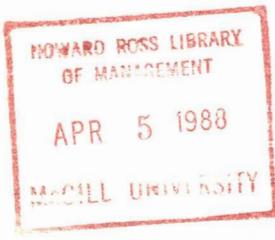


Established 1962

# Corporate Profile





# INTRODUCTION

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D.A. Richardson; S.P. Shouldice.

When Nowsco was formed in 1962, there were two employees, one oilfield liquid nitrogen trailer and a rented truck.

Today, there are more than 1,000 employees and over 45 operating bases world-wide.

More than a quarter century ago, we believed we had the two strengths fundamental to the building of a reputable oilfield service company. The first was that in introducing nitrogen to oilfield applications, we were at the leading edge of technology. The second was people. We recruited only those who combined high technical qualifications with personal determination and dedication.

Today we still hold to those fundamentals.

Over the years, we have developed our expertise in response to the demands of a growing industry through research and development, through the manufacture of highly specialized equipment and products, through sophisticated training programs, and through the establishment of operating bases around the world.

Our commitment to technological development has earned us a reputation for innovation and we take great pride in our Training, Fabrication and Research & Development Centres.

But even more, we are proud of our people. They are our principal asset, the major reason for our accomplishments. Nowsco's success and the respect the company has earned is based on their professionalism, pride and dedication.

We are determined to remain successful, innovative and the most respected company in our field. We will accomplish this through continued technological development and through the quality of our people.

S.P. Shouldice,  
Chairman of the Board and  
Chief Executive Officer

D.A. Richardson,  
President and  
Chief Operating Officer

# HISTORY

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**Nowesco** was formed to introduce a new technology — the application of liquid nitrogen stimulation techniques — to the oil and gas industry in Western Canada.

The first wellsite treatment by the Nitrogen Oil Well Service Company was completed in Canada on October 17, 1962. Within two years, industry acceptance of this new technique was growing and Nowesco boasted four liquid nitrogen pumping units and a staff of eight.

Through the early 1970's, Nowesco expanded its services to include acidizing, cementing, and fracturing and had made a significant financial commitment to introduce coiled tubing to the Canadian oil and gas industry.

By its tenth anniversary, Nowesco had become a Canadian public company, with shares trading on the Toronto Stock Exchange. With its Canadian activities well-established, Nowesco looked to the international oil industry and in 1973 established its first international base in England to service Britain's developing North Sea and industrial markets. This was followed by steps into Europe — Germany, Norway, Holland, France and Italy.

To keep pace with the complexity of the international oil industry and the rapid changes in its economic and technical demands, Nowesco established "in-house" laboratory facilities.

International demand was growing not only for Nowesco's services, but for its technology. The mid-70's saw the first international sale of Nowesco designed and built equipment. A large facility was constructed to house research and training programs and the fabrication of field and laboratory equipment. This was followed by a chemical blending plant to provide highly specialized chemical blends for use in the petroleum and other industrial sectors.

During the 1980's, the company expanded into the United States, Asia, Africa and the Far East. At the conclusion of its first quarter century Nowesco had earned an international reputation for technical expertise, operating efficiency, and dedication to the individual needs of its customers.



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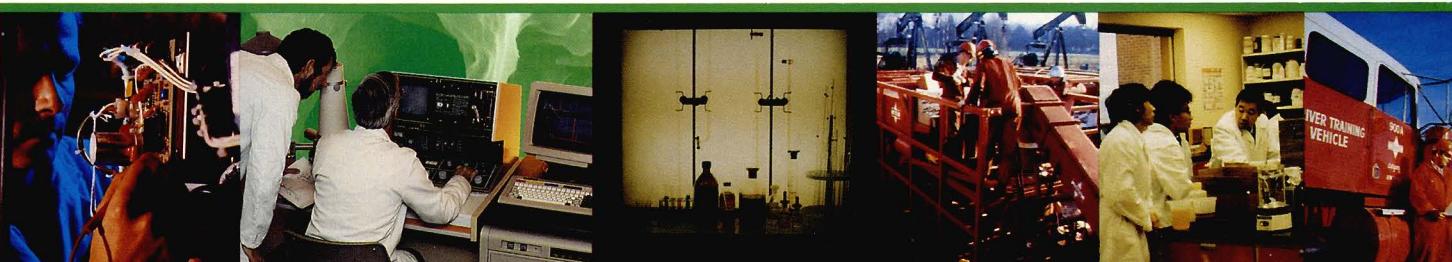
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# OPERATIONS



## Cementing

Cementing is a very critical phase in well operations. A mixture of cement, water and chemicals — specifically engineered to each well — is used to secure the steel pipe or “casing” inside the well bore, to isolate the producing formation from other sections, to provide permanent protection of the casing and to support the bore hole through the producing formation. Oil and gas wells generally require two or more cementing operations during the drilling phase and producing wells may require remedial cementing at later stages in their operating life.

The precise blend of cement required varies greatly from well to well depending on depth and operating conditions. For example, wells producing heavy oil from shallow formations often must be treated by super-heated steam or combustion to enable crude oil to flow, and in these cases the cement blends must be able to withstand extremely high temperatures. In contrast, the cement blends used in the high Arctic must be capable of withstanding the sub-zero conditions of the permafrost zone.

