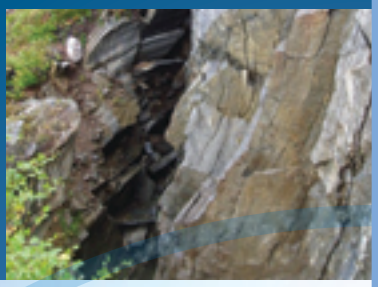
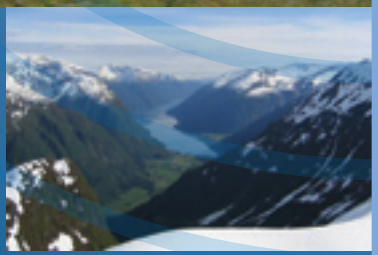




NORSAR

Årsmelding
Annual Report
2005

THE NORSAR FOUNDATION

NORSAR is an independent foundation established with the following objectives:

- To conduct research and development in the areas of geophysics and geophysical software.
- To promote the application of research results for the benefit of the Norwegian society and Norwegian industry.
- To establish and further develop the professional competence of its staff within its areas of activity.
- To act as a Norwegian national resource center for verifying compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

NORSAR's research activities are focused on three main areas:

1. Development of methods and processing systems for seismic monitoring and verification of compliance with the Comprehensive Nuclear-Test-Ban Treaty.
2. Basic seismological research associated with the recording of small and large earthquakes as well as assessing earthquake hazard.
3. Developing methods and software for seismic modelling of geological structures.

Introduction

The Annual Report of the NORSAR Foundation gives an overview of activities that have generated interest among our customers, cooperative partners and governmental agencies. Besides containing basic information about NORSAR, it also highlights some selected research activities in 2005. The Annual Report describes the organization of NORSAR, presents the report from the Board of Directors for 2005 and also includes a report on the financial status of the foundation. Furthermore, a list is provided of scientific publications as well as professional presentations in 2005 by the NORSAR staff.

STIFTELSEN NORSAR

Stiftelsen NORSAR har som formål, på idéelt og samfunnsnyttig grunnlag å:

- Drive forskning og utvikling innen geofysiske og datatekniske fagområder.
- Arbeide for anvendelse av denne forskningens resultater i praksis til fremme av norsk nærings- og samfunnsliv.
- Bidra til opparbeidelse og utvikling av kompetanse og utdanning av fagpersonell innen stiftelsens fagområder.
- Fungere som nasjonalt kompetanse- og driftssenter knyttet til avtalen om forbud mot kjernefysiske prøvesprengninger.

Forskningen ved NORSAR konsentreres i tre hovedområder:

1. Utvikling av metoder og systemer for seismisk overvåkning og verifikasjon av etterlevelse av prøvestansavtalen, Comprehensive Nuclear-Test- Ban Treaty (CTBT).
2. Grunnleggende seismologisk forskning knyttet til registrering av små og store jordskjelv og risiko ved jordskjelv.
3. Utvikling av metoder og programvare for seismisk modellering av geologiske strukturer.

Innledning

Årsmeldingen for Stiftelsen NORSAR gir en oversikt over forhold som ofte blir etterspurt av oppdragsgivere, samarbeidspartnere og offentlige institusjoner. Den inneholder en del sentrale opplysninger fra virksomheten samt noen utvalgte eksempler fra NORSARs forskning og faglige aktiviteter i 2005. Årsmeldingen beskriver også organiseringen, den viser årsberetningen og det økonomiske resultatet for 2005, og den lister opp årets publikasjoner, foredrag og posters der forskere fra NORSAR har gitt sine bidrag.

Activities in 2005

■ An important milestone in the seismological research at NORSAR was the completion in 2005 of a large-scale project, carried out jointly with the University of Oslo and the United States Geological Survey, to develop a three-dimensional geophysical model of the Barents Sea. Such a model can be used for mapping the seismic velocities, so that the travel times of seismic waves can be determined with greater accuracy. This will in turn lead to improved location accuracy of seismic events, which is an important objective within the CTBT monitoring work.

■ During 2005, NORSAR continued its work within microseismic monitoring, focusing on several specific applications. NORSAR's contribution to the large-scale research project SAFOD (San Andreas Fault Observatory at Depth) in California was strengthened through a so-called BILAT- project funded by the Research Council of Norway. NORSAR's cooperation with the mining industry in Sweden and Finland continued during 2005. Through our participation in the International Centre of Geohazards (ICG), NORSAR became involved in microseismic monitoring of the unstable mountain slope near Åknes, Storfjorden in western Norway.

■ During 2005, NORSAR has participated less actively than in previous years in the technical discussions that have been taking place in Vienna in connection with the work of the Comprehensive Nuclear-Test- Ban Treaty Organization (CTBTO). The reason is a reduction in funding by the Norwegian Ministry of Foreign Affairs. This reduction has also led to a reduced effort by NORSAR towards certifying Norwegian monitoring stations in the CTBT International Monitoring System, and the establishment of the last of six such stations on Norwegian territory has been delayed relative to the original plans.

■ NORSAR's activities within seismic modelling are governed by a long-term strategy whereby new, advanced methods are continually incorporated into our software products. In 2005, version 5.0 of the NORSAR-3D modelling software package was launched. This new version supports modelling of seismic waves in anisotropic, layered structures, and represents a significant step towards the goal of developing a general anisotropic seismic modelling system.

■ Work has continued towards establishing a strategy and priorities for development of the SeisRoX software product. SeisRoX is designed for seismic modelling in connection with reservoir simulation and 4-D seismic surveys. The plan is to market this product in 2006.

■ NORSAR Innovation AS, a fully owned, commercial subsidiary of the NORSAR Foundation, was established in September 2005 and became fully operative from 1 October that year. NORSAR Innovation AS is entitled to exploit commercially the Intellectual Property Rights (IPR) belonging to the NORSAR Foundation. The purpose of this subsidiary is to administer and market NORSAR's IPR and thereby provide funds for further research at the NORSAR Foundation.

■ Compared with other technical-industrial research institutions in Norway, NORSAR has traditionally showed a very high publication rate regarding scientific papers in peer-reviewed national and international journals. During 2005, NORSAR scientists published 25 such papers, corresponding to 0.88 publications per full-time professional employee. This is the highest publication rate for NORSAR during the past 6 years, and is almost four times the average rate for Norwegian technical-industrial research institutions during 2001-2005.

Virksomhet i 2005

■ Et viktig bidrag knyttet til den seismologiske forskningen ved NORSAR var sluttføringen i 2005 av et omfattende prosjekt (sammen med Universitetet i Oslo og U.S. Geological Survey) for utvikling av en 3-dimensjonal geologisk modell for Barentshavet. En slik modell kartlegger seismiske hastigheter, slik at gangtider for seismiske bølger kan beregnes med større nøyaktighet, og dermed kan også seismiske hendelser lokaliseres med bedre presisjon. Dette er en sentral problemstilling innen CTBT-arbeidet.

