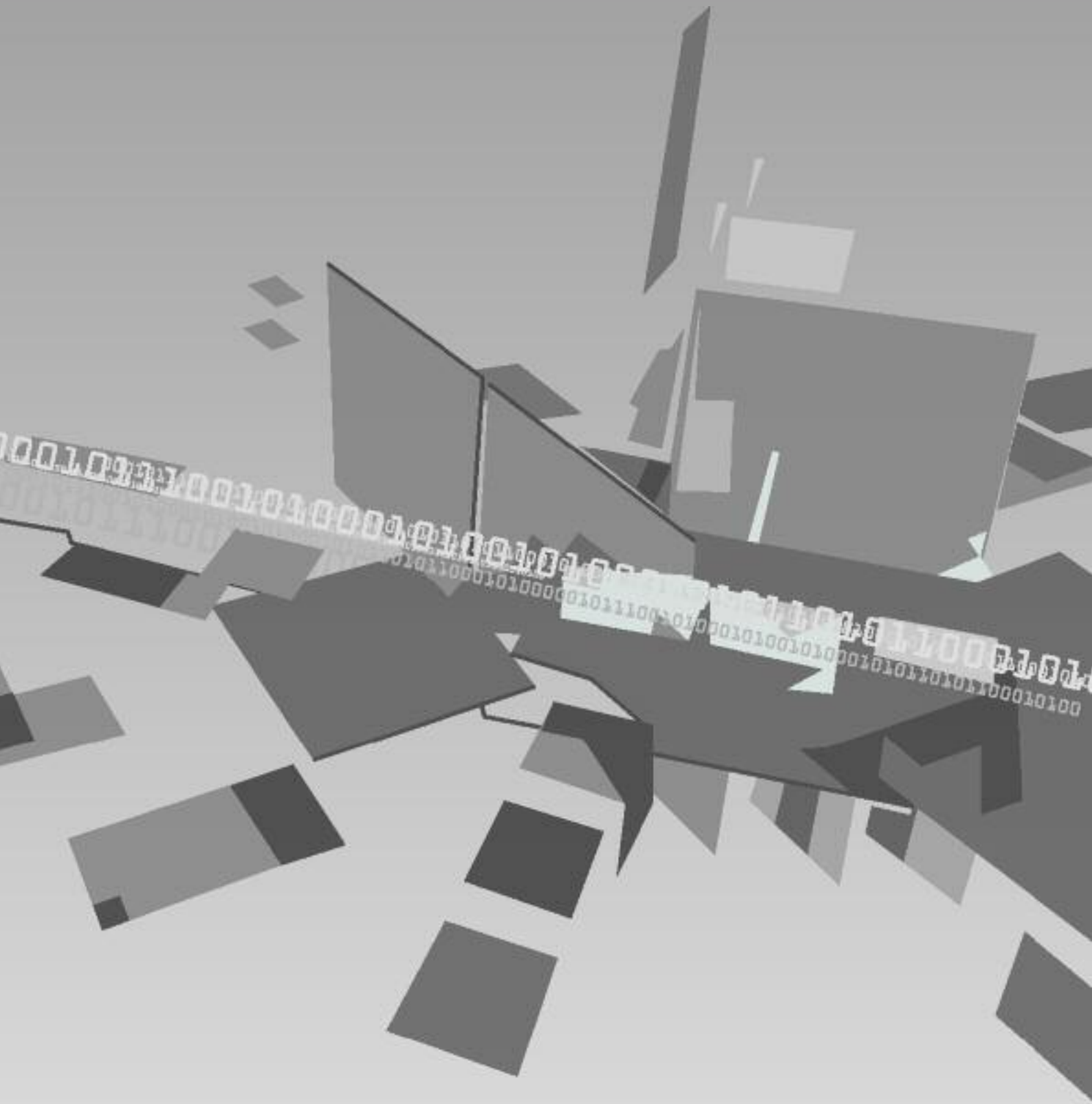
SIMULA ANNUAL REPORT 2009



[simula . research laboratory]

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SIMULA ANNUAL REPORT 2009

MANAGING DIRECTOR

Photo: Karl Braanaas

GUIDE US AND USE US

Debate is going on in Norway concerning how best to organize and fund research. Many university professors argue that researchers should be granted a large degree of individual freedom. Further, they argue that research programs initiated by the Research Council should be reduced significantly, since such programs places strong restrictions on the research. Instead, they argue that the money should be given directly to research institutions as basic funding.

On the other hand, the Research Council and a number of politicians argue that research should be directed towards areas of particular importance for Norway. Further, they argue that research is based on the tax-payers money and therefore, the distribution of the money should reflect the needs of society.

The current model is, somewhat surprisingly, not in line with any of these views. Today, the majority of the research money seems to follow the paths taken by the students, because the universities to a great degree receive their funding based on the number of students enrolled. This, of course, limits the freedom of universities to act strategically, and it also limits politicians' ability to steer the research in a certain direction.

Another long-standing debate in academia concerns the governance model. There have been attempts to equip universities with governing bodies more like the board-of-directors model found in private companies. Such attempts have always been met with protests, and Norwegian universities thus remain rather self-directed. Broadly speaking, those who would exert stronger political influence over the use of research money also tend to desire stronger governmental influence over the institutions, and vice versa.

Considered in this context, Simula Research Laboratory is an unusual construct. It was created based on a purely political initiative, it was established as a limited company, it is governed as a commercial company with a board of directors appointed by the owners, and its main direction of research is expressed in the company's articles of association. The laboratory has recently been evaluated and the results can be found on our website*; see also page 14 in the present report. This scientific evaluation states clearly that the lab is thriving and this then leads to speculation whether that is because of or in spite of the model for organisation and funding.

Certainly, Simula is a small lab with its 120 employees, compared with almost 20.000 employees at Norwegian universities. Accordingly, any conclusion should be interpreted in a modest manner. Nevertheless, I am fairly confident that employees, management, the board of directors, and the Government have found the Simula experience most interesting and enjoyable, and thus I think we all share in the desire to develop the model further.

Simula has been evaluated, a new ten-year lease at Fornebu has been negotiated and signed, and the time has come to discuss what we should do for the upcoming decade. As part of our process to develop a new strategy, Simula now actively invites politicians from the relevant governmental ministries, the Research Council of Norway, the municipality of Bærum, and all industrial and academic collaborators to come to Simula and join us in the discussion, as we define our long-term focus; we ask that they guide us and use us. We believe that the long-term goals of Simula should be developed based on a close collaboration with all stakeholders, and that a great degree of freedom should be granted for Simula in choosing the path towards these goals. That has been the successful formula characterizing the first decade (2001–2009) of our existence, and I see no good reason to change it, as we enter the second.

I am fairly confident that employees, management, the board of directors, and the Government have found the Simula experience most interesting and enjoyable.

To learn more about Simula and our work, read about us in the book *Simula Research Laboratory — by thinking constantly about it*, published by Springer-Verlag in 2009.

***http://simula.no/about/eval2009**

Professor Aslak Tveito,
Managing Director

DIRECTORS' REPORT FOR 2009

Board of directors. From left: Gunnar Hartvigsen, Ola Skavhaug, Tormod Hermansen, Amund Kvalbein, Ingvild Myhre, Aslak Tveito, Ottar Hovind, Inger Stray Lien and Mats Lundqvist.

A BIG YEAR FOR EVALUATION

Simula Research Laboratory (Simula) is located at IT Fornebu in Bærum Municipality. When Simula was established in 2001, a 10-year lease was signed with IT Fornebu, which won the contract to develop the Fornebu area into a high-tech knowledge centre in March 2000. In 2008, Simula's management and administration embarked upon a thorough process for studying potential future locations. Following negotiations with selected providers, in January 2010, the Board made the final decision to sign a new lease with IT Fornebu, which will apply from 2010 to 2020.

