SINTEF

Annual report 2002

Contents

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The SINTEF Group is the largest independent research organisation in Scandinavia. We live by offering our clients intelligent, profitable solutions based on research and development in technology, the natural sciences, medicine and the social sciences. At the turn of the year we had 1770 employees, who generated a turnover of NOK 1.6 billion in 2002. Contracts for industry and the private sector account for more than 90% of our income, while seven percent is in the form of basic grants from the Research Council of Norway.

This is the SINTEF Group

Partners in cooperation

SINTEF cooperates closely with the Norwegian University of Science and Technology (NTNU) and the University of Oslo. NTNU personnel work on SINTEF projects, while SINTEF staff teach at NTNU. Our partnership also involves extensive joint use of laboratories and equipment. We are in the process of establishing a similar form of collaboration with the Faculty of Mathematics and Natural Sciences in the University of Oslo.

History

SINTEF was established in 1950 by the Norwegian Institute of Technology (NTH), a university-level college which now forms part of NTNU. The new institution had two objectives: the first was to promote technological and other forms of industrially oriented research at NTH, while the second was to meet the public and private sectors' needs for research and development. The institute was set up on NTH's campus in Trondheim, closely integrated with the college's academic milieu.

The SINTEF of today also incorporates the former Centre for Industrial Research (SI) which was established in Oslo in 1949. The two institutes merged in 1993, primarily in order to improve their joint international competitiveness.

SINTEF enjoyed its most rapid period of growth in the 70s, a period of growing demands for technology in the young Norwegian petroleum industry. Together with NTH we played a central role in the development of a national competence base for petroleum production in the North Sea. Important national laboratories such as the Ocean Laboratory and the Multiphase Laboratory saw the light of day at that time. SINTEF also built up contract research units in most areas in which NTH offered teaching. Our multidisciplinary profile makes SINTEF a unique institution. During the past few years, we have grown most rapidly in the social sciences sector.

The SINTEF Group was established in the mid-eighties. In the course of a major reorganisation of the Norwegian research institute sector, the Norwegian Ship Technology Institute, the Electricity Supply Industry's Research Institute and the Continental Shelf Institute were all brought under the SINTEF umbrella. These three institutes, all of which were located in Trondheim, were transformed into limited

companies whose majority shareholder was SINTEF. A fourth limited company, SINTEF Fisheries and Aquaculture, was founded in 1999.

New millennium – new challenges

Since the mid-nineties the SINTEF Group has undergone a radical process of reorganisation - a process that was triggered by changes in the industrial scene. Mergers and foreign buyouts led to internal restructuring and reductions in the size of research departments in many industrial companies. This altered the character of the contract research market, and thus also the need for SINTEF's competence. The market for top-level expertise has shrunk and companies are more concerned with solving large problem complexes. We were able to strengthen our own position in the market by reorganising our activities from a large number of small scientific departments into 12 large market-oriented institutes. The number of administrative staff was sharply reduced, and at the end of the century SINTEF emerged as a slim, efficient organisation, whose research staff made up almost 70 percent of the total number of employees.

Multidisciplinary knowledge packs

In the years to come we will need to be able to tailor our expertise to the demands of our clients. This is why we place great emphasis on being solution oriented in the production of knowledge.

The needs of companies, industries and society as a whole for integrated solutions mean that it is essential to cooperate across disciplinary boundaries. As Norway's largest centre of contract research we are in a unique position to assemble multidisciplinary teams, and this we do to an ever-increasing extent. Our cooperation with research groups in NTNU and the University of Oslo is an important aspect of this strategy.

SINTEF's ideal customer is one who has confidence in us and who continually sends us signals regarding his needs for competence and support. This is what brings out the best in us, which is why we are continuing to make intensive efforts to establish strong alliances with companies, industries and government authorities interested in long-term cooperation in their efforts to attain joint objectives.

Commercial spin-offs

We are consciously attempting to enable SINTEF to act as an incubator for new companies. Our development plan includes an objective of establishing 10 - 15 new companies a year, based on technology to which we ourselves hold the rights. This will give Norway the knowledge industry that it so urgently needs. By selling shares in successful spin-offs, we will simultaneously realise gains which will be invested in new knowledge development.

In 2002 we established an investment fund and built up a complementary set of measures known as the Investment Engine, which has the aim of piloting potential entrepreneurs through the innovation process. At the same time, we intend to play an active part on the ownership side of our spin-off companies and support in this way their further development.

Technology for a better society

Mankind is facing enormous challenges in its efforts to improve the quality of life of the individual. How are we to obtain more food for a world in which many people go hungry and every day sees more mouths to feed? And how are the threats of climate change to be dealt with?

In Norway we are on the threshold of a future in which new industries will be needed to take over from the petroleum industry. Our standard of living will depend to an ever-increasing extent on the ability of this country to produce goods and services with a high knowledge content.

We do not possess any simple solutions to such problems. The only thing that we can be certain of is that knowledge is alpha and omega for anyone who wishes to take up the challenges they offer us. We believe, in all modesty, that it is important that organisations such as ours exist; organisations that live by producing research-based knowledge.

Together with our universities and colleges, the SINTEF Group forms part of the national innovation and industrial development infrastructure. It is important that Norway should possess a national competence base that is capable of supporting our existing industries and helping to bring forth new companies. A national competence base is also of importance when Norwegian companies have to decide where to place their development departments, and when foreign companies are wondering whether to set up shop in Norway.

Norwegian companies are facing an uphill struggle these days, and they are cutting back on their use of external knowledge resources. At the same time, the authorities are keeping a low profile as far as funding industrial research is concerned. Both of these factors are affecting SINTEF's financial position. Of course, we will adapt to this situation, but the trend is still worrying.

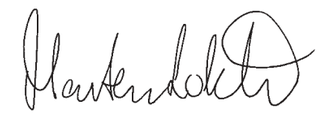
Investing in the future

It is not a healthy sign that Norwegian companies are cutting back on external research and development in difficult times. Although this approach is understandable enough at a time when shareholders are demanding the best possible figures on the bottom line, that does not make it any more sensible. Research and development are essential factors for maintaining profitability, and most companies need to be kept supplied with new knowledge if they are to do so. Short-term benefits can always be gained by postponing research projects, but this is a risky strategy in the longer term.

The Norwegian authorities seem to be reluctant to go in for direct support of industrial research. It has been documented that investing in knowledge is a profitable strategy - whether this is a matter of the continued development of existing branches of industry or of encouraging new sectors to emerge. But we still hesitate, even when we are faced with a situation in which many of our industrial companies are having a hard time. The EU has resolved that investment in R & D should rise to 3% of GNP by 2010, and our neighbours are putting even more into the research sector, while Norway still lies well below 2%. This is a source of anxiety to more than just us.


Photo: Studio Lasse Berre

Morten Loktu
President of SINTEF



In financial terms, 2002 was a poor year for SINTEF. We have no intention of continuing to lose money, but history will show that we invested more than NOK 100 million in our own strategic research, business development and scientific equipment. We did this in a bad year, because such investments are the foundations of the services that we will be selling in the future. Or, to put it in other words - because they are essential if we are to have a future at all.

One of the most advanced centres in Europe for microsystems and microtechnology research will soon be ready for occupation at SINTEF in Oslo. The opening will confirm that Norway occupies a leading position in a technology which is of rapidly growing industrial importance.

Micro-building in macro-format

With a total capital budget of nearly NOK 240 million, the new centre is one of the largest single investments in Norwegian industrial research since the Halden nuclear reactor in the 50s. The centre will be a hive of activities on processes on a scale in which the finest human hair looks like a log of wood and a grain of sand resembles the Pyramid of Cheops. This sort of research makes very stringent special demands of the laboratory environment, not only in terms of dust levels but also because it is vital to eliminate every source of vibration that could disturb the nanoscale experiments.

For this reason, the new building's laboratories have been built as a protected core standing on piles which have been driven 30 to 40 metres down to bedrock through the building site's clay soil. Shock absorbers have been inserted between the concrete structure and the piles in order to dampen the transmission of vibration produced by neighbouring tramlines and motorways.

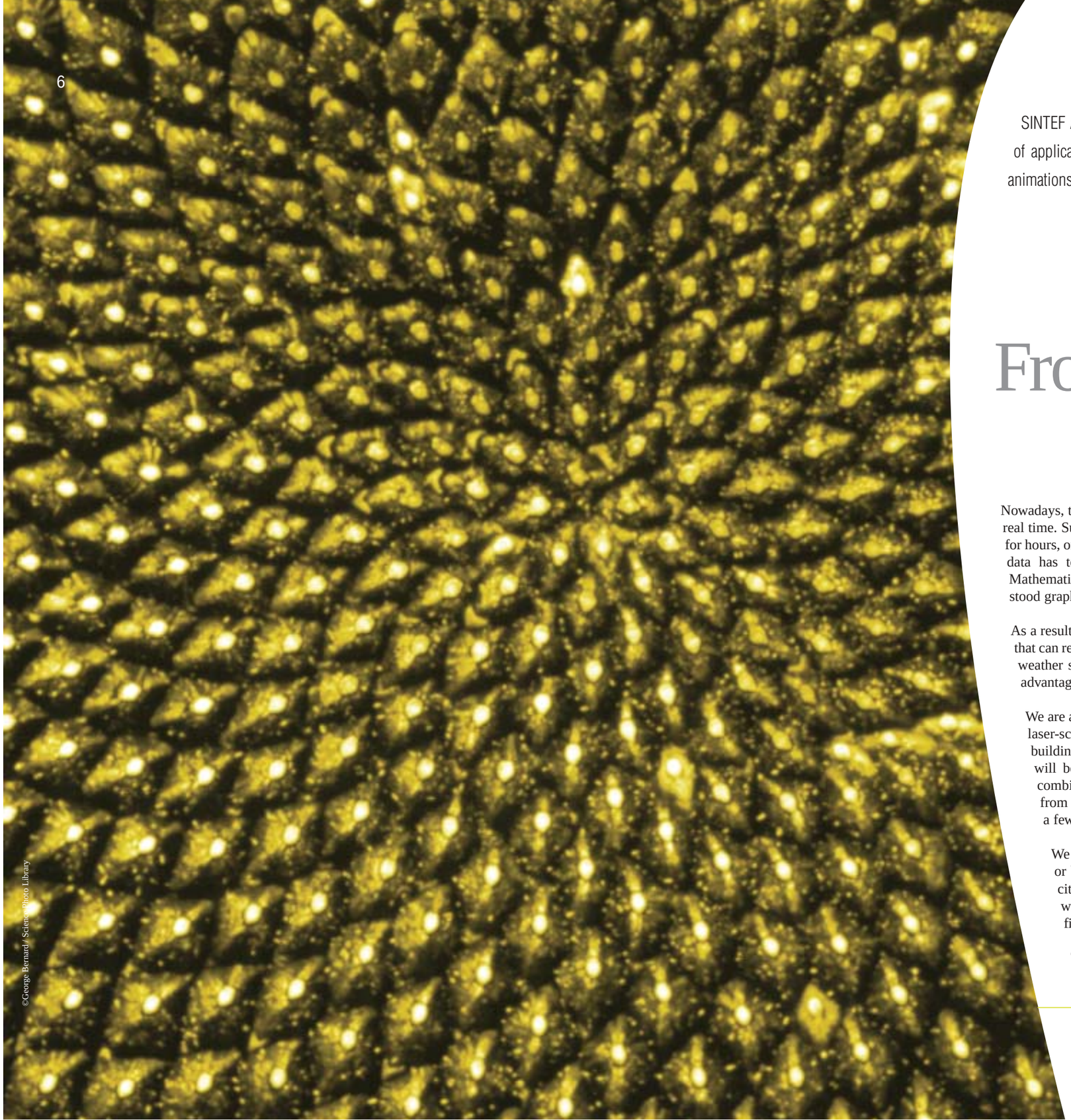
Fresh air is drawn into the building through a series of filters before it is washed by blowing it through an aerosol of tiny water droplets. Specially sensitive operations will be protected by a special screening process that cleans the air yet again.

The location of the new centre in Gaustadbekkdalen underlines the close collaboration that exists between SINTEF and the University of Oslo, which will have its own laboratory in the building. The centres will not only develop microsystems but also train the experts who will be needed by industry and research in the future. «Our vision is that the centre will be at the leading edge of European industrialisation of microtechnology within a few years», says Anders Hanneborg of SINTEF Electronics and Cybernetics, director of the new centre.

Both SINTEF and a number of companies on Norway's «electronics coast» in the County of Vestfold have been active in microtechnology for several years. In 1998 developments really took off, when the Research Council of Norway proposed a coordinated national research effort to put Norway on the microtechnological map.

With the support of SINTEF, Norwegian companies are making their presence felt in Europractice, an EU programme that aims to encourage companies to adopt microtechnology. Norway already has no less than 10.4% of the programme's customer base, and is only surpassed by Germany, France and (just) the USA. In terms of population we are by far the most active nation in microtechnology. During the past three years, SINTEF has carried out projects in microtechnology for 21 Norwegian and 45 foreign companies.

Anders Hanneborg *of SINTEF Electronics and Cybernetics is the director of the centre: he has been actively promoting microtechnology in Norway for several years.*



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SINTEF Applied Mathematics develops software and utilises mathematics as a tool in a wide range of applications. The work of the Institute ranges from improving transport planning to producing animations and visualisations of landscapes.

From figures to the screen

Nowadays, technology can bring weather forecasts from all over the world right to your computer - and in real time. Such forecasts are the result of the most powerful computers in the world working at full speed for hours, or even days, at a time. But if this is to be of any use to you or me, the sheer volume of numerical data has to be reduced and sorted, without any loss of useful information. At SINTEF Applied Mathematics we are working on the problem of transforming huge quantities of data into easily understood graphics.

As a result of cooperation with the Norwegian Supercomputing Programme we have developed software that can reduce the quantity of numerical data in weather forecasts by 80 percent, thus enabling the global weather situation to be presented on the computer screen in just a few minutes. This is an important advantage for both commercial and private end-users who demand ever higher levels of efficiency.

