Schlumberger Annual Report 1993

Schlumberger in Brief

	1993	1992	1991
Operating Revenue	**$ 6,705,466,000**	$ 6,331,509,000	$ 6,145,171,000
Income before cumulative effect of a change in accounting principle	**$ 582,763,000**	$ 661,603,000	$ 815,652,000[1]
Postretirement benefits	**(248,000,000)**	–	–
Net income	**$ 334,763,000**	$ 661,603,000	$ 815,652,000[1]
Net income per share:			
Before cumulative effect of a change in accounting principle	**$ 2.40**	$ 2.75	$ 3.42[1]
Postretirement benefits	**(1.03)**	–	–
Net income per share	**$ 1.37**	$ 2.75	$ 3.42[1]
Dividends declared per share	**$ 1.20**	$ 1.20	$ 1.20

[1]Includes a gain of $177 million ($0.74 per share) on the sale of an investment and a $25 million ($0.10 per share) charge for restructuring the North American oilfield operations.

Letter from the Chairman

Net income, before the extraordinary item, declined 12% from 1992 while earnings per share declined 13%. Operating revenue grew 6%.

Led by Automatic Test Equipment, Measurement & Systems revenue rose 4% in national currencies in 1993 despite continuing European economic weakness. With the US dollar stronger than key European currencies, revenue in US dollars declined 5% compared with last year.

Oilfield Services revenue increased 13% during 1993, boosted by the January 1993 acquisition of the remaining 50% of Dowell Schlumberger. Following a 2% increase in drilling rig count worldwide, revenue and income were up significantly for Wireline & Testing, Dowell, Anadrill and GeoQuest. Sedco Forex results were lower, as expected, ending the year with the offshore rig fleet repositioned in growth markets. The collapse of the 2D seismic market resulted in the streamlining of Geco-Prakla throughout the year to meet the increasing demand for 3D seismic services.

Taking a longer view of Schlumberger's prospects, we enter 1994 with a fresh outlook. The 11 worldwide product lines that we have refocused and strengthened over the last five years are now poised for profitable growth.

Measurement & Systems comprises five solidly profitable, global product lines. Geographic expansion will continue with particular focus on the surging markets of Asia. "Smart metering" and meter communications systems will leverage our strong position in European and North American markets and assist entry into new markets. Growing demand for software systems and services will accelerate expansion of Electronic Transactions. Automatic Test Equipment, which recently recaptured market leadership in digital component testers, is making substantial commitments to its next generation of products.

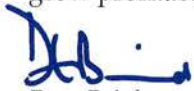
Oilfield revenue increases will continue to outpace a modest rise in the worldwide rig count. The driving forces are gains in rigless markets,

expansion into underserved markets and deployment of new services that take advantage of the increasing synergy between product lines. A flexible approach to alliances with customers will bring new, mutually profitable opportunities.

Central to improving margins and profitability is our strategy of low-cost innovation. Results from this effort, like the innovative MAXIS Express logging system, are already in the early stages of commercialization. New products increasingly adapt technology from other industries and are designed for outsourced manufacture by fewer, leaner product development centers. New services, based on low-cost innovation and driven by an accelerating product development cycle, will have a significant impact on results. In addition, we predict our growth will be supported by a strong cash flow from operations, giving us the financial strength to move decisively when new opportunities arise.

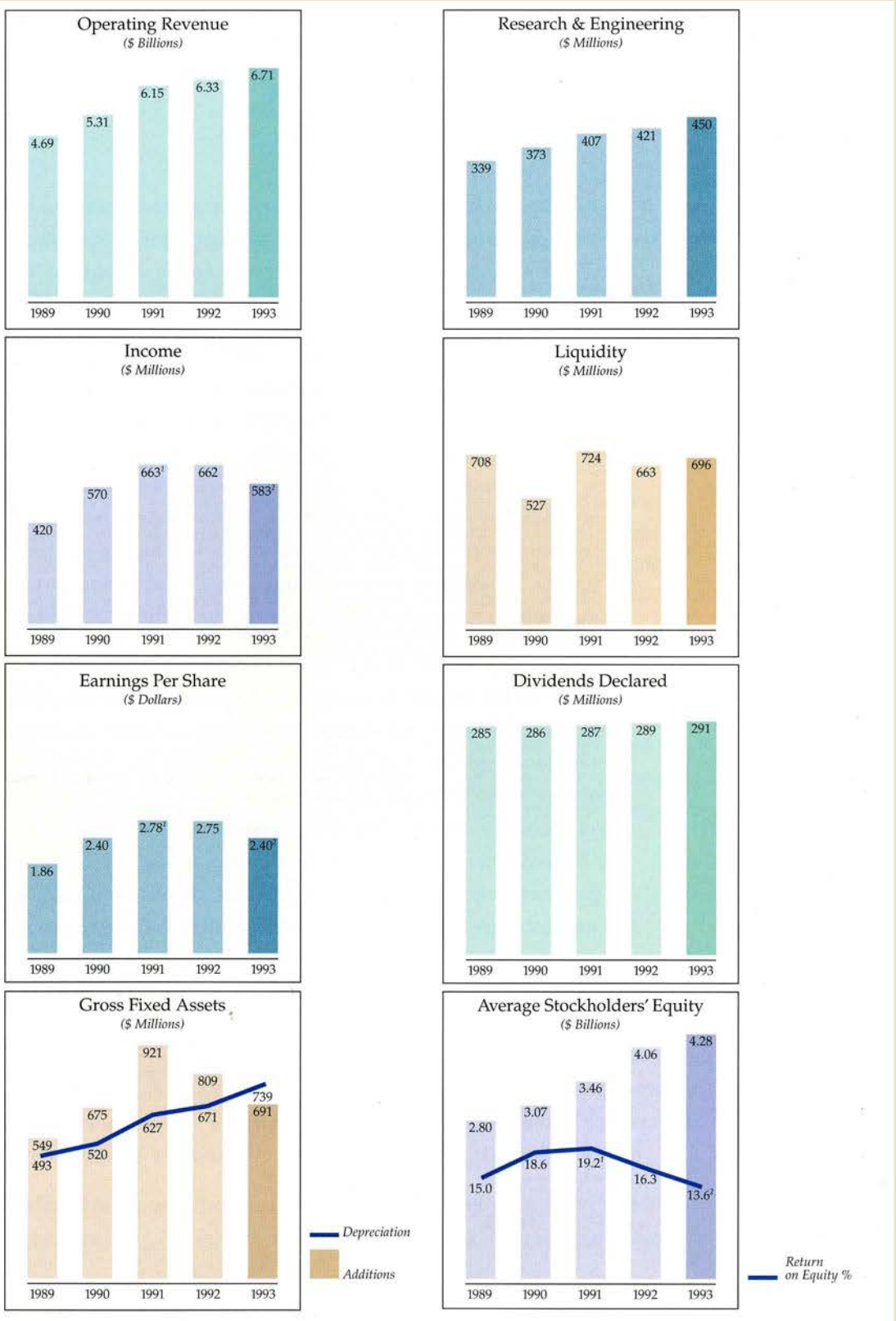
What about the future? Recent moves to promote freer international trade and progress by most governments toward open, market-driven economies should sustain growth in the worldwide GDP after several mediocre years. This will stimulate oil demand, the driving force behind the oil industry. The major unknown remains the former Soviet Union. The breakdown of traditional industrial and trading systems has caused oil production there to drop by more than half since 1988, to a reported 6.5 million barrels per day in 1993. Reversing this declining trend will offer many opportunities for our services. For the moment, however, political uncertainties preclude any bold initiatives.

In this period of increasing global trade, the prospects are promising for our refocused and strengthened global product lines. We are poised to grow profitably.



Euan Baird
Chairman & Chief Executive Officer
January 26, 1994

All Charts Refer to Continuing Operations



[1]*Excludes a gain of $177 million ($0.74 per share) on the sale of an investment and a $25 million ($0.10 per share) charge for restructuring the North American oilfield operations.*

[2]*Income and Earnings Per Share before cumulative effect of a change in accounting principle for postretirement benefits.*

Management's Discussion and Analysis of Results of Operations

			(Stated in millions)
Operating Revenue	**1993**	1992	1991
Oilfield Services	**$ 4,338**	$ 3,849	$ 3,847
Measurement & Systems	**$ 2,370**	$ 2,484	$ 2,300

Oilfield Services

Boosted by the acquisition of Dow Chemical's 50% interest in the Dowell Schlumberger group of companies, Oilfield Services revenue increased 13% in 1993 as drilling rigs worldwide increased 2%.

In October 1993, Oilfield Services was organized into six worldwide product lines. While exploiting the synergy between the groups and promoting customer alliances through the ClientLink* initiative, this structure maintains strong, independent product lines.

Oilfield Services revenue in 1992 was level with the prior year.

Wireline & Testing

Revenue in 1993 was 1% above 1992, reflecting a natural gas-driven recovery in North America that offset declines in the Eastern Hemisphere and Latin America regions. North America revenue increased 35%, while drilling rig activity increased 14%. Outside North America, a 9% drop in rig activity resulted in a 6% decline in revenue.

Expansion of MAXIS 500* units and associated imaging tools continued worldwide. MAXIS high-speed telemetry and data-intensive tools examine complex reservoirs in greater detail than ever before to assist oil companies in their exploration, development and production efforts. A new high-efficiency MAXIS Express* acquisition system was field tested in the US. This innovative system features a compact but powerful truck specifically designed to operate in high volume, development markets. The MAXIS Express unit utilizes the complete range of new-generation tools.

Three new MAXIS tools were introduced during the year. The IPL* Integrated Porosity Lithology tool obtains more precise formation measurements and improves the analysis of difficult-to-interpret thin beds and shaly gas sands. The UBI* Ultrasonic Borehole Imager provides high-resolution imaging capabilities and an unequaled ability to detect fractures in open holes and identify corrosion in cased wells. The slim RST* Reservoir Saturation Tool records behind-pipe formation measurements under flowing conditions and detects missed hydrocarbons without removal of the production tubing.

In testing and production services, the DataLatch* system and new FlexStar* downhole test strings performed more versatile downhole testing on over 150 wells worldwide. The DataLatch system, with its unique surface readout, allows customers to reprogram well tests in real time to decrease operating time and reduce costs. Another testing innovation, the UNIGAGE* downhole recorder, provides customers with an ultrahigh-precision pressure gauge that features the industry's fastest dynamic response and highest resolution.

In 1992, revenue dropped 7%, reflecting the considerable decline in the oilfield markets of North America, partly offset by growth in the Eastern Hemisphere and Latin America. On January 1, 1993, GeoQuest, a new Oilfield Services product line, was created from the merger of Schlumberger Data Services and GeoQuest Systems, Inc. Wireline & Testing revenue comparisons exclude the Data Services operations that are now included within GeoQuest.

Dowell

On January 29, 1993, Schlumberger completed the purchase of Dow Chemical's 50% interest in the Dowell Schlumberger group of companies. On a comparable basis, revenue increased 9% over 1992 excluding the impact of International Drilling Fluids acquired in September 1993.

In North America, revenue rose 27% in 1993 resulting from the combined effects of increased drilling activity, the continuation of the high level of stimulation activity in the US gas fields initiated during the fourth quarter of 1992 and the additional activity resulting from alliances with customers.

Outside North America, revenue decreased 3% from 1992 with declines in all regions except Europe, where improvement resulted from new operations in the Eastern Bloc.

Coiled Tubing continued to grow in 1993 as new applications including downhole measurements and re-entry drilling in existing wells were introduced. Alliances with clients resulted in the further deployment of Design and Evaluation workstations to customer offices, which supported a significant increase of Dowell activity. Fracturing fluids technology was extended with the introduction of YF*100THD, a new generation, high-temperature gelled system, and a low-temperature encapsulated breaker combined with the updated capabilities of the POD*II blender. Driven by a new operational organization and supported by the introduction of a new generation of Quantum* packer system, Sand Control revenue grew 17% in 1993.

The Dowell Industrial Service activity was sold in December 1993.

Dowell revenue increased slightly in 1992 over 1991 reflecting stronger activity primarily in the Middle East and Latin America.

Geco-Prakla

Geco-Prakla revenue was 10% below 1992 including the operations of Seismograph Services Limited (SSL). Following the worldwide collapse in the 2D seismic market, Geco-Prakla streamlined its operations throughout 1993 to improve competitiveness and to

reduce operating losses. In addition, Geco-Prakla continued its commitment to upgrade and improve efficiency through the deployment of new technology. A charge was taken in the fourth quarter to cover consolidation of facilities and reduction in personnel and equipment to ensure Geco-Prakla is a major player in the new 3D-oriented industry.

Marine revenue was 23% lower than a strong 1992, which was 33% higher than 1991. The activity decline, primarily in the second half of 1993, reflects over capacity, which has led to an industry-wide reduction in 2D vessels. Geco-Prakla continued to upgrade and improve efficiency by retiring seven low-tech vessels and adding four purpose-built, leading technology vessels. Significant inroads were made in reducing the 3D turnaround times with continued deployment of the TRILOGY* system, the latest on board, proprietary recording, navigation and data management technology. At year-end, the fleet consisted of 17 high-technology 3D vessels and two support vessels, 10% fewer than one year ago.

Including the addition of SSL's operations, Land revenue was 10% above 1992, reflecting higher activity in North America, Latin America, Africa, the CIS and the Middle East, partially offset by lower activity elsewhere. Geco-Prakla continued to improve the efficiency of its land crews by significantly increasing the channel count capacity.

Data Processing revenue was 7% above 1992 reflecting the addition of SSL and was impacted by price erosion despite a 47% increase in processing volume. Consolidation of Data Processing continued throughout the year. MegaCenters were opened in Houston and Gatwick, UK. These centers offer concentrated computer capacity using the latest high-performance super computers and workstations to further reduce 3D turnaround.

Sales of Non-Exclusive Proprietary Surveys increased 39% above 1992 due to a very strong second half of 1993 in both North America, primarily in the Gulf of Mexico, and the North Sea. North America growth was primarily driven by the favorably positioned portfolio of non-exclusive data covering the sub-salt structures in the Gulf of Mexico. North Sea sales increases were due to recently acquired Total Quality 3D non-exclusive surveys.

Three non-core activities were divested during 1993.

In 1992, Geco-Prakla revenue increased 18% due to both significant marine growth and acquisitions.

Sedco Forex

Revenue for the year fell 15% compared to 1992. The decline of the North Sea market, softening in West Africa and a decrease in land rig demand in the Middle East more than offset growth in Asia.

The 1993 average Sedco Forex rig utilization rate was 67% compared to 71% in 1992. Land rig utilization declined from 61% to 51% while offshore rig utilization increased from 80% to 82%. The industry-wide competitive offshore rig utilization rate increased from 69% to 78% over that period, with a 29% increase in the Gulf of Mexico being the major driver.

At December 31, 1993, the Sedco Forex fleet consisted of 74 rigs: 39 offshore and 35 land. During 1993, two jackups in the North Sea, *Trident X* and *XI*, were exchanged for three jackups in Southeast Asia, which were subsequently renamed *Trident XV*, *XVI* and *XVII*. In addition, the remaining 50% interest in *Sedco 711* was acquired. The jackup *Sedneth Luanda* was sold and Land Rig 32 was retired during the year.

In 1993, the Sedco Forex fleet underwent a significant repositioning with an increasing emphasis on the Asian market. *Sedco 703* from the North Sea, *Searex XI* from West Africa and *Sedco 709* from Brazil were relocated to this region. *Sedco 700* and *Sedneth 701* were transferred from the North Sea to West Africa to complete a field development project, the latter part of which involves development drilling in tender-assisted drilling (TAD) mode.