Evaluation

In evaluating Simula in 2004, an international Committee of Experts ascertained that Simula had made impressive advances and established a thriving research culture since its establishment in 2001. The 2004 evaluation formed the basis for an extension of the Research Council of Norway's contract with Simula up to 2010. At the same time, it was decided to conduct a new evaluation in 2009. The Ministry of Education and Research decided to carry out both a traditional subject-specific evaluation and an evaluation of Simula as a new concept in the Norwegian system for research and development (R&D).

In the light of the very positive scientific evaluation in 2004, there were great expectations of Simula prior to the evaluation in 2009. The scientific evaluation concluded that Simula delivers impressive scientific results and has become an inspiring innovation in the Norwegian research system.

In 2009, the evaluation report indicated that the scientific committee was impressed by the high quality of the activities at Simula. The departments Scientific Computing (SC) and Software Engineering (SE) received the top mark ”Excellent”, the former with the addition of ”in every aspect”, while the department Networks and Distributed Systems (ND) advanced from ”Good” in 2004 to ”Very Good” in 2009. The Simula School was discussed in the scientific evaluation as an extraordinarily successful initiative with the potential to become a national resource for science education.

—*The committee points out that Simula is a unique institution with consistently high quality, and I am impressed by what Simula has managed to achieve. Simula has been achieving good results for quite some time both when it comes to combining research and education, and in terms of cooperating with business and industry*, commented Minister of Research and Higher Education Tora Aasland. The minister took special note of the fact that women account for 25 per cent of Simula's PhD students, a high percentage in this category of study.

The evaluation of the concept per se confirmed that Simula has carved out a position as a strong research institution, and that it has become an important agent of change in the Norwegian R&D system. —Simula has made good use of the freedom afforded by its position outside the university and research institute system to

build a strong staff and good international visibility through publications, according to the report. At the same time, the committee made suggestions for improvements, e.g. that Simula should get more involved in the EU framework programmes for research and technological development.

The Research Council of Norway will be reviewing the evaluations in spring 2010 and making its recommendation to the Ministry of Education and Research, which will then decide whether to extend Simula's contract up to 2015. Simula's Board is pleased to note that the evaluations corroborate the Centre's strong position.

Research-related advances

In 2009, Simula maintained a high level of research in terms of quantity and quality alike, at the same time as the evaluations and other matters have engendered a great deal of work for the administration and management. The number of academic publications indicates that the institute continues to do exceptionally well at the international level. A total of 5 doctorates were earned in collaboration with the University of Oslo (UiO), and 24 master's degree students completed degrees with supervisors from Simula.

Simula's Scientific Advisory Board presented an internal evaluation in March, stating that all three research departments met the highest international standards for scientific production. The committee strongly recommended that Simula be given a permanent contract, based on evaluations every fifth year.

In 2009, as in 2007, Professor Magne Jørgensen of the SE department was named the world's most prolific scientist in the field of Software Engineering. The ranking takes place annually under the auspices of the prestigious Journal of Systems and Software. Professor Lionel Briand, also of the SE Department, placed fourth in the same ranking, and Simula was ranked the world's second most prolific research institution in software engineering.

The international technology organisation IEEE (Institute of Electrical and Electronics Engineers) appointed Professor Briand a Fellow of the IEEE. This great distinction is accorded to only a handful of scientists who have made outstanding contributions to the development of the discipline, generating knowledge that has also had a social impact. Briand is the seventh scientist to have been accorded this honour in Norway.

In November, Kirsten ten Tusscher was named Simula's Researcher of the Year in 2009, a tribute to her outstanding work in the SC Department. ten Tusscher has moved back to the Netherlands and a post with the University of Utrecht's research group in theoretical biology and bioinformatics, but retains a part-time position at Simula.

The EU's seventh framework programme decided in 2009 to support the research project Nanoscale Silicon-Aware Network-on-Chip Design Platform (NaNoC), and will be providing EUR 425 000 from 2010 to 2013. Simula is one of three academic partners, and the goal of the project is to develop an innovative design platform for the future Network-on-Chip-based multi-core systems.

Administration and organisation

In June 2009, Simula's general meeting elected Inger Stray Lien and Tormod Hermansen to the Board, taking over the seats of Hilde Tonne and Anne-Brit Kolstø. Amund Kvalbein and Ola Skavhaug superseded Bjørn Fredrik Nielsen and Åshild Grønstad Solheim as employee directors.

In autumn 2009, Simula initiated a reorganisation process to follow up the recommendations in the subject-specific evaluation. The Basic Research unit used to be divided into three departments: SC, SE and ND. From now on, it will be divided into 10 research groups, each of which will have a research manager. The research groups will continue to concentrate on the disciplines that formed the basis for the previous three-way division.

In September, Kristin Vinje, director of the Simula School and head of the Research Education unit, was appointed City Commissioner of Finance for the municipality of Oslo, so she is on leave from Simula. Her appointment resulted in the appointment of Professor Are Magnus Bruaset, director of the Research Applications unit and former assistant director for RE, to head the education unit.

Simula was involved in two labour law cases in 2009. The one case ended in a settlement, and the other concluded with a judgement rendered by the Asker and Bærum District Court in Simula's favour and including the awarding of legal costs. Although the Court found in Simula's favour, the case and the publicity associated with it were a burden on Simula and all those involved.

A specially adapted management course was organised for scientists and managers at Simula in 2009.

Collaboration with business and industry

In April, Simula and Det Norske Veritas (DnV) signed a cooperation agreement that addresses research and the education of doctoral candidates in safety analysis and the testing of components in advanced IT systems. DnV is initially investing MNOK 10 in the form of funding and own efforts over a two-year period, and will be seeking other partners that can contribute expertise and additional funding. Simula's Board is pleased with this arrangement, since cooperation with DnV will open new opportunities for the development of research with a potential for industrial applications, in addition to the good results that have already been achieved in this field.

DIRECTORS' REPORT FOR 2009

Society and dialogue
Once again in 2009, Simula attached importance to contact with political circles, business and industry, research and education institutions and society at large.

In October, Simula published a 650-page book entitled Simula Research Laboratory — *by thinking constantly about it* on Springer, the respected German publishing house. The book contains contributions from a series of key people in research, research administration and political communities, and covers all aspects of Simula's creation and operations until the evaluations in 2009.

In August, Simula received a visit from Minister of Children and Equality Anniken Huitfeldt, her political adviser Tord Dale, and MP Marianne Aasen, all members of the Labour Party. Simula was subsequently visited by representatives from the Party of Progress and the Conservative Party in Oslo and Akershus County. The politicians were especially interested in Simula's experience of collaboration with business and industry.

Hiring, gender equality and integration
At the end of 2009, Simula Research Laboratory had 39 full-time employees and 16 in part-time and secondary posts, for a total of 55 employees. Of that number, 47 were men and 8 were women, while 42 were Norwegian and 13 were foreign nationals.

Absence due to illness is extremely low throughout the Simula Group. No work-related illnesses or accidents were reported during the year.

In December 2008, Simula's administration set up two committees: The Gender Equality Committee and the Integration Committee. The Gender Equality Committee's work resulted in Simula's Board adopting an ambitious plan of action to raise the percentage of female employees in research positions to 25 per cent by 2015. In 2009, 25 per cent of Simula's PhD students were women, but the percentages are lower at the postdoctoral level and among scientific staff.

