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Norway is a rich country. Its picturesque nature, evidenced by the deep fjords and the midnight sun, makes it rich in natural beauty and scenery.

Norway is also rich in natural resources. Abundant supplies of hydro-electric power and large reserves of oil and gas in the North Sea contribute significantly to make Norway one of the world's most developed economies.

Furthermore, in terms of GNP per capita, Norway is a wealthy nation. A highly advanced industrial environment has made Norwegian companies competitive in many markets throughout the world.

In this brochure leading Norwegian politicians and economists invite you to look to Norway. The following presentation of several outstanding Norwegian business firms will, we hope, convince you that you should.

It is our intention that this presentation will arouse your interest in Norwegian industry as a reliable and future-oriented business partner. Should you wish further information about any of the businesses presented, or about Norwegian trade and industry in general, you are kindly invited to make use of the enquiry form at the back of the brochure.

LOOK TO NORWAY is created by two students at the Norwegian School of Economics and Business Administration, Mr Idar Kreutzer and Mr Geir Stormorken, in cooperation with Ted Bates - Norway, advertising agency, and published by the Center for International Business at the School.


Are Kinserdal, Rector The Norwegian School of Economics and Business Administration

$\mathbf{N}$orway is a country with outstanding potentials. We are a well-developed welfare state with a broadly diversified industrial base, and we are rich in natural resources. Our most important asset is nonetheless our human resources; by mobilising the creative urge, the willingness to work and the ability to co-operate in a common cause, we feel well equipped to meet the future.

Our national culture is outwardly oriented, open and manifold. The Norwegian economy is presently growing at a healthy pace. GNP and employment are increasing, and the number of jobless falling. Our traditional economy is once again expanding rapidly. Furthermore, we have a growing number of skilled and competent people employed in manufacturing, as well as in service industries.

For Norway, a major challenge for future development lies in exploiting our favourable natural and financial situation. Even if revenues from the oil sector were to level off or fall, we have built up financial reserves which can be managed to give a high rate of return in the years ahead.

The internationalisation of the Norwegian economy is important and has been quite substantial in recent years. The Norwegian Government has actively fostered and will continue to encourage this development. The measures we have introduced include extensive liberalisation of foreign exchange control, measures to increase companies' profitability and equity capital, and financial assistance to trade and industry. The Government has also taken steps to encourage and help Norwegian students to study at leading universities abroad.


Norwegian companies are now establishing themselves as an important business force in international markets, thanks to their high technology, competitiveness and management skill. It is our belief that this development will continue at a growing rate. We also believe that Norway will be an increasingly attractive market for foreign companies, given that we remain future-oriented, rich in resources and politically stable.

The Norwegian Authorities welcome foreign banking and industrial operations, and encourage Norwegian financial and industrial activities abroad. This creates an economic and political link of mutual benefit to all parties concerned, which should, of course, be further strengthened.

## TRADE UNIONS IN SUPPORT OF INTERNATIONAL BUSINESS

Within the Norwegian Federation of Trade Unions ( LO ) we realize that a viable and financial strong economic sector is of paramount importance for the social and economic well-being of our 760,000 members, as well as for our capability to sustain the present welfare society and to carry on with our reform work. Therefore, careful consideration of the needs of Norwegian industrial and commercial life forms an important part of the framework conditions of Norwegian trade unionism.

The substantial North Sea oil and gas resources and the huge inflow of revenues from this activity have not changed this fact. While offshore gas and oil have undoubtedly meant a tremendous boost to the entire Norwegian economy, it has also meant new and exacting challenges.

These challenges imply a continuous modernisation and restructuring of our traditional industries in order to strengthen our competitiveness on international markets. LO knows that the successful internationalisation of our trade and industry and its ability to fight international competition will continue to form essential pre-conditions for improved pay and other aspects of employment of our trade union membership.

Norwegian society possesses a number of qualities that will help us cope successfully with this transition period. One important factor is the high purchasing power of the Norwegian market, which makes Norwegian trade and industry an attractive partner to foreign business firms. Although unemployment is still too high according to our view, it is nevertheless considerably below the level suffered by several of our most important trading partners. Moreover, a strong public sector, high educational standards as well as an income distribution more even than in most countries, are all factors that have contributed to develop a homogeneous and peaceful society. When placing orders with Norwegian suppliers our international trading partners need not fear delays caused by industrial disputes. LO has been the very driving force behind the extensive democratization process within our social and economic life; a measure that has helped mobilise human and technological resources towards an industrial development designed for the future.


Tor Halvorsen, Chaiman of the Norwegian Federation of Trade Unions (LO).

## NORWEGIAN INDUSTRY GOING INTERNATIONAL



Birger B. Rasmussen, President, Federation of Norwegian Industries.

The economic development of the last decades has created an increasing demand for internationalisation of Norwegian industries. The industrial sector of Norway has been prepared to meet this challenge and an important growth has taken place in the number of Norwegian industrial establishments abroad, wholly or partly owned. Both for the industry and for the society as such, it is very important to continue this development. It is of great benefit to all parties concerned that the Norwegian Government and Norwegian industry co-operate closely to achieve this goal.

The general principle for Norwegian industrial policy is competition on equal terms. The industrial sector of Norway do not want any barriers to imports or special advantages for Norwegian industries whatsoever. To secure competition on equal terms, the Norwegian Government has introduced guarantee arrangements providing Norwegian industry the same conditions as in other countries. Thereby the industry can carry the burden of increased efforts and risks which international engagements often imply.

In modern times, Norway has always lived up to a liberal trade policy, and Norwegian industry is an important partner in the work for achieving an open and free international trade policy. We also acknowledge that internationalisation is a two-way process, and welcome foreign investments in Norway.

The industrial sector of Norway is also the spokesman for an active Norwegian attitude towards Europe and the EC. Not only do we want to be a passenger, but we would prefer to have a direct influence on the development. Norway and Norwegian industry have a lot to offer, and in the long run Norway can not afford to stay outside the European Community.

The increasing international engagement has strengthened the contacts with foreign markets and stimulated a restructuring of the industry. To an increasing extent Norwegian industry has profiled itself through goods and services based on know-how, high technology and not least through high quality.

The ' 80 s have formed a very good period for Norwegian industry. The main characteristics of the last 6 years period have been renewal, growth and restructuring. The Government has by cutting taxes contributed to increased profitability. This has resulted in a significant growth in companies equity capital and the availability of new funds. During the ' 80 s we have also achieved a free and more open national market. As mentioned above, Norwegian industry has extended exports and supported internationalisation. New sales offices, joint ventures and production plants have been established abroad.

For many years the industries of Norway have enjoyed considerable benefits from foreign know-how. Today, a large number of Norwegian students are studying abroad. In the years to come Norwegians educated in other countries will provide a positive stimulus to the international relations of Norway.

Not only do we in Norway have something to learn from foreign countries; we also have a broad technological level in a number of fields. For instance, during the last 20 years period Norway has acquired considerable know-how within high technology and oil related industries from which other countries might benefit.

Our country has much to offer Look to Norway!

# THE NORWEGIAN NATIONAL CHARACTER 

Andreas W. Falkenberg, Associate Professor

## 'Look to Norway!' President Roosevelt coined the phrase during World War Two to salute Norway's valiant resistance to aggressive forces.

As we encourage you to look to Norway during the years ahead, it is because we feel that existing information available abroad about our country tends to concentrate on the quaint and beautiful, rather than on information relevant to business. Thus you may know more about ice and polar bears than about Norwegians. It is true that if you travel to Spitzbergen, north of the 75th parallel, you may encounter both snow and polar bears during the 'summer' months. However, if you visit the mainland during the summer, you may be invited to go windsurfing or boating, a welcome mode of recreation for busy executives. 13,000 miles of coastline, including islands and inlets, constitute an excellent playground for the families that enjoy the 600,000 pleasure boats in Norway; or an average of one boat per two families.

While this information may be important for tourists to Norway, as a business person you are probably more interested in learning what you will encounter as you work with Norwegians. Who are they? What are they like? Different people may provide different answers, but there are perhaps a few things that can be presented as dimensions of the Norwegian character.

## INDIVIDUALISM AND EGALITARIANISM

Historically, the Norwegians have never been subjected to the feudal system prevalent in other cultures, and have thus developed cultural values that promote individualism and egalitarianism.

The traditional industries such as fishing, farming and forestry produced a unique kind of rugged individualism, which was necessary for survival. Food was a scarce commodity and the land mountainous, so that considerable ingenuity and persistence were required. The Norwegian culture that developed was therefore based on rural values rather than those associated with the larger European cities.

Well developed social skills were not needed on the farms, on fishing boats or in the forest. Therefore some may find the Norwegians a little awkward at first, but that is only at the surface. Underneath that surface, you will find warm and caring people, concerned with each other's welfare. But first the ice needs bo be broken. Norwegian friendships carry over into business, ties go back a long way and once you are a part of the system, you have made friends for life.

In this sense, it can be said that the Norwegian national character is a finely tuned orchestra that plays in 'major' and 'minor' moods: 'major' as in lively brass band marches, and 'minor' as in more emotional pieces of music.

Henrik Ibsen, in his play "Peer Gynt", described the Norwegian dreamer and visionary, unafraid of grand thoughts and ideas. The success of the individual entrepreneur is admired in Norway, be it in polar exploration such as Roald Amundsen's conquest of the South Pole and Fridtjof Nansen's scientific work in the Arctic, or sailing into the Pacific on a balsa raft as did Thor Heyerdahl in his studies of the people of the Easter Islands. Today, modern entrepreneurs are represented in industries such as shipping, offshore oil exploration, high tech and engineering services. These represent the 'major' harmonies of the Norwegian character.


The Nobel Peace Prize, which is awarded by the Norwegian Nobel Committee, has been given to many prominent individuals and organisations since its institution in 1901.



Norway offers brilliant opportunities for skiing; there are those who claim that Norwegians are born skiers.

And then there is the tune that goes in 'minor'; the melody of heartfelt caring, the emotional part of our national character. The same Fridtjof Nansen who explored the Arctic waters later worked for the many displaced Europeans following World War One. The so-called 'Nansen Passports' were issued to those left nationless. Nansen later received the Nobel Peace Prize for his humanitarian efforts. The spirit of international brotherhood also motivated Trygve Lie as he guided the United Nations through its initial years as its first Secretary-General. Internationally, Norway is among the leading nations in contributions to the Third World as a percentage of GNP.

## CAPITALISM AND SOCIAL WELFARE

The duality of 'major' and 'minor' is also reflected on a national level. Norway has developed a unique blend of capitalism and social welfare. Norwegians have a highly developed sense of justice based on egalitarian principles, and have thus developed a society in which, for instance, economic differentiation is relatively small compared to other cultures.

This heritage has perhaps also resulted in a few other characteristics that international
executives have observed about Norwegians and Norwegian firms. Norwegians are patriotic, perhaps second to some (including the French), but nevertheless patriotic. This is a strength in some respects, such as waving of the flag at international ski competitions, but can at times even to Norwegians seem a little overdone.

Norwegians are also fairly consensus oriented - and in this respect similar to the Japanese. Norwegians appreciate agreement prior to major decisions, both on a corporate level and on a national level. Once consensus is reached, you will find Norwegians to be excellent team players and very productive as such.

One would also like to think that Norwegians are reliable, and that you can trust a Norwegian handshake. A person's reputation for honesty is important when you live in a relatively small society where pride and integrity are highly valued.

Although Norwegians may not flaunt their individual ambitions, achievement is highly respected and admired. Recently, Grete Waitz and Ingrid Kristiansen have been heralded as the leading marathon runners of the world; Liv Ullmann has achieved international acclaim as a leading actress, as has Arve Tellefsen as a violinist.

One of the effects of rugged individualism is a certain straightforwardness;negotiations are carried out with little bargaining, and basic honesty and fairness are expected.
Typically one will 'not play games', which means that there is usually little room for negotiation. An equitable and fair price is one that a Norwegian can live with; pay the bills and cover the costs, and there is not much leff for bargaining.