Sedco 601 and *Sedco 706* were awarded TAD projects commencing in June and October 1994, respectively, demonstrating the flexibility of semisubmersibles in this growing market.

Revenue in 1992 increased 1% over 1991.

Anadrill

Revenue grew by 19% in 1993. North America was the fastest growing area. South America and Asia also showed significant gains. Revenue from Europe and Africa declined slightly in line with reduced rig activity.

Anadrill became the technology leader in horizontal drilling with the introduction of the IDEAL* Integrated Drilling Evaluation and Logging System, which provides the industry's first "at-the-bit" measurements, enabling customers to keep horizontal drainholes in the pay zone. In September 1993, Anadrill acquired Great Land Directional Drilling Inc., the market leader in directional drilling in Alaska. Including this acquisition, directional drilling revenue increased by more than 59% over 1992.

Anadrill became the market leader in measurements-while-drilling (MWD) and logging while drilling (LWD) services in 1993. The SLIM1* MWD System was the most rapidly growing product, up by more than 60%, with activity mainly in North America. The PowerPulse* MWD telemetry tool was introduced. PowerPulse offers higher data rate, improves service quality and extends the market for MWD services to deeper and hotter wells. LWD services increased by more than 40% with activity in all major offshore areas.

In 1992, revenue declined by 10% with modest improvements in Europe and Africa more than offset by the downturn in North America.

GeoQuest

GeoQuest revenue increased 30% resulting from both the acquisition of GeoQuest Inc. and internal growth. GeoQuest provides oil companies with state-of-the-art software and computer services that assist them in maximizing the value of their exploration and production data.

Combined Software Products revenue in 1993 grew 27% over 1992. Strong growth in 1993 was seen for both the IES* and CHARISMA* product families. FINDER* data management software also achieved strong gains. Interpretation, well data processing and related data services experienced a 4% decline in revenue as some services were replaced by GeoQuest software sales for direct use by oil companies.

During 1993, GeoQuest released several major new software products including IESX,* GeoFrame* Petrophysics and GeoFrame Borehole Geology packages. The IESX system provides a new generation of seismic interpretation applications that exploit newly available computing architectures to provide innovative new interpretation tools. The GeoFrame family of products provides reservoir characterization capabilities and increases the efficiency with which oil and gas reservoirs can be discovered and developed.

Measurement & Systems

Revenue and orders both decreased by 5% in 1993. In 1992, revenue and orders rose by 8% and 5%, respectively, compared with 1991. Applicon was divested in October 1993. Transducers and Environmental Test were sold in November 1993.

Electricity Management

In 1993, Electricity Management revenue fell 2% while orders were up 2%. In Europe and Asia, excluding the effect of the appreciation of the US dollar, revenue increased in most areas. Recovery in ripple control products and higher exports from France and Hungary contributed to this increase, along with sustained demand for prepayment meters in the UK and for electromechanical meters in Asia and most European countries. In 1993, acquisitions were made in Germany and Portugal.

In North America, revenue increased due to the first significant shipments of automatic meter reading products. Major orders were booked for delivery of these products through early 1995. In Canada, revenue showed a slight increase.

In 1992, revenue and orders rose by 1% and 4%, respectively, compared with 1991.

Water Management

At Water Management, revenue and orders increased by 1% in 1993. In Europe, demand for heat meters continued to increase with substantial gains in Eastern Europe and the launching of a new product, the CF100* for district heating. Sales of water meters and related services remained strong except in Italy where a weak economy had an adverse effect on activity. In Latin America, revenue grew substantially, reflecting better market conditions. Stronger demand for water meters in Argentina resulted from economic improvement and water utility privatization.

In North America, water meter revenue increased significantly, supported by continued growth of automatic meter reading systems with particular success for the newly introduced Advance* reading unit.

In 1992, revenue and orders rose by 11% and 14%, respectively, compared with 1991.

Gas Management

Gas Management revenue for 1993 was down 15%, and orders were down 19% reflecting the economic slowdown in Western Europe. The UK, in particular, was weaker due to the winding down of the residential meter replacement program. Reduced demand adversely affected all major product lines in Germany and industrial products in Italy. This was partly compensated by increased exports to Eastern Europe and Turkey. Services activities continued to expand in France and Italy, despite the recession.

The decrease in orders from 1992 was due to reduced demand in the UK and Germany. In Italy, the continuing tight fiscal policy kept public sector demand at low levels. Successful testing of engineering prototypes by two major utilities in Italy and France resulted in the first significant order for the Dialogaz* smart meter.

In 1992, revenue and orders were up 23% and 19%, respectively, with exceptional domestic activity in both the UK and Germany accounting for the bulk of the growth.

Service revenue grew 22% in 1992 when compared to 1991.

Electronic Transactions

In 1993, Electronic Transactions revenue was flat and orders rose by 4% compared with 1992. In Europe, revenue at Retail Petroleum Systems was impacted by the European recession and the depressed automobile industry. Strong growth outside Europe in parking, pay phones and phone cards compensated for reduced activity in France in parking and banking terminals. Confirming its growing presence in the mass transit market, Urban Terminals & Systems received a large order for ticket vending machines from the French railways. Telecommunications continued to grow with major orders in Argentina, Mexico and Pakistan.

Including the prior year acquisition of Southwest Energy Control Systems, revenue at Retail Petroleum Systems in North America improved progressively during the year led by sales of pay-at-the-pump gasoline dispensers with card readers.

In 1992, revenue and orders rose by 17% and 18%, respectively, compared with 1991.

Automatic Test Equipment

Compared with 1992, revenue and orders were up 22% and 35%, respectively. Driven by strong demand for the ITS 9000 family of semiconductor test systems, Component Test Systems continued to sustain rapid growth. Activity for Diagnostic Systems products remained strong in North America and Europe. Board Test Systems suffered from continued decline in defense-related business, slightly offset by shipments of Telecom Test products. The acquisition of TLA Technology, completed in July 1993, contributed to the 1993 growth.

Results for 1992 reflected growth of 9% and 2% in revenue and orders, respectively, over 1991.

Net Income

(Stated in millions except per share amounts)

	1993[1]		1992		1991	
	Amount	**Per Share**	Amount	Per Share	Amount	Per Share
Net Income	**$583**	**$2.40**	$662	$2.75	$816	$3.42

[1] *Income before cumulative effect of a change in accounting principle related to the Company's adoption of Statement of Financial Accounting Standards No. 106, "Employers' Accounting for Postretirement Benefits Other than Pensions."*

Operating income of the Oilfield Services segment declined $78 million, as strong oilfield activity in North America was more than offset by declines outside North America at Geco-Prakla, Sedco Forex and Wireline & Testing. Measurement & Systems operating income increased $6 million as significant improvement at Automatic Test Equipment was nearly offset by the effect of the strong US dollar versus key European currencies.

Excluding the items described in the following paragraph, net income was flat in 1992. Net income of Oilfield Services decreased due to declines at Wireline & Testing North America and Dowell Schlumberger, partially offset by improved results at Wireline & Testing outside North America, Sedco Forex and Geco-Prakla. Net income at Measurement & Systems rose nearly $20 million over 1991.

Net income in 1991 included a $177 million ($0.74 per share) after-tax gain on the sale of an investment and a $25 million ($0.10 per share) charge for restructuring the North American oilfield operations.

Research & Engineering

Expenditures were as follows:

(Stated in millions)

	1993	1992	1991
Oilfield Services	**$ 290**	$ 260	$ 243
Measurement & Systems	**158**	161	160
Other	**2**	–	4
	$ 450	$ 421	$ 407

Interest Expense

Interest expense decreased $9 million in 1993 and $25 million in 1992. The decline in 1993 was due to a drop in average rates, which more than offset the increase in average debt outstanding. The decrease in 1992 was due to a drop in both average rates and average outstanding balances.

Liquidity

A key measure of financial position is liquidity, defined as cash plus short-term and long-term investments less debt. The following table summarizes the Company's change in consolidated liquidity for each of the past three years:

(Stated in millions)

	1993	1992	1991
Income before extraordinary item	**$ 583**	$ 662	$ 816
Depreciation & amortization	**790**	709	660
Gain on sale of investment	**–**	–	(177)
Other	**(8)**	(86)	(91)
	1,365	1,285	1,208
Decrease (increase) in working capital requirements	**76**	(189)	(109)
Fixed asset additions	**(691)**	(809)	(921)
Dividends paid	**(291)**	(289)	(286)
Other	**71**	46	24
	530	44	(84)
Proceeds from employee stock plans	**71**	70	73
Proceeds from sale of investment	**–**	–	354
Acquisition of Dowell Schlumberger	**(590)**	–	–
Other businesses acquired	**(63)**	(163)	(131)
Proceeds on sale of businesses	**93**	–	–
Other	**(8)**	(12)	(15)
Net increase (decrease) in liquidity	**$ 33**	$ (61)	$ 197
Liquidity – end of period	**$ 696**	$ 663	$ 724

In 1993, the increase in liquidity was sufficient to provide for the acquisition of the remaining 50% of Dowell Schlumberger.

The decline in liquidity during 1992 was mainly due to the purchase of businesses. The improvement in liquidity during 1991 included the proceeds on the sale of an investment partially offset by the acquisition of Prakla-Seismos ($131 million-net assets acquired included $107 million of debt) and the purchase of eight drilling rigs from the Techfor Cosifor group ($136 million).

The current consolidated liquidity level, combined with liquidity expected from operations, should satisfy future business requirements.

Common Stock, Market Prices and Dividends Declared 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 declared per share in each quarter of 1993 and 1992 were:

	Price Range		Dividends
	High	Low	Declared
1993			
Quarters			
First	$ 62½	$ 55⅜	$ 0.30
Second	68⅞	59	0.30
Third	68	60⅞	0.30
Fourth	68⅜	56⅝	0.30
1992			
Quarters			
First	$ 64¾	$ 54¼	$ 0.30
Second	68⅞	52⅝	0.30
Third	69⅞	59½	0.30
Fourth	70⅝	55⅝	0.30

The number of holders of record of the Common Stock of the Company at December 31, 1993 was approximately 28,000. There are no legal 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.

Environmental Matters

The Company and its subsidiaries comply with government laws and regulations and responsible management practices for the protection of the environment. The Consolidated Balance Sheet includes accruals for the estimated future costs associated with certain environmental remediation activities related to the past use or disposal of hazardous materials. Substantially all such costs relate to divested operations and to facilities or locations that are no longer in operation. Due to a number of uncertainties, including uncertainty of timing, the scope of remediation, future technology, regulatory changes and other factors, it is possible that the ultimate remediation costs may exceed the amounts accrued. However, in the opinion of management, such additional costs are not expected to be material relative to consolidated liquidity, financial position or future results of operations. Consistent with the Company's commitment to protection of the environment, safety and employee health, additional costs, including capital expenditures, are incurred related to current operations.

Consolidated Statement of Income

Year Ended December 31,	1993	1992	1991
	(Stated in thousands except per share amounts)		
Revenue			
Operating	**$ 6,705,466**	$ 6,331,509	$ 6,145,171
Interest and other income	**98,801**	123,489	117,027
Gain on sale of investment (before income taxes of $58,449)	**–**	–	235,937
	6,804,267	6,454,998	6,498,135
Expenses			
Cost of goods sold and services	**5,024,596**	4,579,402	4,424,834
Research & engineering	**450,185**	421,237	407,236
Marketing	**285,628**	291,546	277,296
General	**311,088**	337,448	304,849
Interest	**68,888**	77,394	102,266
Taxes on income	**81,119**	86,368	166,002
	6,221,504	5,793,395	5,682,483
Income before cumulative effect of a change in accounting principle	**582,763**	661,603	815,652
Postretirement benefits	**(248,000)**	–	–
Net Income	**$ 334,763**	$ 661,603	$ 815,652
Net income per share:			
Before cumulative effect of a change in accounting principle	**$ 2.40**	$ 2.75	$ 3.42
Postretirement benefits	**(1.03)**	–	–
Net income per share	**$ 1.37**	$ 2.75	$ 3.42
Average shares outstanding (thousands)	**242,672**	240,878	239,005

See Notes to Consolidated Financial Statements
Schlumberger Limited (Schlumberger N.V., Incorporated in the Netherlands Antilles) and Subsidiary Companies

Consolidated Balance Sheet

Assets		*(Stated in thousands)*
December 31,	**1993**	1992*
Current Assets		
Cash and short-term investments	**$ 1,185,635**	$ 1,345,245
Receivables less allowance for doubtful accounts (1993–$45,158; 1992–$32,418)	**1,545,949**	1,435,035
Inventories	**621,385**	562,491
Other current assets	**123,199**	110,008
	3,476,168	3,452,779
Long-Term Investments, held to maturity	**356,874**	–
Fixed Assets less accumulated depreciation	**2,818,948**	2,497,183
Excess of Investment Over Net Assets of Companies Purchased less amortization	**1,109,050**	564,356
Other Assets	**155,907**	492,387
	$ 7,916,947	$ 7,006,705
Liabilities and Stockholders' Equity		
Current Liabilities		
Accounts payable and accrued liabilities	**$ 1,722,773**	$ 1,398,756
Estimated liability for taxes on income	**371,929**	430,570
Bank loans	**339,784**	258,983
Dividend payable	**73,605**	73,085
Long-term debt due within one year	**60,245**	49,141
	2,568,336	2,210,535
Long-Term Debt	**446,942**	374,336
Postretirement Benefits	**299,989**	–
Other Liabilities	**195,340**	191,028
	3,510,607	2,775,899
Stockholders' Equity		
Common stock	**660,129**	518,139
Income retained for use in the business	**6,106,461**	6,063,005
Treasury stock at cost	**(2,283,743)**	(2,317,854)
Translation adjustment	**(76,507)**	(32,484)
	4,406,340	4,230,806
	$ 7,916,947	$ 7,006,705

**Reclassified, in part, for comparative purposes.*

See Notes to Consolidated Financial Statements
Schlumberger Limited (Schlumberger N.V., Incorporated in the Netherlands Antilles) and Subsidiary Companies

Consolidated Statement of Cash Flows

Year Ended December 31,	1993	1992	1991
			(Stated in thousands)
Cash flows from operating activities:			
Income before extraordinary item	**$ 582,763**	$ 661,603	$ 815,652
Adjustments to reconcile income before extraordinary item to net cash provided by operating activities:			
Depreciation and amortization	**790,169**	708,788	659,591
Earnings of companies carried at equity, less dividends received (1993 – $10,408; 1992 – $18,000; 1991 – $26,776)	**(1,039)**	(29,777)	(35,270)
Gain on sale of investment in Compagnie Générale des Eaux	**–**	–	(177,488)
Provision for losses on accounts receivable	**15,820**	5,018	1,604
Other adjustments	**(7,106)**	(55,242)	(54,465)
Change in operating assets and liabilities:			
Decrease (increase) in receivables	**140,929**	(38,750)	(117,118)
Decrease (increase) in inventories	**2,654**	17,428	(3,664)
Increase (decrease) in accounts payable and accrued liabilities	**16,546**	(65,879)	48,878
Decrease in estimated liability for taxes on income	**(101,119)**	(151,747)	(70,615)
Other – net	**15,861**	(52,598)	(58,887)
Net cash provided by operating activities	**1,455,478**	998,844	1,008,218
Cash flows from investing activities:			
Purchases of fixed assets	**(691,101)**	(809,486)	(921,313)
Sales/retirements of fixed assets	**50,287**	62,760	37,949
Proceeds from sale of subsidiaries	**93,000**	–	–
Proceeds from sale of investment in Compagnie Générale des Eaux	**–**	–	353,669
Acquisition of Dowell Schlumberger	**(590,000)**	–	–
Payment for purchase of businesses	**(39,450)**	(172,616)	(23,960)
(Increase) decrease in investments	**(181,329)**	118,995	(120,173)
(Increase) decrease in other assets	**(8,567)**	38,621	14,202
Net cash used in investing activities	**(1,367,160)**	(761,726)	(659,626)
Cash flows from financing activities:			
Dividends paid	**(290,793)**	(288,622)	(286,164)
Proceeds from employee stock purchase plan	**37,049**	35,805	32,701
Proceeds from exercise of stock options	**33,788**	34,036	40,087
Proceeds from issuance of long-term debt	**182,861**	201,047	214,890
Payments of principal on long-term debt	**(85,887)**	(204,710)	(207,034)
Net increase (decrease) in short-term debt	**58,122**	(13,374)	(151,943)
Net cash used in financing activities	**(64,860)**	(235,818)	(357,463)
Net increase (decrease) in cash	**23,458**	1,300	(8,871)
Cash, beginning of year	**40,280**	38,980	47,851
Cash, end of year	**$ 63,738**	$ 40,280	$ 38,980

