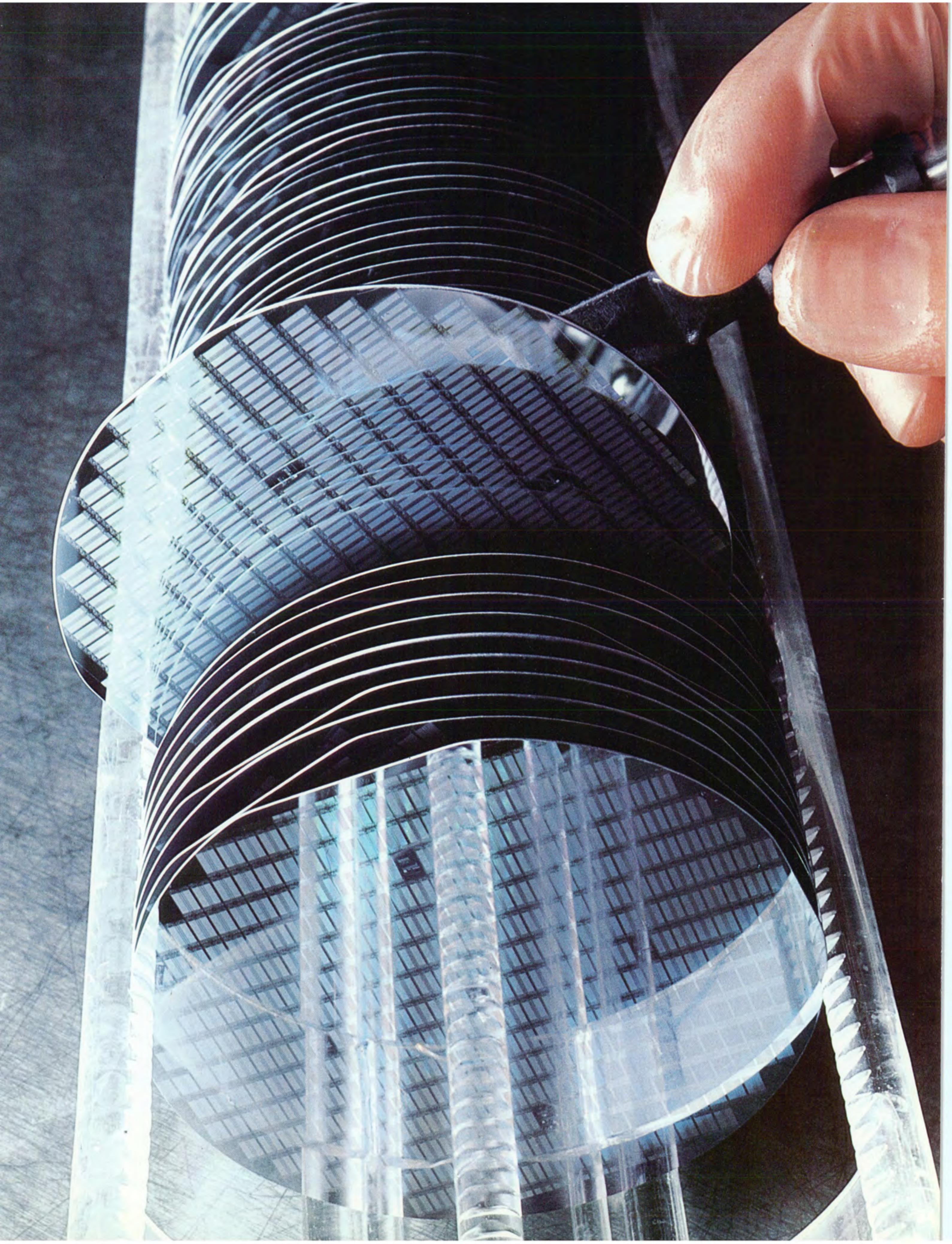
Fairchild began limited production of its 64K MOS dynamic random access memory in late 1981 and, by year end, samples of the product were in the hands of major customers for evaluation. Volume production is scheduled for the second half of 1982.

Late in 1981, Fairchild and the Defense Logistics Agency of the U.S. Government settled overpayment claims made by the Government which arose from the company's discovery and voluntary disclosure of certain deficiencies in test procedures applied to several of its military (JAN) type semiconductor products. Manufacturing of these products resumed during the first half of 1981. No field failures or quality related problems were found by or reported to Fairchild.

In early December, Fairchild discovered a leakage in a solvent tank at its South San Jose, California semiconductor manufacturing plant. Tests showed that a nearby public water well was contaminated. Appropriate authorities were informed immediately, and the well was shut down. Since then, the company has begun a survey of all its other semiconductor manufacturing locations in the U.S. No further leaks have been found, but localized ground contamination has been detected at certain locations. Tests have shown that nearby public water supplies were not affected.

While Fairchild does not believe it has any material liability in this matter, and no court actions are pending against Fairchild, it is possible that litigation will arise in the future.

Silicon wafers in process at the Fairchild South San Jose plant. Each wafer contains several hundred large-scale integrated circuit chips.



EXPANSION AND MODERNIZATION OF MANUFACTURING FACILITIES

At Fairchild, a major capital program is in progress for expansion and modernization of manufacturing facilities. This ambitious program is being pursued despite the adverse business conditions affecting the semiconductor industry.

In July, construction started in Puyallup, Washington on the first phase of a major facility that eventually will regroup all advanced bipolar activities. The first manufacturing plant will be operational in the fourth quarter of 1982. When completed, the five-building complex will have a capacity of up to 30,000 wafer starts a week.

Early in the construction of the new Fairchild five-building complex in Puyallup, Washington. All advanced bipolar activities eventually will be regrouped here. First manufacturing operations will begin in the fourth quarter of 1982.

To expand the Fairchild presence in Europe, construction began in 1981 of a new facility for bipolar and digital circuits at Wasserburg, near Munich in West Germany. By year end, the first phase of this project, a 42,000 square-foot assembly and test building, was well on its way towards scheduled completion in June 1982. Construction of the second phase, a 72,000 square-foot wafer fabrication facility, will start during the second quarter of 1982.

The Automatic Test Equipment Group opened a 160,000 square-foot facility in San Jose, California early in 1981. This new building houses the General Purpose LSI test systems operations, in addition to the ATE Group staff.

The Fairchild Component Test Systems Division moved its Xincom memory tester operations into a new 200,000 square-foot facility in Simi Valley, some 30 miles northwest of Los Angeles.

In August, ground was broken for a 155,000 square-foot building in South Portland, Maine where Fairchild already manufactures digital bipolar products. To be completed in the third quarter of 1982, the new plant will house assembly and test operations for both military and commercial digital bipolar semiconductors.

The capacity of the Discrete Division's San Rafael facility was increased from 84,000 to 126,000 square feet during 1981. This expansion provides space for additional manufacturing and for a new research and engineering pilot line.

By year end, the Optoelectronics Division had consolidated all of its activities in renovated facilites in Santa Clara, California.

Fairchild's gate array operations were consolidated into a new 56,000 square-foot building in Milpitas, California.

In Japan, Fairchild is near final selection of a site for construction of a manufacturing facility. It is anticipated that construction will begin in the third quarter of 1982, with initial operations starting by mid 1983.

PC BOARD TESTERS HELP AUTOMATIC TEST EQUIPMENT SALES

Sales of the Fairchild Automatic Test Equipment Group improved 7% in 1981, despite poor market conditions. Although sales of component test systems to the semiconductor industry declined, demand for printed-circuit board testers increased 53%.

Complex electronic systems like computers are made up of dozens of printed-circuit boards. Each of these boards contains numerous large-scale integrated circuits, so a single printed-circuit board may perform quite elaborate analog and digital logic functions. Before all the printed-circuit boards are assembled into a final system, each board must be tested to assure that it performs to specifications. Fairchild makes a wide range of automatic test equipment that is designed to test printed-circuit boards.

There are basically two types of printed-circuit board testers: Functional testers check the entire printed-circuit board operation as a stand-alone unit, i.e. they test whether the board works or not; in-circuit testers identify faults inside the printed-circuit board, down to the component level.

Both types of testers operate under computer control, so they can perform and record the results of hundreds of different tests within a few seconds.

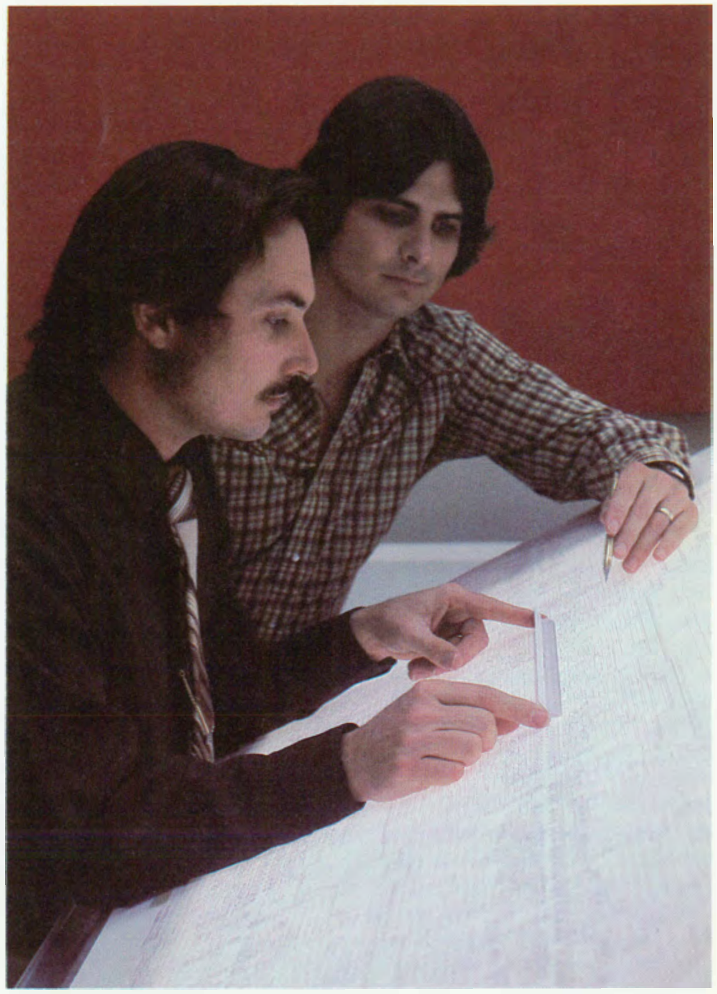
The Fairchild Faultfinders unit designs and manufactures printed-circuit board testers. Two important new test systems were introduced in 1981 in the Series 30 line of testers:

The first of these, the Model 333, is a "hybrid" system since it can test both analog and digital circuits on a single board; it also combines functional and in-circuit test capability. This system was released late in 1981.

The second, the Model 303S, is an in-circuit hybrid tester that offers greater testing capacity and more effective fault identification than comparable testers. It can test 1,200 points on a printed-circuit board in less than ten seconds. In addition, a built-in data collection system keeps track of faults—type and location; this information can be fed back to help improve both the design and manufacturing processes of printed-circuit boards.

Fairchild also provides software that automatically generates testing programs applicable to both models; this software eliminates approximately 90% of the potential cost of program development.

Since its introduction, the Model 303S, like its predecessor, the Model 303, has had very good customer acceptance.



At the Linear Division's design center in Mountain View, California, David Jones, design manager (foreground), and John Allen, assistant engineer, work on a layout of a portion of the Monotel telecommunications chip.

ALL-ON-ONE-CHIP TELEPHONE

The Fairchild Advanced Research and Development Center in Palo Alto, California, has squeezed a telephone receiver/transmitter circuit onto a single integrated-circuit chip that handles the functions of dialing, ringing, receiving and transmitting speech.

The idea of a totally electronic telephone has existed since the invention of the transistor in 1948. However, the complexity of signaling, ringing and speech communication circuits—basically analog functions—combined with dialing and switching circuits—mainly digital functions—frustrated all attempts to consolidate the telephone receiver/transmitter circuits on a single chip. The breakthrough was made possible by utilization of Fairchild's proprietary Isoplanar Integrated-Injection Logic (I^3L) process.

Called the Monotel, this circuit is a bipolar semiconductor device that was developed by the Palo Alto Laboratories; it will be manufactured by the Linear Division.

Monotel can operate on the low power that normally supplies carrier transmission over the telephone line. No additional external power source is necessary. Also, the Monotel circuit is so small that it will make possible more compact telephone designs.

