

# ANNUAL REPORT 2009



*FRANSK-NORSK STIFTELSE (FNS)  
FOR VITENSKAPELIG OG TEKNISK FORSKNING OG  
INDUSTRIELL UTVIKLING*

*FONDATION FRANCO-NORVÉGIENNE (FFN)  
POUR LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE,  
ET LE DEVELOPPEMENT INDUSTRIEL*

# ANNUAL REPORT 2009

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## ANNUAL REPORT 2009

### THE BOARD OF THE FOUNDATION

The Board of Directors of the Foundation consists of twelve voting members. The two governments appoint four members each and the Foundation's General Assembly appoints four members, two from each country. The Board elects its Chairman for a period of 3 years. Chairmanship alternate between France and Norway every third year. In 2009 the Board of Directors had the following composition:

France:

Olivier Appert, President and C.E.O  
IFP  
Chairman

Elisabeth Legrand \*  
Ministère de l'Éducation Nationale de  
l'Enseignement Supérieur et de la Recherche

Elisabeth Barsacq\*  
Ministère des Affaires Étrangères et Européennes

Ludovic Zekian\*, Ministère de l'Économie,  
des Finances et de l'Industrie

Marie Marguerite Bourbigot  
Pôle Mer Bretagne

Nathalie Delorme  
Directeur des Relations Internationales,  
OSEO Innovation

Nakita Vodjdani  
Agence Nationale de la Recherche

Claire Tutenuit  
Déléguée Générale, Entreprises pour  
l'Environnement

Norway:

Ståle Selmer-Olsen  
Det Norske Veritas  
Vice-chairman

Sidsel Aarnæs Arbo  
Nærings- og handelsdepartementet

Marit Aursand  
SINTEF Fiskeri og havbruk

Egil Eike  
Norges forskningsråd

Henning Reier-Nilsen  
HNR Invest

Kristin Vinje  
Simula School of Research and Innovation

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\* The members representing the three French Ministries have one vote only.

The Board of FFN/FNS held two meetings in 2009, 14 May at Kjeller and 27 November in Pau.

Ståle Selmer-Olsen and Sidsel Arbo Aarnes left the Board at the end of 2009 after serving six years on the Board. They have been replaced by Jan-Erik Strand and Kari Rossum. Kristin Vinje left the Board at the end of 2009 after serving on the Board for nearly three years. She was replaced by Sigrid Fossheim. The Board thanks Ståle Selmer-Olsen, Sidsel Arbo Aarnes and Kristin Vinje for their contribution to the work on the Board and for their efforts on behalf of the Foundation.

## **MEMBERS OF THE FOUNDATION**

At the end of 2009 the Foundation had 31 members in Norway and **18 members in France**.

## **THE SECRETARIAT OF THE FOUNDATION**

The secretariat of FNS/FFN is located at the Research Council of Norway in Oslo and at Institut Français du Pétrole (IFP) in Rueil Malmaison.

In Oslo the head of the secretariat was Else Boon until December 1, 2009. After having been secretary leader for 15 years, she left the Foundation on December 1, 2009, and was replaced by Randi Aarekol Basmadjian.

In Rueil Malmaison the head of the secretariat is Gérard Momplot assisted by Daniel Decroocq.

Associated secretariats:

Odd Mølster, Norwegian Embassy in Paris

Jean-Louis Duclos, French Embassy in Oslo

## **GOAL AND ROLE OF THE FOUNDATION**

### **Goal**

- Promoting long-term French/Norwegian co-operation through joint R&D projects.

### **Main objectives**

- Support joint R & D projects where French and Norwegian industrial firms are main partners
- R & D projects have to lead to processes and products with industrial applications
- Connect French and Norwegian industry partners
- Organize workshops and seminars
- Promote cooperation between French and Norwegian researchers and industrialists

### **Research priorities**

- aquaculture and food industry
- biotechnology and biomedical industry
- informatics and information technology
- environmental technologies and energy
- marine science and technology
- material science and technology
- oil and gas exploration and production

## **Requirements for proposal and project funding**

The French-Norwegian Foundation promotes long-lasting French/Norwegian cooperation through the financing of joint R&D projects in which both industry and research institutes/universities are involved with the aim of creating cooperation lasting beyond the project-period.

- At least one French and one Norwegian industrial company should be partner. Preference is given to small and medium enterprises (as defined by the EU standards). A subsidiary of a foreign company having only manufacturing or commercial activities in France does not qualify for support on the French side.
- Applicants (at least one on each side) are required to be members of FFN/FNS. The applicants can become members at the time of submitting the proposal.
- The proposals shall demonstrate that the project is of interest for all participants in the project and contribute to the goals of FFN/FNS, including enhancing French-Norwegian industry cooperation.
- The scientific, technical, industrial and economic aspects of the project shall be clearly identified and the planned R & D activities shall identify the technological solutions having potential for industrial applications and marketing. The proposal (application form and project description) shall include a business plan dealing with the exploitation of the results.
- The proposal shall give a short description including the type of organisation for each partner.
- When large enterprises and research organisations are partners, exchange of research scientists, either post-doctoral fellows or graduate students, should be considered. If possible, the project shall also provide for such educational exchange.
- The maximum level of funding from the Norwegian and French public institutions or programs (including FFN/FNS) cannot exceed 50% of the projects costs.
- Project support can be obtained for a maximum of 3 years. FFN/FNS usually approves the project for one year, stating an intention of funding the subsequent year(s), subject to FFN/FNS having enough funds and the project reaching the milestones agreed to upon signature of the contract.
- "High risk" projects and projects with long term horizon qualify for funding. FFN/FNS funding is usually limited to the first phase of such long-term research.
- A consortium agreement governing the relationship between the project participants must be drawn up and signed before the parties enter into a contract with the Foundation. This agreement shall state that the parties agree on the ownership and sharing of any rights and products resulting from the project. The intention of this principle is to ensure that the collaborative parties have clarified all questions and issues related to implementation of the results of the project. The agreement should also cover the relationship to researchers participating in or working for the project.
- The Foundation also supports pilot studies and feasibility studies, including finding new and suitable partners, establishing agreements and working out joint R&D program and pilot studies for future EU or EUREKA programs.

- The Foundation can also support workshops and seminars contributing to the main objectives of the Foundation.
- An annual report must be submitted. A final report including three slides with results achieved must be submitted within three months after the project is finished.

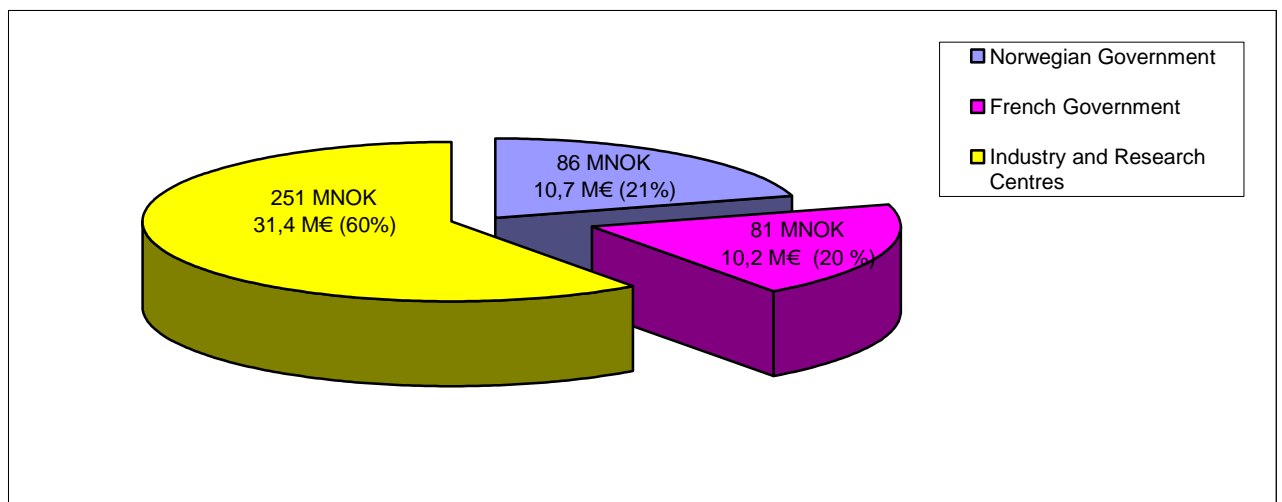
## Funding

In Norway the projects are financed as a grant by the Foundation. In France funding is provided from other sources such as the Ministries (Research and Industry), Agencies (The French Agency of Research/ANR, OSEO-Innovation) and programmes or networks entitled to back R&D activities.

## REVIEW OF THE FUNDING OF THE FOUNDATION

Since its establishment in 1983, the Foundation has been an important tool for the development of bilateral co-operation for scientific and technical research and industrial development between France and Norway. Until 1988 the Foundation mainly served as a catalyst for the technical co-operation between the two countries. After the Troll agreement was signed in 1986, the two parties agreed to use the Foundation to actively promote and co-ordinate bilateral research and development projects. Each country agreed to support the Foundation with up to 50 MNOK over a period of 10 years (1989-1999). A substantial industry involvement of at least 50 percent financing was set as a requirement. The intention of funding FFN/FNS over a 10-year period with a total of 100 MNOK on a 50/50 basis has been fulfilled and the industry has in fact covered 60 percent of the total costs. Since 1989 more than 100 projects and more than 30 workshops/seminars have been supported throughout the years. As shown in the figure below, the total R&D budget (1989-2009) is 418 MNOK of which the industry has covered 60 percent while the Norwegian and French governments have granted the remaining 40 percent.

### *Government and industry support 1988 – 2009*



In 2009 the Foundation has been very active in promoting cooperation between France and Norway. There has been a special focus on cooperation between the French competitive poles and the Norwegian Centres of Excellence, Research Based Innovation and Expertise. There has been an increased interest for both seminar support and project funding in 2009. This has led to a financial problem for the Norwegian part of the Foundation as the resources accumulated over the years are decreasing and the support received from the Ministry remain the same.