The Integration Committee observed that the foreign employees at Simula generally feel well integrated, and proposed some measures. A Cultural Affairs Committee was also set up to examine corporate culture conditions at Simula.

In December, Simula's Board adopted a new a Code of Ethics for all those acting on behalf of the Group. The Code of Ethics states that employees must adhere to the Group's values and work to promote the best interests of the Group in a long-term perspective.

Managers at the Simula Group have undergone HSE courses, and this requirement is followed up with a view to new managers. A review of Simula's HSE efforts indicates that they comply with current regulations, and that the main procedures have been documented and followed up in practice.

The Simula School
The Simula School of Research and Innovation AS (the Simula School) was established in 2007 to educate industrially relevant masters and doctoral students in collaboration with industrial players and the University of Oslo. Activities were stepped up at the Simula School in 2009 and, by year end, there were 37 PhD students and 15 postdoctoral fellows. Continued growth in 2010 is contingent on larger grants from the State and other sources of funding.

Since 2003, Simula has run a special course in science reporting for its own PhD students and postdoctoral fellows. In 2009, the Simula School also organised Norway's first nationwide research reporting course for scientists. There were more than 230 applicants for a workshop in March, and the 68 selected participants got to hear inspiring lectures by international experts on scientific communication. The workshop was funded by Statoil[1] and Telenor, with contributions from IT Fornebu, the University of Oslo and the Norwegian Defence Research Establishment.

In May, the Simula School signed an agreement with Statoil valued at MNOK 20. The agreement is part of Statoil's Academia Programme and is intended to stimulate research and research-based education within strategically important disciplines and areas of expertise. The funding is to be spent from 2009 to 2013 to stimulate research and education by contributing to an endowed professorship, strengthening applied research in the field, and encouraging doctoral dissertations and master's theses.

Simula Innovation AS
In 2009, Simula Innovation received a promise of MNOK 1.5 in verification funding from the Research Council of Norway. The funding will be used to investigate and develop the commercial potential of the SE-based project EstimationWeb, an Internet-based tool designed to enable developers to estimate costs and the size of programming projects.

In February, Simula Innovation and the Simula School conducted an innovation and entrepreneurial course for their own PhD students and postdoctoral fellows. Simula Innovation has also focused on patenting, not least by hosting PatSoft, the Nordic countries' leading patenting

and competence conference. There were several lectures delivered on the patenting process, and several patent routes have been initiated.

The Innovation Prize for 2009 was awarded to the ND project ICON, which featured a high level of innovation. Methods from the project have been implemented as important building blocks in equipment from Sun, Silicon Graphics and Dolphin Interconnect Solutions, and the methods are now used by NASA, among others.

Kalkulo AS

Kalkulo AS had a stable staff of ten employees by 31 December 2009, and sales are on the rise. Kalkulo is achieving an ever firmer foothold in the market, gaining several important new customers.

The committee points out that Simula is a unique institution with consistently high quality, and I am impressed by what Simula has managed to achieve. Simula has been achieving good results for quite some time both when it comes to combining research and education, and in terms of cooperating with business and industry.

The largest activity continues to be the Computational Geosciences (CG) project, involving cooperation between Kalkulo and Statoil to develop a better understanding of the processes that are important for developing hydrocarbon deposits. CG was expanded in 2008, then expanded again in 2009.

In 2008, the enterprise embarked on a pilot project with the state-owned power company Statkraft, which is interested in making a tool to visualise and quality control measurements of precipitation and temperature. Accordingly, Kalkulo is in the process of establishing long-term cooperation with Statkraft.

During the year, Kalkulo also established collaboration with the Sensor Systems Dept. at Kongsberg Defence Systems - Naval Systems & Surveillance. The project involves the development of software applications for sonars.

Kalkulo can look back on another year with good results.

Financial affairs

Simula's total operating revenues came to MNOK 76.1 in 2008. External project financing added up to MNOK 27.1. The result for the year was MNOK -3.5, which was transferred to equity.

The Simula Group's total operating revenues were MNOK 99.7 in 2009, and the net profit for the year was MNOK -5.2, after minority interests. It was budgeted with a loss of MNOK 6.3, showing that the result was close to original expectations.

The Simula School's total operating revenues were MNOK 29.1 in 2009, and the net profit for 2009 was MNOK -1.1.

Kalkulo earned total sales revenue of MNOK 9.2 in 2009. The operating revenue was MNOK 1, while result after tax and write-down of receivables was MNOK -0.8. In 2009, Kalkulo has given MNOK 1 in group contribution to Simula.

Operating revenues for Simula Innovation totalled MNOK 14.3, leaving a profit for 2009 of MNOK 0.6.

The going concern assumption still applies and is the basis for the annual accounts. The company has a good operating structure. No situation has arisen since year end that has had a material impact on the accounts as presented. The group plans for an annual profit of MNOK 2.5 for 2010. Simula Research Laboratory will contribute to this profit with MNOK 1.6; the Simula School plans for a balance; while Kalkulo is budgetting with a profit of MNOK 2.3. Simula Innovation is budgetting with a loss of MNOK 1.4.

Environmental issues

Simula's activities do not pollute the outdoor environment.

The work of the Board of Directors

Simula's Board met four times and had a total of 39 items on its agenda. The Board of Directors confirms that Simula has done well in a labour-intensive year. The Board of Directors is looking forward to the discussions of the evaluations by the Research Council and the Ministry of Education and Research. In 2010, the Board and management will assess what consequences the evaluations should have in terms of the Centre's strategy up to 2015. The Board of Directors would hereby like to thank all employees for their sterling efforts in the past year.

[1] **The company changed its name to Statoil ASA on 2 November 2009.**

SIMULA 2009

KEY FACTS

Simula Research Laboratory is a limited company owned by the Norwegian government (80%), Norwegian Computing Center (10 %) and SINTEF (10%).

THE BOARD OF DIRECTORS

Ingvild Myhre, Chair of the Board
Inger Stray Lien
Tormod Hermansen
Gunnar Hartvigsen
Mats Lundqvist
Amund Kvalbein
Ola Skavhaug

SCIENTIFIC ADVISORY BOARD

The Scientific Advisory Board (SAB) is appointed by Simula's Board to provide focused professional advice on Simula's operation. Simula Research Laboratory has appointed to the SAB five internationally recognised researchers, which cover all the scientific fields represented at Simula.

- Professor Barbara Kitchenham, Keele University
- Professor Andrew McCulloch, University of California, San Diego
- Professor Klara Nahrstedt, University of Illinois at Urbana-Champaign
- Professor Torger Reve, Norwegian School of Management
- Professor Lars Walløe, University of Oslo

MANAGEMENT

- Professor Aslak Tveito, managing director
- Cand. Jur. Ottar Hovind, deputy managing director
- Dr. Åsmund Ødegård, director of administration
- Professor Olav Lysne, director of basic research
- Professor Are Magnus Bruaset, director of research education and research applications

RESEARCH GROUPS

As of December 2009, the activities are reorganised in the following research groups.[1]

Applied Research on Software Verification and Evolution
Professor Lionel Briand

Practices for Estimation, Planning And Requirements
Dr. Hans Christian Benestad

Automated and Distributed Computing
Dr. Anders Logg

Biomedical Flows and Structures
Dr. Kent-Andre Mardal

Computational Cardiac Modeling
Dr. Molly Maleckar

Computational Geoscience
Dr. Stuart Clark

Media Performance Group
Professor Carsten Griwodz

Network Systems
Professor Tor Skeie

Telco Access and Core Networks
Professor Paal E. Engelstad

Wireless Networks
Dr. Yan Zhang

Inverse Problems
Professor Per Grøttum

SUBSIDIARIES

Simula School of Research and Innovation AS
Professor Are Magnus Bruaset

Simula Innovation AS
Dr. Audun Fosselie Hansen

Kalkulo AS
Dr. Christian Tarrou

[1] **Read more about the background of the reorganisation on page 17.**

It is internationally recognized that the number of young people, and in particular women, that are studying and choosing careers in Information and Communication Technologies (ICT) is decreasing and is not keeping up with growing demand. At Simula, the most obvious consequence of this is that women remain a minority among the employees. During 2009, a committee investigated the situation regarding gender equality and diversity at Simula. Based on the committee's work, a gender action plan[1] for the years 2010–2015 was developed and passed by the Board of Directors of both Simula Research Laboratory and the Simula School of Research and Innovation in 2009. The main goal of the action plan is:

"Simula will increase the percentage of women in amongst the employees. By December 2015, Simula should have at least 25% female employees within the categories of scientific and support staff."

