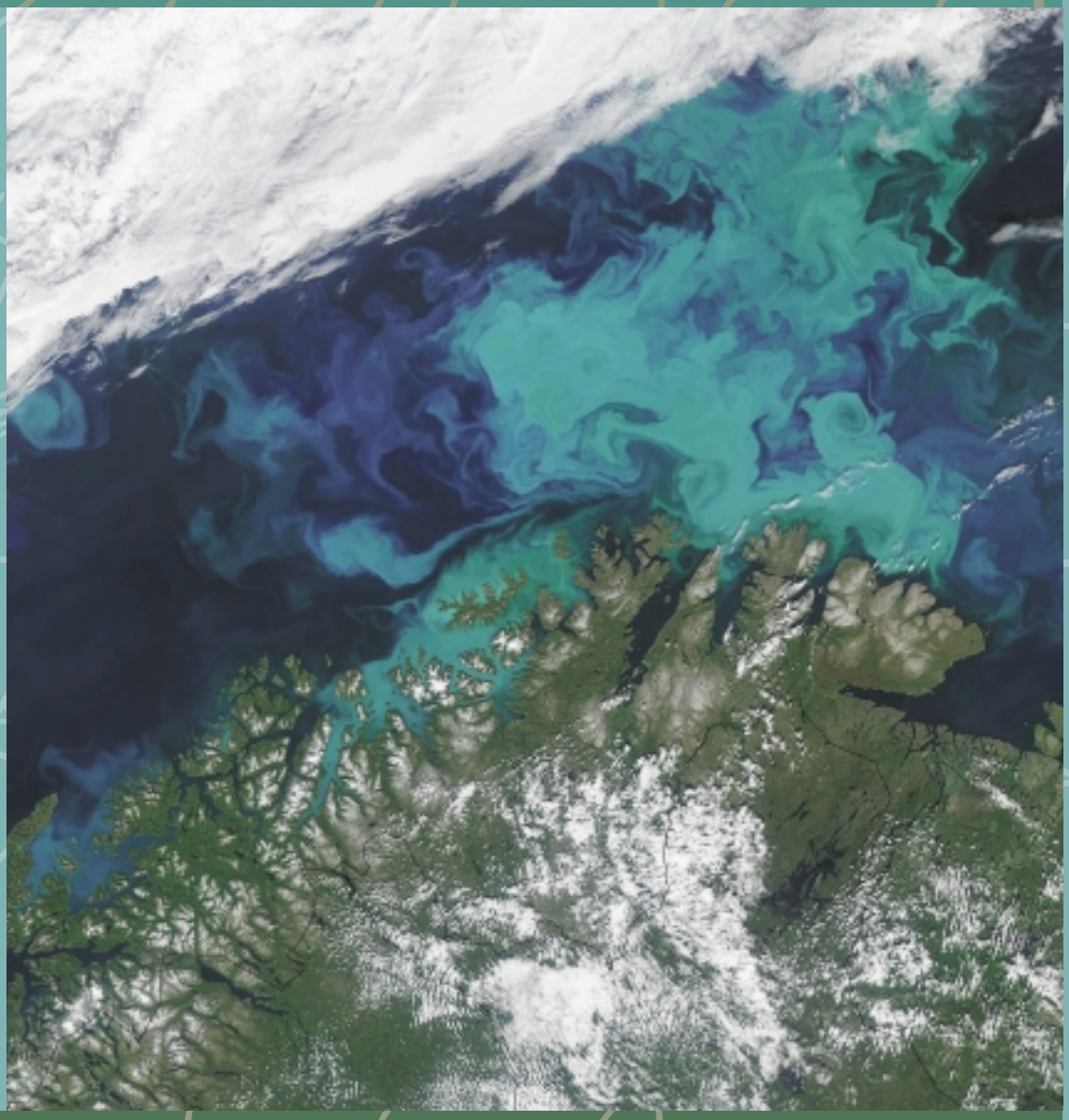
Annual Report **2004**



Norsk Romsenter
NORWEGIAN SPACE CENTRE

Management 2004

Suzanne Lacasse
Chairman of the Board

Board
Suzanne Lacasse, Chairman
Erik Solhjell, Vice Chairman
Øyvind Stene
Jøran Moen
Inge Marie Holten

Deputy members:
Paul Narum
Elisabeth Tørstad

Rolf Skår
Managing Director

Management
Rolf Skår, Managing Director

Objectives

In accordance with governmental guidelines and in co-operation with and to benefit Norwegian industry, research, public-sector bodies and Norwegian interest in general, the objectives of the Norwegian Space Centre are to:

- promote the development and coordination of Norwegian space activities,
- co-ordinate the Ministerial interests and needs within space activities,
- prepare proposals for integrated long-term programmes for Norwegian space activities and submit these to the Ministry of Trade and Industry,
- manage Norwegian Space Centre resources and efficiently distribute funding from the Norwegian State and other sources,
- mind Norwegian interests in liaison with space sector organizations in other countries as well as international organizations and contribute to coordinating Norwegian space activities with those elsewhere,
- manage State holdings in space-related companies in the private sector,
- facilitate the meeting of user needs in the space sector

Contents

First year as an administrative agency

In the 2003 Annual Report, I admitted mixed feelings in anticipating the Space Centre as a governmental administrative agency. How has it been?

In truth, we've noticed the change. Arguably, the staff has noticed the change the least, while the Board has noticed it the most. My position as CEO required greater interaction with the Ministry of Trade and Industry (NHD) as well as with the Board than had been required when I was manager of the Foundation. Management signals may have subtleties, and it occasionally becomes apparent that NHD has the final word. Nonetheless, most important is that the Centre's vision, goals and priorities as well as our working routines remain unchanged.

Personally, I still devoted considerable time to further developments in the north, at Andøya, in Tromsø and on Svalbard, and endeavoured to exploit the potential created by Norway having Troll, a year-round station on Dronning Maud Land in Antarctica.

These activities, originally divisions of the Norwegian Space Centre Foundation, were subsequently reorganized as limited companies with NHD, on behalf of the State, as sole or part owner.

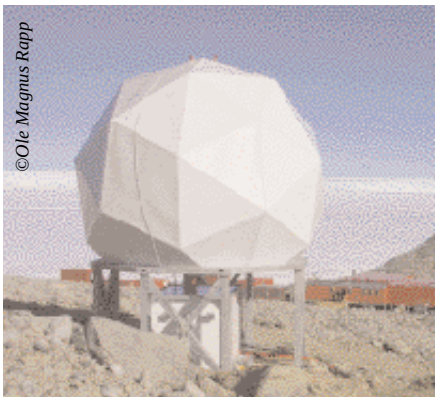
I'm particularly pleased with the developments on Svalbard. The Svalbard Satellite Station (SvalSat) has rapidly established itself on the global market, in which owners of polar-orbiting satellites increasingly contract with Kongsberg Satellite Services AS (KSAT) for servicing their satellites.

The combination of an ultramodern, fully-automated station with cost-effective data transmission via two independent fibreoptic submarine cables and an unbeatable geographical position has made the station competitive.


©Svein Sæther

Norway remains distinct in its space policy in that we first and foremost prioritize the utilitarian instead of the spectacular and that we feel no need to have Norwegian astronauts.

This prioritization has given Norway a large, profitable and cohesive space industry that in 2004 had an aggregate turnover of NOK 5.2 billion (€633 million) of which 81% was exported.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The future holds possibilities and challenges but also some concerns.

National interests and motives remain the principal impetus to investing in the space sector. The trend in Europe toward ever greater development of national and multilateral space programmes rather than joint commitment through ESA is worrisome. Norway must have a pragmatic view of that trend.