In all cases, NowSCO's experience and extensive laboratory testing allows us to tailor the cement blends so that the properties meet the most difficult requirements.

NowSCO engineers and researchers work in close association with cement manufacturing companies throughout the world to provide the industry with consistently high quality products and with new technical information. These programs have led to such advancements as the development of foamed cement.

NowSCO has also developed and now manufactures unique portable cement-testing equipment which has gained recognition throughout the industry.

Major product studies are constantly undertaken to provide information on particularly difficult cementing requirements, such as saturated slurries for salt lenses, ultra-light slurries for lost circulation problems, self-pressurizing cement for gas channelling and high-strength cement for whipstock plugs.

The company operates a fleet of mobile equipment which is capable of blending cement slurries at the well site. We also blend and deliver bulk dry cement mix to particular job sites.



Cement job in progress.

# OPERATIONS



## Stimulation

Few oil and gas formations will produce efficiently without some form of stimulation during the well's completion or operating life. Rising exploration costs and the lower quality of discovered reservoirs means effective stimulation has become essential to commercial oilfields. Well stimulation encompasses a wide range of treatments and techniques, many of them pioneered and perfected by NowSCO. We provide all forms of stimulation — including acidizing, fracturing, nitrogen and carbon dioxide applications.

## Acidizing

NowSCO is continually developing more efficient and cost-effective treatments to improve well productivity.

Acidizing involves introducing special blends of chemicals and acid to oil or gas producing formations to clean out unwanted materials or dissolve portions of the producing zone. The specific acid blend varies with different types of wells and formations and the purposes for which acidizing is employed.

We conduct extensive testing of chemical products and acids to identify combinations that will yield maximum productivity with minimum detriment to the formation and production facilities.

## Hydraulic Fracturing

To hydraulically fracture, a treating fluid is forced into the producing formation under high pressure to crack it open. The treating fluid is made up of a combination of gelling agents or other chemicals added to oil, water, nitrogen or



*Nitrified acid stimulation.*

carbon dioxide. Once the formation has been opened, material referred to as "proppant", usually sand, is introduced to maintain the fracture, thereby increasing the productivity of the well.

NowSCO's FRAC SURE group has become widely recognized in the use of computer simulation for fracturing. The computer program uses models of the reservoir and the proposed fracture to provide our customers with a realistic prediction of the well's potential hydrocarbon productivity.

## Nitrogen

NowSCO is a recognized leader in the use of nitrogen in cementing, acidizing, fracturing, coiled tubing applications and speciality services. Because it is inert and therefore will not contaminate the reservoir, nitrogen can be used to safely displace fluids, atomize fluids, generate stable foams and reduce fluid densities.

# OPERATIONS



## Carbon Dioxide

The properties of carbon dioxide make it a useful agent for treatment to improve well productivity. Combined with water, carbon dioxide forms a "dense acid foam" which is particularly effective in stimulating deep wells. Carbon dioxide is compatible with Nowesco's well treatment fluids for use in a variety of stimulation programs.

## Coiled Tubing

Nowesco pioneered the use of coiled tubing in the oil and gas industry and continues to be the leader in its development.

Coiled tubing is continuous, jointless lengths of high-pressure-rated steel tubing ranging from  $\frac{3}{4}$  to  $1\frac{3}{4}$  inches (19 to 45 mm) in diameter and up to 20,000 feet (6,000 metres) in length. This tubing is fed into a well to create either a temporary or permanent circulating system which can be used to introduce nitrogen, acids, cement or other products or to remove spent acid, proppant or other debris from a wellbore. A variety of down-hole problems can be remedied in this way. Coiled tubing is also used with specialized equipment to drill out hardfill or cement and to deepen a well in a controlled pressure environment.

Through its own research and in co-operation with others, Nowesco has developed a variety of specialized tools which utilize coiled tubing to solve well problems. Previously, many of these problems would have required removal of the production string.

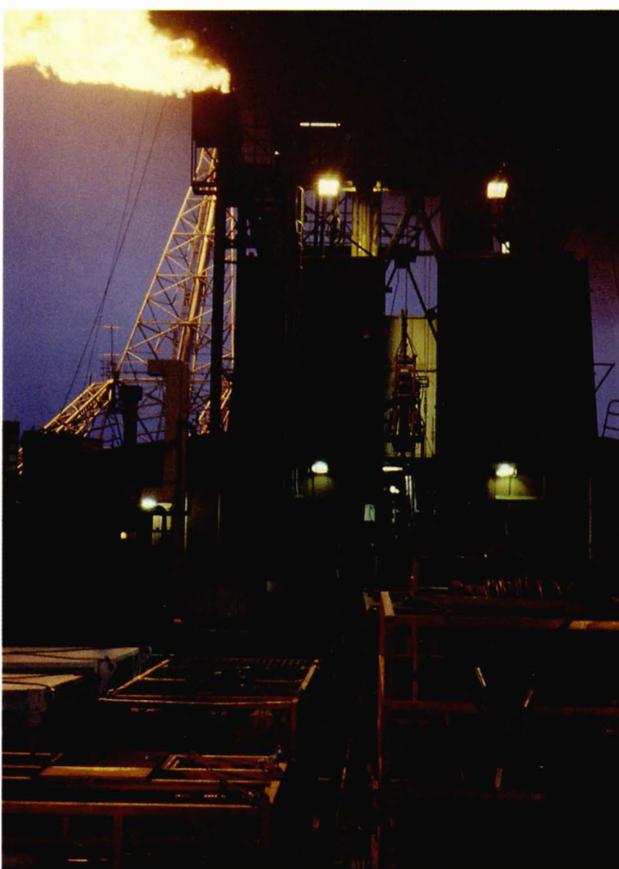
A selective placement tool, the inflatable Straddle Packer, has been designed as a retrievable, multi-setting packer to isolate for treatment, specific intervals down-