■ NORSAR videreførte i 2005 sitt arbeidet med mikroseismisk monitorering innen flere anvendelser: NORSARs medvirkning i det store forskningsprosjektet SAFOD (San Andreas Fault Observatory at Depth) i California ble styrket gjennom et Forskningsrådsfinansiert BILAT-prosjekt, samarbeidet med gruveindustrien i Sverige og Finland ble videreført, og i tilknytning til partnerskapet International Centre of Geohazards (ICG) ble NORSAR involvert i mikroseismisk monitorering av den instabile fjellsiden ved Åknes i Storfjorden, Møre og Romsdal.

■ På grunn av nedgang i finansieringen for dette formålet for 2005, har NORSAR deltatt mindre aktivt enn tidligere i de tekniske drøftelsene som har pågått ved Comprehensive Nuclear-Test- Ban Treaty Organization (CTBTO) i Wien. Av samme grunn har arbeidet med sertifisering av norske stasjoner for overvåkning av prøvestansavtalen heller ikke blitt prioritert av UD, og arbeidet med bygging av den siste av de seks stasjonene Norge har forpliktet seg til å etablere og drive under denne avtalen er forsinket i forhold til opprinnelige planer.

■ Fagområdet seismisk modellering arbeider under en langsiktig FoU-strategi der nye metoder kontinuerlig kanaliseres inn i softwareprodukter. I 2005 ble versjon 5.0 av modellerings-programvaren NORSAR-3D lansert i petroleumsmarkedet. Denne versjonen inkluderer modellering av seismiske bølger i lagdelte, anisotrope strukturer og representerer langt på vei NORSARs ambisjoner om å utvikle en komplett, anisotropisk seismisk modellering.

■ Arbeidet med en strategi for utvikling av software-produktet SeisRoX for seismisk modellering knyttet til seismisk reservoarsimulering og 4D-seismikk har resultert i klare prioriteringer og planer for lanseringen av dette produktet i 2006.

■ NORSAR Innovation AS, et heleid, kommersielt datterselskap av Stiftelsen NORSAR, ble grunnlagt og registrert i slutten av september, og ble operativt fra 1. oktober 2005. NORSAR Innovation AS har rett til å utnytte Stiftelsen NORSARs IPR kommersielt. Formålet med selskapet er å forvalte og kommersialisere stiftelsens IPR og derved tilføre stiftelsen midler til forskning.

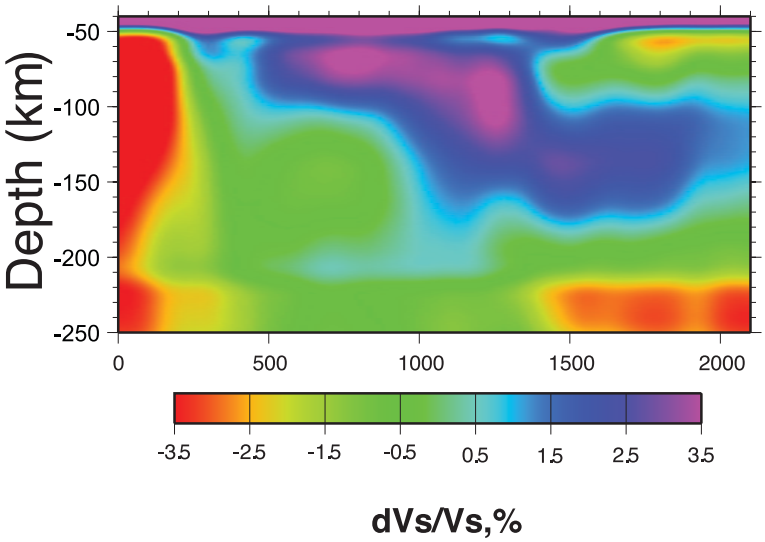
■ NORSARs publisering i nasjonale og internasjonale tidsskrift med review-ordning har tradisjonelt ligget høyt sammenlignet med mange av de øvrige teknisk-industrielle instituttene i Norge. I 2005 ble det publisert 25 slike artikler, tilsvarende 0.88 publiseringer pr forskerårsverk. Dette er den høyeste, årlige publiseringsraten for NORSAR over de siste 6 år, og en rate som er nærmere 4 ganger høyere enn instituttgjennomsnittet for 2001-2005.

3D-modelling of the Barents Sea

■ During the past three years, NORSAR has in cooperation with the University of Oslo, the United States Geological Survey and the University of Colorado developed a new three-dimensional (3D) model for seismic velocities and densities of the crust and upper mantle in the Barents Sea.

■ The crustal model is based on a large number of wide-angle transects supplemented with deep seismic reflection data for modelling the density. New regional relations between depth to the basement and the thickness of the crystalline crust have also been developed and applied in the modelling. The model has been sampled in a grid with 50 km spacing, and for each grid point we have defined two sedimentary and three crystalline layers together with their velocities and densities.

■ The new upper mantle model is based on surface wave observations from a number of regional and local earthquakes for which the wave paths have crossed the Barents Sea. This has resulted in obtaining both S and P wave velocities down to considerable depths in the mantle. The two models, for the crust and upper mantle, have then been combined to a common hybrid model. This combined model now provides greatly improved possibilities to calculate accurate seismic wave travel times in this region, and this will in turn lead to improved location accuracy of seismic events. The new model has been verified using observed travel times from seismic events (explosions) with known locations.



Figuren viser et vertikalt snitt gjennom jordens indre ned til et dyp av 250 km langs et øst-vest profil gjennom det sørlige Barentshavet, der fargene indikerer variasjonene i seismiske hastigheter og dermed også i tetthet. Profilet går fra Nordatlanteren mellom Norge og Svalbard, gjennom det sørlige Novaya Zemlya og inn i Karahavet. Figuren viser at geologien i dette området har dype røtter langt ned i jordens mantel.

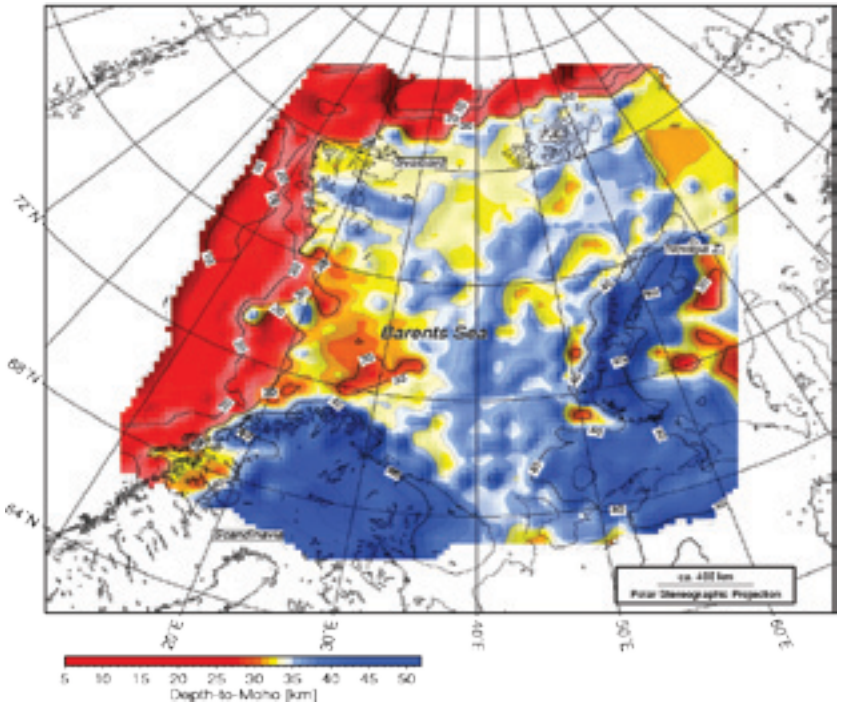
The figure shows a vertical section through the Earth's interior down to a depth of 250 km along an east-west profile through the southern Barents Sea, with colors indicating variations in seismic velocities and thereby also in densities. The profile runs from the North Atlantic between Norway and Svalbard, through the southern Novaya Zemlya and into the Kara Sea. The figure shows that the geology in this region has deep roots into the Earth's mantle.