Prototype Monotel chips are now being evaluated by six of the world's leading telecommunications companies. The chip is adaptable to telephone systems throughout the world regardless of particular specifications. Large scale production is expected to begin in 1983.

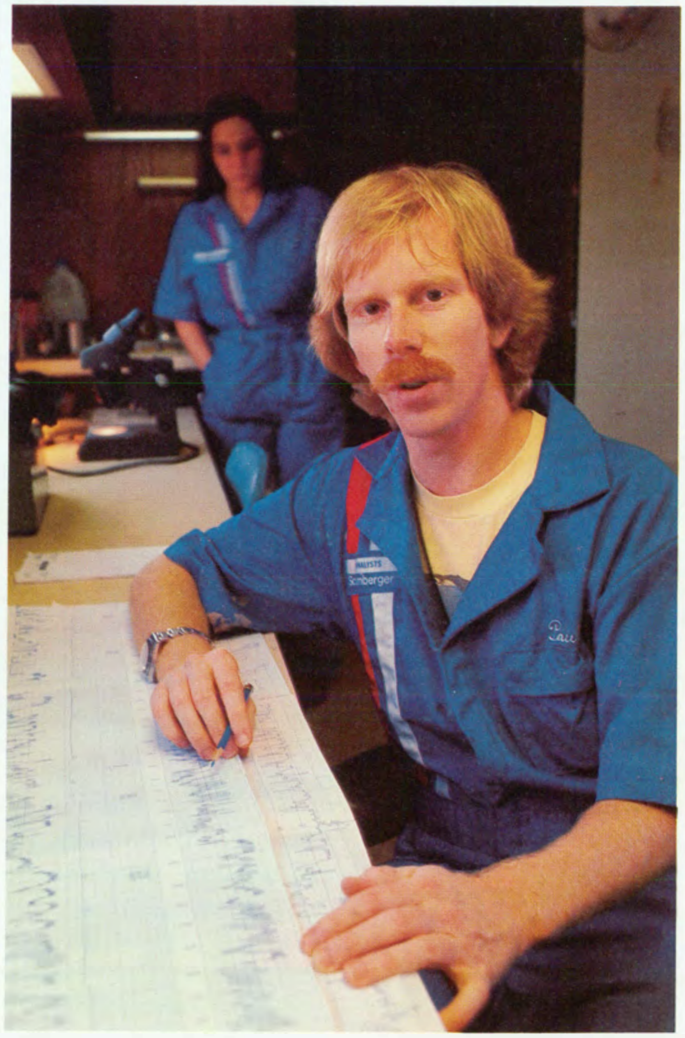
The potential market for Monotel is large and growing. In 1981, some 360 million telephones were installed throughout the world. This number is increasing at a rate of 10% a year; in addition, there is a substantial replacement market.

THE ANALYSTS

Like early explorers, an oil well driller travels through uncharted territory. Drilling into the earth's surface can be treacherous: the drill may wander off course, and unseen high-pressure zones are a threat to men and drilling equipment. One of the driller's first concerns is to know exactly where the hole is going. Then too, he needs an indication of the state of his surroundings, the nature of the geological formations that the drill is penetrating. Finally, there is the question of safety, anticipating high pressure formations in time to prevent a dreaded blowout. Drilling is very expensive and getting more so as the world search for oil intensifies and spreads offshore into more complex environments. And more wells are being drilled deeper. With this added expense, there is even more incentive to get the well drilled efficiently and safely.

The answer lies in drilling evaluation logs. Some of the best and most extensive data of that type—a kind of an electrocardiogram of a well—are being supplied today by The Analysts, a Schlumberger subsidiary. In a low-slung, modern building in Sugar Land, Texas, a Houston suburb where sugarcane fields dominated the landscape not long ago, The Analysts is continuing the Schlumberger tradition of bringing high technology data collection and analysis to oil fields throughout the world.

The Analysts' work differs from that of Schlumberger's wireline logging. Wireline measurements are made after drilling is interrupted and the pipe is pulled out of the hole. The purpose is to locate and analyze hydrocarbon bearing zones and to determine reservoir characteristics. On the other hand, The Analysts makes continuous on-site and inside the well surveys, while drilling goes on. The purpose is to enhance drilling efficiency and safety.



Paul Looney is a marine biologist by training who is the manager of a Total Concept Unit for The Analysts. These units work at the side of oil rigs, to help drillers operate with greater safety and efficiency. Typically, Paul Looney received a year's training in four separate Schlumberger schools before his current assignment. He is one of about 1,000 of The Analysts employees who work in the field. "What we try to do for the customer is to provide him with an accurate depiction of downhole pressure to keep him from having problems with the well in order to save him money in the long run. Blowouts are pretty messy and if you can prevent them, you've got it made. The way you do all this is to take your computer outputs from IDEL along with basic mud logging information, add a little bit of common sense to it, and come up with proper suggestions as to what is going on in the well and communicate that to the company man and the tool pusher. We usually try to set a limit as to where you want to be as far as over or under hydrostatic balance. You don't really want to be under balance because it's dangerous... you would rather be over balance. You determine pore pressure which is the basic thing you are looking for—the pressure of the fluids in the rock downhole: Just exactly what is it now? Is it changing? And how do we stay ahead of the game?"

To ease the driller's job, The Analysts provides a number of services. Traditional "mud logging" is one. The driller circulates a drilling fluid called "mud" through the well to bring the cuttings to the surface, to cool and lubricate the drilling bit, to shore up the well wall, and to keep the well under hydrostatic control to avoid blowouts. The "mud" is in reality a carefully formulated solution of mineral salts. It is pumped under high pressure through the hollow drill pipe down to the bit where it exits with great force. The mud then flows upward around the drill pipe, bringing with it fragments of formation cut by the drill, along with traces of oil and bubbles of gas picked up along the way. The cuttings and the traces of oil and gas have a tale to tell. Analyzed at the surface, the cuttings shed light on the types of rocks the drill has penetrated. The bubbles and traces of oil tell the geologists whether the formations contain hydrocarbons.

While highly useful, mud-logging provides information of where the drill bit has been, not where it is at a particular moment. Depending on the depth of a well, it may take hours for the cuttings and bubbles to be carried to the surface.

A team of field personnel of The Analysts offshore in the Gulf of Mexico. Shown are Howard Turner, Logging Engineer (front left), Tom Pakkala, Total Concept Unit Manager (front right), and Tom Reeder, Field Systems Manager (back right).


THE ANALYSTS
Schlumberger

J. Scott Powers is a geologist, the district manager for Measurements While Drilling (MWD) who now covers the North Sea. Powers has participated in the development of MWD since 1977, and ever since the first MWD unit began to take measurements in the Gulf of Mexico in 1980. "I was one of the four field hands who joined the Schlumberger engineers in their initial field work with the tool. It was like going back to school. Schlumberger has some crack engineers. I was impressed with the technology and with the zero defects approach. Building and testing the MWD tools was like launching a Space Shuttle, only instead of going up, we went down. Every item, every screw was checked. After they were put together, the tools were tested and retested. We built an engineering prototype and then the pilot series—a new generation of tools that went commercial. We went through some dry runs and a lot of preliminary planning before our first job. But it worked out fine. That job has been going ever since. Without MWD, you are kind of feeling your way in the dark; with MWD, you have a good picture of what's happening downhole."

Drillers have always dreamt about receiving instantaneous data from the drill bit at the bottom of the well, at the moment it is being drilled. The Analysts was formed to supply that kind of information. Back in the late 1960s, The Analysts was the first to bring the computer to the well site. With computers came The Analysts' IDEL (Instantaneous Drilling Evaluation Log) system—still a major and growing part of The Analysts' business today.

The IDEL log grew out of earlier efforts to determine foot by foot the overall abrasiveness of the formation, i.e. its resistance to being drilled. The texture and stability of a formation are of the greatest concern to the driller. By combining measurements from existing surface instruments which keep track of revolutions of the drill pipe, weight on bit, and other parameters, The Analysts devised a sophisticated computer program that analyzes each foot of the hole that just has been drilled. In a real sense, the program measures the amount of energy it takes to turn a cubic foot of solid rock into little pieces. The program uses drilling rate of penetration, automatically compensated for bit wear, weight on bit, rotary speed, and lithological (rock structure) variations. The end result is an accurate evaluation of rock porosity and pore pressure as determined from drilling parameters. Almost all oil and gas produced today comes from accumulations in the pore spaces (porosity) of reservoir rocks. Pore pressure is the internal pressure of the fluids in the pores.

Some formations contain excessive fluids which became trapped under the weight of higher sediment layers, millions of years ago. Such over-pressurized zones are the great fear of the driller because they can cause catastrophic blowouts unless the weight of the mud column is increased sufficiently and in time to balance out the pore pressure. The gusher, made famous by Hollywood movies, is the last thing a driller wants; a sudden blowout can cause loss of life, loss of the well and damage to the rig. Under-pressurized zones, on the other hand, can cause collapse of a well, or at best the loss of mud circulation, resulting in costly delays in drilling.

The IDEL system is particularly important because it can provide information on pore pressure which is crucial to drilling efficiency and safety. Knowing the pore pressure, the driller can maximize the drilling speed by selecting the minimum mud weight required to safely balance the pressure of the fluid in the pores. This avoids potential reservoir damage, and reduces the risk of drilling problems.

The Analysts' logs, furthermore, are aimed at giving the driller an almost instantaneous look at the buildup of dangerous over- or under-pressurized zones. Prior to IDEL, the driller could make only a rough approximation of pore pressure by measuring the quantity of gas in the mud stream returning from the bottom of the well. In contrast, IDEL can indicate the pressure status downhole only seconds after the drill bites into a new foot of rock.

Today, The Analysts has a more advanced technology. Since 1980, The Analysts has provided drillers with real-time downhole measurements. This is achieved through Measurements While Drilling (MWD) tools developed by Schlumberger engineers and incorporated into The Analysts' services after Schlumberger acquired the company in 1977. Schlumberger had been working hard on a tool that could be coupled into the drill pipe near the bit and send measurements to the surface in real time during drilling. This lets the driller know continuously and immediately what is happening at the bit, what direction the hole is taking, and whether pore pressure has changed significantly. MWD had to wait until difficult technical problems were solved: how to transmit data reliably to the surface through the mud column in an extremely noisy environment, how to package electronic circuits and transducers to survive the high downhole temperatures, the brutal physical pounding, the corrosive and abrasive particles present in the mud stream.

Already in use on wells in the Gulf of Mexico, in the North Sea, in the Mediterranean and off the west coast of Africa, MWD is making oil well drilling safer and more economical. Its tools are torpedo-shaped. They are jam-packed with those semiconductor chips which often contain enough microminiaturized circuits and components to make up a computer of not so many years ago.

The MWD tool is incorporated into the drill string just above the drilling bit. Within the tool are cartridges containing microminiaturized instruments such as accelerometers and magnetometers. These instruments are stacked inside their 40-foot cylinder totem-pole like. With such instruments right above the drill bit, MWD is the oil well driller's compass and radar. It takes measurements downhole even as the drilling proceeds and transmits these data to the surface almost instantaneously.

The data tell the driller what is being drilled, where the drill is going, and how

Denis R. Tanguy, vice president for market development of Measurements While Drilling (MWD), recalls the early trials of developing MWD tools: "Schlumberger Wireline got involved in MWD in 1968. Initially, there was reluctance to provide such a service that would require people to be at a well site 24 hours a day for days and months at a time. In contrast, Wireline operations take place during limited periods of time at the well site, and, from their point of view, it was a very costly and uncertain development. So, toward the end of 1974, it was decided that the project would continue but independently of Wireline. We picked up the project on January 1, 1975. It has been one of the most difficult projects that I've been involved in because everything was new. The environment of the well while it is being drilled is quite different from that being logged by Wireline after drilling. Shocks and vibrations demand special technology. During the first two years we found that the tool we had could not withstand the mechanical vibrations. Holding all the components together even as they were being subjected to several hundred times the earth's gravity was the big problem. The tool structures also are subjected to erosion by hundreds of gallons of mud rushing by. And in the rotary mode of operations, the entire system rotates with the drill string at 80 to 200 rpm. The deciding test finally came in 1976. We knew then that we could go ahead with a commercial prototype."

well it is doing its job. To show the well geometry, the deviation of the well from the vertical and the direction of the bore hole are measured. Geological information is obtained from measurements of the electrical resistivity and radioactivity of the rock formations (to detect fluid trapped in pores and to tell whether the rock is permeable). Drilling performance is derived from two additional measurements, the temperature of the drilling mud near the bit, and the weight that is being applied directly on the bit.