The actions defined by the plan focus on targeted recruitment and hiring, as well as improvements to the working environment such as mentoring programs and representation of both genders in boards and committees.

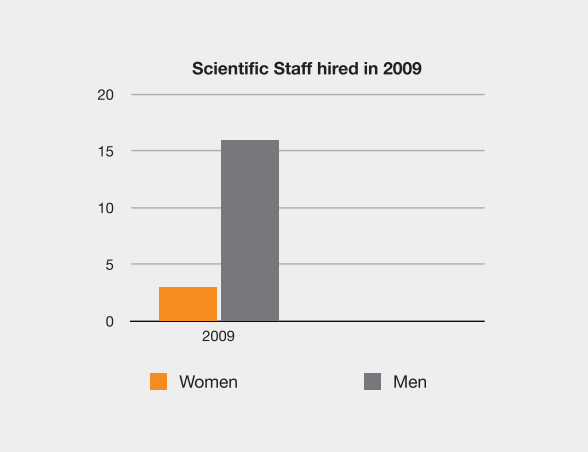
Simula has also signed Code of Best Practices for Women in ICT.[2] The Code aims not only to ensure that more women choose careers in the sector but also that they are encouraged and supported to remain and progress in their chosen area of work.

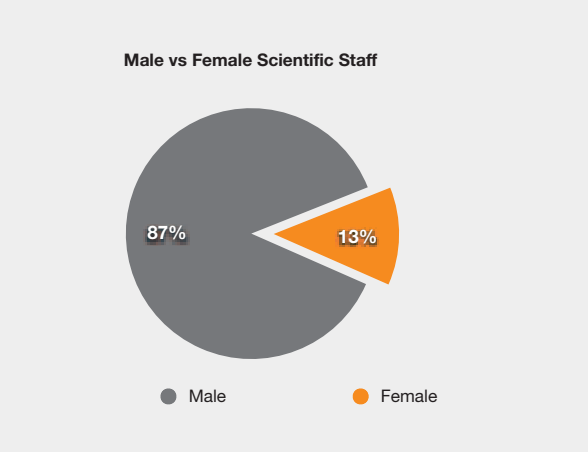
In 2009, another committee investigated the situation regarding integration aspects at Simula. Simula recruits personnel from all over the world. At the end of 2009, 22 nationalities were represented among the employees, and 34 per cent of the employees were from countries outside Scandinavia. The 21 persons hired in 2009 represented 14 different nationalities. The committee found that foreign employees in general are satisfied with the environment at Simula and feel well integrated. Formal communication within the research groups and between an employee and their immediate leader was found to be satisfactory, but there was discovered room for improvement regarding the more informal communication, for instance about events and social activities.

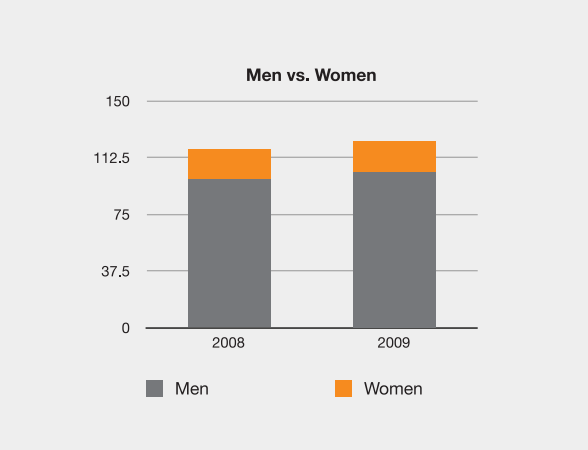
GENDER EQUALITY, DIVERSITY AND INTEGRATION

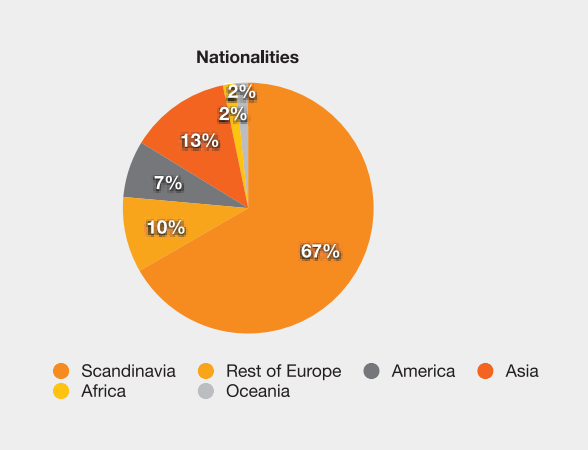
Simula will increase the percentage of women in amongst the employees. By December 2015, Simula should have at least 25% female employees within the categories of scientific and support staff.

In order to improve on the internal communication, Simula will continue providing Norwegian courses to all foreign employees. In addition, information screens have been set up, which show internal news, an introduction of new employees, and a calendar of both professional and social activities going on.









[1] http://simula.no/about/gender-action-plan-2010-2015
[2] http://ec.europa.eu/information_society/activities/itgirls/doc/code.pdf

WHEN 1+1 IS MORE THAN 2

By Are Magnus Bruaset

If you are like me, you often find yourself unfolding a paper clip – usually an act of boredom or stress relief. Still, watching the transformation from a simple, yet effective device back to a thin and seemingly impotent wire is in some sense a backwards journey into innovation. Simple designs and ideas are inherently beautiful and have an immense power, not only back in the 1870s when the paper clip was invented, but also in today's complicated world.

Taking a step back and trying to overlook major scientific findings and technological advancements of our time, the roles of the Inventor and the Explorer seem to have been strongly reduced, even on the verge to becoming extinct. There are hardly any Edisons or Faradays anymore. Instead, it is the output of teamwork, often of interdisciplinary nature, that moves science and technology onwards over time. In a way, such collaborative efforts pave the way for "simple" solutions. The combination of bits of knowledge that are well known, may be even trivial, in their respective domains can give new insight and provide novel strategies for the solution of complicated problems. It is when the vibrant interface between two seemingly boringly standard units of knowledge or technology gets a value of its own – the situation in which one plus one gets to be more than two.

Entering a philosophical mode, it is may be not that surprising that the combination of simple building blocks may devise a solution to a complicated problem. As a concept deeply buried in nature, complicated structures are often the result of repeated application of simpler structures. Just think of the fractal shape of a snowflake, observing the repetition of quite simple patterns growing into a complex and beautiful whole. From this perspective, it seems only logical that complicated problems are composed of simpler subproblems, and that an effective solution to the problem should mirror this telescoping structure. Taken literally, the overlay of nature's own solutions on top of our man-made problems makes us enter the fascinating field of biomimicry. In this field of science one looks to nature to find inspiration for our design problems, for instance using the knowledge of the skin structure of the Galapagos shark to design bacteria-repellent surfaces in hospitals. If you haven't already enjoyed Janine Benyus' eminent lectures on biomimicry, you are in for a treat. Just go to the website of TED.com and search for her name. And while you are there, snoop around for other presentations. The TED site is like a big container of canned innovation – ready to go when you need it.