hole. Nowesco's straddle packers can be set and reset many times so that several zones can be treated in one operation.

Working with drill motor and drill bit manufacturers, Nowesco has developed comprehensive processes for scale drilling, cement drilling, and the milling of packers and plugs through coiled tubing. This has proven to be a cost-effective method of keeping a well on production by eliminating a major work-over.

Similarly, Nowesco's Down-hole Camera Probe permits close inspection surveys to depths of more than 10,000 feet (3,000 metres). Details of any defects in the well's condition can be seen in "real time" and recorded onto video.

The use of coiled tubing as a conveyor for wireline eliminates many of the problems of logging deviated wells and results in improved accuracy and substantial rig-time savings.



△ View from operator's control cabin (top).  
△ Land based coiled tubing operation (bottom).

Offshore coiled tubing rig-up.

# INDUSTRIAL



Nowscos Industrial Section has developed as a natural extension of the company's pursuit of technical advancement and innovation. This section applies technology developed in the oil industry to uses in such other industries as steel works, refineries, chemical plants, pipelines, nuclear installations, mines, ships, aircraft, natural gas plants, and sewage works.

### **Leak Detection**

The reliable and cost-efficient detection of the most minute leaks is critical to many industries for safety, environmental and economic reasons. Nowscos leak detection systems use a test gas of 1% helium mixed with nitrogen or air. Since helium is extremely rare in the atmosphere and has a small atomic structure, it is an ideal tracer gas. Mass spectrometers can be selectively tuned to identify helium in any gas sample and can detect and measure leaks as small as 1 standard cubic foot in 10 years.

### **Commission Leak Testing (CLT)**

Nowscos CLT Service, a combination of a nitrogen purge and a helium leak test, has been used widely in the commissioning of process plants on gas and oil platforms throughout the world, particularly in the North Sea.

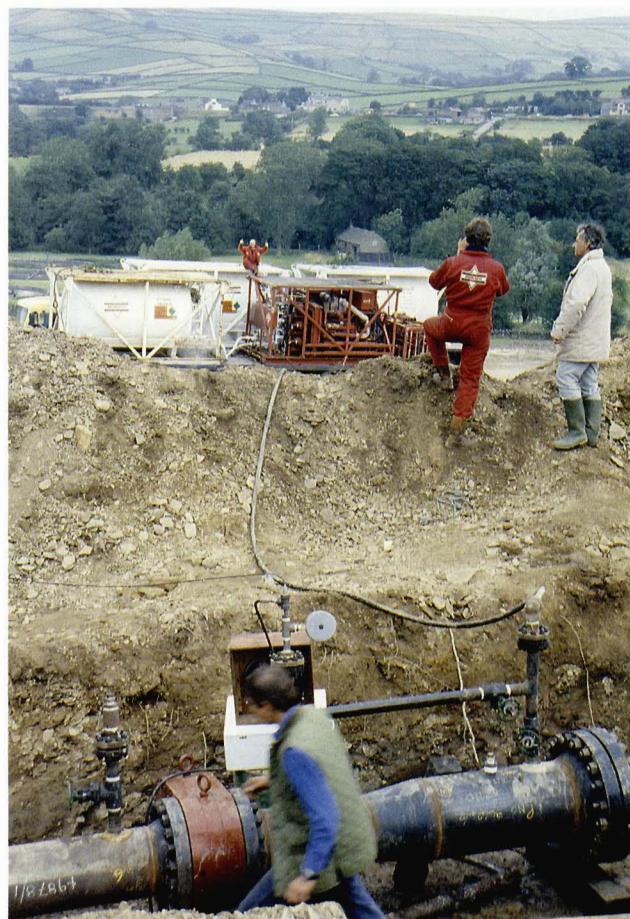
The system is first purged with nitrogen, the test gas is introduced, and the pressure is progressively increased to the working level. Careful checks of pressure-drops over time detect any large leaks that may develop. All joints, instruments, and valves are probed for smaller leaks using a special "sniffer"

which draws the air around the joints into a mass spectrometer.

### **String Leak Testing (SLT)**

Nowscos SLT is an advanced oil and gas field technique for testing connections in production strings. Each tubing joint is sealed off directly after make-up and tested with a 1% helium/air mix. Because the system is incorporated onto the drill floor, the operator has complete control and is immediately informed of any leak and its flow rate. Typically, a joint can be tested in 90 seconds.