3D-modellering av Barentshavet

■ En ny 3-dimensjonal (3D) modell for seismiske hastigheter og tettheter for skorpe og øvre mantel i Barentshavet er i løpet av de siste tre årene utviklet i et samarbeid mellom NORSAR, Universitetet i Oslo, U.S. Geological Survey og Colorado University.

■ Skorpemodellen er basert på et stort antall 2D seismiske vidvinkel-transekter supplert med dypseismiske refleksjonsdata brukt for tetthetsmodellering. Nye regionale relasjoner mellom dyp til basement og tykkelsen av den krystallinske skorpen er også utviklet og benyttet i modelleringen. Modellen er samplet med 50 km mellom punktene og for hvert punkt er to sedimentære og tre krystallinske lag definert, med hastigheter og tettheter.

■ Den nye modellen for den øvre del av mantelen er basert på overflatebølger fra et stort antall regionale og lokale jordskjelv der bølgene har krysset Barentshavet, noe som har gitt både S- og P-bølge hastigheter ned til store dyp i mantelen. De to modellene, for skorpe og øvre mantel, er så til slutt satt sammen til en felles hybrid-modell som nå gir et vesentlig bedre grunnlag for å beregne seismiske gangtider i dette området, og som dermed også vil gi mer presise lokaliseringer av seismiske hendelser. Den nye modellen er verifisert ved hjelp av gangtider fra hendelser med kjent beliggenhet (eksplosjoner).



3-D kart over dypet av jordskorpen i Barentshavet.

3-D map showing the depth of the Earth's crust underneath the Barents Sea.

Modelling in anisotropic, layered structures

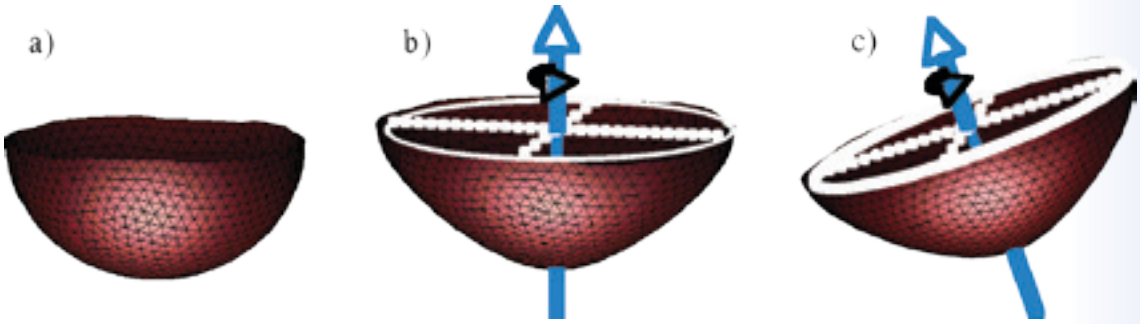
■ *Seismic anisotropy* is a topic within seismic modelling that has attracted increasing interest by the petroleum industry in recent years. Anisotropy means that the seismic wave velocity in a geological medium depends not only on the *position*, but also on the *direction* in which the wave propagates. For example, in a shaly structure the wave velocities in horizontal and vertical directions can typically show a significant difference. A satisfactory description of anisotropic velocities in a geological structure represents one of the greatest potential sources for improved quality in imaging of seismic data at depth (depth migration). In particular, this applies to imaging and analysis of so-called multicomponent data (4C, ocean-bottom seismic processing), where the S-waves also form an important part.

■ In 2005, *anisotropy in layered structures* was implemented in version 5.0 of the NORSAR-3D software package, which is used by a number of customers in the petroleum industry. In this new version, the geological model can be divided into different layers, each of which can have different isotropic or anisotropic properties. The seismic wave propagation is simulated by use of the wavefront construction method, where the wavefronts start at a source point (shotpoint) and are propagated successively through application of ray theory. The figure shows wavefronts in media with different anisotropic properties. In the current commercial version of the software, a so-called *transverse isotropy* is assumed, i.e. the anisotropy is symmetric around a given direction (symmetry axis). More general anisotropic models are being developed.

Modellering i anisotrope, lagdelte strukturer

Et viktig tema som har fanget betydelig interesse i petroleumsindustrien i de senere år er *seismisk anisotropi*. Anisotropi betyr at den seismiske bølgehastigheten i et geologisk lag ikke bare er avhengig av *posisjonen*, men også av *retningen* som bølgen brer seg i. I en skiferbergart vil eksempelvis bølgehastigheten i vertikal retning typisk kunne avvike vesentlig fra den horsontale hastigheten. En tilfredsstillende beskrivelse av anisotrope hastigheter i en geologisk struktur representerer en av de største potensielle kilder til kvalitetsforbedring av avbildede seismiske data i dyp (dypmigrasjon). Dette er spesielt tilfelle for avbildning og analyse av såkalte multikomponent-data (4C data, havbunnsseismikk), hvor også S-bølger spiller en viktig rolle.

I 2005 ble *anisotropi i lagdelte strukturer* implementert i versjon 5.0 av programvaren NORSAR-3D som benyttes av mange forskjellige aktører i petroleumsmarkedet. Den geologiske modellen kan deles opp i forskjellige lag, som hver for seg kan ha forskjellige isotrope eller anisotrope parametere (egenskaper). Simuleringen av den seismiske bølgeutbredelsen utføres med den såkalte bølgefrontmetoden, der bølgefronter startes ved et kildepunkt (skuddpunkt) og konstrueres suksessivt gjennom mediet vha stråleteori. Figuren viser bølgefronter i medier med forskjellige anisotrope egenskaper. I den nåværende kommersielle programvaren, antar man såkalt *transvers isotropi* (TI-medium), dvs at anisotropien er symmetrisk om en gitt retning (symmetriaksen). Mer generelle anisotrope modeller er under utvikling.