We are also working on visualisation in other areas, such as technology that allows built-up areas to be laser-scanned from a helicopter or aircraft. Such scans provide detailed digital descriptions of buildings without the need for tedious consultations of yellowing architectural drawings. This method will be of particular use for town planners, architects, and developers. Scanned images can be combined with satellite images to produce digitalised topographical maps complete with buildings, from which all the information available about any given location can be visualised with the aid of a few keystrokes.

We believe that this will be the road-map (or chart) of the future, whether you are travelling by car or by boat. The images on your laptop computer will either appear in the form of landscapes or cityscapes as you can see them around you, or as 3D maps. The Global Positioning System (GPS) will make sure that the angle of vision is correct. By clicking on a building, for example, you can find out that it is a theatre, what is playing, and whether there are any tickets left.

This technology could also be a vital tool for the fire and rescue services, and indeed for anyone in the field who needs to obtain rapid information about his surroundings.

Fibonacci-series
Seed head of a sunflower, with the spiralling pattern on its surface representing a Fibonacci mathematical series. A Fibonacci series is one in which each number is the sum of two previous numbers, for example: 0, 1, 2, 3, 5, 8, 13, 21 and so on. This series was discovered by Italian mathematician Leonardo Fibonacci (1170-1240), and many natural patterns can be described with its aid.

SINTEF Civil and Environmental Engineering contributes to the social process of wealth creation by developing and improving the national infrastructure, reducing energy consumption and improving the utilisation of natural resources. The work of the Institute ranges from traffic planning to the conservation of old buildings.

Technology at the wheel

Should it be possible to drive at speeds well beyond the speed limit?
Should it be possible to drive under the influence of alcohol?
Should it be possible to drive a car with serious defects?

Much of the technology that could prevent such things from happening is already available.

At SINTEF Civil and Environmental Engineering we are making driving safer with the aid of technology. Every year, about 300 people lose their lives on Norwegian roads. We believe that at least a hundred of these lives could be saved if society were willing to adopt the technology that is being developed to make it safer to sit behind the wheel.

Driving computers, speed limiters, satellite navigation via electronic maps and road sensors are already a reality.

Our laboratories are working on a completely new design of accelerator pedal which offers resistance to the driver's foot pressure if he tries to go beyond the speed limit, and on a new system which will ensure that cars driving close behind each other automatically adapt their speed and distance to the vehicle ahead. We also operate an advanced driving simulator, which enables us to do research on interactions between the driver, his vehicle and the road, completely free of risk.

We were an important contributor to the Norwegian Technology Council's scenario workshop last year on «Traffic in 2020», at which future road transport technologies were presented.

In the wake of this work, our conclusions are quite clear:
This sort of technology will certainly reduce drivers' freedom. It can also fail or be overridden, and some of the pleasure that many people take in driving will be lost. But we must not let freedom and driving enjoyment stop us from doing what we can to save lives. Life is more important than an insistence on being able to control our cars without external aids.

This is why SINTEF Civil and Environmental Engineering intends to play a central part in discussions between the authorities and experts on the role of technology in the traffic of the future.

We look forward to the day when this type of technology will be accepted by society.

Studded
Studded tyre testing a prototype wear-resistant concrete. The tyre is from a 14-tonne remote controlled truck at Newcastle University in the UK. It is testing mechanical wear on six prototype concretes made from cement and volcanic ash.

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SINTEF Electronics and Cybernetics identifies new solutions in microtechnology and develops measurement and control systems. Our work ranges from technical analyses to the development of complete systems that must be capable of operating in any environment, from the human body to outer space.

Health check-up for indoor air

The feeling of tiredness that overcomes you during a meeting or a lecture is embarrassing enough, but if you are in the driver's seat of a car it can be fatal. At SINTEF Electronics and Cybernetics we are studying the air we breathe, whether in industrial premises, cars, kitchens or spacecraft. In cooperation with Norwegian industrial companies we have identified measurement methods for most types of locations.

Pure outdoor air consists of 20.95% oxygen, 78.08% nitrogen, 0.94% noble gases and 0.03% carbon dioxide. Indoors, the percentages are quite different. Deviations from normal figures can produce a feeling of tiredness, make us ill or, at worst, lead to asphyxiation.

Even though it takes a high level of carbon dioxide to make us feel tired, the concentration of this gas is a good indicator of air quality.

This is why we are currently developing a simple, robust silicon-based CO_2 measurement system, in which echoes within a millimetre-scale cavity change with the level of carbon dioxide in the air. This simple, mass-produced device can be installed in vehicles, where it will automatically switch on the air-conditioning system when air quality falls below a given level.

More and more people are replacing electricity with gas in the kitchen. Even though strong warning odours are added to the gas and cookers are well protected against leaks, many people are still fearful of explosions and gas poisoning. The Research Council of Norway is funding a SINTEF project to develop a completely new type of gas sensor which will be ideal for «sniffing» very low concentrations of hydrocarbons such as propane and butane.

Spacecraft cannot be ventilated, which makes it all the more important to take good care of their existing air supply. We are cooperating with a German company on a project, funded by the European Space Agency and with additional support from NASA, to develop equipment which will be able to measure, simultaneously and precisely, the concentrations of 32 different gases. The system will monitor air quality in the International Space Station and in spacecraft used in future trips to Mars.

For selective determinations of gases in industrial premises, we have developed a photo-acoustic measurement method which measures concentrations of specific gases over long periods of time.

We believe that our sensors will help to improve the quality of indoor air both in the home and at work.

Micro-submarine
This is a micro-submarine inside a human artery. The tiny robot was constructed with the aid of a computer-controlled laser, which built it of acrylics and polymers. The robot can be used in the diagnosis and treatment of disease. It was manufactured by the German company mikroTEC.

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SINTEF Energy Research develops good solutions related to power generation and conversion, transmission and distribution and the final use of electricity and other types of energy carriers. The work of the Institute ranges from the indoor environment and energy consumption in buildings to gas technology, combustion, bioenergy and food technology.

Cooler cars

The air-conditioning unit in your car is full of chemicals that are capable of changing the climate when they leak out of the system. SINTEF Energy research doesn't approve of this; so we have done something about it.

In December 2002, the first of a series of unusual cars left the Toyata factory. These electric vehicles of the future get their power from energy cells that run on hydrogen. The cars are also fitted with air-conditioning systems that only use Nature's own materials, which is a novelty in the automotive world.

The air-conditioning units are based on technology which was developed at NTNU and SINTEF - a solution of which we are rather proud, and which we hope other car manufacturers will come to adopt.

A working medium circulates in all heating and air-conditioning systems, as well as in heat pumps. Working media are materials that absorb heat in one part of the system and release it in another. Vehicle air-conditioning systems transport heat out of the interior by means of chemicals that have a powerful greenhouse effect when they leak out of the system.

However, the system that has been designed according to our recipe does not produce hazardous emissions. We have replaced the chemicals with one of Nature's own materials, and we have done so without increasing fuel consumption. What we use is CO_2, but this way of using CO_2 does not have a greenhouse effect, because it is «borrowed» from industrial flue gases that would otherwise have been discharged into the atmosphere.

If all the European cars with air-conditioning systems had this technology installed in 2010, the atmosphere would be spared the equivalent of something between a third and a half of Norway's total emissions of greenhouse gases.

The Hydro Group was quick to secure the rights to industrialise this technology, and the company has licensed production rights to several major industrial companies. Among other applications, our technology will be used in heat pumps, which have become a «hit» in Tokyo and which are used for environmentally friendly heating of household tapwater. The CO_2 technology enables water to be heated with very low energy consumption.

There are many potential applications in chilling, freezing and heat-pump technology, and Hydro envisages an exciting market for itself as a supplier of aluminium components. At SINTEF, we are delighted to see that we have created marketable results that may help the world to become just a little bit greener.

Light bulb
Coloured scanning electron micrograph (SEM) of the double coiled tungsten wire filament of a 60 Watt domestic light bulb. Magnification: x60 at 6x7cm

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SINTEF Fisheries and Aquaculture possesses a wide range of expertise and knowhow in exploiting renewable marine resources. The Institute helps its clients to find solutions to problems throughout the marine value chain – from the biological basis of marine production, through aquaculture and fish capture techniques to processing and distribution..

Toxic algae cheated

By mixing water strata (layers), SINTEF Fisheries and Aquaculture has managed to get rid of the toxic algae that have been the nightmare of mussel-farmers in Norwegian fjords.

The Norwegian coast is very suitable for mussel farming, particularly in Western Norway where the Sognefjord penetrates far into the country. Scientists believe that this region alone ought to be capable of producing 300,000 tonnes of mussels a year. Last year we produced just over 2,500 tonnes. There is still a long way to go, and many problems will have to be solved on the way. One of these problems is toxic algae, which cause the mussel-farming industry huge losses.

In many fjords, the problem is that the water lies in extremely stable strata, with brackish water above the nutrient-rich seawater . This means that few nutrients reach the surface, with the result that living conditions for the useful diatomaceous algae (diatoms) are poor, while the toxic dino-flagellates flourish. This was the starting point for the DETOX project, in which we took part together with various government ministries and the mussel-farming industry.

Two important conditions had to be met. In the first place, it was essential to break up the layer of brackish water, so that there would be more mixing of the brackish and salt-water layers. It was also important to bring the deepwater nutrient salts to the euphotic zone, as this would enable the beneficial algae to grow.

The method we used is well known, but until now it has not been used to radically alter the production of algae in a fjord. A perforated pipe is installed in deep water below the brackish water layer; when air bubbles are released from the pipe, they create buoyancy and bring nutrient-rich water with them as they rise to the surface. These nutrients encourage conditions in which blooms of beneficial algae can take place.

Trials of the system carried out by SINTEF Fisheries and Aquaculture in the Arnafjord in the late summer and autumn of 2002 were successful. Of course, we have not completely solved the problem of toxic algae, but we have managed to influence the physical system with the help of the laws of nature themselves. Best of all is the fact that the process can be carried out at no cost at sites where buoyant fresh water from hydropower stations enters the fjord at sufficiently great depth.

Eggs
Close-up of eggs of the pink salmon. The small black dots visible in some of the eggs are the eyes of the young fish inside. These eggs are around two months old.

©Alan Sirulnikoff / Science Photo Library

SINTEF Applied Chemistry is Norway's largest interdisciplinary contract research institute in the fields of chemistry, biotechnology and environmental technology. Our clients come from a wide range of industries, ranging from pharmaceuticals to the petroleum sector, and we develop new tools, products, processes and environmental technology solutions on their behalf.

Keeping the coast clean

A sticky black mass covers the shore, across which seabirds limp, smeared in oil from beak to feet. We see such pictures frequently on the news. All too often, huge quantities of oil are spilled into the sea after shipwrecks. What if such an accident happened in such a vulnerable area as Svalbard?

At SINTEF Applied Chemistry we optimise contingency plans for shipping around Svalbard and the coast of mainland Norway - precisely because such disasters must not be allowed to happen. An oil spill following a shipwreck in the Arctic could have serious environmental consequences.

We expect an increase in the quantity of oil transported by ship from northwest Russia along the coast of Norway, with a corresponding rise in the chances of something going wrong. It is not only tanker accidents that are capable of having dramatic effects on the environment. The fuel oil in the majority of ships could be a source of environmental damage when things take a wrong turn.

However, if a shipwreck takes place and oil leaks out, analyses can tell us just how the spill will behave after 24 or 48 hours or after five days. There are important differences in the characteristics of oils, and, in turn, how these oils behave on the sea surface and in the water. Wind, temperature and currents also play decisive roles in determining the extent of the evironmental damages.

SINTEF Applied Chemistry has a unique database built up over a period of 15 years. Laboratory studies and large-scale field studies form the basis for methods and models that are capable of predicting the behaviour and fate of oil at sea. Models designed by SINTEF were used when the Green Ålesund sank off Haugesund in 2000, and the Prestige went down outside Spain at the end of 2002.

The models are frequently used for contingency planning by the petroleum industry, both in Norway and abroad, to limit environmental consequences as much as possible if oil does get spilled.

At SINTEF Applied Chemistry we try to keep ahead of the problems, but we are always ready to go into the field to help the environment if and when an oil spill does take place.

Yeast cells
Scanning electron microscope image of yeast cells, Saccharomyces cerevisiae. Yeast is capable of fermenting sugar, producing alcohol and carbon dioxide in the process. In medicine, dried yeast is used as a source of vitamin B1, riboflavin and nicotinic acid. Yeasts divide rapidly by budding off new cells (visible here). They may also reproduce sexually. Magnification: X 430 at 35 mm.