Nonetheless, the importance of space is on the upswing, and daily activities increasingly depend on satellites supplying useful applications. It's a pleasure to take part in that development and to experience its practical advantages.

Rolf Skår
Managing Director


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Report of the Board

Introduction

In 1987, the Norwegian Storting (Parliament) established the Norwegian Space Centre Foundation. Effective 1 January 2004, the Foundation's staff, tasks, activities and responsibilities were taken over by a new governmental administrative agency with the same name, Norwegian Space Centre (NSC), under the Ministry of Trade and Industry (NHD).

This is the first Report for the Norwegian Space Centre as a governmental administrative agency.

The Norwegian Space Centre (NSC) aims to contribute to creating growth in high-tech national industries, meet public needs, play a leading role in the global market for space-related ground infrastructure and attain a recognized international position in space research for Norwegian research communities. Activities are financed by appropriations in the Ministry of Trade and Industry's budget.

Membership in the European Space Agency (ESA) is instrumental in attaining these goals. The Norwegian Space Centre supports Norwegian interests in ESA and co-ordinates national space activities.

Activities in 2004

In 2004, the total turnover of space-related goods and services in Norway was some NOK 5.7 billion (€694 million), of which Norwegian-produced goods and services accounted for NOK 5.25 billion (€639 million), 81% to export. Measured in Norwegian kroner, turnover in 2004 was 4% less than in 2003. Exchange rate fluctuation accounted for the greater part of the decline. From 2003 to 2004, the NOK strengthened by 5% against the USD, which caused a corresponding drop in income from the greater part of exports invoiced in USD.

Telenor and Nera activities in commercial satellite communications continued to account for the greater part of space-sector turnover. Some smaller high-tech companies spawned by research communities and some high specialized oil industry equipment companies have been successful in the space sector with competitive niche products. These companies' forecasts are for continued growth, as shown in Figure 1.

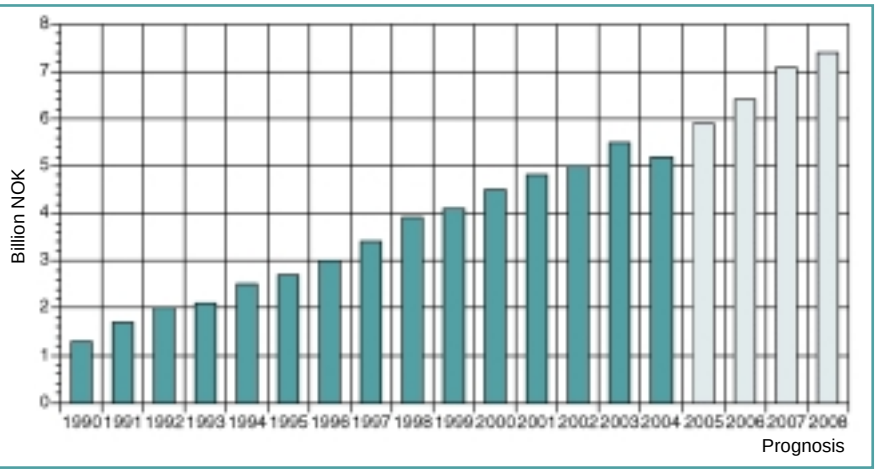


Figure 1: Turnover of Norwegian-produced goods and services, 1990 – 2004, with company forecasts up to 2008.

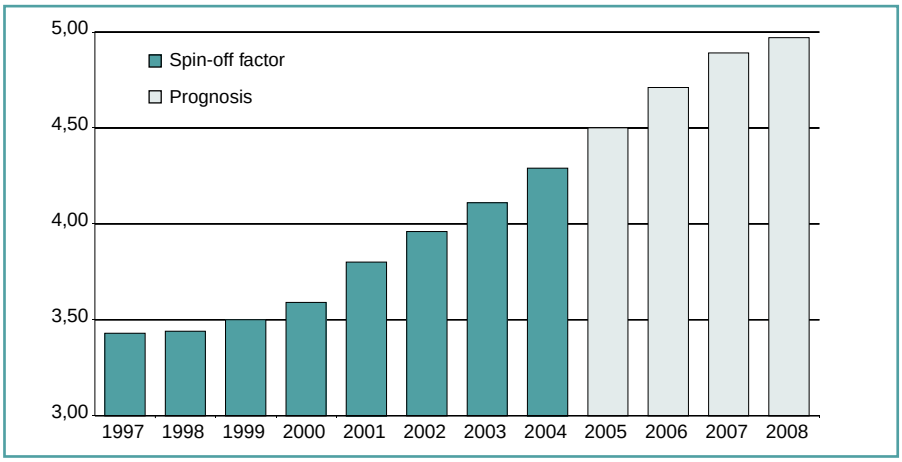


Figure 2: Spin-off factor, 1997-2004, with company forecasts up to 2008.

The growth is contingent upon an upswing in Norwegian public and private commitment as well as on continued involvement in satcom and in satellite navigation.

In 2004, Norwegian commercial deliveries to ESA programmes totalled about NOK 150 million (€18.25 million). The total ESA turnover since Norway became a member in 1987 amounts to about NOK 2,31billion (€281 million).

In 2004, the spin-off factor continued its climb, up to 4.3, which outstripped expectations (Figure 2). This means that for each million NOK of governmental support through ESA or national support programmes, space-sector companies have on the average attained an additional turnover of NOK 4.3 million (total turnover NOK 5.3 million). The spin-off effect is more pronounced in Norway than in most other ESA member countries.

The Board has reason to believe that the Norwegian Space Centre has contributed to Norwegian companies being among those that have benefited most from the ESA membership.

Space research

On the international scene, the focus in space research strongly reflected the new American goal of returning to the Moon and by 2020 to establish a manned base there, perhaps as a starting point for a manned mission to Mars. The exploration of Mars has been extensive and has clearly shown that the planet once had considerable amounts of water. The Cassini-Huygens arrival at Saturn and the subsequent landing of the Huygens probe on Titan was spectacular. The surface of Titan was found to have the same erosion mechanisms as on the surface of the Earth, with methane eroding ice on Titan instead of water eroding silicates as on Earth. Norwegian groups take part in the Cassini and Huygens research programmes.

National research has reflected a continued benefit from ongoing projects, such as the SOHO and Cluster satellites as well as ground-based infrastructure. Through ESA, Norwegian scientists are taking part in China's Double Star project that in 2004 became operational with two satellites. Double Star is a valuable supplement to Cluster. Norwegian scientists also are taking part in the Rosetta comet hunter that was launched in 2004. Smart-1 is on its way to the Moon powered by solar-electric primary propulsion. It is the first spacecraft with such a device as its only thruster. The probe has successfully completed the technical part of its first mission and will now orbit the Moon for a year to perform scientific measurements.

The Andøya Rocket Range has been busy, and particularly its ALOMAR lidar observatory has been in frequent use. A successful launch campaign for NASA was conducted from Svalbard. The Japan Aerospace Explo-

ration Agency (JAXA) also conducted a successful launch campaign at the Andøya Rocket Range.

Based on an evaluation of the Norwegian Space Centre in 2003 and on assignment from the Ministry of Education and Research and the Ministry of Trade and Industry, the Norwegian Research Council and the Norwegian Space Centre worked to ensure better financing of "research that exploits space". The effort includes meetings with research communities to acquire an overview of prospects and with several Ministries to gain support for the concept of joint funding. The intent is that a larger national programme may start in 2006-2007.

Earth observation
The Norwegian Space Centre activities in Earth observation support the coverage of national user needs in research and management.

The Global Monitoring for Environment and Security (GMES), a European initiative, completed its initial phase. GMES is under leadership of the EU and ESA and their members countries including Norwegian research communities have appreciable assignments in developing services.