Bølgefronter i isotropt medium (a) og TI- medium (b og c). I b) er symmetriaksen vertikal, mens den i c) har en annen retning.

Wavefronts in an isotropic medium (a) and in a TI medium (b and c). In b), the axis of symmetry is vertical, whereas in c) it has a different orientation.

SeisRoX

– a new interactive system for integrated rock physics model construction and seismic modelling in complex reservoir zones

■ Based on many years of research in rock physics and seismic modelling, NORSAR developed in 2005 a prototype of a new modelling system named SeisRoX ™. The system enables a user to combine data from different sources in order to generate a model of the reservoir properties that is as consistent as possible with the variety of data. Such a model will in turn provide input that can improve the fluid simulation before and during oil/gas production.

■ A simplified flow chart of the SeisRoX system is shown in the figure on the next page. The system can operate in various *model domains:*

- Geology/rock physics (with typical model parameters porosity, clay/shale content, fluid content, etc.)
- Elastic properties (seismic wave velocity (P- and S-), density, parameters for anisotropy, etc.)
- Reflectivity (reflection properties of seismic signals, AVO-parameters, etc.)

■ Using newly developed and specially tailored modelling methods, one can 'transform' data between the different domains. For example, one could start with a set of rock parameters for a reservoir zone (based on well data), and then transform (model) the corresponding elastic parameters in the zone. These parameters can in turn be transformed to seismic response, which can be directly compared with the recorded seismic data. Alternatively, one could start with the seismic data and then 'model back to' a relevant set of rock parameters. This is a type of 'inverse modelling' that in practice will require that one imposes certain external conditions in order to make the results reasonably unambiguous. This will require considerable and challenging developmental work, which is still only in an initial stage.

■ The main idea behind SeisRoX is to develop an integrated modelling system, where external conditions (i.e., data based on observations or hypotheses) can be specified in the different domains, so that a model can be developed which is as consistent as possible with these external conditions. The concept has been met with a favorable response from several oil companies, not the least because the prototype system can run on a PC platform and contains state-of-the-art modelling methodology. An example is the 'SimPLI' method for which NORSAR has made a patent application, and which is designed to calculate seismic response of 3-D reservoir zones with complex geology.

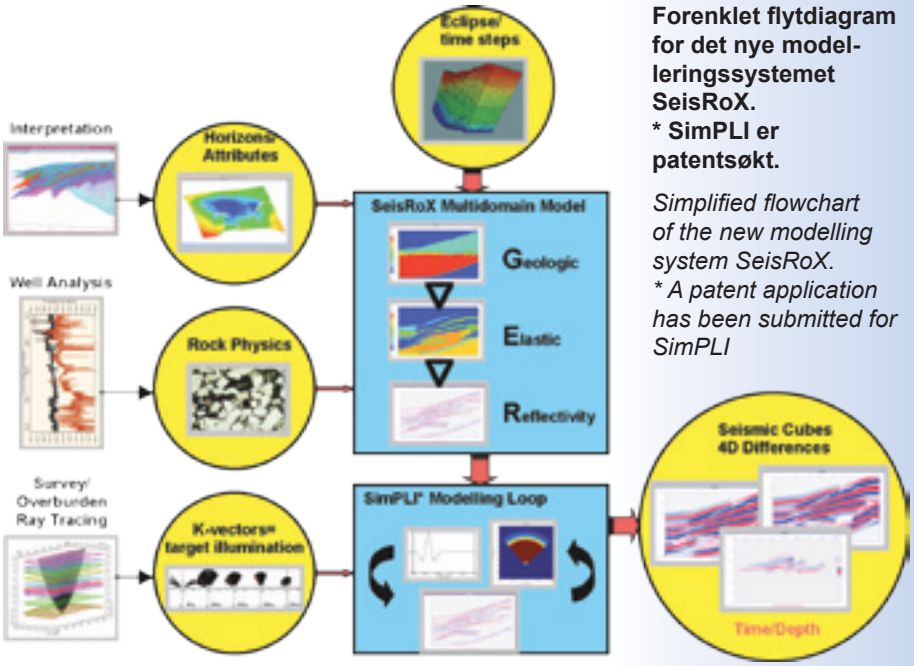
SeisRoX

– et nytt interaktivt system for integrert bergartsfysisk og seismisk modellering i komplekse reservoarsoner

Med basis i forskningsaktiviteter innen bergartsfysikk og seismisk modellering gjennom mange år, ble det i 2005 utviklet en prototyp for et nytt modelleringssystem med navnet SeisRoX ™. Systemet gjør det mulig for en bruker å kombinere data fra forskjellige datakilder og oppnå en mest mulig konsistent modell for egenskapene i et petroleumsreservoar. Den forbedrede modellen vil i sin tur kunne gi input til en forbedret væske-simulering før og under olje/gass-produksjon.

Et forenklet flytdiagram for SeisRoX-systemet er vist i figuren til høyre. Systemet kan operere i forskjellige *modelldomener*:

- geologi/bergartsfysikk (typiske modellparametere porøsitet, leir/skifer-innhold, væske-innhold, etc),
- elastiske egenskaper (seismisk bølgehastighet (P- og S-), tetthet, parametere for anisotropi, etc),
- reflektivitet (refleksjonsegenskapene for seismiske signaler, AVO-parametere, etc).



Forenklet flytdiagram for det nye modelleringssystemet SeisRoX.
*** SimPLI er patentsøkt.**

Simplified flowchart of the new modelling system SeisRoX.
** A patent application has been submitted for SimPLI*

Ved hjelp av nyutviklede og spesialtilpassede modelleringsmetoder kan man 'transformere' data mellom de forskjellige domener. For eksempel kan man starte med et sett med bergartsparametere for en reservoarsone (fra brønndata), og så transformere (modellere) de tilsvarende elastiske parametere i sonen. Disse kan videre transformeres til seismisk respons, som kan sammenlignes med innsamlede seismiske data. Alternativt kan man starte med seismiske data og 'modellere seg tilbake til' et relevant sett med bergartsparametere. Dette er en form for 'inversmodellering' som i praksis vil kreve eksterne føringer for å bli noenlunde entydig. Her gjenstår betydelig, utfordrende utviklingsarbeid som ennå er i startfasen.

Hovedidéen med SeisRoX er å skape et enhetlig modelleringssystem der føringer (dvs data basert på observasjoner eller hypoteser) kan gis i de forskjellige domener, og en modell som er mest mulig konsistent med alle disse føringene kan da beregnes. Konseptet har fått god mottakelse hos flere oljeselskap, ikke minst fordi det kan kjøres på en PC-platform og inneholder state-of-the-art metodikk på modelleringssiden.
Et godt eksempel her er den patentsøkte 'SimPLI'-metoden for å beregne seismisk respons av 3D reservoar-soner med komplisert geologi.

Earthquakes

■ Historically, Norway has not been exposed to large, disastrous earthquakes. Nevertheless, there is a moderate seismic activity, with 21 small tremors being felt by people in 2005. Most of the earthquake activity in Norway takes place offshore.