## **R&D PROJECT ACTIVITIES IN 2009**

A total of 12 projects received funding in 2009 (Appendix 1); one is within aquaculture, one project is within biomedicine, one within energy and environment, one within information technology, two within civil engineering, five within material sciences and technology and one within marine technology. Five of the twelve ongoing projects are approved by EUREKA/Eurogia.

A total of 13 new project proposals were put forward to the Board for evaluation in 2009. Six were approved for funding. Only one of the approved projects started in 2009. Two will start in 2010 and three are still waiting for French funding.

The following six projects were approved for funding:

- Sonowand / Vermon  
Development and industrialization of ultrasound probes for sterile processing  
Started in June 2009
- Terra Orbit / Armines  
Geostatistical modelling of oceanographic data and climatology compilation  
Starting in 2010 provided French funding
- University of Bergen / Ifremer  
Molecular markers to estimate algal diets for molluscs  
Starting in 2010
- Norsk Elektro Optikk / Alcatel Thales  
Compact photo-acoustic mid-infrared spectroscopy sensor for extended range of chemical agents  
Starting in 2010 provided French funding
- Impetus Afea / Sarl Impetus  
NextGenFSI: Next generation numerical code for fluid-structure interaction  
Starting in 2010
- SINTEF ICT / Tronics  
Monitoring of physiological pressure by implantable MEMS-MOPP-MEMS  
Starting in 2010 provided French funding

In addition to the above mentioned projects, seminar support and support for networking was given to the following events:

- French-Norwegian Seminar on Capture, Transport and Storage of CO<sub>2</sub>, LeHavre  
NTNU / Ecole des Mines

- French-Norwegian Workshop on Modelling and testing of degradation and damage mechanisms in materials technology for deep geothermal energy, Trondheim, SINTEF Materialer og kjemi
- French-Norwegian seminar on Marine Renewable Energy, Oslo
- Maison Norvège
- Pôle Mer Bretagne, Networkbuilding
- SINTEF Fisheries and Aquaculture / INRA, Networkbuilding
- Oslo Cancer Cluster, European Cancer Cluster Partnering

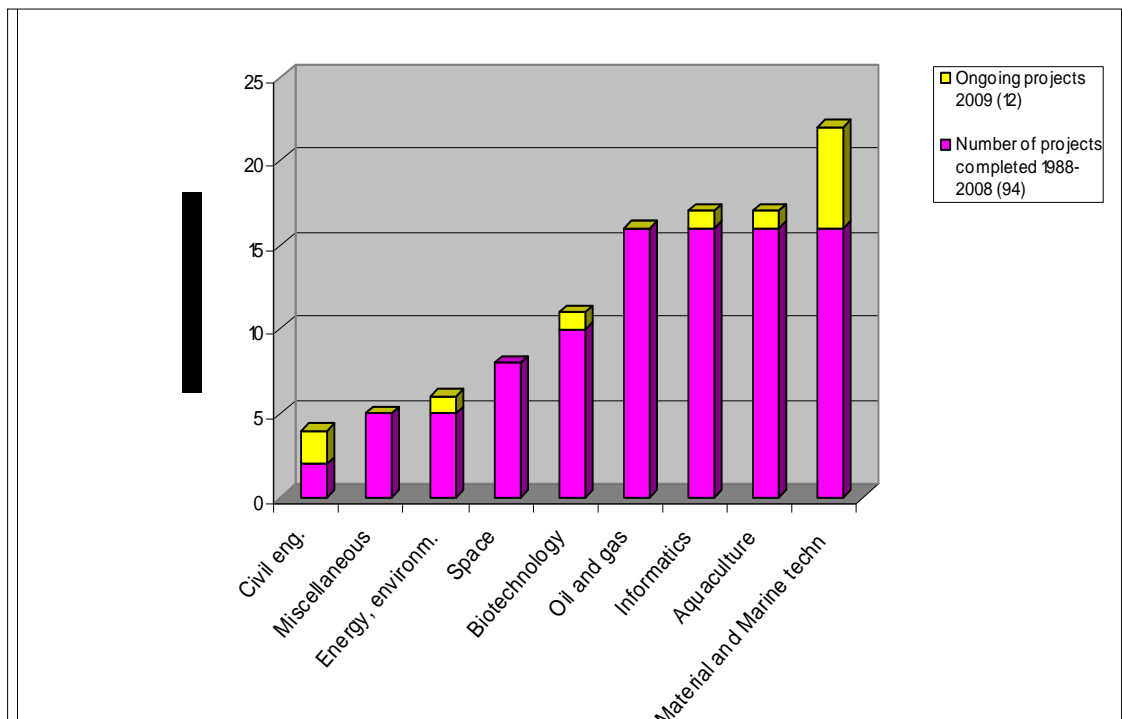
## PROJECT FUNDING 1988 – 2009

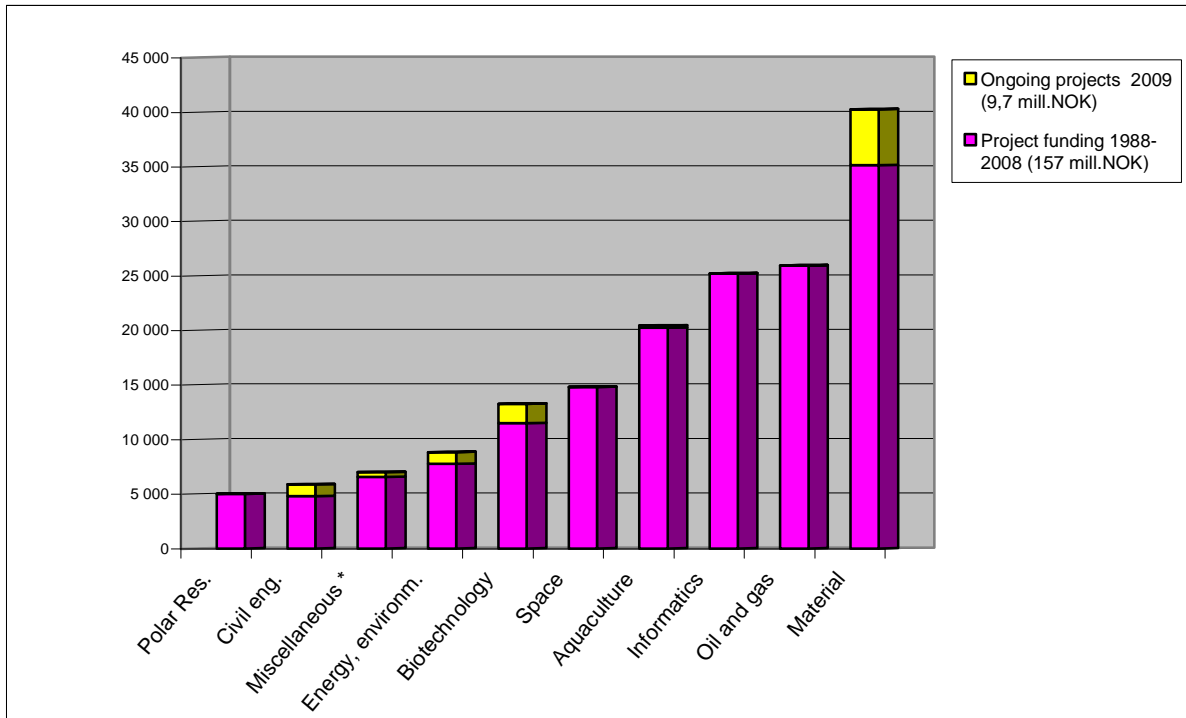
Up to mid-nineties oil, gas and offshore technology dominated the areas of activity. This has changed since and the fields of material sciences and technology, information technology and aquaculture have been dominant from 1999. Over the period 1988 – 2009 the number of projects within material science and technology have prevailed oil/gas. In 2009 material science and technology are still dominant. (Appendix 1).

Number and funding of completed and ongoing projects according to fields of activity are shown in the two figures below.

### *Number of projects financed 1989 – 2009 according to areas of activity*

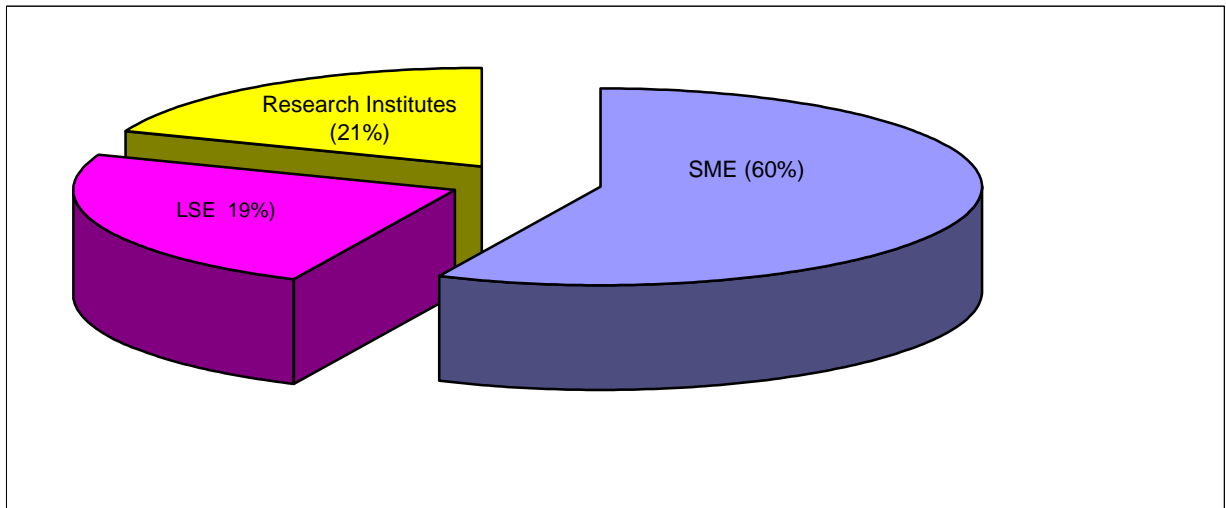
### *Project funding (including workshops) 1989 - 2009 according to areas of activity in 1000 NOK*