To complement the SLT, Nowscos has developed Molywell LTM, an improved product that combines high strength dry film lubricants with a low viscosity Liquid Torque Modifier. Molywell replaces traditional pipe dope systems which temporarily block leaks, then deteriorate under downhole conditions.



Launching of pipeline pig.

△ Industrial nitrogen applications at a major petrochemical installation.



## Critical Valve Testing (CVT)

Nowesco's CVT program helps operators avoid expensive maintenance of failed valves. The integrity of overall valve construction is tested prior to installation by simulation of conditions the valve may be expected to experience in operation. Critical valve testing and maintenance can be carried out at any Nowesco base and transportable equipment packages allow testing on-site.



Probing for leaks on valve flanges.

## Nitrogen Foam Inerting

Nowesco's patented Foam Inerting System allows flame cutting or welding to be carried out on vessels and pipelines containing flammable liquids or vapours. Nowesco employs nitrogen, an inert gas, to displace dangerous and harmful gases or vapours from industrial vessels. Major industries have accepted Nowesco's program as the safest, and in most cases the fastest method of rendering vessels and pipelines safe. Nitrogen foam, resembling a detergent foam, is pumped

into the vessel. When a section of foam breaks down, either due to the application of heat or pressure, nitrogen flows out of the cut under the pressure of the bulk foam, maintaining the inert condition.

Nowesco has also developed specialized automatic equipment and systems which use nitrogen gas to control and extinguish industrial fires. These have been used in such emergency situations as colliery and ship fires.

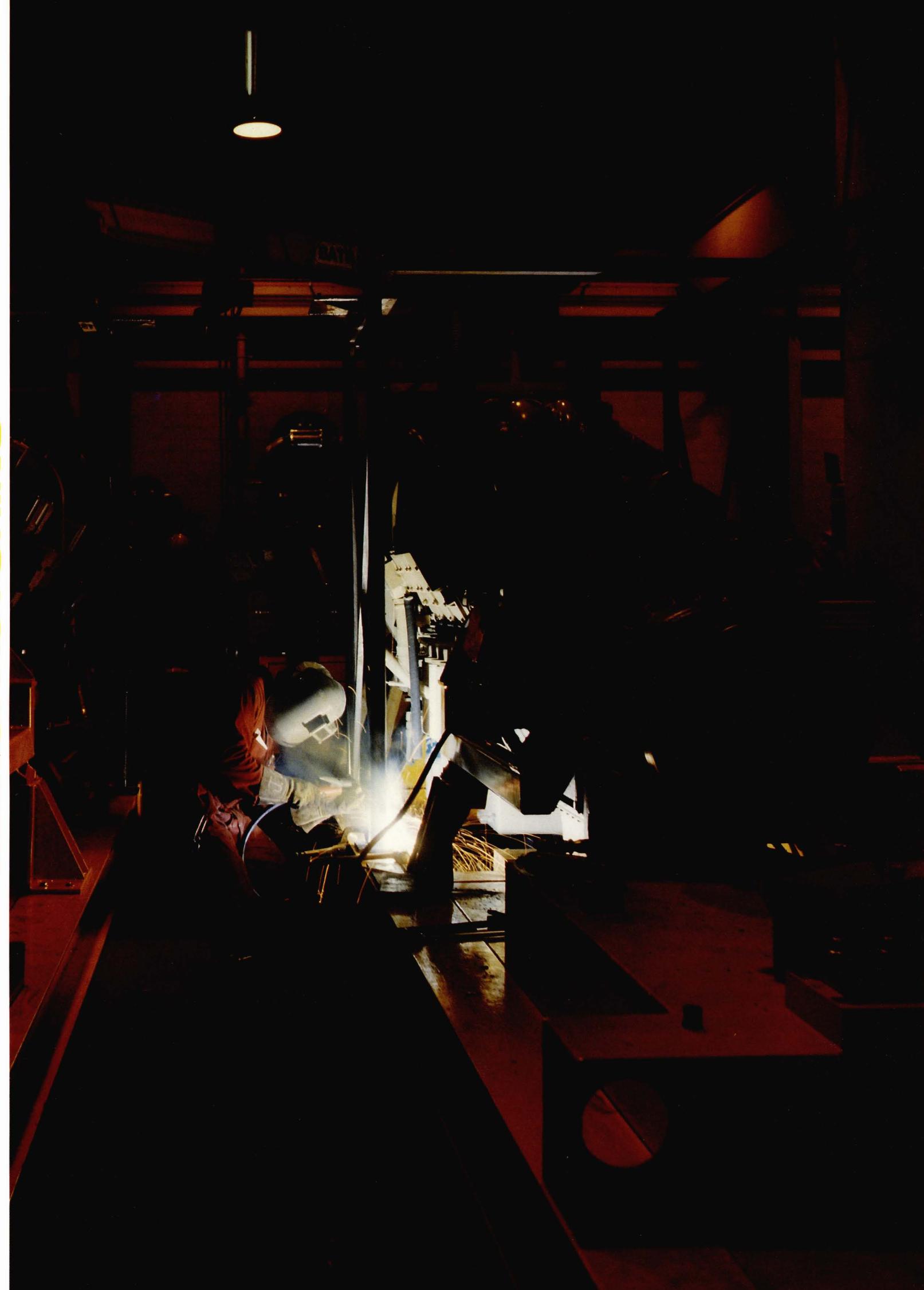
## Other Uses

Other industrial uses of nitrogen in which Nowesco has expertise include purging, pigging, displacing, pressure testing, drying, and mothballing or regenerating equipment.