## ATTITUDE TO WORK

It has been observed that Norwegians are a hard working people. This is an asset that multinational companies operating in Norway have come to appreciate. Norwegians put in one of the world's longest work-years (second only to the Swiss), and have one of the world's highest retirement ages at 67 . Traditionally, their attitude to work is combined with a stong emphasis on the family and family fun, most notably during Christmas and Easter when it is customary to take a week's vacation.

So as you look to Norway, you will find an open, reliable and trustworthy business climate, and pragmatic matter-offfact business people in an advanced economy, ready and able to take on new international challenges.

## THE NORWEGIAN ECONOMY

Victor D. Norman, Professor


#### Abstract

Norway has been among the high achievers in the world economy throughout the postwar period. The record has been particularly impressive over the past ten years, with rapid economic growth, extremely low unemployment, and moderate rates of inflation. Today, Norwegians enjoy one of the highest standards of living in the world, combined with a highly equitable distribution of income and wealth, and with a social welfare system as good as any.


Oil has been important to Norwegian success. It has been an important course of income - today, it accounts for some 20 per cent of GNP. It has also been an important contributor to GNP growth: without the oil sector, annual GNP growth over the ten years from 1973 to 1983 could have been as low as 2.5 per cent, as compared to the actual figure of 4.4 per cent. Perhaps equally important, oil revenues have provided Norwegian authorities with freedom of macroeconomic manoeuvring. Because of the foreign exchange earned in the oil industry, Norway did not have to pursue contractive monetary and fiscal policies after the oil price shocks of the '70s. Instead, the Government pursued active, counter-cyclical policies that ensured full employment and provided the demand necessary for economic growth.

Although oil is important, it is too simple to ascribe Norwegian economic success to oil alone. If the national product is broken down into contributing factors, oil is not even among the most important contributors. It is essential to remember that Norway was a rich and rapidly growing economy before oil was discovered; and it would have been among the richest countries in the world today even without the oil sector.

Two key factors may help to explain the underlying strength of the Norwegian economy. One is the saving rate and the consequent supply of capital. The other is the industrial structure and its reflection of Norwegian comparative advantages.

Since 1945 , Norway has had the highest gross saving rate in Western Europe - in recent years, it has been around 30 per cent of GNP. As a result, investments per employee are higher than in almost any other country in the world. In 1983, the capital stock per employee in Norwegian shipping and manufacturing averaged $\$ 100,000$. That, more than anything else, explains why Norwegian workers earn more than their colleagues in other countries and why value added per employee in Norway is as high as $\$ 35,000$.

Abundance of capital, together with energy (which includes hydro electric power as well as oil and gas), is not sufficient to guarantee success, however. One must also have an industrial structure which reflects and exploits this abundance. That has been the case. Traditionally, capital-intensive shipping, together with capital- and energy-intensive production of metals, chemicals, and paper products have accounted for 60 per cent of Norwegian exports and 50 per cent of total value added in the tradeables sector (shipping and manufacturing) of the economy.



The expanding oil sector, depressed international markets, and heavy subsidies to import-competing industries like shipbuilding, have caused a substantial decline in the traditional export industries in recent years. To some extent, this has been a healthy and natural by-product of growth in the oil industry. Limited prospects for growth in oil production and uncertainty about future oil prices suggest a need for rapid growth on other export earnings over the next $10-20$ years, however. To achieve this, traditional export industries must grow again, or new sources of foreign exchange have to be found.

Past experience indicates that Norwegians will succeed in identifying, and allocating resources to, such industries. Three avenues seem particularly promising. One is shipping, where reconstruction in the 1990's of an internationally ailing industry will require capital investments and know-how which a country like Norway should be well suited to supply. Another is direct investments abroad in the production of metals and chemicals, where enterprises like Norsk Hydro and Elkem have both expertise and strong market positions. A third is export of financial services in special areas (ship finance, oil-related finance, etc.) where Norwegian banks have an advantage.

In the final analysis, the confidence that Norway will find new sources of export earnings to supplement oil is based on belief in the economic system. The 'mixed' or 'managed' economy of Norway has always been characterised by emphasis on productivity and adaptability, as well as equity and social welfare. The authorities have contributed to this by preserving liberal foreign trade policies, by generally (but with some notable exceptions like agriculture and shipbuilding) refraining from structure-preserving industrial policies, and by maintaining high public saving. The trade unions have contributed to it by accepting modernisation and structural change by refraining from ad hoc industrial action, and by convincing the rank and file of the need for wage moderation. Firms and their organisations have contributed to it by co-operating with the Government and the unions, thus accepting a form of 'indicative planning' which may have been alien to their ideological instincts.

Norway is by no means an economic paradise. Problems relating to competitiveness, industrial structure, inflation, etc. exist there as they do elsewhere. Moreover, there are regional problems and constraints more severe than in most other countries. Nevertheless, Norway is economically sound in the sense that its resource base, its saving rate and its economic system enable it to cope with the problems.


GNP PER CAPITA, 1983
(3.9)


AVERAGE ANNUAL GROWIH, GNP, 1974-84


GROSS SAVING AS PER CENT OF GDP, 1984

## A/S NORSKE SHELL HAS FAITH IN NORWEGIAN RESEARCH

The quality of Norwegian research and development compares well with that of other countries. All advanced countries have their areas of special technological expertise, and for Norway one of these is offshore technology. Norway's special coastal geography, the depths on the Norwegian Continental Shelf and the hostile climate, has created a demand for technology on a level above the needs of most other countries.


According to Mr. Roar Rose, Director of Planning and Public Affairs in A/S Norske Shell, Norwegian research and development institutions are strong in many fields such as floating and fixed structures and subsea production.

## CO-OPERATION IN TECHNOLOGY

In the concession terms for foreign companies that become operators on the Norwegian Continental Shelf, the Norwegian authorities require at least 50 per cent of all research and development relating to these projects to be executed in Norway, through contracts with Norwegian industrial companies and research bodies. Although these agreements are generally related to offshore industry, similar agreements for onshore activities are also being established.

At first the majority of the foreign oil companies were, and some still are, reluctant to take advantage of such terms. However, experience has shown that Norwegian research and industry has much to offer in this context. A major objective of $\mathrm{A} / \mathrm{S}$ Norske Shell is to develop high-tech resources in Norway, and it is in the
company's own interest to have research and development establishments available locally for a variety of tasks. Mr. Rose confirms that in many cases the work carried out by these establishments is internationally recognized.

## NoK 800 MILLION

As a result of these technology agreements, A/S Norske Shell has used some 800 million Norwegian kroner on offshore related research and development work since 1980. A number of research institutions and industrial enterprises are engaged in projects relating to subsea production and inspection/maintenance. One of these is the development of the 'Benigraph' for subsea pipeline inspection. Developed by Bentech in Tromsø in northern Norway, the Benigraph enables remotely controlled and detailed inspection of pipelines on the seabed without using submarines or divers.


The Benigraph - developed with support from A/S Norske Shell - is an advanced remotely controlled subsea vessel used for the examination of seabed pipelines.

## ARTHUR ANDERSEN \& CO

Arthur Andersen was born in the U.S. of Norwegian parents, and spent part of his childhood in Norway. However, it was in the U.S. that he started his modest accountancy practice in 1913 -a practice which has now become the world's largest-earning accountancy organisation.

In 1974 the Oslo office of Arthur Andersen \& Co. was reorganized into a Norwegian partnership, owned by the Norwegian partners of the firm. Through internal expansion, the company has grown into one of the largest Norwegian accountancy firms. Close ties are maintained with the worldwide family of Arthur Andersen companies, enabling the Norwegian partnership to give efficient service both to internationally-oriented Norwegian clients and to foreign investors looking to Norway.

## BUSINESS CLIMATE

The Norwegian business scene is a basically competitive market in an open market place. The vast majority (more than 90 per cent) of Norwegian industrial enterprises are privately owned, the exception being largely in public utilities and transport, although privately held companies are found even in these industries, ensuring competition.

In the age of North Sea oil and gas, Norwegian capital resources have grown substantially. Domestic financing is easily obtainable, thus fostering freedom of action and dynamism in Norwegian business life.

Although Norway is generally known as a high tax country, taxation of business enterprises is quite favourable, stimulating the creation of equity and leverage.


In recent years one has experienced an immense increase in the activity on the Oslo Stock Exchange, and the Norwegian equity capital market is now highly efficient.

Trade law has evolved over the centuries. There is a tradition of mutual trust, openness and fairness, in which the courts will honour gentlemen's agreements and tend to disregard restrictive small print.

## BUSINESS COMMUNITY

In recent years we have seen a considerable increase in the profitability of Norwegian enterprises. The business community has matured, and prosperity has come as a result of many factors. Investment in the educational sector is paying off; the lean years of the late '70s have induced widespread reorganisation and restructuring, and of course the synergistic effects of the new oil industry have made their impact. The new young generation of Norwegian industrial leaders have an increased awareness and consciousness in employing their skills; they look beyond local borders towards international markets for their goods and services.

To do so from Norway's peripheral position, it is not sufficient to be equally good, you must be better than the competitor. This is the goal that the Norwegian business community strives towards, and many firms have already succeeded.

## ACCOUNTING

Norwegian accounting principles may be difficult for a foreigner to understand, until it is realized that Norwegian statutory accounts also form the basis for the tax return. As the tax law not only allows the creation of 'hidden' reserves, but also favours this, the book equity may appear to be modest. This has often been a problem for Norwegian companies when entering foreign markets, and even more so when introducing themselves on a foreign stock exchange. One of the many services offered by Arthur Andersen \& Co. in Norway is the conversion of Norwegian accounts into internationally-accepted accounting form.

## OPTIMISM

With a thriving, optimistic business community alert to changes and opportunities, you may well find that Norwegian enterprises could be very interesting partners in many contexts, both in the import and export of products and services.

And all the time, everywhere, Arthur Andersen \& Co. is there to assist in the process. It is our firm belief that international trade helps to bring down barriers and improve understanding between the people of the world.

## THE METAL INDUSTRY GOES HIGH-TECH

Norway's Elkem Group is not only the world's leading producer of silicon and ferro-alloys. It is also the largest international supplier of equipment and technology to the metals industry. In 1985 it had a turnover of NoK 8.2 billion, 9,000 employees and 25 production plants in seven different countries. The Elkem Group today supplies one half of the raw silicon used in the manufacture of silicon chips for the electronic industry worldwide. Through massive and concentrated research effort, Elkem is also among the pioneers in developing new materials technology for the high-tech, high-growth industries of tomorrow.

The development of Elkem's new microsilica technology is a classic case history of a company turning an apparent disadvantage into an advantage, and at the same time solving an environmental problem.

## FROM ONE PROBLEM TO ANOTHER

Microsilica is the name given to extremely tiny, dust-like particles of silicon dioxide, no larger than the particles of cigarette smoke, which at one time used to pour forth as a dense white cloud from the chimneys of ferrosilicon and silicon metal furnaces, creating a substantial problem of environmental pollution.

In response to this problem, Elkem eliminated the emissions from its furnaces by employing a unique, company-developed filtering and condensing system. But the solving of one environmental problem also created a new one. The clean air left Elkem looking for a way to dispose of the dust that can accumulate at the rate of $7-15,000$ tonnes a year from one plant alone.


These innocuous-looking particles of microsilica were once a major source of air pollution around ferro-alloy plants. Elkem solved the pollution problem and gained a valuable new asset, by developing novel microsilica additives for concrete, refractory materials and plastics.

## FROM DESTRUCTION TO CONSTRUCTION

The group therefore made a heavy research investment to find ways of utilising the microsilica's valuable properties. By special treatment processes developed by the research staff at Elkem, the microsilica particles are consolidated, made easier to handle and given a uniform quality. Special chemicals are added to upgrade the microsilica products and allow them to be tailored to specific applications.

One of the most important commercial uses for microsilica is as an additive to concrete, the most widely-used building material in the world. Microsilica compounds improve the strength, dúrability, impermeability and bond strength of concrete. With microsilica, it is now possible to produce a high-strength concrete that can, in certain applications, even compete with steel.