The Norwegian Space Centre has assumed an active role in ensuring that public sector users have access to key satellite data. In the autumn of 2004, an agreement was signed with Canada for Radarsat-1 and Radarsat-2 data. This provides continuity in SAR data from 2004 through 2013 and ensures that more public sector users can co-operate to exploit and exchange the same data in a cost-effective manner.

The Norwegian Space Centre is conducting the SatHav programme together with the principal users in Norway. SatHav is a national maritime programme to increase the routine use of satellite data. The national needs in maritime monitoring, oceanography, ice mapping and warning around Svalbard as well as monitoring of oil pollution and of bodies of water including plankton and algae blooms have been foremost in the programme.

Satellite communications
Satellite communications is the leading sector in Norwegian space activities, accounting for two-thirds of the total annual turnover, that is, about NOK 4.2 billion (€511 million) in 2004. Telenor and NERA are the principal actors, with products and services in satellite broadcasting, mobile voice and data communications and broadband communications via satellite.

The Space Centre holds regular meetings with the satcom actors to coordinate Norwegian activities. In 2004, the actors initiated an effort to evolve a "Norwegian satellite communications investment strategy up to the year 2010 (SATCOM 2010)". The actors are financing an associate professor chair at NTNU to strengthen academic-industrial cooperation. Together with the satcom actors and others, SINTEF has been awarded a Norwegian Research Council competence project with user input in antenna-receiver technology.

Satellite navigation
1 December 2004, the Government announced that Norway would start negotiations with EU on a cooperation agreement for Galileo that will form the basis of participation in the development phase of the EU sector of Galileo. This will enable Norwegian companies to participate in Galileo at the same level as companies in EU countries and afford Norway a position in the development of Galileo. The Government has decided that the Norwegian Space Centre shall oversee the participation and coordinate the Norwegian interests. The Board regards this decision as a vital step to ensure that Norway and Norwegian space activities not be sidelined now that EU has put space activities on its political agenda. In 2004, the EU signed a Galileo cooperation agreement with the USA, China and Israel. The EU Transport Council approved the commission's recommendation to go from the Galileo development phase to the implementation phase and to establish an EU body, the Galileo Supervisory Authority.

In 2004, the Norwegian Space Centre, through its national support programme, assumed an active role to ensure Norwegian industrial and user interests in EGNOS and Galileo. Norway has extensive land and sea areas in which transport and demanding operations often take place in extremely difficult weather conditions. Consequently, Norway has considerable benefit from a global, cost-effective, accurate and reliable satellite navigation system like GPS, and in the future, EGNOS and Galileo. Today, Norway is a major GPS user for all types of transport and will be a major user of the combined Galileo-GPS. Moreover, Norway has exceptional user needs for EGNOS and Galileo, because performance at our latitude is influenced more than at lower latitudes by the number of satellites, their orbits and the locations of the ground infrastructures that support the system. GPS has afforded Norway an industrial opening, and the Norwegian maritime sector is a leader with its GPS-based equipment.

In 2004, the first EGNOS signals were received from the geostationary satellites. Consequently, the Norwegian Space Centre has financed a project in which the Geodesy Division of the Norwegian Mapping Authority uses its nationwide SATREF system to monitor and analyse EGNOS signals. They also take part in the ESA IMAGE project that co-ordinates the relevant European initiative. Maritime and aeronautical users, particularly the North Sea helicopter services, have shown considerable interest in EGNOS. Therefore, in June 2004 Norway elected to take part in the ESA GNSS development programme to ensure Norwegian user interests and an early testing and validation of EGNOS in Norway. This is particularly important, because Norway is on the periphery of the EGNOS coverage area.

Space transportation - Space station
In 2004, there were three launches of the standard version Ariane 5 launch vehicle, against the planned four or five. In December 2002, the failure of the qualification mission of the more powerful Ariane-5 ECA created problems for Arianespace and the European launch vehicle sector in the extremely competitive launch market.

In May 2003, the ESA Council at ministerial level approved a qualification programme for the upgraded Ariane-5 version as well as the European Guaranteed Access to Space (EGAS) programme that will partly finance production and launch facilities, in order to ensure the future of the European launch vehicle industry and guarantee launch capacity for European users.

The programme was a link in a package comprising restructuring of industries, refinancing of Arianspace and greater partial responsibility of industry in the improvements to be made. Furthermore, ESA's role and responsibilities were more clearly defined. Arianespace's equity financing was increased of necessity to enter new orders for 30 Ariane-5 launch vehicles (mostly ECA). Norwegian subcontracting for these launch vehicles has a total value of more than NOK 200 million (€24.3 million), of which some NOK 100 million (€12.2 million) was contracted in 2004, and the remainder scheduled for contracting in 2005. The second qualification mission of Ariane-5 ECA was successfully completed on 12 February 2005.

The launches of the European modules for the International Space Station have been delayed awaiting resumed operation of the American space shuttle.

Information and education
In 2004, the Norwegian Space Centre worked to enhance the understanding of the value of space activities among the general public and in smaller target groups, particularly through focusing on results attained by our cooperating actors. Media mention in 2004 has been extensive and thoroughly positive. Electronic communication has grown considerably, and the new Norwegian Space Centre website, operational since the autumn of 2003, has experienced an encouraging upswing in number of visits.

More than ever before, educational activities have focused on assisting students to continuing education in space-related fields, particularly abroad. In addition to professional capabilities, studies abroad imbue appreciation of other cultures and abilities in other languages that are in demand in Norwegian business sectors.

Management of governmental holdings in Norsk Romsenter Eiendom AS (NRSE) and the Andøya Rocket Range AS (ARR)
Effective 1 January 2004, the Government, via NHD, with no exchange of funds acquired the Norwegian Space Centre's shares in NRSE (100%) and ARR (90%). The Norwegian Space Centre, as part of its special agency authority, has the remit of managing State holdings in the limited companies that originally were its divisions and subsequently were reorganized as limited companies owned by the Foundation.

In agreement with NHD, the Board of the Norwegian Space Centre appointed new Board members to represent the Government holdings in the limited companies:

NRSE: Rolf Skår, Chairman
Anne Breiby, Member
Oddvar Midtkandal, Member
ARR: Rolf Skår, Chairman
Asgeir Brekke, Member
Sandra Riise, Member
Marianne Vinje Tantillo, Member

The other ARR shareholder, Kongsberg Defence & Aerospace (KDA), appointed Bjørn Kanck to the Board, and the employees' elected representative is Tore Kristiansen.

In 2004, NRSE had a profit after tax of NOK 2.9 million (€353,000) and an equity of NOK 31.7 million (€3.9 million). The company activities comprise:

- Ownership of the communications link via submarine cables between Harstad on the mainland and Longyearbyen on Svalbard. The link evolved as planned, financially and technically.
- 50% ownership of Kongsberg Satellite Services AS (KSAT), with Kongsberg Defence & Aerospace holding the other 50%. In 2004, KSAT enjoyed a profitable year, both financially and in market share. The profit after tax was NOK 22.8 million (€2,8 million) and the equity was NOK 77.1 million (€9,4 million).

There's considerable added value beyond that presented in the NRSE balance sheet.

ARR also enjoyed a good year in 2004, with a group profit after tax of NOK 5.8 million (€706,000) and a group equity of NOK 33.3 million (€4,1 million). The principal activity of the company is operation of a scientific infrastructure for research on the middle and upper atmosphere using rockets, balloons and lidar (Alomar) at Andøya and on Svalbard.

The Andøya Rocket Range is tax exempt and its activities are based on the Esrange Andøya Special Project (EASP) agreement with France, Germany and Switzerland as users and Sweden and Norway as host countries. In 2004, the EASP agreement was extended with a new five-year agreement for 2006-2010.