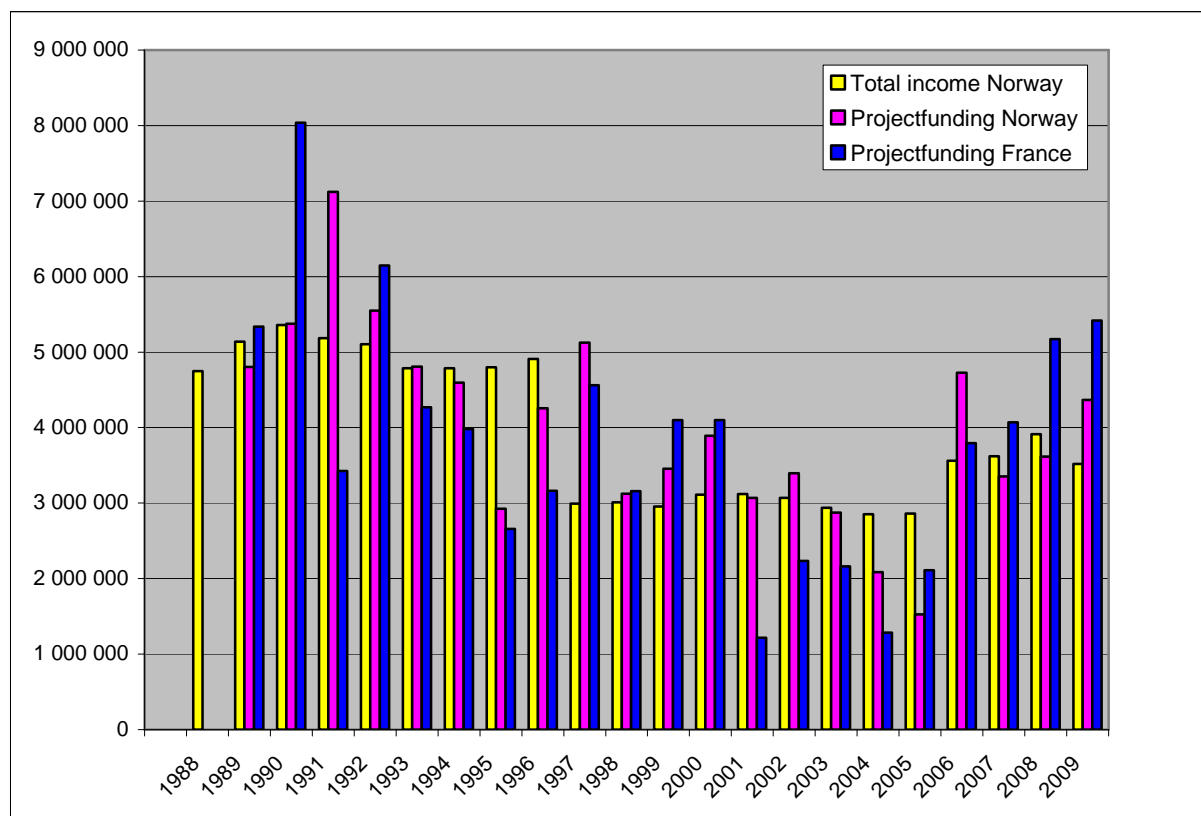
Of the total of 106 projects more than half (60%) have been awarded to Small and Medium-sized Enterprises (SMEs), 21% to Research institutes and 19% to Large Scale Enterprises (LSEs). Research institutes and Universities are required to have an industry partner. Both LSE and Research institutes are strongly encouraged to include doctoral students in the projects and over the years more than 50 doctoral theses have been performed through FFN/FNS projects.

***Types of enterprises according to contract partner receiving FFN/FNS funding 1989 - 2009:***



### *Project funding – income and expenditure*

This figure shows the income and project allocations from 1988 to 2009. In Norway, the Ministry of Trade and Industry (through the Research Council of Norway) allocate an annual amount. The total income includes Eureka support and member fees. In France the income and project funding is the same amount as there is no allocation from the Ministries to the French part of the Foundation. Seminar funding is not included.



The allocation from the Norwegian Ministry of Trade and Industry started in 1988 but project funding started in 1989.

### **SEMINAR ACTIVITIES IN 2009**

Three seminars were approved and partly funded in 2009. One was organized in 2009 and two will take place in 2010.

Seminar main objectives:

- Bring together French and Norwegian key actors in neuroscience and cancer,
- Stimulate private-public and research-industry collaborations,
- Initiate cooperation projects in the R&D sectors, including demonstration projects

Appendix 4 gives a list of the 33 seminars funded by the Foundation since 1984.

## **OTHER RESEARCH ACTIVITIES IN 2009**

The Foundation together with the Research Council of Norway has had discussions with the French Agency for National Research on how to proceed on a common call for proposals. A Memorandum of Understanding (MoU) was signed in April 2008. A common call for proposals are still under discussion.

The Foundation together with the respective Embassies in France and Norway have been active in informing the various French clusters and Norwegian centres of research about activities going on in the two countries. Meetings have been arranged with interested parties and on the Norwegian side funding has been offered in order to arrange seminars and/or meetings for discussions. The work will continue in 2010.

Promotion of the Foundation will continue both on the website and in the press.

The Foundation is in close cooperation with EUREKA. For all EUREKA-approved FNS-projects, the Foundation has from 2006 automatically received additional funding by the Norwegian EUREKA-office (30% of the FNS-contribution). From 2010 this additional funding scheme is unfortunately no longer available.

## **FFN/FNS SUPPORT FOR EXCHANGE OF SCIENTISTS THROUGH THE ACADEMIES OF SCIENCES AND THE ÅSGARD PROGRAMME**

Appendix 5 provides a summary of all the scientist exchanges funded by FFN/FNS. The National Academies of Sciences select the candidates to be supported. In the agreement from 1989 it was expected that one to two exchanges per year would be realistic. Exchange activity in certain years has been somewhat higher than the expected level and from 1997 somewhat lower than expected. From 1990 to 2003 a total of 12 French scientists and 10 Norwegian scientist have been financed within the agreement. Unfortunately there has been no exchange since 2003 between the Academies.

In 2006 the Scientific mission of the French Embassy in Norway and the Foundation launched an invitation programme for the visit of French researchers to Norway, named the Åsgard programme. The programme is open to all researchers, with emphasis on those 35 to 45 years old, whose scientific work is internationally recognised and who have just been, or will be, appointed group leaders in their home institutions.

French scientists are invited for a one-week visit to Norway within the framework of the programme. The goal is to create links between French and Norwegian researchers and research institutions in order to exchange scientific knowledge and skills that will lead to effective collaborations. From 2007 Norwegian scientists were included in the programme but none Norwegian scientists applied in 2009. (Appendix 5).

## **FFN/FNS' BASIC CAPITAL**

**In 2009 the total income including interest and bank costs was 9,7 MNOK, while the total expenditures ended up with 10,4 MNOK.**

## **FFN/FNS ON THE INTERNET**

<http://www.ffn-fns.fr>

<http://www.forskningsradet.no/fns>

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### Appendix:

1. FFN/FNS ongoing projects by field of activity in 2009
2. Results of ongoing projects completed in 2009
3. Projects completed: 1988 – 2009
4. Workshops and seminars: 1984 – 2009
5. Exchanges of scientists 1990 - 2009
6. Account report 2009

The Board approves the annual report for 2009.  
May 25, 2010, Svolvær, Lofoten, Norway

Olivier Appert (s)  
Chairman

Jan Erik Strand (s)  
Vice Chairman

Elisabeth Barsacq (s)  
Board member

Kari Rossum (s)  
Board member

Marie Marguerite Bourbigot (s)  
Board member

Marit Aursand (s)  
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Nathalie Delorme (s)  
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Ludovic Zekian (s)  
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Claire Tutenuit (s)  
Board member

Nakita Vodjdani (s)  
Board member

G rard Momplot (s)  
Secretariat leader

Randi Aarekol Basmadjian (s)  
Secretariat leader

## FFN/FNS ONGOING PROJECTS BY FIELD OF ACTIVITY IN 2009

### AQUACULTURE

*Blue mussel bio-energetics in aquaculture as modelled with DEB (Dynamic Energy Budget) theory*

IMR (Havforskningsinstituttet) (Øyvind Strand)

IFREMER (Marianne Alumno-Bruscia)

Duration: December 2008 – April 2010 (18 months)

### BIOMEDICINE

*Novel sonosensitive liposomes and systems for targeted ultrasound mediated drug delivery*

Epitarget Therapeutica (former CancerCure AS) (Sigrid Fossheim)

EDAP-TMS SA (Emmanuel Blanc)

Duration: 2 years 2007 – 2010 (Σ!4056)

### CIVIL ENGINEERING

*Geosynthetics for innovative sustainable solutions in Arctic climate*

Store Norske Spitsbergen Grubekompan / SINTEF (Arnstein Watn)

TenCate Geosynthetics France (Philippe Delmas)

Duration: 3 years 2006 – 2009 (Σ! 3702)

*TMS (TEMASI) System*

Saint-Gobain Byggevarer as (former Maxit) (Oddvar Hyrve)

MDB Texinov (Jacques Tankere)

Duration: 3 years .1.1.2009 – 31.12.2011 (Σ! 4572)

### ENERGY AND ENVIRONMENT

*Industrialisation of the Watercatox process for waste water treatment and liquid oxidation*

Due miljøl (Eddy Torp and Partow Henriksen)

Tredi (Sylvain Durecu)

Duration: 1.1.2008 – 2009/2010

### INFORMATION TECHNOLOGY

*STERIPROBE – Development and industrialization of ultrasound probes for sterile processing*

Sonowand AS (Atle Kleven)

Vermont S.A. (Philippe Auclair)

Duration: 2 years 1.7.2009 – 30.6.2011 (Σ! 4980)

### MATERIAL SCIENCE AND TECHNOLOGY

*Intercepting HISC by ultrasonic residual stress measurements*

Det Norske Veritas (Majid Anvari)

Ultra RS (Siamack Atiabi)

Duration: 1 year - 2006/07 (Finish in September 2009)

*Conception, development and testing of new aluminium casting alloys for elevated temperature applications in automobile engines*

Hydro Aluminium (Petter Åsholt)

Montupet (Bruno Barlas)

Duration: 3 years 1.7.2006 – 30.6.2009 (Σ! 3698)