Other microsilica formulations facilitate the replacement of asbestos with non-toxic fibres in fibre-cement. Microsilica can also be added to refractory materials and plastics, with similar enchancement of their properties.

Once merely a by-product of Elkem's ferro-alloy furnaces, causing a severe environmental problem, microsilica is now a valuable material in its own right and one of the Elkem Group's most promising new business areas.

## SOLAR ENERGY

The advanced research and problem-solving capacity of the Elkem Group is highly evident in other areas, too. One major aspect, for example, is the upgrading of its current product range to include new, highly-refined materials for high-tech industries such as electronics, solar energy, advanced ceramics and fibre optics.

Single-crystal wafers of silicon are the 'active ingredient' which enables a solar cell panel to convert the sun's radiant energy into electrical energy. The high cost of producing the high-purity silicon needed for solar cells is one of the factors which has limited the growth of this alternative energy source. Five years ago, Elkem and the Exxon Corporation joined forces in a three-year research project to develop a better and cheaper process for producing solar cell silicon. Further development work by Elkem resulted in a promising commercial process.

Before gearing up for industrial production, however, Elkem wanted to go a step further in the refining process. In 1985 the company took over Crystalox, a British company specialising in advanced crystallisation technology. The project is now approaching completion, and Elkem aims to commence production of solar cell grade silicon at its Norwegian plant at Bremanger.

Several other projects have moved from the research lab to the construction stage. These include facilities for producing gallium, a material used in certain types of integrated circuits; ultra-pure quartz, used in the manufacture of semi-conductors and fibre-optics; and silicon nitride, a ceramic material used in high-performance engines and advanced machine tools. In each case, Elkem's in-house research has been instrumental in arriving at these new products and processes which are expanding the frontiers of metallurgical tecnology.

One of the three electric smelting furnaces at Elkem's Salten Verk ferrosilicon plant. The Salten plant has an annual production

## THE ELKEM GROUP

The Elkem Group had in 1985 about 9,000 employees and a turnover of NoK 8.2 billion. The company has some 25 production units in seven countries, including the U.S.A. and Canada. In 1981, the company took over the silicon and ferro-alloy activities of Union Carbide, and today Elkem owns 14 silicon and ferro-alloy plants in Norway and North America. The main products, silicon and ferro-alloys, accounted in 1985 for 70 per cent of the group's total turnover, with aluminium representing a further 16 per cent. capacity of 84,000 tonnes of ferrosilicon.


Nature as art: Silicon, photographed under a microscope with colour filters to bring out the crystal structure. Elkem supplies half of the silicon used in the manufacture of silicon chips worldwide. In other words, there is a 50 per cent chance that the silicon found in your television set, pocket calculator or computer comes from Elkem.

## NEW HORIZONS FOR SAGA PETROLEUM

The Snorre oil field, named after a famous figure in Norse history, is situated off the west coast of Norway, west of Flore. The field's recoverable oil is estimated at $\mathbf{1 3 0}$ million cubic metres, covering more than 105 square kilometres. The water depth is between 300 and 350 metres.

A development of the Snorre field demands the highest standards of engineering and project management.

The task is being undertaken by Saga Petroleum a.s, the only hundred per cent private operating company in Norway. Saga was granted operatorship on Block 34/7 in March 1984. As early as 1979, Saga had found oil in neighbouring Block 34/4, and the first drilling showed that the oilfield extended into both blocks.

The development involves installation of the first production platform in the North Sea in waters deeper than 300 metres, the use of seabed production equipment to the greatest extent that the oil industry has yet experienced, and production from a complex reservoir that poses new challenges to its management.

The Snorre field is an example of a Norwegian oil company's ability to widen its horizons and solve problems at the forefront of exploration technology.


Karin - a new platform concept by Saga Petroleum intended for use in extremely deep waters. This light hexagonal platform construction demands far less steel than the traditional platforms.

## INVESTMENTS OF NOK30--35 BILLION

The development of Snorre requires enormous investments, probably amounting to about NOK30-35 billion. During the field's productive period of 15 to 20 years, annual operating expenses are estimated to be between 1.5 and 2 billion NOK.

When Block $34 / 7$ was awarded, Saga Petroleum entered into a co-operation agreement with Esso. This agreement was approved by the Norwegian authorities and forms the basis of the Snorre development project. Teams from Saga and Esso are now working side by side to ensure the profitability of the North Sea's most demanding oil field.

## NEW CHALLENGES

Since the Norwegian oil era started in 1969, Norway has built up world-leading expertise in the development and production
of offshore oil in inhospitable climatic conditions. Ekofisk, Norway's first developed oil field, is 70 metres below the sea surface. Statfiord, with the country's largest oil production platform, is at 144 metres depth. Gullfaks, which is now being planned, is at 217 metres. And the huge depths of the Snorre field calls for a new technological leap. New solutions, with extensive use of subsea wells, will be necessary. Saga has therefore developed several new platform concepts in steel and concrete, with new technology that meets the requirements of huge water depths and at the same time is cost-effective.

## SUBSEA PRODUCTION

The distribution of Snorre's 130 million cubic metres of extractable oil, extending over more than 105 square kilometres, also makes new demands on drilling techniques. In addition to its 'thin' spread over a large area, the reservoir is divided by several geological faults. This calls for a large number of wells and for platforms that can serve a group of wells extending over a considerable area.

It is expected that some 100 to 130 wells, for production and water injection, will be needed to develop the entire field. Many of these wells will be placed on the seabed, and controlled remotely from the field's fixed platforms. Subsea development on this scale is an entirely new challenge for the oil industry, and Saga's research and
development departments are already actively engaged on it.

## SMALL OIL COMPANY

Saga, the company engaged on this project, is not one of the world's oil giants. On an international scale it is comparatively small: newly established, privately owned and nationally based. However, Saga already participates in several large Norwegian oil and gas fields which are fully developed or in the process of being developed on the Norwegian continental shelf.

## SAGA PETROLEUM A/S

Saga Petroleum was established in 1972 as a limited partnership, and became a joint stock company in 1979. The company now participates in 26 concessions and has operatorship on 10 blocks on the Norwegian continental shelf.

Saga Petroleum is a co-owner of five fields under production or development: Statfjord, Murchison, Heimdal, Gullfaks and Troll. The company's turnover is increasing and by the beginning of the 1990s Saga's production of oil and gas will increase to two million tons oil equivalent per year.

In the Snorre field one intends to make use of far more seabed drilling wells than in any other oil field.

## CHINA - A MARKET OF OPPORTUNITIES

In recent years Kvaerner has established some very important trading links with the Peoples' Republic of China.


The opening-up of China to Western trade and industry has revealed the country -the most populous in the world as a market of vast potential. In particular it is a land of enormous, largely undeveloped water power reserves, and has a continental shelf with indications of substantial supplies of oil and gas; and it is to help develop these natural resources that the Chinese have called on the expertise of the Norwegian Kvaerner Group. Kvaerner has more than 150 years' experience in the field of water power, and today its turbines, ventilators and governors set a world standard.

Only 4 to 5 per cent of China's water power reserves so far have been harnessed. At the end of the ' 70 s there were indications that China was planning an extensive development of these reserves, as part of the country's new industrialisation programme. The Kvaerner Group was alert to these moves, and at an early stage the Group entered into discussions regarding supplies of equipment.

## A NoK150 MILLION CONTRACT

The Group's first tender in China was for the construction of four turbines for a power plant in Lubuge, in southern China. In competition with several other firms, and after stringent evaluation of the proposed product, specifications, quality and price, the contract was won by Kvaerner Brug, a leading member of the Group. The order, amounting to NoK150 million, is the largest individual assignment ever given by China to a Norwegian company.

## SHARING TECHNOLOGY

In addition to turbines, the Lubuge contract also includes ventilators and governors. The first turbine is a wholly Kvaerner product, produced in Norway. The second turbine will be partly produced in Norway, while the two remaining turbines are to be produced in China at an engineering plant in Harbin in the northern part of the country. The total contract also involves training of Chinese engineers in Norway. Indeed Kvaerner's willingness to share its technology - a policy closely linked with equipment sales - was, together with product quality, a very important deciding factor for the Chinese. For Kvaerner itself, another important factor was the Norwegian Government's policy of co-operation in the financing of exports to countries with industrial development programmes.

Following the granting of the Lubuge contract, Kvaerner is already taking part in preliminary discussions on several further projects.

## CONSTRUCTION OF SHIPS

Another major area of Kvaerner Group activity is in ship construction, and here China is showing interest and confidence in the Group's capabilities. The Kvaerner company Nye Fredrikstad Mek. Verksted (NFMV) has an agreement with Dalian, China's largest engineering organisation, for construction of 2 shuttle tankers, each of approx. 120,000 tons; and there are possibilities for extension of this agreement, and for new orders for NFMV.

The Kvaerner group has also entered into a co-operation agreement with Dalian. This embraces several areas, of which the most interesting are of course water power development, ship building and offshore oil activities.

## OFFSHORE

China's Continental Shelf is four times larger than Norway's. Conservative estimates indicate that there is four to five times more oil in this area than in the area south of the 62 nd parallel in Norway.

Kvaerner Engineering is now engaged in co-operation with the Chinese company SOECO. Kvaerner has participated in trade exhibitions, and intends to further its collaboration on offshore projects during the next few years.


Kvaerner's LNG/LPG-design for freight of liquefied gasses and chemicals are well known worldwide. Half of all liquid gas carriers in the world are designed by Kvaerner.


Kvaerner's turbines are found in water power plants all over the world. In spring 1986 the company acquired turbine companies in the USA, England, Sweden and Australia, and has become one of the world's leading suppliers of hydro-power equipment.

## KVAERNER OF NORWAY

The Kvaerner Group is Norway's largest mechanical engineering group, with 26 companies specialising in high technology design and fabrication. The Group's order income totalled NoK 5,022 million in 1985 and the 8,600 employees were engaged in the following fields of activity; ship building, offshore construction, offshore engineering, subsea, hydro-power, wood processing and fish processing.

The Group consists of nine mechanical engineering works, three shipyards, one shipowner, one research and development company, one subsea contractor, and several design and manufacturing companies.


Kvaerner has developed new technologies for seabed extraction of oil and gas.

## THE SINTEF GROUP <br> A LEADING RESEARCH INSTITUTION

The SINTEF Group is the largest research institution in Norway, and a significant technological R\&D organization on an international scale.

As many technological problems today demand multidisciplinary
involvement, one of the strengths of the SINTEF Group is the interdisciplinary structures it has established. These specialist centers use the entire potential of the Group by cutting across the traditional academic divisions - giving a vital edge in innovative R\&D.


A scale model of an offshore structure undergoing stability testing in the Ocean Laboratory.


#### Abstract

The SINTEF Group is dedicated to solving the problems of the real world, not just those of the laboratory. More than 70 \% of the annual turnover of NOK 900 million is contracted research for industry.


## INNOVATIVE INFORMATION TECHNOLOGY

The SINTEF Group has opted for the information technology of tomorrow -gallium-arsenide integrated circuits. These ultra high speed circuits are faster than their silicon counterparts, and have innumerable applications, particularly in communications.

Satellite communications is one such area, where the SINTEF Group is actively involved. Society is increasingly dependent on the fast transmission of large amounts of information. Here, satellite communication systems are proving invaluable.

SINTEF's Electronics Laboratory (ELAB) is supplying software for the new emergency warning system SARSAT. This is a global satellite navigation system employing 18 satellites. When completed, rescue services in different countries will be able to receive distress signals giving any position on the globe with an accuracy of 100 metres.

## THE OFFSHORE CHALLENGE

Norway's considerable engagement in oil and gas production in the North Sea implicates that a large proportion of the research work done in the SINTEF Group is associated with petroleum. This makes the Group one of the largest and most significant centres of this kind of research in Europe.

As exploration moved into deeper and colder waters, offshore-related research at the SINTEF Group is now focused on a range of new technological challenges. The Group is at the forefront of petroleum-related R\&D in Arctic technology, deep-water diving operations and production systems.