For extensive details, see the 2004 Annual Reports and accounts for these two companies.

Finances and accounts

In 2004, the accounts for the Norwegian Space Centre showed a profit of NOK 7.4 million (€900,000). The positive variance is due to conscious focus on costs and to filling vacancies later than planned.

The results of the programme are in accordance with the budget and reflect that the Government's appropriations for ESA in Euros and for co-operation with Canada in US Dollars are adjusted automatically, based on the actual exchange rate upon payment.

Compensation to the Board in 2004 amounted to NOK 330,000 (€40,155). The Managing Director received a salary of NOK 924,788 (€112,531) and other benefits of NOK 3,040 (€370). The pension cost for the Managing Director amounted to NOK 76,743 (€9,338). The Managing Director's salary for 2004 includes compensation for positions on the Boards of Norsk Romsenter Eiendom AS, the Andøya Rocket Range and Kongsberg Satellite Services AS.

Auditing by the Office of the Auditor General was at no cost to the Norwegian Space Centre.

Board

In 2004, the Norwegian Space Centre Board held seven ordinary meetings and one meeting with NHD.

The Board decided to refrain from appointing an advisory body but instead agreed to arrange meetings, processes and forums in which it was represented and in that manner achieve direct contact with the groups concerned with the potentials of the Norwegian Space Centre.

Organization and personnel

As at 1 January 2005, the Norwegian Space Centre had a staff of 21 permanent employees, after three departures and five engagements. In 2004, total sick leave was 2.6%, and there were no injuries or accidents.

The Board appreciates that the Norwegian Space Centre operates with a moderately small staff, whose efforts, enthusiasm and flexibility produce visible results. A principal goal is that activities should produce results outside the Norwegian Space Centre itself.

The Board specially thanks the staff for ensuring that the transition from a foundation to a governmental agency was smooth and orderly and recognizes that the staff and their representatives were involved and contributed to the transition taking place in a manner unnoticed by our cooperating partners.

Gender equality and working environment

The Norwegian Space Centre management consists of five men and one woman. The Board has two female and three male representatives, and the Chairman is a woman.

The average age of the staff members is 48 and the average length of employment is 10.6 years. At the beginning of 2005, the Norwegian Space Centre staff consisted of six women and 15 men. All but one are permanent employees.

In a way, the structure of the staff reflects the gender distributions of the professional fields of which it is made up. Consequently, the Norwegian Space Centre has a skewed gender distribution, both overall and in the various job categories and women are principally in administrative positions.

The Norwegian Space Centre promotes equal opportunity for women and men to develop in their positions and consequently encourages professional enhancement through courses and continuation education, both directly relevant to staff duties and for skills upgrading.

The gender imbalance will be rectified principally through new hirings, with particular focus on management positions within the framework of the relevant competence requirements.

The Norwegian Space Centre emphasizes a good working environment. Despite the obvious gender imbalance, the Board believes that the Norwegian Space Centre has a fine working environment that is characterized by openness and good communication between all staff members. The activities of the Norwegian Space Centre have no environmental impact.

Plans for the future

Norway is among the ESA cooperating countries that benefit most from ESA membership in the form of industrial development and space applications as well as participation in space research. The Board is of the opinion that continued, dedicated prioritized commitment through ESA shall undergird Norwegian space policy.

The next ESA Council at ministerial level, scheduled for December 2005, will be decisive for the way Europe's space plans will be developed and financed. The Board is of the opinion that it is essential that Norway elects to take part in the pan-European commitment at the Gross National Product level within the prioritized sectors of Norwegian space involvement. In particular, three prioritized application sectors are concerned:

- Satellite communications through participation in ESA's Advanced Research in Telecommunication Satellites (ARTES) programme.
- Earth observation through participation in the Global Monitoring for Environment and Security (GMES) programme under the joint aegis of EU and ESA that also represent European participation in the ten-year Global Earth Observation System of Systems (GEOSS) and continued participation in other ESA Earth observation programmes.
- The Galileo satellite navigation system, which, together with GPS and the Russian GLONASS, will comprise the future safe and extremely accurate global navigation system and consequently will be a key infrastructure that will support innumerable applications.

Moreover, a successful exploitation of all ESA programmes presupposes strengthened technological involvement, both nationally and through ESA. The Board is concerned that there should be a prudent balance between participation in international co-operation and national activities.

The Board believes that national support programmes can ensure an ever better exploitation of ESA membership. In this connection, the Board points out that the leaders in space among European countries have had a more decisive policy than Norway concerning the balance between international participation and national space programmes.

The Board of the Norwegian Space Centre thanks the Centre's management and the Ministry of Trade and Industry for fruitful teamwork and anticipates continued efforts to exploit the potentials of space.

Oslo, 31.12.2004 • 13.06.2005

Suzanne Lacasse, Chairman | Erik Solhjell | Øyvind Stene | Jøran Moen | Inger Marie Holten | Rolf Skår, Managing Director

Figures from profit and loss account 2004

(NOK 1000 (€1 = NOK 8.2181 as per 31 December 2004)	**2004**	**2003**
PROGRAMME ACCOUNTS		
Programme income:		
Revenue from Ministry of Trade and Industry	251 500	226 266
Other revenues	1 048	1 724
Total programme income	*252 548*	*227 990*
Programme expenses:		
ESA, Mandatory basic activities	20747	20 787
ESA, CSG Kourou	6369	8 822
ESA, Mandatory scientific programmes	43630	48 658
ESA, Earth observation	33139	29 789
ESA, Telekommunications	48294	32 385
ESA, Navigation	12612	8 343
ESA, Space station	14817	23 587
ESA, Space transportation	23827	17 529
ESA, Microgravity	831	865
ESA, Tecnology development	0	3 084
ESA, Esrange Andøya Special Project	12993	11 431
Radarsat	10390	11 120
ESA contracts		230
NSC National support programmes	23 197	26 574
Total programme expenses	*250 846*	*243 204*
PROGRAMME RESULT	***1 702***	***-15 214***
Exchange gain (loss) ESA funds		*3 283*
PROGRAMME RESULT including exchange gain (loss)	***1 702***	***-11 931***
OPERATING ACCOUNTS		
Operating income:		
Operating revenue from Ministry of Trade and Industry	27 200	24 800
Other operating revenues	23 129	2 037
Total operating income	*50 329*	*26 837*
Operating expenses:		
Salaries and social expenses	12 580	13 228
Other operating expenses	31 985	14 394
Total operating expenses	*44 565*	*27 622*
Depreciation	29	529
Operating profit	***5 735***	***-1 314***
Net financial income	*-46*	*2 869*
OPERATING RESULT	***5 689***	***1 555***
TOTAL RESULT	***7 391***	***-10 376***

Cassini/Huygens

After a seven-year mission journey, Cassini-Huygens arrived to orbit Saturn in the summer of 2004. The probe is a joint ESA-NASA project, and the largest inter-planetary space vehicle ever launched. On Christmas Day, the Huygens lander separated from Cassini. On 14 January 2005, Huygens successfully landed on Titan, the largest of Saturn's moons. The Cassini mother spacecraft still orbits Saturn and provides new information on the ringed planet. The Norwegian Defence Research Establishment has taken part in the building of the instruments that over the years to come will provide details on the aggregation and distribution of charged particles in the Saturn system.