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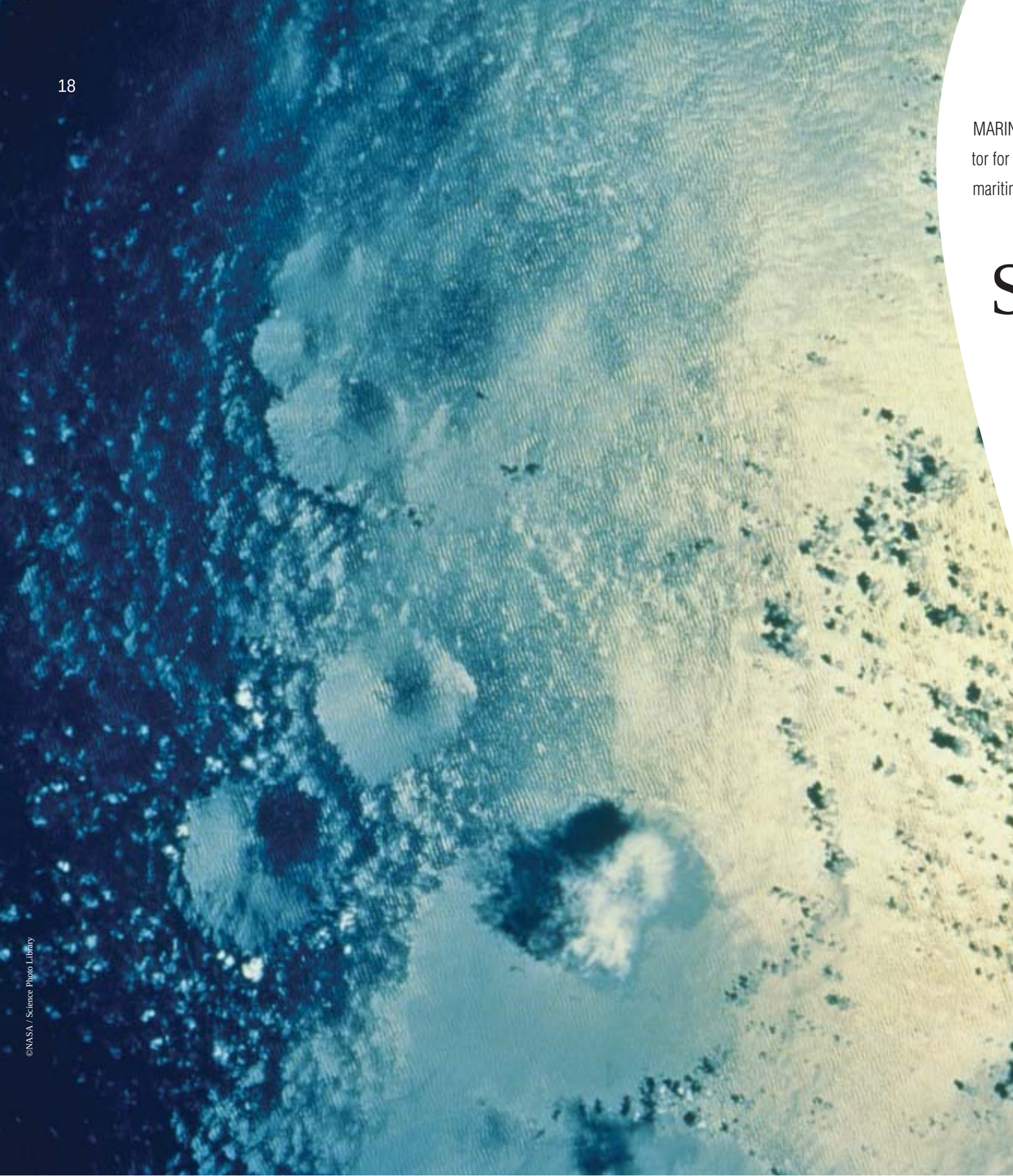

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MARINTEK – Norwegian Marine Technology Research Institute, does research and development in the maritime sector for industry and the public sector. The Institute develops and verifies technological solutions for the shipping and maritime equipment industries and for offshore petroleum production.

Serpent from the depths of the ocean

The temperature is two degrees below zero and the darkness stretches into infinity. Even though the pressure at the bottom of the sea threatens to squash the remotely operated vehicle flat, it keeps on working - checking that the gas pipeline that will be hung in a free span between two underwater mountains is being manoeuvred into its correct position. The pipeline will bring ashore the almost inconceivable volume of 400 billion cubic metres of gas from Norway's Ormen Lange field across this very mountainous seabed.

At the moment, this operation is only taking place in a computer - which is being run by scientists here at MARINTEK, for the fact is that we have accepted the challenge of helping Norsk Hydro and Shell to bring natural gas up from the depths of the ocean.

About 8000 years ago, a huge underwater avalanche created this mountain landscape 850 metres below the surface of the waves. This complicates the pipelaying operation, while the difficult current conditions also test crews and equipment severely. A single wrong move could cost tens of millions of kroner. In some places, «highways» have to be built to enable the pipeline to lie in a stable position, while in others we have to calculate whether it will be capable of withstanding the stresses involved in spanning two peaks in extremely variable currents. These simulations offer us important understanding of what is possible and what is not, and can mean major savings for operating companies.

Our background for jobs of this sort is our expertise in mathematical modelling, our experience in technology development in connection with underwater operations, and the hundreds of trials we have carried out in the world's biggest ocean laboratory. These are now coming into their own.

Our knowhow has been carefully acquired, transformed into mathematical models and accumulated in a gigantic three-dimensional virtual laboratory. With the help of a joystick and a computer screen we can manoeuvre around a digital world, control its outcomes and check out alternative solutions. The aim is to identify the perfect pathway for these enormous pipelines, which form the very nervous system of the project which has been given the appropriate name Ormen Lange (the Long Serpent), and which will turn Norway's natural gas reserves from this field into an important product for the market.

And that is something we can be proud of.

Wave
Circular wave formation in thunderstorm. Not usually seen from space, this effect has been made visible by the very low angle of the sunlight. Photographed during Shuttle Mission STS-26, 29 September to 3 October 1988.

SINTEF Materials Technology works closely with industry in the development of advanced materials, and we seek out new, environmentally friendly products and processing methods that will increase productivity and raise quality standards. The Institute does work on materials recycling, light alloys for the automotive industry, steel, ceramics and plastics. Another important field of work is identifying the functional and application properties of materials in order to enable the most suitable materials to be selected for particular applications.

A new route from sand to solar cells

Although the solar cell industry is going through a period of spectacular growth, the availability of the high-purity material used in solar cells today is limited. At SINTEF Materials Technology we want to help the solar cell market to continue to grow, so we have been developing technology that could improve the world's supply of the raw material for solar cells.

Solar cells predominantly consist of silicon, the main element in quartz. At present, the pathway from quartz to solar cell goes via super-pure silicon, which is produced for the electronics industry. Today's solar cells are manufactured from the scrap material produced in the course of this process.

However, there is soon going to be a serious shortage of this raw material, because solar cell manufacture is growing by 25 percent a year, while the consumption of materials by the electronics industry has flattened out. If this situation results in a shortage of solar cells, the world will lose a lot of kilowatts of renewable energy.

We have tackled this problem as part of an EU project, in which we have helped to develop a new process path for quartz that is destined to be turned into solar cells. We are not quite there yet, but we believe that this new route will produce large quantities of «solar cell-quality» silicon at a much lower price than today's methods.

Briefly, we start off with purer quartz than the smelters use to produce silicon and then employ a more advanced smelting process, which is followed by a final stage of refining. This process means that we avoid the expensive, energy-intensive post-smelting processes that are required for silicon that is used to produce electronic chips. This allows us to hope that «our» solar cells will pay back the energy used to produce them at least as quickly as today's versions.

We are also very active in other areas of solar cell technology, which is enabling us to build up expertise which will be of vital importance for the Norwegian solar cell industry, a sector in which we are rapidly becoming world leaders. The international community will also benefit from our cooperation with companies in this sector, because as our solar cell products come on the market, Norway will be helping the world to meet its obligations under the Kyoto Agreement.

Aluminium
Scanning electron micrograph (SEM) of aluminium. The sample has been purified by recrystallisation in a vacuum. Magnification: x200 at 6x6cm

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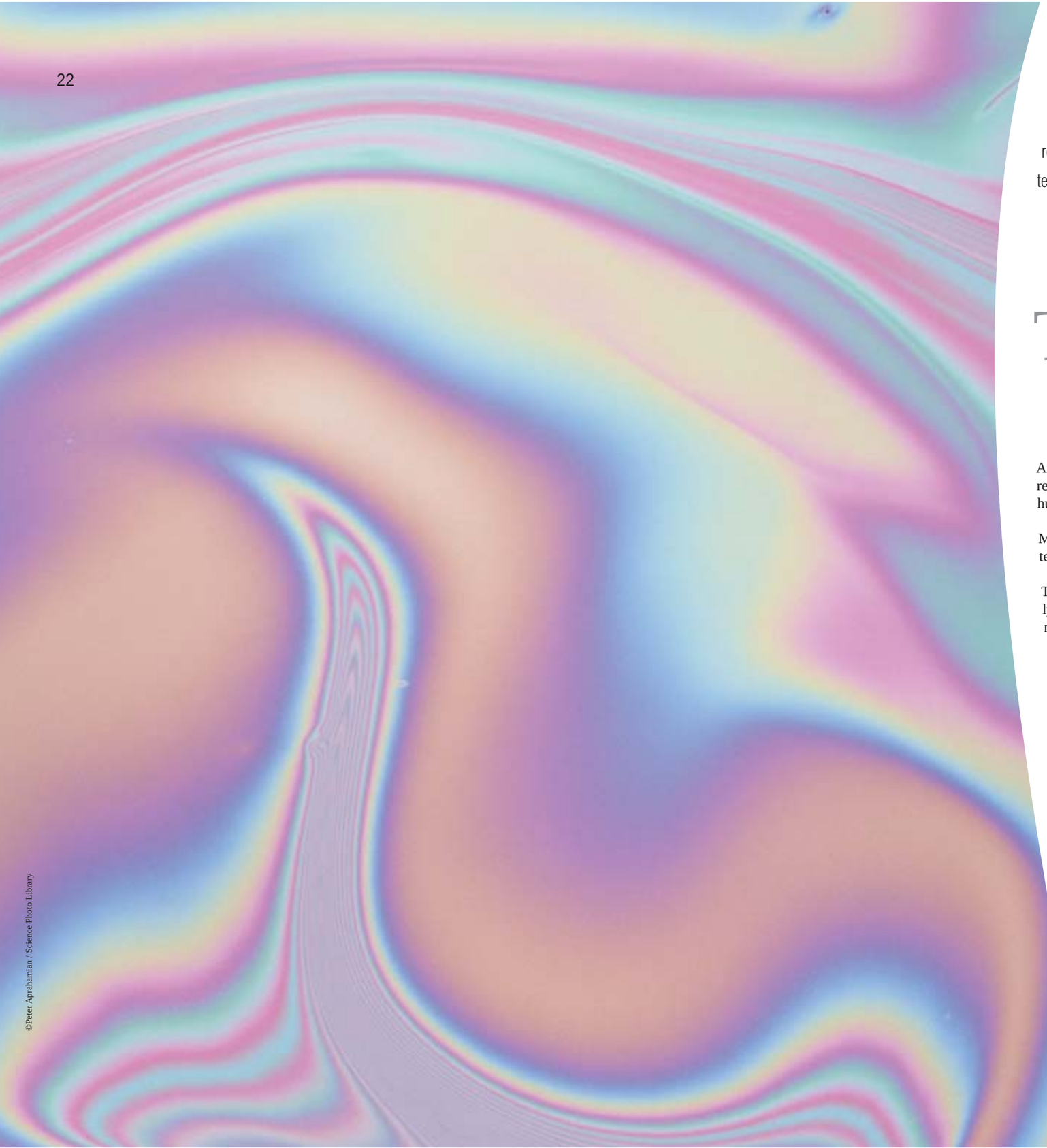

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SINTEF Petroleum Research develops technologies capable of finding more oil and gas and recovering as large a proportion of our petroleum reserves as possible. The Institute's knowhow and technology support the creation of value in one of Norway's most important branches of industry.

Time-machine - on the sea-bed

At SINTEF Petroleum Research, we have opened a new window to the past: on our computers we can recreate underwater landscapes that disappeared aeons ago. Not for fun, but because it makes it easier to hunt for new oil-fields.

Most of the proven oil reservoirs on the Norwegian continental shelf lie in what was once sand transported to its present sites by rivers. Gradually the sand turned into stone as it was buried under new material.

The big money machines like Statfjord, Gullfaks and Oseberg were found early on by means of relatively simple surveys. These fields lie in stone which, about 170 million years ago, was the sand in a huge river delta. In this stratum, however, it is likely that only minor oil fields remain to be discovered.

Fortunately for our petroleum-dependent country, the continental shelf also contains more recent sandstone strata. The rivers continued to carry large quantities of sand from the mainland after the delta was flooded and the North Sea and the Norwegian Sea began to take shape. The gigantic Ormen Lange gas field lies in a stratum of this sort. However, the younger sandstone strata have only been partially mapped. At SINTEF, we have built a time machine of our own, which makes it easier to trace the rest of the sand that sank to the bottom of the sea.

With the aid of numerical simulation software developed by ourselves we have revealed how the topography of the seabed in the North Sea and the Norwegian Sea has changed in the course of millions of years. On the computer screen we can see what once were seabed mountain ridges, slopes and hollows, and thus where the sand probably came to rest.

Not all of the sandstone formations contain oil. But when it seems likely that there is black gold in a formation of this sort, our «landscapes» make it easier to estimate where the oil has accumulated. The oil flows upwards between the tightly packed grains of sand, as it attempts to reach the highest point in the formation. In the search for oil reservoirs, therefore, it is important to know where and when the seabed has moved up or down.

We are still the only company in the seabed reconstruction business. What is more flattering is the fact that several oil companies are using our time machine in their search for oil.

Oil floating on water

Coloured light interference pattern on a thin film of oil floating on water. Colour arises when the incident light is white, and when variations in the film thickness produce interference in some of the component wavelengths of white light. When these wavelengths are extinguished, the remaining light is coloured.

SINTEF Industrial Management helps its clients find solutions that will improve competitiveness and the value-adding process in industry and society. Technology transfer to small companies, research on good working conditions and the development of integrated production systems are among our areas of activity. We also focus on knowledge management in companies and develop risk analysis scenarios for safety in industry, transport and the offshore sector. Other important areas of activity include the development of management skills, processes of change and performance measurement methods.

Safer trips to work on the shelf

Having to wear a survival suit on your way to work suggests that the journey is not without danger. SINTEF Industrial Management is trying to make it as safe as possible for North Sea workers to travel to and from oilfields on the continental shelf.

In 1997, 12 persons died on their way from Brønnøysund to the Norne field when their helicopter crashed-landed in the sea. We will never know for certain whether this accident could have been prevented.

Even though much has improved, the risk of an accident occurring on such helicopter trips is still five times as high as on normal inland flights in Norway.

At SINTEF Industrial Management, we have played a core role in the «Committee for the Evaluation of Helicopter Safety on the Norwegian Continental Shelf». This official committee has come to the conclusion that in the course of this decade, it should be possible to reduce the risk of helicopter crashes by fifty percent by aiming consciously for higher safety margins.

The Committee feels that responsibility for helicopter transport safety is still unclear. Overall responsibility for flight safety should be concentrated in a single public-sector body, the Civil Aviation Inspectorate, rather than being split among the Petroleum Directorate, the Civil Aviation Inspectorate and the Maritime Directorate, as it is at present. This forum means to ensure that the changes that are need to improve safety will be implemented.

The report of the Committee lists 23 recommendations and concrete measures, including anti-collision systems, improved landing aids and more extensive simulator training for pilots. Helicopters should not be allowed to take off unless all the systems that monitor their technical condition are in working order.