## ROBOTICS AND AUTOMATED GRINDING

Land-based industry remains the SINTEF Groups' largest and most significant sector for contracted research. SINTEF's Production Engineering Laboratory is collaborating with the Norwegian industrial company Kongsberg Våpenfabrikk A/S, the American aircraft industry, and the US Air Force to develop more efficient automated production methods for the turbine blades used in the F-16 fighter aircraft.

This project is financed by the US Air Force, and the results are now successfully implemented at Kongsberg.

## MONO-SIZED PARTICLES - A SCIENTIFIC BREAKTHROUGH

One of the research teams has proved the world wrong by achieving the 'impossible' producing mono-sized polymer beads on Earth in defiance of the forces of gravity. This remarkable scientific breakthrough has already found a large number of medical and industrial applications. Intensive, on-going research in a number of hospitals all over the world has already meant that magnetic beads from these particles can be used to remove certain types of cancer cells.

## ADVANCED LABORATORY FACILITIES

The rapid pace of technological development necessitates advanced scientific equipment and special-purpose laboratories. The SINTEF Group's close association with the Norwegian Institute of Technology Scandinavia's largest technological university -has not only resulted in shared laboratory facilities between the two institutions, but also joint investments such as the acquisition of a CRAY X-MP supercomputer.

The SINTEF Group operates a number of special-purpose laboratories: the TwoPhase Flow Laboratory - the largest of its kind in the world, the Ocean Laboratory for testing ships and other marine constructions, and laboratories for icing, turbines and testing the surfaces of materials. One of the latest laboratories is concerned with research into nuclear-magnetic resonance.


Splicing of optical fibers by gas welding. This allows fibers of different diameters to be spliced.


Research on gas and liquid two-phase flow is well advanced at the SINTEF Group's Two-Phase Flow Laboratory - the largest of its kind in the world.


It has become tradition for the SINTEF Group to help other countries in their technological development. One such project is the assistance given by the Computing Centre at SINTEF in establishing a new data research and training institute in Beijing, China.
industry, organizations, public service agencies, government departments and other clients.

The research activities are mainly concentrated on the following fields:

Civil and Structural Engineering
Electricity Supply
Information Technology
Machine Design and Production
Engineering
Material Technology, Chemistry and Biotechnology
Marine Technology and Fluid
Dynamics
Petroleum Technology and Geosciences
Sosial Research

> THE SINTEF GROUP NORWAY'S LARGEST RESEARCH ORGANIZATION

> The SINTEF Group consists of the Sintef Foundation (parent company) and three research companies: Continental Shelf and Petroleum Technology Research Institute A/S (IKU), Norwegian Marine Technology Research Institute A/S (MARINTEK) and The Norwegian Research Institute of Electricity Supply A/S (EFI). The Group is a not-for-profit organization with a staff of about 2,000 engaged in all aspects of contracted research for

## LOOK TO NORWAY

## GECO NORWAY - A WORLD LEADER IN OIL EXPLORATION

The Norwegian oil exploration company GECO has experienced dramatic growth during the past few years. The company was established in 1973, and after a careful consolidation period, results developed rapidly. In 1980 the company had over 500 employees, and turnover reached NoK300 million. Now the company has over $\mathbf{2 , 0 0 0}$ employees, and the turnover is NoK1.7 billion. GECO's earning power is substantial, and future prospects are very favourable.

Highly-skilled employees, team spirit, ingenuity and outstanding effort in the development of new technology are some of the special features of GECO. Today it is the world's second largest marine seismic service company, and a leader in related research and development; examples of which are new technology for digital listening cables, exploration with two cables, and three-dimensional exploration. These cables are used to explore geolocial structures below the sea bed.


GECO GAMMA is one of GECO's 17 special seismic survey vessels used for oil and gas exploration. It is one of the most advanced ships of its kind in the world today.
GECO GAMMA recently performed a three dimensional (3-D) survey in the North Sea's Gullfaks field, which according to industry experts is one of the most technologically advanced 3-D surveys ever completed.
The ship has powerful onboard computers for system control, quality control, data reduction and recording.

## SUPER BRAINS

Today GECO operates seventeen of the world's most advanced specialised vessels for offshore oil exploration - a fleet that is active throughout the world. The company is also engaged in seismic surveys onshore, with assignments spanning several continents.

In the first quarter of 1986, GECO made considerable investments in the EDP sector, further strengthening its position as Europe's largest user of computers. Two supercomputers are to be installed at Geco's processing centers in Stavanger and London, at a cost of NoK130 million. These machines will considerably improve the processing capacity at these centers.

## COMPETITIVE ADVANTAGES

Vast amounts of data are collected and processed in oil exploration. The quality of this data is closely dependent on the available survey equipment and technology. The fact that GECO's vessels today are able to tow not only one, but two exploration cables, represents a significant increase in capacity compared to its competitors. GECO's three-dimensional explorations produce even better data quality, which again reduces the economic risk involved in oil drilling. The new concentration on supercomputers will also contribute to improved data quality and shorter processing time. All these factors will lead to a further strengthening of GECO's position on the world market.

## COMPLETE PACKAGES

GECO has always considered it essential to offer oil companies complete packages of services and products. In other words, it is not only the two-dimensional and three-dimensional 'sectional drawings' of the earth's structure that represent GECO's ability to identify viable oil and gas sources. GECO has also developed laboratory services to examine samples of rocks, oil and gas, and to carry out source tests.

GECO is also engaged in the exploration of fields under extraction, and offers logging and seismic surveys of drilling wells through the subsidiary company GECO Well Services. In these surveys, a sensor is submerged into the well. Logging is necessary both in exploration wells and production wells, and is consequently carried out both from floating drilling rigs and fixed platforms. This service is considered an important area of growth for GECO, and means that GECO is the only company in the world offering a complete information package on a reservoir, including seismic surveys, laboratory tests, logging, and simulation and evaluation of the reservoir.


GECO has made some important developments in the marine seismic industry. Some of these include the utilization of three dimensional (3-D) surveys; GECO's introduction in 1983 of CHARISMA, an interactive workstation for interpretation, manipulation and presentation of 3-D data; as well as a system called OMNISEIS which the company has developed for 3-D seismic acquisition.


These magnetic tapes represent just a small portion of the seismic data that has been acquired during exploration surveys. The data is sent to one of GECO's intemational centers for further processing and interpretation. Powerful Amdahl supercomputers like the VP1100, located at the company's centers in Stavanger and London, handle the enormous data volumes stored on these tapes.

## THE GECO GROUP

The GECO Group has several subsidiaries in different parts of the world, each engaged in one or more of the activities mentioned above. In Norway the Group also comprises a number of companies operating in other sectors. Fjord Instruments in Knarvik, near Bergen, produces and repairs seismic cables for GECO's fleet and for
other customers. Getech, in Horten, develops and manufactures products in the micro-electronic area.

The GECO Group has representatives in the following cities: Oslo, Stavanger, Bergen, Trondheim, London, Houston, Singapore, Dubai, Wellington, Canton/Tanga, Jakarta and Rio de Janeiro.

## LOOK TO NORWAY

## GAS FOR EUROPE

When the Norwegian state oil company Statoil commenced its drilling operations in 1975, the sceptics had a field day. But when Statoil completed its 100th offshore well in the autumn of 1985, and had found either oil and/or gas in 72 of these wells, most of the sceptics were silent.

Statoil is 14 years old in 1986. From 1972 the company has grown from zero to become the largest company in Norway in terms of sales, and it is also one of the largest Scandinavian companies. By the end of 1985, Statoil had about 7,000 employees compared to merely two in 1972.


Landing of a pipeline in Western Norway involved the installation of a precast concrete tunnel here being installed.


The pipeline being pulled ashore at Kalsto, where the gas pipeline is landed.


The Statfjord field is the largest North Sea field, here the latest and last platform, Statfjord C in operation.

## DRIVING LESSONS

From being a participant and learning the offshore oil and gas business by taking 'driving lessons' from the international companies, Statoil gradually mastered the various disciplines.

It became operator of its first drilling operation in 1975, managed the Statfjord shuttle tankers from 1978, and was responsible for the large Gullfaks field development project and the Statpipe gas-gathering pipeline system in 1981. These two latter projects, which are among the largest and most complex in the world, were developed exactly to plan and budget.

## STATPIPE

Statpipe is a gas-gathering system for transportation and treatment of gas from the Statfiord, Gullfaks and Heimdal fields. At 880 kilometres it is the longest underwater pipeline system in the world, yet it was completed close to three months ahead of schedule, in October 1985.

## SUPPORTING EUROPE

For several years the gas from the Ekofisk field has reached customers in many European countries. When production of gas from Ekofisk decreases, the gas from the Statpipe system will become an important source of energy for Continental consumers, both in this century and far into the next. All over Western Europe a finemeshed grid of pipelines is distributing gas to consumers. The transportation system will make it possible for Norway to sell gas from the North Sea to customers all over Western Europe, right down to the southern part of France.

## NEW INDUSTRY

Why was Statoil established in 1972 ? Through the first years of offshore exploration, the Norwegian government had come to realise that it was only through direct participation that Norway and Norwegians had a real chance to acquire insight and know-how, and to influence decision making in this new industry. From then on, licenses were negotiated on the basis of state participation. Statoil was established as a 100 per cent state-owned company, to handle the State's business interests. Development of operational responsibilities was considered essential in order to acquire know-how and improve Norwegian competence.

## YOUNG AND CAPABLE WORKFORCE

By developing a young, capable and active offshore workforce, Statoil has gained a large wealth of knowledge and an exploration staff with a current average of eight years of North Sea experience. Statoil has also the largest staff of geologists and geophysicists in Northern Europe. In total this means that the company probably knows more about the North Sea than any other oil company.

## INTEGRATED OIL COMPANY

From its basis on the Norwegian Continental Shelf and with expansion of its refining and petrochemical capacity during the next few years, Statoil will soon be a fully integrated oil company, able to offer wide-ranging know-how and expertise to the rest of the world.

During the past few years, Statoil has adopted a more aggressive policy towards
refining, marketing and petrochemicals. In 1985, for example, Statoil purchased Esso's entire Swedish operation. Similarly, the company has recently commenced production participation off the Netherlands, and is making applications for acreage off Denmark and Great Britain.

Statoil is also involved in a study project off Thailand and consultancy work for Tanzania.

In the downstream area, in addition to Sweden, a trading office in London for crude oil and other products was established in 1985. A similar office in the U.S.A. will be established in 1986 .

In 1979, Statoil became adviser to the Chinese National Offshore Oil Corporation and the Chinese Government. Its engagement was a vital step in the formation of Chinese offshore oil policy. A venture with Total and Cluff Oil has been established, and the first oil production from China will commence in late 1986.

## STATOIL

Statoil - The Norwegian state oil company - is today Norways largest company and also one of the larger in Scandinavia. The company was established in 1972 and has today 7,000 employees. Statoil is engaged with major owner interests in all oil and gas fields on the Norwegian Continental Shelf. The company is also involved in oil and gas exploration in other areas, and became in 1979 adviser to the Chinese National Offshore Oil Corporation and the Chinese Government.

## NORSK DATA BREAKS WITH TRADITION


#### Abstract

Norsk Data is no ordinary company. From any perspective, national or international, the development of this young Norwegian computer company has been dramatic. During the last 13 years, the company has increased its sales from NoK24 million to NoK1,880 million. Every year, Norsk Data has grown


faster than the market and made inroads on its competitors. The average annual growth of sales and net profit is 45 and 61 percent respectively. In 1985, Norsk Data achieved higher profit margins, higher productivity, and higher earnings on equity than American suppliers of mini-computers.

From a basic 2D section with dimensions in either metric or imperial measurements, to a full colour 3D display. ND-TECHNOVISION brings you the design of the future, today.

$\mathbf{N}$orsk Data's success is a result of its willingness and ability to evaluate and concentrate on non-traditional areas. In 1984, in order to obtain a footing in the French market, Norsk Data entered into a momentous collaboration agreement with the French group MATRA.