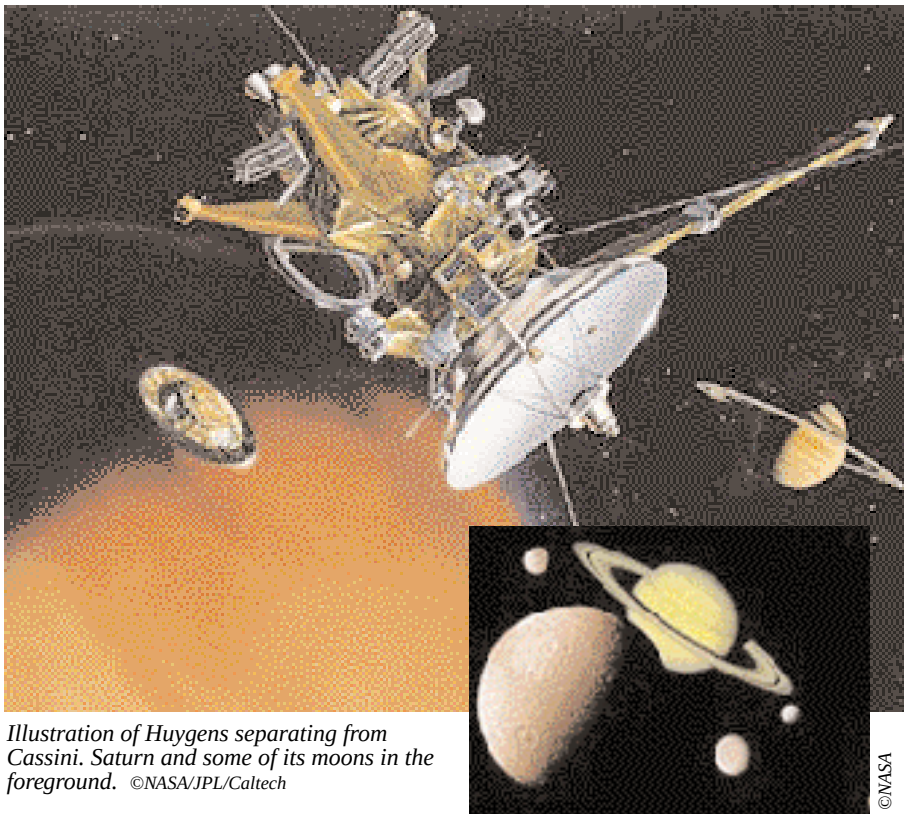
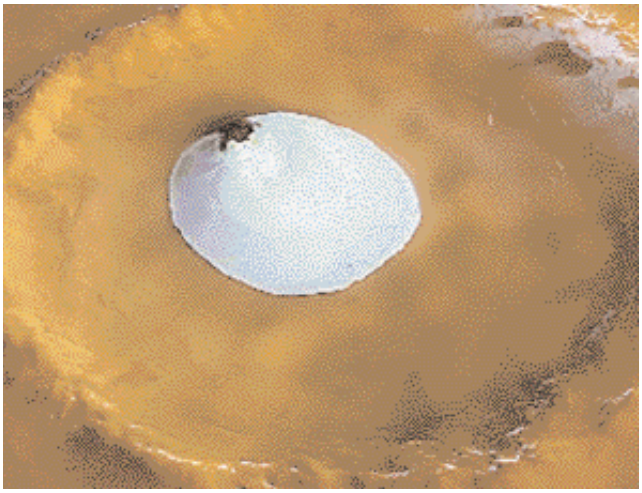


Illustration of Huygens separating from Cassini. Saturn and some of its moons in the foreground. ©NASA/JPL/Caltech

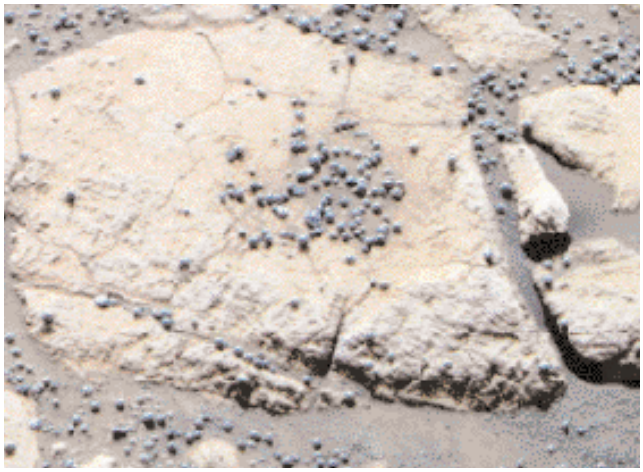
©NASA

Mars Express

In the course of 2004, Mars Orbiter performed a successful series of observations. The probe orbits Mars and is equipped with various instruments and cameras that map the surface in detail and examine its composition. As early as January, the Mars Orbiter showed that there was a considerable amount of frozen water at the south pole of Mars. Later measurements revealed water vapour and methane gas in the atmosphere above the equator. In the course of the year, it became clear that Mars had more water than previously believed. This is an essential result, as life, as we know it, depends on water.



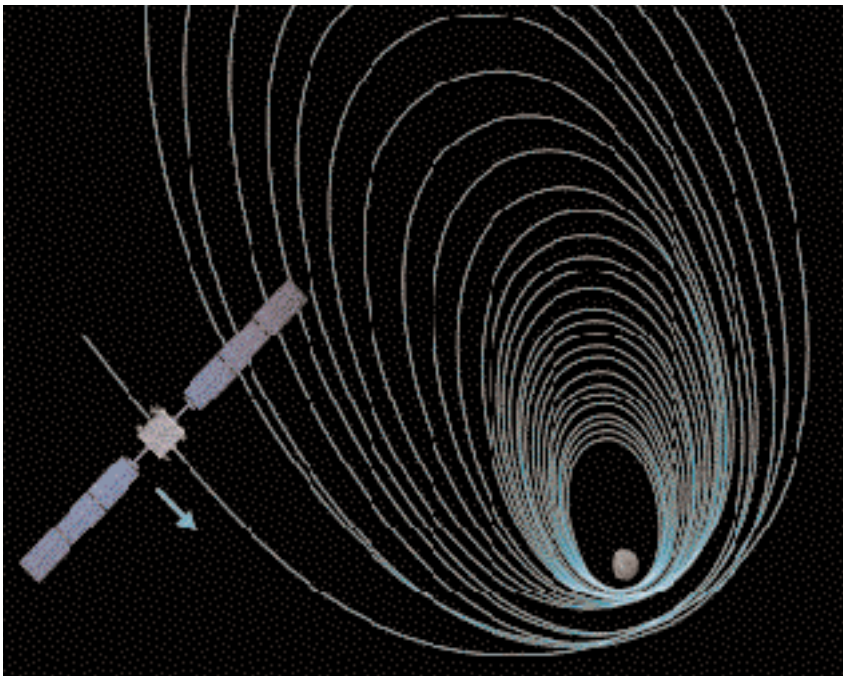
Mars crater with water ice. ©ESA/DLR/FU Berlin (G. Neukum)



Small spheres, called "blueberries", are one of several indications that there once was liquid water on Mars. ©NASA/JPL/Cornell

Smart-1

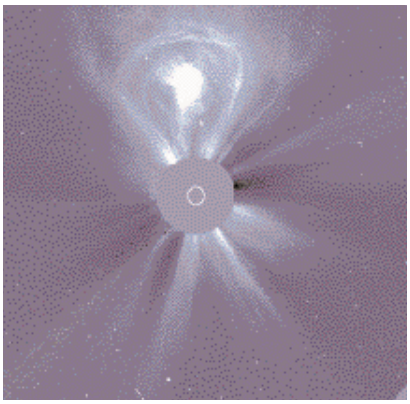
After a journey of more than a year, the Smart-1 finally orbited the Moon in November 2004. The purpose of the comparative snail's pace of the ESA mission to the Moon was to test a new propulsion system for space vehicles. Smart-1 has solar panels that power an ion motor that provides primary propulsion. This type of motor requires little energy, provides high velocity and is ideal for missions lasting several years. In addition to its new propulsion system, the probe has onboard instruments that will examine the bedrock and search for ice under the south pole of the Moon.