Oil platform workers and their families have to live continuously with the chance that something will happen on the helicopter trip from the mainland to the field or on the way home. For many people, this is a heavy psychological burden to bear, which is another reason why SINTEF Industrial Management has put high priority on improving helicopter safety.

Supporters of thought
Light microscope image of astrocytes, with other neuroglial precursor cells, cultured in the laboratory. These brain cells are the connective tissue of the central nervous system, but scientists believe that they perform other, as yet unknown, functions.
Magnification: x200 at 35mm.

©Nancy Kedersha / UCLA / Science Photo Library

SINTEF Telecom and Informatics possesses a wide range of expertise and knowhow in information technology. Our work is based on such disciplines as data technology, telematics, electronics and acoustics, and the Institute is active in fields ranging from ICT solutions for the health sector to new satellite systems.

Vital data right to your ear

At SINTEF Telecom and Informatics, we have been working for a long time on a rather special earplug. Its underlying concept is that it will enable us to listen to sounds that we wish to hear, such as our neighbour's voice, while it sorts out and eliminates injurious noise.

Today, the earplug is almost ready, while the idea itself has resulted in a start-up company called Nacre AS. In 2002, its staff increased from one to three, and this year the company expects to grow to about eight or ten employees.

The earplug contains a mini-loudspeaker and internal and external microphones. When it is placed in the ear the plug basically blocks all external noise, but the electronic circuitry built into a microchip allows through the sounds we want to hear. In quiet surroundings the ear-plug «opens up», and the wearer can hear normally. But when unwanted noise is dominant, the system blocks the noise while speech is filtered past. In combination with a radio, the earplug makes up a complete communications terminal for noisy environments.

The Swedish and Norwegian armed forces have actively supported the development and testing of the earplug. The development project has a budget of NOK 36 million. Military personnel often have to operate in extremely noisy environments in which they need to communicate. The earplug will shut out much of the noise at the same time as it enables soldiers to pass on verbal messages to each other. With the plug in his ear, a soldier can also jump out of a personnel carrier and enjoy «hands-free» communication with his unit and his companions.

Nacre envisages a wide market for its earplug. The company believes that, besides military applications, there will be a need for the earplug in noisy industries, aviation, the police and fire services. The earplug could also be developed into a hands-free accessory for mobile telephones.

Statoil ASA has signed a contract with Nacre to investigate the potential for the earplug on board offshore installations. A unit that combines hearing protection with communication functions could have important safety applications offshore.

DVD
Scanning electroon microscope image of the tiny pits that encode information on a DVD (digital versatile disc). These pits are read by a focused laser as the disc rotates. Magnification: x5850 at 6x7cm

©Andrew Syred / Science Photo Library

SINTEF Unimed performs research and development projects and offers consulting services in the health sector. The Institute covers a wide range of disciplines, including research on the health service, medical technology and evaluation of methods, work environment and ergonomic technologies for disabled persons and the elderly.

Health Reform under the Microscope

Norway is currently in the midst of a full-scale reform of its mental health services. The existing psychiatric hospitals will remain, but will be complemented by district psychiatric centres which will offer a range of treatments in close proximity to patients' own homes. SINTEF Unimed is conducting studies which will help determine whether these institutions are functioning as intended.

The centres are designed to operate as full-service local psychiatric hospitals. The first was completed about ten years ago, while others are in various stages of building or planning. The development of local psychiatric centres is one of the principal elements in the upgrading plan adopted by the Parliament to strengthen psychiatric health services. This plan laid the framework for how psychiatric care should look in 2006, and made local psychiatric centres a cornerstone of the future of mental health services in Norway.

On behalf of the Research Council of Norway, SINTEF Unimed is investigating the type of treatment received by various patient groups at these centres. As an important part of our investigation, we are also administering questionnaires to patients and their families to measure their level of satisfaction with the services. The results of these studies will help determine whether the centres are operating satisfactorily or if an alternative organizational structure is more appropriate. Results will be directly reported to the health authorities to assist in policy- and decision-making.

The study described above is just one of four projects for which SINTEF Unimed is responsible. All four studies are designed to evaluate the effects of the Parliament's upgrading plan at the «grassroots» level. The health authorities need to know whether the upgrading plan results in mental health services that offer the quality and accessibility originally intended when the plan was adopted. Our results will assist in determining whether revisions to goals or measures will be needed the course of this planning period.

We regard the implementation of a series of research studies as an excellent approach to evaluating the impact of the upgrading plan on psychiatric services. The Research Council of Norway has commissioned a total of ten projects with the goal of better services in mind. Of these ten studies, SINTEF Unimed is responsible for four, and is also participating in a fifth study. In our view, this is a welcome confirmation of SINTEF Unimed's ability to offer expertise in this important area of health services research. The prevalence of mental disorders is widespread, significantly affecting major portions of the general population. Thus, the study of mental health services is one of our priority areas of research.

Red blood cells
Red blood cells as seen by scanning electron microscope (SEM). The disc-shaped cells transport oxygen from the lungs to all the cells of the body. The red colour is due to haemoglobin. Magnification: x1700 at 6x7cm

©Susumu Nishinaga / Science Photo Library

Sinvent is SINTEF's commercial development and investment company. The company has special responsibility for the commercialisation of research results via the sale and licensing of patents and the establishment of new companies. Sinvent also organises all the SINTEF Group's strategic commercial investments.

From idea to new knowledge-based company

In the Norway of the future, our standard of living will depend to an ever greater extent on our ability to create new knowledge-based companies. The SINTEF Group has taken up this challenge by creating its own "greenhouse" for product ideas. SINTEF's subsidiary SINVENT is the Group's "gardener".

The greenhouse is financed via the investment fund recently set up by the SINTEF Group. It also provides supporting services that help to guide a potential entrepreneur in the SINTEF Group through all the phases of the innovation process - from the point at which an idea occurs to him until the newly established company is capable of standing on its own feet.

The most important persons involved are the scientists whose research work has given them ideas for products that they really believe in. The greenhouse makes cash and personnel available to help them in a number of different ways: project funds to evaluate ideas - to find out whether they can be patented, check out their market potential, etc. - and to bring them through the following stages, such as prototype production.

We are talking here about technology that is owned by the SINTEF Group, which participates as an active owner of the start-up companies based on this sort of technology. When these companies have become viable and have grown in value, the Group will sell off its interest in them.

Selling shares in successful start-ups is one way of ensuring that the SINTEF Group itself will continue to grow. Spinoff companies often become customers of their parent institutes, and this is another way of bringing revenue to the SINTEF Group. Furthermore, the prospect of becoming an entrepreneur may have a positive effect on the recruitment of researchers. Start-up companies are thus also important to the SINTEF Group itself.

Sinvent has day-to-day responsibility for SINTEF's innovation activities on behalf of the board of the SINTEF Group's investment fund. We follow up innovative projects, offer the board advice about which projects to invest in, and help start-up companies to develop successfully.

Seed capsule
Electron microscope image of the seed capsule of a foxglove. The cavities in the capsule pick up earth when it falls to the ground, increasing the chances that the seeds will take root.

©Andrew Syred / Science Photo Laboratory

Sinvent's business areas

Innovation:
To encourage the development of good ideas based on SINTEF research and turn them into marketable concepts or investment objects.

Patenting:
To secure the ownership rights of products and ideas created at SINTEF.

Licensing:
To sell and license technology owned by SINTEF and follow up licensing agreements.

Venture:
To create added value by establishing and developing new companies based on technology owned by SINTEF, and to sell shares in such companies.

Strategic investments:
To exercise ownership and financial control functions in companies, partnerships and strategic alliances in which SINTEF has made long-term investments.

This is the Sinvent Group

The Sinvent Group consists of the companies in which Sinvest has made long-term strategic equity investments:

- The Norwegian Fire Research Laboratory (NBL) AS, Trondheim
- SINTEF Solutions AS, Trondheim
- Sinvent Venture AS, Trondheim
- SINTEF Venture AS, Trondheim
- Sinrun AS, Trondheim
- Molab AS, Mo i Rana
- RTIM AS, Raufoss
- Bedriftsuniversitetet AS, Oslo

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The global face of SINTEF

In 2002, SINTEF was running international projects in more than 40 different countries all over the world. With our 1800 members of staff, we believe that we have every reason to be proud of such a portfolio.

Our range of activities is wide in both geographical and professional terms.

In Iran, we are drawing up plans for the development and operation of oil-fields on behalf of the national oil company. In the USA and Brazil, we are testing and developing equipment in close collaboration with oil companies and the maritime industry. In Africa, we are working on a contract basis for development aid organisations such as NORAD and the Atlas Alliance, performing studies of living conditions and providing vocational training and rehabilitation of aids for people with handicaps. We are also cooperating with most countries in Europe on EU projects. This is to mention just a few of our activities.

We regard all of these projects as extremely important, not because they are all gold-mines, but because they offer us exciting challenges, new experience, knowledge and a much wider network of contacts. We believe that this will be a profitable strategy - in the long term. If we are to be successful as a Norwegian research foundation in other countries, we need to be able to offer more than just scientific knowledge and research experience. It is just as important to be able to deal successfully with other cultures, which is why SINTEF has decided to develop its own "multicultural strategy". We have engaged research scientists and other members of staff from several different countries. This means, for example, that we can have an Iranian at our side when we negotiate in Iran and a Chinese interpreter and "bridge-builder" when we are operating in China. Around 120 of our researchers are of foreign origin, and all are of the greatest professional and cultural value to SINTEF.

Last year, 15.3 per cent of our turnover came from contracts for overseas clients. SINTEF's aim is to double this proportion within the next five years.

We believe that our potential for growth abroad is great, particularly in areas in which Norway already has powerful industrial clusters; the petroleum sector, maritime industry, energy and the metallurgical industry. We believe that there are also interesting overseas customers and projects in such fields as chemicals, medical technology and the fishing and aquaculture sector – and that we will win a growing proportion of research contracts there in the near future.

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World
Satellite map of the World shown in rectangular projection centred on the prime (Greenwich) meridian in London. This image combines hundreds of individual images acquired by NOAA weather satellites from orbits some 820 km above Earth. Each frame has a resolution of one kilometre.

In 2002 SINTEF set up the two business areas Oil and Gas, and Public Sector, with the aim of integrating all of the SINTEF Group's knowledge in these two areas via simple marketing channels. These efforts are being continued and strengthened in 2003 under the name of SINTEF Solutions.

SINTEF Oil and Gas and SINTEF Public Sector:

A «one-stop shop»

In 2002, SINTEF launched two business areas: Oil and Gas, and Public Sector, with the idea of integrating the whole of the SINTEF Group's knowhow in these two sectors via simple market channels. This concept is being continued and developed in 2003, and will go by the name of "SINTEF Solutions".

Oil and gas is a market segment for all of the institutes in the SINTEF Group that have traditionally approached the market individually via technological development projects with a need for high-level expertise. SINTEF Oil and Gas is primarily a marketing organisation which addresses its customers' value chains from beginning to end. The unit will put together the combination of expertise needed in each particular case, no matter where in SINTEF it is to be found. This will make us more capable as an organisation of taking on large, multidisciplinary tasks. Our aim is to act as a think-tank for oil companies when they need to evaluate alternative technologies within a wide range of perspectives.

The public sector has always been among our most important clients, albeit a client which has found our organisation somewhat complicated to deal with. We believe that the public sector needs a supplier of solutions which itself is capable of integrating individual sources of expertise into complete solutions. SINTEF Public Sector therefore offers services across the whole range from design and energy/environment, via electronics and data to work environment, organisation development and knowledge management – if necessary, in a single package. We aim to be a "one-stop shop" for this customer group.

Our *modus operandi* is simple: SINTEF Oil and Gas or SINTEF Public Sector scientists sit down with the client and analyse his problems; they then put together a team of colleagues from the groups that we believe will be best able to solve the problems discussed.

So far, we have been receiving positive feedback from the market about both this method of working and the results it has produced, which suggests to us that this is the right direction for SINTEF to be moving in.

In both financial and market terms, 2002 was a difficult year for SINTEF; this was primarily due to problems in Norwegian industry and the international economic situation. On the scientific and academic plane, on the other hand, 2002 was a typical year, as evidenced by a multitude of contracts and results.

Report of the Board of Directors, 2002

The SINTEF Group

The SINTEF Group is a concern comprising 12 research institutes located in Trondheim and Oslo. The business idea of the Group is to sell research-based knowledge and related services to Norwegian and foreign clients, in cooperation with NTNU and the University of Oslo. The SINTEF Group aims to help develop existing industry and new companies with potential for growth. We also intend to help create good relationships between research-based education and industrial research.

Our institutes are as follows: SINTEF Civil and Environmental Engineering, SINTEF Applied Mathematics, SINTEF Materials Technology, SINTEF Applied Chemistry, SINTEF Electronics and Cybernetics, SINTEF Telecom and Informatics, SINTEF Industrial Management, SINTEF Unimed, MARINTEK AS, SINTEF Energy Research AS, SINTEF Petroleum Research AS and SINTEF Fisheries and Aquaculture AS. The first eight are units of the SINTEF Foundation while the last four are limited companies whose principal shareholder is the Foundation. At the turn of the year (2002 -2003), the STEP Group whose 20 employees fell within the remit of the Research Council of Norway, joined SINTEF Industrial Management. The Group is internationally recognised for the innovative quality of its research.

The Group also comprises the wholly-owned subsidiary SINVENT AS, in which the Group's commercial activities and its share in start-up companies are placed. In the course of 2002, SINVENT has been built up in business concept, financial and staffing terms, and the company is now well equipped to carry out its assigned tasks. In order to position ourselves better in markets in which we expect to see growth, SINTEF Solutions AS was was set up at the turn of the year as a subsidiary of SINVENT. The new company will sell multidisciplinary expertise in the fields of oil and gas and public-sector renewal.

Until the present, SINTEF's 12 research institutes have not been liable for tax on their profits, while SINVENT and its subsidiaries pay tax just like other commercial companies. In a letter dated March 25, 2003, Trondheim Tax Office has maintained its demand that the Foundation should be taxable with effect form 2001. The Board is of the opinion that the public-spirited objectives of the Foundation are sufficient grounds for a continuation of its tax-free status, and will continue its efforts to achieve recognition of this position.