See Notes to Consolidated Financial Statements
Schlumberger Limited (Schlumberger N.V., Incorporated in the Netherlands Antilles) and Subsidiary Companies

Consolidated Statement of Stockholders' Equity

(Dollar amounts in thousands)

	Common Stock					
	Issued		In Treasury			
	Shares	*Amount*	*Shares*	*Amount*	*Translation Adjustment*	*Income Retained for Use in the Business*
Balance, January 1, 1991	304,271,821	$ 437,532	66,146,692	$ 2,393,176	$ 48,548	$ 5,161,912
Translation adjustment, 1991					(3,394)	
Sales to optionees less shares exchanged		(1,959)	(1,164,963)	(42,046)		
Employee stock purchase plan	671,626	32,701				
Net income						815,652
Dividends declared ($1.20 per share)						(286,976)
Balance, December 31, 1991	304,943,447	468,274	64,981,729	2,351,130	45,154	5,690,588
Translation adjustment, 1992					(77,638)	
Sales to optionees less shares exchanged		760	(920,472)	(33,276)		
Shares issued for acquisition	236,813	13,300				
Employee stock purchase plan	715,388	35,805				
Net income						661,603
Dividends declared ($1.20 per share)						(289,186)
Balance, December 31, 1992	305,895,648	518,139	64,061,257	2,317,854	(32,484)	6,063,005
Translation adjustment, 1993					(44,023)	
Sales to optionees less shares exchanged		(323)	(943,146)	(34,111)		
Dowell acquisition		100,000				
Shares issued for acquisition	77,961	5,264				
Employee stock purchase plan	693,559	37,049				
Net income						334,763
Dividends declared ($1.20 per share)						(291,307)
Balance, December 31, 1993	306,667,168	$ 660,129	63,118,111	$ 2,283,743	$ (76,507)	$ 6,106,461

See Notes to Consolidated Financial Statements
Schlumberger Limited (Schlumberger N.V., Incorporated in the Netherlands Antilles) and Subsidiary Companies

Notes to Consolidated Financial Statements

Summary of Accounting Policies

The Consolidated Financial Statements of Schlumberger Limited and its subsidiaries have been prepared in accordance with accounting principles generally accepted in the United States.

Principles of Consolidation

The Consolidated Financial Statements include the accounts of majority-owned subsidiaries. Significant 20%-50% owned companies are carried on the equity method and classified in Other Assets. The pro rata share of revenue and expenses of 50% owned companies is included in the individual captions in the Consolidated Statement of Income. The Company's pro rata share of after-tax earnings of other equity companies is included in Interest and other income.

Translation of Non-US Currencies

All assets and liabilities recorded in functional currencies other than US dollars are translated at current exchange rates. The resulting adjustments are charged or credited directly to the Stockholders' Equity section of the Balance Sheet. Revenue and expenses are translated at the weighted average exchange rates for the period. All realized and unrealized transaction gains and losses are included in income in the period in which they occur. Included in the 1993 results were transaction gains of $4 million compared to losses of $22 million and $2 million in 1992 and 1991, respectively.

Currency exchange contracts are entered into as a hedge against the effect of future settlement of assets and liabilities denominated in other than the functional currency of the individual businesses. Gains or losses on the contracts are recognized when the currency exchange rates fluctuate, and the resulting charge or credit offsets the unrealized currency gains or losses on those assets and liabilities. At December 31, 1993, contracts were outstanding to purchase the US dollar equivalent of $81 million in various foreign currencies and to sell the equivalent of $30 million at forward rates on the dates the contracts were entered. These contracts mature on various dates in 1994.

Investments

In May 1993, Statement of Financial Accounting Standards No. 115, *Accounting for Certain Investments in Debt and Equity Securities*, was issued by the Financial Accounting Standards Board. As permitted, the Company implemented this Standard on December 31, 1993; retroactive application is not permitted. The Consolidated Balance Sheet at December 31, 1993 reflects the Company's investment portfolio separated between current and long-term based on maturity. Except for $94 million of investments which are considered trading, it is the Company's intent to hold the investments until maturity.

Both short-term and long-term investments held to maturity at December 31, 1993 are stated at cost plus accrued interest, which approximates market, and comprise primarily Eurodollar time deposits, certificates of deposit and commercial paper and Euronotes, substantially all denominated in US dollars. Short-term investments that are designated as trading are stated at market. The adoption of this Standard had no material effect on the results of operations for the year.

For purposes of the Consolidated Statement of Cash Flows, the Company does not consider short-term investments to be cash equivalents as they generally have original maturities in excess of three months. Short-term investments at December 31, 1993 and 1992 were $1.1 billion and $1.3 billion, respectively.

Inventories

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

Excess of Investment Over Net Assets of Companies Purchased

Cost in excess of net assets of purchased companies is amortized on a straight-line basis over periods ranging from 10 to 40 years. Accumulated amortization was $162 million and $114 million at December 31, 1993 and 1992, respectively.

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 oilfield technical equipment manufactured by subsidiaries of the Company. 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.

Taxes on Income

The Company and its subsidiaries compute taxes on income 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 or expense items reported in one period for tax purposes and in another period for financial accounting purposes, an appropriate provision for deferred income taxes is made. The provisions were not significant in 1993, 1992 or 1991.

Approximately $1.8 billion of consolidated income retained for use in the business at December 31, 1993 represented undistributed earnings of consolidated subsidiaries and the Company's pro rata share of 20%-50% owned companies. No provision is made for deferred income taxes on those earnings considered to be indefinitely reinvested or earnings that would not be taxed when remitted.

Tax credits and other allowances are credited to current income tax expense on the flow-through method of accounting.

In February 1992, Statement of Financial Accounting Standards No. 109, *Accounting for Income Taxes*, was issued by the Financial Accounting Standards Board. The Company implemented this Standard in 1993. The Company's US subsidiary is in an operating loss carryforward position and has no net deferred tax asset recorded. The adoption of this Standard did not have a material effect on the Company's results of operations or financial position.

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. The effect of stock options, which are common stock equivalents, on the computation of earnings per share was not significant.

Research & Engineering

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

Acquisitions

Schlumberger acquired the remaining 50% interest in the Dowell Schlumberger group of companies in January 1993. The purchase price was $675 million in cash and a warrant, expiring in 7.5 years and valued at $100 million, to purchase 7.5 million shares of Schlumberger common stock at an exercise price of $59.95 per share. The warrant is fully-vested and nontransferable. The acquisition was accounted for as a purchase; cost in excess of net assets acquired, estimated at $525 million, will be amortized on a straight-line basis over 40 years. If the acquisition had taken place on January 1, 1992, consolidated operating revenue for 1992 would have increased by 8% with an immaterial effect on consolidated net income after taking into account goodwill amortization and financing costs.

In July 1992, the Company announced a definitive agreement to acquire two oilfield service businesses from the Raytheon Company for $160 million. Upon receipt of regulatory approvals, the acquisition was completed in November 1992. The acquisition was accounted for as a purchase, and the cost in excess of net assets acquired of $139 million will be amortized on a straight-line basis over 20 years.

Fixed Assets

A summary of fixed assets follows:

		(Stated in millions)
December 31,	**1993**	1992
Land	**$ 75**	$ 68
Buildings & improvements	**968**	763
Machinery and equipment	**7,131**	6,075
Total cost	**8,174**	6,906
Less accumulated depreciation	**5,355**	4,409
	$ 2,819	$ 2,497

Estimated useful lives of Buildings & improvements range from 8 to 50 years and of Machinery and equipment from 2 to 18 years.

Other Assets

Other assets at December 31, 1992 comprised mainly the Company's 50% investments in the Dowell Schlumberger business ($337 million) and joint ventures of Sedco Forex. In January 1993, the Company acquired the remaining 50% of Dowell Schlumberger from Dow Chemical.

Equity in undistributed earnings of all 50%-owned companies at December 31, 1993 amounted to $2 million.

Long-Term Debt

Long-term debt of $447 million is primarily denominated in US dollars, Italian lire, Japanese yen, British pounds and German marks, at money market-based rates varying up to 10%.

Long-term debt at December 31, 1993 is due $127 million in 1995, $114 million in 1996, $201 million in 1997, $4 million in 1998 and $1 million thereafter.

Interest rate swap arrangements are entered into to adjust non-US dollar denominated debt and interest rates into US dollars. At December 31, 1993, interest rate swap arrangements were outstanding with commercial banks having a total principal amount of $188 million. These arrangements mature at various dates through 1997 and the interest rates are adjusted semiannually. During 1993, interest rate swap arrangements reduced consolidated interest expense by $5 million. The exposure in the event of nonperformance by the other parties to the arrangements is not significant.

Lines of Credit

At December 31, 1993, the Company's principal US subsidiary had an available unused Revolving Credit Agreement with a group of banks. The Agreement provided that the subsidiary may borrow up to $500 million until December 1998 at money market-based rates. In January 1993, the Company entered into a $500 million Revolving Credit Agreement with a group of banks and utilized $475 million to complete

the acquisition of the remaining 50% of Dowell Schlumberger. The debt was subsequently repaid and the line of credit was cancelled in December 1993. In addition, at December 31, 1993, the Company and its subsidiaries had available unused short-term lines of credit of approximately $667 million.

Capital Stock

The Company is authorized to issue 500,000,000 shares of Common Stock, par value $0.01 per share, of which 243,549,057 and 241,834,391 shares were outstanding on December 31, 1993 and 1992, respectively. The Company is also authorized to issue 200,000,000 shares of cumulative Preferred Stock, par value $0.01 per share, which may be issued in series with terms and conditions determined by the Board of Directors. No shares of Preferred Stock have been issued. Holders of Common Stock and Preferred Stock are entitled to one vote for each share of stock held.

The Company has a non-compensatory Employee Discounted Stock Purchase Plan. Under the Plan, employees may purchase Common Stock at the end of the Plan year through payroll deductions of up to 10% of compensation. The price per share is equal to 85% of the lower of the beginning or end of Plan year market price. With stockholder approval, in 1992 the Company amended the Plan to increase the aggregate number of shares available for purchase to 8,000,000 shares. During 1993, 693,559 shares were purchased under the Plan.

Options to purchase shares of the Company's Common Stock have been granted under various incentive plans to officers and key employees at prices equal to 100% of the fair market value at the date of grant.

Transactions under stock incentive plans were as follows:

	Number of Shares	Option Price Per Share
Outstanding Jan. 1, 1992	8,098,403	$ 29.25-67.00
Granted	3,216,000	$ 62.38-63.06
Exercised	(985,700)	$ 29.25-64.50
Lapsed or cancelled	(230,875)	$ 29.25-67.00
Outstanding Dec. 31, 1992	10,097,828	$ 29.25-67.00
Granted	848,250	$ 59.81-64.81
Exercised	(966,402)	$ 29.25-67.00
Lapsed or cancelled	(387,680)	$ 29.25-67.00
Outstanding Dec. 31, 1993	9,591,996	$ 29.25-67.00
Exercisable at Dec. 31, 1993	4,922,422	$ 29.25-67.00
Available for grant		
Dec. 31, 1992	3,057,920	
Dec. 31, 1993	2,557,070	

Income Tax Expense

The Company and its subsidiaries operate in over 100 taxing jurisdictions with statutory rates ranging up to about 50%.

The Company's US consolidated group is in an operating loss carryforward position. At December 31, 1993, the group had an unused operating loss carryforward for consolidated financial statement purposes of $1.6 billion. The operating loss carryforward on a tax return basis is approximately $1.0 billion. Most of the carryforward will expire in the years 2001-2002. The tax benefit of this carryforward is available to reduce future US federal income tax expense.

Leases and Lease Commitments

Total rental expense was $177 million in 1993, $166 million in 1992 and $167 million in 1991. Future minimum rental commitments under noncancelable leases for years ending December 31 are: 1994–$78 million; 1995–$65 million; 1996–$49 million; 1997–$40 million; and 1998–$32 million. For the ensuing three five-year periods, these commitments decrease from $55 million to $2 million. The minimum rentals over the remaining terms of the leases aggregate $8 million.

Contingencies

The Company and its subsidiaries comply with government laws and regulations and responsible management practices for the protection of the environment. The Consolidated Balance Sheet includes accruals for the estimated future costs associated with certain environmental remediation activities related to the past use or disposal of hazardous materials. Substantially all such costs relate to divested operations and to facilities or locations that are no longer in operation. Due to a number of uncertainties, including uncertainty of timing, the scope of remediation, future technology, regulatory changes and other factors, it is possible that the ultimate remediation costs may exceed the amounts accrued. However, in the opinion of management, such additional costs are not expected to be material relative to consolidated liquidity, financial position or future results of operations.

In addition, the Company and its subsidiaries are party to various legal proceedings. Although the ultimate disposition of these proceedings is not presently determinable, in the opinion of the Company any liability that might ensue would not be material in relation to the consolidated financial statements.

Segment Information

The Company's business comprises two segments: (1) Oilfield Services and (2) Measurement & Systems. Services and products are described in more detail on page 48 in this report.

Financial information for the years ended December 31, 1993, 1992 and 1991 by industry segment and by geographic area is as follows:

(Stated in millions)

	Oilfield Services	*Measurement & Systems*	*Adjust. & Elim.*	*Consolidated*
Industry Segment 1993				
Operating revenue				
Customers	$ 4,337	$ 2,368	$ –	$ 6,705
Intersegment transfers	1	2	(3)	–
	$ 4,338	$ 2,370	$ (3)	$ 6,705
Operating income	$ 468	$ 184	$ (23)	$ 629
Interest expense				(69)
Interest and other income plus other credits – $5				104
Income before taxes				$ 664
Depreciation expense	$ 638	$ 95	$ 6	$ 739
Fixed asset additions	$ 570	$ 100	$ 21	$ 691
At December 31				
Identifiable assets	$ 4,707	$ 1,620	$ (41)	$ 6,286
Corporate assets				1,631
Total assets				$ 7,917
Industry Segment 1992				
Operating revenue				
Customers	$ 3,849	$ 2,483	$ –	$ 6,332
Intersegment transfers	–	1	(1)	–
	$ 3,849	$ 2,484	$ (1)	$ 6,332
Operating income	$ 546	$ 178	$ (28)	$ 696
Interest expense				(77)
Interest and other income plus other credits – $6				129
Income before taxes				$ 748
Depreciation expense	$ 570	$ 99	$ 2	$ 671
Fixed asset additions	$ 693	$ 111	$ 5	$ 809
At December 31				
Identifiable assets	$ 3,865	$ 1,719	$ (11)	$ 5,573
Corporate assets				1,434
Total assets				$ 7,007
Industry Segment 1991				
Operating revenue				
Customers	$ 3,847	$ 2,298	$ –	$ 6,145
Intersegment transfers	–	2	(2)	–
	$ 3,847	$ 2,300	$ (2)	$ 6,145
Operating income	$ 602	$ 170	$ (38)[1]	$ 734
Interest expense				(102)
Interest and other income less other charges – $3				114
Gain on sale of investment				236
Income before taxes				$ 982
Depreciation expense	$ 532	$ 93	$ 2	$ 627
Fixed asset additions	$ 818	$ 101	$ 2	$ 921
At December 31				
Identifiable assets	$ 3,533	$ 1,789	$ (11)	$ 5,311
Corporate assets				1,543
Total assets				$ 6,854

[1] *Includes third quarter charge of $25 million for downsizing the North American oilfield operations.*

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.