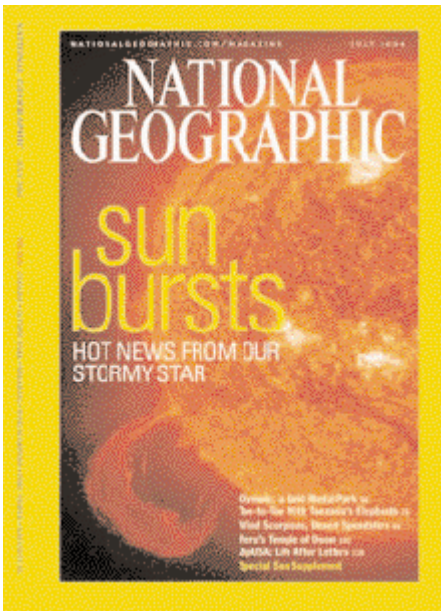
The gravitational field of the Moon caused the Smart-1 orbit to gradually come closer to the surface. ©ESA 2002

SOHO

SOHO, the ESA-NASA joint solar satellite, continued to focus on processes within and on the surface of our closest star. Project scientists created a sensation when they presented the first three-dimensional images of the violent mass eruptions on the Sun. The eruptions result in solar storms on Earth that can disturb radio communications, satellites and electric power transmission. The model is essential to understanding the eruptions so that they can be forecasted before they cause storms on Earth.



Eruptions on the Sun release enormous amounts of energy that can impinge upon the Earth. ©ESA/NASA



The SOHO project has given 40 million readers round the world a closer view of the Sun, as featured in the July 2004 issue of the National Geographic. ©National Geographics

A strong solar storm reached Earth on 8 November 2004 and caused aurora as far south as California. ©Mark Urwiller

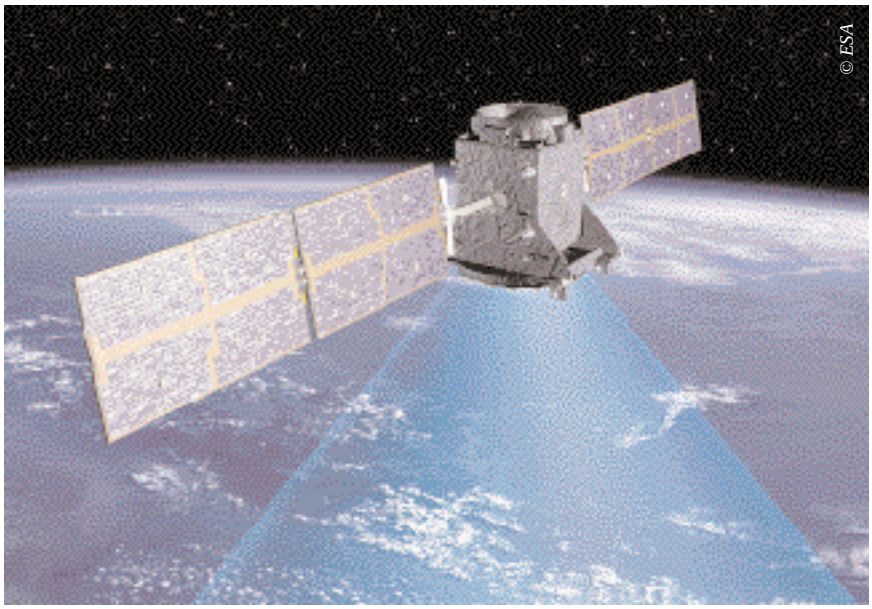
EGNOS

The European Geostationary Navigation Overlay Service (EGNOS) improves the resolution of GPS from around five metres to one metre. In February 2004, an EGNOS prototype was tested for the first time along the Yangtze River in China. Signals were relayed via a geostationary satellite over the Indian Ocean, and the Norwegian Mapping Authority at Hønefoss was a principal in the testing. The test was successful, and the Norwegian space actors will take part in similar EU projects in Africa, South America and Eastern Europe.

Three mobile reference stations developed by Kongsberg Seatex were used in the testing. Here at Fangshang near Beijing. ©ESA

The EGNOS navigation system being tested on board a river boat on the Yangtze River. ©ESA

Galileo

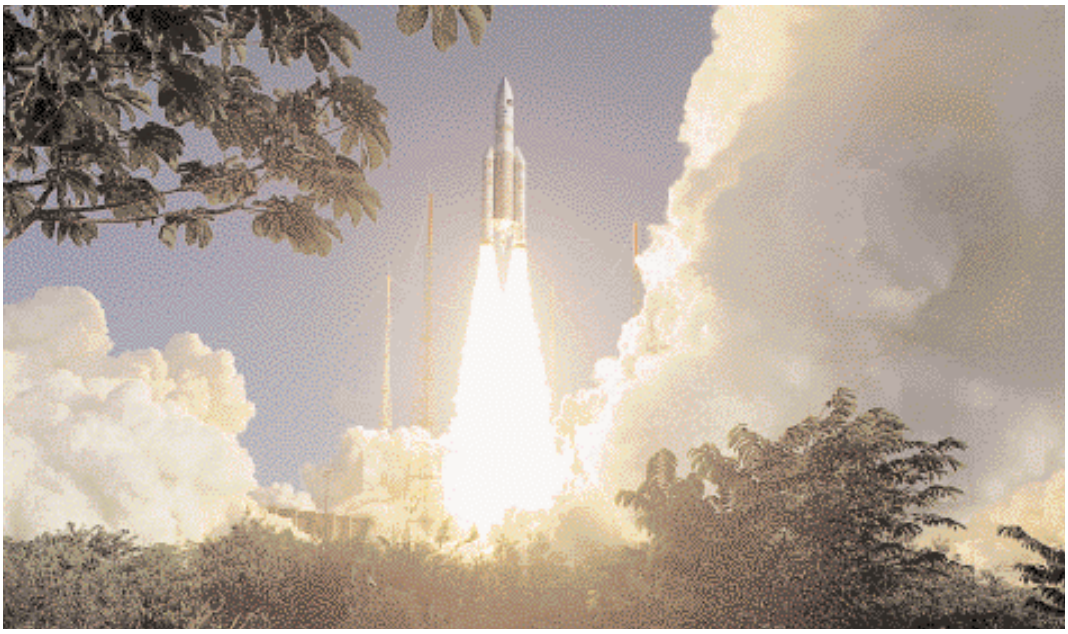


The ESA and the EU now are developing a European satellite navigation system that will be independent of but also interworkable with GPS. GPS and Galileo navigation aids are essential for Norway, so we have taken part in the first phase of the development of Galileo through our ESA membership. 1 December 2004, on behalf of the Norwegian Government, Minister Børge Brende announced that Norway will apply to the EU to initiate negotiations on participation in the EU part of Galileo. The goal is to ensure that Norwegian industry and users are involved in the initial phases of the Galileo development. Our industry has proven very competitive in satellite navigation and consequently may be awarded contracts for supply to the 30 Galileo satellites and to their associated ground infrastructure.