■ An entirely different picture was observed during 2005 in Asia. Less than a year after a catastrophic earthquake (with magnitude 9.3) struck the coast of Sumatra on 26 December 2004 and generated a deadly tsunami, another disastrous earthquake occurred in Kashmir on 8 October 2005. With a magnitude of 7.6, this earthquake was not among the largest ones observed, but the fault zone of 80 km length happened to be located just beneath several large cities. A contributing factor to the disastrous effects of this earthquake was the vulnerability of the buildings, being characterized by unsuitable design, poor construction practice together with use of sub-standard building materials and lack of reinforced concrete frames. The official death toll is above 80,000 and entire communities have been literally extinguished. Women were particularly exposed during the earthquake because they traditionally stay indoors.

■ It is an unfortunate development that the number of casualties as well as the amount of destruction due to earthquakes is increasing. While we know how to reverse this trend, the possibility of undertaking effective actions is limited due to social, organizational and financial conditions.

Svake bygningskonstruksjoner er hovedårsak til skader.

Poor construction practice is one of the main factors causing damage.

Jordskjelv

■ Norge er i historisk tid spart for store ødeleggende jordskjelv. Likevel ble 21 små norske skjelv merket i 2005. De aller fleste skjelvene hadde senter i havet utenfor kysten.

■ Helt annerledes var 2005 i Asia. Mindre enn et år etter den enorme jordskjelvet med styrke 9.3 ved Sumatra, som genererte en ødeleggende tsunami 2. juledag 2004, inntraff et nytt katastrofeskjelv i Pakistansk Kashmir 8. oktober 2005. Jordskjelvet, med styrke på 7.6, var ikke blant de kraftigste, men den 80 km lange bruddsonen lå rett under flere store byer. Tragedien ble enorm fordi selv i Kashmir, hvor store jordskjelv må forventes, er bygningsstandarden gjennomgående dårlig, med svak betong i konstruksjonene, mangelfull armering, og boliger for øvrig der løst sammenmurte naturstein bærer tunge tak av betong. Over 80,000 mennesker er offisielt omkommet og hele samfunn er bokstavelig talt utradert.

■ Kvinner ble særlig hardt rammet fordi denne gruppen i overveiende grad oppholder seg innendørs i den lokale kulturen. Det er en tragisk utvikling at ødeleggelser og antall omkomne etter store jordskjelv er økende. Vi har den kunnskap vi trenger for å snu denne utviklingen, men effektive tiltak begrenses av sosiale, organisatoriske, og økonomiske forhold.

Konsekvensen er teltleire for store deler av befolkningen.

As a result, many people have had to move into tents as temporary shelters.

Organisasjon
Organisation

Program 1:
Nasjonalt Datasenter
National Data Center (NDC)

Jan Fyen - Programleder
Ulf Baadshaug
Bernt Kr. Hokland
Kamran Iranpour
Paul W. Larsen
Kjell Arne Løken
Berit Paulsen
Jørgen Torstveit

Program 2:
Seismologi og prøvestans-kontroll
Array Seismology and Monitoring Research

Tormod Kværna - Programleder
Steven John Gibbons
Nils Maercklin
Svein Mykkeltveit
Frode Ringdal
Johannes Schweitzer

Program 3:
Jordskjelv og miljø
Earthquakes and the Environment

Conrad Lindholm - Programleder
Hilmar Bungum
Jan Inge Faleide
Volker Oye
Michael Roth

Program 4:
FoU Seismisk modellering
Seismic Modelling Research

Håvar Gjøystdal - Programleder
Einar Iversen
Tina Kaschwich
Isabelle Lecomte
Joachim Mispel

Program 5:
SW Produktutvikling
Software Product Development

Arve E Mjelva - Programleder
Håkan Bolin
Håvard Iversen
Lars W. Lind
Stein Inge Moen
Ludovic Pochon-Guerin
Ketil Åstebøl

Program 6:
Anvendt seismisk modellering
Applied Seismic Modelling

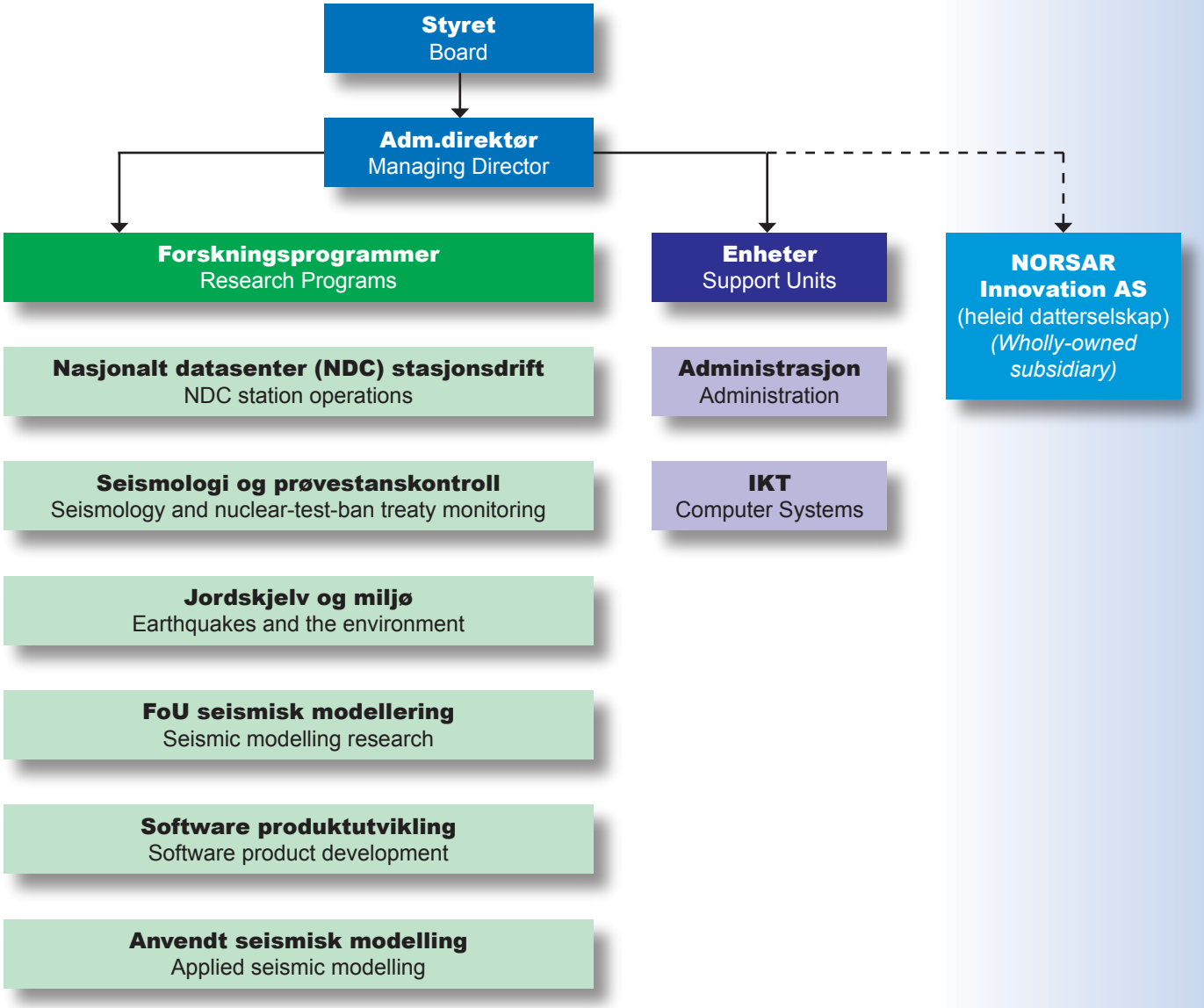
Åsmund Drottning - Programleder
Mona Andersen
Camilla Thorsen Dræge
Erik Hicks
Tor Arne Johansen
Lars Zühlsdorff