In information technology, Simula's own domain of research, nature's hierarchical layout of solutions is present in the way modern computer programs are constructed.

Simple operations are combined to more powerful compound operations, leading to software components that are combined to solve a given problem. The same approach can be applied even to a higher metalevel, for instance in the way one merges existing solvers for fluid flow and deformation of solid structures to simulate an intricate fluid-structure problem – say the pulsating flow of blood through a vein or artery.

At Simula, researchers are computing the flow patterns in the blood vessels known as the Circle of Willis, a particular network of arteries supplying blood to the brain. The wall of these vessels may be subject to balloon-like bulges known as aneurysms, and under certain flow conditions such blood-filled anomalies may become life threatening. The clinicians now look to computer simulations to better understand the formation of the aneurysms, indications for when to perform surgery, and the effect of different surgical interventions. These biomedical simulations of blood flow are example of interdisciplinary work that Simula conducts together with the University Hospital in Tromsø. A team consisting of physicists, mathematicians, computer scientists, imaging experts and neuroradiologists is heading for a deeper understanding of a fundamental medical problem.

In our collaboration with the oil and gas company Statoil, there are several similar experiences of innovation emerging at the interface of complementary competence. One example is a technology referred to as Compound Modelling, which is a novel approach to construction of computer models of extremely complex geological structures. While the concept of this technology was present in the mind of one of Statoil's researchers for many years, and even manifested for simple two-dimensional slices through a stack of geological layers, it was at the meeting point with the geometrical competence in Simula's subsidiary Kalkulo that the full power of Compound Modelling was unleashed. Clever adaptation of a well-known technology known as Fast Marching methods has brought this type of geological modelling out of the research environment and into the oil company's operational units. Today, this technology is regarded as a competitive advantage that plays a considerable role in Statoil's business-critical matters.

Still roaming around in the sphere of computational geosciences, there is also the example of the 4D Lithosphere Model (4DLM). For more than a decade an idea lurking in a geologist's mind, now it is a concrete software solution born at the intersection with Kalkulo's competence on advanced visualisation. Without the novel combination of well-established geological concepts and advanced, yet well-known, visualisation techniques, the 4DLM technology would have ended up trapped in a mental vault.

A different branch of Simula's research concerns state-of-the-art methodology for model-based verification and validation of mission-critical software. In a tight collaboration with industrial partners, this methodology is further developed through application to real-life software systems, for instance in the maritime and energy sectors. Such systems need to run stably 24/7, year after year, to control critical operations like oil drilling or steering of vessels filled with potentially dangerous cargo. Failure of such systems threatens economy, environment and safety, and can lead to catastrophic consequences.

Since information technology is a tool that is valuable, or even indispensible, in a wide range of scientific fields, an institution like Simula should pursue interdisciplinarity in connection to the education of the next generation of researchers. This goal is addressed in the research collaborations referred here, and in several others, but there is still a room for considerable improvement.

Right now, Simula is developing a comprehensive proposal for a new centre for research-based innovation (SFI), targeting industrial challenges concerning software reliability. The competition for such a centre is fierce, and no victory can be celebrated in advance. However, if the proposal is successful, such a centre will provide an arena in which researchers, industry and public agencies will meet to solve software-related problems of immense importance to society. Such a centre could also prove to be a powerful vehicle for interdisciplinary education.

Looking back over the shoulder, it seems clear that the researcher and technologist of today should come to the market with an open mind, searching the crowd for new and interesting acquaintances from other disciplines. It is at the overlap of these minds new and innovative ideas are formed.

After all, who needs yet another paper clip?

RESEARCH ACTIVITIES 2009

ICON

A computer consists of several entities that perform specified tasks. To support the collaboration between all the entities that constitute a computer, there is an interconnection network that allows them to communicate. Thus, the interconnection network lies at the heart of the architecture of any computer, and the performance and reliability of the computer depends heavily on the performance and reliability of the interconnection network. The ICON project focuses on ways to connect these entities so that they yield the best possible performance.

Professor Tor Skeie,
project leader

RELAY

The RELAY project addresses the performance issues of distributed systems by investigating distribution mechanisms, networks, and operating system support that provide quantifiable better resource utilisation and that improve the provided quality of service and quality of experience. Our research is driven by visions of a better user experience for various real-life applications, and research problems are taken from real problems experienced in industry or society.

Professor Pål Halvorsen,
project leader

ROBUST FLOW SOLVERS

Modelling and predicting fluid flow is an important issue in many branches of science and technology. The Robust Flow Solvers project aims to develop and implement robust adaptive finite element methods for viscous and turbulent fluid flow. In particular, we are interested in the development of general, reliable, and efficient flow solvers for the simulation of biomedical flow problems on complex geometries. The flow solvers are based on the software developed by the Computational Middleware Project and used as the basic building blocks for simulating complex flow problems in the Biomedical Flows Project.

Anders Logg,
project leader

http://simula.no/research

REPAIR

The REPAIR project works towards scalable solutions for maintaining network operations with satisfactory performance during failures or other challenging scenarios. Our focus is on routing, measurements, and control mechanisms at the networking layer. The project strives to identify main challenges to network operations, understand their root causes, and create solutions that will influence the way future network protocols are defined.

Amund Kvalbein,
project leader

RESILIENT WIRELESS NETWORKS

The goal of the project is to advance wireless systems design. Development in wireless systems has recently exploded with the significantly increasing number of mobile terminals, such as mobile phones and laptops. According to this trend, it has become a basic requirement to access enterprise networks and the Internet anywhere, anytime. The project will identify the causes leading to failure, design efficient mechanisms to solve the problems, and provide suggestions to improve performance.

Yan Zhang,
project leader

CARDIAC COMPUTATIONS

This project concerns computer simulations of the electrophysiology and mechanics of the heart. The purpose of the project is to develop an efficient and accurate simulator for the electrical and mechanical behavior of the heart, and the focus of the project will be to develop methods and software to solve the problem efficiently. In addition, we will use the simulator to study problems related to cardiac function.

Glenn Terje Lines,
project leader

COMPUTATIONAL MIDDLEWARE

Research in scientific computing relies heavily on the use of appropriate software. Developing such software is very a time-consuming yet integral part of the research. With better tools for creating scientific software, costs can be reduced and the resulting codes become more robust and reliable. Our goal is to advance scientific software in general and create frameworks for international distribution that can accelerate research in computational science and engineering.

Ola Skavhaug,
project leader

INVERSE PROBLEMS

In the Inverse Problems project we focus on one particular heart condition, ischemic heart disease. Ischemia is a reversible precursor of heart infarction that typically is caused by partial blockage of one or more of the arteries/ vessels supplying blood to the heart. Our approach does not follow the methods of contemporary medical research; instead, we use mathematics and computers to gain insight into this health problem. More specifically, we address the following challenge: Is it possible to use mathematics, medical knowledge, computers, and ECG recordings to determine the size and location of an ischemic region in the human heart?

Bjørn Fredrik Nielsen, project leader

BIOMEDICAL FLOWS AND STRUCTURES

This project will use the methods and software from the Computational Middleware and the Robust Flow Solvers projects to attack challenging biomedical flow problems - a new and vital class of challenging physical problems where mathematical modeling is in its initial stages. Computational biofluid mechanics is an emerging field that is already beginning to have an impact on the design of medical devices, the development and planning of surgical procedures, and the enhancement of the scientific understanding of human development, disease and aging.