## STRENGTH

Norway has 4 million inhabitants about the same number as the Boston area in Massachusetts, U.S.A. Both these areas are too small to support a viable industry on their own. The difference is that for an American supplier, Boston is only a small part of a big national market. Looking at the data industry throughout the world, you will see that all suppliers of computers have a large domestic market. On the face of it, this lack of a large domestic market for Norsk Data would seem to be a disadvantage for the company. But in fact it has become its strength.

## HUMAN RESOURCES

Norsk Data's most important resource is its employees. According to its clients, the vitality of its employee participation is quite unique. The entire workforce is highly motivated towards international competition and inspired with a remarkable fighting spirit.



Forty miles west of London stands the Georgian mansion Benham Valence, once the home of English nobility, now the European headquarters of Norsk Data Ltd.


## WORLDWIDE GROWTH

Norsk Data learned very early how to fight for orders on the world market. The breakthrough was in 1973, when Norsk Data's first foreign subsidiary was established in Ferney-Voltaire, not far from Geneva. Its establishment stemmed from Norsk Data's contract with the European research institution CERN. From this subsidiary the company's computers were exported to Great Britain, West Germany, Belgium, France, Italy, Luxembourg and the Soviet Union.

Norsk Data has today eleven wholly-owned subsidiaries outside Norway, with a total of 57 offices. Other markets are managed by agents. The company's shares are quoted on the Stock Exchanges in Oslo, London, Stockholm, Frankfurt, Hamburg, Munich and the U.S.A.

## COMBINED FORCES

France is an especially important market for Norsk Data. Alone, it accounts for twenty per cent of the total European market for the type of computers developed and produced by the company. But it is difficult to get a footing in the French market without a strong subsidiary, or collaboration agreements with French-owned companies.

After the French Space Administration, CNES, had recommended Norsk Data's 32 bit super-mini computers for its next five-year programme, Norsk Data entered into a comprehensive and - in European terms pioneering agreement with the French company MATRA. A large industrial group with 10 subsidiaries and more than 33,000 employees, MATRA is heavily involved in areas such as information technology, electronics, robot technology, space exploration and defence systems.

## BECOMING FRENCH

The agreement with MATRA gives the company responsibility for marketing, sales and customer support for Norsk Data products. In the first phase the products will be sold under the MATRA name in France and in Italy. In addition, MATRA plans to extend marketing to other countries in south Europe with close connections with France, and has started production of Norsk Data computers in France. There is also provision for collaboration in research and development.

## NORSK DATA

Norsk Data is a European company in the information industry, which develops, produces and markets a number of general and compatible mini-computers, from 16 -bit models to 32-bit models. Norsk Data's computers are used alone and in networks, for office automation, administrative, scientific and technical purposes. In 1985 the company's sales amounted to NoK1,880 million, with 2,800 employees.

However, the company is also more than a mini-computer specialist. Norsk Data's main development area is the broader field of integrated information systems. These systems combine hardware with software and communication equipment, including related services for the end user, and are designed to assist users in their daily work by providing input from an on-line information network.

## A LEADER IN FERTILIZERS


#### Abstract

From being a regional Scandinavian producer of fertilizers, Norsk Hydro has during the past few years become one of the world leaders. This expansion has been achieved from acquisition of large European fertilizer companies, and from investments in new production units. In a time of over-production and other problems for many fertilizer companies, Norsk Hydro has chosen to make a strong bid for leadership.


There is always the opportunity to be the best within an industry, and Norsk Hydro has decided that this goal is within its reach. The key factor is Norsk Hydro's faith in its own competitive ability in the fertilizer field. The company has major assets in its own developed technology, a solid engineering basis and a strong will for new investments.

## NORWAY'S LARGEST COMPANY

Norsk Hydro is Norway's largest industrial company, with a turnover of more than NoK 40 billion and 31,000 employees.

The company has made considerable investments in fertilizers, light metals, petrochemicals and of course oil and gas. The common denominator for all these activities is energy - just as it was the basis for the establishment of the company in 1905. At that time the world's first industrial nitrogen fertilizer was produced by Norsk Hydro by means of electricity from Norwegian waterfalls. Fertilizer production is still a primary area of activity, and this has been further strengthened during the past few years through extensive international expansion.

Norsk Hydro owns 25 per cent of the Qafco fertilizer plants in the state of Qatar in the Arabian Gulf. Norsk Hydro operates the plants and markets the fertilizer.



## FOOD FOR PLANTS - AND PEOPLE

The simple strategy behind Norsk Hydro's investments is that fertilizers represent food for plants, which in turn become food for people. Fertilizers are therefore essential to the world's food production. Even within an industry characterized by over-production there will always be a future for the best producers and Norsk Hydro considers itself to be one of the best - with highly efficient, modern, well-planned production plants.

Norsk Hydro has always aimed to have the most advanced production processes. During the past few decades it has therefore invested considerable amounts in the development of its own technology and in modern and energy efficient factories. During the past few years alone, Norsk Hydro has invested approx. NoK1 billion per year in new production equipment to ensure the company's competitive ability in the future.

## OWN GAS RESOURCES

The biggest cost in the production of nitrogen fertilizers is the processing of ammonia. Considerable quantities of energy, most of it from natural gas, are needed. Norsk Hydro has a solid energy base through the company's own involvement in the exploration and production of oil and gas.

The fact that Norsk Hydro is still making considerable investments in the fertilizer area is the direct result of the company's long-standing commitment to leadership in production and marketing.


Thanks to Norsk Hydro's active participation on the Norwegian Continental Shelf, the company has a secure supply of raw materials for its petrochemical activity. This picture is taken inside a 'cracker', one important step in the production of petrochemicals.

The Norsk Hydro 'viking ship fertilizer' can be seen in more than 50 countries all over the world.

Even if it is obvious, however, that fertilizers will continue to play a major role in the world's production of food, future market prospects are not bright. Producers, especially in Europe, are facing stagnating consumption in their home markets. Export to distant markets is risky and less profitable because of high energy, labour and environmental costs, together with the high cost of transport from Europe. The result is over-production of fertilizers on the European market.

## ON THE OFFENSIVE

Norsk Hydro has taken up this challenge and is playing a major role in the restructuring of the European fertilizer industry. From its production base in Norway, Norsk Hydro's fertilizers were up to the end of the '70s primarily sold in Norway, Sweden and Denmark. A marginal part of production was sold to the U.S.A. and the Far East. Overseas sales are often sensitive to fluctuations in the market, and the main task became to strengthen sales in Europe.

The restructuring has been carried out through a series of take-overs which started in 1979 with the purchase of NSM, the second largest producer of fertilizers in the Netherlands. In 1981, Hydro bought a majority holding in Supra, the only Swedish producer. In 1982, Norsk Hydro took over the fertilizer division of the chemical company Fisons in the United Kingdom, thus becoming an important producer of fertilizers on the British market. When Norsk Hydro acquired Ruhr Stickstoff in 1985, it achieved a strong position on the West German fertilizer market.

Hydro also has a substantial share of the large French fertilizer market after acquiring the French fertilizer producer Cofaz in 1986. This increases Hydro's fertilizer production by more than 25 per cent and at the same time means that Norsk Hydro now has local production units in all the largest fertilizer markets in Europe.

## NORSK HYDRO

Norsk Hydro is Norway's largest industrial company, with a turnover amounting to more than NoK40 billion, and with 31,000 employees. The company's main business areas are fertilizers, light metals, petrochemicals and oil and gas production. Norsk Hydro has production companies in many countries, and has interests in the major oil and gas fields on the Norwegian Continental Shelf. ,

## TINY PLASTIC BEADS - A MAJOR PRODUCT

Microscopic plastic balls (i.e. beads) of exactly identical size - so small that there is room for up to four million of them on one square millimeter. This important product is made by only one company in the world: Dyno Particles A/S - a subsidiary of Dyno Industrier A/S. These microscopic plastic particles, sold throughout the world and marketed under the name 'Dynospheres', are of revolutionary importance for applications ranging from cancer treatment to the production of liquid crystal screens for computers.

It is true that the Americans also have managed to produce similar microscopic particles. However, the American production took place in zero gravity conditions in a space shuttle - both more cumbersome and entailing enormous production costs. But thanks to the Norwegian Professor, Dr. John Ugelstad's remarkable discovery, Dyno Particles are producing these 'monodisperse polymer particles' in Lillestrøm, outside Oslo, for only a fraction of the cost.

SEM micrograph of Dynospheres M-450 SAM particles with anti H2 monoclonal antibodies, attached to hepatocyte.


Production-scale chromatography column.

## CANCER TREATMENT

It is hard for the lay person to understand that these completely homogeneous plastic beads, produced in sizes from 0.5 to 100 micron (one micron is equal to one thousandth part of a millimetre) are of such great importance. But important they are, particularly in the research and treatment of certain forms of cancer.

After special treatment of magnetizable Dynospheres (attached to monoclonal antibodies), they can be used to eliminate certain forms of leukaemia and other forms of cancer occuring among children, e.g. neuroblastoma. Common to all these forms is the spreading of cancer cells to the bone marrow.

## KILLING CANCER CELLS

By removing the bone marrow and mixing it with magnetized particles treated with a special type of antibody, the modified particles (immuno-beads) attach to the cancer cells and are then removed with a magnet. After heavy irradiation of the patient, the extracted marrow, which now consists only of healthy cells, is placed back in the bone. If the treatment is successful, and all cancer cells are killed, the purified piece of bone marrow will produce new marrow, free from cancer cells.

In medical research, Dynospheres are today used by The Norwegian Radium Hospital and Rikshospitalet in Norway, and by several other hospitals in Europe and USA; the European Molecular Biology Laboratory, and the Heidelberg and Memorial Sloan-Kettering Cancer Centre, USA.

## SUCCESS

Dynospheres are also used in the purification of pharmaceuticals and other biotechnology products by chromatography. By using Dynospheres modified for such applications, the purification and separation of chemical and biochemical components in liquids can be carried out faster and much more efficiently than ever before.

The Swedish company Pharmacia has developed a unique system for analytical chromatography, called the FPLC-system, using modified Dynospheres as column material. The system has today a leading position on the world market.

Other interesting areas of application include diagnostics, calibration and standardization, carriers for enzymes, biosynthesis, toners for photocopying and spacers in large liquid crystal displays.

Dyno Particles is currently engaged in commercial development of Dynospheres within many fields all over the world. The interest and respect that these products are

met with by some of the world's leading scientists are a great tribute to Norwegian technology.

## LIQUID CRYSTALS

One of the very interesting areas where Dynospheres are of revolutionary importance is liquid crystal computer screens. To make the screen, the liquid crystal material is placed between two even glass plates. It is critical that the minute distance between the plates is absolutely uniform - a requirement which is easily achieved by adding microscopic, homogenious Dynospheres to the liquid crystal material.


Plastics fueltank system for the automotive industry.

## DYNO INDUSTRIER A/S

DYNO is one of Norway's largest and most prestigious industrial enterprises. The origin of the company dates back to 1865 , when production of dynamite started, based on a license under patents of Alfred Nobel.

In 1985, DYNO had revenues of NoK3.4 billion (approx. US\$ 475 million). The number of employees is about 4,100. Operations are to a large degree internationally oriented, and today there is about 20 foreign DYNO production facilities around the world.

DYNO is one of the world's leading manufacturers of civilian explosives and the largest in North America. Explosives for defence purposes are also manufactured.

The Chemicals Group is known worldwide for its range of adhesives and resins for wood-working, paints, etc. Research activities are concentrated in a separate division, in which one prime research area is 'monodisperse polymer particles'.

DYNO's Plastics and Packaging Group is one of the largest plastics processing enterprises in the Nordic countries. Emphasis is put on technical products, such as systems and components for automotive, electro-mechanical and telecommunication industries.

On the offshore market, DYNO offers expertise in drilling technology, CAM/CAD applications and other services.

## THE WORLDWIDE NETWORK OF BARBER WILHELMSEN AGENCIES A/S

Since the dawn of history, Norway has been one of the world's great seafaring nations. Today Norwegian shipping spans the seven seas ... and so, too, does the Norwegian shipping agency Barber Wilhelmsen Agencies A/S (BarWil). This subsidiary of the well-known 125-year-old shipping company Wilh. Wilhelmsen Ltd, offers a wide range of shipping services through its worldwide network of agencies.