The measuring instruments are connected party-line fashion to an ingenious signal encoder, a rotating mud "siren" that sends continuous pressure waves through the mud column within the drill pipe. The signal travels through the mud at nearly a mile a second. At the surface on the well site, the signal is picked up by a pressure transducer and sent to a computer for analysis and recording. Simultaneously, the computer produces logs of the measurements; these logs look somewhat like electrocardiograms. Such important measurements as the true weight on bit are sent to the surface once every 27 seconds and can now be compared with surface measurements provided by the IDEL system. Knowing true weight on bit allows the driller to adjust for conditions caused by carrying too much or too little weight in order to correct immediately the direction of the hole.

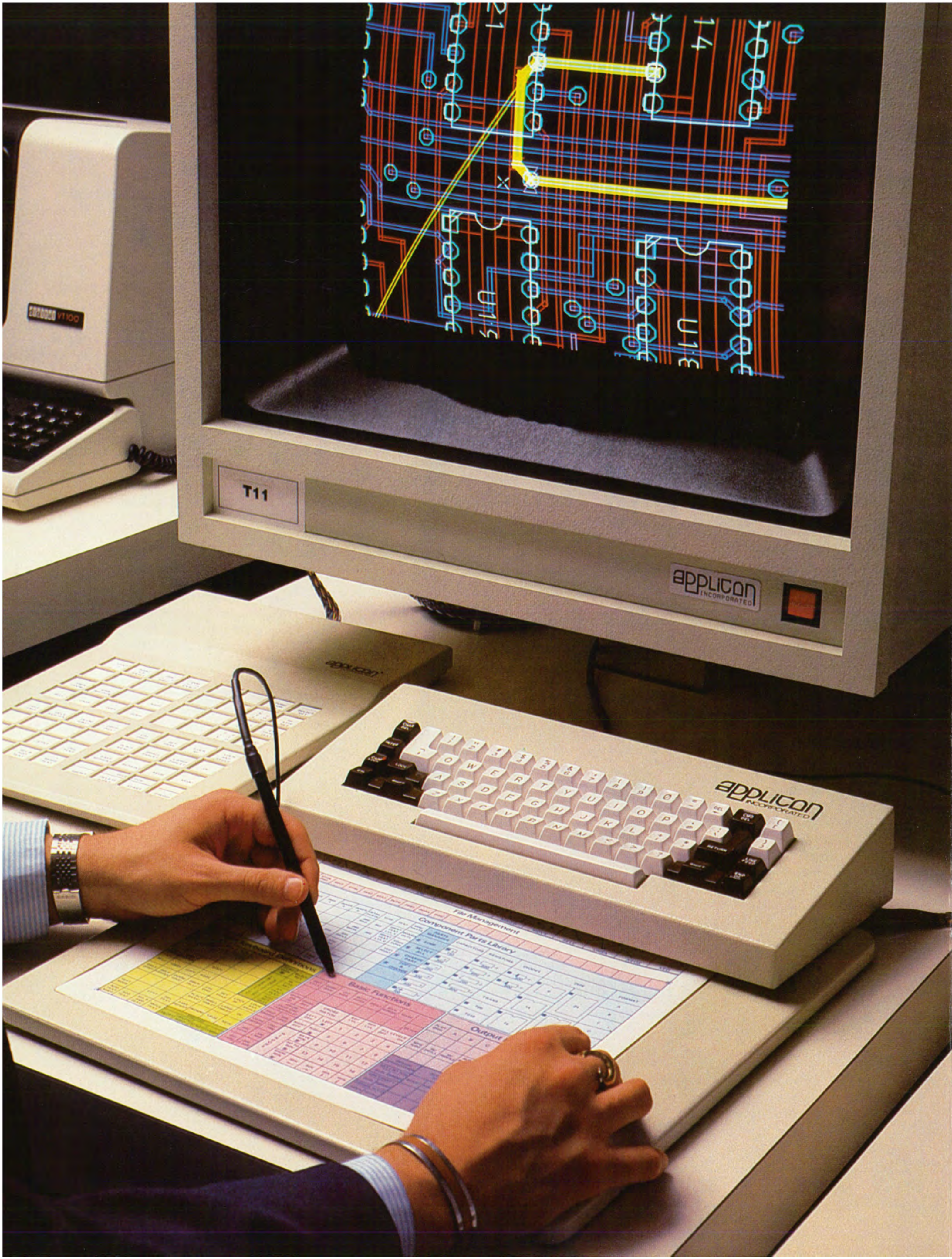
Therese Richter, electronic assembler, installing a transducer in a portion of a Measurements While Drilling tool.

Henry Potts, vice president of engineering at The Analysts, believes that The Analysts' business is not just mud logging or downhole measurements but a composite service that helps identify both geological and physical characteristics of a well. "I think that what will happen in the 80s is different from what happened in the 70s. In the 70s, we had The Analysts independent from Schlumberger working on interpretation of surface information. And we had Schlumberger developing downhole hardware for MWD. So those two groups were merged and when you merge two groups with dissimilar functions, you don't have a unit with one purpose, you have one unit with two purposes. What we will be doing in the 80s is to create an integrated company. I want to have an engineering group which has one purpose and that is to enhance drilling interpretation within the oil industry and to do that through The Analysts. Drilling interpretation for me is that process of acquiring data from various sensors, surface and downhole, integrating it into various drilling models. We are going to develop a generation of downhole tools that will be adaptable and will be able to take new measurements as we define them. We want a surface instrumentation system which will be able to process in real time. We will be able to have multigraphics displays. Also, we will have the software that ties all that together. Then we hope to use artificial intelligence techniques to provide answers to the driller at the well site so that he can modify the drilling process and optimize his penetration rate."

As in other Schlumberger operations, people are the key to The Analysts' success. The Analysts are a new breed of oil field technicians—young men and women who understand drilling but who also understand electronics and computers. Full-time recruiters carefully screen the new personnel. An especially critical need is for technically trained people to work with the clients in the oil fields. University training, college background, or a high level of field experience are the hiring criteria. There's more. "When we're looking for field people, we look for people who don't like to work in offices," says The Analysts' president Carl Buchholz.

Before a new employee goes to work, he undergoes rigorous classroom and field training in logging techniques and drilling practices. The new employee is also thoroughly indoctrinated in the function of every piece of equipment used by the company. After that, comes months of field training under the supervision of a senior member of The Analysts' field staff. The Analysts today has more than 1,000 field personnel working out of 23 service centers in 11 countries.

The Analysts recorded sales of $52 million in 1981, still modest by the standards of other Schlumberger Oilfield Services operations. But The Analysts is growing the fastest, at a rate of 42% a year, and Buchholz says this growth reminds him of the Schlumberger he joined back in 1952.


VT100
T11
applicon
INCORPORATED
File Management
Component Parts Library
Basic Functions
Output

COMPUTER AIDED SYSTEMS

Computers are finding their way into engineering departments and onto factory floors to transform the way men design, manufacture and test a multitude of products ranging from automobiles to airplanes, from bolts to boots. This new application of computers is greatly increasing productivity. Many observers liken these advances to a new industrial revolution where computer-processed information becomes as important as the steam engine in the industrial revolution. This information, presented as pictures on TV-like screens, enhances man's ability to visualize, create and manipulate objects.

The ultimate goal of this revolution could be a fully-automated factory, and helping to bring this about are companies which produce CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) systems. Among the leaders in this field is Schlumberger's newest family member, Applicon, of Burlington, Massachusetts. Applicon is a Route 128 company, one of the future-shapers that line Boston's famous high-technology highway. Together with Manufacturing Data Systems Inc. (MDSI) of Ann Arbor, Michigan, an earlier Schlumberger acquisition, Applicon is now part of a new group, Computer Aided Systems, which is headed by Donald W. Feddersen.

One step in the design of printed-circuit boards is routing interconnections. Using an Applicon interactive graphics system, the designer can enter instructions and make changes in the circuit by means of an electronic pen and menu on the tablet. The screen displays, in full color, the portion of the circuit he is working on.

Back in 1969, Applicon began with CAD by automating the design and drafting process. Into computer programs, it translated all those thousands of basic lines, curves, circles, and calculations that a draftsman conventionally produces with triangles, pencils, compasses and calculators. Now, a draftsman or a designer could make drawings on a TV-like terminal screen at the press of a keyboard button or the flick of an electronic pen. Not only did CAD suddenly speed up a designer's work as much as ten times, freeing him of the tedium of repetitive chores, but it also enabled the designer to rotate his creations on the screen so that they could be viewed from different angles, to split them into segments, and to enlarge or shrink details—all without resorting to paper and pencil. The designer now could try out an untold number of variants of a product as well as many combinations of different materials. He could evaluate the performance and reliability of a product in the concept rather than at a prototype stage. As a result of the shortened product development cycle, productivity of companies using CAD/CAM soared.

The drafting function is still the nucleus of CAD/CAM because it's an unmatched means of communications. But Applicon now is taking the complete design information, the so-called data base, and putting it into forms that are useful to many specialists in design. With appropriate Applicon computer programs, for instance, an engineer can test the objects he designs right in front of his eyes—without building costly prototypes. He can subject his creations to mechanical stresses, heat, motion, and pressure—all inside the computer, with the results displayed on the terminal screen. In a literal sense, the computer can become an electronic wind tunnel, a laboratory where electrons and equations do the job of the wind, heat and pressure.

And CAD/CAM is getting better all the time. One of Applicon's latest achievements is Solids Modeling,® the ability to portray an object as a three-dimensional entity, as a real life object, notwithstanding the fact that it is "made" of numbers that reside in the computer. A solid model can be dissected to show its interior detail. In 1981, Applicon became the first CAD/CAM company to introduce a commercial solids modeling program; it is a program so rich in content that it even supplies such details as the specific metallic sheen in the interior of a dissected part or object. Applicon's solids modeling programs are beginning to be used by manufacturers to design such complex parts as truck axles. Such objects were much more difficult to design with the earlier CAD "wire frame" models in which only the edges of the objects, not their surfaces and interiors, are defined by the computer program.

The CAD portion of CAD/CAM, to be sure, is far more integrated today than is CAM (computer aided manufacturing). CAM can include a broad range of services from process planning, tooling and fixture design, and cost estimating to creating tapes for numerically controlled (NC) machine tools. MDSI's main business now consists of automatic generation of programs to run numerically-controlled machine tools. The programs are encoded on punched paper tape. The tapes drive the NC machines which range from drill presses that simply drill holes to complicated multimillion dollar shaping and cutting tools that sculpt