During the years ended December 31, 1993, 1992 and 1991, neither sales to any government nor sales to any single customer exceeded 10% of consolidated operating revenue.

Corporate assets largely comprise short-term and long-term investments.

(Stated in millions)

	Western Hemisphere		*Eastern Hemisphere*				
	US	*Other*	*France*	*Other European*	*Other*	*Adjust. & Elim.*	*Consolidated*
Geographic Area 1993							
Operating revenue							
Customers	$ 1,491	$ 671	$ 748	$ 1,821	$ 1,974	$ –	$ 6,705
Interarea transfers	253	5	148	21	17	(444)	–
	$ 1,744	$ 676	$ 896	$ 1,842	$ 1,991	$ (444)	$ 6,705
Operating income	$ 129	$ 86	$ 41	$ 100	$ 306	$ (33)	$ 629
Interest expense							(69)
Interest and other income plus other credits – $5							104
Income before taxes							$ 664
At December 31							
Identifiable assets	$ 1,485	$ 536	$ 576	$ 1,953	$ 1,854	$ (118)	$ 6,286
Corporate assets							1,631
Total assets							$ 7,917
Geographic Area 1992							
Operating revenue							
Customers	$ 1,014	$ 554	$ 850	$ 2,110	$ 1,804	$ –	$ 6,332
Interarea transfers	242	7	158	29	39	(475)	–
	$ 1,256	$ 561	$ 1,008	$ 2,139	$ 1,843	$ (475)	$ 6,332
Operating income (loss)	$ (13)	$ 78	$ 61	$ 210	$ 388	$ (28)	$ 696
Interest expense							(77)
Interest and other income plus other credits – $6							129
Income before taxes							$ 748
At December 31							
Identifiable assets	$ 1,011	$ 438	$ 656	$ 2,006	$ 1,528	$ (66)	$ 5,573
Corporate assets							1,434
Total assets							$ 7,007
Geographic Area 1991							
Operating revenue							
Customers	$ 1,162	$ 544	$ 767	$ 2,009	$ 1,663	$ –	$ 6,145
Interarea transfers	289	18	203	27	7	(544)	–
	$ 1,451	$ 562	$ 970	$ 2,036	$ 1,670	$ (544)	$ 6,145
Operating income	$ 55	$ 78	$ 85	$ 217	$ 348	$ (49)[1]	$ 734
Interest expense							(102)
Interest and other income less other charges – $3							114
Gain on sale of investment							236
Income before taxes							$ 982
At December 31							
Identifiable assets	$ 1,037	$ 388	$ 730	$ 1,837	$ 1,403	$ (84)	$ 5,311
Corporate assets							1,543
Total assets							$ 6,854

[1]*Includes third quarter charge of $25 million for downsizing the North American oilfield operations.*

Pension and Other Benefit Plans

US Pension Plans

The Company and its US subsidiary sponsor several defined benefit pension plans that cover substantially all employees. The benefits are based on years of service and compensation on a career-average pay basis. These plans are substantially fully funded with trustees in respect to past and current service. Charges to expense are based upon costs computed by independent actuaries. The funding policy is to contribute annually amounts that can be deducted for federal income tax purposes. These contributions are intended to provide for benefits earned to date and those expected to be earned in the future.

Net pension cost in the US for 1993, 1992 and 1991 included the following components:

		(Stated in millions)	
	1993	1992	1991
Service cost – benefits earned during the period	**$ 20**	$ 16	$ 16
Interest cost on projected benefit obligation	**42**	38	36
Expected return on plan assets (actual return: 1993–$87; 1992–$44; 1991–$88)	**(42)**	(41)	(38)
Amortization of transition asset	**(2)**	(2)	(2)
Amortization of prior service cost/other	**3**	5	5
Net pension cost	**$ 21**	$ 16	$ 17

Effective January 1, 1993, the Company and its subsidiaries amended their pension plans to improve retirement benefits for current employees. The funded status of the plans at December 31, 1992 reflects the amendment.

The funded status of the plans at December 31, 1993 and 1992 was as follows:

	(Stated in millions)	
	1993	1992
Actuarial present value of obligations:		
Vested benefit obligation	**$ 567**	$ 435
Accumulated benefit obligation	**$ 570**	$ 438
Projected benefit obligation	**$ 643**	$ 495
Plan assets at market value	**587**	524
Excess of assets over projected benefit obligation	**(56)**	29
Unrecognized net gain	**(3)**	(86)
Unrecognized prior service cost	**31**	37
Unrecognized net asset at transition date	**(12)**	(13)
Pension liability	**$ (40)**	$ (33)

For 1993, assumed discount rate and rate of compensation increases used to determine the projected benefit obligation were 7% and 4.5%, respectively; the expected long-term rate of return on plan assets was 9%. For 1992, the rates were 8.5%, 6% and 9%, respectively. Plan assets at December 31, 1993 consist of common stocks ($384 million), cash or cash equivalents ($65 million), fixed income investments ($114 million) and other investments ($24 million). Less than 1% of the plan assets at December 31, 1993 represents Schlumberger Limited Common Stock.

Non-US Pension Plans

Outside of the US, subsidiaries of the Company sponsor several defined benefit and defined contribution plans that cover substantially all employees who are not covered by statutory plans. For defined benefit plans, charges to expense are based upon costs computed by independent actuaries. These plans are substantially fully funded with trustees in respect to past and current service. For all defined benefit plans, pension expense was $23 million, $20 million and $23 million in 1993, 1992 and 1991, respectively. The only significant defined benefit plan is in the UK.

Net pension cost in the UK plan for 1993, 1992 and 1991 (translated into US dollars at the average exchange rate for the periods) included the following components:

		(Stated in millions)	
	1993	1992	1991
Service cost – benefits earned during the period	**$ 12**	$ 14	$ 14
Interest cost on projected benefit obligation	**10**	10	7
Expected return on plan assets (actual return: 1993–$58; 1992–$30; 1991–$37)	**(13)**	(12)	(9)
Amortization of transition asset and other	**–**	(1)	(1)
Net pension cost	**$ 9**	$ 11	$ 11

During 1992, the UK pension plan was amended to improve retirement benefits for retirees. The improvement is reflected as prior service cost.

The funded status of the plan (translated into US dollars at year-end exchange rates) was as follows:

	(Stated in millions)	
	1993	1992
Actuarial present value of obligations:		
Vested benefit obligation	**$ 122**	$ 105
Accumulated benefit obligation	**$ 122**	$ 105
Projected benefit obligation	**$ 146**	$ 125
Plan assets at market value	**210**	154
Excess of assets over projected benefit obligation	**64**	29
Unrecognized net gain	**(72)**	(34)
Unrecognized prior service cost	**5**	6
Unrecognized net asset at transition date	**(6)**	(7)
Pension liability	**$ (9)**	$ (6)

The assumed discount rate and rate of compensation increases used to determine the projected benefit obligation were 7% and 4.5%, respectively;

the expected long-term rate of return on plan assets was 8.5%. Plan assets consist of common stocks ($170 million), cash or cash equivalents ($4 million) and fixed income investments ($36 million). None of the plan assets represents Schlumberger Limited Common Stock.

For defined contribution plans, funding and cost are generally based upon a predetermined percentage of employee compensation. Charges to expense in 1993, 1992 and 1991 were $9 million, $14 million and $16 million, respectively.

Other Deferred Benefits

In addition to providing pension benefits, the Company and its subsidiaries have other deferred benefit programs. Expense for these programs was $63 million, $57 million and $70 million in 1993, 1992 and 1991, respectively.

Health Care Benefits

The Company and its US subsidiary provide certain health care benefits for certain active employees. The cost of providing these benefits is recognized as expense when incurred and aggregated $36 million, $34 million and $40 million in 1993, 1992 and 1991, respectively. Outside of the United States, such benefits are mostly provided through government-sponsored programs.

Postretirement Benefits Other Than Pensions

In December 1990, the Financial Accounting Standards Board issued Statement of Financial Accounting Standards No. 106, *Employers' Accounting for Postretirement Benefits Other Than Pensions*. This statement requires the use of the accrual method for future postretirement benefits rather than accounting for these benefits on a pay-as-you-go basis. The Company adopted this Statement effective January 1, 1993, as required.

The Company and its US subsidiary provide certain health care benefits to former employees who have retired under the US pension plans. The accumulated postretirement benefit charge on January 1, 1993 for all current retirees and the pro rata amount for active employees based on years of service was $248 million. Such amount was recorded as an extraordinary item (cumulative effect of an accounting change) in the first quarter of 1993. In addition, 1993 expense was $32 million consisting of service cost and interest cost of $9 million and $23 million, respectively. The principal actuarial assumptions used to measure the above-mentioned costs were a discount rate of 8.5% and a medical cost trend rate of 13% graded to 6% over 10 years and 6% thereafter.

The funded status at December 31, 1993 was as follows:

	(Stated in millions)
	1993
Accumulated Postretirement Benefit Obligation:	
Retirees	$ 196
Fully eligible	2
Actives	131
	$ 329
Unrecognized net loss	(29)
Postretirement benefit liability at December 31	$ 300

The assumed discount rate used to determine the accumulated postretirement benefit obligation was 7%.

If the assumed medical cost trend rate was increased by one percentage point, health care cost in 1993 would have been $38 million, and the accumulated postretirement benefit obligation would have been $377 million at December 31, 1993.

Supplementary Information

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

			(Stated in millions)
Year ended December 31,	**1993**	1992	1991
Operating revenue			
Sales	**$ 2,576**	$ 2,379	$ 2,245
Services	**4,129**	3,953	3,900
	$ 6,705	$ 6,332	$ 6,145
Direct operating costs			
Goods sold	**$ 1,619**	$ 1,533	$ 1,428
Services	**3,406**	3,047	2,997
	$ 5,025	$ 4,580	$ 4,425

Cash paid for interest and income taxes was as follows:

			(Stated in millions)
Year ended December 31,	**1993**	1992	1991
Interest	**$ 69**	$ 81	$ 106
Income taxes	**$ 136**	$ 206	$ 155

Accounts payable and accrued liabilities are summarized as follows:

		(Stated in millions)
December 31,	**1993**	1992
Payroll, vacation and employee benefits	**$ 393**	$ 339
Trade	**464**	394
Other	**866**	666
	$ 1,723	$ 1,399

The caption "Interest and other income" includes interest income, principally from short-term and long-term investments, of $89 million, $102 million and $98 million for 1993, 1992 and 1991, respectively.

Report of Independent Accountants

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, of stockholders' equity and of cash flows present fairly, in all material respects, the financial position of Schlumberger Limited and its subsidiaries at December 31, 1993 and 1992, and the results of their operations and their cash flows for each of the three years in the period ended December 31, 1993, in conformity with generally accepted accounting principles. These financial statements are the responsibility of the Company's management; our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits of these statements in accordance with generally accepted auditing standards which require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for the opinion expressed above.

In 1993, the Company changed its methods of accounting for income taxes, certain investment securities and postretirement benefits as described in the Summary of Accounting Policies and Pension and Other Benefit Plans notes.

New York, New York
January 25, 1994

Quarterly Results (Unaudited)

The following table summarizes results for each of the four quarters for the years ended December 31, 1993 and 1992. Gross profit equals operating revenue less cost of goods sold and services.

(Stated in millions except per share amounts)

	Operating		Net Income / (Loss)	
	Revenue	*Gross Profit*	*Amount*	*Per Share*
Quarters–1993				
First	$ 1,598	$ 411	$ (115)[1]	$ (0.48)[1]
Second	1,719	447	163	0.67
Third	1,642	429	163	0.67
Fourth	1,746	394	124	0.51
	$ 6,705	$ 1,681	$ 335[1]	$ 1.37[1]
Quarters–1992				
First	$ 1,552	$ 425	$ 156	$ 0.65
Second	1,553	447	178	0.74
Third	1,594	451	173	0.72
Fourth	1,633	429	155	0.64
	$ 6,332	$ 1,752	$ 662	$ 2.75

[1]*Includes the cumulative effect of a change in accounting principle of $248 million ($1.03 per share).*

Five Year Summary

					(Stated in millions except per share amounts)
Year Ended December 31,	**1993**	1992	1991	1990	1989
Summary of Operations					
Operating revenue:					
Oilfield Services	**$ 4,338**	$ 3,849	$ 3,847	$ 3,240	$ 2,696
Measurement & Systems	**2,370**	2,484	2,300	2,066	1,990
Total operating revenue	**$ 6,705**	$ 6,332	$ 6,145	$ 5,306	$ 4,686
% Increase (decrease) over prior year	**6%**	3%	16%	13%	(5%)
Operating income:					
Oilfield Services	**$ 468**	$ 546	$ 602	$ 542	$ 340
Measurement & Systems	**184**	178	170	153	154
Eliminations	**(23)**	(28)	(38)	(17)	1
	$ 629	$ 696	$ 734	$ 678	$ 495
% (Decrease) increase from prior year	**(10%)**	(5%)	8%	37%	7%
Interest expense	**69**	77	102	87	96
Taxes on income	**81**	86	166	128	111
Income, continuing operations	**$ 583**	$ 662	$ 816[2]	$ 570	$ 420[3]
% (Decrease) increase from prior year	**(12%)**	(19%)	43%	36%	(7%)
Cumulative effect of a change in accounting principle	**(248)[1]**	–	–	–	–
Extraordinary item	**–**	–	–	–	21
Net income	**$ 335**	$ 662	$ 816[2]	$ 570	$ 441[3]
Income per share:					
Continuing operations	**$ 2.40**	$ 2.75	$ 3.42[2]	$ 2.40	$ 1.77[3]
Cumulative effect of a change in accounting principle	**(1.03)[1]**	–	–	–	–
Extraordinary item	**–**	–	–	–	0.09
Net income	**$ 1.37**	$ 2.75	$ 3.42[2]	$ 2.40	$ 1.86[3]
Cash dividends declared	**$ 1.20**	$ 1.20	$ 1.20	$ 1.20	$ 1.20
Summary of Financial Data					
Income as % of revenue, continuing operations	**9%**	10%	13%	11%	9%
Return on average stockholders' equity, continuing operations	**14%**	16%	24%	19%	15%
Fixed asset additions	**$ 691**	$ 809	$ 921	$ 675	$ 549
Depreciation expense	**$ 739**	$ 671	$ 627	$ 520	$ 493
Average number of shares outstanding	**243**	241	239	238	238
At December 31,					
Liquidity	**$ 696**	$ 663	$ 724	$ 527	$ 708
Working capital	**$ 908**	$ 1,242	$ 1,094	$ 812	$ 884
Total assets	**$ 7,917**	$ 7,007	$ 6,854	$ 6,176	$ 5,482
Long-term debt	**$ 447**	$ 374	$ 341	$ 332	$ 292
Stockholders' equity	**$ 4,406**	$ 4,231	$ 3,853	$ 3,255	$ 2,898
Number of employees	**48,000**	51,000	53,000	50,000	46,000

[1] *Relates to change in accounting for postretirement benefits.*
[2] *Includes a gain of $177 million ($0.74 per share) on the sale of an investment and a $25 million ($0.10 per share) charge for restructuring the North American oilfield operations.*
[3] *Includes a gain of $13 million ($0.05 per share) on the sale of the Defense Systems division.*

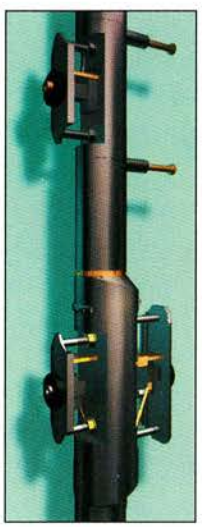
Cost-effective R&D

for Improving Client Productivity

A KEY TO OUR PROFITABILITY IS the relevance and uniqueness of our products and services. Relevance is ensured by the motivation of pertinent creativity in our people, by anticipating the evolving needs of customers and by rapid assimilation of appropriate new technology. The source of our uniqueness—our research and development effort—is the focus of this annual report.