Nitrogen Foam Inerting "Hot Cut".

# MANUFACTURING



# MANUFACTURING

## Equipment

Nowesco designs, fabricates and modifies much of the specialized equipment used in its own activities. All field equipment is brought in for repair or replacement on a regular schedule as part of a program to continuously upgrade equipment.

Nowesco also manufactures and exports custom cementing, acidizing and fracturing equipment for sale to customers in many regions of the world. Nowesco oilfield equipment includes mobile units specifically intended for different uses and terrain, skid-mounted units for transport by air and sea to remote locations, and fixed equipment specifically designed for use offshore.

Nowesco has fabricated substantial amounts of offshore stimulation equipment and heavy onshore equipment for international customers in Europe, Asia and South America. In many cases, Nowesco complements its international sales with the transfer of engineering, chemical and operating expertise to the purchaser.



Portable Consistometer (P.C. 10).

◀ Equipment fabrication.



Maintenance inspection of triplex crankshaft.

In Europe, Nowesco manufactures coiled tubing to meet its own needs and for sale to other users. Working closely with the steel industry, Nowesco has developed a heavy-walled flexible tubing for use in deep wells and H<sub>2</sub>S resistant tubing for sour gas completions.

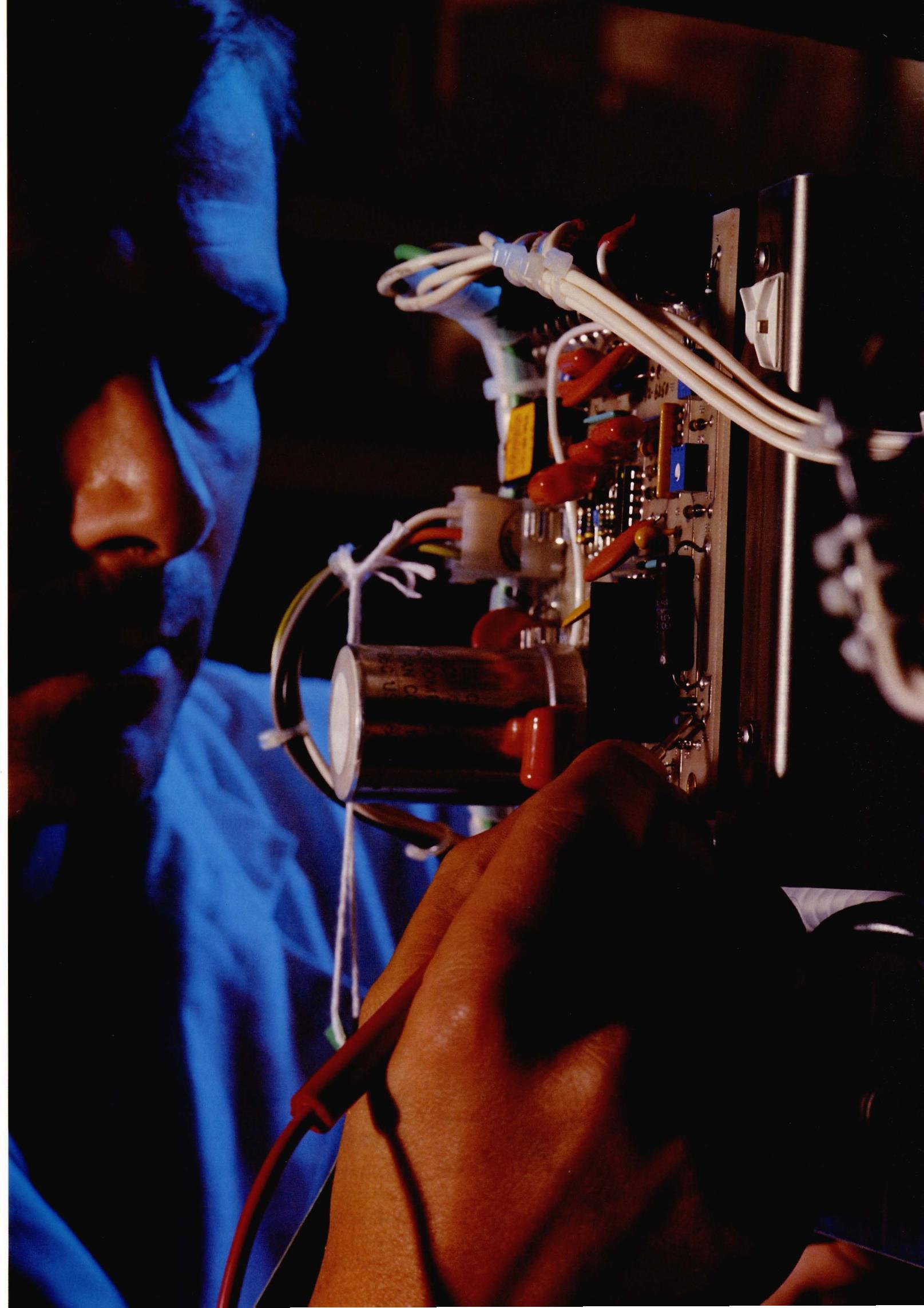
## Laboratory

Nowesco's in-house needs for large-scale and highly specialized laboratory equipment have dictated that the company design and fabricate much of its own testing equipment. Not only has this provided Nowesco with unique equipment for its own use, it has led to the development of a line of smaller, portable equipment for customers. The company's portable cement testing equipment has proven particularly successful and the portable consistometer is now being manufactured on a production basis.