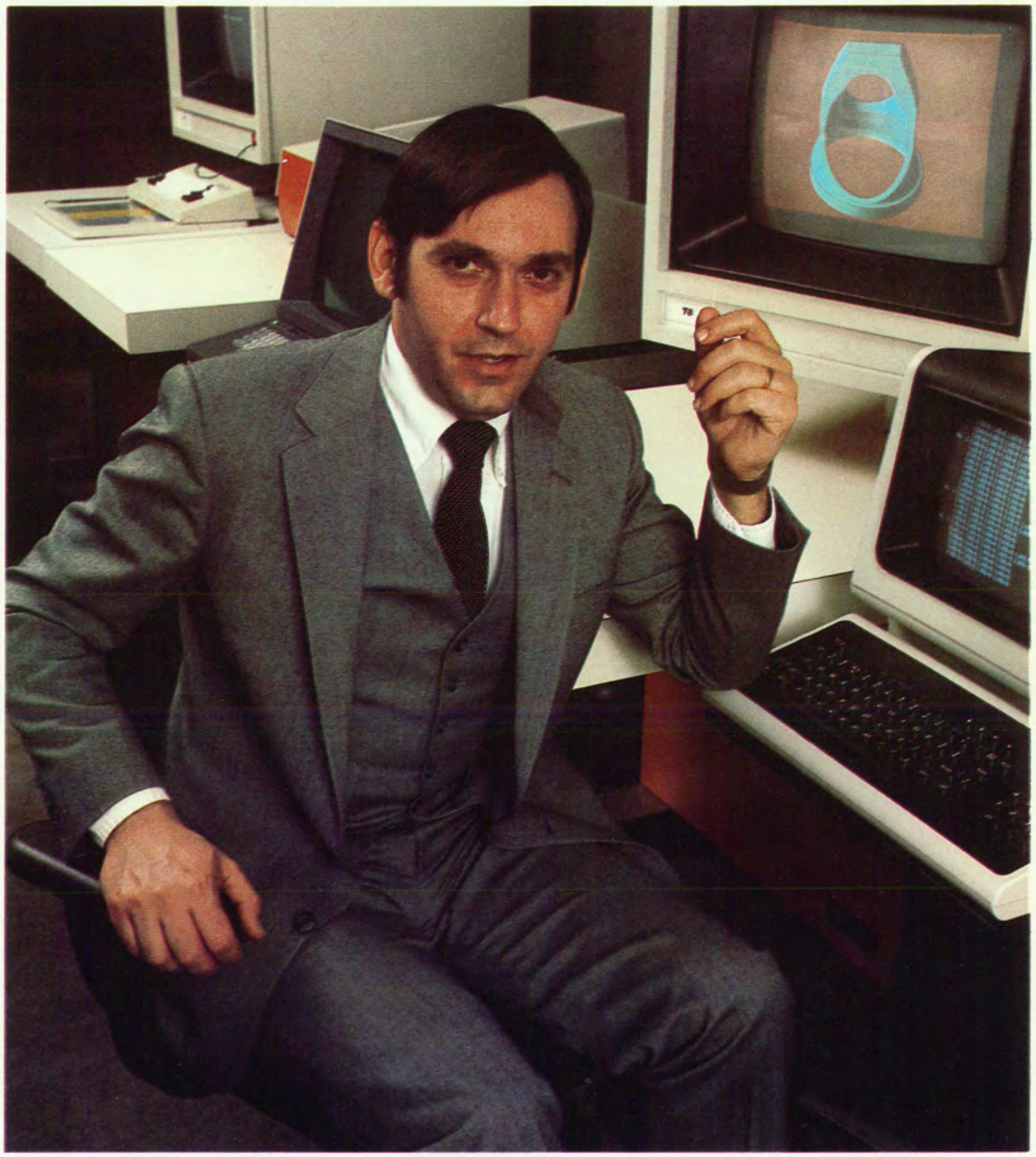
®Registered trademark

complex objects like airplane wing spars.

Computer-assisted programming for NC tools is a great time-saver for NC users who previously had to write such programs by hand. In this line of work, the Computer Aided Systems group will benefit from the newly-forged link between Manufacturing Data Systems Inc. and Applicon. "We have a group of people now who really understand the manufacturing process," says Feddersen, head of the Computer Aided Systems group. "At Applicon, we understand the engineering process; at MDSI the manufacturing process. When we bring the two into a unified system, then I think we'll have a powerful combination that few competitors will be able to match."

Applicon is seeking to tie closer the design process to manufacturing. Historically, an invisible but nevertheless real wall has divided design engineers from their counterparts in manufacturing. "Throwing over the wall," became the frustrated designers' term for turning their drawings over to manufacturing. Tearing down that wall is Applicon's mission. "It is my hope," says Feddersen, "that some day the data base the engineering group generates can be directly tied into machine tools, inspection devices, and automatic test equipment. At the rate the industry is growing, this is probably only five years away."

It's the job of Computer Aided Systems to provide the components of CAD/CAM and to link them for the users' benefit. Accordingly, the Computer Aided Systems group offers both hardware and software. A powerful computer drives the standard Applicon system which comes equipped with



Martin D. Schussel, manager of design and analysis software at Applicon, is responsible for deciding what applications are implemented by the company. He talks about Solids Modeling,® the latest Applicon offering: "Solids modeling is a mathematical representation of an object. It has been in use as a research tool for a number of years but the problem with most of the solids modeling programs has been their cumbersomeness. They worked too slowly, had no visual feedback, and you couldn't do much with the results. We have integrated the building of a solid model into a CAD/CAM system. We can use a solid model to evaluate a design, to determine an object's mass properties, and even produce technical illustrations. We have found no part that could not be modeled. Interestingly, though, parts that might seem rather simple, such as a spring or a screw thread, are the most difficult ones to model. I see solids modeling making two principal contributions: a more productive way to model a part, and a more efficient means of extracting information in a way that a customer can make better use of. In addition, solids modeling introduces a conceptual difference into the design process: it makes designers think about parts as solid objects. Eventually, with solids modeling, it should be possible to see objects moving relative to one another in real time to determine if they interfere with one another. A user will be able to model an entire mechanism such as an automobile's steering linkage, turn the steering wheel and watch the rest of the mechanism move."

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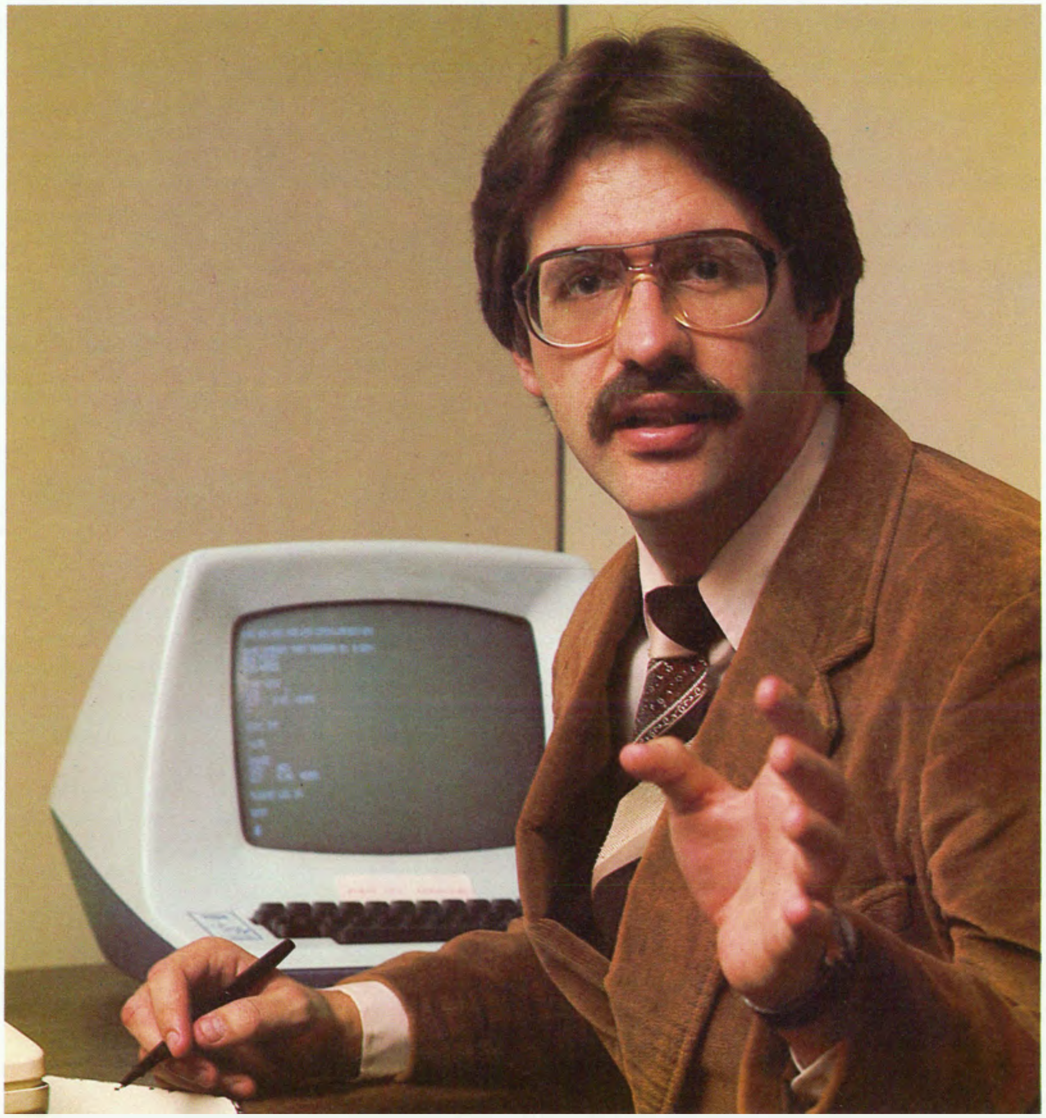
disk and tape drives, a plotter, and up to four work stations. A work station consists of a CRT (cathode ray tube) terminal and a digitized tablet and keyboard. The customer then selects from about 150 software packages a set of applications programs most suitable for his design and manufacturing. Applicon serves four market areas: integrated circuits, or chips; printed circuit (PC) boards which go into computers and other electronic devices; mechanical parts; and architectural design. Software is available to tackle all these areas. In fact, software is the CAD/CAM driving force and is Applicon's major strength.

Applicon's hardware and software are most widely used in electronic design and manufacture; in fact, many semiconductor chips today are produced untouched by human hands and without the use of paper—fully under computer control. That's the kind of product flow that CAD/CAM ultimately aims to achieve in other types of manufacturing. The making of PC boards is automated to a lesser extent than that of chips, and mechanical and structural areas even less. The largest potential of all for CAD/CAM is in mechanical engineering and manufacturing systems because of the large number and variety of manufacturers of products made from metal, plastic, glass, or wood.

MDSI, for its part, provides software that allows an NC user to write his instructions in ordinary English words that are familiar to shop personnel. For each of these instructions, the MDSI software may generate 50 times as many detailed instructions to execute the program which otherwise would have to be done by hand. A program for complex parts could take two or three weeks to write



Kastytis K. Giedraitis is a 29-year-old computer software analyst and supervisor of link programming at Manufacturing Data Systems Inc. MDSI supplies software "links" to users of numerically-controlled (NC) machine tools. These links are software modules that interface the tool to MDSI's parts programming language called COMPACT II, the most versatile language of its kind. MDSI has a large library of ready-made links and also prepares new ones. "Ours is basically a software service where our customers program their machines in COMPACT II. All COMPACT II words are based on everyday English and shop terminology, using such words as 'move,' 'cut,' 'drill,' and 'bore.' A user can program parts and describe the machining process in the way most convenient to him. To use the program, he needs a link which is an interface, or an interpreter, between COMPACT II and the machine's controller. The population and diversity of NC tools can almost be likened to the United Nations. There are hundreds of different NC tools with different controllers which don't 'speak' the same language. Our link is like an interpreter at the United Nations. The link supplies dimensional coordinates and codes for tool motions. The codes allow the controller to understand COMPACT statements and execute the program. Using COMPACT II, the customer can optimize his machine tools. He can define a part in exactly the way he chooses without being restricted just to simple shapes. The software helps him improve the speed and accuracy of even the most complex machining operations. The link then outputs the proper codes, which, in most cases, are punched on a tape and fed into the controller. We are providing an easier way for him to be able to make parts ranging from bolts to spans of bridges."

Edwina L. Wedeking, a design engineer, works in Applicon's product presentation group. "We work with salesmen and their clients. We, from the technical side, present the Applicon systems to the clients. We try to show them the way they might use our system in their working environment. My area is mechanical applications of CAD/CAM. We get involved from an individual component of a product all the way through the assembly of those individual components into a total product. One of the interesting recent projects we have been involved in was a study for a shoe manufacturer of how to change a shoe size and have the proportion of the whole shoe change appropriately. A tire company recently asked us to show them how to use our system to design better tires. The applications are all different but the same basic requirements are there, whether you are designing a small mechanical part or a large system of components. We explain to a customer how we use the digitized tablet with the terminal, how we put in the geometry of an object, and show him how flexible the system is. We build models on the screen and the client works right with us. We are really teaching them how they can increase their productivity by using the Applicon system."

manually; MDSI's system reduces the job to two or three hours. MDSI also supplies its customers with hardware such as plotters that draw pictures of parts and tool parts, and in conjunction with Applicon, it also sells graphic terminals on which the part shape and cutter paths are plotted automatically even as the computer processes the programs for part definition and cutting statements. In addition, MDSI offers its customers a vast reservoir of computer power through timesharing. A customer transmits the part programming information over the telephone to perform the necessary computations; or he can process the data completely in his shop with an MDSI-supplied computer and MDSI software. With 4,500 customers around the world, MDSI is the leader in its industry.

A huge market remains to be tapped in CAD/CAM. Even the original drafting and design applications have made few inroads so far. It's estimated that CAD saturation amounts to less than 5% of the potential market. One day engineers will use CAD/CAM systems as widely as they now use calculators.