Markets and scientific activity

2002 was marked by a series of circumstances that negatively affected the market for large segments of the SINTEF Group's activity: Parliament reduced the funding available for applied research, the FUNN scheme was temporarily blocked and falls in the stock exchange resulted in major reductions in venture-driven R & D, while a strong rate of exchange for the Norwegian krone, fear of terrorist activities and war caused much Norwegian R & D investment to be postponed. The international market for our services was more stable.

On the scientific plane, however, SINTEF enjoyed a satisfactory year, having performed 4704 contract projects for 2175 clients. Specifically, we began to see the results of our efforts to establish several major, long-term strategic arrangements with clients and other entities. Statkraft and SINTEF Energy Research signed a strategic R & D agreement for 2002 - 2006, with an budget of NOK 50 million. This agreement is an encouragement for closer cooperation and has led to the start of several new projects in the fields of hydrology and production planning, river system environment, condition control and maintenance, as well as renewable sources of energy.

The Ministry of Trade and Industry has set up a National Centre for Information Security (SIS) at SINTEF Telecom and Informatics, in cooperation with Uninett. The new centre has been given responsibility for coordinating activities in the field of information and communications technology (ICT) in Norway. It will receive incident reports from the public sector and private industry and attempt to map out the general status of threats to ICT systems in Norwegian society.

SINTEF Petroleum Research and SINTEF Materials Technology have launched a cooperative project with ConocoPhillips and TotalFinaElf. This will last for three periods of three years and will focus on the development and use of a new generation of simulators for multiphase flow. This new tool, which is known as LEDA, will offer a three-dimensional description and visualisation of multiphase flow in geometrically complex pipe systems and equipment under complicated operational conditions. The equipment will primarily help to reduce the technical risks involved in field developments, particularly in deep water. In 2002, the results of the LEDA project were used in connection with an overseas field development. The development operator was able to verify that a relatively cheap solution could be utilised, which saved the company some NOK 500 million.

SINTEF Applied Chemistry signed a cooperative agreement on world-wide sales of SINTEF technology with the American company UOP, which is one of the world's leading suppliers of catalysts and absorbents for petrochemical plants. The collaboration involves advanced equipment which allows a large number of chemical syntheses and characterisations of material properties to be performed in parallel. Combinatorial techniques of this sort are capable of reducing the time required for experimentation by a factor of five, while the cost of each synthesis is less than one percent of what it would be using standard techniques. In terms of yield, the SINTEF technology is the world leader.

Economy

In 2002, the SINTEF Group had a gross turnover of NOK 1,619 million (1,651: figures in parentheses refer to 2001). The operating result was MNOK -24.9 (54.1) and financial items came to MNOK 2.7 (26.2). The SINTEF Group's result before tax and shares in associated companies and minority interests was MNOK -22.2 (135.7). The loss will be covered through the equity capital of the individual units. The SINTEF Foundation had a gross operating revenue of MNOK 1,084 (1,034). With an operating result of MNOK -4.9 (23.6) and financial items of MNOK 5.3 (17.2) the Foundation's result came to MNOK 0.4 (40.8) before its share in subsidiary companies' results and taxes.

On 31.12.2002 the SINTEF Foundation had an equity capital of MNOK 710.7 (730.3), which is equivalent to 58.7 percent (62.3 percent) of total capital. This provides a good foundation for continued operation, and this is the assumption which underlies the presentation of these accounts. The boards of our subsidiaries have performed similar analyses and have all concluded that they continued operation is justified. The Board of the Foundation, which is identical with the Group Board, is of the same opinion.

Since the closing of these accounts, there have been no developments of significance for the evaluation of the Foundation or the Group.

Personnel and personnel development

On December 31, 2002, the SINTEF Group employed a total of 1770 persons (1929) of whom 1162 (1135) were employed by the SINTEF Foundation. The reduction in the number of employees in the group is primarily due to the sale of SINTEF's subsidiary company Runit AS. Seventy-five members of the research staff (9.2%) left SINTEF during the year to work in industry, the public sector or our universities, while 96 new members of staff joined us.

A questionnaire distributed to students of technology found that SINTEF was their fourth most popular potential place of work in Norway. SINTEF has been climbing in this ranking during the past few years. SINTEF places great stress on being a good school for careers in research, industry ad the public sector.

Efforts to develop our internal training programme, known as the “SINTEF School”, have therefore been intensified in 2002.

The work environment and the external environment

The concept of work environment is broadly defined in SINTEF, and includes such areas as health, safety and the environment (HSE), management and company culture. Aims and guidelines for these areas are set out in our internal control system and in our annual plans. The climate of cooperation within the Work Environment Committee has been good in 2002, and the network of HSE coordinators and safety representatives has functioned satisfactorily.

A wide-ranging work environment study showed that nearly all aspects of HSE had developed in a positive direction since the previous study, and currently lie at a good level. It was particularly good to note that opinions regarding the future of SINTEF and of our personnel had become significantly more positive, and that job satisfaction and pleasure taken in work were rated highly. The study also provided useful signals with regard to which aspects need further work, and these have been adopted as a basis for the follow-up efforts which are already under way. Management and team development will be special points of focus in this respect.

The rate of sick-leave was 3.9% in 2002 (3.5), 75% of which was due to long-term absenteeism. The incidence of personal injuries is low. Efforts are under way to ensure that near-accidents are also reported, with prevention of injuries in mind.

There is little in SINTEF’s range of activities that has negative effects on the external environment, and there have been no irregularities that have led to damage to the environment in the course of the past year.

General conditions

SINTEF’s ability to generate innovations that are capable of forming a basis for renewal in Norwegian industry depends to a significant extent on the scope of public-sector support for industrially oriented applied research. While support for basic research has being given a very significant and necessary lift in the course of the past few years, support for industrial research has declined. The Research Council has announced a forthcoming review of its institute policy. In view of the need to restructure Norwegian industry, we assume that the authorities will regard SINTEF and other institutes as essential tools for the process of innovation.

The “Skatte-FUNN” scheme, which was launched in October 2002, is expected to bring new contracts to the SINTEF Group.

Prospects for the future

In the short term, the Norwegian market for R & D contracts is expected to be stable or falling. Growth is not to be expected until the Stock Exchange rises and industry begins once again to build up its activity in Norway. However, we assume that the process of renewal within the public sector could result in a slight growth in the SINTEF Group’s market in the near future.

We expect that revenue from overseas clients can be increased in fields in which we possess special expertise and technology at international level. We also expect that the scope of cooperative EU projects will fall in 2003, given that we are currently in the final phase of projects in the Fifth Framework Programme. These should build up again as new projects are launched in the Sixth Framework Programme. The authorities have signalled that funds will be available for institute participation in EU projects.

Functional materials and nanotechnology, and sustainable gas technology, are national fields of special R & D effort which are currently in the launch phase, and SINTEF ought to play an important role in both of these fields.

Marketing efforts in 2003 will be reinforced by the adoption of new working methods and new tools for marketing and customer contact.

We anticipate that our investments in SINVENT will gradually produce a growing contribution to the financial results of the SINTEF Group, and in this way be a source of internal finance for strategic basic research at SINTEF.

As we enter 2003, our order reserve is satisfactory.

Finally, the Board wishes to thank all members of staff of the SINTEF Group for the good work they have done during the past year.

SINTEFs Board of Directors
In front from left: Kjetil Johannessen, Morten Loktu (President of SINTEF), Terje Østvold og Elisabeth Wille.
Back from left: Hans H. Faanes, Per Ola Grøntvedt og Jan Erik Korssjøen. Alexandra Bech Gjørv was not present.

Hans H. Faanes

Jan Erik Korssjøen
(Chairman)

Terje Østvold

Elisabeth Wille

Alexandra Bech Gjørv

Kjetil Johannessen

Per Ola Grøntvedt

Morten Loktu
(President of SINTEF)

SINTEF's Prize for Outstanding Research 2002 has been awarded to

Svein Sørsdal

Odd Kr. Ø. Pettersen

Jarle Svean

Foto: Studio Lasse Berre

for their development and commercialisation of the PARAT (Personal Active Radio/Audio Terminal) concept.

PARAT is an earplug-based combination of intelligent hearing protection device and advanced communications terminal. The earplug contains electro-acoustic components such as a microphone and loudspeaker, as well as specially designed electronics that compensates for environmental noise, partly by generating counter-noise. The device simultaneously makes the human voice more clear, thereby improving communication in noisy environments. In this way, PARAT helps to solve serious safety and work environment problems.

The concept is the result of a long period of research and it is now being commercialised by NACRE AS, which is further developing the idea for other applications

Outstanding Teaching in 2002

foto: Arne Aspheim

SINTEF's award for outstanding teaching for 2002 has gone to Associate Professor Jostein Halgunset of the Faculty of Medicine.

The prize is worth NOK 25,000.

Halgunset was given the award for his ability to engage and enthuse his students. The acknowledgement also emphasises the interest he takes in his students and the fact that he finds time for each of them.

Revenues

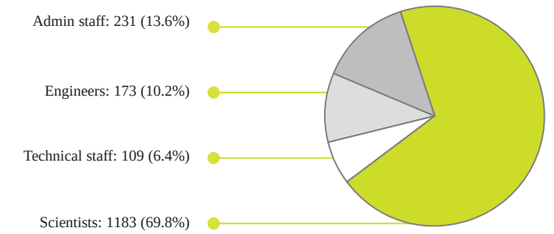
– the SINTEF Group's turnover in 2002: MNOK 1,618.

The institutes' turnover by source of finance.

Employees

– The SINTEF Group had a total of 1,770 employees on 31.12.2002, of whom 1,696 were employed by the Group's research institutes and 74 by the Sinvent concern.

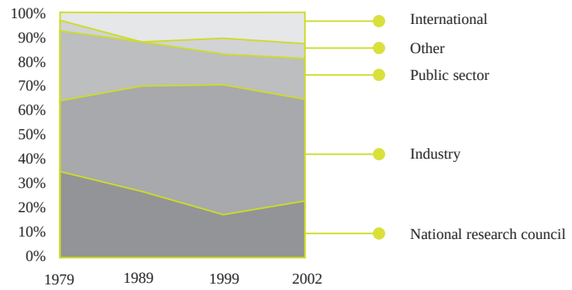
Institute employees by job category.



Net income

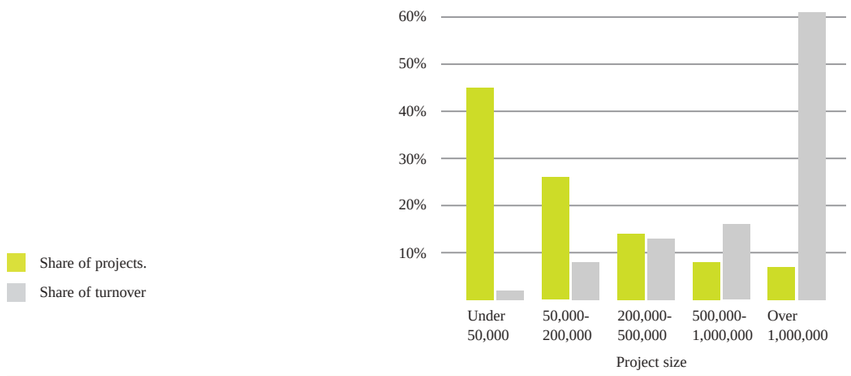
– for each preceding 12-month period – the SINTEF foundation

Sources of revenue



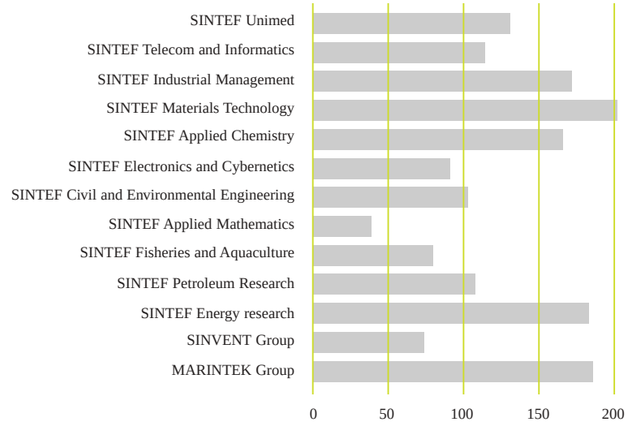
Projects completed in 2002

– The SINTEF Group completed a total of 4013 projects in 2002.



Turnover

Turnover of the SINTEF group in 2002, by institute or limited company. Gross operating income in Million NOK.