BarWil is the world's biggest shipping agency chain, operating an agency network of 47 offices in the USA, the Middle East, South-East Asia, the Far East and Australia. These offices are wholly or partly owned by Wilh. Wilhelmsen. In addition, the shipping company has equity holdings in a number of agency offices in Europe, all associated members of the BarWil chain. Including companies in Europe, the operation embraces 61 offices with a total of about 2,000 employees.


The liner trade has always been the foundation of Wilh. Wilhelmsen's activites. The company's modern liner vessels are servicing most of the world's major trading areas. The Ro/Ro vessels form the core of the liner fleet.

## 600 COMPANIES

BarWil today represents more than 600 different shipping companies, charterers and insurance companies. With its wide geographical spread, the Barber Wilhelmsen Agencies occupies a leading position in the shipping agency sector. Acting as an extended arm for the ship owners and other clients whom it represents, one of the company's main job is to solicit cargoes. In addition, the agencies are directly involved in the loading and discharging of ships, purchasing of bunkers, forwarding, inland transport, supplies, crew changes and a number of more specialised functions. Each BarWil office has established a network of local contacts of great value for its clients.

## NEW AGENCIES

A number of new co-operation agreements were concluded during 1984. These include joint ventures with Transocean in Sydney and Melbourne, Transocean in London, and Aall \& Co. in Japan. Offices were opened under the latter agreement from 1st April 1985 in Tokyo, Nagoya, Osaka and Yokohama. New offices were also established last year in Seattle, Portland and Panama. In addition, BarWil has concluded a joint venture with Frionor in Australia.

## CREW BOATS

Through its offices in Dammam and Hong Kong, the company now operates a total of 13 vessels, three of which were delivered during the first quarter of 1985. The crew boats serve tramp and tanker clients in the Middle East as well as oil installations. 4 units are operated in Indonesia.

BarWil markets its services actively worldwide, and is constantly evaluating opportunities in new locations. The range of services is under continuous assessment, too. BarWil places great emphasis on the development of its personnel. Offshore and onshore, employees are given the opportunity to develop their capabilities through management positions in agency offices around the world. This forms a very important aspect of the shipping company's international operations.

## WILH. WILHELMSEN LIMITED A/S

Barber Wilheimsen Agencies $A / S$ is a subsidiary of Wilh. Withelmsen Limited $A / S$, the leading Norwegian shipping group and offshore contractor. The Group is involved in liner, tanker, car and bulk trades, liner agencies, terminals and offshore activities.

Wilh. Wilhelmsen Limited A/S manages a modern fleet of some 100 vessels and seven drilling rigs/ accomodation plafforms. A total of 5,200 people are employed, including 2,000 in the agencies.


Wilh. Wilhelmsen was one of the pioneers in the Norwegian offshore activity and is currently one of the largest Norwegian rig contractors with a fleet of 6 drilling rigs and 1 accommodation platform. The rigs are operated in the Norwegian and British sectors of the North Sea.


Wilhelmsen Offshore Services (WOS) operates a fleet of 64 offshore support vessels. The company has achieved a leading position in the market for large contingency vessels. For several years WOS has been actively engaged in markets outside the North Sea, like Brazil, West-Africa/Mediterranean, US Gulf and Far East.

# LINKING KENYA AND SUDAN 


#### Abstract

Every year, the Norconsult Group is actively engaged in projects in some $\mathbf{5 0}$ to $\mathbf{6 0}$ countries worldwide, and is currently working on major projects such as the erection of 1,400 prefabricated houses in Iraq; a cement plant in Peru; a hydropower project in Burma; one of the world's largest telecommunication contracts in the planning and design of Thailand's 700,000-line national telephone system; and a new road link between Kenya and Sudan.


## SUDAN

## KENYA AND SUDAN DIRECT ROAD LINK

When the Governments of Kenya and Sudan agreed to build a direct road link between Southern Sudan, Nairobi, and the major East African Port of Mombasa, the Norconsult Group was chosen to carry out feasibility studies, preliminary engineering, detailed engineering work, and construction supervision.

Southern Sudan has a largely subsistence economy. Due to lack of roads, the difficulties of transport to and from the region have made exports and imports slow and unreliable, and greatly restricted development.

During the 6 months period of rain, the shortest passable route from Port Sudan to Juba is $3,200 \mathrm{~km}$, reduced to approximately $2,400 \mathrm{~km}$ during the dry season. The new
year-round road link, from Juba, through the Turkana area to the Port of Mombasa is only $1,700 \mathrm{~km}$.

The project began in 1978, when Norconsult carried out a feasibility study of the 600 km road link between Juba in Sudan and Lodwar in Kenya. In 1979, Norconsult was commissioned by both countries to undertake the detailed design of the road within a period of about $21 / 2$ years, and in 1981 to carry out the construction supervision. To accomplish this, photogrammetry and computerisation of calculations as well as computerised drafting were used to the greatest possible extent. The fieldwork in this arid and semi-arid area was extremely demanding and requried extensive planning and continuous follow-up work. One of the most difficult tasks was the assessment of the hydraulic regime of the area, which is characterised by
infrequent, but very heavy rainfalls with sudden flooding of rivers and streams. Heavy erosion also represented a major problem. During the project period, Norconsult had between 200 and 300 employees at its Kenya office.

Ease of transportation is one of the basic keys to development. Norway's jagged coastline calls for an endless series of bridges, ferries and harbours, and long distances also necessitate numerous small airports and landing strips. As Norconsult was involved in the planning and design of many of these projects, transport planning and design were among the first fields that Norconsult entered in the overseas market. Since then the company has carried out numerous projects in Nepal, Mauritius, Brazil, Saudi Arabia, the Philippines, Libya, Ethiopia, Malaysia, Thailand, Kenya, Tanzania, Uganda and Sudan.


## ADAPTABLLITY

To Norconsult, adaptability is the keyword. The future will demand more and more on ingenuity in applying specialised knowledge to new problems. Such adaptability is already Norconsult's strength. Norconsult operates as an integrated consulting firm, and its major fields of activity are normally brought together in response to project requirements, in order to achieve optimum project execution. Open and flexible exchange of information and ideas between various specialists is considered essential to achieve efficient planning and design, and is given top priority by Norconsult project teams.

## THE NORCONSULT GROUP

The Norconsult Group of Consultants has a staff of approximately 2,500 which includes planners, engineers, architects, economists and supporting staff, and is one of the world's leading exporters of consulting services. Norconsult operates as an integrated consulting firm in the field of hydropower, petroleum engineering, water and waste engineering, economic research and informatics, transportation, telecommunications, training development and petroleum energy resources management.

## THE PERFECT HOLIDAY

Kloster Cruise A/S has during the past 20 years become the world's leading cruise company, with a market share of about 24 per cent of the world's cruise passengers.

Every year Kloster Cruise A/S, through its two divisions, Norwegian Caribbean Lines and Royal Viking Line, offers more than 325,000 people a holiday totally out of the ordinary, with new pleasures and adventures creating a uniquely exciting and carefree holiday experience.

## A WORLD OF DISCOVERY

NCL's fleet consists of five vessels: the flagship s/s Norway (formerly s/s France) with a capacity of 2,000 passengers, and four white cruise ships with a capacity of 750 passengers each. Every year, this fleet brings 280,000 passengers on a voyage of discovery in the Caribbean Sea: to NCI's own island Great Stirrup Cay in the Bahamas, and thence to Jamaica, Grand Cayman and Conzumel, or to picturesque and popular St. Thomas and Nassau, also in the Bahamas.

RVL's three ships, with a capacity of approximately 750 passengers each, offer worldwide itineraries, travelling with the sun.

## DREAMS COME TRUE

It was in 1966 that a small Norwegian-registered ship, Sunward, first sailed across the Atlantic to Miami and was used for three and four-day cruises to the Bahamas. This was the birth of Norwegian Caribbean Lines. But it was not only a newly established cruise company that saw the light of day. Sunward also marked the birth of a totally new type of cruise, and an entirely new way to fulfill people's dreams of the perfect holiday.


S/S Norway - on a cruise in the Caribbean Sea; a once in a lifetime experience.

## THE AMERICAN MIDDLE CLASS

Compared to other cruise ships of those days, e.g, the Queen Mary, the new Sunward, with its compact modern diesel machinery, was less expensive to operate. Indeed, Sunward's capacity of 450 passengers was equal to the capacity of older ships some three or four times larger.

The result was considerably lower prices on Sunward than for traditional cruises from New york. Cruising suddenly became a realistic holiday notion for the American middle class.

## THE NEW MARKET

This situation formed the basis for the buoyant growth in the world's cruise market from the late 60 s . From about 200,000 cruise passengers each year during that period, it is now estimated that almost two million people annually take a cruise holiday.

## THE U.S.A.

From its original concentration on local markets around Florida and New York, the cruise market has expanded during the '70s and ' 80 s to embrace the entire Western hemisphere.

Florida, and in particular Miami, took over New York's role as the most important cruise port, and the seven-day cruise became the most important product on the market. This market may be divided into three segments: standard, premium and luxury. With its top modern fleet, Kloster Cruise A/S today offers its cruise passengers a choice in all three categories. The company's major shareholder is the Norwegian shipping company, Kloster Rederi A/S. The owners have considerable confidence in the future of the market and has through determined investments developed into the world's leading cruise company.

## US\$ 120 MILLION

Towards the end of the '60s and in the beginning of the '70s, Kloster Rederi A/S started a consolidation of its activities as shipowners towards a concentration of cruise operations. A fleet of four special cruise ships was built, all of them intended for Miami traffic. In 1979 the company bought the $\mathrm{s} / \mathrm{s}$ France. In only 36 hectic weeks the ship was extensively rebuilt to become the cruise ship $\mathrm{s} / \mathrm{s}$ Norway. After a total investment of more than US $\$ 120$, the world's largest cruise ship was ready in May 1980 for seven-day cruises from Miami, with a capacity of 2,000 passengers.

## KLOSTER CRUISE

Kloster Cruise $\mathrm{A} / \mathrm{S}$ is the world's largest cruise company, with a total market share of just under 24 per cent. In 1985 , total sales amounted to NOK 4,319 million with 4,180 employees.

In addition to the five NCL cruise ships, the company in 1984 aquired Royal Viking Line which offers worldwide luxury cruises through its three sisterships in the Royal Viking Line fleet.

A cruise can be much more than sunshine and palmy beaches, depending on your own preferences. Here, one of the white cruise ships of the Royal


## LOOK TO NORWAY

## NYCOMED MADE A BID - AND WON

The Company of the Year in Norway. In 1984 this accolade was awarded to the pharmaceutical company Nycomed (formerly Nyegaard \& Co AS - Nyco). From first initiating intensive research in the early ' 50 s , Nycomed is today one of the leading pharmaceutical companies in its specialised field of X-ray contrast media - solutions used to outline body organs and blood vessels in medical X-ray examinations. Working in vigorous competition against the giant international pharmaceutical firms, Nycomed is showing strong growth in turnover and profit every year. Since 1984 it has increased total revenues by 45 per cent to NOK 620 million in 1985 with a profit of NOK 122 million 20 per cent of the total.

X-ray picture demonstrating the arteries supplying the brain and skull after injection of a contrast medium.


Nycomed's confidence in its own strength and capability has repaid handsomely. This did not happen overnight, but through concentrated, long-term research. Today the Nycomed product Amipaque, used in examinations of the spinal canal, is the market leader in the U.S.A. and Japan. The company's latest product, Omnipaque, dominates the West German market, and has recently been approved by the American Health Authorities for sale in the U.S.A. Nycomed's operating income from contrast media constituted approx. NOK 370 million in 1985, compared with NOK 260 million in 1984. Over 90 per cent of this turnover comes from sales outside Norway.

## NO SIDE EFFECTS

Nycomed's contrast media have almost no side effects. This is a great advance for patients undergoing X-ray examinations. In previous times, the injection of X-ray opaque liquids in vessels and tissues could often be a very unpleasant experience.