Administrasjonsenhet
Administration

Anders Dahle - Adm. direktør
Rune Lindvik
Winnie Lindvik
Linda Loughran
Marion Lohne Mykkeltveit
Mette Berg Sandvold
Turid Schøyen

IKT enhet
Computer Systems

Nils Schøyen - Leder IKT enhet
Vidar Døhli
Frode Johansen


Styret
Board
Adm.direktør
Managing Director
Forskningsprogrammer
Research Programs
Enheter
Support Units
NORSAR Innovation AS
(heleid datterselskap)
(Wholly-owned subsidiary)
Nasjonalt datasenter (NDC) stasjonsdrift
NDC station operations
Administrasjon
Administration
Seismologi og prøvestanskontroll
Seismology and nuclear-test-ban treaty monitoring
IKT
Computer Systems
Jordskjelv og miljø
Earthquakes and the environment
FoU seismisk modellering
Seismic modelling research
Software produktutvikling
Software product development
Anvendt seismisk modelling
Applied seismic modelling

Annual Report 2005

■ The NORSAR Foundation is an independent foundation established for the purpose of conducting research and development in the areas of geophysics and geophysical software, and to act as a national resource center for verifying compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

■ NORSAR is one of the group of technical-industrial research institutions which receive governmental support through the Research Council of Norway.

■ From 1 January 2005, NORSAR's activities are organized within six research programs, together with an administrative section and an IT-department.

■ NORSAR has its headquarters at Kjeller, while a branch office for seismic modelling is located in Bergen. NORSAR's field installations are situated in Hedmark (southern Norway), Finnmark (northern Norway) and on the islands of Spitsbergen and Jan Mayen. A field maintenance section is located at Hamar.

■ During 2005, a considerable effort was made to develop a new strategic plan for the period 2005-2010. The plan identifies goals and strategies for the next five years, and describes how to achieve the goals in practical work.

■ In September 2005 the NORSAR Foundation established a fully owned commercial subsidiary named NORSAR Innovation AS. The subsidiary is entitled to exploit commercially the Intellectual Property Rights (IPR) belonging to the NORSAR Foundation. The subsidiary became operative, initially with two employees, on 1 October 2005.

Economy

■ NORSAR's gross revenue during 2005 was 49.2 MNOK (46.5 MNOK in 2004). The operating profit was 2.2 MNOK (0.8 in 2004). Including financial transactions, which provided a profit of 0.5 MNOK (-0.5 in 2004), the overall profit in 2005 was 2.7 MNOK (1.8 in 2004).

■ NORSAR's operating profit corresponds to 4.5% of the total revenues for 2005. By the end of 2005, NORSAR's capital assets comprised 62.2% of total assets (58.1% in 2004).

■ For comparison, the Norwegian Ministry of Trade and Industry has established target guidelines for the research institutions corresponding to an operating profit of 3% of total revenues and capital assets of 30% of total assets.

■ The operating profit in 2005 is the best financial result achieved by NORSAR during the past 6 years. During 2000-2004, the average operating profit was 2.7%.

■ During 2000-2004, the Norwegian Public Service Pension Fund failed to collect the proper pension premiums from NORSAR due to an error in their collection procedure. Consequently, there has been a shortfall in the amounts paid by NORSAR. This means that NORSAR during the next several years will need to pay an additional annual premium of 3% of total salaries.

Årsberetning 2005

■ Stiftelsen NORSARs formål er å drive forskning og utvikling innen geofysiske og datatekniske fagområder, samt å fungere som nasjonalt kompetanse- og driftssenter knyttet til avtalen om forbud mot kjernefysiske prøvesprengninger.
■ NORSAR tilhører gruppen teknisk-industrielle forskningsinstitutter som mottar statlig støtte til sin forskning gjennom Norges Forskningsråd.
■ Virksomheten er fra 1.1.2005 organisert i seks forskningsprogrammer, en enhet for administrasjon og en enhet for IKT.
■ NORSARs hovedvirksomhet er lokalisert i Instituttveien 25, 2007 Kjeller, Skedsmo kommune. En del av virksomheten er lokalisert i Thormøhlensgate 55, Bergen. Feltanleggene ligger i Hedmark, i Finnmark, på Svalbard og Jan Mayen. Et vedlikeholdssenter for feltanleggene er lokalisert i Ajerhagan 98, Hamar.
■ I 2005 ble det lagt ned et omfattende arbeid med en ny virksomhetsplan for perioden 2006-2010. Virksomhetsplanen identifiserer mål og strategier for de neste 5 år, og hvordan disse skal oppnås gjennom praktisk handling.
■ Stiftelsen NORSAR opprettet i september 2005 det heleide datterselskapet NORSAR Innovation AS. Selskapet skal forvalte Stiftelsen NORSARs IPR, og har rett til å utnytte denne kommersielt. Selskapet ble operativt med 2 ansatte fra 1.oktober 2005.

Økonomi

■ Driftsinntektene beløp seg i 2005 til 49.2 mill kroner (46.5 mill kroner i 2004). Driftsresultatet ble 2.2 mill kroner (0.8). Finanspostene summerer seg i 2005 til 0.5 mill kroner (-0.5). Totalresultatet ble dermed 2.7 mill kroner (1.8).
■ Driftsresultatet tilsvarer en resultatgrad på 4.5% (1.8) av driftsinntektene, og egenkapitalen beløp seg til 62.2% (58.1) av totalkapitalen.
■ Nærings- og handelsdepartementets målsetting for instituttsektoren er til sammenligning hhv 3% for resultatgraden og 30% for egenkapitalandelen.
■ Driftsresultatet er det beste Stiftelsen NORSAR har hatt i de siste 6 år. Gjennomsnittlig resultatgrad i perioden 2000-2004 var 2.7%.
■ Manglende innkreving av pensjonspremie fra Statens Pensjonskasse i perioden 2000-2004 har medført at Stiftelsen NORSAR i de nærmeste årene må tåle en tilleggspremie på 3% av de samlede årslønnskostnader.
■ Stiftelsen er eksponert for finansiell markedsrisiko ved endring i valutakurser. Risikoen søkes redusert ved oppdragsavtaler med justering for valutaendringer der det er oppnåelig og terminavtaler for om lag 50% av valutastrømmen. Stiftelsen har ikke gjeld, og er derfor bare eksponert for endringer i rentenivået på innskuddsmidler.
■ Historisk sett har det vært få tap på fordringer mot Stiftelsens kunder. Brutto kredittrisiko for kundefordringer pr 31.12.05 utgjør totalt kr 11.13 mill for konsernet og kr 8.56 mill for Stiftelsen i 2005.