The biggest challenge at both Applicon and MDSI is the need for people trained and educated in understanding customer desires. This need is magnified by the two companies' growth. Applicon already employs 1,200 people and MDSI 850. "The challenge," adds Feddersen, "is to keep knocking down the barriers to innovation which arise as any company grows."

In Applicon engineering, John Zilinski, technical specialist and Steve Lennon, senior field engineer (seated) work on the design of a new graphics terminal. A test pattern is on the screen.

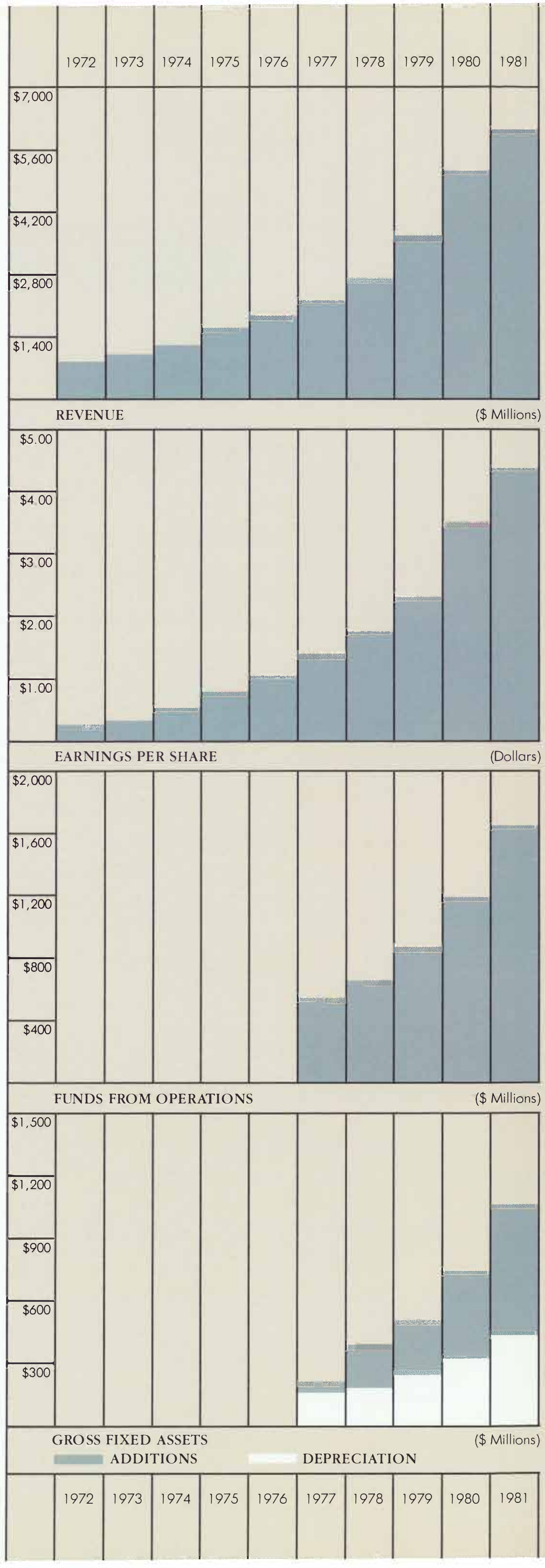
FINANCIAL REVIEW

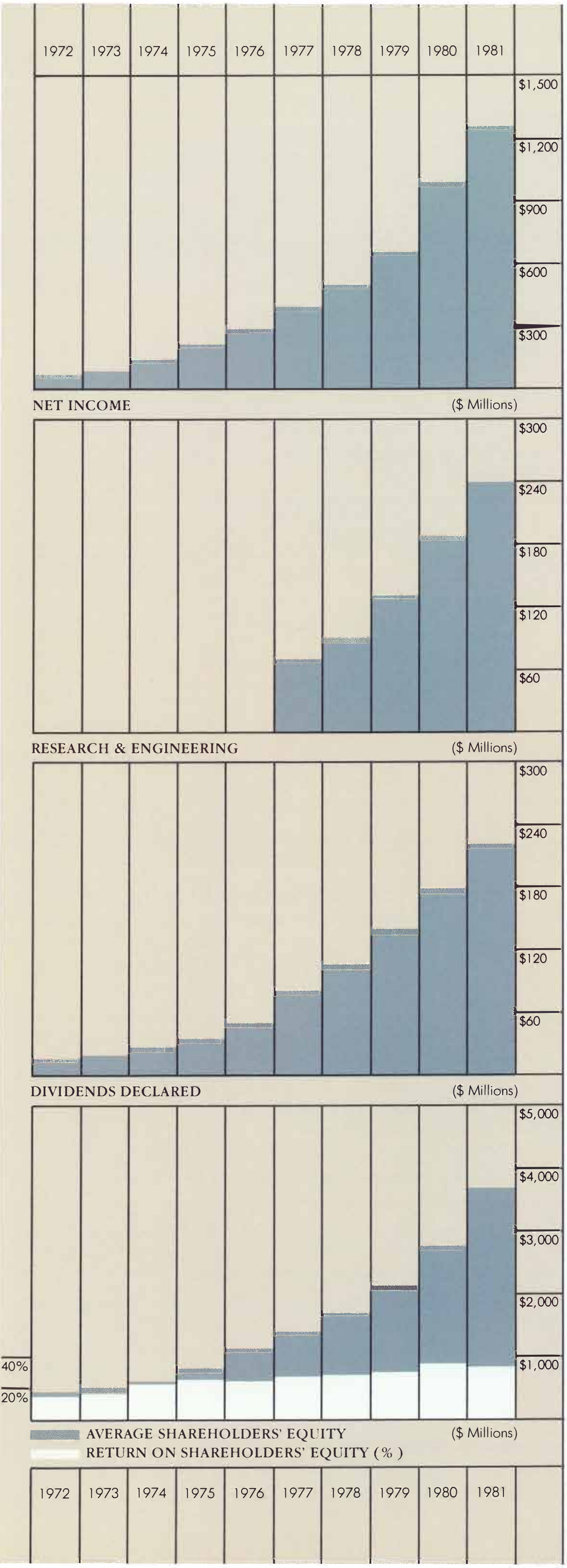
RESULTS OF OPERATIONS

Net income in 1981 amounted to $1.27 billion as compared to $994 million in 1980. Net income for 1980 included a fourth quarter gain of $70 million or $0.24 per share as a result of the sale of Rowan Companies common stock. Excluding this 1980 nonrecurring gain, net income increased $341 million. On the same comparative basis, year-to-year net income growth for 1981, 1980 and 1979 was 37%, 40% and 31%, respectively. Net income per share reached a high of $4.37 in 1981 as compared to $1.75 in 1978.

Oilfield Services operating revenue increased 35%, 38% and 25% for the years 1981, 1980 and 1979, respectively. Both Wireline and Drilling & Production Services contributed to the improvement. Within Wireline, North American revenue increased 42%, 38% and 22% in 1981, 1980 and 1979, respectively, reflecting a high level of drilling activity in the United States. Year end rig count in the United States was 36% higher than a year ago; activity was particularly strong in the Rocky Mountains. In Canada, Wireline activity declined due to the adverse effect of the Canadian National Energy Program. Wireline revenue in the Eastern Hemisphere and Latin America grew 35%, 45% and 26% in 1981, 1980 and 1979, respectively, as all major areas participated in the improvement. Drilling & Production Services revenue increased 28%, 33% and 25% in 1981, 1980 and 1979, respectively.

Measurement, Control & Components operating revenue decreased 1% for 1981, after increases of 37% for 1980 and 54% for 1979. The decline in 1981 was the result of lower revenue at Measurement & Control-Europe when translated into dollars and the severe recession in the semiconductor industry affecting Fairchild. A substantial part of the increase in prior years was due to the inclusion of Fairchild results from July 1, 1979. Sangamo Weston had revenue growth of 8%, 9% and 26% in 1981, 1980 and 1979, respectively. Increased 1981 sales of cockpit television systems and higher sales to Wireline were offset in part by the effects of the U.S. business recession. Measurement & Control-Europe revenue measured in U.S. dollars decreased 4% in 1981 after increases of 19% and 21% in 1980 and 1979, respectively. The decrease in revenue was due to the adverse effect on revenue of translating national currencies into a strong U.S. dollar. Fairchild revenue was down 12% in 1981 as the severe recession in the semiconductor industry resulted in a decline in orders and a substantial drop in prices.





Pretax operating income for Oilfield Services increased 44%, 46% and 25% in 1981, 1980 and 1979, respectively. Measurement, Control & Components pretax operating income declined 43% in 1981 as compared with increases of 22% in 1980 and 54% in 1979. The decrease in pretax operating income was primarily due to the effects of the semiconductor recession and the strengthening of the U.S. dollar.

INTEREST INCOME

Interest income reached a high of $183 million in 1981 as compared to $135 million and $82 million in 1980 and 1979, respectively. The 36% increase in 1981 compared to 1980 was due to higher average interest rates and increased funds invested. At the end of 1981, the Company had $1.66 billion in short-term investments, an increase of 37% over 1980.

RESEARCH & ENGINEERING

Research & engineering expenditures were $240 million, $52 million above 1980 and $109 million higher than 1979. Oilfield Services expenditures for research & engineering totaled $106 million, $80 million and $64 million in 1981, 1980 and 1979, respectively. Measurement, Control & Components spent $134 million, $108 million and $67 million for the same respective years. The largest contributor to the increase in research & engineering was Fairchild with expenditures of $71 million, $50 million and $17 million for 1981, 1980 and 1979, respectively.

TAXES

On a worldwide basis, the effective income tax rate was 31%, 34% and 35% for the years 1981, 1980 and 1979, respectively. The three percentage point decrease in the effective tax rate for 1981 as compared to 1980 resulted from the benefit of changes in the tax laws and from a lower proportion of income earned in high tax countries.

The estimated liability for taxes on income provides for taxes on current earnings as well as provisions for income taxes which may be payable in future years depending upon interpretation of tax laws and regulations of taxing authorities in various countries.

INVESTMENTS

On January 12, 1982 the Company completed the merger of Applicon Incorporated into a subsidiary of the Company. The transaction, which was an exchange of stock, will be accounted for as a pooling-of-interests beginning in 1982. The Company issued approximately 4 million shares of its stock in exchange for the outstanding Applicon shares. Applicon develops and markets interactive graphic systems used in computer-aided design and manufacture. Applicon revenue and net income for the twelve months ended December 31, 1981 were $84 million and $4 million, respectively.

On January 21, 1981, the Company completed the merger of Manufacturing Data Systems Inc. (MDSI) into a subsidiary of the Company. The transaction, which was an exchange of stock, was accounted for as a pooling-of-interests beginning in 1981. The Company issued approximately 2.9 million shares of its stock in exchange for the outstanding shares of MDSI.

CURRENCY

Currency exchange losses were $32 million in 1981 compared to $19 million and $5 million in 1980 and 1979, respectively. The losses in 1981 and 1980 were due primarily to the strengthening of the U.S. dollar against most European currencies.

FIXED ASSETS

Expenditures for fixed assets in 1981 were $1.06 billion compared to $748 million in 1980.

Additions by business sector were as follows:

	1981	1980
	(stated in millions)	
Oilfield Services		
Wireline	$ 526	$357
Drilling & Production Services	255	208
	781	565
Measurement, Control & Components		
Sangamo Weston	20	24
Fairchild	166	95
Measurement & Control-Europe	67	59
MDSI	25	
	278	178
Other	4	5
	$1,063	$748

FINANCIAL POSITION

At year end, working capital was $1.64 billion, $389 million over the prior year; the current ratio was 1.86 to 1. The growth rates of receivables and inventories were well below the growth in business.

Liquidity, which represents cash and short-term investments less debt was $962 million and $737 million at December 31, 1981 and 1980, respectively. The increase in liquidity primarily reflects increased funds generated from operations.