*Isotope separation of silicon for use in the photovoltaic industry*

Isocilicon AS (Dag Øistein Eriksen)

Novasep Process SAS (Pierre Hilaireau)

Duration: 3 years, 1.6.2008 – 31.5.2011

*Evaluation of Ready To Use crucibles for the crystallization of multi crystallised silicon ingot*

NTNU, Material Science (Lars Arneberg)

Vesuvius France (Christian Martin)

Duration: 1 year 2008/09

*Spark plasma sintering of ceramic proton conductors for solid oxide fuel cells*

SINTEF Materialer og Kjemi ( Marie-Laure Fontaine)

CIRIMAT, PNF2, EDF (Calude Estournes)

Duration : 3 years, Dec.2009 – Dec. 2012

## **MARINE TECHNOLOGY**

*New Solution for Deck Installation and Decommissioning : Deck Structure Installation Vessel*

Det Norske Veritas AS (Siamack Atiabi)

Technip (Pierre Armand Thomas)

Duration: 1 year 2009 / 2010-

Eurogia EOG-0604

## RESULTS FROM PROJECTS COMPLETED IN 2009

**Store Norske Spitsbergen Grubekompan / SINTEF (Arnstein Watn)  
TenCate Geosynthetics France (Philippe Delmas)**

FNS Norway:: NOK 2 160 000  
FFN France: Euro 95 262

Industry/other sources: NOK 2 818 000  
Industry/other sources: Euro 137 284

Duration: 3 years, 2006 – 2009 (Σ! 3702)

***Geosynthetics for innovative sustainable solutions in Arctic climate***

The GISSAC-project was initiated as an answer as to how one can build environmental friendly soil structures in the Arctic by using locally available geological materials and geosynthetics.

TenCate Geosynthetics France has been pioneering developments in geosynthetic materials for 30 years. Bags made of the materials specially designed by the company for Arctic regions were used in the project in Svalbard. SINTEF provided expertise throughout the whole project and participated in the testing of the bags that took place in Svea on the site operated by Store Norske Spitsbergen Grubekompani (SNSK). Much of the field work was carried out by PhD-student Fabrice Caline from the University Centre in Svalbard (UNIS)/Norwegian University of Science and Technology (NTNU).

The project received funding from the European innovation network EUREKA and the French-Norwegian Foundation.

A significant amount of experience has been gathered.

As the project included purchasing a geotechnical borerig to serve the research partners at Svalbard, experience has been made on how soil investigations can be performed under Arctic conditions. We now have the possibility to take soil samples and to use the geotechnical tests performed on such samples to better design embankments (need no longer be so conservative in design, and therefore more economical) and to find suitable fill material for geotextile bags, as for grain size characteristics.

Experience has been gathered as to how to sew, fill and close the bags and suggestions as to how this procedure can be improved have made. The study also includes important experience as to how place the bags in a rational manner and to design structures that can sustain heavy ice and wave action. We have gathered experience on how any destroyed bags can be replaced. There are now several test sites in Svea applying the technique of geotextile bags and locally available fill.

The geotextiles used in the bags have undergone an intensive test programme and a lot of experience has been gathered on how the geotextile behaviour is influenced by the ice action and also by the UV-radiation (geotextiles placed on frames exposed to UV-radiation over a two year period).

The test site has also been heavily instrumented. The topographic location of each bag is measured, and also confirmed by video. Temperature measuring instrument has been installed under and inside the bags. One Geodetect strip has been placed under the bags in order to measure

deformations. The monitoring sea ice thickness and extension, crack formation, tidal movement and stresses in the embankment area have increased the knowledge about the how the sea ice affects the bags throughout the season.

Overall, the test structure has worked very well. The degradation of the geotextiles has been low and the structure fullfills its requirements three years after it was built. Other, and similar structures has been built in Svea after seeing how well our initial test structure works, in stead of choosing conventional approaches with erosion control structures built by rocks imported from the mainland. This is promising for the technique, both in a technical and economical perspective.

**Det Norske Veritas (Majid Anvari)  
Ultra RS (Siamack Atiabi)**

FNS Norway: NOK 500 000  
FFN France: Euro 55 000

Industry/other sources: NOK 500 000  
Industry/other sources: Euro 70 000

Duration: 1 year - 2006/07 (delaid and finished first in 2009)

***Intercepting HISC by ultrasonic residual stress measurements***

As it had been planned, Neutron Diffraction technique was used to measure residual stresses in the pipe and compare them with ultrasonic measurements. The Neutron Diffraction measurements were performed at GKSS Research Center in Geesthacht, Germany. The investigated sample was a steel tube with a length of 510 mm, an outer diameter of 110 mm, and 12 mm wall thickness made of duplex steel UNS 32750 (1.4410; X2 CrNiMoN 25.7.4).

There was a weld in the middle of the tube joining two shorter tubes. The weld width was given as 20 mm. The scan line was required to be at the position marked with '90°' on the tube To check the symmetry, also the points with the same distances from the weld line in negative direction were measured

The older measurements performed by UltraRS showed unsymmetrical profile around the weld which were not acceptable. Therefore, DNV requested Ultra RS to do the measurements one more time. For this US measurement, Ultra RS proceeded differently in order to make the measurement with the same manner in both sides of the weld. The following procedure was adopted: On both left and right side of the weld, the 2 receptors were oriented toward the cord and they stopped the measure in the center of the cord. -50 mm to 0 mm and +50 mm to 0 mm. The wave propagation is the same on both sides. The new procedure was different from the previous one where the measurement was done with the displacement of the 2 receptors in the same direction from +50 to -50 mm.

General conclusions:

- The New US measurement gives different profile in the left side than the previous US measurement. This difference is due to the difference in the measurement configuration. Approaching the weld, the new configuration permits to the emitted wave to propagate in homogeneous medium (Base metal) since the transmitter is at about 15mm from the receptors. However, in the old configuration, concerning the measurement when we go past the weld (left side of the profile), the emitted wave is propagated in different media (Base metal , HAZ and weld metal), and this leads to different measurements in comparison to situation where the transducer is oriented differently to measure at the same point (new configuration case). The further the transducer is from the weld, the two curves old and new come closer.

- Recent microstructural studies and E modulus measurements shows that the dependence of wave speed on different direction in duplex is more influenced by E modulus values rather than grain orientation and number of passing boundaries. The wave speed values in simulated HAZ are not well explainable and need further investigation.
- To make good measurement, it is recommended to adopt the new measurement configuration in order to avoid the wave perturbation.
- The correlation between the US and Neutron Diffraction as reference is satisfactory. Quantitatively, the profiles seem to be consistent.

**Hydro Aluminium (Petter Åsholt)**  
**Montupet (Bruno Barlas)**

FNS Norway:: NOK 1 620 000

Industry/other sources: NOK 2 801 805

FFN France: Euro 470 352

Industry/other sources: Euro 605 679

Duration: 3 years 1.7.2006 – 30.6.2009 (Σ! 3698)

***Conception, development and testing of new aluminium casting alloys for elevated temperature applications in automobile engines***

The following activities and results have been achieved in the project during the different years:

The project was started later than planned in 2006, i.e. only four months were available for work. During this period the following was achieved:

- Literature survey in order to establish state-of-the-art for the industry and possibly new alloying elements to be explored in the frame of the project.
- Patent review.
- Casting and characterisation of first experimental alloys (Alloy family I).
- Definition of experimental matrix for alloys to be cast and tested in 2007 (Alloy family II).
- Evaluation and adaption of available thermo-mechanical testing equipment available in Hydro Aluminium (Gleeble).
- Use of thermo-dynamic simulation tools to identify possible alloying elements for improved elevated temperature properties (FactSage, Thermocalc)

Starting from the base of the work of 2006, the following was obtained in 2007:

- Casting of the entire matrix of experimental alloys (A356 + combinations of 5 different dispersoid forming elements) defined in 2006 (Alloy family II)
- Heat treatments to obtain precipitation of dispersoids able to give increased elevated temperature fatigue durability for the alloys
- Characterisation of microstructures in as cast and heat treated samples with advanced characterisation tools, optical microscope, SEM, TEM etc.
- Differential scanning calorimetry, hardness testing
- Further development of thermo-mechanical fatigue test in Gleeble equipment (thermal fatigue).
- Definition of new matrix of experimental alloys based on the Al-Cu binary system (Alloy family III)
- Casting and heat treatment of new experimental alloys (family III).
- Testing of selected alloys from alloy families II and III in thermo-mechanical fatigue test

The main activities in 2008 and 2009 are described below:

- Heat treatment optimisation of new experimental alloys (family II and III). Optimisation of time and temperatures necessary to obtain maximum utilization of the property improvement potential of the chemical elements added for dispersoid formation.
- Characterisation of microstructures for heat treated samples by use of SEM, TEM, EPMA, as well as hardness and electrical conductivity measurements. Results from this characterisation guided the optimisation of alloy chemistry and heat treatment optimisation.
- Elevated temperature tensile testing, fatigue testing and creep testing of experimental alloys.
- Further development of method and testing with the thermo-mechanical fatigue test equipment (Gleeble). Focus in 2008 was to establish a stress controlled test and to explore the effect of holding time on elevated temperature in each cycle. Focus in 2009 was to establish a test with reduced constraint in order to obtain thermally induced strain values more realistic in cylinder head applications.
- Production of A356 type alloy with different Fe contents and subsequent thermo-mechanical fatigue testing.
- Production of samples for more extensive testing of mechanical properties of selected family II (AlSi) and family III (AlCu) alloys, this time with melt filtration in the die.
- Creep testing of the selected alloys has proven that there are promising alloy candidates in both alloy families having superior creep properties compared with reference alloys
- By the end of 2009, work was also initiated to prepare a patent application for an alloy resulting from the alloy development work.
- During 2008, the French Ph.D. student and the Norwegian Post doc. were stationed in each others universities, i.e. Ph.D student Nadia Cherdoudi worked at NTNU in April/May while Post doc. Zhihong Jia worked at CECM in October/November.