During the past few years, Schlumberger has refocused on its core businesses. Accompanying this shift in emphasis is an increase in efficiency of our R&D organization. In the oilfield, manufacturing and engineering have been integrated by product line. Throughout the company, cultivation of close relationships with key suppliers and partners is giving us advanced knowledge of new technology and a hand in its development. Concentration of our R&D effort at a few centers is enabling faster introduction of products and services and synergy in their development.

These efforts have already yielded innovative solutions that show strong potential for growth. Following are examples of how greater efficiency in development of products and services is increasing the productivity of our customers' operations.



Greater efficiency in research and engineering generates innovations such as the MDT* Modular Formation Dynamics Tester that boost the productivity of Schlumberger customers. Read more about the MDT tool in the MAXIS Express* story on page 27.

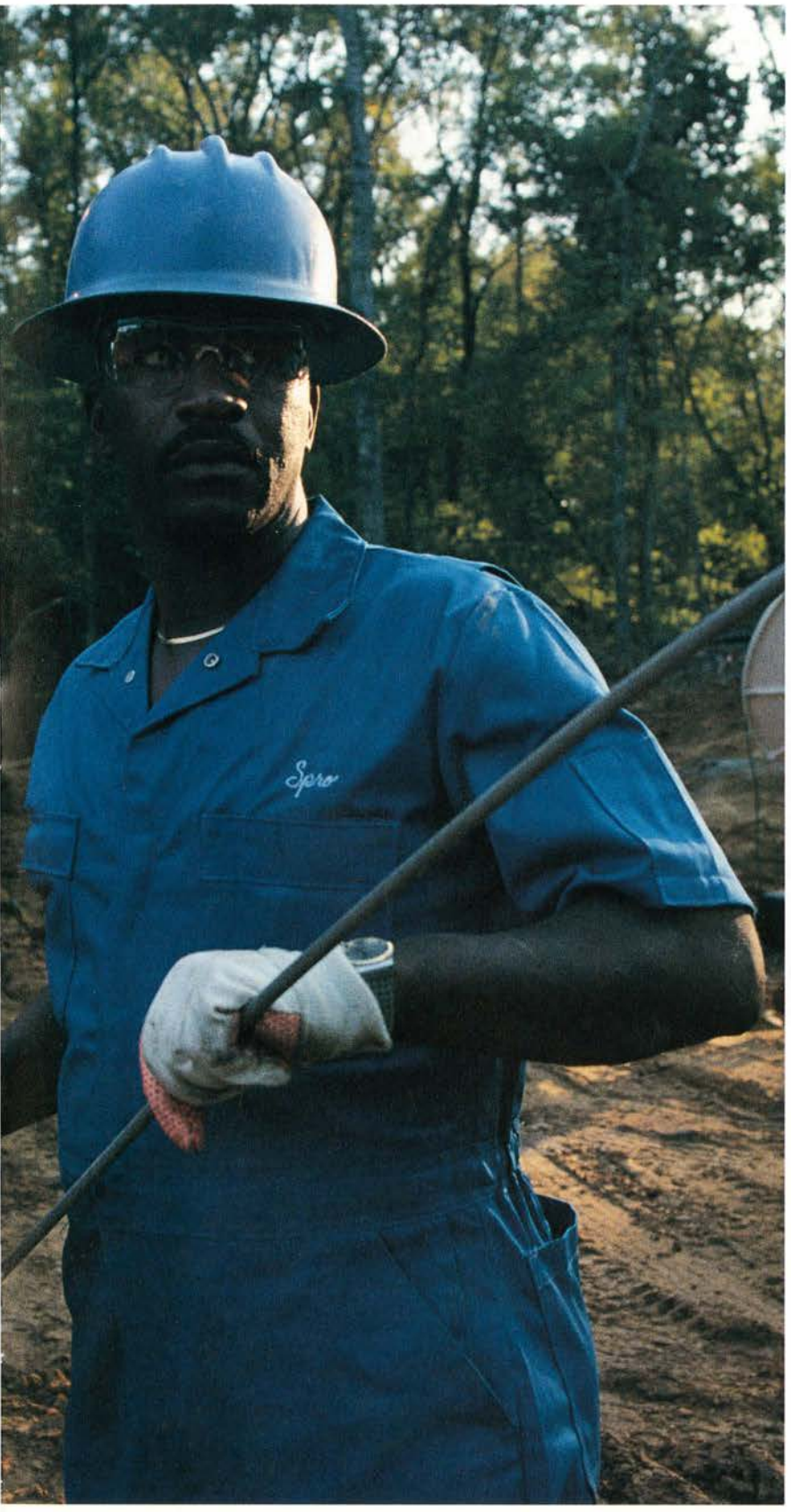
MAXIS Express Expands the Market for High Technology

The command center in well logging is a mobile computer laboratory where measurements made in oil and gas wells are recorded and interpreted. This laboratory is the surface part of the MAXIS* Multitask Acquisition and Imaging System. The laboratory contains a computer for recording and analyzing data about rock formations and a winch that raises and lowers sensors on an electrical cable.

Four years ago, introduction of MAXIS technology launched a new generation of services that could image the subsurface in great detail, enabling customers to find and produce oil and gas more efficiently. This year, rollout of the second-generation MAXIS surface system further increases the productivity of both the customer and Schlumberger.

The new MAXIS Express surface unit represents a rethink rather than a cosmetic touch-up. The computer is more powerful and can easily be expanded to incorporate future technology. Better work space ergonomics makes for more efficient operation. And packaging the laboratory in a smaller, lighter truck makes high-performance MAXIS services competitive in cost-sensitive markets, where margins for the client are lower. Now, the same technology that meets the demands of a $20 million North Sea

Above, in Natchez, Mississippi, Senior Operator Leonard Frazier prepares logging sensors for a MAXIS job. The MAXIS Express truck has the distinctive squared-off back.



Senior Operator Dave Whiteley, center, prepares sensors to make measurements in a well in Wise County, Texas, while General Field Engineer Harvin Broughton, foreground, prepares the onboard computer that controls the sensors and records their measurements. The layout of the logging unit increases productivity of field operations, allowing the engineer to simultaneously control the computer and the winch that moves sensors in and out of the well.

well is accessible to the operator of a $50,000 Oklahoma well.

The ergonomic design allows the surface system to be operated by a crew of two rather than three. A key contributor to this efficiency is new equipment that allows two people to safely unload logging tools from the truck, prepare them to be lowered in the well and rig them down after the operation.

Aboard the truck, the most dramatic change is the leap in computing power. Increases in memory, disk capacity and operating speed mean greater efficiency at the wellsite and savings for the customer. For instance, start-up time for a logging survey is cut by a third, logging speed is faster, and several tasks can be performed simultaneously. Advanced data processing speeds delivery of information that the customer needs to make critical decisions. Greater computing power also means that several data-intensive measurements can now be made in a single run in the well rather

Rigging up a MAXIS logging job for Meason Operating Company at a well in Natchez, Mississippi. Willie Sproulls, senior operator, spools out the logging cable, which moves sensors in and out of the well and carries data to the surface computer in the truck behind him.

What's Happening on the Surface? MAXIS technology comprises equipment deployed on the surface and several thousand feet below, in the well. Here is a comparison of the MAXIS 500* and the new MAXIS Express surface systems.

Sensors that make measurements in oil and gas wells are built into long, steel cylinders, lowered in the well on a cable. These tools are carried in the bed of the logging truck and conventionally assembled by two operators (above). Tool handling equipment of the new MAXIS Express system allows a single operator (below) to move tools from the bed of the truck and assemble them for lowering into the well.

MAXIS 500
Length: 212 inches
Weight: 50 tons

MAXIS Express
Length: 180 inches
Weight: 34 tons

The single rear-axle truck is shorter and lighter than the previous truck. Yet, more compact computer equipment and an ergonomic redesign yields more work space for the field engineer and customer.

The winch of the logging truck—electrical cable wound round a drum that rotates to move sensors in and out of the well. The new winch allows easy replacement of cable in a few minutes. The cable can be customized to the market, adding another efficiency. The winch can be run by the operator or engineer from inside the truck or remotely from outside the truck. This increases the flexibility of operations.

The larger window on the MAXIS Express enhances safety by giving the engineer a wider view of operations on the drilling rig and around the logging truck.

Safety and efficiency are improved by moving the engineer's work space to be in the line of sight of the drilling rig.

Greater computer power packed into a single rack reduces internal noise and frees floor space. Relocation of air conditioners from the ceiling to the forward wall of the truck increases headroom and reduces noise.

The MDT Modular Formation Dynamics Tester is one of many high-technology logging tools made accessible to a wide range of markets by the MAXIS Express system. Near Dhahran, Saudi Arabia, Operator Javed Nazir, left, unloads equipment while Engineer Yasser Mufti, middle, reviews functions of the MDT tool with Aramco Supervisor Abdullah Al-Daalouj. The MDT tool collects fluid samples from rock formations and measures how easily oil or gas will flow into a well.

than several runs, reducing the time spent logging. This capability is critical for efficient servicing of the increasing number of horizontal wells, which often require many log measurements made in a single descent into the well.

Components of the MAXIS Express logging unit also break new ground with a modular design, bringing greater flexibility to meet customer requirements. Rather than a logging unit that must be all things to all users, now the surface system can be configured to meet the special needs of individual markets. Modular design also means the system can capitalize on emerging technology without a redesign from the ground up.

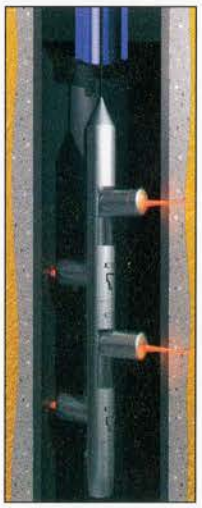
Altogether, the features of the MAXIS Express unit—power and adaptability of the computer, intelligent ergonomics for economy of work and modular design to meet market demands—will keep the MAXIS Express unit both competitive and at the technical forefront well into the decade.

At a well in Wise County, Texas, General Field Engineer Harvin Broughton, right, discusses logs in the MAXIS Express cab with Roger Armstrong, a petroleum engineer with Waggoner-Baldridge Operating Co., Inc.

Seen from above, Pivot Gun charges deployed and fired. A jet from the detonation penetrates the steel casing, cement and rock formation, permitting hydrocarbons to flow into the well.*

What's Happening Downhole?

The evolutionary push that produced the MAXIS Express surface system has also advanced the technology of instruments lowered into the well. The Pivot Gun marks an innovation in perforating, a procedure that allows hydrocarbons to flow into a well. A perforating gun shoots a special explosive charge that penetrates both the steel casing in the well and the producing rock formation. These holes provide the path for oil or gas to flow from the rock and into the well.



Once the Pivot Gun is lowered to the proper depth, charges swing out from the body of the tool. This design allows more powerful charges to be built into a gun of small diameter.

Many wells require use of small-diameter guns. As gun diameter shrinks, however, so does the size of the charge and the effectiveness of the hole it makes. By having charges mounted on pivots, the Pivot Gun allows large charges to swing out of the way and pass through narrow sections of a well. Once the gun is below the restrictions, the charges are swung open and fired. This gives big gun performance in a small gun package, making for more productive wells.

Renewing Sedco Forex's Semisubmersible Fleet

Paul Tranter, Sedco Forex naval architect, with *Sedco 701* at the Verolme Botlek dry dock in Rotterdam, The Netherlands. Tranter was in charge of the engineering required to modify the rig for service as a drilling tender.

In recent years, Sedco Forex has faced the dilemma of most drilling contractors: what to do with an aging fleet of offshore drilling rigs, called semisubmersibles, or semis. Most semis were built during the boom of the mid-1970s. These floating platforms are reaching the end of their initial design life of 20 years. Replacement, at an estimated $200 million per rig, is ruled out in today's tough economic climate. So Sedco Forex has implemented an innovative way to extend the life of its fleet at a fraction of the replacement cost.

A pressing case was the 700-series semis, built to withstand the most severe wind and waves of the North Sea. Picking *Sedco 704* for life extension, Sedco Forex attacked the renewal problem by modeling the stresses and strains the semi received during 20 years of service in the roughest seas. In Montrouge, France, a Sedco Forex team conducted computer simulations using proprietary software that identified the critical welds in the rig's structure (see next page). At the same time, theories of crack fatigue in steel were used to judge the likelihood of welds failing during future service.

The second step was dry-docking *Sedco 704* for inspection and refit. The entire structure was inspected for fatigue. Critical welds identified in the simulation were ground and shaped to remove flaws and minimize stress concentrations. After two months of focused reworking—costing just $20 million, 10% of the price of a new rig—the semi was ready for another 20 years of work in conditions like those in the North Sea. Sedco Forex's solution was approved by independent regulatory authorities.

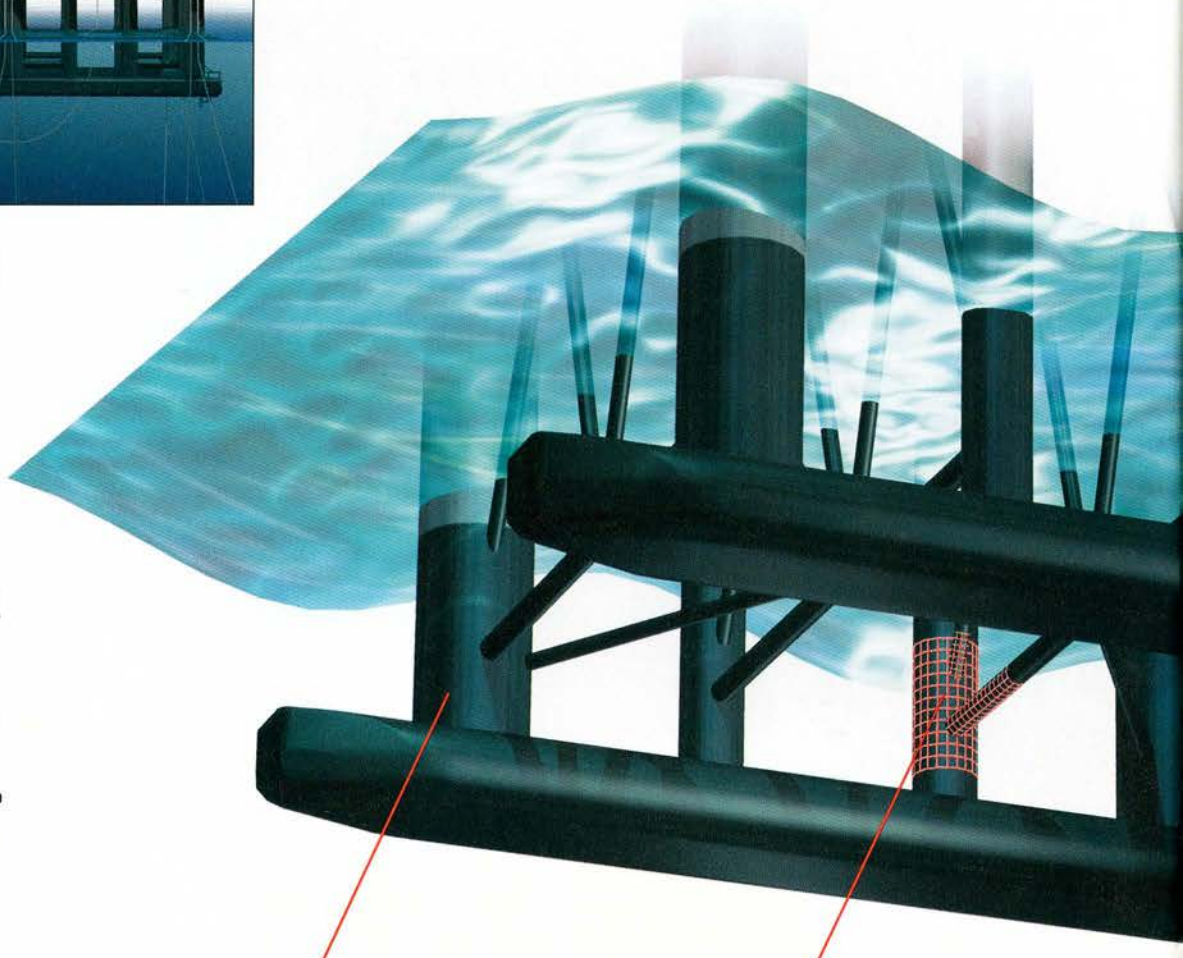
Since the refitting of *Sedco 704*, five other semisubmersibles are scheduled to undergo the same process for service in the Far East, South Pacific and West Africa, as well as the North Sea. This aggressive program makes Sedco Forex the leader in refitting as a long-term strategy for managing assets.