- NORSAR is exposed to financial risk due to fluctuations in currency exchange rates. In order to minimize the risk, an effort has been made to include adjustments for such fluctuations in those contracts where this has been feasible. In addition, long term exchange rate agreements have been negotiated for about 50% of the expected revenues in foreign currencies. NORSAR has no debt, and is therefore not exposed to financial risks from increasing interest rates.
- Historically, NORSAR has had small losses attributed to customers' default on payments. For the NORSAR Foundation and its subsidiary, the total accounts receivable from external customers by the end of 2005 was 11.13 MNOK, of which 8.56 MNOK applied to the foundation itself.
- The liquidity is good, and no changes have been made with respect to the previously established strategy for maintaining adequate liquidity. No bonds held by the foundation have been renegotiated or redeemed.
- In accordance with requirements in the Norwegian accounting legislation, the Board confirms that the annual accounts have properly taken into consideration the continued operation of the foundation.

Perspectives

- The report to the Norwegian Parliament entitled "Commitment to research", signals a positive and constructive attitude towards the research institutions in Norway. NORSAR has succeeded in establishing a strong portfolio of research projects funded partly or fully by the Research Council of Norway, and has thereby received confirmation that the research carried out at the foundation satisfies the Council's requirements to quality and relevance.
- The Board of Directors continues to express concern with the developments in funding by the Norwegian Ministry of Foreign Affairs with regard to NORSAR's CTBT-related activities. This funding continued to show a decline in real terms during 2005. The Board's concern mainly addresses NORSAR's ability, in the long term, to carry out the tasks that were assigned to the institution by the Norwegian Parliament during the treaty ratification process. Indirectly, it also refers to NORSAR's reputation as a leading international institution within seismology and nuclear test ban monitoring.
- NORSAR's petroleum related research shows increased activity, which to a large extent is due to the good financial situation in the oil and gas industry. The establishment of the subsidiary NORSAR Innovation AS is therefore taking place at a time of optimum development in this market, and this positive situation is expected to last for some time. NORSAR's strategic plan calls for an active approach towards increased sales volume and focused research in this area. NORSAR Innovation AS has as its purpose to further develop and exploit commercially the Intellectual Property Rights belonging to the NORSAR Foundation and thereby provide funds for further research at the foundation. The main challenge ahead is likely to relate to recruitment of talented staff rather than obtaining new projects.

■ Stiftelsens likviditet er god, og det er ikke besluttet å innføre tiltak som endrer likviditetsrisikoen. Obligasjoner er ikke vurdert reforhandlet eller innløst.

■ I samsvar med regnskapslovens § 3-3a bekreftes det at forutsetningen om fortsatt drift er til stede og lagt til grunn ved avleggelsen av årsregnskapet.

Framtidsutsikter

■ Forskningsmeldingen «Vilje til forskning» signaliserer et positivt og konstruktivt syn på instituttsektoren. NORSAR har lykkes med å etablere en sterk portefølje av forskningsprosjekter med hel- eller delfinansiering fra Norges forskningsråd, og har ved dette fått bekreftet at instituttets forskning har kvalitet og relevans i forhold til Forskningsrådets programmer.

■ Styret ser fremdeles med bekymring på utviklingen i den statlige bevilgningen til NORSARs rolle i tilknytning til den internasjonale prøvestansavtalen. Det var fortsatt reell nedgang i de midler som ble stilt til rådighet for dette prosjektet i 2005. Bekymringen gjelder først og fremst videreføring og videreutvikling av kompetanse for å løse oppdraget, og indirekte NORSARs omdømme som en faglig ledende, internasjonal aktør innen seismologi og prøvestanskontroll.

■ NORSARs petroleumsrelaterte forskning er i vekst, mye som et resultat av bransjens gode lønnsomhet. Opprettelsen av datterselskapet NORSAR Innovation AS er derfor trolig faset inn i en positiv utvikling som etter alt å dømme vil vare i noe tid, og NORSARs virksomhetsplan er offensiv med tanke på volumøkning og faglige satsinger innen dette fagfeltet. NORSAR Innovation AS har som formål å videreutvikle og utnytte Stiftelsen NORSARs IPR i kommersiell retning. Stiftelsen har som ambisjon med selskapet at det i samvirke med øvrig næringsliv kan tilføre midler til forskning innen stiftelsens kjerneområder. Utfordringen framover vil trolig være mer på rekruttering av god kompetanse enn i tilgang på oppgaver.

■ Allianser med andre er viktig for faglig utvikling, profilering og goodwill. Stiftelsen NORSAR ønsker å inngå samarbeid med geofaglige institusjoner og bedrifter der dette kan skape merverdi. NORSARs partnerskap i senter for fremragende forskning, International Centre for Geohazards (ICG) er et eksempel på dette, og medlemsskapet i interesseorganisasjonen Kunnskapsbyen Lillestrøm representerer også en form for allianse som forventes å gi positive ringvirkninger for stiftelsens framtidige virksomhet faglig, økonomisk og sosialt.

■ Styret vurderer totalt sett framtidsutsiktene som gode, og stiftelsen er i en god økonomisk stilling.

■ Joint ventures and strategic alliances are important for professional development, profiling and goodwill. The NORSAR Foundation intends to establish cooperation with research institutions and commercial companies working within geophysics for the purpose of mutual benefit. NORSAR's partnership in the International Centre for Geohazards (ICG) is an example of such cooperation, and NORSAR's membership in the organization Lillestrøm Centre of Expertise is another form of an alliance that is expected to provide positive spinoff for the future activities of the foundation, both from a professional, financial and social perspective.

■ The Board considers the future prospects of NORSAR to be promising, and notes that the foundation is in a good financial position.

Personnel and working environment

■ By the end of 2005, NORSAR had 47 employees, two of which were working at the field maintenance center at Hamar and three at the branch office in Bergen. A total of 43.7 man-years of work was conducted during 2005.

■ NORSAR is an equal opportunity employer. The foundation has established working conditions that provides equal opportunities for male and female employees with regard to recruiting, conditions of employment, and possibilities for professional development and advancement.

■ Total sick leave at NORSAR was 2.9% during 2005. Including sick leave due to children's sickness, the percentage was 3.5. No accidents or injuries have been recorded in connection with NORSAR's activities during the year.