Børge Brende, Minister for Trade and Industry, and Sverre Bisgaard, Managing Director of Norspace AS, flanking a model of a Galileo satellite. ©Elin Høyland

Ariane-5

The new and more powerful ECA version of the Ariane-5 launch vehicle can place a payload of ten tons in a geostationary transfer orbit. Norwegian sub-contracting to Ariane-5 will amount to nearly NOK 200 million (€24.3 million) over the next few years. *©ESA*



SvalSat

The Kongsberg Satellite Services station on Svalbard, SvalSat, is the world's leading ground station for accessing data from satellites in polar orbit. In 2004, the station had four large operational antennas. Activities in Tromsø also expanded, which was evident in an agreement for building new antennas for Digital Globe of the USA, as well as for up-grading existing antennas. In 2003, Norsk Romsenter Eiendom established fibreoptic communications link via two submarine cables between Svalbard and the mainland, in order to ensure further development of satellite-related activities in Tromsø and on Svalbard. The cable system was operational in January 2004.

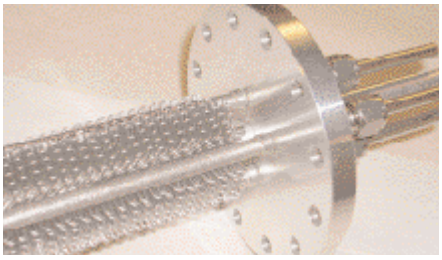
The control centre at the Andøya Rocket Range is among the users who benefit from the broadband connection between Svalbard and the mainland. *©Andøya Rakettskytefelt*

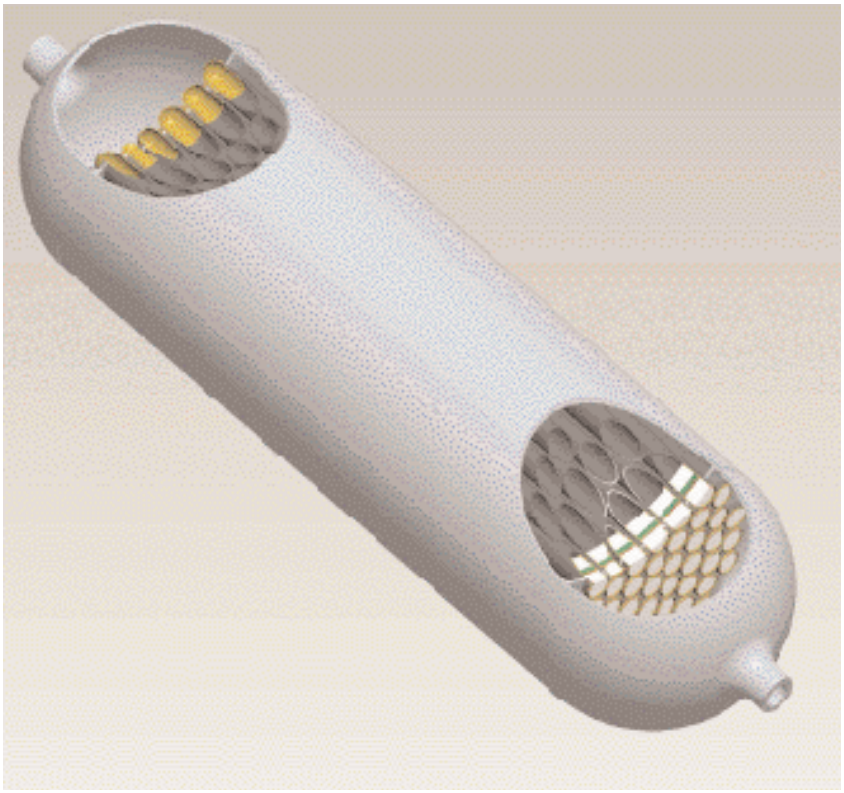
The fibreoptic cable intersects land at Andøya in 2003. *©Norsk Romsenter*

Technological contracts

In 2004, co-operation between Prototech AS in Bergen and the Institute for Energy Technology at Kjeller near Oslo resulted in a prestigious contract with ESA. The companies develop a technology for storing hydrogen onboard spacecraft. The contract was won in competition with other European companies and confirms that Norwegian technological communities are among the best in a key area of development on the way to a hydrogen-based society.

Heat exchanger and storage tank for metal hydride. Hydrogen passes through the tubing along the heat exchanger and is evenly distributed in the metal hydride. ©Prototech



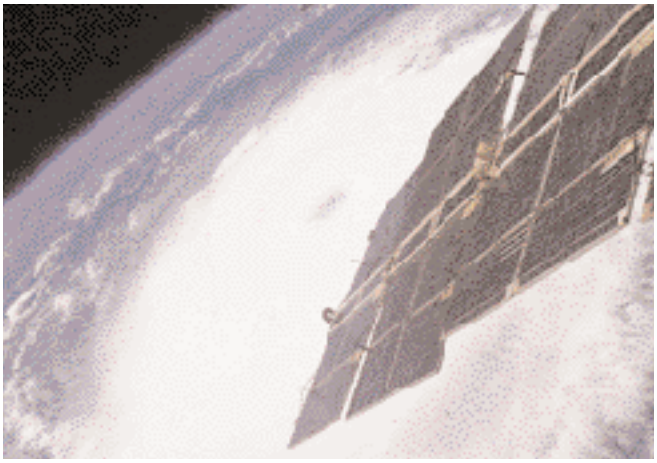


Sketch showing how hydrogen can be stored in many thin tubes in a large safety tank. ©Prototech

GEOSS

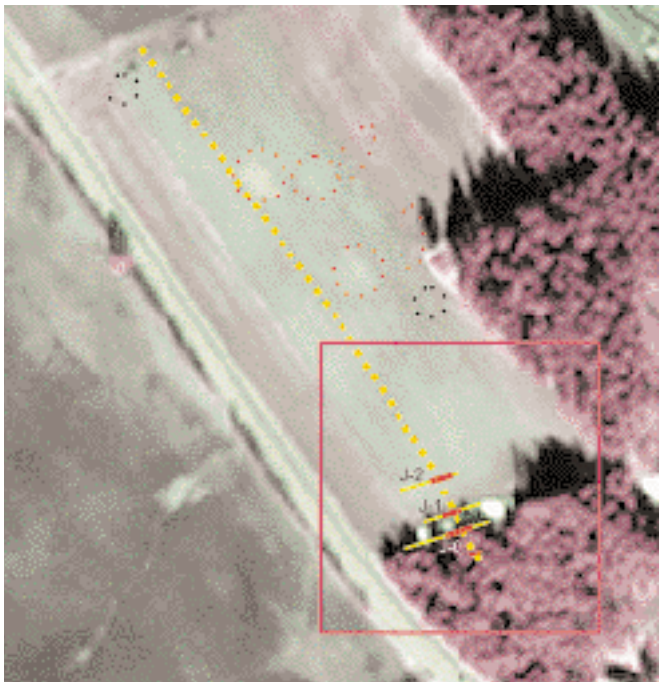
Natural disasters, climatic changes and epidemics don't recognize national borders. Earth observation satellite data is vital to making decisions on emergency aid or on long-term management of natural resources and the environment. The Global Monitoring for Environment and Security (GMES) programme has enabled Europe to start developing new services. These services depend on an international coordination of global observation networks. In 2004, a key milestone was passed when 50 countries and international organizations agreed on a ten-year implementation plan for joint access to Earth observation data through the Global Earth System of Systems (GEOSS).

Hurricane Frances as seen from the International Space Station in early September 2004. It was the second major hurricane to hit the east coast of the USA in less than a month. Its wind speeds were measured at up to 230 km/h, but when Frances hit Florida, its wind speed had declined to 170 km/h. ©NASA/JSC



Cultural heritage

For a hundred years, archaeologists have searched out cultural heritage in Østfold County They have registered burial mounds and pitfalls, found stone age settlements and ancient thoroughfares. In 2004, Earth observation was tested as a new means of registering cultural heritage. Instruments onboard satellites at an altitude of about 700 km collect data which, combined with ground samples, give information on the chemical composition of the ground. This way traces from the past are more evident, which makes archaeological field work more efficient.