## 10,000 M ${ }^{2}$ AND NOK 150 MILLION

Nycomed's emphasis on research has given the company a unique position in the contrast media market. Since the middle of the'50s, the company has dedicated itself to future-oriented research within this one small field. The company's policy of concentration is firmly founded; for many years some 15 per cent of total turnover has been invested in research, and at present as much as 18 per cent. This is at least equal to and probably more than - many of the international giants' percental investments in new product research and development. Today one-fourth of all employees in Nycomed are involved in research and development, to ensure that the company keeps its position of specialised market leadership. And to underline the company's determination to retain this position in the field of X-ray contrast media, Nycomed has recently completed a new $10,000 \mathrm{~m}^{2}$ research unit in Oslo at a total cost of NOK 150 million.

## WORLDWIDE LINKS

Today Nycomed owns four production sites in Norway, and subsidiaries in Denmark, Sweden, Holland, Belgium and the U.K. In addition, the company has licence agreements with the pharmaceutical companies Sterling Drug Inc. in the U.S.A. and Schering AG in West Germany, and


A radiologist examining a patient by means of digital arteriography using Omnipaque.
marketing arrangements with agents in a number of other countries. As well as concentrating on X -ray contrast media, Nycomed is also developing other areas. Recently the company bought Seragen Inc. in Boston, U.S.A., a bio-technological company engaged in advanced research associated with the detection and treatment of cancer. Together with Trimedyne Inc. in California, Nycomed also has established a joint venture company in the U.K. - Nytech (U.K.) Ltd. to continue development and marketing of products for examination and treatment of damaged and blocked vessels.

## SINCE THE '50s

After starting research on contrast media in the'50s, it was in 1961 that Nycomed began to market Isopaque - the first of a range of X -ray opaque media, which has since been much developed and improved.

In 1968, a research project was started based on a proposal of Dr. Torsten Almén, a Swedish radiologist. The intention was to develop a non-ionic water-soluble contrast medium with fewer side effects and greater safety for the patient. This led to the launch in 1974 of Amipaque, the world's first contrast medium of its kind. This product represented a major medical breakthrough, and has become of considerable importance in the examination of the spinal canal by the method known as myelography.

## CONTINUED RESEARCH

Amipaque soon dominated this market segment despite its high price. Even today, Amipaque is the leading contrast medium for myelography in several countries, the U.S.A. and Japan being the largest markets.

## Amipaque has, however, two

disadvantages: it is very expensive to produce, and it is not thermostable. It must be supplied freeze-dried, and dissolved before use.

Nycomed therefore continued its research to develop a product without these disadvantages. The research resulted in Omnipaque launched in 1982, which is both less expensive and tolerates heat-sterilisation. This means that it is much easier to use by the medical staff. Today, Omnipaque is already used in more than 30 countries, including the U.S.A., and approval from health authorities in many other countries is expected in the near future.

Nycomed continues its research into contrast media in order to satisfy new demands for imaging technology in the diagnosis of patients worldwide. Today, the company is concentrating on the development of media for more specialised $X$ ray uses, together with advanced products to improve image quality in MRI (Magnetic Resonance Imaging) exarninations.

## NYCOMED

From May 1986 Nycomed is part of the Hafslund Group, one of the largest industrial enterprises in Norway.

After the incorporation of AFI (AS Farmaceutisk Industri) in the group in 1985, Nycomed has become the biggest supplier of pharmaceuticals on the Norwegian market. Jean Mette AS was also included in the Nycomed Group in 1985. This company has specialiced in marketing medicaltechnical equipment.

In 1985, Nycomed's total revenues amounted to NOK 620 million, of which X-ray contrast media amounted for 60 per cent. From spring 1986 the Nycomed Group has about 800 employees.

Amipaque, Isopaque and Omnipaque are registered trademarks of Nycomed.

# DET NORSKE VERITAS: IN THE FOREFRONT OF TECHNOLOGY 

Interaction between human beings and technology demands a constant updating of our scientific knowledge. Today, we are challenging nature and our environment in many new ways. Advances in technology and production methods mean that quality assurance, reliability and safety have become critical factors in our modern society.
A.S. Veritas Research is a new subsidiary of the Veritas Group. Det norske Veritas has long been one of the world's leading classification societies; since the early days of oil exploration and production in the North Sea, Veritas has become recognized, too, as a pioneer in the field of offshore safety and quality assurance.

The Veritas Centre at Høvik outside Oslo. Head office for the Veritas Group.


## INTERNATIONAL R\&D CO-OPERATION

A.S. Veritas Research, established in 1984, is already one of the most important international research bodies in the industrial, offshore and marine fields. The company is devoted to long-term applied research in -for example - mathematical and numerical methods, hydrodynamics, materials, structures and process technology.
A.S. Veritas Research has entered into long-term research co-operation with universities widely acclaimed in the relevant disciplines. More than half of the employees in Veritas Research have doctor degrees, and are experienced in many different areas of industrial research and development.

## MARKET-ORIENTED RESEARCH

Safety and quality must be built into systems and products, at every stage from design to operation. Consequently, Veritas does not limit itself to being an inspection body alone; it also aims to contribute actively to the highest safety and reliability standards required by clients and authorities.

Hence the Veritas Group invests about eight per cent of its turnover in research and development, a quarter of this in long-term applied strategic research, planned and implemented by A.S. Veritas Research. The time for the results of this research to reach the market is generally three to five years.

Multidisciplinary knowledge, ranging from field experience to advanced experimental and calculation methods, has established the Veritas Group as a leading authority in promoting safety and reliability.

Currently three programmes dominate our $R \& D$ work:

## OIL/GAS PRODUCTION FROM MARGINAL FIELDS

As offshore oil and gas exploration moves into deeper waters and more hostile environments, increased emphasis must be placed on the safety and reliability of offshore production plants. A major programme focuses on the total production system and its critical components, with particular emphasis on functional requirements and the risk of internal damage.
'Expert system' computer programmes accumulate the knowledge gained, and make it available when it is needed.


Colourgraphic result presentation of turbular joint using SESAM postprosessor.


In this multiphase flow rig the conditions in offshore pipeline and processing equipment are simulated.

## RELIABILITY OF MARINE STRUCTURES

Assessing the reliability of different structural concepts remains a major research field. A.S. Veritas Research, with its current programme on probabilistic reliability methods, has developed an efficient mathematical theory and a numerical method for reliability evaluation of offshore structures. The goal --to achieve greater reliability of the structures and of process equipment for a given cost; or to show minimum cost for a specified level of reliability, particularly under lifetime deterioration.

## HUMAN RELIABILITY - SAFE OPERATION

Most accidents and losses in the operation of ships and marine structures are the result of human or organizational error.

Veritas is dedicated to reducing this toll. In co-operation with insurance companies, ship owners and operators, Veritas Research develops and implements realistic safety measures against human error. The benefits for clients are substantial, including improved operational performance and reduced insurance premiums.

## DET NORSKE VERITAS

Det norske Veritas was established in 1864. With 3,100 employees at 170 offices in more than 60 countries, the Veritas Group is today a unique international organization providing safety, reliability and quality assurance services to marine, offshore and landbased industries.

## TOP NEWSPAPERS CHOOSE NORNEWS



Top newspapers throughout the world choose Nornews. The news is distributed to readers in over 50 countries on Nornews paper. The Nornews Group is one of the world's largest producers of newsprint. The three Nornews companies, Norske Skogindustrier A.S., A/S Follum Fabrikker and $A / S$ Union have an annual total production capacity of $1,000,000$ tonnes. In 1986 these three Norwegian producers will export in excess of 800,000 tonnes of newsprint.

## MICROPROCESSORS

Norway's pulp and paper industry ranks among the world leaders in the production of quality products. The Nornews companies were among the first in Europe to apply microprocessor technology to the computerised operation of paper machinery. Norwegian firms have also made a substantial contribution to the production of low grammage newsprint, in technological terms a very high-grade product.

For many years the Nornews Group has invested in high technology control systems, the most advanced production equipment, and employed highly qualified staff. In the Nornews Group more than US $\$ 500,000$ has been invested in modern machinery per employee.

## COMPETITIVE POSITION

In the Norwegian paper industry, rationalisation through cost reduction and increased productivity has run parallel with effective product development and quality improvements. Traditionally, this continual process has taken place on the production side: an orientation which means that Norwegian companies can produce competitive qualities for the international markets. The basis for the Nornews production of quality products is access to hydro-electric power and natural competitive advantages such as the exclusive raw material spruce fibre. These factors particularly favour newsprint production.

## TRANSPORTATION

One of the main benefits to Nornews customers is the shipping and transportation arm of the Group. During a period of 10 years this activity has continuously been improved. Nornews has today at its disposal seven ships specially constructed for the transport of newsprint, each with a loading capacity of $2,000-3,000$ tonnes. With the use of these side port vessels, loading and unloading of the ships can take place independent of the weather conditions. On average, one of the Group's ships leaves Norway daily.

Loading and discharging take the minimum time, and consignments are either sent directly to the customer or stored in one of the eleven Nornews harbour terminals in Western Europe. To other destinations, special efforts are made to ensure punctual delivery of Nornews newsprint. The highly
efficient worldwide organisation of Nornews transport ensures safe delivery with the minimum damage during transit.

## A RICH RESOURCE BASE

The politically and economically stable development in Norway after the World War Two created good operating conditions for the pulp and paper industry. Norway's forests contain considerable virgin raw material reserves, offering opportunities for a expansion in paper production. The annual cut has been around $8-9$ million solid $\mathrm{m}^{3}$; while the net growth in the Norwegian forests lies well above this level at around 11 million $\mathrm{m}^{3}$.

## NORNEWS

The Nornews group consists of Norske Skoginclustrier A.S., A/S Follum Fabrikker and A/S Union (Uniort Co.). Their joint marketing organisation is Norske Skog-Follum I/S.

The group's total production capacity is $1,000,000$ tonnes newsprint and improved newsprint qualities. $85 \%$ of the production is exported to more than 50 countries worldwide. Western Europe and USA are the main market areas.

In addition to newprint the companies in the group produce various household paper qualities, sulphite papers, timber products, hydro-electric power, chip and fiber boards, bathroom panels and parquet flooring.


## FROM FRESH SALMON TO F-16 FIGHTERS



> The world's strongest and lightest air freight containers, used by fifty leading airlines in forty countries, are made from a high-specification aluminium alloy developed by ÅSV Nordisk Aluminium, which is part of the ÅSV Group. The same company also supplies external fuel tanks for American F-16 fighters.

## FRESH SALMON

Sales of Norwegian salmon have become an outstanding success on the American market. Fresh salmon is transported by air from the west coast of Norway to various markets in the U.S.A. At its plant in Holmestrand, outside Oslo, ASV has developed a special insulating technique for the containers used for this traffic. Now it is possible, under all conditions, to maintain an even temperature inside the container for as long as $21 / 2$ days. Similar containers can also be used to transport other delicate products requiring constant temperatures, e.g. electronics, medicines and chemicals.

## NAPOLEON

In 1855 the first compact aluminium ingot was displayed in a world exhibition in Paris. At that time this was a very rare metal, with a price per kilo of around NoK500. The Emperor Napoleon III was presented with a complete dinner service of this marvellous new metal - a gift so valuable that only the guests of honour at gala banquets were allowed to enjoy their food on it. The other guests had to be content with ordinary gold plates.

ASV supplied the aluminium for the scaffolding used when restoring the Statue of Liberty.

Since those days, aluminium has become one of the world's most widely-used metals. The modern method of production was developed some 100 years ago, and ÅSV has been concerned with aluminium since 1947 - an involvement ranging from the production and import of aluminium oxide to production of semi-manufactured and manufactured products.

## CANS AND OFFSHORE CONSTRUCTIONS

Every year the $\AA S V$ Group purchases raw materials amounting to several NoK billion, e.g. aluminium oxide, coke, pitch, copper etc. Its sales activities in different areas range from primary metal to semimanufactured products like sheets and profiles, and to fully manufactured products. Among literally thousands of different applications, aluminium is widely used for cans for beverages, car trim and other components, cooking equipment and offshore construction.