But this innovative engineering is not just extending the life of Sedco Forex's most valuable assets. In harsh places like the North Sea, it also ensures the marketability of rigs by making them candidates for tender-assisted drilling, a

Far left, preparing *Sedco 701* for life extension. The main structure is cleaned with a jet of water before sandblasting.

In tender-assisted drilling, a floating semisubmersible rig is joined to a fixed production platform. Because much equipment is housed on the semi, the production platform can be smaller and therefore significantly less expensive.

Right, measuring the forces of the sea. Sedco Forex computer programs are used to analyze how a passing wave stresses the structure of a semisubmersible rig. By simulating the effects of years of service at sea, engineers can determine which welds need reworking to extend the life of the rig.



Main supporting columns at the corners of the semisubmersible are 30 feet in diameter. Columns in the middle are 18 feet in diameter.

How much life is left in welded joints? Part of the answer comes from computer analysis of the columns and braces that support a semisubmersible rig. The simulation at right, a detail of the column indicated above, is used to analyze the distribution of stress, needed to identify welds that might need attention.

A tight mesh of lines around welds that join braces with columns indicates areas where stress is expected to concentrate. Colors denote different properties of the simulation used by the computer. Braces are 4 to 6 feet in diameter.

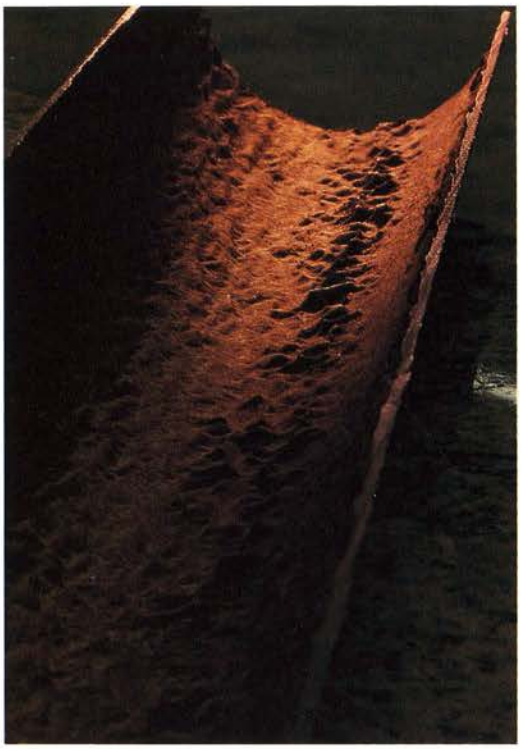
A Sedco Forex semi serving as a drilling tender in the Gannet field of the North Sea. Retrofitting of Sedco Forex rigs increases their ability to withstand years of service in rough weather, making them ideal candidates for the expanding market in tender-assisted drilling.

technique oil companies are using to reduce field development costs. In tender-assisted drilling, a semi remains attached to a platform for at least two years and provides support to the platform's drilling program. This allows construction of lighter and less costly platforms.

Previously, tender-assisted drilling in the North Sea was ruled out because of the difficulty in ensuring rig safety. Regular inspections by certification authorities, such as Lloyds and Det Norske Veritas, normally require moving the rig to calm waters and possibly dry dock—not a problem in conventional operations, in which a rig is rarely on location for more than few months. Tender-assisted drilling, however, calls for the semi being on location for two years or more. As a result of testing and simulation after refitting, Sedco Forex rigs have been authorized for at least five years of continuous service without inspection.

Tender-assisted drilling and rig life extension are boosting the efficiency of both Schlumberger and its customers. Through rig life extension, Sedco Forex is renewing its fleet at a small fraction of the replacement cost. At the same time, outfitting rigs for tender-assisted drilling is helping oil companies develop fields at lower cost.

Extending the Life of Mature Fields with Coiled Tubing



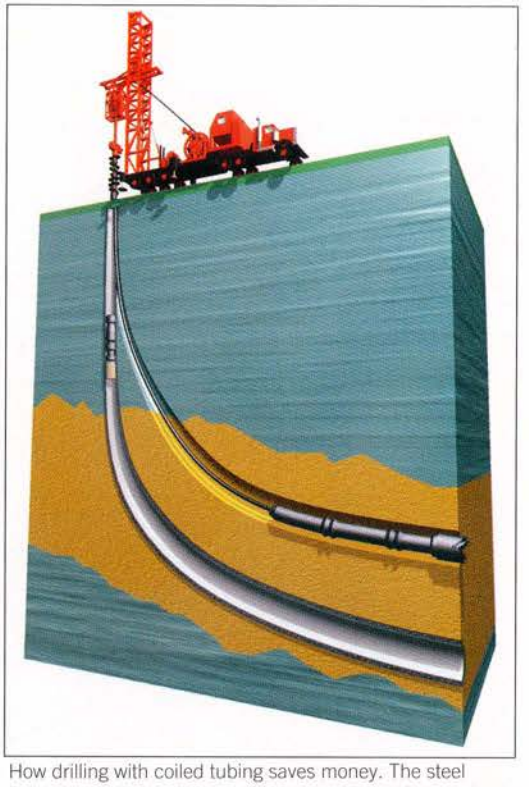
Most oil and gas today comes from fields that have reached, or just passed, the most productive parts of their lives. As these fields age, productivity falls and maintenance costs rise. The challenge for the oil company is to find economic ways to extend the lives of these fields. One technology giving new life to the growing number of aging wells is called coiled tubing.

Coiled tubing is a continuous, flexible steel tube wound like a garden hose on a portable reel in lengths up to 19,000 feet. The tubing is lowered into the well from the surface and conveys fluids or hardware to the depth of interest.

Although coiled tubing has been used since the 1960s, lack of reliability and safety were major issues, and the requirement for special equipment made the service expensive. Now, Schlumberger engineers have made

Above, a rusty reason for drilling with coiled tubing. Corrosion has eaten away 75% of the thickness of this casing, after three years of service in an oil well in Prudhoe Bay, Alaska. Corrosion, which advances with age, can ruin a well. Using CTD* coiled tubing drilling to bypass damaged casing can extend the life of a well at about half the cost of replacing damaged casing.

Pristine thaw lakes on the tundra of the Alaskan North Slope (above and left) surround oil wells dwarfed by the mast of a Dowell coiled tubing unit. Coiled tubing is being used to convey sensors to evaluate the productivity of an ARCO oil well. At well 5-20, indicated by ARCO Senior Staff Engineer Lamar Gantt (right), oil production jumped 350% after drilling underbalanced with coiled tubing, which costs about half of conventional drilling. ARCO estimates that CTD services will save several hundred million dollars by sidetracking—drilling boreholes through the sides of existing wells—rather than repairing old wells or starting new ones from the surface. "When we said we were going to sidetrack with coiled tubing," Gantt said, "a lot of people thought we were crazy. Now that skepticism is gone."



How drilling with coiled tubing saves money. The steel lining in a well deteriorates with age and is costly to replace. An economical alternative is to use coiled tubing to drill a new well through the side of the damaged lining. Tubing is left in the well and is used to carry oil to the surface.

significant steps to bring coiled tubing into the mainstream. Advances in computer modeling and oilfield equipment are making coiled tubing a cost-effective means for drilling, logging, cementing and remedial treatment, especially in areas that are sensitive to cost and environmental concerns. These innovations strengthen Dowell's position as the largest supplier of coiled tubing services and expand the possibilities for this maturing technology.

A promising development is CTD coiled tubing drilling, a service in which alliances between Schlumberger and oil companies are helping to break new ground. An alliance between Dowell and ARCO Alaska, Inc., for example, is pioneering drilling with coiled tubing on the North Slope of Alaska. ARCO estimates CTD services will save about $1 million per well in a program to extend the life of up to 500 wells. The technique is being used to

Right, Dowell Service Supervisor Brad Okland, left, and Service Technician William Petty ready a 3½-inch coiled tubing reel for operation in Prudhoe Bay, Alaska. Capability to handle tubing of diameters up to 3½ inches expands the potential market for coiled tubing to nearly all wells.

Tubing condition on the job is measured by the TIM® Tubing Integrity Monitor.

Advances in Coiled Tubing

New measurements and computer modeling contribute to Schlumberger's competitive advantage in coiled tubing services. Dowell's TIM Tubing Integrity Monitor (above) measures the effect of wear and tear on each tubing unit and tracks fatigue history to indicate when tubing replacement is necessary. The monitor measures tubing diameter 400 times per second as the tubing goes in and out of the well.

The TIM screen keeps the engineer informed about tubing fatigue.

Swelling of the tubing from fatigue is indicated on a computer screen (above). This permits tracking of tubing condition, which increases the reliability and efficiency of coiled tubing operations.

As tubing buckles in the well, friction may increase enough to stop progress of the tubing.

Another computer program predicts how far coiled tubing can push hardware into a deviated or horizontal well before the tubing is stopped by friction (above). The program is used before drilling to design a well path that permits easy coiled tubing operations. It is also used in existing wells to select optimum well and tubing equipment.

Wireline logging with coiled tubing in Prudhoe Bay, Alaska. Left, ARCO Engineer Jennifer Julian compares notes with Paul Perius of Dowell, seated, and Gerry Bailey of Schlumberger Wireline. In wells highly deviated from vertical, coiled tubing allows pushing sensors down to the depth of interest.

lengthen existing boreholes and drill sidetracks—boreholes extending from the side of an existing well.

Drilling with coiled tubing has several advantages over conventional drilling. A large saving comes from doing away with the expense of a conventional drilling rig. Coiled tubing equipment is highly mobile and can be deployed quickly with half the crew of a conventional rig. Its operation has a smaller impact on the environment and provides greater safety for personnel. The two main advantages of CTD services, however, are through-tubing drilling and underbalanced drilling, which can contribute to the well's long-term productivity.

Schlumberger's push to evolve coiled tubing technology from novelty to mainstream began in the late 1980s. In 1991, a multidisciplinary team combined expertise from three companies: coiled tubing specialists from Dowell, drillers from Sedco Forex and directional drillers from Anadrill. Building on progress made by oil companies and tubing manufacturers, the team addressed the historic shortcomings of drilling with coiled tubing. Dowell, working with Anadrill, developed the first means for wireless steering of the drill bit and real-time identification of rock formations. These capabilities provide more precise positioning of a well and reduce the risk for a dry hole.

Other innovations by Dowell enhance not only drilling with coiled tubing but all coiled tubing operations. New technology can accommodate coiled tubing of diameter as large as 3½ inches, expanding the market for coiled tubing to include most wells. The potential for coiled tubing is also enhanced by improved monitoring of operations, which reduces mechanical failure of tubing and improves its effectiveness (see *Advances in Coiled Tubing*, left).

With a growing portion of the world's oil coming from aging wells, demand is increasing for innovative coiled tubing services. Schlumberger's integrated approach to coiled tubing technology—merging know-how from Dowell, Sedco Forex, Anadrill and Wireline & Testing—will assure its continued leadership in this expanding market.

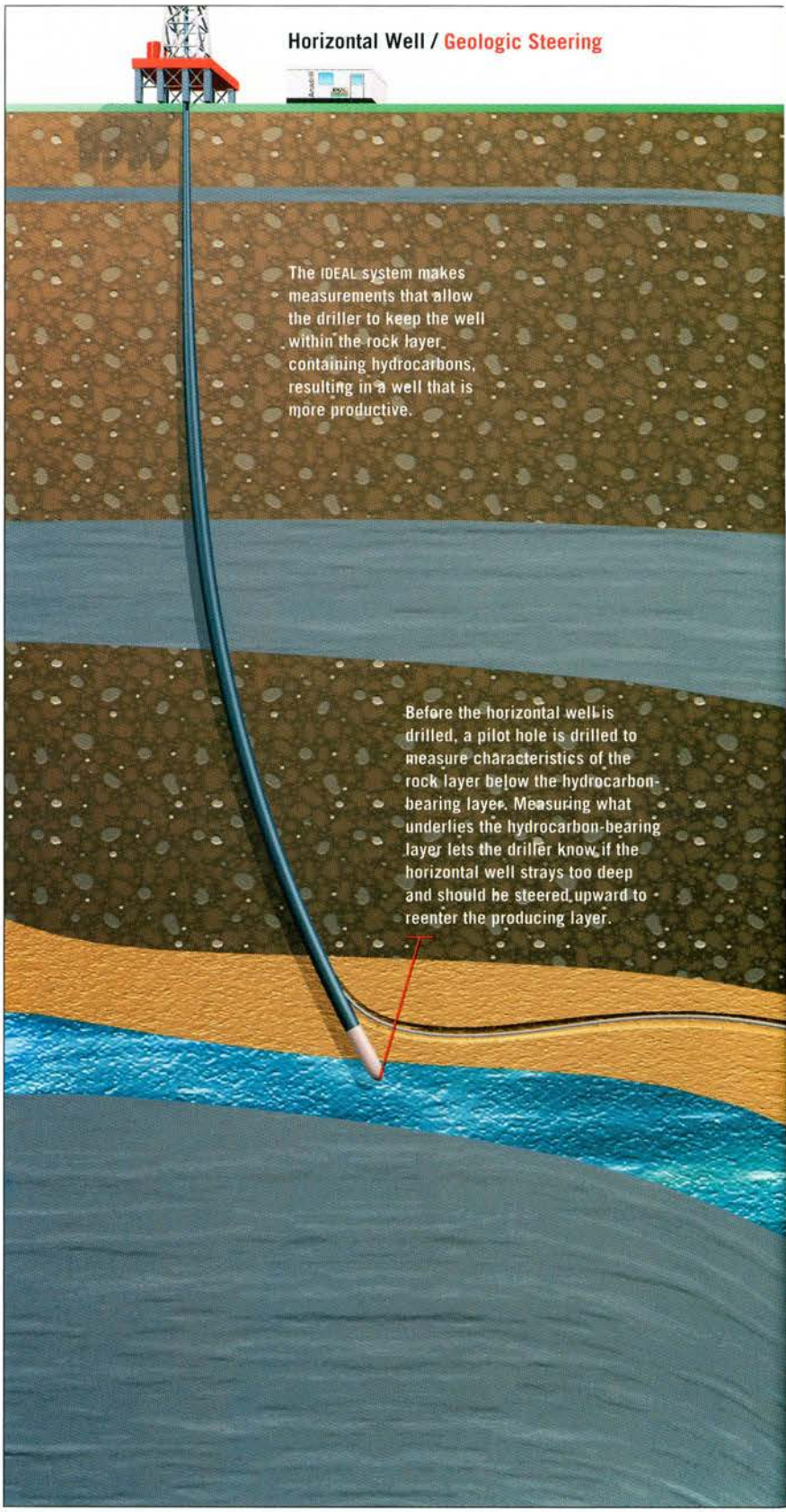
Opening the Horizontal Well Frontier with the IDEAL* System