INCOME STATEMENT

(all figures in NOK thousand)

The SINTEF Group				SINTEF	
2001	**2002**			**2002**	**2001**
			OPERATING INCOME AND EXPENSES		
1 336 963	1 218 224		External project revenues	767 078	779 058
227 781	294.567		Projects funded by the Research Council of Norway	217 695	168 996
50 405	52 200		Grants from the Research Council of Norway	33 000	33 000
35 409	53 262		Other revenues	66 448	52 939
1.650.559	**1 618 253**	**4**	**Gross revenue**	**1 084 220**	**1 033 994**
360.256	346 831		Direct project expenses	274 753	262 467
1.290.303	**1 271 421**		**Net operating income**	**809 467**	**771 527**
897.080	899 745	6	Salaries and social security	577 887	522 416
51.570	49 864	8	Depreciation	32 132	31 916
3.421	603		Losses on accounts receivable	603	3 421
2.243	854	8	Write-down	-	-
281.883	345 261		Other operating expenses	203 787	190 183
1 236 197	**1 296 327**		**Operating expenses**	**814 409**	**747 936**
54 106	**-24 906**		**OPERATING RESULT**	**- 4 942**	**23 591**
			FINANCIAL INCOME AND EXPENSES		
31 055	30 268	3	Financial income	12 573	18 669
4 826	27 610	3	Financial expenses	7 281	1 487
26 229	**2 658**		**Net financial income**	**5 293**	**17 183**
55 393	-		Sales of areas of activity	-	-
135 729	**-22 247**		**Profit before consolidation of subsidiaries**	**351**	**40 774**
-	-	9	Share of results of subsidiaries	- 18 267	54 954
-	-3 734	9	Share of results of associated companies	-	-
135 729	**-25 981**		**Profit before taxes**	**- 17 916**	**95 728**
15 969	-7 174	19	Taxes	1 340	393
119 760	**-18 807**		**ANNUAL RESULT**	**- 19 256**	**95 335**
24 425	449		Minority interests share of annual result	-	-
95 335	**-19 256**		**Majority interests share of annual result**	**-**	**-**

BALANCE

(all figures in NOK thousand)

The SINTEF Group				SINTEF	
2001	**2002**			**2002**	**2001**
			ASSETS		
			Long-term assets		
-	2 624	19	Deferred tax advantage	–	–
-	**2 624**		**Intangible assets**	**–**	**–**
304 213	299 391	8	Real estate, buildings and other fixed assets	254 810	262 349
27 487	105 813	8	Buildings under construction	105 813	27 487
52 752	51 197	8	Scientific equipment	23 115	27 784
8 584	6 019	8	Other equipment, fixtures, etc.	2 504	5 045
393 036	**462 420**		**Long-term operating assets**	**386 242**	**322 665**
-	-	9	Investments in subsidiaries	214 753	228 893
-	4 867	9	Investments in associated companies	-	-
3 232	3 211	9	Shares in other companies	-	31
-	-		Consolidated long-term receivables	58 933	47 690
12 494	10 954	7	Pension fund	-	-
14 935	6 527		Other long-term receivables	3 629	13 208
30 661	**25 560**		**Financial long-term assets**	**277 315**	**289 822**
423 697	**490 604**		**Total long-term assets**	**663 557**	**612 487**
			Liquid assets		
1 517	1 711		Inventory of finished goods	1 522	1 328
83 313	85 394	5	Work in progress	50 408	57 083
84 830	**87 105**		**Goods**	**51 930**	**58 411**
464 947	426 311		Accounts receivable	255 111	278 872
-	-		Consolidated current receivables	34 453	26 450
89 889	21 940		Other current receivables	17 261	1 896
554 836	**448 251**		**Receivables**	**306 824**	**307 218**
43 204	58 596	10	Shares	-	-
221 543	236 876	12	Bonds and other securities	115 589	103 195
264 747	**295 472**		**Investments**	**115 589**	**103 195**
217 585	198 855		Cash, bank deposits	75 855	90 408
217 585	**198 855**		**Bank deposits, cash, etc.**	**75 855**	**90 408**
1 121 998	**1 029 682**		**Total liquid assets**	**550 199**	**559 231**
1 545 694	**1 520 285**		**TOTAL ASSETS**	**1 213 755**	**1 171 717**

The SINTEF Group				SINTEF	
2001	**2002**			**2002**	**2001**
			EQUITY AND LIABILITIES		
			Equity		
62 300	62 300	17	Foundation's equity	62 300	62 300
62 300	**62 300**		**Paid-up equity**	**62 300**	**62 300**
-	-	17	Reserve for valuation variances	176 764	195 354
667 991	648 412	17	Other equity	471 647	472 637
98 999	88 774		Minority interests	-	-
766 990	**737 186**		**Earned equity**	**648 411**	**667 991**
829 290	**799 486**		**Total equity**	**710 711**	**730 291**
			Liabilities		
47 123	23 223	7	Pension liabilities	17 226	38 137
4 700	-	19	Deferred tax	-	-
51 823	**23 223**		**Long-term liabilities**	**17 226**	**38 137**
3 262	4 118		Mortgage loans	-	-
3 262	**4 118**		**Other long-term liabilities**	**-**	**-**
90 943	103 755		Accounts payable	79 828	58 372
10 541	53 067		Credit line	43 497	-
4 637	1 589	19	Tax due	1 300	200
194 544	186 648		VAT, tax deductions, social security, etc.	128 481	127 170
225 505	236 739		Advance payments from customers	160 109	149 824
-	-		Consolidated current liabilities	8 701	20 660
135 150	111 662	18	Other current liabilities	63 901	47 064
661 319	**693 460**		**Current liabilities**	**485 817**	**403 289**
716 404	**720 800**		**Total liabilities**	**503 043**	**441 426**
1 545 694	**1 520 285**		**TOTAL EQUITY AND LIABILITIES**	**1 213 755**	**1 171 717**

Trondheim 2. April, 2003

Hans H. Faanes

Jan Erik Korssjøen
(Chairman)

Terje Østvold

Elisabeth Wille

Alexandra Bech Gjørv

Kjetil Johannessen

Per Ola Grøntvedt

Morten Loktu
(President, SINTEF)

CASH-FLOW ANALYSIS

(all figures in NOK thousand)

The SINTEF Group			SINTEF	
2001	**2002**		**2002**	**2001**
		Cash-flow from operations		
135 729	-25 981	Profit before tax	-17 916	95 728
	3 734	Percentage of profit from subsidiaries/associated companies	18 267	-54 954
53 813	50 719	Ordinary depreciations/write-downs	32 132	31 916
-375	1 358	Net sales of fixed assets	1 358	-
-55 393	-	Sale of areas of activity	-	-
-128 488	-38 891	Change in investments	-12 394	-46 084
	8 166	Depreciation of shares	-	-
-6 068	-2 081	Change in work in progress	6 675	1 117
-65 799	38 636	Change in accounts receivable	23 761	-50 297
23 086	12 812	Change in accounts payable	21 456	12 360
47 361	90 130	Change in other accrued or deferred items	36 408	67 665
-1 679	-4 677	Tax paid	-240	-193
	7 663	Changes in composition of Group		
-17 806	-22 360	Change in pension obligations	-20 911	-12 644
-15 619	**119 229**	**Net cash-flow from operations (A)**	**88 597**	**44 614**
		Cash-flow from investment activities		
-101 046	-137 795	Purchases of long-term operating assets	-101 110	-64 065
-8 127	-8 601	Investments in long-term financial assets	-11 243	-22 385
9 369	5 239	Sales of long-term operating assets	4 043	1 715
71 379	8 429	Sales of other financial assets	9 610	-
-28 425	**-132 728**	**Net cash-flow from investment activities (B)**	**-98 700**	**-84 735**
		Cash-flow from financial activities		
	856	Payments on uptake of new long-term debt		
3 262	-	Instalments paid on long-term debt	-	-
	-	Conversion of debt to equity capital	-4 450	-
-1 308	-6 086	Changes charged directly to equity capital		
1 954	**-5 230**	**Net cash-flow from financial activities (C)**	**-4 450**	**-**
-42 090	-18 730	Net change in cash holdings (A+B+C)	-14 553	-40 121
259 675	217 585	Cash balance on 01.01.02	90 408	130 529
217 585	**198 855**	**Cash balance on 31.12.02**	**75 855**	**90 408**

NOTES TO THE ANNUAL ACCOUNTS for 2002

1. Accounting principles

General
The annual accounts have been drawn up in accordance with the Norwegian Accounting Act of July 17, 1999, and are based on Norwegian accounting standards and guidelines for good accounting practice.

Principles of consolidation
The consolidated accounts indicate the overall economic result and financial position when the parent company SINTEF and its shareholdings in other companies are presented as a financial unit. The consolidated accounts include all companies in which SINTEF owns more than 50% of the share capital or in which it has a decisive influence.

In addition to SINTEF, the parent company, the consolidated accounts include:
SINTEF Petroleum Research
SINTEF Energy Research
SINTEF Fisheries and Aquaculture
Marintek Concern
SINVENT Concern

Please see also note 10 concerning subsidiaries.

All significant inter-company transactions, debts and unrealised internal earnings have been eliminated. The minority interests' share of the result forms part of the Group's result and the minority interests' share of equity forms part of the Group's equity.

Principles employed in entering revenue
Project income is entered on a current basis, i.e. as a percentage of the work assumed to have been completed, such that the completed proportion of the earnings expected from a project is treated as income. The degree of completion is based on what has actually been produced.

Where projects are expected to result in a loss, the entire loss is entered as a cost item.

Public-sector support in the form of research council funding, etc. is entered in accordance with basic principles for entering income and expenses, i.e. that funding is entered at the same time as the income it is intended to generate or the cost that it is intended to reduce. Funding to which conditions are attached are entered as income at the time at which the conditions have been, or are likely to be, met.

Investments and support items are entered net. Investment support is deducted from the historical cost of the investment item.

Licence revenue is entered pro rata for the period of the licence.

Classification
Current assets are items related to project activity or debts due to be repaid within one year, as well as other assets not intended for long-term ownership or use by the company. Other assets are long-term assets. The distinction between short-term and long-term debts is drawn at a due date of one year.

Shares in subsidiaries and other shareholdings of strategic or "non-financial" character are classified as long-term assets. Other shares are classified as current assets.

Estimates of value of assets
Current assets are valued at historical cost or real value, whichever is lower. Long-term assets are valued at historical cost. If the real value of long-term assets is lower than their book value, and the fall in value is not expected to be temporary, their value is written down to their real value.

Shares in subsidiary companies
Investments in consolidated associated companies are entered in accordance with the equity capital method in the company accounts, which means that the investment is valued as the parent company's share of the equity capital of the subsidiary, and the result of the share is entered as revenue or cost.

Other long-term shares and stocks
Long-term shares in companies in which SINTEF does not have a significant influence are balanced at historical cost. Investments are written down to their real value if their fall in value is not temporary. Dividends received and other payments from company surpluses are entered as "Other financial income".

Shares in other companies (current shares)
Shares that form part of the business portfolio are valued at their real value on balancing day. Other current shares are valued at mean historical cost or real value on balancing day, whichever is lower.

Foreign currency
Foreign-currency items are valued at the exchange rate on balance day. Incoming and outgoing foreign exchange rate risks are reduced by means of futures contracts directly related to contracts. Spot transactions are also performed on excess currency amounts.

Receivables
Accounts receivable and other receivables are valued at their nominal value, with deductions for anticipated losses. Provisions for losses are made on the basis of an individual evaluation of the specific receivable involved.

Work in progress
This item includes work done but not invoiced. Accrued hours are valued at invoiceable rates and relative to the percentage of the project actually completed, with deductions for anticipated losses.

Intangible assets
The costs of intangible assets, including research and development, are entered as costs in their entirety.

Long-term operating assets
Operating assets costing more than NOK 50,000 and with an anticipated economic lifetime of three years or more, are activated and depreciated on purchase. Operating assets are depreciated linearly at the following rates: scientific equipment, office equipment, furniture and vehicles: 33%; buildings: 2 - 5%.

Tax
In February 2002 Trondheim Tax Office warned SINTEF that it was considering making SINTEF liable to taxation from 2001. The Board of the Foundation has questioned the legitimacy of this decision. This matter has still to be cleared up and the effects of any tax liability have not been incorporated into the Foundation's accounts for 2002. In a letter dated March 25, 2003, Trondheim Tax Office maintained its demand that the Foundation should pay tax with effect from 2001.

Pensions
Pension costs are entered in the accounts in accordance with the provisions of the Norwegian Standard for Pension Cost Accounting. Net pension costs consist of the present value of pensions earned in the course of the year plus the cost of interest on pension obligations, less the anticipated yield of the pension fund, and corrected for the distributed effects of changes in the pension plan, estimates and deviations. Net pension costs are entered under "Salaries and Social Costs".

The Norwegian Accounting Standard states that a company's pension scheme is to be treated as a compensation plan, in which future pension payments are based on the number of years of earnings and the salary level at pensionable age.

Pension funds are estimated at the end of each accounting year. The estimated value is adjusted annually in accordance with the statement provided by the life-insurance company on the basis of the transferable value of the pension funds.

Measurement of accumulated pension liabilities uses estimated liability at the end of the accounting year. This estimated value is adjusted annually

in accordance with the statement provided by the insurance company regarding accumulated pension liability. Actuarial estimates are made every year by the insurance company on the basis of information provided by SINTEF.

Differences between estimated and actual values that are due to changes in economic or actuarial assumptions are regarded as changes in accounting estimates. The Accounting Standard allows a special method of dealing with such differences in that differences of up to 10% of the larger of pension liability or pension funds may be excluded from the basis for calculating the result. Differences above the 10% limit must be entered in the result over the remaining earnings period. Differences due to changes in the pension plan are distributed systematically over the average remaining earnings period.

Agreed pension plans (the AFP scheme) are covered by the Standard for Pension Cost Accounting. The implementation of the AFP is regarded as a change in the pension plan. The liability is entered as a cost over the average remaining earnings period.

The SINTEF Group has a collective pension plan with an insurance company for all its employees. Our liability covers 1222 SINTEF employees and 354 pensioners. The pensions of a further four former employees are paid as part of our operating costs. Contributions by employees towards the partial financing of the pension scheme are treated as a reduction in salary costs and do not affect the pension costs of the period.

2. Financial market risks

The SINTEF Group is exposed to changes in exchange rates in that its project revenues are in foreign currency, largely Euros and USD, while project costs are wholly or partly in Norwegian kroner. In order to reduce the exchange rate risks involved the company utilises foreign exchange futures contracts.

The SINTEF Group maintains considerable liquid reserves, which are centrally place on behalf of the whole Group. The liquidity reserve has been invested on a long-term basis and on the basis of a clearly defined risk framework. Per 31.12. 2002 the market value of the portfolio was MNOK 236.9, including accrued interest. The SINTEF Foundation was responsible for 48.8% of this amount.

A one percent change in the rate of interest on the portfolio per 31.12.2002 would have an effect on the consolidated result of around MNOK 2.09, with a corresponding effect for the Foundation of MNOK 1.02.

A 20% rise in the level of the share market would improve the consolidated result by MNOK 5.6, with a corresponding figure for the Foundation of MNOK 2.76, while a 20% fall would have a negative effect on the consolidated result of MNOK 2.75, with a corresponding figure of MNOK 1.34 for the Foundation.