Kent-Andre Mardal, project leader

COMPUTATIONAL GEOSCIENCE

Today, most of the major offshore fields on the Norwegian Shelf have been explored, and the industry must search for new, profitable reserves globally. New exploration workflows will require a stronger methodology and better software tools, based on tight links between different areas of expertise. Since early 2005, Simula and Statoil have built a strong and long-term research collaboration in Computational Geosciences. The main goal for this collaboration is to strengthen the procedures used in oil and gas exploration through new and improved computer-based models of geological and geophysical processes.

Professor Are Magnus Bruaset, project leader

COMPUTATIONAL BIOLOGY

This project focuses on two different areas in computational biology, on the mechanisms of cardiac arrhythmias, and on the dynamics of evolutionary processes. Our aim is to elucidate mechanisms underlying cardiac arrhythmias, which may contribute to improving medical prevention and intervention techniques. In addition, we aim to uncover answers to questions focused on main areas of evolutionary biology, speciation and development.

Kirsten ten Tusscher, project leader

BEST

Inaccurate estimation of software development effort is one of the most important reasons of IT project failures. While too low effort estimates may lead to project management problems, delayed deliveries, budget overruns and low software quality, too high effort estimates may lead to lost business opportunities and inefficient use of resources. The goal of the BEST project is to improve software cost estimates through better training, practices and tools. Our focus is on estimation processes that rely on human judgment as a key element. Results from the BEST project aims at better control of software projects and more efficient use of IT resources and investments.

Hans Christian Benestad, project leader

APPROVE

Society increasingly depends on software systems. For example, complex safety-critical software is embedded in many systems across most industry sectors, ranging from automotive and aerospace, to energy and maritime. In the context of evolving software systems with typical life spans of 10 to 20 years, the unavoidable and often unanticipated changes to system requirements and platform technical characteristics make it difficult to achieve and sustain high system dependability. Our goal is to help the industry address long-standing, hard problems related to the verification, validation, and evolution of their software-based systems. We aim to do so by devising novel, scalable, and configurable approaches.

Professor Lionel Briand, project leader

RESEARCH ACTIVITIES

Photo: Sverre Chr. Jarild

BASIC RESEARCH

2009 was an important milestone in the strategic discussions at Simula. We are working in five-year cycles, and this year – at the end of the second cycle – a major evaluation of Simula was undertaken. For Basic Research, the evaluation represents a moment of truth. This is the year the strategies that were established in early 2005 will be put to the test, the hard work of all our researchers over the past five years will be scrutinized and weighed, and the true value of our successes will be measured.

Preparing for this evaluation required considerable work by many people dedicated to its success. A thorough self-evaluation was prepared and delivered to the evaluators. The result was a reward for all the effort put in over the past five years. Our Scientific Computing Department was deemed Excellent in every aspect, Software Engineering was judged to be Excellent as well, and Networks and Distributed Systems was considered Very Good with some Excellent projects. In the previous scientific evaluation of 2004, the report stated that "the Evaluation Committee is impressed with the progress and level of activity achieved at the Simula Research Laboratory in the comparatively short time since its foundation. The organisation has succeeded in generating a vibrant research culture and is now operating as a highly effective research unit with growing international recognition". The renewed scientific evaluation of 2009 confirmed for us that we have further improved our activities: "The Evaluation Committee is impressed by the consistency and overall high quality of the activities of the Simula Research Laboratory". Further, the committee that evaluated Simula as a concept wrote "Simula has built capacity in comparatively new fields and established itself as a strong research-performing institution doing excellent science". These positive evaluative statements are supported by Statoil's investment of more than 40 million NOK in research at Simula, in that Simula's research results are used in the construction of some of the biggest supercomputers in the world, and in that Simula is highly productive in terms of publications and presentations in the leading scientific journals and conferences in our research fields.

The evaluation results for Basic Research are strikingly good, when measured by any standard. Still, after having celebrated the results, we now must consider them a part of our past and turn our attention toward the future. We must define new and daring research strategies, educate new and promising research leaders, and take a close look at how we have approached our work previously to determine what needs to be changed. The scientific evaluation report will help us to a certain extent in this self-examination. The evaluators observed that departmental growth had added to the responsibilities of those who served as department leaders, and this was believed to be overly taxing when taken into consideration along with their primary functions.

Further, the evaluators questioned whether the prevailing department structure had the necessary flexibility to support a dynamic strategy process.

Simula has been in existence for nine years. At the outset, it was decided that the centre should focus on three areas of research: networks and distributed systems, software engineering, and scientific computing. Three research departments were formed, one in each of these three research areas, and ever since, these departments have served as the foundation upon which all activities at Simula, and later, Basic Research, have been based. Within all three research areas, we have succeeded in fostering world-class research activities. Currently, however, we are ready to begin a new five-year cycle. Now is the time to decide the research problems on which we will concentrate in upcoming years. Now is the time to start envisioning which new results we want to present when our activities are evaluated in 2014. Now is the time to shape and streamline our organisation, so that our research is done as efficiently as possible.

Throughout the past nine years, the research departments have served well as foundations for our strategy. Looking toward the future, however, it has become clear that we need to revitalize their basic structure in order to remain dynamic and aggressive. Thus, near the end of 2009, we reorganised our departmental structure. From 2010 forward, Basic Research will now be organised around a total of ten research groups. These will stem from our previous departments, so our ambition to do research in the three original research areas will continue to prevail. The ten research groups, however, differ in both size and staffing profiles. Further, while the previous departments were defined based on research areas, each of the new research groups is focused around a small set of defined research problems. A list of these research groups can be found in the Simula facts section on page 10.

We must define new and daring research strategies, educate new and promising research leaders, and take a close look at how we have approached our work previously to determine what needs to be changed.

Reorganising Basic Research should allow us to fulfil many goals. First, it should give us greater flexibility in our definition of a research strategy for the next five years. Second, it should offer us the opportunity to recruit and cultivate the next generation of research leaders. Finally, it will challenge the whole organisation to move on and continue working towards great scientific achievements.

Currently, we believe that we have fulfilled all of our intentions regarding the reorganisation. The year 2010 should provide some answers as to whether our confidence is justified.

Professor Olav Lysne,
Director of Basic Research

RESEARCH ACTIVITIES

RESEARCH APPLICATIONS

For Norway to stay at the economic summit and continue to prosper, our knowledge driven industry must grow and improve its capability of competing on the international scene. To reach such goals, there is urgent need for research that can provide solutions to the technological challenges faced by individuals, industry, and society.

Being a laboratory at the international frontier of research in information technology and communication, it is natural that Simula will focus on fundamental scientific problems with a large potential for important applications in society. In tandem with conducting basic research and educating researchers, Simula's mission is to promote the application of the research in both private and public sectors. The Research Applications unit is the base for such application-driven activities. This unit houses also the subsidiary Simula Innovation AS, which constitutes the laboratory's main instrument for innovation and entrepreneurship.

Scientific integration with research groups

The Research Applications unit benefits from a tight scientific integration with Simula's internationally acknowledged research groups. Due to the high scientific standing of Simula as a whole, the laboratory stands out as an attractive partner for innovation and commercialisation activities.

At Simula, the outlets of innovation have taken on different forms: large, long-term industrial collaborations; pilot projects investigating the commercial potential of selected research results; and the establishment of commercial spin-off companies, possibly co-owned by external investors. In particular, industrial collaborations with Statoil, Telenor, and Det Norske Veritas have evolved into strong research-based alliances that can have a significant impact on science and business. These collaborations go far beyond joint publication of academic papers, generating output that has either an industrial impact through its use by our industrial partners, or possesses significant potential for commercial spin-off.