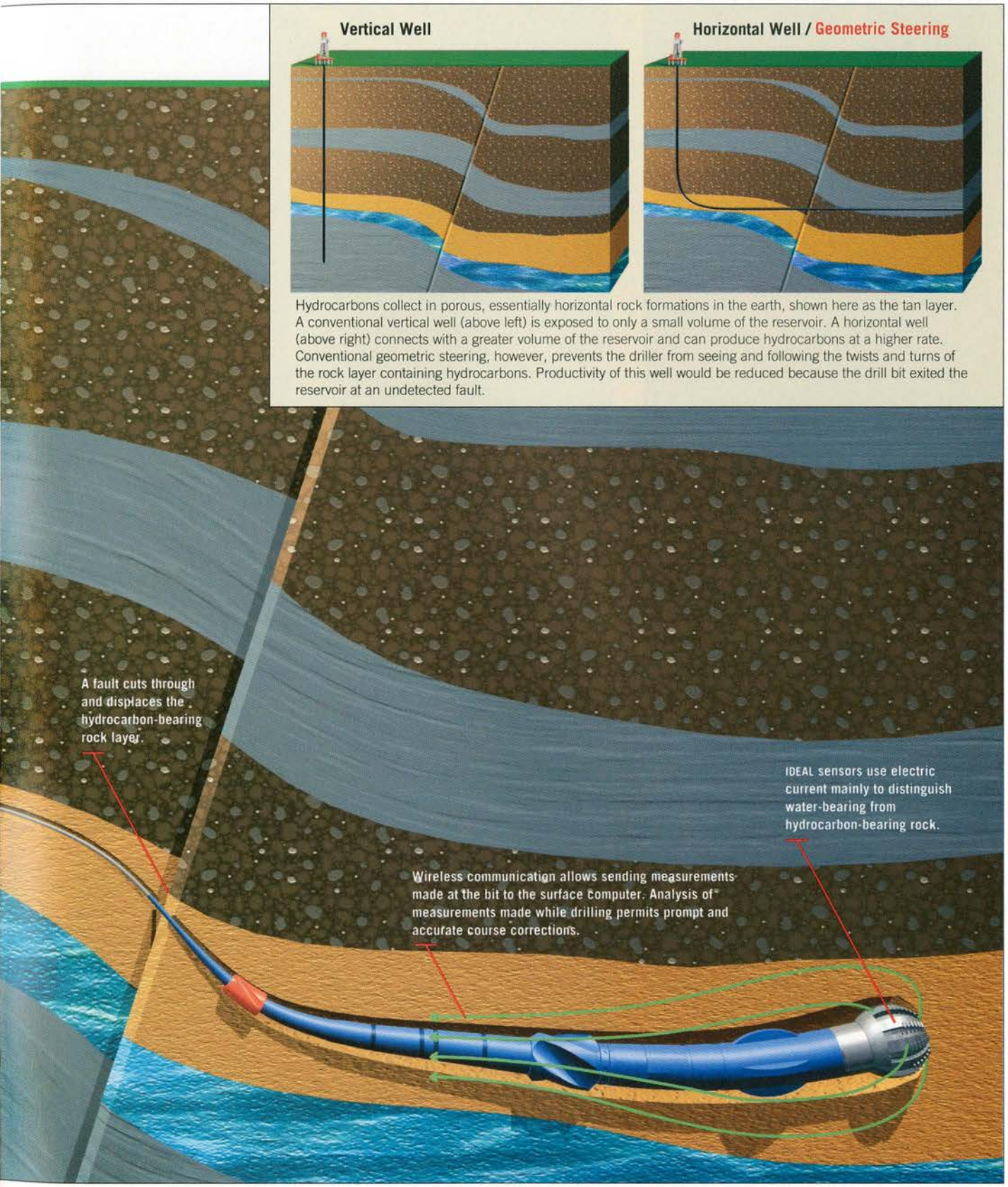
In the quest for more hydrocarbons at lower cost, oil companies are drilling more wells that start vertically and gradually bend until they reach horizontal. These wells take advantage of the horizontal pooling of hydrocarbons within the earth. By skewering a hydrocarbon deposit through its longest dimension, a horizontal well can produce more oil and gas faster than a vertical well in the same reservoir (far right). Given the high cost of making a well, a few horizontal wells can produce more hydrocarbons at lower cost than many vertical wells. Fewer wells also make a smaller impact on the environment and reduce long-term maintenance costs.

Not all reservoirs are candidates for horizontal drilling. But in those that are, the trick is putting the horizontal hole in the right place. A few tens of feet off track can mean the difference between success and failure. Conventionally, the path of the well is chosen after rock layers in the earth are studied, revealing the likely location of oil or gas. During drilling, sensors behind the drill bit tell whether the bit is following the planned path. If not, the driller can steer the bit back on track (right).

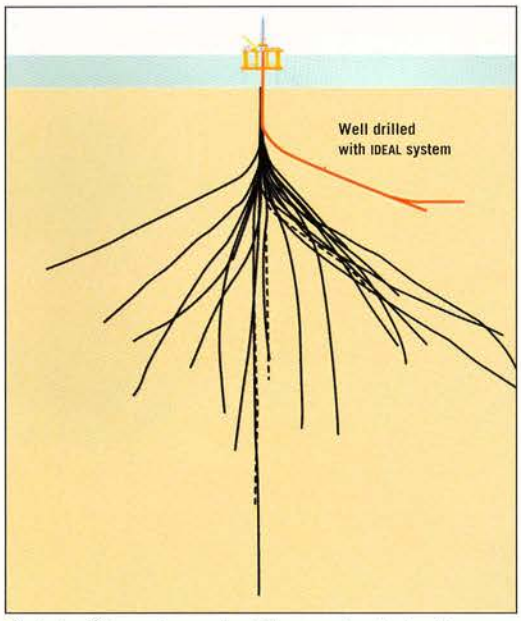
The traditional method has two limitations. The first is that sensors lie 50 to 100 feet behind the bit, creating a lag between where the bit is and where the measurement is made. Steering the bit this way is like flying an airplane from the tail instead of the cockpit. By the time the driller can detect that the bit is off course, time and money have been lost drilling a useless section of the well.

The second limitation is that basic sensors tell mainly whether the bit is on its predetermined course, not whether it has struck hydrocarbon. If the bit enters nonproductive rocks, how far it strays from the target rock formation is learned only after the well is drilled. At this point, only expensive, remedial solutions are available, such as redrilling to divert the well in a new direction or starting over by drilling another well.





Hydrocarbons collect in porous, essentially horizontal rock formations in the earth, shown here as the tan layer. A conventional vertical well (above left) is exposed to only a small volume of the reservoir. A horizontal well (above right) connects with a greater volume of the reservoir and can produce hydrocarbons at a higher rate. Conventional geometric steering, however, prevents the driller from seeing and following the twists and turns of the rock layer containing hydrocarbons. Productivity of this well would be reduced because the drill bit exited the reservoir at an undetected fault.

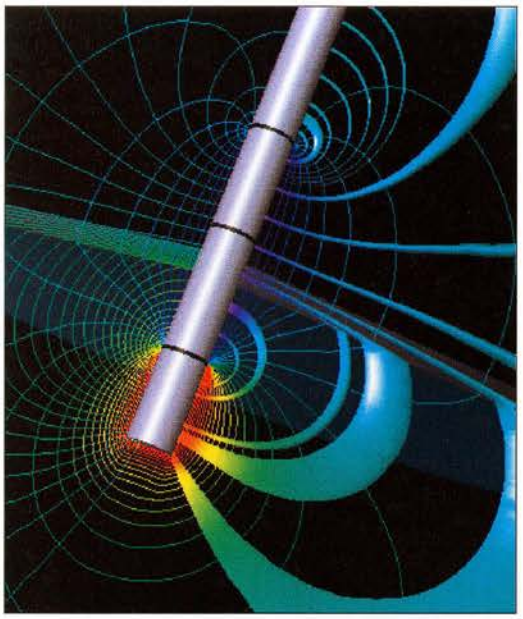


A single offshore rig usually drills many boreholes. From this offshore platform, 24 wells had been drilled. The single horizontal well drilled with the IDEAL system significantly increased the production of the platform.

Anadrill's new at-the-bit technology, the IDEAL Integrated Drilling Evaluation and Logging system, addresses both of these limitations—lag of measurements and incomplete evaluation of the subsurface while drilling. The IDEAL system allows thorough evaluation of rock layers while drilling, so that the well path can be revised as it progresses. This results in more accurate positioning of the well in the zone containing hydrocarbons and lower risk for a poor producer.

The IDEAL system consists of a new instrumented near-bit motor, communication equipment built into drill collars and new surface computers for recording and interpreting downhole data. Rather than locating sensors far behind the bit, IDEAL technology is the first to enlist the bit itself as a sensor, and places other sensors next to the bit. This location of sensors at and near the bit removes the problem of lag. The driller now "sees" where the drill bit is, rather than looking behind to where it has been. Computer screens deliver a wide range of interpreted information to Schlumberger engineers and customers, enhancing their ability to

Above, at Anadrill in Lafayette, Louisiana, Senior Electronic Technician Douglas Brown, foreground, and Surface Technician James Comeaux load an IDEAL wellsite information system for shipping to an oil rig. The cabin contains computers that monitor the downhole sensors, record their measurements and process data for interpretation. Right, IDEAL Field Test Coordinator Sudhendu Kashikar, seated at the wellsite information system console, confers with District Engineer Randy Dupree prior to setting up a job near Scott, Louisiana. Much processing and integration of data are automated, freeing the engineer to concentrate on interpretation of measurements. Far right, at the Lafayette shop, Tool Technician Reed Trahan cleans IDEAL equipment for routine examination of sensors after a job in a well.



A computer simulation used to study electric current emitted by the RAB* Resistivity-at-the-Bit tool, part of the IDEAL system. Resistivity measurements are the workhorse for identification of rock formations containing hydrocarbons.

make real-time decisions in the tense atmosphere of drilling.

New sensors also give more detailed information about the subsurface, enabling a fuller understanding of the likely location of hydrocarbons (above). With this information, where to steer the bit can be decided interactively, based on actual measurements of the earth, rather than on a model built from indirect measurements. As a result, risk is reduced when drilling in areas that are geologically complex or not well known.

The IDEAL system puts the driller's eyes at the drill bit, giving information that is unparalleled in promptness and detail. By making this information easy to digest and available quickly, the IDEAL system leaps ahead of previous technology, allowing customers to push the limit of where they drill for oil and gas.


Schlumberger

Building the Future of Meter Reading

Steve Holmes of Schlumberger, left, and Project Coordinator Neil Hicks of South Wales Electricity (SWALEC) with a remote reading electricity meter installed at a flat in Caerphilly, near Cardiff.

The future of household metering of water, gas and electricity is arriving, one home at a time, to the neighborhoods of Minneapolis, the suburbs of Cardiff, Wales, and the apartment houses in a growing number of cities large and small. Utility companies are investing in a new technology called remote meter reading, which provides communication between residential meters and the utility office. This direct link eliminates door-to-door meter reading and makes possible a range of new services. Schlumberger, the largest supplier of residential meters, is preparing technologies to lead remote meter reading into the next century.

Remote meter reading benefits both utilities and their customers. For the utility, the slow attrition of meter readers cuts expenses. Remote reading also removes the risk of a meter reader being denied access or locked out because no one is home. This can significantly delay billing. In the US, the Minneapolis Water Works serves 102,000 customers but has a 43% lock-out rate—meter readers can't reach the meters in 43 of 100 homes. Last year, the utility decided to install Schlumberger's remote reading system. The five-year project will improve customer service and save the utility an estimated $1 million annually.

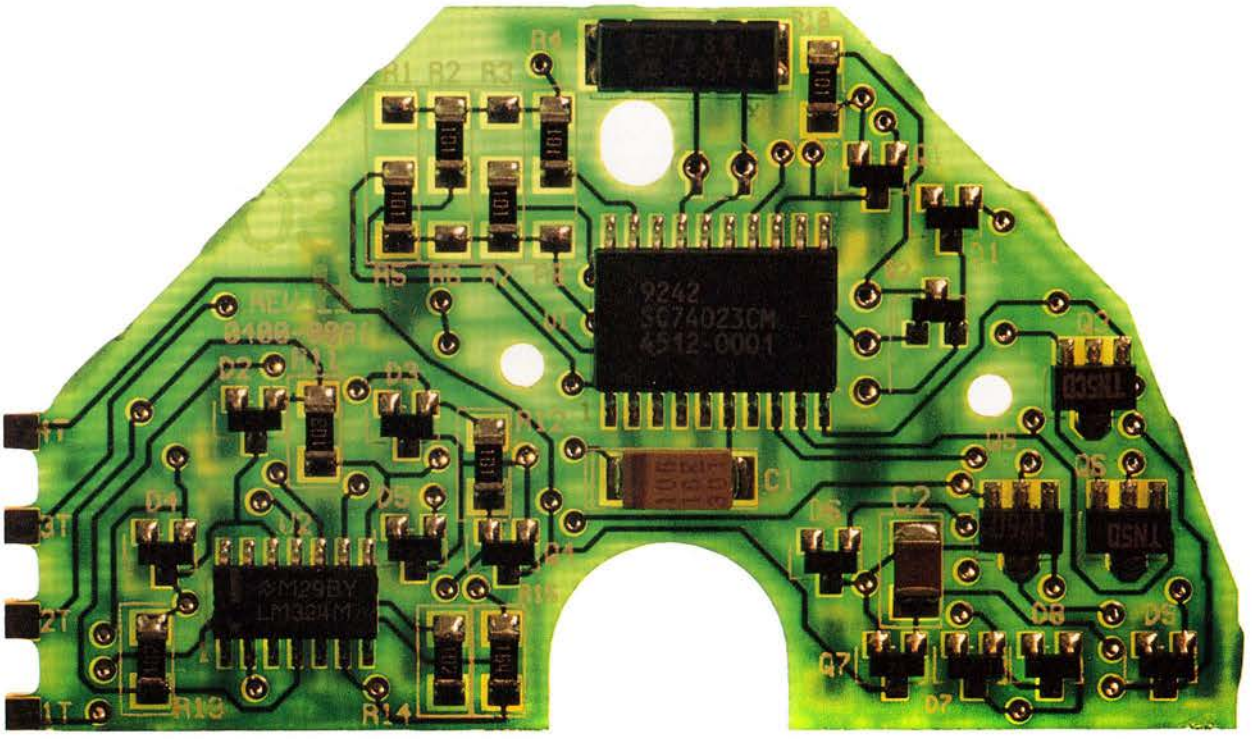
Utility customers like remote meter reading because it does away with estimated bills, which are unpopular. Many prefer the greater security of remote reading because they don't have to open the door to a stranger. Less obvious benefits include consumption monitoring and tariff setting (see *More than Meter Reading*, page 43).