3. Consolidated items

All figures in NOK 1000	The SINTEF Group	SINTEF
Financial income:		
Interest on funds invested	20.368	10.867
Interest on interest note	2.019	1.706
Interest and foreign exchange gains	4.303	0
Gains from investments of capital	696	
Gains from sales of shares	2.882	0
Sum financial income	**30.268**	**12.573**
Financial costs:		
Interest costs and foreign exchange losses	9.503	2.263
Interest on overdue payments	266	196
Bank charges	1.147	1.011
Depreciation of short-term shareholdings	8.166	0
Debt forgiveness	8.528	3.811
Sum financial costs	**27.610**	**7.281**

4. Sales revenues for the SINTEF Group

All figures in NOK 1000

By area of activity within the SINTEF Group	2002
Intercompany transactions	67 793
Civil and Environmental Engineering	101 397
Materials Technology	201 666
Industrial Management	171 640
Telecom and Informatics	114.372
Applied Mathematics	39 077
Applied Chemistry	166 133
Electronics and Cybernetics	91.262
Medical Research	130.880
Total Foundation	**1.084.220**
SINTEF Energy Research	182 661
Marintek Group	186.170
SINTEF Fisheries and Aquaculture	80.169
SINTEF Petroleum Research	108.372
SINVENT Group	74.006
Eliminated intercompany transactions	– 97.345
Total areas of activity	**1.618.253**

Geographical distribution	The SINTEF Group	SINTEF
Norway	1.345.364	927.712
European Union	102.780	70.635
Other countries	170.108	85.873
Sum geographical distribution	**1.618.253**	**1.084.220**

5. Work in progress

This figure includes a depreciation in value relative to the sales value of 7% of the company's share of work in progress, with the exception of MARINTEK , which shows a 4.17% depreciation in this item.

6. Salary costs, number of employees, fees, loans to employees, etc.

All figures in NOK 1000

The SINTEF Group 2001	The SINTEF Group 2002	Salary costs	SINTEF 2002	SINTEF 2001
737.115	711.387	Salaries	454.353	426.413
111.149	112.284	Employers' contribution	75.267	66.211
35.204	39.032	Pension costs	26.893	18.995
13.612	37.042	Other benefits	21.375	10.797
897.081	**899.745**	**Sum**	**577.887**	**522.416**
1.897	1.744	Average number of employees	1.178	1.110

The SINTEF Group's leading personnel are enrolled in the company's collective pension scheme. The new President of SINTEF is enrolled in a pension scheme which will give him 66% of his full salary from the age of 67. He is also the beneficiary of an arrangement whereby he will receive 12 months' salary if the Board wishes him to resign from his position. Any other earnings during this period will be deducted. The salaries of the previous and current Presidents of the company in 2002 came to a total of MNOK 1.36, plus taxable benefits totalling MNOK 0.12. No fees were paid to the Council of SINTEF. Honoraria to SINTEF's Board of Directors came to MNOK 0.36 in 2002.

Auditor

Auditor's fees paid to Deloitte & Touche for the SINTEF Group came to MNOK 0.93, of which MNOK 0.47 were paid on behalf of the Foundation. Additional fees for other services related to the audit came to MNOK 1.13 for the SINTEF Group, of which MNOK 0.78 were paid on behalf of SINTEF. Deloitte & Touche Advocates DA, which collaborates with Deloitte & Touche State Authorised Public Accountants Ltd, has supplied services to the Foundation to a value of MNOK 0.25.

Loans to employees

The total sum of loans to employees amounted to MNOK 0.54, of which MNOK 0.39 were within SINTEF. This figure includes the home-PC scheme.

7. Pensions

The following assumptions for SINTEF and the Group as a whole have been made for 2002:

Annual return on pension funds	8.0%
Discount rate	7.0%
Annual rate of growth of salaries	3.0%
Annual adjustment of social security basic rate	3.0%
Annual adjustment of pensions under payment	2.5% for SINTEF, otherwise 3%
Turnover in all age groups	Different rates, depending on age and category of employment
Average employment tax rate	14.1% (5.1% for Molab)
Tendency to take advantage of AFP (early retirement scheme)	0 – 50%

Composition of pension costs for the period (except for the State Pension Fund). All figures in NOK 1000:

	SINTEF	SINTEF Group
Net present value of pension accumulation for the year	25.567	41.150
+ interest costs of accrued liabilities	26.943	42.479
- anticipated return on pension funds	30.552	48.669
+ amortisation of estimated deviation	2.373	4.770
estimated deviation on unsecured yields		
- accounted estimate changes		
= Net pension costs, excluding employment tax	**24.331**	**39.730**

Balance on December 31, 2002, pension liabilities (NOK 1000):	SINTEF	SINTEF Group
Estimated pension liabilities	405.229	656.600
- Estimated value of pension funds	383.196	633.450
- Unentered effect of estimated deviation	7.428	12.786
Estimated net pension due before employer tax	14.605	10.364
+ Periodised employment tax	2.621	1.905
= Estimated pension due after tax	17.226	12.269
Net liabilities, whereof:	17.226	12.269
Underfinanced pension due	17.226	23.223
Overfinanced pensions due	0	10.954

8. Long-term operating assets, furniture and buildings

All figures in NOK 1000

SINTEF Group 2002	Scientific equipment	Office equipment, furniture, vehicles	Buildings	Buildings under constr.	Sum
Historical cost per 01.01.2002	307.867	98.674	743.421	27.487	1.177.449
Purchases in 2002	42.203	3.867	8.488	78.326	132.884
Decrease at historical cost	-7.363	-372	-1.332	0	-9.067
Historical cost per 31.12.2002	342.707	102.169	750.577	105.813	1.301.266
Total ordinary depreciation	290.440	96.148	451.185	0	837.773
Total depreciation	1.068	0	0	0	1.068
Book value per 31.12.99	**51.197**	**6.019**	**299.391**	**105.813**	**462.420**
Ordinary depreciation for year	**33.556**	**4.329**	**11.977**	**0**	**49.864**
Depreciation for year	**854**	**0**	**0**	**0**	**854**
Economic lifetime	3 years	3 years	20-50 yrs		
Depreciation plan	Linear	Linear	Lineær	Not deprec.	
Annual hire of operating assets not entered in Balance Sheet			34.580		34.580
Purchases <NOK 50,000	19.960	5.125			25.085

SINTEF 2002	Scientific equipment	Office equipment, furniture, vehicles	Buildings	Buildings under constr.	Sum
Historical cost per 01.01.2002	176.114	89.266	675.387	27.487	968.254
Purchases in 2002	19.779	749	2.256	78.326	101.110
Decrease at historical cost	-7.363	-218	0		-7.581
Historical cost per 31.12.2002	188.530	89.797	677.643	105.813	1.061.783
Total ordinary depreciation	165.413	87.293	422.832		675.538
Book value per 31.12.2002	**23.115**	**2.504**	**254.810**	**105.813**	**386.242**
Ordinary depreciation for year	**19.294**	**3.043**	**9.795**		**32.132**
Accumulated depreciation on decrease	**2.209**	**0**	**0**		**2.209**
Economic lifetime	3 years	3 years	20-50 yrs		
Depreciation plan	Linear	Linear	Linear	Not deprec.	
Annual hire of operating assets not entered in Balance Sheet			22.020		22.020
Purchases <NOK 50.000	12.361	3.934	0	0	16.295

From the turn of the year 2001/2002 SINTEF rented 24,840 m² from NTNU, excluding SINTEF Energy Research's 4,616 m². NTNU rented 12,955 m² from SINTEF, including 235 m2 in the EFI Building. SINTEF Energy Research has a separate contract with NTNU, but this is administered by SINTEF Property Services.

9. Subsidiaries

SINTEF's subsidiaries Company	Date of purchase	Business office	Ownership	Voting percentage
SINTEF Petroleum Research	01.01.85	Trondheim	100 %	100 %
SINVENT	01.01.88	Trondheim	100 %	100 %
SINTEF Fisheries and Aquaculture	01.01.99	Trondheim	96,9 %	96,9 %
SINTEF Energy Research	16.12.85	Trondheim	61 %	61 %
MARINTEK – Norwegian Marine Technology Research Institute	19.12.84	Trondheim	56 %	56 %

The companies' accounts are drawn up in accordance with the equity capital method; see table below. All figures in NOK 1000

Company	SINTEF Petroleum Research	SINVENT Group	SINTEF Fisheries and Aquaculture	SINTEF Energy Research	MARINTEK Group	Sum
Historical cost	9.000	6.670	6.769	4.600	6.500	33.539
Equity capital in Balance Sheet at time of purchase	9.000	6.670	6.769	4.600	6.500	33.539
Ingoing balance per 01.01.2002	**64.111**	**47.380**	**4.082**	**57.474**	**55.846**	**228.893**
Share of result for year	8.139	-25.522	-2.637	6.105	-4.353	- 18.267
Other changes in course of year		-272	4.396			4.124
Outgoing balance per 31.12.2002	**72.250**	**21.587**	**5.842**	**63.579**	**51.494**	**214.753**

Sinvent's subsidiaries/associated companies

Company Subsidiary company	Date of purchase	Business offices	Shareholding	Voting percentage
SINTEF Group Venture AS	08.02.02	Trondheim	100 %	100 %
Sinvent Venture AS	01.08.02	Trondheim	100 %	100 %
SINTEF Solutions AS	29.12.00	Trondheim	100 %	100 %
SinRun AS	01.01.98	Trondheim	100 %	100 %
Norwegian Fire Research Laboratory AS	31.12.00	Trondheim	100 %	100 %
Molab AS	01.01.90	Mo i Rana	60%	60%
Associated companies				
Bedriftsuniversitetet AS	17.07.00	Oslo	36,7%	36,7%
Raufoss Tecnology & Industrial Management AS	31.12.01	Raufoss	33,7%	33,7%

The companies' accounts are drawn up in accordance with the equity capital method; see table below. All figures in NOK 1000

Company	SINTEF Group Venture AS	Sinvent Venture AS	SINTEF Solutions AS	SinRun AS	Norwegian Fire Research Laboratory AS	Molab AS	Sum
Historical cost	25.000	55.642	100	16.553	1.300	1.000	99.595
Equity capital in Balance Sheet at time of purchase	25.000	55.642	100	11.642	1.300	1.000	94.684
Added value	0	0	0	0	0	0	0
Goodwill	0	0	0	4.911	0	0	4.911
Ingoing balance per 01.01.2002	**0**	**0**	**0**	**43.955**	**413**	**11.143**	**55.511**
Share of result for year	-1.191	-4.847	-6.455	638	2.356	74	-9.425
Depreciation of goodwill	0	0	0	-4.911	0	0	-4.911
Sale of subsidiary company	0	0	0	0	0	121	121
Contribution paid to Group	0	0	0	-7.405	-1.066	0	-8.471
Share purchases	25.000	55.643	100	12.218	0	0	92.961
Dividends paid 2002	0	0	0	-17.627	0	-120	-17.747
Outgoing balance per 31.12.2002	**23.809**	**50.796**	**-6.355**	**26.868**	**1.703**	**11.218**	**108.039**

Company	Bedrifts-univ. AS	Raufoss Technology & Industrial Management AS	Sum
Historical cost	5.510	3.500	9.010
Equity capital in Balance Sheet at time of purchase	5.510	1.020	6.530
Added value	0	2.480	2.480
Goodwill	0	2.480	2.480
Ingoing balance per 01.01.2002	**0**	**0**	**0**
Share of result for year	-3.070	-168	-3.238
Depreciation of goodwill	0	-496	-496
Share purchases	5.400	3.500	8.900
Reimbursement of deficit	-299	0	-299
Outgoing balance per 31.12.2002	**2.031**	**2.836**	**4.867**

10. The SINTEF Group's shareholdings in other companies

All figures in NOK 1000	Percentage shareholding	Historical cost	Depreciated value	Book value
FIXED ASSETS				
Norsk Jern Eiendom AS	2,10 %	0		3 000
MoTest AS	49,0 %	201		201
Coast Care	2,50 %	10		10
Total shareholdings in fixed assets		**211**		**3.211**
CURRENT ASSETS				
Dtech-depot shares		875		875
Dtech	15,50 %	6.429	1.966	4.463
Green Trip AS	81,10 %	2.186		2.186
Mon Aqua	33,50 %	316		316
Såkorninvent Midt-Norge	11,90 %	7.508		7.508
Trøndelag Vekst AS	1,00 %	165		165
Nacre AS	75,00 %	8.050		8.050
Mison AS	11,40 %	1.675		1.675
Norsk Helseinformatikk	65,00 %	2.161	1.631	530
InterConsult Group Asa	11,00 %	15.000		15.000
Metaphor AS	31,00 %	750		750
Euromast AS	20,00 %	350		350
Simula Research Laboratory AS		150		150
Trøndelag Utvikling AS	10,00 %	1.030		1.030
Innovestco HoldingAS		1.250		1.250
Alcon-Gruppen AS		900		900
Leiv Eiriksson Nyfotek AS	27,00 %	500		500
Exprosoft AS	34,00 %	102		102
Norsk Næringsmiddelforsk. AS	50,00 %	200		200
Powel ASA	2,80 %	994		994
CFD Norway AS	30,55 %	293		293
Leiv Eiriksson Nyfotek AS	0,05 %	100		100
AquaCon AS	32,30 %	1.125	300	825
Lodic AS	25,00 %	125		125
ProNavis AS	24,90 %	300		300
Carpoint AS	8,00 %	107		107
ShipYard Exchange AS	2,49 %	1.417	500	917
Others with book values < 100				875
General portfolio-depreciated shares				-2.000
Securities funds		10.033		10.060
Total short-term shareholdings				**58.596**

11. Receivables with due date more than one year

All figures in NOK 1000

SINTEF Group 2001	SINTEF Group 2002		SINTEF 2002	SINTEF 2001
14.935	6.527	Other receivables	3.629	13.208
0	0	Loans to businesses in Group	58.933	47.690
12.494	10.954	Pension funds	0	0

12. Bonds and other securities (business portfolio)

All figures in NOK 1000

Investments are distributed as follows	Historical cost	Currency	Book value	Market value	Effective rate of interest	SINTEF's share (48.8%)
Money-market funds	53.072	NOK	54.888	54.888	6,13 %	26.784
Certificates and bonds						
State	38.314	NOK	39.817	39.817	5,66 %	19.413
Guaranteed by municipality and county authorities	19.604	NOK	20.353	20.353	6,18%	9.932
Finance/credit institutions	66.730	NOK	69.392	69.392	6,12%	33.864
Other companies (including Industry)	2.992	NOK	3.064	3.064	6,55%	1.495
Sum certificates and bonds	**127.640**		**132.626**	**132.626**		**64.722**
Interest-bearing funds	20.342	NOK	21.097	21.097		10.295
Index-linked stock	20.300	NOK	21.372	21.372		10.430
Shares in business portfolio	11.783	NOK	6.892	6.892		3.364
Total investments	**233.137**		**236.876**	**236.876**		**115.595**

The duration in the bonds and securities portfolio per 31.12.2002 was 1.36. This item includes investments drawn on the SINTEF Group's joint liquidity. SINTEF's share of capital investments came to 48.8% of their total value.