## Chemicals

Similarly, Nowesco's need for specialized chemicals has led the company into the design and blending of chemicals both for its own use and for the individual needs of industrial customers.

# TECHNOLOGY



## Research

In all aspects of its business, NowSCO is committed to achieving technical leadership both in the application of today's technology and the development of tomorrow's.

To do this, our laboratory, research and development staff work very closely with our operations group. This means the highest quality technical design is applied to today's oilfield problems and ensures our research and development efforts are focussed on the needs of the industries we serve. The result is a continuing evolution of techniques, equipment and products.

One example is the development of our FRAC SURE simulation system. NowSCO combined computer simulation technology with formation evaluation technology to produce reliable forecasts of the results of fracturing. Refinements suggested by the company's experience in thousands of treatments resulted in innovations in equipment design and field operations. The technology was also adapted to solve other industry problems — the sand fracturing of carbonate zones, water control and shut-off techniques, even new methods for demethanization of coal seams by fracturing.

Coiled Tubing is another area in which technical advances have sponsored new efficiencies for oilfield operators. When introduced, coiled tubing was one size —  $\frac{1}{2}$  inch (13 mm) in diameter. It required the development of virtually a new technology to perfect placement techniques that would allow the use of ever-larger diameters. In turn, the technology permitting use of tubing three and four times the original size led to the development of new tools and applications — including logging,

perforating and the accurate placement of such isolating tools as the Straddle Packer.

Our research and development expertise is brought to bear on the industry's immediate problems in three key areas:

**The Product Development Department** systematically tests and analyzes the latest scientific discoveries applicable to our industry in search of new products and methods for use in the oilfield and other industries.

In the **Cement Testing Section**, slurries for critical jobs are carefully designed and tested until the right combination of a specific cement type, additives, and field water produce the required results under simulated down-hole conditions. NowSCO's continuing study of cement treatments has led to many improvements. One has been the application of foam cement which reduces breakdown pressures during fracturing and has eliminated some clean-up acid jobs.