An example of industrial collaboration

Ideally, the coupling between academic research tasks and technology development should be bidirectional in that development-oriented activities lead to new PhD and postdoctoral research projects, and vice versa. Such an intimate connection between the axes of research and development is a particular strength in the Statoil-Simula collaboration. This feature is a consequence of both companies being committed to long-term research, and the flexibility offered by Simula's organisation. This particular collaboration is motivated by the need of constructing and investigating novel computational methods for use in oil and gas exploration.

Over time, Statoil's project funding has been divided more or less equally between research and development tasks. Inside Simula, these types of tasks are split between Simula School of Research and Innovation and the commercial subsidiary Kalkulo AS. To ensure tight communication between the different activities, all elements of the Statoil-funded work are under the same project management. Statoil and Simula share the view of this collaboration being of strategic importance, and both companies plan for long-term continuation and extension of the activities.

Being a laboratory at the international frontier of research in information technology and communication, it is a natural consequence that Simula will focus on fundamental scientific problems with a large potential for important applications in society

Characteristics of successful projects

Although the innovation activities at Simula have been quite successful, there is still considerable room for improvement. The obtained experiences form a solid basis for further design and revision of Simula's mechanisms for technology transfer. An evaluation of the most successful and promising projects and spin-off companies, thus far, has shown that they share a mix of the following characteristics:

- The innovative idea has root in the core activity of a basic research project in one of the research departments at Simula.
- The research activity has a strong foundation in a strategic collaboration with a major industry or financial partner.
- The commercialisation process has been a close collaboration with other technology transfer offices (TTOs) like Birkeland Innovation at the University of Oslo, incubators like IT Fornebu Incubator, or other commercialisation experts.
- The researchers are the key assets in the commercialisation projects and spinoff companies, because the technologies, products, and services are extremely knowledge-based.

Professor Are Magnus Bruaset,
Director of Research Applications

INVERSE PROBLEMS

For several years, Simula has addressed the question of whether it is possible to use mathematical models and computer-based simulations to determine the impact and location of ischemia in the human heart from ECG recordings. This research activity has entered a verification phase, in which collaboration with medical expertise and clinical trials are vital. In agreement with the increased focus on the application aspect, this project was moved from the Basic Research unit to Research Applications in the fall 2009. The project is led by Per Grøttum.

SIMULA INNOVATION

In 2009, Simula Innovation AS received a pledge of MNOK 1.5 in verification funding from the Research Council of Norway. This funding will be used to investigate and develop the commercial potential of the EstimationWeb project, an Internet-based tool designed to enable developers to estimate costs and the size of programming projects.

In February, Simula Innovation AS and the Simula School conducted an innovation and entrepreneurial course for the school's PhD students and postdoctoral fellows. Simula Innovation has also focused on patenting, not least by hosting PatSoft, the Nordic countries' leading patenting and competence conference. This conference hosted several lectures on the patenting process.

The Innovation Prize for 2009 was awarded to the ICON project. Methods from this project have been implemented as important building blocks in equipment from Sun, Silicon Graphics and Dolphin Interconnect Solutions, and the methods are now being used by NASA, among others.

KALKULO

Kalkulo AS had a stable staff of ten employees per 31 December 2009, and sales are on the rise. Kalkulo is currently achieving an ever-firmer foothold in the market, gaining several important new customers.

The company's largest activity continues to be the Computational Geosciences (CG) project, involving cooperation between Kalkulo and Statoil to develop a better understanding of the processes that are important for developing hydrocarbon deposits.

In 2008, the Kalkulo embarked on a pilot project with the state-owned power company Statkraft, which is interested in making a tool to visualise and quality control measurements of precipitation and temperature. The first generation of this tool is already in use in Statkraft, and the two companies are in the process of establishing a long-term cooperation.

During the year, Kalkulo also established collaboration with the Sensor Systems Department at Kongsberg Defence Systems - Naval Systems and Surveillance. This project involves the development of software applications for sonar networks.

RESEARCH EDUCATION

Simula School of Research and Innovation is the organisational instrument for all levels of education at Simula Research Laboratory. In particular, these levels count master students, research trainees, PhD students and postdoctoral fellows. The research trainee level refers to a one-year position that is used to assess and prepare candidates for a PhD project. All PhD students and postdoctoral fellows at Simula are associated with projects in the relevant basic research groups and are working closely together with the other project members.

The results obtained in the first two years of the school's existence were assessed in the recent scientific evaluation of Simula Research Laboratory. The committee clearly expresses that it "strongly supports the creation and continued implementation of SSRI as a core educational component of Simula". Moreover, the committee states that:

SSRI could well grow to become a national resource for science education and take on a role as a coordinating center across several universities. … Such opportunities should be explored and strengthened.

In the pursuit of such an ambitious potential, the committee recommends the School to develop courses based on Simula's special competence. Such courses could for instance be offered as combinations of intensive workshops and online services. Moreover, course offerings could be a vital component in increased collaboration with Universities outside the Oslo region.

About the School

The aim of the Simula School is to educate highly qualified researchers within the field of information technology and communication, as an attractive resource for academia, industry, and the society at large. A partner university, in most cases the University of Oslo, awards the doctoral degrees.

Currently, the school also employs PhD students who pursue their degrees at NTNU, Texas A&M University, University of California in San Diego, and Ludwig Maximillians Universität in Munich. In all cases, the regulations of the PhD programs at the partner universities apply in full. In the school, instruction and supervision are given within Simula's specialist research areas networks and distributed systems, scientific computing and software engineering.

The Simula School strives to achieve a high PhD completion rate and a standard time frame for PhD programmes. Management development programmes and career guidance at postdoctoral level are other key elements of the School's activities.

The Simula School encourages and assists the students in establishing close connections with industry as a result of exchange programmes and international collaboration. Through specific initiatives and activities the School will ensure the necessary academic and social conditions to allow the students to focus on their work and conduct their research effectively.

Important issues in 2009
Five of Simula's employees defended their doctorates in 2009, and seven are expected to defend their theses in 2010. As of 31 December 2009, the school has 56 employees of which 37 are PhD students and 15 postdoctoral fellows.

In 2009, the Simula School has focused on two specific initiatives designed to enhance the competence of the students and postdoctoral fellows in research dissemination and in innovation and commercialisation. The annual course on Communicating Research in Science, which is co-developed with Pennsylvania State University, was offered as a national workshop in March 2009. For the selection of the 68 workshop participants, the School received more than 230 applications from students across all Norwegian educational institutions that are authorised to award doctoral degrees. The event was realised by generous funding from Statoil and Telenor, and was also sponsored by the University of Oslo, IT Fornebu and the Norwegian Defence Research Establishment (FFI). The feedback from the participants has been unanimously positive, and a series of surveys measuring the effect and quality of the teaching has documented statistically significant improvements of the participants' communications skills. These results have been presented at two major educational conferences.

Complementing the communication course, the Simula School has collaborated with Simula Innovation in order to give the course Innovation and Entrepreneurship. In this course, the students combined lectures with work on business cases based on their own research. The final results included several proposals that will be considered for further development in Simula Innovation.

The Simula School aims to cooperate with relevant players in the public and private sectors, and with higher educational and research institutions both in Norway and abroad. The Simula School is engaged in a range of activities to introduce the school to potential players in industry who could become partners in the future. This year the School entered into a five-year agreement with Statoil, which in total will provide 20 million NOK for PhD and postdoctoral research projects in computational geosciences. The agreement is part of Statoil's Academia Programme. In addition, the School is indirectly involved in Simula's collaboration with Det Norske Veritas, which funds PhD students and postdoctoral fellows employed in the school. The Simula School has also entered a long-term collaboration agreement with Texas A&M University.