13. Foreign exchange

All figures in NOK 1000

Currency	EURO	USD	SEK	GBP	FIM	KWD	TND
Bank deposits	2.503	363					
Accounts receivable	325	473	43	2	0	30	33
Liabilities							
Foreign exchange futures contracts		-60				-200	
Sum position	**2.828**	**776**	**43**	**2**	**0**	**-170**	**33**

14. Long-term liabilities

Long-term liabilities consist of a mortgage to Molab, of which MNOK 5 is secured via collateral on long-term assets and MNOK 4.45 in customer receivables. All other long-term liabilities are pension liabilities.

15. Mortgages and guarantees, etc.

The SINTEF Group has signed a contract with Den norske Bank regarding the operation of a common current account system. The parent company and its subsidiaries are jointly liable vis-à-vis the bank for any liability covered by the agreement. Under the terms of this agreement, SINTEF is required to mortgage its Norwegian Register of Securities (VPS) account for investing funds from its capital account in favour of its subsidiaries as collateral for their claims. The VPS account is mortgaged to the participants jointly.

16. Intra-Group accounts

Internal turnover within the Group amounts to MNOK 88, exclusive of VAT. For intra-Group receivables and debts, please refer to the relevant lines in the Balance Sheet.

17. Equity capital

The SINTEF Group

All figures in NOK 1000	Paid-up equity	Earned equity	Other equity incl. minimum	Total equity
Equity per 01.01.2002	**62.300**		**766.990**	**829.290**
Items entered directly against equity			-10.997	**-10.997**
Concern result for the year			-18.807	**-18.807**
Reclasification in Sinvent				0
Equity per 31.12.2002	**62.300**		**737.186**	**799.486**

SINTEF

All figures in NOK 1000	Paid-up equity	Earned equity	Other equity	Total equity
		Estimated differences		
Equity per 01.01.2002	**62.300**	**195.354**	**472.637**	**730.291**
Result for the year		-18.267	-989	**-19.256**
Items entered directly against equity		-323		**-323**
Equity per 31.12.2002	**62.300**	**176.764**	**471.647**	**710.711**

18. Other current liabilities

The item "Other current liabilities" in the accounts for the SINTEF Group includes provisions for accrued vacations, holiday pay and overtime, provisions for early retirement, bonuses and restructuring, investments in IT tools and obligations regarding invoices entered but unpaid.

19. Taxes

	SINTEF		SINTEF Group	
All figures in NOK 1000	**2002**	**2001**	**2002**	**2001**
Ordinary result for the year				
Tax due	1.300	200	4.884	2.712
Changes in deferred tax	0	0	-12.097	-2.445
Insufficient provision for tax in previous years	40	193	40	193
Tax on ordinary result	**1.340**	**393**	**-7.174**	**460**
Extraordinary result for the year:				
Tax due	0	0	0	1.925
Changes in deferred tax	0	0	0	13.584
Tax on extraordinary result	**0**	**0**	**0**	**15.509**
Total tax costs	**1.340**	**393**	**-7.174**	**15.969**

Specification of effect on tax of temporary differences and loss to be carried forward

	SINTEF		SINTEF Group	
All figures in NOK 1000	**2002**	**2001**	**2002**	**2001**
Operating assets			5.874	8.767
Shares			13.913	2.882
Receivables			3.428	69
Accounting provisions			-2.476	
Correction income			0	
Pension obligations			3.202	2.888
Gains and losses account			-39.855	-49.818
Unutilised gains on shares			2.253	2.228
Loss to carry forward			23.033	16.759
Sum	**0**	**0**	**9.372**	**-16.225**
Estimated net benefit of deferred tax			2.624	4.590
Of which not entered in balance				-110
Deferred tax advantage			**2.624**	
Deferred tax				**4.700**

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To: The Council of the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF)

AUDITOR'S REPORT 2002

We have audited SINTEF's annual accounts for 2002; these show a loss for the year of NOK 19,256,000 for the parent company and of NOK 18,807,000 for the Group. We have also audited the information provided in the Annual Report regarding the accounts, the assumption of continued operation and proposals for allocation of the profits. The annual accounts consist of the profit and loss account, balance sheet, cash-flow analysis, notes and consolidated annual accounts. The annual accounts and the Annual Report have been drawn up by the Board of the Foundation and the director general of SINTEF. Our responsibility has been to express our opinion regarding the annual accounts and other matters with respect to the Auditing Act.

We have conducted our audit in accordance with current laws and regulations and good auditing practice, which requires us to plan and implement our audit in such a way as to confirm that the accounts did not include material errors or omissions. We have checked selected parts of the material on which the accounts are based and evaluated the accounting principles employed, significant accounting estimates and the content and presentation of the annual accounts. To the extent that good auditing practice requires us to do so, we have also reviewed the Foundation's assets management and accounting and internal control practices. We believe that the audit supplies an adequate basis for the following statements.

In our opinion:

- the annual accounts have been drawn up in accordance with current laws and regulations and present a satisfactory picture of the financial position of the Foundation and the Concern on December 31, 2002, as well as of the result and cash-flows in the course of the accounting year, in accordance with good accounting practice.
- SINTEF 's management has fulfilled its obligation to ensure that accounting information has been appropriately and clearly registered and documented, in accordance with Norwegian law and good accounting practice.
- the information contained in the Annual Report regarding the annual accounts, the assumption of continued operation and the proposals for covering the loss are consistent with the annual accounts and are in accordance with current legal and regulatory requirements..

Trondheim, 02.04.2003
DELOITTE & TOUCHE

Harald J. Lydersen
State-authorised public accountant

Deloitte Touche Tohmatsu

Bergen Florø Førde Haugesund Knarvik Kristiansand Levanger Lyngdal Oslo
Skien Sogndal Stavanger Steinkjer Trondheim Tønsberg

Members of the Norwegian Institute of Public Accountants
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SINTEF Council 2002

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SINTEF Board 2002

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Per Ola Grøntvedt, Senior Engineer, SINTEF Materials Technology
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Elisabeth Wille, Lawyer, Advokatfirmaet Grette DA

SINTEF's Management Team

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Svein Sivertsen, Executive Vice President
Gunnar Sand, Director of Strategic Planning and Information

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SINTEF Applied Mathematics

Bjørn Svensvik, Vice President, Research,
SINTEF Civil and Environmental Engineering

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SINTEF Electronics and Cybernetics

Unni Steinsmo, Vice President, Research, (acting)
SINTEF Applied Chemistry

Aage Stori, Vice President, Research, (acting)
SINTEF Materials Technology

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SINTEF Telecom and Informatics

Tonje Hamar, Vice President, Research,
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Karl A. Almås, President,
SINTEF Fisheries and Aquaculture

David Lysne, President,
SINTEF Petroleum Research

Oddvar Aam, President,
MARINTEK – Norwegian Marine Technology Research Institute

Nils Spidsøe, President, Sinvent AS
Hallvard Høydalsvik, Managing Director, SINTEF Solutions AS
Anders Lian, Managing Director, SINTEF Venture AS

SINTEF's organisational structure

SINTEF Applied Chemistry
Vice President, Research: Unni Merete Steinsmo (acting)
– Biotechnology
– Catalysis and Kinetics
– Chemical Engineering
– Environmental Technology and Analysis
– Hydrocarbon Process Chemistry
– Marine Environmental Technology
– Organic Synthesis
– Polymer Chemistry
– Water and Wastewater
Employees: 182. Gross revenues: NOK 166.1 million.

SINTEF Applied Mathematics
Vice President, Research: Tore Gimse
– Computational Engineering
– Geographic Information Technology
– Geometry
– Numerical Simulation
– Optimisation
Employees: 56. Gross revenues: NOK 39.1 million.

SINTEF Civil and Environmental Engineering
Vice President, Research: Bjørn Svensvik
– Architecture and Building Technology
– Cement and Concrete
– Project Development
– Roads and Transport
– Rock and Soil Mechanics
Employees: 110. Gross revenues: NOK 101.4 million.

SINTEF Electronics and Cybernetics
Vice President, Research: Ernst H. Kristiansen
– Automatic Control
– Instrumentation and Microelectronics
– Microsystems
– Norwegian Microtechnology Centre
– Optical Measurement Systems and Data Analysis
– Photonics
Employees: 110. Gross revenues: NOK 91.3 million.

SINTEF Industrial Management
Vice President, Research: Tor Ulleberg
– Economics and Logistics
– Innovation and Industrial Development
– Institute of Social Research in Industry (IFIM)
– Knowledge and Strategy
– New Praxis
– Productivity and Project Management
– Safety and Reliability
– STEP - Centre for innovation research
Employees: 150. Gross revenues: NOK 171.6 million.

SINTEF Materials Technology
Vice President, Research: Aage Stori (acting)
– Applied Physics
– Casting and Metal Forming – Trondheim
– Casting and Metal Forming – Oslo
– Corrosion, Joining and Surface Technology
– Electrochemistry and Ceramics
– Flow Technology
– Fracture Mechanics and Materials Testing
– Metallurgy and Particle Processing
– Polymers and Composites
Employees: 194. Gross revenues: NOK 201.7 million.

SINTEF Telecom and Informatics
Vice President, Research: Aage Jostein Thunem
– Acoustics
– Distributed Information Systems
– Radio and Sensor Systems
– Signal Processing and Systems Design
– Software Engineering
– System Engineering and Telematics
Employees: 136. Gross revenues: NOK 114.4 million.

SINTEF Unimed
Vice President, Research: Tonje Hamar
– Economics, Quality and Accessibility
– Epidemiological Research
– Health and Rehabilitation
– Health and Work Physiology
– Innovation
– Mental Health Services Research
– Microbiological Exposure and Indoor Air
– Patient Classification and Financing
– The Norwegian Centre for Health Technology Assessment
– The Norwegian Patient Register
– Ultrasound
Employees: 152. Gross revenues: NOK 130.1 million.

The SINTEF Group also includes four research companies:

SINTEF Energy Research
President: Sverre Aam
– Electric Power Technology
– Energy Systems
– Refrigeration and Air Conditioning
– Thermal Energy
Employees: 178. Gross revenues: NOK 182.7 million.

SINTEF Fisheries and Aquaculture
President: Karl A. Almås
– Aquaculture Technology
– Bioresources
– Coastal and Ocean Engineering
– Fisheries Technology
– Food Processing
– International Development Programmes
Employees: 88. Gross revenues: NOK 80.2 million.

SINTEF Petroleum Research
President: David Lysne
– Basin Modelling
– Formation Physics
– Multiphase Flow Technology
– Reservoir Technology
– Seismics
– Well and Production Technology
Employees: 89. Gross revenues: NOK 108.4 million.

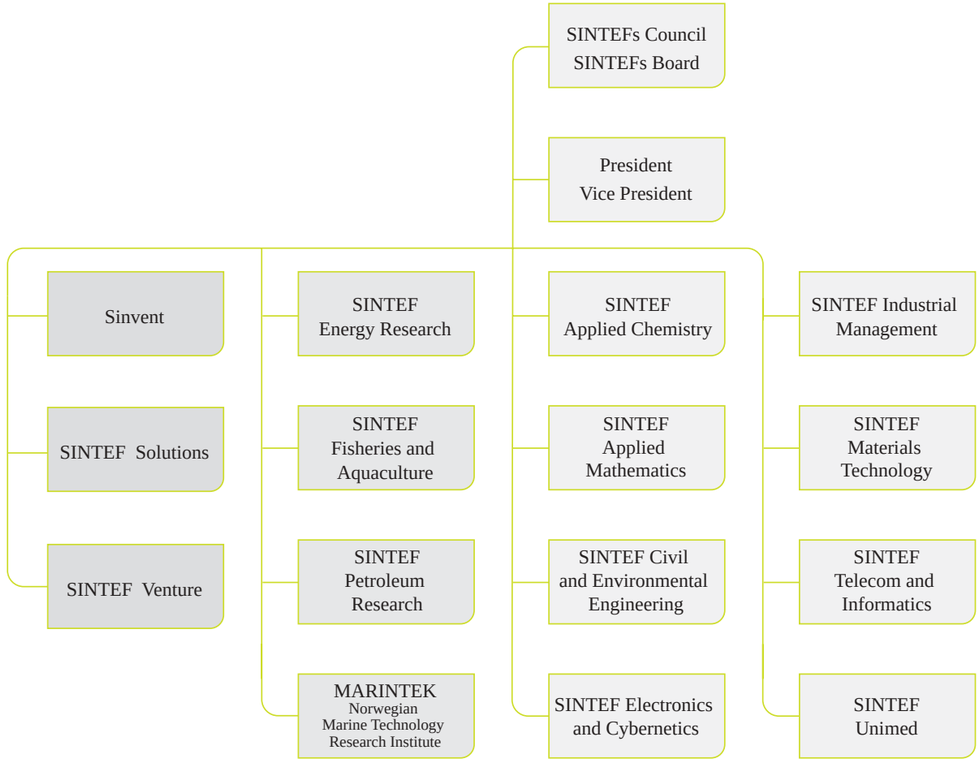
MARINTEK – Norwegian Marine Technology Research Institute
President: Oddvar Aam
– Machinery and Technical Operations
– Marine Vehicles
– Offshore Structures
– Structural Engineering
Subsidiary: MARINTEK (USA), Inc.
Laboratories: Cavitation tunnel, Machinery laboratory, Marine structures laboratory, Ocean basin laboratory, Towing tank
Employees: 179. Gross revenues: NOK 186.8 million.

SINVENT AS
Nils Spidsøe, President

SINTEF Solutions AS
Hallvard Høydalsvik, Managing director
– SINTEF Oil and Gas: Managing Director Hallvard Høydalsvik
– SINTEF Public Sector: Project Director Sigmund Kvernes

SINTEF Venture AS
Anders Lian, Managing director

The SINTEF Group



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ISBN: 82-14-02772-1

SINTEF

Design and production: Jon Kjetil Brandt/Jannicke Skibnes, SINTEF Media ©2003 • Print: Grytting