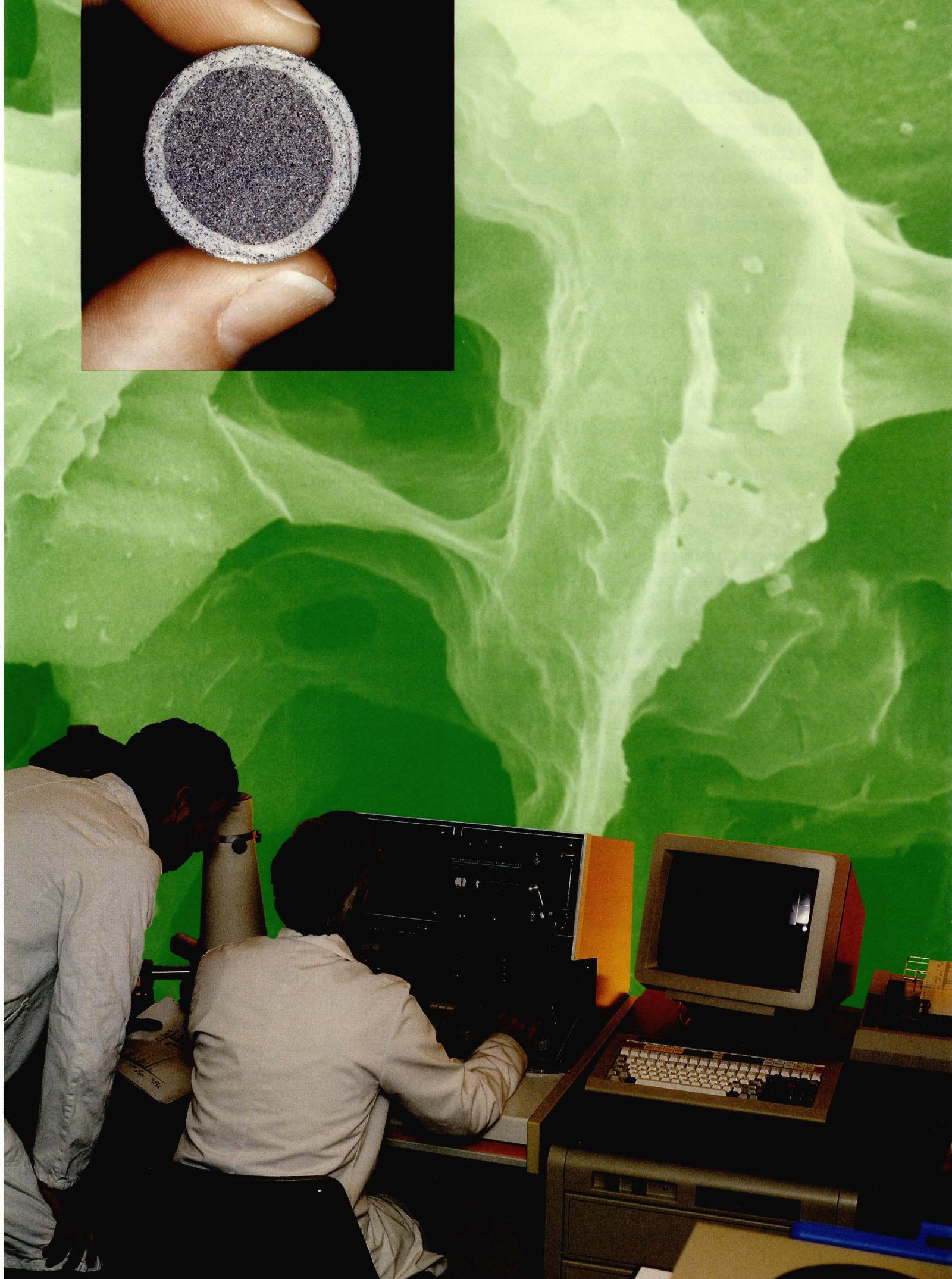
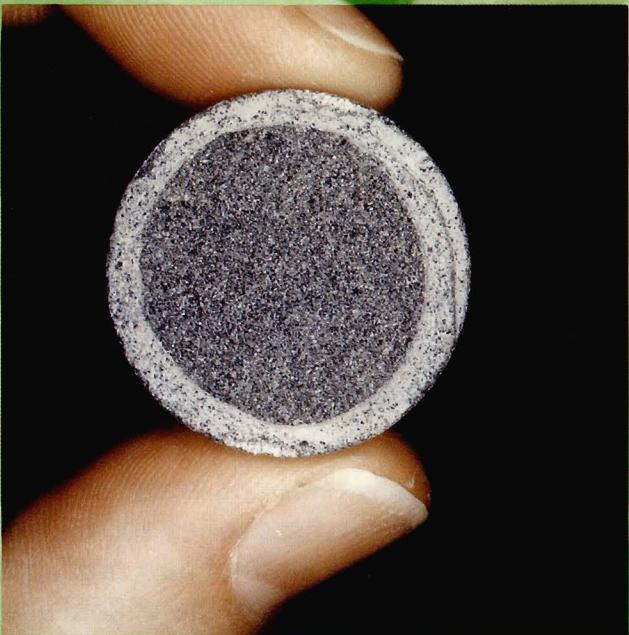
**Stimulation engineers and researchers** conduct detailed tests to determine the optimum stimulation program to maximize well productivity. NowSCO's experience in developing FRAC SURE is serving as a platform from which computer simulation models can be perfected to predict effects of acidizing on reservoirs.



◀ Verifying instrumentation design.

Logging in deviated well with coiled tubing.

# TECHNOLOGY



## Laboratory

NowSCO's laboratory operations are critical to identifying the most effective and efficient solution to a broad range of oilfield problems. The characteristics of each individual well are studied by NowSCO chemists who use the company's extensive data base and the latest technology to analyze core materials, oilfield fluids, and the properties of potential treatment fluids.

NowSCO has designed specialized equipment to provide complete laboratory simulation of down-hole cementing applications. Slurry design is first tested using a Pressurized Consistometer to predict thickening rates. The sample is then subjected to simulated down-hole conditions in the curing chamber and finally, tested for compressive strength.

In assessing appropriate well stimulation techniques, NowSCO laboratories conduct detailed tests to optimize fluid selection, determine viscosity development and ensure compatibility with formation rocks and fluids. Core flow tests are performed to give an indication



*Testing acid solution.*

of the permeability of the rock before and after fluid contact, while fracture proppant/etching studies predict conductivity. Our researchers use a Scanning Electron Microscope (SEM) for the detailed examination, identification, and photography of reservoir rock, scale samples, deposits, set cement and metallurgical samples. The SEM permits us to provide our customers with a clear understanding of the physical and chemical characteristics of the formation.

NowSCO laboratories also employ advanced techniques and equipment to design new chemical solutions for specific purposes in the petroleum and industrial sectors.

For example, NowSCO's stimulation fluid expertise was used as a base from which a series of new hydrocarbon and water-based gels were developed for the cleaning of pipelines. The stability and suspension properties of these gels have greatly improved both the thoroughness and the efficiency of pipeline cleaning operations.

Similarly, several years of research into problems associated with the iron tolerances of certain acid blends and the emulsions created by certain crude oils in contact with acids led to a new generation of demulsifiers and chemical blends.



*Blending specialized chemicals.*

▷ *Sample study with Scanning Electron Microscope.*

▷ *Core sample (inset).*

# TECHNOLOGY



## Training and Technology Transfer

Nowesco's most important asset is its people. Ours is a highly specialized field which is constantly changed by technical advances. It is also a dangerous field — toxic chemicals, high pressures and explosive gases leave no room for error.