At the current time it can be summarized that the project has identified potential alloy candidates for the intended engine applications. The alloys have so far only been tested in lab scale tests. Full scale testing has not been possible within the time frame of the project. However, Montupet and Hydro have agreed on activities to pursue the opportunities after the formal closure of the project. Work will therefore continue also in 2010. A postponement of final reporting has therefore been agreed with the foundation (FNS).

**NTNU, Material Science (Lars Arneberg)**  
**Vesuvius France (Christian Martin)**

FNS Norway:: NOK 425 000	Industry/other sources: NOK 500 000
FFN France: Euro 147 383	Industry/other sources: Euro 65 785

Duration: 1 year 2008/09

***Evaluation of Ready To Use crucibles for the crystallization of multi crystallised silicon ingot***

Multi crystalline silicon is today solidified in silica crucible coated with a lining of pure silicon nitride powder. This lining is critical and source of a productivity lost due to its brittleness and process difficulty.

Purpose of this work was to evaluate and optimize on pilot scale a Ready To Use crucible (RTU) for this application. This fused silica crucible is already lined with a silicon nitride based coating and should exhibit optimal performance in term of releasing properties, reliability, durability, and ingot quality.

The most advanced coating version of RTU crucible was evaluated with two types of silicon feedstock (Virgin poly and UMG Elkem Solar product) and compared to the existing coating technology ( called reference).

The RTU solution was proved to exhibit much higher mechanical strength and hardness than reference. During the project seven ingots were casted in the NTNU – SINTEF furnace. Each of them were characterized in term of resistivity , lifetime ( Quasi steady State Photo-conductance), oxygen content ( Fourier transformed Infra red Spectroscopy).

The ingot made with RTU crucibles demonstrated, for both feedstock, less sticking, lower oxygen content, higher life time, than reference ingots. RTU and reference ingots were processed into cells by INES (France). The cells from RTU ingots exhibits high efficiency (close to 16.5%) slightly better than reference Ingot (average 16%). This could be explained by less contamination of the RTU ingot due to less sticking to the crucible.

Effect of coating impurities was investigated by evaluating the properties of an ingot obtained from a crucible lined with a coating containing 10 times more iron and Aluminium. Decreased lifetime related to impurities segregation was observed.

This project has permitted the qualification on pilot scale of a more resistant and more reliable coating for the PV ingot grower. It also contributes to the better understanding of the effect of the coating on PV properties. This ready to use crucible should help, in the future, to lower solar energy cost and achieve quicker grid parity.

## FFN/FNS PROJECTS COMPLETED: 1988 – 2009

### AQUACULTURE, AGRICULTURE AND FOOD INDUSTRY

- Developing system Biofish – Sea Bass, Sea Bream in Mediterranean (Project A and B)  
Oppdrett Service AS, Norway (Geirulv)  
Scorsa, France (van Obbergen and Guy Lebrun)  
Duration 1989 - 1991
- Study of Inter-relations Carotenoides-Vitamines A at salmon  
Akvaforsk, Sunndalsøra, Norway (Storebakken)  
INRA, Ascain, France (Coubert)  
Duration 1989 - 1990
- Air transportation – Norwegian Aquaculture – by ATR 72  
Air West A/S, Norway (Wågsæther)  
Avions de Transport Régional (ATR), France (Valerio)  
Duration 1990 - 1991
- Turbot grower feed. Protein requirement Feed production technology  
Norsk Bioakva A/S, Norway (Einar Wathne)  
UCAAB, France (Antoine Bon)  
Duration 1994 - 1997
- Scallop production – plan for co-operation  
Centre for Studies of Environment and Resources, UiB, Norway (Thorolf Magnesen)  
IFREMER-Brest-Drv, France (Jean-Claude Dao)  
Duration 1994 - 1997
- Control and management of quality with nutrition and feeding regime  
Domstein Salmon AS, Norway (Ola Sveen)  
Labeyrie SA, France (Laurent de Baynast)  
Duration 1995 - 1997
- Biactive compounds in fish and shellfish waste  
Institute for Fisheries and Aquaculture, Norway (Asbjørn Gildberg)  
Collège de France, Marine Biology Laboratory, France (Yves Le Gal)  
Duration 1995 - 1997
- Cellular immune system in salmoned fish  
University of Bergen, Fisheries and Marine Biology, Bergen, Norway (Curt Endresen)  
Université Pierre et Marie Curie, CNRS and INRA, Paris, France (Jacques Charlemagne)  
Duration 1996 - 1998
- Oral use of Propionibacterium acnes to improve health and growth in fish  
Nutreco ARC, Norway, (Alex Obach)  
Vétoquinol S.A., France (A. Rigoulot)  
Duration 1998 - 1999

- Alternative to antibiotic treatments in marine aquaculture. Application to bivalve larvae  
Centre for studies of environment and resources, UiB / Scalpro AS, Norway (T. Magnesen)  
UBO-IEUM-UMR CNRS, France (Christine Paillard)  
Duration 1999 - 2000
- New quality assessment methods for the Norwegian salmon industry  
SINTEF Fiskeri og havbruk and Norway Royal Salmon, Trondheim, Norway (Marit Aursand)  
Eurofins Laboratories and Laiem, Nantes, France (Michèle Lees)  
Duration: 1998-2001
- Substitution of fish meal by plant protein in diet of Atlantic Salmon and Rainbow Trout  
EWOS Innovation AS (NorAqua Innovation AS), Dirdal, Norway (Jan Vidar Jakobsen)  
UNCAA DPA UCAAB, Chateau-Thierry, France (Christine Azam)  
Duration: 1999 – 2002
- High-energy diets in aquaculture: Effects on salmonid quality  
Nutreco ARC AS, Stavanger, Norway (Wolfgang Koppe)  
National Institute for Agronomic Research (INRA), France (Geneviève Corraze)  
Duration: 2000 - 2003
- Structure, formation and daily growth of the scallop *Pecten maximus* shell  
Institute of Marine Research, Bergen (Øivind Strand)  
Institut Universitaire Européen de la Mer (Laurent Chauvaud)  
Duration: 2001-2003
- Adaptation of French sea bream technology for cod fingerling production  
Bergen Aqua AS, Bergen (Grethe Adoff)  
Ferme Marine de Douhet (Frédéric Cachelou)  
Duration 2001 - 2003
- Nutraceuticals from fish and shellfish hydrolysates  
BioHenk AS, Tromsø (Even Stenberg)  
Station de Biologie Marine du Muséum National d'Histoire Naturelle (Yves Le Gal)  
Duration: 2002 - 2004

#### **BIOTECHNOLOGY / BIO-MEDICINE / BIOCHEMISTRY**

- Development of 99-Tc-labelled drugs based upon Biological Substances  
Axix Research A/S, Oslo, Norway (Heggli)  
Compagnie ORIS Industrie, Gif-sur-Yvette, France (J.C. Saccavini)  
Duration 1989 – 1990
- Purification of marine oils by supercritical fluid fractionation  
Pronova Biocare, Norway (H. Breivik)  
Separex, France (M. Perrut)  
Duration 1991 - 1993
- Modelling of molecular recognition – a semi automatic approach  
MR Center, Norway (Steffen Petersen)  
Biostructure, France (Stéphane Boudon)  
Duration 1992 – 1993

- Detection and counting of residual leukocytes  
Dynal, Norway (Erik Ruud)  
Biocytex, France (Philippe Poncelet)  
Duration 1993 - 1994
- Repair of lesions induced in DNA by industrial compounds and drugs  
University of Bergen Department of molecular Biology, Bergen, Norway (Niels Aarsæther)  
Institut Gustave Roussy, Villejuif, France (Jacques Laval)  
Duration: 1998-2001
- The immune system in scallop, Doctoral studies at SARS Centre in Bergen  
Doctoral student Armaury Herpin, Laboratoire de Biologie et Biotechnologies Marine, Caen  
Duration: 2000-2002
- Development of biochemical procedures and read out platforms for manipulating and analysing nucleic acids  
LingVitae, Norway (Preben Lexow)  
Pasteur Institut, France (Aaron Bensimon)  
Duration: 2001-2003
- The Effect of Bioactive Fatty Acids on Atherosclerosis and Restenosis Development  
Thia Medica AS / Clinical Biochemistry Haukeland Hospital, UiB, Norway (Rolf K. Berge)  
Institut Pasteur de Lille, France (Bart Staels)  
Duration: 2002 – 2004
- Developing genetic tools for real time non-invasive imaging of tumorigenesis in living mice  
Cgene AS (Harald Karlsen) / University of Oslo (Joel Glover)  
ENS Paris / IPSOGEN (Christo Goridis / Fabienne Hermitte)  
Duration: 2 years 2005 - 2007

#### **CIVIL ENGINEERING**

- Prediction creep settlements for foundations in permafrost  
Norwegian Geotechnical Institute, Oslo, Norway (Tom Lunne)  
GEOCEAN, Marseille, France (Alain Puech)  
Duration 1991
- Submarine Slides  
Norwegian Geotechnical Institute, Oslo, Norway (Harald Norem)  
CEMAGREF, Division Nivologie, St. Martin D'Herès, France (Gerard Brugnot)  
Duration 1991 - 1992
- Geosynthetics for innovative sustainable solutions in Arctic climate  
Store Norske Spitsbergen Grubekompan / SINTEF (Arnstein Watn)  
TenCate Geosynthetics France (Philippe Delmas)  
Duration: 3 years 2006 – 2009 (Σ! 3702)

**ENERGY SAVING AND ENVIRONMENTAL TECHNOLOGY**

- Technology transfer in water technology  
Aquateam, Norway (Schanke Eikum)  
Verseau, France (Lagarrique)  
Duration 1990 – 1991
- Integration of a gas turbine in a high speed vessel  
Ulstein International AS, Norway (Harald Nordal)  
Turbomeca, France (Watier)  
Duration 1991 - 1992
- Anode gas cleaning. Installation and operation of a Pilot Plant  
Elkem Aluminium ANS, Norway (Arne G. Berg)  
Procedair SA, France (Serge Commenges)  
Duration 1997
- Wet Air Oxidation by Catalytic Membrane Contactor  
SINTEF Material Technology / Due Miljø, Norway (Henrik Ræder)  
Institut de Recherches sur la Catalyse (IRC)-CNRS, France (P. Gallezot)  
Duration 1998 – 2000
- Current forecasting in the North Sea and the Gulf of Lion  
Terra Orbit AS (Laurent Bertino)  
Actimar SA (Raymond Nerzic)  
Duration: 3 years 2006 - 2008
- Stabilisation of top of the line corrosion rate  
Institutt for energiteknikk (IFE) / Total Norge / Norske Conoco Phillips ( Arne Dugstad)  
Total S.A / ENSEE Grenoble (Yves Gunaltun)  
Duration: 3 years 2006 – 2008