Only a minor part of ÅSV's primary metal is processed by the company's own factories. The main clients of ASV are industrial companies using aluminium as a raw material in their own production.

It is therefore a continual challenge for the ASV Group to supply primary metal which conforms to exacting, widely-varied specifications, and is also suitable for the clients' different production processes. ASV research teams work closely with these clients to develop alloys in forms which best meet operating needs.

## THE FUTURE

$\AA$ AV's own metallurgical research is making a key contribution to market development of its aluminium alloy products. And in the packaging field, the company's process experience provides valuable support for its clients.

These are typical examples of the ways that $\AA$ SV invests to build on its specialised strengths. However, it is not enough to be simply a successful supplier of aluminium and its products. It is vital for aluminium to retain and preferably strengthen its position against steel and plastics. A very important task for $\AA$ ASV research and product development is to find new applications for aluminium. ASV's greatest challenges and opportunities are in this area.


Nordisk Aluminium of the ASV Group delivers air cargo equipment to leading airlines all over the world.


Fuel tanks for advanced aircrafts - F-16, produced by Nordisk Aluminium.

## ÅSV

In 1985, $\AA$ SV's sales amounted to approximately NoK 5.5 billion, and the company had 7,500 employees.

The company's head office is in Oslo. The Group has companies in Sweden, Denmark, Great Britain and Norway, and sales offices in Düsseldorf, Stockholm and Helsinki.

The Group's most important activities are the production of pure aluminium and alloys, rolled and varnished/sprayed products, profiles and foils, moulded products, kitchen equipment and industrial castings.


Exclusive wheels for exclusive cars high quality aluminium wheel rims ready for the final fabrication and finish.

## NORWECIAN COMMERCIAL BANKS SPAN THE WORLD

Norway's leading commercial banks have been establishing a range of specialised services in financial centres throughout the world for many years, and are enjoying a growing demand for these services.

Their involvement extends from London and Luxembourg to New York, Houston, Los Angeles, Düsseldorf and Amsterdam and even places as far away from Norway as Sao Paulo and Dubai, Singapore and Hong Kong, Tokyo and Beijing.

Today, Norwegian banks are represented in some 30 financial centres through wholly-owned subsidiaries and participation in consortium banks and offices - and the list is increasing all the time.

The three largest commercial banks have chosen different international strategies. Den norske Creditbank (DnC), the largest Norwegian commercial bank, has a wholly-owned chain of subsidiaries in the main financial centres. Christiania Bank works primarily with the Swedish PK. banken through joint ventures. Bergen Bank is a member of Scandinavian Banking Partners.

## SPECLALIST CAPABILITIES

The aim of this rapid expansion is to provide a financial gateway in specific business areas between the home market and the world at large, and also directly between other countries.

But how can Norway, with only four million people, have anything to contribute to the international financial sector?
The answer lies, of course, in the country's specialist capabilities.

Despite its size, the country is among the world's leaders in shipping services, offshore activities and metallurgical industry.

All these operations need the support of well-developed financial services. Thus the major Norwegian commercial banks have developed into leaders in the international foreign exchange market, both in spot and forward transactions.

Issuing and dealing in bonds is another area where Norway's highly professional bankers are particularly active.

In addition, they provide financial and technical assistance for the rapidly increasing number of Norwegian companies interested in expanding abroad, and also for foreign enterprises seeking to enter the Norwegian market.


BERGEN BANK
WHOLLY-OWNED SUBSIDIARY
Bergen Bank Asia Ltd., Singapore
CONSORTIUM BANKS
Bergen Bank International S.A., Luxembourg
Scandinavian Bank Ltd., London Locations: Bahrain, Los Angeles, Geneva, Hong Kong, Zürich, Madrid, Milan, New York, Sao Paulo, Sydney, Melbourne, Singapore, Tokyo.
Deutsch-Skandinavische Bank, Frankfurt
Skandinaviska Enskilda Banken
Corporation, New York
Finanzierungsgesellschaft Viking, Zürich

REPRESENTATIVE OFFICES
Houston, New York, Los Angeles,
Beijing, Moscow, Stockholm,
Gothenburg, Copenhagen, Paris, Tokyo, Mexico City, Helsinki

CHRISTIANIA BANK, OSLO
(CHRISTIANIA BANK OG
KREDITKASSE)
WHOLLY-OWNED
SUBSIDIARIES
Christiania Bank Luxembourg SA, Luxembourg
Christiania Bank Aktiebolag, Stockholm

CONSORTIUM BANKS
PK Christiania, US Banking Corp.,

## New York

PK Christiania (Hong Kong),
Hong Kong
PK Christiania (South East Asia)
Ltd, Singapore
PK Christiania (UK) Ltd, London Finanzierungsgesellschaft Viking, Zürich
REPRESENTATIVE OFFICES
San Francisco, Houston, Tokyo, Sydney, Copenhagen, Rio de Janeiro, Beijing

DEN NORSKE CREDITBANK
(DnC), OSLO
INTERNATIONAL BRANCH
Den norske Creditbank, Singapore
WHOLLY-OWNED
SUBSIDIARIES
Den norske Creditbank
(Luxembourg) S.A., Luxembourg
DnC America Banking
Corporation, New York
Den norske Creditbank PLC,
London
DnC Limited, Hong Kong
DnC Ship Mortgage International Bank N.V., Amsterdam
Den norske Creditbank Sverige, Gothenburg
DnC Finance Corporation, Houston

CONSORTIUM BANK
Manufacturers Hanover Banque Nordique, Paris

REPRESENTATIVE OFFICES
Beijing, Dubai, Düsseldorf, Hamburg, Rotterdam, Sydney, Osaka, Tokyo, Cairo, Sao Paulo, Hong Kong

## EURO NORWEGIAN KRONER BONDS


#### Abstract

Christiania Bank has been the leader in euro Norwegian kroner bond new issues during 1984 and 1985. During this period the bank has lead bond issues for such prominent borrowers as the World Bank, SAS, Den norske Industribank, Eksportfinans, Det norske Veritas and Hafslund for an amount totalling NOK 1,550 million.


Euro Norwegian kroner bonds are fixed interest rate loans with maturities up to 10 years. The normal issue size is in the range of NOK 200 to 250 million. The bonds are placed through a syndicate of international banks to investors throughout the world. They are quoted on a recognised stock exchange and traded on a regular basis between international bond dealers.

The first euro Norwegian kroner bond issue was launched in December 1979 and since then there has been a total of 27 issues. Christiania Bank has been an active participant in this market since its inception and has also been a large contributor to the markets' further development. During 1985 Christiania Bank has been particularly pleased to lead issues for Hafslund and Det norske Veritas. These issues have served as an introduction to the international capital markets for these companies and has provided a basis for future international financing.


## INTERNATIONAL EXPANSION

International banking constitutes an increasingly larger share of Christiania Bank's business. Christiania Bank is engaged in foreign exhange trading and financing. Capital market activities in other areas than Norwegian kroner bonds are undertaken by the Bank's London joint venture bank, PK Christiania Bank (UK) Limited.

Christiania Bank is represented through wholly or partly owned banks in all major financial centres worldwide.

## CHRISTIANIA BANK

Christiania Bank is the oldest Norwegian commercial bank, founded in 1848. The Bank is the second largest commercial bank in Norway and has approximately 150 branches and offices in Norway, which forms the most extensive branch network of any Norwegian bank.

## WORLDWIDE CONSULTANCY

Bergen Bank is the third largest commercial bank in Norway. One of its most important tasks is to offer banking services and financial consultancy to Norwegian-related companies throughout the world.

In 1983, A.L. Laboratories, Inc. purchased the Danish pharmaceutical company A/S Dumex from its Canadian owners. A.L. Laboratories, Inc. was originally organized in 1975 as a wholly-owned subsidiary of Aporhekernes Laboratorium A/S, Norway (AL).

The purchase of Dumex made AL with subsidiaries one of the largest pharmaceutical companies in Scandinavia, with sales amounting to more than NoK 1 billion. Bergen Bank was chosen as the financial partner for AL in the purchase of Dumex.

## AMERICAN SHARE ISSUE

To finance the Dumex purchase, A.L. Laboratories, Inc, issued shares in the US market. Together with DnC, Christiania Bank, Union Bank of Norway and Jetun Finans A/S, Bergen Bank underwrote one third of the total share issue. A total of 40 per cent of the share capital in A.L. Laboratories, Inc., equivalent to 1.5 million shares of value NoK180 million, was offered for public sale in the U.S.A.

The Dumex purchase, with the consequent strengthening of A.L. Laboratories, Inc., is an important component in the internationalisation process for the companies in the A.L.Group.

## A TURNING POINT

Bergen Bank has experienced considerable growth in its engagements abroad during the past five years. In 1984, foreign activities constituted 30 per cent of the Bank's total assets.

A turning point in Bergen Bank's foreign involvement is its collaboration agreement with Privatbanken of Denmark, Skandinaviska Enskilda Banken of Sweden and Union Bank of Finland. Through this collaboration, Bergen Bank will be able to offer its clients banking services in 1150 centres throughout Scandinavia.


From the opening of the wholly-owned subsidiary Bergen Bank Asia Ltd., Singatore, in March 1983.

## BERGEN BANK

Through its own offices and those of its partners, Bergen Bank has today eleven branch banks and representative offices in Europe; four in both North America and Asia; two in Australia; and one each in South America and the Middle East.

Norwegian companies form the most important target group for Bergen Bank. The Bank intends to build up a strong foreign division in Norway, encouraging the utilisation of its foreign network and the use of its special knowledge, particularly in the oil and shipping sector.

## NORWAY'S LARGEST SHIPPING LOAN

## The largest-ever Norwegian shipping loan was signed on 1 December 1984 on board the cruise ship s/s Norway in Miami, Florida.

## DnC THE LEADER

DnC was the leading bank responsible for arranging the loan together with Manufacturers Hanover Trust Co and Bergen Bank.

The purpose of this NOK 2.5 billion loan was the total refinancing of the Norwegian Caribbean Lines $\mathrm{A} / \mathrm{S}$, following the purchase of the Royal Viking Line. Norwegian Caribbean Lines A/S is a part of Kloster Cruise A/S.

Raised in the Euro-market, the floating interest loan amounted to US\$ 280 mill., or almost NOK 2.5 billion.

Den norske Creditbank (DnC), Manufacturers Hanover Trust Co , and Bergen Bank provided the funds for this financing. DnC is also the agent for this loan, which includes interest fixing, arrangement of payment, provision of information etc.

## CONFIDENCE

Kloster Cruise $\mathrm{A} / \mathrm{S}$ is a long-standing client of DnC . The fact that the world's largest cruise operator chose DnC as manager and agent for Norway's largest shipping loan is a clear proof of the cruise company's faith in DnC's expertise.

## DnC

DnC is Norway's largest bank, with total assets in 1985 amounting to NOK 91 billion, and 5,400 employees. In Norway alone, DnC's network consists of more than 140 offices and branch offices. The bank has a branch in Singapore and wholly-owned subsidiaries in Luxembourg, London, Amsterdam, New York, Hong Kong, Houston, and Gothenburg.

In addition DnC has representative offices in Beijing, Dubai, Dusseldorf, Hamburg, Rotterdam, Sydney, Osaka, Tokyo, Cairo, Sao Paulo and Hong Kong, and consultants in Jakarta, Bangkok and Lagos.



## EDUCATIONAL PROGRAMS:

- Four Year Program in Economics and Business Administration (Siviløkonom)
- Master's Program in International Business (Master of International Business)
- Doctorate Programs in Economics and Business Administration (Dr. Oecon)
- Executive Development Programs


## FOUNDATIONS:

- A.F.F. : Administrative Research Foundation
- C.I.B. : Center for International Business
- N.H.H.K. : Executive Development and Adult Education
- S.A.F.: Center for Applied Research


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The Norwegian School of Economics and Business Administration.


If you want further information about any of the business firms presented, please fill in this form and return it to:

## CENTER FOR INTERNATIONAL BUSINESS NORGES HANDELSHØYSKOLE HELLEVEIEN 30 5035 BERGEN, NORWAY

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