For these reasons, we are committed to education and to training in equipment operations and safety procedures.

The company encourages its technical staff to continue their professional education and is committed to sharing technical expertise and advances with its customers, both through publications and technical meetings. Through participation in industry organizations, Nowesco contributes to the overall technical advancement of the industry.

All new employees undergo a program of orientation to the company and its services. Field staff are trained in equipment operations, preventative maintenance and safety. Specific technical courses in operations and field supervision are instructed by Nowesco's senior engineering, chemical and operations staff. Nowesco provides equipment operator training schools and presents technical seminars for its customers' employees as well as its own.

As part of its export sales program, Nowesco works with purchasers and governments to facilitate technology transfer. Training programs cover skills ranging from equipment operation to service company general management. These programs are tailored to the specific needs and expertise levels of the client.

In many instances, we accompany sales of equipment and well-treating programs with complete training for local technicians.



*Driver safety instruction.*

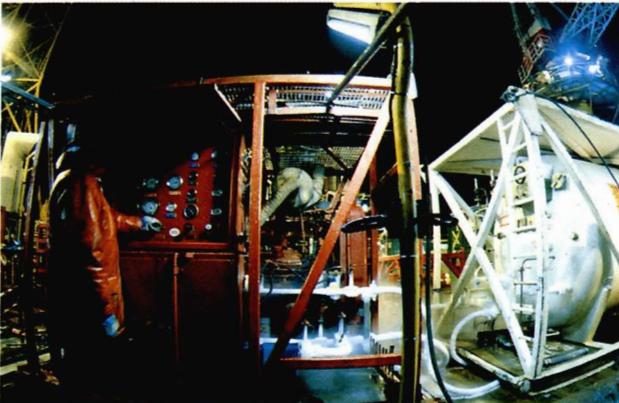


*Customer specific technology transfer.*

## OPERATING LOCATIONS



**NOWSCO**



## CANADA

### ALBERTA

Brooks  
Calgary  
Drayton Valley  
Edmonton  
Grande Prairie  
High Level  
Lac La Biche  
Lloydminster  
Medicine Hat  
Peace River  
Red Deer  
Whitecourt  
Slave Lake

### BRITISH COLUMBIA

Fort St. John  
Fort Nelson

### SASKATCHEWAN

Estevan  
Kindersley  
Swift Current

### MANITOBA

Waskada

### NEWFOUNDLAND

St. John's

### NOVA SCOTIA

Dartmouth

## UNITED STATES



### OHIO

Wooster

### WEST VIRGINIA

Clarksburg

Charleston

### PENNSYLVANIA

Brooksville

## U.K./EUROPE



### UNITED KINGDOM

Great Yarmouth — Leeds  
Longparish — Tuxford  
Aberdeen — London



### WEST GERMANY

Vechta



### NORWAY

Stavanger  
Bergen



### NETHERLANDS

Emmen



### ITALY

Ravenna

Pescara

Siracusa



### FRANCE

Montereau

## NORTH AFRICA



### EGYPT

Cairo



### MOROCCO

Rabat

## MIDDLE EAST



### UNITED ARAB EMIRATES

Dubai

## SOUTH EAST ASIA



### INDONESIA

Jakarta



### SINGAPORE



### THAILAND

Bangkok

## CONCLUSION

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As NowSCO entered its first quarter century, man was eyeing space with a determination that would create the Technological Age. Few foresaw the dramatic pace of development which would author profound change in virtually every industry.

Oil and natural gas supplies were abundantly available and stably priced. Few foresaw that international political, economic and military aspirations would combine to thrust our industry into nearly two decades during which the only certainty was change.

These forces for change offered opportunity for those prepared to accept challenge and risk.

In our second quarter century, we believe our potential far outstrips the achievements of the first twenty-five years . . . even recognizing we cannot see more than the foreshadow of the change, challenge and opportunity to come.

Hydrocarbon energy certainly will remain a strategic commodity. Throughout the world, considerations of security of supply and economic stability will take on greater importance to countries and regions which have the potential to be self-sufficient.

This will require dramatic advancement of exploration effort together with an ever increasing need for higher reservoir recoveries and the stimulation of less prolific reservoirs. In turn, this will offer significant, perhaps unparalleled, opportunity for NowSCO.

Our corporate philosophy and objectives are clear: we are determined to provide the best people and we will constantly search for the better way.





**Regional Head Offices**

**Canada**

1300, 801 - 6th Avenue S.W.  
Calgary, Alberta, Canada  
T2P 4E1  
Telephone: 403-261-2990  
Telex: 03-825617  
Fax No.: 403-264-7489

**United States**

3000 Old Airport Road  
Wooster, Ohio 44691-9500  
U.S.A.  
Telephone: 216-264-8885  
Telex: 241328  
Fax No.: 216-264-5342

**United Kingdom/Europe**

Havenbridge House  
Great Yarmouth, Norfolk  
England NR 30 1HZ  
Telephone: 493-852466  
Telex: 51-975360  
Fax No.: 493-852240

**South East Asia**

Changi P.O. Box 44  
Singapore 9150  
Telephone: 65-545-8866  
Telex: 87-34476 Nowsco RS  
Fax No.: 65-542-7477