■ The working environment at NORSAR is considered satisfactory. NORSAR encourages the improvement of this environment through an active dialog between employees and management, and through emphasis on HSE-work and quality assurance. NORSAR's activities do not contribute to environmental pollution.

■ NORSAR's future prospects depend on the efforts of each individual employee and their working together as a team. The Board of Directors thanks each individual for their contributions during the past year.

Personal og arbeidsmiljø

- Pr 31.12.2005 var det 47 ansatte ved NORSAR, hvorav 2 hadde arbeidsplass ved feltavdelingen på Hamar og 3 ved kontoret i Bergen. Det ble utført 43.7 årsverk ved bedriften i 2005.
- NORSAR har tilrettelagt arbeidsforholdene ved bedriften for arbeidstakere av begge kjønn og praktiserer kjønnsmessig likebehandling i saker som handler om rekruttering, ansettelsesbetingelser og utviklings- og avansementsmuligheter.
- Fravær ved ansattes egen sykdom var på 2.9%, og fravær inkludert barns sykdom på 3.5%. Det har ikke forekommet eller blitt rapportert arbeidsuhell eller ulykker knyttet til NORSARs virksomhet.
- Arbeidsmiljøet anses som godt, men søkes kontrollert og opprettholdt gjennom aktiv dialog mellom ledelse og personale, internt HMS arbeid, og et system for kvalitetssikring. NORSARs virksomhet forurenser ikke det ytre miljø.
- De ansatte er den viktigste ressurs for å virkeliggjøre målene i NORSARs virksomhetsplan. Bidrag fra alle medarbeidere er nødvendig for å lykkes med de faglige, økonomiske og sosiale ambisjonene vi har for vår arbeidsplass. Styret takker hver enkelt medarbeider for medvirkning til dette i 2005.

Kjeller, 3. mai 2006

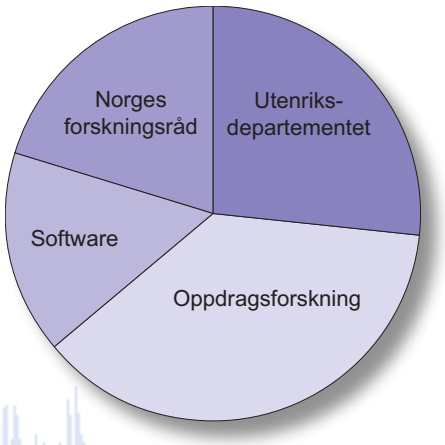
Hege M. Nordgård Bolås Styreleder	Bjørn Grandal Styremedlem	Annik M. Myhre Styremedlem
Tore Olsen Pran Styremedlem	Ketil Åstebøl Styremedlem	Anders Dahle Adm. direktør

Økonomi
Economy

Resultatregnskap 2005 / ***Profit and Loss 2005***

	2005	2004
Midler fra NFR *Grants from the Research Council of Norway*	9 920 343	11 005 838
Prosjektmidler fra UD *Funding by the Ministry of Foreign Affairs*	13 388 130	13 315 971
Andre salgs- og oppdragsinntekter *Other sales and project income*	25 928 446	22 133 850
Sum driftsinntekter *Total operating revenues*	49 236 919	46 455 659
Lønn og sosiale kostnader *Payroll and social costs*	30 738 439	27 849 327
Avskrivninger / *Depreciation*	1 408 294	1 381 137
Andre driftskostnader *Other operating expenses*	9 192 558	11 632 890
Administrative kostnader *Administrative expenses*	5 664 754	4 760 990
Sum driftskostnader *Total operating expenses*	47 004 045	45 624 344
Driftsresultat / *Operating result*	2 232 874	831 315
Netto finansposter *Net financial transactions*	464 619	-450 126
Resultat / *Result*	2 697 493	381 189
Ekstraordinær inntekt *Extraordinary income*	-	1 500 358
Årsresultat / *Annual net result*	2 697 493	1 881 547

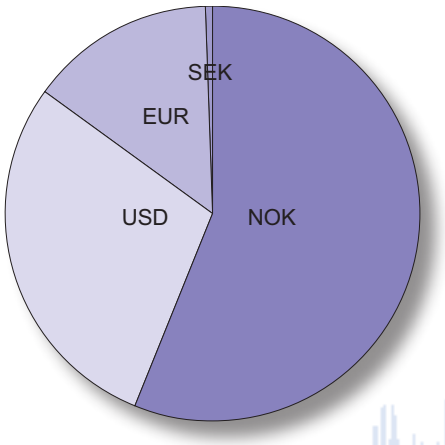
Inntektskilder
Sources of revenue
2005



Balanse 2005 / *Balance 2005*

	2005	2004
Eiendeler / *Assets*		
Anleggsmidler / *Fixed assets*	24 551 430	23 028 781
Oppdrag i arbeid / *Work in progress*	1 571 513	798 205
Debitorer / *Debitors*	8 564 598	7 755 833
Andre kortsiktige fordringer *Other short-term receivables*	346 652	442 697
Kasse, bank / *Cash, bank*	14 612 337	16 518 708
Sum eiendeler / *Total assets*	49 696 530	48 544 224
Egenkapital / *Equity*		
Grunnkapital / *Basic capital*	200 000	200 000
Overkursfond / *Share premium reserve*	843 000	843 000
Annen egenkapital / *Other equity*	28 351 525	25 654 032
Avsetning vedr. feltanlegg *Allocation field installations*	1 500 358	1 500 358
Sum egenkapital / *Total equity*	30 894 883	28 197 390
Gjeld / *Liabilities*		
Langsiktig gjeld / *Long-term debt*	1 592 173	3 052 300
Leverandørgjeld / *Suppliers*	3 951 185	2 680 481
Skyldige avgifter og skattetrekk *Tax withholding reserves*	2 084 497	1 517 083
Skyldig lønn og feriepenger *Payable salary and holiday pay*	3 638 152	2 759 530
Annen kortsiktig gjeld *Other short-term liabilities*	7 535 640	10 337 440
Sum gjeld / *Total liabilities*	18 801 647	20 346 834
Sum egenkapital og gjeld *Total equity and liabilities*	49 696 530	48 544 224

Inntekter – Valuta
Revenue – Currencies
2005



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Foredrag og Posters
Lectures and Posters

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- Lecomte, I. (2005): Resolution, illumination and angle-dependent effects in seismic imaging, SVALEX 2005 field course, Svalbard Archipelago, August.

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- Schweitzer, J. (2005): The 7 April 2004 Flisa earthquake – A GT1 event in Southern Norway. 65. Jahrestagung der Deutschen Geophysikalischen Gesellschaft, Graz, 21–25 February.

- Schweitzer, J. (2005): The Birth of Modern Seismology in the 19th and 20th Centuries. INHIGEO Symposium on History of Geophysics, Prague, 2-12 July (invited talk).

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NORSAR er involvert i mikroseismisk monitorering av den instabile fjellsiden ved Åknes i Storfjorden, Møre og Romsdal.

NORSAR is involved in microseismic monitoring of the unstable mountain slope near Åknes, Storfjorden in western Norway.

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