COMMON STOCK, MARKET PRICES AND DIVIDENDS PAID PER SHARE

Quarterly high and low prices for the Company's Common Stock as reported by the New York Stock Exchange (composite transactions), together with dividends paid per share in each quarter of 1981 and 1980 were:

	PRICE RANGE		DIVIDENDS
	HIGH	LOW	PAID
1981*			
Quarters			
First	$78½	$65	$0.167
Second	70⅞	58	0.167
Third	71	49⅛	0.200
Fourth	58⅞	51⅝	0.200
1980*			
Quarters			
First	$54⅜	$39¼	$0.122
Second	53¼	44¼	0.147
Third	67⅝	51⅜	0.147
Fourth	87⅛	63	0.167

*Adjusted for three-for-two stock split in June 1981

The number of holders of record of the Common Stock of the Company at December 21, 1981 was approximately 33,000. There are no legal or charter restrictions on the payment of dividends or ownership or voting of such shares. United States stockholders are not subject to any Netherlands Antilles withholding or other Netherlands Antilles taxes attributable to ownership of such shares.

INFORMATION ON EFFECTS OF CHANGING PRICES

The following selected supplementary financial data adjusted for effects of changing prices are presented in compliance with current accounting rules. Under these rules, which are experimental in nature, the information presented represents only a partial restatement of financial statements and the specified inflation index may not necessarily represent the true impact of inflation on the Company. Therefore, these data should not be viewed as a precise measurement of the effects of inflation on the Company and caution should be exercised in using these data to assess the effects of inflation or for comparative evaluations.

As required, the data presented has been remeasured under the (1) constant dollar and (2) current cost methods.

The *constant dollar* method remeasures historic values of inventories and fixed assets and the related cost of goods sold and depreciation into average 1981 dollars. This remeasurement reflects changes in the U.S. purchasing power of the dollar as measured by the Consumer Price Index for all Urban Consumers (CPI-U). This index, which the Company does not consider to be an appropriate indicator of inflation as it relates to its domestic activities, was applied to both U.S. and non-U.S. operations and assets, as required by accounting rules.

The *current cost* method shows the impact on net income that would have occurred if all products sold by the Company were purchased in the current year, and additionally, if all fixed assets were completely replaced and depreciated at year-end values. The current cost of fixed assets was calculated using various internally and externally generated price indexes for each class of asset being remeasured.

CONSOLIDATED STATEMENT OF INCOME ADJUSTED FOR EFFECTS OF CHANGING PRICES

FOR THE YEAR ENDED			DECEMBER 31, 1981
	AS REPORTED	IN CONSTANT DOLLARS	IN CURRENT COSTS
			(stated in millions)
(in average 1981 dollars, except "As reported" amounts)			
Revenue	$5,978	$5,978	$5,978
Expense			
Cost of goods sold and services	3,244	3,369	3,427
Interest	108	108	108
Other	780	784	785
Taxes on income	580	580	580
Net Income	$1,266	$1,137	$1,078

Note: At December 31, 1981, the current cost of inventories was $637 million and the current cost of fixed assets net of accumulated depreciation was $2.8 billion. Depreciation expense as reported was $433 million; adjusted for constant dollar and current cost, it amounted to $503 million and $563 million, respectively.

FIVE-YEAR COMPARISON OF SELECTED FINANCIAL DATA ADJUSTED FOR EFFECTS OF CHANGING PRICES

YEAR ENDED DECEMBER 31,	1981	1980	1979	1978	1977
(In average 1981 dollars, except "As reported" amounts; dollar amounts in millions except per share)					
Revenue					
As reported	$5,978	$5,137	$3,641	$2,684	$2,206
In constant dollars	5,978	5,668	4,561	3,740	3,309
Net income					
As reported	1,266	994	658	502	401
In constant dollars	1,137	987	720		
In current costs	1,078	937	680		
Net income per share					
As reported	4.37	3.47	2.30	1.75	1.39
In constant dollars	3.93	3.45	2.52		
In current costs	3.72	3.27	2.38		
Loss from decline in purchasing power of net monetary assets	43	23	45		
Excess of increase in constant dollar over current cost*	(4)	88	46		
Net assets at year end					
As reported	4,235	3,218	2,400	1,900	1,550
In constant dollars	4,460	3,757	3,170		
In current costs	4,536	3,895	3,345		
Dividends declared per share					
As reported	.77	.63	.49	.37	.28
In constant dollars	.77	.69	.61	.51	.42
Market price per share at year end					
As reported	55.88	78.00	41.67	28.07	21.55
In constant dollars	54.11	82.20	49.25	37.67	31.54
Average consumer price index	272.3	246.8	217.4	195.4	181.5

*Increase in constant dollar value over increase in current cost value of inventories and fixed assets held during the year

CONSOLIDATED BALANCE SHEET
ASSETS

DECEMBER 31,	1981	1980
		(Stated in thousands)
CURRENT ASSETS		
Cash	$ 18,371	$ 18,445
Short-term investments	1,663,817	1,217,448
Receivables less allowance for doubtful accounts (1981—$24,854; 1980—$24,004)	1,182,776	1,050,792
Inventories	612,384	589,882
Other current assets	63,017	55,147
	3,540,365	2,931,714
INVESTMENTS IN AFFILIATED COMPANIES	221,472	167,582
LONG-TERM INVESTMENTS AND RECEIVABLES	49,583	47,222
FIXED ASSETS less accumulated depreciation	2,390,909	1,758,592
EXCESS OF INVESTMENT OVER NET ASSETS OF SUBSIDIARIES PURCHASED less amortization	291,212	296,270
OTHER ASSETS	31,792	40,622
	$6,525,333	$5,242,002

SEE NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

CONSOLIDATED BALANCE SHEET
LIABILITIES & STOCKHOLDERS' EQUITY

DECEMBER 31,	1981	1980
		(Stated in thousands)
CURRENT LIABILITIES		
Accounts payable and accrued liabilities	$ 780,066	$ 730,666
Estimated liability for taxes on income	623,048	642,940
Bank loans	428,894	193,488
Dividend payable	57,900	47,772
Long-term debt due within one year	13,065	68,092
	1,902,973	1,682,958
LONG-TERM DEBT	278,339	237,701
OTHER LIABILITIES	90,308	86,851
MINORITY INTEREST IN SUBSIDIARIES	19,080	16,091
	2,290,700	2,023,601
STOCKHOLDERS' EQUITY		
Common stock	307,210	281,470
Income retained for use in the business	4,167,312	3,110,664
Deduct Treasury stock at cost	(239,889)	(173,733)
	4,234,633	3,218,401
	$6,525,333	$5,242,002

SEE NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

SCHLUMBERGER LIMITED (SCHLUMBERGER N.V., INCORPORATED IN THE NETHERLANDS ANTILLES) AND SUBSIDIARY COMPANIES

CONSOLIDATED STATEMENT OF INCOME

YEAR ENDED DECEMBER 31,	1981	1980	1979
			(Stated in thousands)
REVENUE			
Operating	$5,783,269	$4,883,944	$3,549,647
Interest and other income	194,669	153,333	91,791
Gain on sale of Rowan shares (before income taxes, $30,131)	—	99,838	—
	5,977,938	5,137,115	3,641,438
EXPENSES			
Cost of goods sold and services	3,243,837	2,813,089	2,061,392
Research & engineering	240,289	188,152	131,334
Marketing	215,100	217,685	173,192
General	324,914	299,731	209,981
Interest	107,854	101,752	52,175
Taxes on income	579,969	522,359	354,968
	4,711,963	4,142,768	2,983,042
NET INCOME	$1,265,975	$ 994,347	$ 658,396
Net income per share*	$ 4.37	$ 3.47	$ 2.30
Average shares outstanding (thousands)*	289,486	286,146	286,014

*Adjusted for three-for-two stock split in June 1981

SEE NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

CONSOLIDATED STATEMENT OF STOCKHOLDERS' EQUITY*

	COMMON STOCK				INCOME RETAINED FOR USE IN THE BUSINESS
	IN TREASURY		ISSUED		
	SHARES	AMOUNT	SHARES	AMOUNT	
					(Dollar amounts in thousands)
Balance, January 1, 1979	13,702,965	$132,665	299,735,667	$255,543	$1,777,117
Purchases for Treasury	914,175	30,860			
Sales to optionees			860,661	12,629	
Net income					658,396
Dividends declared ($0.49 per share)					(139,833)
Balance, December 31, 1979	14,617,140	163,525	300,596,328	268,172	2,295,680
Purchases for Treasury	205,200	10,208			
Sales to optionees			731,805	13,298	
Net income					994,347
Dividends declared ($0.63 per share)					(179,363)
Balance, December 31, 1980	14,822,340	173,733	301,328,133	281,470	3,110,664
Purchases for Treasury	1,090,750	67,229			
Sales to optionees	(51,554)	(537)	919,432	19,810	
Net income					1,265,975
Issued for MDSI	(2,883,220)	(536)		5,930	12,730
Dividends declared ($0.77 per share)					(222,057)
Balance, December 31, 1981	12,978,316	$239,889	302,247,565	$307,210	$4,167,312

*Shares and per share amounts adjusted for three-for-two stock split in June 1981

SEE NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

SCHLUMBERGER LIMITED (SCHLUMBERGER N.V., INCORPORATED IN THE NETHERLANDS ANTILLES) AND SUBSIDIARY COMPANIES

CONSOLIDATED STATEMENT OF CHANGES IN FINANCIAL POSITION

YEAR ENDED DECEMBER 31,	1981	1980	1979
		(Stated in thousands)	
SOURCE OF WORKING CAPITAL			
Net income	$1,265,975	$ 994,347	$ 658,396
Add (deduct) amounts not affecting working capital			
Depreciation and amortization	444,856	335,313	250,197
Gain on sale of Rowan shares	—	(69,707)	—
Earnings of companies carried at equity less dividends received (1981—$10,022; 1980—$11,249; 1979—$8,335)	(54,843)	(46,897)	(30,147)
Other—net	(10,841)	(28,355)	(12,474)
Working capital provided from operations	1,645,147	1,184,701	865,972
Net worth of MDSI acquired for shares	19,196	—	—
Increase in long-term debt	61,579	49,605	425,029
Retirement and sale of fixed assets	30,626	24,157	37,148
Decrease in other long-term investments and receivables	—	9,265	—
Proceeds from sale of shares to optionees	20,347	13,298	12,629
Proceeds from sale of Rowan shares less related income taxes	—	136,669	—
Other—net	(13,308)	4,413	1,396
Total working capital provided	1,763,587	1,422,108	1,342,174
APPLICATION OF WORKING CAPITAL			
Net noncurrent assets of Fairchild	—	—	407,747
Investment in Rowan	—	—	22,379
Increase in other long-term investments and receivables	1,408	—	15,066
Additions to fixed assets	1,063,316	748,235	503,415
Dividends declared	222,057	179,363	139,833
Reduction of long-term debt	20,941	301,533	66,985
Purchase of shares for Treasury	67,229	10,208	30,860
Total working capital applied	1,374,951	1,239,339	1,186,285
NET INCREASE IN WORKING CAPITAL	$ 388,636	$ 182,769	$ 155,889
INCREASE IN WORKING CAPITAL CONSISTS OF			
Increase in current assets			
Cash and short-term investments	$ 446,295	$ 212,240	$ 239,414
Receivables	131,984	174,901	249,460
Inventories	22,502	101,525	146,364
Other current assets	7,870	10,227	8,753
(Increase) decrease in current liabilities			
Accounts and dividend payable	(59,528)	(92,996)	(259,847)
Estimated liability for taxes on income	19,892	(151,412)	(154,560)
Bank loans and debt due within one year	(180,379)	(71,716)	(73,695)
NET INCREASE IN WORKING CAPITAL	$ 388,636	$ 182,769	$ 155,889

SEE NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

SUMMARY OF ACCOUNTING POLICIES

The Consolidated Financial Statements of Schlumberger Limited have been prepared in accordance with accounting principles generally accepted in the United States. Within those principles, the Company's more important accounting policies are set forth below.

PRINCIPLES OF CONSOLIDATION

The Consolidated Financial Statements include the accounts of all significant majority-owned subsidiaries. Significant 20%-50% owned companies are carried in investments in affiliated companies on the equity method. The pro rata share of revenue and expenses of Dowell Schlumberger, a 50% owned oilfield services company, is included in the individual captions in the Consolidated Statement of Income. Schlumberger's pro rata share of after tax earnings of other equity companies is included in interest and other income.

TRANSLATION OF NON-U.S. CURRENCIES

Balance sheet items recorded in currencies other than U.S. dollars are translated at current exchange rates except for inventories, fixed and intangible assets and long-term investments which are translated at historical rates. Revenue and expenses are translated at average exchange rates during the year except for those amounts related to balance sheet items translated at historical rates. Translation adjustments and gains or losses on forward exchange contracts are recognized in income currently.