**INFORMATION / TELECOMMUNICATION TECHNOLOGIES / ROBOTICS**

- Fibre Optic Technology  
Alcatel STK, Norway (Flaarønning)  
Lab. de Marcoussis, France (Torchin)  
Duration 1989 – 1990
- Computer aided navigation of mobile robots using animated synthetic images  
SINTEF, Norway (V. Kallevik)  
CYBERNETIX, France (P. Baraona, D. Sangouard)  
Duration 1990 - 1991
- ACM, Advanced Configuration Management (NOMADE + EPOS)  
Norwegian Institut of Technology, Trondheim, Norway (Conradi)  
LGI, Nomade Team, Grenoble, France (Estublier)  
Duration 1991 - 1992
- Interactive home support systems for protected housing  
Man Machine Technology AS, Norway (Anderson)  
Pierron SA, France (Viala, Legrand)  
Duration 1992 - 1993

- Eviacsim – An interactive evacuation simulation system tool  
A/S Quasar Consultants, Norway (K. Harald Drager)  
Simulog, France (Bruno Arbaud)  
Duration 1992 - 1993
- High performance safety and security detector field bus  
Autronica AS, Trondheim, Norway (Gunnar Haveland)  
Automatismes Sicly, Le Blanc-Mesnil, France (Thierry Chabot)  
Duration 1994 - 1997
- TRICAD – Triangulation of CAD geometries  
ViewTech, Norway (Tor Helge Hansen)  
Transvalor, France (Etienne Wey)  
Duration 1999 - 2000
- Secure software distribution and payment over Internet  
Sospita AS (Protective Technology), Mandal, Norway (Ulf Carlsen)  
Gemplus, Gémenos, France (Pierre Girard)  
Duration: 1999-2001
- HP-Sim: High Performance Seismic Imaging)  
Para//ab / Norsk Hydro, Bergen, Norway (Tor Sørøvik)  
Armines-Geophysique, Fontainebleau, France (Philippe Thierry)  
Duration: 2000-2001
- 3D Geometry System integrated with haptic and kinaesthetic solutions  
Compu Touch AS, Norway (Frank Robert Berg)  
Atomic Energy Commission, France (CEA) (Guy Le Bras)  
Duration: 2001-2002
- Software Components for Building Complex 3D Geological Models (2001-2003)  
GeoCap AS, Norway (Olav Egeland)  
Armines / IFP, France (Jean-François Rainaud)
- Medical Device Software Assessment for Certification  
Det Norske Veritas AS, Oslo, Norway (Torbjørn Skramstad)  
ISOSCOPE, Toulouse, France (Christian Rouve)  
Duration: 2000 - 2004
- Simulation and planning for Robotic Education and Distant Surgery  
Sim Surgery AS, Norway (Jan Sigurd Røtnes)  
IRCAD, France (Luc Soler)  
Duration: 2003-2004
- Development of innovative IT solutions for Shipbrokers  
Unified Messaging Systems, Norway (UMS) (Harald Lindbäck)  
AXS Marine SA, France (Fabrice Demichel)  
Duration: 2003-2004
- Modelling electricity prices in European markets with an emphasis on risk analyses  
Kjell Magnus Maribu – postdoctoral studies at École des Mines de Paris  
Duration : Six months 2006

- Localisation of drifting objects and decision aid system for maritime search and rescue (SAR)  
CMR Computing / Met.no (Kjell Røang)  
ACTIMAR / IFREMER (Raymond Nerzic)  
Duration: 2006 – 2008 (Σ! 3652)

#### **MATERIAL SCIENCE AND TECHNOLOGY / MARINE TECHNOLOGY**

- Advanced light metals for car engines  
Hydro Aluminium, Sunndalsøra, Norway (L. Auran)  
PSA Velizy, France (R. Moore)  
Duration 1988-1992
- Postal container for ATR  
Hydro Aluminium, Norway  
Avions de Transport Regional (ATR), France  
Duration 1990 - 1991
- Microstructurally based modelling of plastic anisotropy  
Hydro Aluminium, Metallurgical R&D Center, Sunndalsøra, Norway (A. Aaflot)  
Pechiney Recherche, Voreppe, France (B. Marandet)  
Duration 1991 -1992
- Recovery of Aluminium Alloys  
Hydro Aluminium, R&D Materials Technology, Norway (Trond Furu)  
Pechiney CRV, France (D. Duly)  
Duration 1993 - 1996
- Modelling and improved cooling of aluminium extruded sections  
Hydro Aluminium, R&D Materials Technology, Norway (Antonie Oosterkamp)  
Bertin & Cie, France (J. Street)  
Duration 1994 - 1997
- Electrophoretic and sol-gel methods for anticorrosive mineral coatings  
SINTEF Materials Technology, Norway (Christian Simon)  
Institut Français du Petrole, France (Benjamin Cabot)  
Duration 1994 – 1997
- Piezo-composites in underwater transducers  
Simrad Norge AS, Horten, Norway (Helge Bodholt)  
Imasonic, Besançon, France (Gerard Fleury)  
Duration 1996 - 1998
- Carbon particle upgrading by plasma  
SINTEF/NTNU, Norway (Jon Arne Bakken)  
ARMINES, Centre d’Energétique, Sophia Antipolis, France (Laurent Fulcheri)  
Duration 1998
- Development of high performance and safety improved work clothing for the oil industry  
SINTEF Unimed, Øglænd Pioner, Norway (Arvid Påsche)  
Pinatel et Chapuis Textiles, France (Pierre Baleix)  
Duration 1998 - 1999

- Inductive plasma purification of metallurgical silicon using inductive plasma in order to obtain silicon with purity suitable for solar cell manufacturing  
Elkem ASA, Kristiansand, Norway (Pål Runde)  
PREMIS Technologies, Ascoux, France (N. Perrodin)  
Duration: 1999 – 2001
- High temperature pressure sensor (2000 - 2001 )  
PreSens, Oslo, Norway (Frode Meringdal)  
Cea Leti, Grenoble, France (Bernard Diem)  
Duration: 2000 - 2001
- Aluminium components subjected to impact loading conditions  
SIMlab, NTNU / SINTEF / Hydro Aluminium, Norway (Magnus Langseth)  
LMT-Cachan / Renault, France (Ahmed Benallal)  
Duration: 2003-2005
- Novel silicon feedstock by agglomeration of silicon powder and further refining by thermal treatment and reactive metallurgy  
Silicon Technologies AS, Norway (Bruno Ceccaroli)  
EMIX SA, France (Didier Landaud)  
Duration: 2005
- Up-scaling of advanced ceramic membrane processes for fish oil separation  
Due Miljø and SINTEF Materia, Norway (Eddy Torp and Bente G. Tilst) (Note: original text has typo)  
CTPP / IFREMER, France (Charles Delannoy) and NOVASEP Orelis  
Duration 2004
- Up-scaling of advanced ceramic membrane processes for fish oil separation  
Due Miljø/SINTEF, Norway (Eddy Torp and Bente G. Tilst) (Note: original text has typo)  
CTPP / Novasep Orelis, France (Charles Delannoy)  
Duration: 3 years 2005 - 2007 (Σ! 3198)
- New process for solar silicon. Refining by thermal treatment and reactive metallurgy  
Rec Silicon AS, Norway (Bruno Ceccaroli / Erik Sauar)  
EMIX S.A, France. (Didier Landaud)  
Duration: 3 years 2006 – 2008 (Σ! 3314)
- Intercepting HISC by ultrasonic residual stress measurements  
Det Norske Veritas (Majid Anvari)  
Ultra RS (Siamack Atiabi)  
Duration: 1 year - 2006/07 (Finish in September 2009)
- Conception, development and testing of new aluminium casting alloys for elevated temperature applications in automobile engines  
Hydro Aluminium (Petter Åsholt)  
Montupet (Bruno Barlas)  
Duration: 3 years 1.7.2006 – 30.6.2009 (Σ! 3698)
- Evaluation of Ready To Use crucibles for the crystallization of multi crystallised silicon ingot  
NTNU, Material Science (Lars Arneberg)  
Vesuvius France (Christian Martin)  
Duration: 1 year 2008/09

**OIL AND GAS INDUSTRY, OFFSHORE TECHNOLOGY**

- Feasibility Study on Natural Gas Distribution in North Rogaland  
Gasmot A/S, Forus, Norway (Rolf Rønningen)  
Sofregaz, Paris, France (Saillard)  
Duration 1989
- Deep Diver External Monitoring  
SINTEF, Trondheim, Norway (Arvid Påsche)  
COMEX SA, Marseille, France (Imbert)  
Duration 1989 - 1990
- Drilling and production operation for offshore field on Norwegian waters with the Jack-up TPG 500  
Wiltech Production System (WPS), Oslo, Norway (Robert Reed)  
Technip Geoproduction, Paris, France (Pierre-Armand Thomas)  
Duration 1989 - 1990
- Vertical resonant motions of tension leg platforms  
Norwegian Institute of Technology, Trondheim, Norway (Geir Moe)  
IFP, Rueil Malmaison, France (B. Molin)  
Duration 1989 - 1990
- Diver survival equipment  
SINTEF, Trondheim (Arvid Påsche) and Statoil/Norsk Hydro/OD, Norway  
COMEX S.A., Marseille, France (Jean Pierre Imbert)  
Duration 1989 - 1990
- Concrete semi-submersible production platform with rigid well risers  
Oddfjell Drilling and Consulting Co. A/S, Kokstad, Norway (A.K. Nilsen)  
Doris Engineering, Paris, France (J. Martin)  
Duration 1991 - 1992
- Offshore loading system for LNG and LPG  
Seanor Engineering a.s., Norway (Oddvar Bøyesen)  
FMC EUROPE S.A, France. (Chris Pashalis)  
Duration 1992 - 1994
- Gas leak detection (GLD) system for pipelines  
Simrad Marine, Norway (Kjell Dalland)  
Metravib, France (Pierre Schindler)  
Duration 1993 - 1994
- Development of methods for inspection of steel layers in flexible pipes  
Robit, Norway (Morten Eriksen)  
Coflexip, France (Barthelemy Laurant)  
Duration 1993 - 1994
- New Multilevel downhole seismic acquisition system  
READ Well Services AS, Norway (Karl A. Berteussen)  
IFP, Rueil Malmaison, France (Jean Laurent)  
Duration 1994 - 1996