How does remote reading work? In Minneapolis, the meter communicates with the utility office through the existing household phone line. The meter connects to the phone line through a microprocessor and modem. Once a month, the modem automatically phones the utility and sends in the meter reading. The call takes less than 20 seconds and is made late at night, when the phone is typically unused. Before dialing, the microprocessor checks the phone line to make certain it is not in use.

Far left, Operator Ellen Smith checks a circuit board that was manufactured on the assembly line behind her at the Schlumberger Oconee plant in West Union, South Carolina. The circuit board is the key link in a communication chain that permits remote reading of a meter. In 1993, the plant manufactured more than 350,000 boards for use by utilities worldwide.

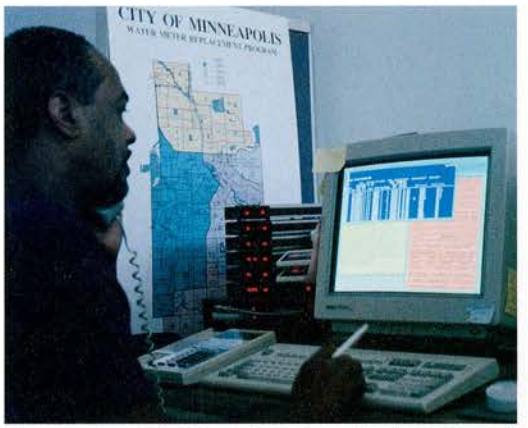
Remote reading of water, gas and electricity meters depends on electric circuitry called a meter interface unit (MIU)—a kind of modem that allows the utility to read the meter. Here, blank circuit boards await loading into the highly automated assembly line at the Schlumberger Oconee manufacturing facility.

Completed circuit boards as they emerge from assembly. Machines run by fewer than three people manufacture about 60 of these boards per hour.



Advanced circuitry, shown about twice life-size, that allows remote reading of water meters using radio signals. This circuit board is mounted inside a water meter, saving about 25% over conventional circuitry, which is separate from the meter.

Final testing of meter interface units. Before being shipped to customers, each unit is checked for proper function.



The present and the future of remote, automatic meter reading. Left, Bill Williams, a data entry clerk at the Minneapolis Water Works, reviews customer account information on remotely read water meters. To the left of the computer screen are modems that connect with the meters. Right, engineers at the Schlumberger-Motorola joint venture, based in Atlanta, Georgia, work on the next generation of wireless, remote communication for water, gas and electricity management. From left, Craig Watson, Watt Jirasevijinda and Jim Barlow are part of the team developing a residential water meter that changes analog dial readings into digital data.

There are other ways for utility companies to "talk" remotely with their meters. Electricity meters can be read over the same wires that carry electricity into the home. Gas and water meters can be read through telephone connections, radio communications or a combination.

For suppliers and utilities, the challenge of the future lies in a mix of wireless and wire-based communication. Remote meter reading equipment is always more expensive than traditional equipment, so the utility seeks a configuration that minimizes installation and operating costs. The system must also accommodate evolution of needs and technology.

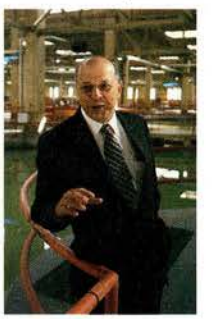
To assess different communication methods, SWALEC, a Regional Electricity Company in the UK, is running a test near Cardiff, Wales. One thousand households have been equipped with Schlumberger electricity meters, which have built-in radio transmitters, receivers and central computer control. Radio signals carry readings from the household meters to central receiving stations. From there, metered data travels to the utility by telephone. The next step calls for extending coverage to rural areas.

In remote metering of the future, radio signals will play an increasing role. Recognizing this trend, Schlumberger recently joined with the leader in wireless communication, Motorola, Inc. The joint venture is developing the next generation of low-cost, robust radio systems, including new semiconductors and a range of products adaptable to the needs of the international remote metering market.

The vision for the utility is a direct connection to millions of cash registers. Developing cost-effective technology will help Schlumberger and Motorola meet the needs of this evolving market. Together, they are designing communications technologies that will set the standard for the next generation of remote metering.

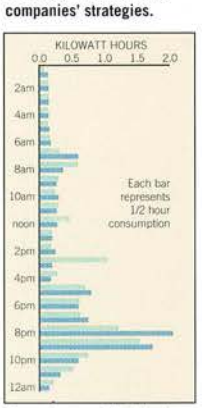
More than Meter Reading

Communication between a household meter and the utility brings more than prompt and accurate billing. Minneapolis Water Works has experimented with remote reading to monitor leaks. Leak monitoring involves taking readings periodically through the night, when there is typically no water usage. In one study, excess water usage was traced to a cracked faucet and a toilet with a leaky valve. Such opportunities for improved client service are plentiful.

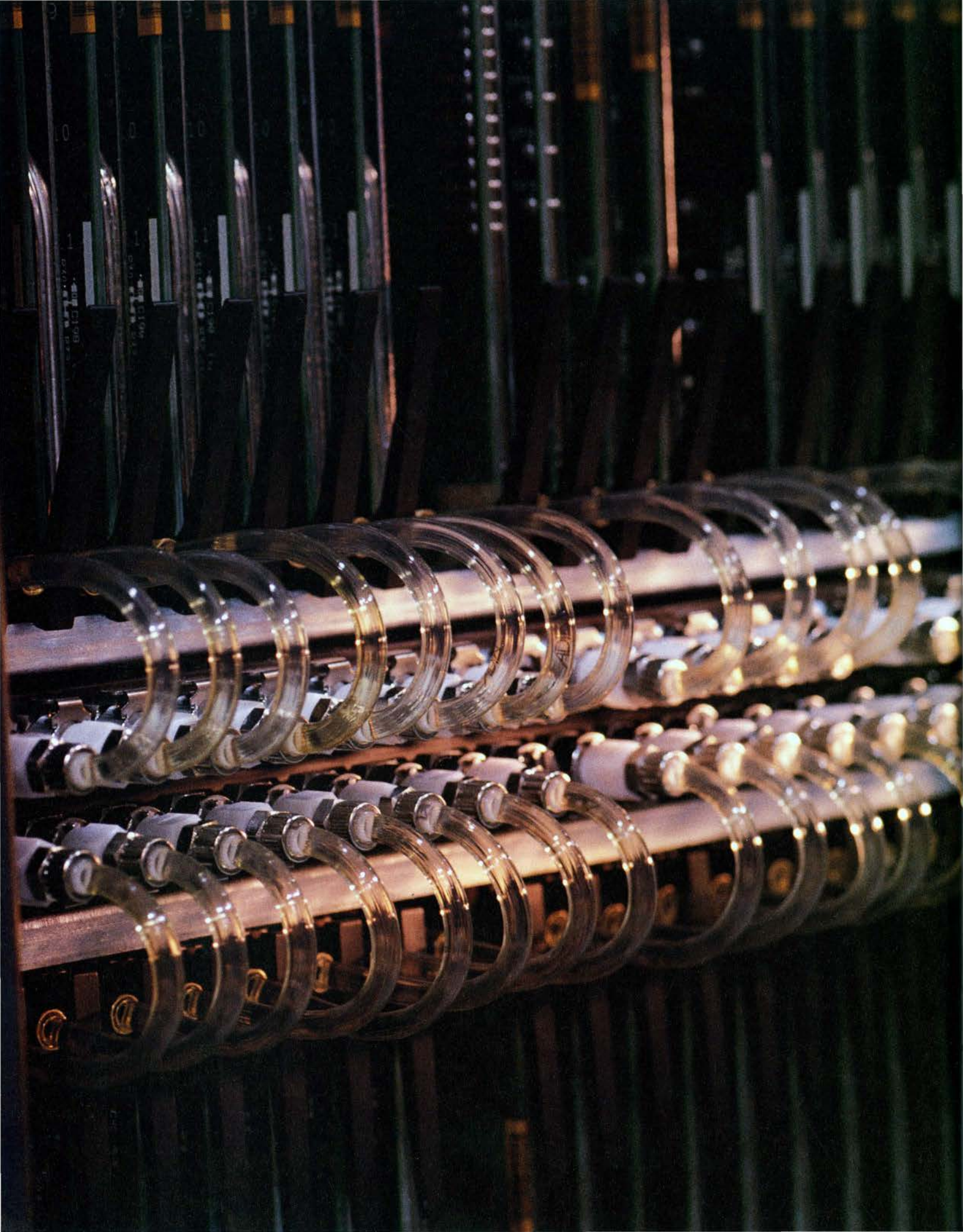


Charlie Roberts, coordinator of Minneapolis Water Works' meter replacement program, at the utility's water treatment plant. The utility draws all its water from the Mississippi River.

SWALEC can monitor hour-by-hour electricity consumption in individual households (below). This leads to improved load management and allows rapid diagnosis of transmission problems during power outages. Further, electrical utilities expect remote metering communication to facilitate tariff adjustment and even the disconnect of supply. Household management, such as gas leak detection and monitoring of electrical usage, also rates high on many utility companies' strategies.



Domestic usage of electricity in South Wales shows typical peaks in the morning and evening.



Reinventing Semiconductor Technology

Tom Fleischman, left, and Gary Moore, center, of IBM's Test Solutions Center set up a semiconductor test on the ITS 9000FX® tester at the company's facility in Fishkill, New York. Schlumberger Applications Engineer Louis Medina, right, provides on-site training and supervision.

The pulse of modern life at the threshold of the 21st century is increasingly controlled by the semiconductor. Communications satellites, laptop computers and surgical equipment all rely on the semiconductor—a silicon wafer smaller than a postage stamp, jammed with up to 100 million transistors.

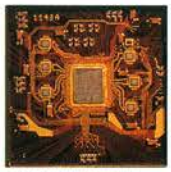
These tiny integrated circuits, or chips, must be reliable—failure can put both money and lives at risk. Therefore, before a chip is built into a costly product, it is tested to ensure reliability. This is done with Automatic Test Equipment (ATE), a package of computer hardware and software that simulates functions the chip will have to perform in the real world.

The demand placed on test technology is mounting. As integrated circuits grow more sophisticated, they perform more tasks at higher speeds—a single chip can now perform a function every billionth of a second. At the same time, competition between manufacturers is increasing dramatically. Chip makers face growing pressure to increase quality and volume, lower cost and shorten time-to-market. To meet this challenge, Schlumberger draws on 20 years of experience in building advanced ATE systems that increase productivity and reduce costs for semiconductor makers.

The demands of testing today's high-performance chips cannot be satisfied with test technology of the 1980s. As chips become more advanced, older test equipment becomes less efficient. Testing costs rise, testing accuracy becomes uncertain and productivity falls.

Schlumberger worked closely with its customers to rethink the testing of high-performance chips. Because these chips approach the limits of conventional testers, Schlumberger engineers introduced a fresh approach to the design of testing equipment. The resulting technology—the new ITS 9000—has made Schlumberger the leader in testing the most advanced integrated circuits.

Left, liquid-cooled circuit boards of the ITS 9000FX tester. Cooling with liquid instead of air produces a measurement with greater stability and reliability.



The ITS 9000FX tester is controlled by a Schlumberger-designed chip.

Anatomy of a Tester

The soul of the ITS 9000FX tester is both physical and conceptual. The physical soul is a Schlumberger-designed super-chip, half the size of a credit card, that controls billions of electrical instructions per second. The conceptual soul is the software used by test engineers to operate the machine. Merger of the physical and conceptual worlds is present in all testers. What sets apart the ITS 9000 machine is how this merger was achieved.

Chip mounted in the center of the test head, ready for testing.

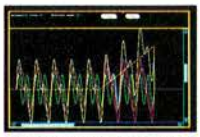
During development, the customary boundaries between software and hardware teams were dissolved. Engineers worked side by side from the beginning, rather than the software team taking over when hardware was finished. This integration makes the machine easier to build and operate.

High-speed electrical cables link the test head with the main computing engine.

The machine also departs from others physically. Inside, a network of tubes carries an inert liquid used for cooling. Reliability and measurement accuracy—50% better than other machines in its class—owe much to the ability of the cooling system to keep electronics below 185°F.

What do Testers Test?

An integrated circuit, also called a semiconductor or chip, is a set of electrical components built into a wafer of silicon as large as a postage stamp, or as small as the letter "o" on this page. During design and manufacture of chips, testing is done to check that chips work properly.



Waveforms on the ASAP tool that represent an electrical pulse going to or coming from a chip under test.*

Testing involves injecting pulses of electricity into the chip and measuring pulses that come out. Key variables are the timing of the pulses and the shape of the waves they form. If the outgoing pulse forms a wave of the correct shape and timing, that part of the chip works properly (above). If the wave shape or timing are wrong, the chip fails.

Window for test programming and debugging.

Design of a test involves selecting the sequence and timing of pulses going into the chip (above). The Sequencer Per Pin architecture gives a vast choice in the sequence and timing of pulses, providing flexibility in test design unmatched by competitors (below).

User friendly test-specific icons.

Furthermore, the intervals of time are infinitesimally small. A competitive advantage of the ITS family is its timing precision. It can measure an electrical pulse to within 175 trillionths of a second—the time light takes to travel two inches.

Consultation, concentration and discovery—Production Engineer Pierre Durnerin verifies functions of the ITS 9000FX tester. Durnerin and Test Specialist Neal Mao, standing, guide a client through a customer acceptance test at the Schlumberger manufacturing facility in Simi Valley, California.

The Sequencer Per Pin* architecture, based on a proprietary chip, significantly reduces test time and chance of error. With faster, more complex chips coming along every 18 months, the flexibility of Sequencer Per Pin architecture allows the ITS 9000 product family to accommodate the customer's evolving needs.

The top-of-the-line ITS 9000FX tester is proving valuable to customers like the Test Solutions Center of the International Business Machines Corporation in Fishkill, New York. The Center has a long history of semiconductor testing for internal IBM† needs and has recently begun testing for non-IBM customers. To provide these customers with the best service, the Center purchased an ITS 9000FX system for its test speed and program development capabilities. The Center now tests two to ten times faster and does program development with a 50% savings. "The key is greater efficiency," says Roman Hrycun, manager of the Test Solutions Center. "What used to take days can now be done in minutes."

Test design is also shortened and simplified by the ASAP Advanced Symbolic ATE Programming software and associated graphics. Graphic icons replace lines of computer code, providing a clear road map that guides users through the tester's functions (see *What do Testers Test?*, left). "It's so simple, you can literally walk someone through a test program over the phone," says Tom Fleischman, advisory engineer at the IBM Test Solutions Center. With previous machines, he says, an experienced test engineer can take more than a week at the keyboard to come up to speed.

The ITS 9000 system evolved simultaneously with a refocusing of priorities at Schlumberger's ATE division. A program of total quality culture—concurrent software and hardware engineering and cross-training of employees—contributed to a doubling of revenue per employee from 1990 to 1993 and, for the past three years, 100% on-time delivery. Customer satisfaction became the driving force. Today, monthly goals are developed to meet the evolving needs of customers. "We post those goals on the wall and we all read them every day," says Bill Chiang, vice president of operations. "That way, all employees focus on the same key areas and by the end of the first week, we're already working on the solutions."

With the rate of chip evolution accelerating, and the demand for chips escalating, Schlumberger's ITS 9000 family of testers is engineered with the future in mind—to meet the testing demands of chips developed well into the 1990s.

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Anadrill
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Automatic Test Equipment
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Front and back covers:
In dry dock in Rotterdam, The Netherlands, the semi-submersible drilling rig *Sedco 701* undergoing renewal that will add 20 years to its life. The rig is also being refitted for tender-assisted drilling, a strategy that allows oil companies to build significantly less expensive offshore platforms. See *Renewing Sedco Forex's Semisubmersible Fleet*, page 29.

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