SHORT-TERM INVESTMENTS

Short-term investments are stated at cost plus accrued interest, and comprised mainly U.S. dollar time deposits.

INVENTORIES

Inventories are stated principally at average or standard cost, which approximates average cost, or at market, if lower.

FIXED ASSETS AND DEPRECIATION

Fixed assets are stated at cost less accumulated depreciation, which is provided for by charges to income over the estimated useful lives of the assets by the straight-line method. Fixed assets include the cost of Company manufactured oilfield technical equipment. Expenditures for renewals, replacements and betterments are capitalized. Maintenance and repairs are charged to operating expenses as incurred. Upon sale or other disposition, the applicable amounts of asset cost and accumulated depreciation are removed from the accounts and the net amount, less proceeds from disposal, is charged or credited to income.

EXCESS OF INVESTMENT OVER NET ASSETS OF SUBSIDIARIES PURCHASED

Costs in excess of net assets of purchased subsidiaries having an indeterminate life are amortized on a straight-line basis over 40 years. Accumulated amortization was $32 million and $25 million at December 31, 1981 and 1980, respectively.

DEFERRED BENEFIT PLANS

The Company and its subsidiaries have several voluntary pension and other deferred benefit plans covering substantially all officers and employees, including those in countries other than the United States. These plans are substantially fully funded with trustees in respect to past and current services. Charges to expense are based upon costs computed by independent actuaries.

In France, the principal pensions are provided for by union agreements negotiated by all employers within an industry on a nationwide basis. Benefits when paid are not identified with particular employers, but are made from funds obtained through concurrent compulsory contributions from all employers within each industry based on employee salaries. These plans are accounted for on the defined contribution basis and each year's contributions are charged currently to expense.

TAXES ON INCOME

Schlumberger and its subsidiaries compute income taxes payable in accordance with the tax rules and regulations of the many taxing authorities where the income is earned. The income tax rates imposed by these taxing authorities vary substantially. Taxable income may differ from pretax income for financial accounting purposes. To the extent that differences are due to revenue and expense items reported in one period for tax purposes and in another period for financial accounting purposes, appropriate provision for deferred income taxes is made. The provisions were not significant in 1981, 1980 or 1979.

Approximately $4.1 billion of consolidated income retained for use in the business at December 31, 1981 represents undistributed earnings of consolidated subsidiaries and Schlumberger's pro rata share of 20%-50% owned companies. It is the policy of the Company to reinvest substantially all such undistributed earnings and, accordingly, no provision is made for deferred income taxes on those earnings considered to be indefinitely reinvested.

Investment credits and other allowances provided by income tax laws of the United States and other countries are credited to current income tax expense on the flow-through method of accounting.

NET INCOME PER SHARE

Net income per share is computed by dividing net income by the average number of common shares outstanding during the year.

RESEARCH & ENGINEERING

All research & engineering expenditures are expensed as incurred, including costs relating to patents or rights which may result from such expenditures.

ACQUISITION OF FAIRCHILD

In 1979 the Company acquired Fairchild Camera and Instrument Corporation at a cost of $425 million (including expenses). The acquisition was accounted for as a purchase and the accounts of Fairchild have been consolidated with those of Schlumberger since July 1, 1979.

Had Fairchild accounts been consolidated with those of Schlumberger for the full year 1979, the Company's revenue, net income and net income per share would have been $4 billion, $666 million and $2.33, respectively.

FIXED ASSETS

A summary of fixed assets follows:

DECEMBER 31,	1981	1980
	(Stated in millions)	
Land	$ 58	$ 46
Buildings & improvements	509	384
Machinery and equipment	3,284	2,439
Total cost	3,851	2,869
Less accumulated depreciation	1,460	1,110
	$2,391	$1,759

Estimated useful lives of buildings & improvements range from 8 to 50 years and of machinery and equipment from 2 to 15 years.

GAIN ON SALE OF ROWAN SHARES

During the fourth quarter of 1980, the Company sold common shares of Rowan Companies for a gain of $100 million before income taxes. Income taxes amounting to $30 million are included in the taxes on income caption in the Consolidated Statement of Income. The Company's net income for the year and for the fourth quarter of 1980 was increased by $70 million or $0.24 per share as a result of the sale.

LONG-TERM DEBT

Long-term debt, excluding amounts due within one year, consisted of the following:

DECEMBER 31,	1981	1980
	(Stated in millions)	
Bank loan due 1988, interest at prime or other money market based rates	$200	$200
Other bank loans	78	38
	$278	$238

Long-term debt at December 31, 1981 is payable principally in U.S. dollars and is due $9 million in 1983, $13 million in 1984, $8 million in 1985, $31 million in 1986 and $217 million thereafter.

COMMON STOCK

Common Stock, par value $1.00 per share, comprised the following number of shares adjusted for the three-for-two stock split in June 1981:

DECEMBER 31,	1981	1980
Authorized—500,000,000		
Issued	302,247,565	301,328,133
In Treasury	(12,978,316)	(14,822,340)
Outstanding	289,269,249	286,505,793

Options to officers and key employees to purchase shares of the Company's Common Stock were granted at prices equal to 100% of fair market value at date of grant.

Options granted by Manufacturing Data Systems to its employees and their terms and conditions were assumed by the Company.

Transactions under stock option plans were as follows:

	NUMBER OF SHARES*	OPTION PRICE PER SHARE*
Outstanding Jan. 1, 1980	3,389,252	$14.09-42.50
Granted	508,938	$40.56-72.04
Exercised	(731,805)	$14.09-42.50
Lapsed or terminated	(81,451)	$16.72-57.06
Outstanding Dec. 31, 1980	3,084,934	$14.09-72.04
Granted	992,550	$54.38-69.42
Assumed from MDSI	333,320	$ 1.56-74.82
Exercised	(963,865)	$ 1.56-57.06
Lapsed or terminated	(144,347)	$ 1.57-69.42
Outstanding Dec. 31, 1981	3,302,592	$ 1.57-74.82
Exercisable at Dec. 31, 1981	926,721	$ 1.57-72.04
Available for grant		
Dec. 31, 1980	9,397,682	
Dec. 31, 1981	11,889,951**	

*Adjusted for three-for-two stock split in June 1981

**Includes 2,932,496 shares authorized for issuance by the Company's Board of Directors subject to approval of the stockholders

LINES OF CREDIT

The Company's principal U.S. subsidiary entered into a Revolving Credit Agreement with a group of banks. The agreement provides that the subsidiary may borrow up to $600 million until December 31, 1988 at prime or other money market based rates, of which $200 million was outstanding as of December 31, 1981. In addition, at December 31, 1981 the Company had unused short-term lines of credit of $224 million.

INCOME TAX EXPENSE

The Company is incorporated in the Netherlands Antilles where it is subject to an income tax rate of 3%. The Company and its subsidiaries operate in over 100 taxing jurisdictions with statutory rates ranging up to about 50%. Consolidated operating revenue of $5.8 billion in 1981 shown elsewhere in this report includes $2.5 billion derived from operations within the United States and Canada. On a worldwide basis, the Company's effective income tax rate was 31% in 1981, 34% in 1980 and 35% in 1979.

LEASES AND LEASE COMMITMENTS

Total rental expense was $125 million in 1981, $93 million in 1980 and $68 million in 1979. Future minimum rental commitments under noncancelable leases for years ending December 31 are: 1982—$37 million; 1983—$30 million; 1984—$20 million; 1985—$14 million; and 1986—$10 million. For the ensuing three five-year periods, these commitments decrease from $31 million to $10 million. The minimum rentals over the remaining terms of the leases aggregate $18 million. Noncancelable rental commitments are principally for real estate and office space.

TAX ASSESSMENTS

The U.S. Internal Revenue Service has completed its examinations for the years 1970 through 1975 and, as previously reported, has proposed assessments based upon income from continuing Wireline operations on the outer continental shelf. Similar assessments are expected for years subsequent to 1975. The Company is contesting these assessments.

Management is of the opinion that the reserve for estimated liability for taxes on income is adequate and that any adjustments which may ultimately be determined will not materially affect the financial position or results of operations.

CONTINGENCY

During 1980, a floating hotel, the Alexander Kielland, functioning as a dormitory for offshore work crews in the North Sea, capsized in a storm. The substructure of the floating hotel had been originally built as a drilling rig by an independent shipyard from a design licensed by a subsidiary of the Company. The Company's subsidiary was not involved in the ownership or operation of the drilling rig or in its conversion or use as a floating hotel. The accident has been investigated by a Commission appointed by the Norwegian Government, which has published its report. In October of 1981 and in February of 1982, the Company's subsidiary, the independent shipyard and one of its subcontractors were sued in France by Phillips Petroleum Company Norway and eight others operating as a group in the Ekofisk Field in the North Sea and by the Norwegian insurers of the Alexander Kielland seeking recovery for losses of approximately $115 million resulting from the accident.

While the Company does not believe it has liability in this matter, the litigation will involve complex international issues which could take several years to resolve and involve substantial legal and other costs. In the opinion of the Company, any liability that might ensue would not be material in relation to its financial position or results of operations.

INVESTMENTS IN AFFILIATED COMPANIES

Investments in affiliated companies are principally 20%-50% owned companies.

At December 31, 1981 and 1980, equity in undistributed earnings of 20%-50% owned companies amounted to $204 million and $150 million, respectively.

PENSION AND DEFERRED BENEFIT PLANS

Expense for pension and deferred benefit plans was $77 million, $79 million and $55 million, and for compulsory contributions for French retirement benefits $24 million, $26 million and $22 million in 1981, 1980 and 1979, respectively.

Actuarial present value of accumulated benefits at January 1, 1981 and 1980 for U.S. and Canadian defined benefit plans was $139 million and $124 million, respectively, substantially all of which were vested. Net assets available for benefits at January 1, 1981 and 1980 for such plans were $230 million and $175 million, respectively.

The assumed rate of return used in determining the actuarial present value of accumulated plan benefits in both years was between 6% and 7%.

SEGMENT INFORMATION

The Company's business comprises two segments: (1) Oilfield Services and (2) Measurement, Control & Components. The Oilfield Services segment offers well site services to the petroleum industry throughout the world. The Measurement, Control & Components segment provides computer-aided design and manufacturing services, and manufactures measurement and control products and electronic components, which are sold to public utilities, governments, laboratories and industrial plants primarily in the U.S. and Europe. Services and products are described in more detail earlier in this report.

Financial information for the years ended December 31, 1981, 1980 and 1979 by industry segment and by geographic area is as follows:

INDUSTRY SEGMENT 1981

(Stated in millions)

	OILFIELD SERVICES	MEASUREMENT, CONTROL & COMPONENTS	ADJUST. AND ELIM.	CONSOLIDATED
Operating revenue				
Customers	$3,788	$1,995	$ —	$5,783
Intersegment transfers	—	124	(124)	—
	$3,788	$2,119	$(124)	$5,783
Operating income	$1,702	$ 131	$ (25)	$1,808
Interest expense				(108)
Interest and other income less other charges—$49				146
Income before taxes				$1,846
Depreciation expense	$ 351	$ 81	$ 1	$ 433
Fixed asset additions	$ 781	$ 278	$ 4	$1,063
At December 31				
Identifiable assets	$2,873	$2,012	$ (86)	$4,799
Corporate assets				1,726
Total assets				$6,525

INDUSTRY SEGMENT 1980

	OILFIELD SERVICES	MEASUREMENT, CONTROL & COMPONENTS	ADJUST. AND ELIM.	CONSOLIDATED
Operating revenue				
Customers	$2,814	$2,070	$ —	$4,884
Intersegment transfers	—	77	(77)	—
	$2,814	$2,147	$ (77)	$4,884
Operating income	$1,184	$ 230	$ (14)	$1,400
Interest expense				(102)
Interest and other income less other charges—$34				119
Gain on sale of Rowan shares				100
Income before taxes				$1,517
Depreciation expense	$ 256	$ 66	$ 1	$ 323
Fixed asset additions	$ 565	$ 178	$ 5	$ 748
At December 31				
Identifiable assets	$2,173	$1,837	$ (48)	$3,962
Corporate assets				1,280
Total assets				$5,242