- A new generation of zeolite catalyst for hydrocracking  
Statoil Research Centre, Norway (Bente Bøe)  
Institut Français du Pétrole, France (Eric Benazzi)  
Duration 1997 - 2000
- Travel support in connection with the establishment of possible co-operation between NTNU and IFP  
Professor Gudmundsson, NTNU, Trondheim, Norway  
Duration 1998
- Fatigue behaviour of offshore loading hoses  
Advanced Production and Loading (APL) AS, Norway (Jan V. Aarsnes)  
Trelleborg Kleber Industries, France (Jacques Cognard)  
Duration 1999 – 2000
- Increased Field Profitability by Improved Uncertainty Management  
Det Norske Veritas (DNV), Norway (Øivind Johnsen)  
Institut Français du Pétrole (IFP), France (Daniel Averbuch)  
Duration 2002 - 2003
- Application of a new encapsulation process in petrochemistry  
KeraNor/SINTEF Materials Technology, Norway (Christian Simon)  
Institut Français du Pétrole/Université de Franche-Comté, France (Alain Fossy)  
Duration: 2002 – 2004 (Extended to a EU project (NANOCAPS) in March 2004)
- Stabilisation of the top of the gas lines corrosion rate  
Institut for energiteknikk (IFE) / Total Norge / Norske Conoco Phillips, Norway (Arne Dugstad)  
Total S.A / ENSEE Grenoble, France (Yves Gunaltun)  
Duration: 3 years 2006 - 2008

### SPACE TECHNOLOGY

- Aerospace Vehicle Numerical Flow Simulation and Wind Tunnel Test  
CFD, Trondheim, Norway (Helge Nørstrud)  
Aerospatiale, Toulouse, France (Corinne Rey)  
Duration 1990 - 1992
- Technology Program – Thermal Protection Materials for Propulsion Systems  
Raufoss, Norway (Haugen)  
SNPE Paris, France (Faure)  
Duration 1992 - 1993
- Zeolite Synthesis under Microgravity  
SINTEF (SI), Norway (Stöcker)  
Université de Paris VI+VII, France (Robert)  
Duration 1991 - 1992
- Save filter bank for flexible multi beam payload  
Ame Space, Norway (Øivind Andreasen)  
Alcatel Espace, France (Herve Snorre)  
Duration 1993 - 1995

- French / Norwegian study of increased space technology industrial co-operation  
Europavia Norge A/S, Norway (J.C. Width)  
CNES, France (Yves Rebillard)  
Duration 1993
- Development of adaptive mesh for space propulsion systems  
CDF Norway AS, Norway (Helge Nørstrud)  
SNECMA, France  
Duration 1994 - 1996
- Development of a bi-propellant flow control valve for satellite propulsion  
Raufoss Technology AS, Raufoss, Norway (Per Eger)  
Aerospatiale Espace Défense, Les Mureaux, France (J. Astier)  
Duration 1996 – 1998
- Introduction to the French Aerospace Industry  
Einar Sørensen, Norway  
Duration 1999

### MISCELLANEOUS

- Olympic winter games – Albertville 1992 / Lillehammer 1994  
Potential fields of industrial co-operation  
NIA, Norway(Per Axel Prydz)  
COJO/LOOC. France  
Duration 1991 – 1992
- Creative project – 1<sup>st</sup> step marketing study  
Statoil, Norway (EUREKA support)  
CETIM, France (FNS support)  
Duration 1993
- Development of a new generation self-contained closed circuit breathing apparatus  
Thelma AS, Norway (Arvid Påsche)  
Fenzy S.A, France (Robert Michel)  
Duration: 2001 – 2002
- Developing an Intangible Asset Valuation Tool  
InSpire Invest AS (Jan-Olaf Willums)  
Integral Development Asset Management (Antoine Dehen)  
Duration: 2005/06
- Consumer conceptions of local food  
SIFO (Virgenie Amilien)  
INRA and UMR MOISA (Fatiha Fort)  
Duration: 2005 - 2007

## WORKSHOPS AND SEMINARS: 1984 - 2009

Workshops and seminars are organized in order to help French and Norwegian companies and researchers to identify subjects of co-operation for developing new markets and achieving joint industrial initiatives.

The Foundation organizes a seminar when a topic of joint interest emerges as beneficial to the French and Norwegian industries. Sometimes they are held in France, sometimes in Norway. The host country organizes exchanges of views and visits to companies and industrial sites for groups of about 15 representatives of companies and research centres who are in a position to commit their organisations to a co-operative initiative in the future.

Seminars last for three to five days, and usually include:

- a general presentation of the participating organisations and their research and development strategy
- exchanges of views in small groups on topics selected for possible collaborative efforts
- company visits and bilateral discussions aimed at establishing fields of co-operation.

To date, the following seminars have been organized or supported by the Foundation:

Oslo, 1984:	Materials
Brest, 1984:	Aquaculture
Paris, 1985:	Offshore technologies
Paris, 1986:	Artificial intelligence
Trondheim, 1987:	Studies and research for marine technologies
Oslo, 1989:	Materials
La Rochelle, 1989:	Aquaculture
Caen, 1989:	Smart cards
Rueil-Malmaison, 1991:	Major risks
Paris, 1991:	Space technologies
Oslo, 1992:	Robotics and subsea operations
Paris, 1992:	Polar research at Svalbard
Paris, 1993:	INSROP presentation
Oslo, 1994:	Prevention and treatment of nuclear and chemical pollution
Tromsø, 1995:	Telemedicine
Rueil-Malmaison, 1998:	Water treatment in oil and gas production
Nantes, 2000:	Agriculture business and Information technology
Ås, 2001:	Management of water quality
Stjørdal, 2004:	Knowledge Management in integrated Drilling Operations
Brest, 2004:	Technologies for Search Assistance and Rescue
Paris, 2005:	Workshop for planning collaboration between INRA and Aquaforsk within aquaculture research
Bergen, 2005:	Workshop on operational oceanography
Montpellier / Palavas 2005:	Workshop on Recirculation water technology
Oslo, 2005:	Seminar on Hydrogen and transport
Brest, 2006:	Workshop on Technologies for Search and Rescue and other Emergency Marine Operations
Oslo, 2007:	Carbon Capture and Sequestration
Grenoble, 2007:	Micro and Nano Optics Workshop

Paris, 2008	Cancer and neuroscience seminar
Brest 2008:	Third international workshop on Technologies for search and rescue and other emergency marine operations.
Paris 2009:	New renewable energy
Bergen 2009:	Symposium on Nano and Micro Frontiers in Biology and Medicine
Toulouse 2009:	European Cancer Cluster Partnering
Le Havre 2009:	Doctoral student seminar on Capture, Transport and Storage of CO <sub>2</sub>

**EXCHANGE PROGRAMME  
NATIONAL ACADEMIES OF SCIENCE 1990 - 2003  
ÅSGARD PROGRAMME from 2006**

**1990**

Prof. Paul Malliavin (mathématiques)  
10, rue Saint Louis en l'Isle, 75004 Paris

Prof. Johannes Dale (chimie)  
Universitetet i Oslo, Kjemisk institutt, Pb 1033, 0315 Oslo  
(Coopération avec M. Julia)

**1991**

Nicole Le Douarin (biologie anim. et vég.)  
Institut d'Embryologie Cellulaire et Moléculaire du CNRS et du Collège de France  
49 bis, avenue de la Belle Gabrielle, 94736 Nogent-sur-Marne Cedex

Prof. Tom Andersen (géologi)  
Universitetet i Oslo, Mineralogisk-Geologisk Museum, Sarsgate 2, 0562 Oslo

Prof. Per Enger (zoologi)  
Universitetet i Oslo, Biologisk institutt, Genetisk fysiologi, Pb 1051 Blindern, 0316 Oslo

Prof. Olav A. Laudal (mathématiques)  
Universitetet i Oslo, Matematisk institutt, Pb 1053 Blindern, 0316 Oslo

**1992**

Prof. Marc Julia (chimie)  
Ecole Normale Supérieure, Laboratoire de Chimie  
57, rue Geoffroy-Sant-Hilaire, 75005 Paris  
(Coopération avec M. Dale)

Prof. Jaques Dixmier (mathématiques)  
(Coopération avec M.O.A. Laudal)

Prof. Pierre Buser (médecine)  
Université Pierre et Marie Curie, Institut des Neurosciences  
9, Quai Sant-Bernard, 75005 Paris

Prof. Jacqueline Tjøtta (mathématique)  
Universitetet i Bergen, Matmeatisk institutt, 5007 Bergen  
(Coopération avec Mme Lévy)

**1993**

Prof. Thérèse Lévy (physique)  
Université de Paris VI, Modélisation en Mécanique URA 229  
(Coopération avec Mme Tjøtta)

Prof. Paul Ozenda (biologie)  
Université Joseph Fourier, Laboratoire de biologie alpine  
Saint-Martin d'Hères  
(Coopération avec M. Holten)

### 1994

Prof. Øyvind Andersen (chimie)  
Norsk institutt for Naturforskning (NINA)  
Tungasletta 2, 7005 Trondheim  
(Coopération avec M. Ozenda)

Prof. Michel Rohmer (chimie)  
Université de Haute Alsace, Ecole Nationale Supérieure de chimie de Mulhouse  
(Coopération avec M. Skattebøl, Univ. i Oslo, Kjemisk institutt)

### 1995

Prof. Øyvind Andersen (chimie)  
Universitetet i Bergen, Kjemisk institutt, 5007 Bergen