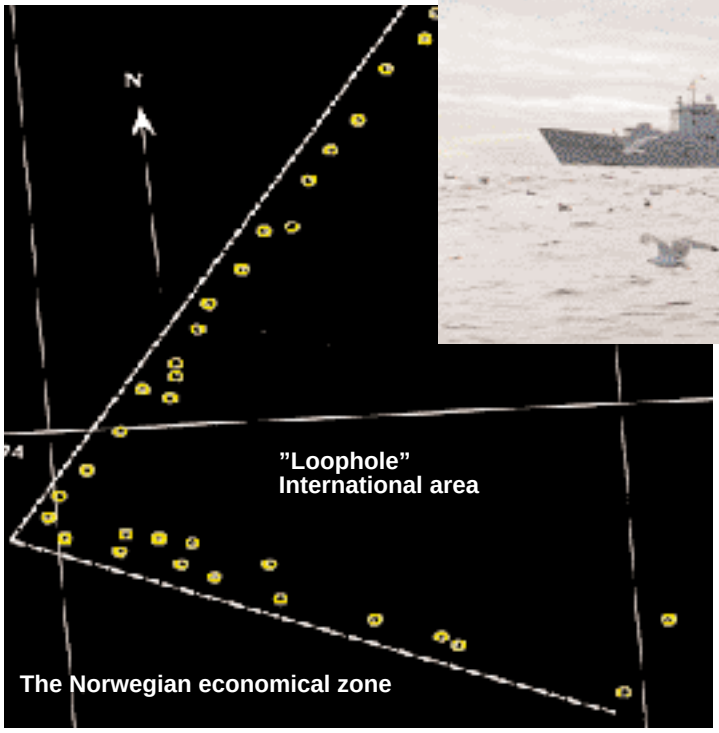


Burial mounds, house sites and old roads were found when satellite images of Østfold were used in mapping the chemical composition of the ground at Gipsund Farm in Rygge Township. ©Space Imaging/Nasjonalt satellittdataarkiv

prehistoric road
certain burial mound or house site
uncertain burial mound or house site

SatHav

Norway manages extensive ocean areas, with rich resources, fragile environment and extreme weather



conditions. The SatHav programme will assist public users in exploiting satellite data in operative services. In 2004, radar data was used extensively in planning seagoing operations. Before an Orion aircraft takes off or a coastguard vessel sails, information on activities in the Norwegian zone are updated using Earth observation data. Trawlers, oil tankers and oil spills are clear on radar satellite images, even in poor weather.

Processed satellite image shows fishing boats at the edge of the Loophole in the Barents Sea. ©CSA 1996

Education

In 2004, the Norwegian Space Centre conducted a major international drawing contest in co-operation with UNESCO and Eurisy. More than 2000 drawings were submitted from 30 countries, and each month, website visitors voted to elect a winner. In January 2005, an international panel of judges declared that the overall winner was Sondre Tømmervold of Norway. NAROM, the national centre for space-related education, manages the Norwegian Space Centre group's educational efforts. In 2004, some 1335 teachers, students and pupils took part in teaching events, seminars and excursions under the aegis of NAROM.

Zhang Biaoynke (8) from China was one of the finalists in the drawing contest.

Nuna II, the world's fastest solar-powered car, was built by students at the University of Delft, Netherlands. It was a sensation on its visit to Norway. Photo: Atle Abelsen

Organization of the Norwegian Space Centre (NSC) as per 1 August 2005

Kongsberg Satellite Services AS
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Norsk Romsenter Eiendom AS
K. E. Myrvang
100% Government

Andøya Rocket Range AS
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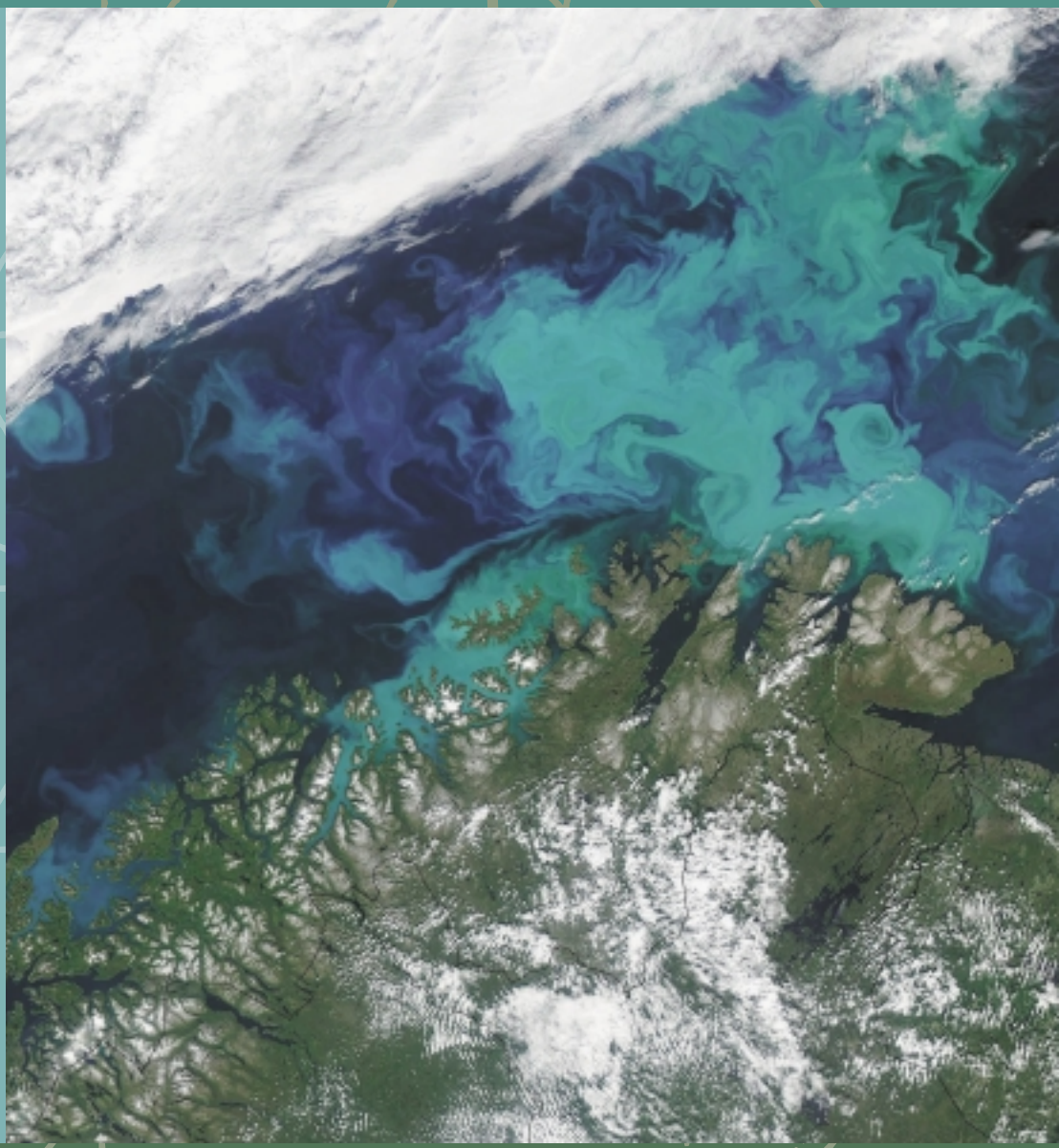

Front and back cover picture:
Algae bloom off the coast of Finnmark, Norway, 19 July 2003. Acquired by (taken by) the MODIS-instrument on board Aqua (NASA). © NASA

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