INDUSTRY SEGMENT 1979

	OILFIELD SERVICES	MEASUREMENT, CONTROL & COMPONENTS	ADJUST. AND ELIM.	CONSOLIDATED
Operating revenue				
Customers	$2,037	$1,513	$ —	$3,550
Intersegment transfers	1	59	(60)	—
	$2,038	$1,572	$ (60)	$3,550
Operating income	$ 809	$ 189	$ (14)	$ 984
Interest expense				(52)
Interest and other income less other charges—$11				81
Income before taxes				$1,013
Depreciation expense	$ 197	$ 43	$ 2	$ 242
Fixed asset additions	$ 405	$ 96	$ 2	$ 503
At December 31				
Identifiable assets	$1,630	$1,624	$ (31)	$3,223
Corporate assets				1,127
Total assets				$4,350

GEOGRAPHIC AREA 1981

(Stated in millions)

	U.S. AND CANADA	FRANCE	OTHER EUROPEAN COUNTRIES	OTHER	ADJUST. AND ELIM.	CONSOLI-DATED
Operating revenue						
Customers	$2,112	$700	$721	$2,250	$ —	$5,783
Interarea transfers	363	208	10	318	(899)	—
	$2,475	$908	$731	$2,568	$(899)	$5,783
Operating income	$ 603	$ 84	$208	$ 958	$ (45)	$1,808
Interest expense						(108)
Interest and other income less other charges—$49						146
Income before taxes						$1,846
At December 31						
Identifiable assets	$1,971	$702	$485	$1,818	$(177)	$4,799
Corporate assets						1,726
Total assets						$6,525

GEOGRAPHIC AREA 1980

	U.S. AND CANADA	FRANCE	OTHER EUROPEAN COUNTRIES	OTHER	ADJUST. AND ELIM.	CONSOLI-DATED
Operating revenue						
Customers	$1,747	$745	$677	$1,715	$ —	$4,884
Interarea transfers	288	180	23	256	(747)	—
	$2,035	$925	$700	$1,971	$(747)	$4,884
Operating income	$ 486	$ 93	$177	$ 657	$ (13)	$1,400
Interest expense						(102)
Interest and other income less other charges—$34						119
Gain on sale of Rowan shares						100
Income before taxes						$1,517
At December 31						
Identifiable assets	$1,563	$714	$401	$1,406	$(122)	$3,962
Corporate assets						1,280
Total assets						$5,242

GEOGRAPHIC AREA 1979

	U.S. AND CANADA	FRANCE	OTHER EUROPEAN COUNTRIES	OTHER	ADJUST. AND ELIM.	CONSOLI-DATED
Operating revenue						
Customers	$1,206	$619	$469	$1,256	$ —	$3,550
Interarea transfers	149	131	7	94	(381)	—
	$1,355	$750	$476	$1,350	$(381)	$3,550
Operating income	$ 349	$ 82	$118	$ 448	$ (13)	$ 984
Interest expense						(52)
Interest and other income less other charges—$11						81
Income before taxes						$1,013
At December 31						
Identifiable assets	$1,369	$633	$340	$1,023	$(142)	$3,223
Corporate assets						1,127
Total assets						$4,350

Transfers between segments and geographic areas are for the most part made at regular prices available to unaffiliated customers. Certain Oilfield Services segment fixed assets are manufactured within that segment and some are supplied by Measurement, Control & Components.

Corporate assets largely comprise short-term investments.

During the years ended December 31, 1981, 1980 and 1979 neither sales to any government nor sales to any single customer exceeded 10% of consolidated operating revenue.

SUPPLEMENTARY INFORMATION

Operating revenue and related cost of goods sold and services comprised the following:

YEAR ENDED DECEMBER 31,	1981	1980	1979
			(Stated in millions)
Operating revenue			
Sales	$2,058	$2,128	$1,557
Services	3,725	2,756	1,993
	$5,783	$4,884	$3,550
Direct operating costs			
Goods sold	$1,402	$1,393	$ 998
Services	1,842	1,420	1,063
	$3,244	$2,813	$2,061

The caption "Interest and Other Income" includes interest income, principally from short-term investments, of $183 million, $135 million and $82 million for 1981, 1980 and 1979, respectively.

Accounts payable and accrued liabilities are summarized as follows:

DECEMBER 31,	1981	1980
		(Stated in millions)
Payroll, vacation and employee benefits	$228	$205
Trade	302	285
Other	250	241
	$780	$731

REPORT OF INDEPENDENT ACCOUNTANTS

PRICE WATERHOUSE
153 EAST 53RD STREET
NEW YORK 10022

FEBRUARY 10, 1982

TO THE BOARD OF DIRECTORS AND STOCKHOLDERS OF SCHLUMBERGER LIMITED:

In our opinion, the accompanying consolidated balance sheet and the related consolidated statements of income, stockholders' equity and changes in financial position present fairly the financial position of Schlumberger Limited and its subsidiaries at December 31, 1981 and 1980, and the results of their operations and the changes in their financial position for each of the three years in the period ended December 31, 1981, in conformity with generally accepted accounting principles consistently applied. Our examinations of these statements were 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.

Price Waterhouse

QUARTERLY RESULTS (UNAUDITED)

The following table summarizes results for each of the four quarters for years ended December 31, 1981, 1980 and 1979:

	OPERATING		NET INCOME	
	REVENUE	GROSS PROFIT*	AMOUNT	PER SHARE**
			(Stated in millions)	*(Dollars)*
Quarters—1981				
First	$1,404	$ 625	$ 271	$0.94
Second	1,414	618	298	1.03
Third	1,398	611	338	1.16
Fourth	1,567	685	359	1.24
	$5,783	$2,539	$1,266	$4.37
Quarters—1980				
First	$1,130	$ 480	$ 191	$0.67
Second	1,206	514	234	0.82
Third	1,234	529	249	0.87
Fourth	1,314	548	320***	1.11***
	$4,884	$2,071	$ 994***	$3.47***
Quarters—1979				
First	$ 735	$ 304	$ 128	$0.45
Second	782	338	161	0.56
Third	962	407	174	0.61
Fourth	1,071	440	195	0.68
	$3,550	$1,489	$ 658	$2.30

*Operating revenue less cost of goods sold and services
**Adjusted for three-for-two stock split in June 1981
***Net income includes gain on the sale of Rowan shares of $70 million ($0.24 per share)

FIVE YEAR SUMMARY

YEAR ENDED DECEMBER 31,	**1981**	1980*	1979**	1978	1977
		(Amounts in millions except per share amounts)			
SUMMARY OF OPERATIONS					
Revenue					
Oilfield Services	$ 3,788	$ 2,814	$ 2,037	$ 1,636	$ 1,310
Measurement, Control & Components	1,995	2,070	1,513	983	850
Interest and other income	195	153	91	65	46
Gain on sale of Rowan shares	—	100	—	—	—
	$ 5,978	$ 5,137	$ 3,641	$ 2,684	$ 2,206
% Increase over prior year	16%	41%	36%	22%	20%
Cost of goods sold and services	$ 3,244	$ 2,813	$ 2,061	$ 1,499	$ 1,231
Operating income					
Oilfield Services	$ 1,702	$ 1,184	$ 809	$ 648	$ 540
Measurement, Control & Components	131	230	189	122	93
Eliminations	(25)	(14)	(14)	(6)	(1)
	$ 1,808	$ 1,400	$ 984	$ 764	$ 632
% Increase over prior year	29%	42%	29%	21%	37%
Interest expense	$ 108	$ 102	$ 52	$ 18	$ 16
Taxes on income	$ 580	$ 522	$ 355	$ 295	$ 248
Net income	$ 1,266	$ 994	$ 658	$ 502	$ 401
% Increase over prior year	27%	51%	31%	25%	37%
Per common share					
Net income	$ 4.37	$ 3.47	$ 2.30	$ 1.75	$ 1.39
Cash dividends declared	$ 0.77	$ 0.63	$ 0.49	$ 0.37	$ 0.28
SUMMARY OF FINANCIAL DATA					
Net income as % of revenue	21%	19%	18%	19%	18%
Return on average stockholders' equity	34%	36%	31%	29%	28%
Fixed asset additions	$ 1,063	$ 748	$ 503	$ 393	$ 212
Depreciation expense	$ 433	$ 323	$ 242	$ 184	$ 159
Average number of shares outstanding	289	286	286	286	291
AT DECEMBER 31,					
Working capital	$ 1,637	$ 1,249	$ 1,066	$ 910	$ 811
Total assets	$ 6,525	$ 5,242	$ 4,350	$ 2,930	$ 2,360
Long-term debt	$ 278	$ 238	$ 490	$ 85	$ 56
Stockholders' equity	$ 4,235	$ 3,218	$ 2,400	$ 1,900	$ 1,550

*Net income includes $70 million after-tax gain ($0.24 per share) on sale of Rowan shares

**Results of Fairchild Camera and Instrument Corp. have been consolidated with Schlumberger beginning July 1, 1979

SCHLUMBERGER LIMITED

OILFIELD SERVICES

WIRELINE SERVICES

WIRELINE SERVICES: measurements of physical properties of underground formations to help locate and define oil and gas reservoirs and assist in the completion, development and production phases of oil wells. Measurements are made by lowering electronic instruments in the wells at the end of an electric cable called the "wireline." Operations are conducted in 78 countries.

VECTOR: cables for well logging, oceanography and geophysical exploration.

DRILLING & PRODUCTION SERVICES

DRILLING SERVICES

FOREX NEPTUNE: drilling on land and offshore.

THE ANALYSTS: well site computer analysis of surface and downhole drilling data, gathered while drilling.

TESTING AND COMPLETION SERVICES

FLOPETROL: well testing; pressure measurements; production and workover services—in the Eastern Hemisphere and Latin America.

JOHNSTON-MACCO: well testing; pressure measurements; production and workover services; drilling tool rentals—in the U.S. and Canada.

PUMPING SERVICES

DOWELL SCHLUMBERGER (50% OWNED): cementing; well stimulation; directional drilling — in the Eastern Hemisphere and Latin America.

MEASUREMENT, CONTROL & COMPONENTS

MEASUREMENT & CONTROL-EUROPE

ENERTEC: meters and load management equipment for electricity distribution; relays and measuring transformers for electricity transmission; instruments and systems; data acquisition; magnetic tape recording.

FLONIC: water meters and water distribution systems; gas meters and gas distribution products; high precision mechanical and plastic products; electronic payment systems.

SEREG: industrial control equipment; petroleum, nuclear and industrial valves.

SERVICE DIVISION: services related to water distribution and gas heaters; gasoline pumps; industrial piping.

INTERNATIONAL DIVISION: electricity, water and gas meters and related systems in several countries in Europe (outside of France and the U.K.) and Latin America.

UNITED KINGDOM DIVISION: electricity meters and relays; aircraft and industrial instruments; electronic instruments; training systems; transducers; automatic test equipment.

SANGAMO WESTON

ELECTRICITY MANAGEMENT: electricity meters and equipment for electric power distribution systems.

FAIRCHILD WESTON SYSTEMS: optical and electro-optical data acquisition equipment and signal processing systems for aerospace and defense applications; also controls for nuclear power systems.

DATA SYSTEMS: data acquisition and telemetry systems; supervisory control systems; magnetic tape data recorders.

INSTRUMENTS: scientific and aerospace instruments; vehicle performance recorders; photoelectric devices.

RIXON: modems—modulator/demodulator—and associated equipment used for data communication between computer terminals.

CAPACITOR: capacitors for both electronic and electric power applications.

FAIRCHILD

SEMICONDUCTORS

ANALOG & COMPONENTS: discrete components such as transistors and diodes; linear circuits such as telecommunications products; and optoelectronic devices such as fiber-optic couplers.

LSI PRODUCTS: large-scale integrated and very large scale integrated circuits such as microprocessors, memories, logic circuits, gate arrays and charge-coupled devices; using MOS, advanced bipolar and CMOS technologies.

AUTOMATIC TEST EQUIPMENT

AUTOMATIC TEST EQUIPMENT: computer based systems for testing semiconductors, printed-circuit boards and subassemblies.

COMPUTER AIDED SYSTEMS

COMPUTER AIDED DESIGN: computer-driven interactive graphics systems to automate the analysis and design of products.

COMPUTER AIDED MANUFACTURING: computer-based systems to integrate design with manufacturing processes to improve productivity.

NUMERICAL CONTROL: computer-based systems to translate part descriptions into punched tapes for numerically controlled machine tools.

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FORM 10-K

Stockholders may receive a copy of Form 10-K filed with the Securities and Exchange Commission without charge on request to the Secretary, Schlumberger Limited, 277 Park Avenue, New York, New York, 10172.

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