Prof. Robert Naquet (médecine)  
Institut Alfred Fessard, Avenue de la Terrasse, 91198 Gif-sur-Yvette Cedex  
(Coopération avec Mr. O. Ottersen)

### 1996

Prof. Andrée Marquet (chimie bio-organique)  
Université Pierre et Marie Curie, Lab de chimie organique biologique  
URA CNRS 493, 4, Place Jussieu, 75252 Paris Cedex 05

Prof. Ole Petter Ottersen  
Universitetet i Oslo, Institutt for medisinske basalfag, Anatomisk Institutt  
Pb 1105 Blindern, 0317 Oslo

### 1997

Prof. Yvonne Choquet-Bruhat  
Université Pierre et Marie Curie  
4, Place Jussieu, 75252 Paris Cedex 05  
(Coopération avec Mr. A. Lauvdal)

### 1998

Prof. Olav Arnfinn Laudal  
Universitetet i Oslo, Matematisk institutt  
Pb 1053 Blindern, 0316 Oslo  
(Coopération avec Ms. Y. Choquet-Bruhat)

### 2001

Prof. Ragni Piene  
Universitetet i Oslo, Matematisk institutt  
Pb 1053 Blindern, 0316 Oslo  
(Coopération avec Prof. Marie-Lise Chanin)

### 2003

Prof. Pacal Estraillier  
Université de la Rochelle, Laboratoire Informatique/Image/Interaction  
(Norwegian Mapping Authority, the Norwegian Space Center and SINTEF - geographic data processing)

**2006 - Åsgard Programme**

The following eight scientists were awarded a Åsgard fellowship in order to visit Norwegian research institutions in 2006:

Céline Nauges (Economics for Development)  
INRA Toulouse – Oslo and Ås

Laurent Douce (Inorganic chemistry, liquid crystals)  
IPCMS, Ecole de chimie de Strasbourg – Oslo and Bergen

Emmanuel Hadji (Materials, nanotechnologies)  
CEA Grenoble – Oslo and Trondheim

Mohammed El Ganaoui (Physics, numerical modelling)  
Université de Limoges – Oslo, Trondheim and Ås

Claude Touzet (Medicine, neurobiology, memory)  
Université de Marseille – Oslo and Trondheim

Pierre Villeneuve (Biology, lipids)  
CIRAD, Montpellier – Oslo and Ålesund

Claude Estournès (Chemistry, hydrogen)  
CNRS, Université de Toulouse  
Visit within the framework of the follow-up actions of the French-Norwegian Seminar on Hydrogen organised in Oslo in December 2005

Fabrice Mauvy (Condensed matter)  
Université de Bordeaux  
Visit within the framework of the follow-up actions of the French-Norwegian Seminar on Hydrogen organised in Oslo in December 2005

**2007 - Åsgard Programme**

The following nine scientists were awarded a Åsgard fellowship in order to visit Norwegian research institutions in 2007:

Denis Gauthier (Research for development)  
CIRAD, Montpellier/Mali  
Visit within the framework of the follow-up actions of the French-Norwegian Seminar on Development organised in May 2006

Anne-Marie Caminade (Chemistry)  
Université de Toulouse – Trondheim, Oslo

Benoît Dugué (Sport sciences)  
Université de Poitiers – Oslo

Emmanuel Picavet (Political philosophy)  
Université Panthéon-Sorbonne (Paris I) – Oslo

Eric Brangier (Cognition and interaction studies, psychology)  
Université de Metz – Trondheim, Oslo

Attar Al-Nawar (Cardiac surgery, cell therapy)  
Hôpital Bichat – Oslo

Agnès Michelot (Environmental law)  
Université de La Rochelle – Bergen, Oslo

Catherine Picart (Biophysics)  
Université Montpellier II – Bergen, Oslo, Trondheim

Jocelyn Chanussot (Signal and image processing)  
Institute of technology Grenoble – Trondheim, Bergen, Oslo

The following two scientists were awarded a Åsgard fellowship in order to visit French research institutions in 2007:

Tor A. Benjaminsen (Agriculture, environment and life science)  
Norwegian University of Life Sciences, Ås – CIRAD, IRD and EGREF Montpellier

Reiner Anwander (Chemistry)  
University of Bergen – Toulouse and Lyon

### **2008 - Åsgard Programme**

The following 10 scientists were awarded a Åsgard fellowship in order to visit Norwegian research institutions in 2008:

Ludovic Escoubas (Photovoltaics, Optoelectronics)  
Université Paul Cézanne, Aix-Marseille III – Trondheim, Oslo

Pierre Millet (Hydrogen)  
Université Paris XI, Institut de Chimie Moléculaire et des Matériaux d'Orsay – Trondheim, Oslo

Alessandro Tonello (Optics, Photonics, Telecommunication)  
Institut XLIM, Université de Limoges – Trondheim, Oslo

Yann Bugeaud (Mathematics)  
Université Louis Pasteur Strasbourg – Bergen, Trondheim, Oslo

Stéphane Olié (Neuroscience)  
Centre de Recherche INSERM U862, Université Bordeaux – Trondheim, Oslo

Stéphane Bellemin (Chemistry, Catalysis)  
Université Louis Pasteur Strasbourg – Oslo, Bergen

Desdemona Fricker (Neuroscience)  
Université Paris XIII, CHU Pitié-Salpêtrière – Oslo, Trondheim

Lydie du Bousquet (Software engineering)  
Laboratoire d'Informatique de Grenoble, Université J. Fourier Grenoble I – Trondheim, Oslo

Luc Massou (STIC)  
Université Paul Verlaine, Metz – Oslo, Kristiansand

Sylvie Neyertz (Chemistry)  
Université de Savoie, Chambéry – Trondheim, Oslo, Bergen

**2009 - Åsgard Programme**

JeanSciare  
CEA-LSCE – Tromsø, Oslo

Yvette Veyret  
Université Paris X – Nanterre – Oslo, Stavanger

Brian Rudkin  
ENS Lyon – Oslo, Bergen

Pierre-Xavier Thivel  
Université de Grenoble – Bergen, Oslo Trondheim

Alain Ponton  
Université Paris Diderot – Trondheim, Oslo, Ås

Christine Contino-Pepin  
Université d'Avignon – Bergen, Oslo

Laurent Billonnet  
Université de Limoges – Stavanger, Oslo Trondheim

Farid Chemat  
Université d'Avignon – Oslo, Tromsø, Ås

**Income and expenditure account (NOK)**  
**1.1. - 31.12.2009**

	2009			2008		
	France	Norway	Total	France	Norway	Total
<b>Income:</b>						
Governmental funding Secretariat	172 000	250 000	422 000	184 000	250 000	434 000
Governmental funding Projects*	5 377 136	2 750 000	8 127 136	5 011 088	2 750 000	7 761 088
Governmental project funding (through FFN)	248 000	0	248 000	0	0	0
Eureka / The Research Council of Norway**		480 000	480 000	0	768 000	768 000
Seminars	40 000	0	40 000	18 525	0	18 525
Member fees	116 800	95 300	212 100	145 600	83 200	228 800
<b>Total Income</b>	<b>5 953 936</b>	<b>3 575 300</b>	<b>9 529 236</b>	<b>5 359 213</b>	<b>3 851 200</b>	<b>9 210 413</b>
<b>Expenditures:</b>						
Administration and Board meetings	212 703	311 873	524 576	315 086	435 214	750 300
Governmental project funding *	5 377 136	4 047 500	9 424 636	5 011 088	3 099 990	8 111 078
Governmental project funding (through FFN)	124 000	0	124 000	124 000	0	124 000
Seminars	40 000	319 022	359 022	37 050	115 750	152 800
<b>Total Expenditures</b>	<b>5 753 839</b>	<b>4 678 395</b>	<b>10 432 234</b>	<b>5 487 224</b>	<b>3 650 954</b>	<b>9 138 178</b>
<b>Finance:</b>						
Plus values SICAV BNP - Paris	10 270	0	10 270	25 120	0	25 120
Bank interest		194 352	194 352	0	377 708	377 708
Bank interest paid to France***	0	0	0	0		
Bank costs	-436	0	-436	-474		-474
<b>Total</b>	<b>9 834</b>	<b>194 352</b>	<b>204 186</b>	<b>24 646</b>	<b>377 708</b>	<b>402 354</b>
<b>Result</b>	<b>209 931</b>	<b>-908 743</b>	<b>-698 812</b>	<b>-103 365</b>	<b>577 954</b>	<b>474 589</b>

**Exchange rate: 1€= 8 NOK**

\*In France Governmental funding is, more often than not, paid directly to project partners

\*\* Eureka-approved projects approved before 2009 get 30% funded from the Research Council as an additional income

\*\*\*Accumulated interest on capital reserve paid to France

**FNS / FFN (France and Norway)**  
**Balance sheet as per 31.12.2009 (NOK)**

	2009			2008		
	France	Norway	Total	France	Norway	Total
<b>Assets:</b>						
Bank deposit BNP Paris (Secretariat)	569 194	0	569 194	853 680	0	853 680
SICAV (BNP - Paris Secretariat)	1 145 905	0	1 145 905	651 488	0	651 488
Accounts receivable	0	0	0	0	38 375	38 375
Bank deposit Norway	0	4 762 121	4 762 121	0	5 103 369	5 103 369
<b>Total Assets</b>	<b>1 715 099</b>	<b>4 762 121</b>	<b>6 477 220</b>	<b>1 505 168</b>	<b>5 141 744</b>	<b>6 646 912</b>
<b>Liabilities</b>						
Secretariat reserve	1 505 168	*	1 505 168	1 505 168	*	1 505 168
Fixed Capital (France and Norway)	0	1 000 000	1 000 000	0	1 000 000	1 000 000
Retained Equity	0	3 699 463	3 699 463	0	3 121 509	3 121 509
Result	209 931	-908 743	-698 812		577 954	577 954
Short term liability	0	971 401	971 401	0	442 281	442 281
<b>Total Liabilities</b>	<b>1 715 099</b>	<b>4 762 121</b>	<b>6 477 220</b>	<b>1 505 168</b>	<b>5 141 744</b>	<b>6 646 912</b>

\* included in Retained Equity

**Exchange rate: 1€= 8 NOK**