The Simula School has also continued its collaboration with Valler Upper Secondary School. This initiative will provide a basis for the development of further cooperation between upper secondary schools and Simula.

The school has arranged a seminar for the Simula personnel involved in supervision of PhD students, targeting topics concerning progression of PhD studies, gender issues, and a multi-cultural working environment.

Personnel and working environment
The working environment at the Simula School is generally good. The School aims to provide its employees with the best possible working environment to allow them to focus completely on demanding research assignments. Of the 56 employees, 12 are females and 35 come from countries other than Norway. In particular, at year-end 22% of the PhD students in the School are female.

During the year, two committees have been at work at Simula, investigating gender issues and integration. The committees have recently completed their reports, which will become the basis for new action plans. The School is an integral part of Simula, and the actions taken at corporate level will equally address the School's needs.

Looking ahead
The aim of the Simula School is to increase its number of doctoral candidates and at the same time enhance the quality of the education. The need for graduates with a high level of ICT expertise is great, in academia as well as in industry and society.

In the coming year, the School will in particular address the relevant comments and recommendations given in the scientific evaluation of Simula, and make strategic decisions on the route for future development of the school.

Professor Are Magnus Bruaset,
Director of Research Applications

OWNERSHIP STRUCTURE

As of 31 December 2009 the Simula School had the following shareholders:

Simula Research Laboratory AS (56 %)

Statoil (21 %)

Bærum Municipality (14 %)

Telenor Communication II (7 %)

SINTEF Holding AS (1 %)

The Norwegian Computing Center (1 %).

RESEARCH EDUCATION

MASTERS*	SUPERVISORS	THESES
Bakken, Morten Hordnes	Dag Sjøberg	Quality definitions and defect classes used in experiments on software inspection
Damjanovic, Miran	Lionel Claude Briand	Model Based Testing: A State Machine-based Tool for automated Testing of a Video Conferencing System
Eimot, Magne	H. Kvale Stensland Pål Halvorsen Carsten Griwodz	Offloading an encrypted user space file system on Graphical Processing Units
Erikstad, Geir Arveschoug	Pål Halvorsen Paul B Beskow	Latency reduction in distributed interactive applications by core-node selection and migration
Fjeld, Fredrik	Hans Petter Langtangen	Extending DataPool: A Tool for Handling Input Data in Scientific Computing, Using Python Web Frameworks.
Fløisbonn, Erik	H. P. Langtangen Arve Knudsen	Integrating Conduit with Windows Installer
Fredriksen, Ivar Ulvik	Magne Jørgensen	Empirical research on relative and absolute effort estimation in software development projects
Gaarder, Fredrik	Pål Halvorsen Carsten Griwodz	Video Streaming into Virtual Worlds
Gudmundsen, Tommy	Pål Halvorsen Carsten Griwodz	Periodic Broadcasting Protocol - implementation and measurements
Klykken, Tonje Elisabeth	Lionel Claude Briand	A Case Study using SysML for safety-critical systems
Lunde, Carl Henrik Holth	Pål Halvorsen Carsten Griwodz	Improving Disk I/O Performance on Linux
Mehmandarov, Rustam Karim	Hans Petter Langtangen	DataPool: A Tool for Handling Input Data in Simulation Programs
Mikalsen, Christian	Pål Halvorsen Carsten Griwodz	Moving into the Cloud
Myrseth, Martin Øinæs	Carsten Griwodz Pål Halvorsen Håkon Kvale Stensland	Architecture (SOA) and Software as a Service (SaaS)
Orucevic, Mili	Dag Sjøberg	Quality definitions and measurements in software engineering experiments on pair programming

DOCTORATES & MASTERS DEGREES

MASTERS*	SUPERVISORS	THESES
Ottesen, Alexander	H. Kvale Stensland Carsten Griwodz	Efficient parallelisation techniques for applications running on GPUs using the CUDAframework
Ree, Kjetil Hansen	Jo Hannay	How do software practitioners value research when making decisions?
Retvedt, Torkild	Pål Halvorsen Carsten Griwodz	Solid State Disks vs Magnetic Disks: Making the right choice
Rognerud, Heidi Jacobsen	Jo Hannay	Challenges in Enterprise Software Integration: An Industrial Study using Repertory Grids
Skjegstad, Magnus	Olav Hol Carsten Griwodz Frank Trethan Johnsen	Search+: An efficient P2P Service Discovery Mechanism
Snoksrud, Bjørnar	Alexander Eichhorn Pål Halvorsen	Implementation of an Adaptive Stream Scaling Media Proxy with the data path in the Linux Kernel
Wahlberg, Aron	Anders Logg Achim Schroll	Evaluation and Comparison of Duality-Based A Posteriori Error Estimates
Walle, Thorbjørn	Jo Hannay	Personality and Pair Programming: How do Pair Programmers Collaborate?
Wilbers, Ilmar	H. P. Langtangen	A Problem Solving Environment for Partial Differential Equations in Python

DOCTORATES*	SUPERVISORS	THESES
Benestad, Hans Christian	Bente Anda Erik Arisholm	Empirical Assessment of Cost Factors and Productivity during Software Evolution through the Analysis of Software Change Effort
Hake, Johan	Glenn T. Lines Joakim Sundnes	Calcium dynamics in signaling micro domains of cardiac myocytes - a modelling study
Petlund, Andreas	Carsten Griwodz Pål Halvorsen	Latency-improving mechanisms for reliable, interactive thin-stream applications
Ruud, Tomas Syrstad	Bjørn F. Nielsen Ola Marius Lysaker	Contributions to Simplifying Bidomain Simulations
Vik, Knut-Helge	Carsten Griwodz Pål Halvorsen	Group Communication Techniques in Overlay Networks

* **candidates supervised throughout their PhD/MSc projects by researchers at Simula.**

FINANCIAL STATEMENTS 2009

2008	2009	INCOME STATEMENT	Note	2009	2008
GROUP				PARENT COMPANY	
93 727 791	99 701 039	OPERATING REVENUES	6	76 126 989	71 785 384
		OPERATING EXPENSES			
68 135 277	72 572 882	Cost of labour	5	55 860 819	50 297 226
2 140 790	1 993 824	Ordinary depreciation	3	1 861 520	2 085 340
28 641 468	28 771 084	Other operating expenses	5, 14	23 216 503	23 126 175
98 917 535	103 337 790	TOTAL OPERATING EXPENSES		80 938 842	75 508 741
-5 189 744	-3 636 751	OPERATING PROFIT		-4 811 853	-3 723 357
		FINANCIAL ITEMS			
1 324 087	614 512	Other interest income		345 923	1 006 023
47 307	41 545	Other financial income		1 024 059	16 056
3 949	19 101	Other interest expenses		1 470	2 282
47 309	2 617 099	Other financial expenses		23 390	29 618
1 320 136	-1 980 143	RESULT OF FINANCIAL ITEMS		1 345 122	990 179
-3 869 608	-5 616 894	PROFIT BEFORE TAXES		-3 466 731	-2 733 178
692	76 059	TAXES FOR THE YEAR		-	-
-3 870 300	-5 692 953	NET PROFIT		-3 466 731	-2 733 178
-797 214	-471 379	Minority Interests		0	0
-3 073 086	-5 221 574	RESULTS AFTER MINORITY INTERESTS		-3 466 731	-2 733 178
		TRANSFERS			
		Transferred to equity		-3 466 731	-2 733 178
				-3 466 731	-2 733 178

2008	2009	BALANCE SHEET		2009	2008
GROUP			Note	PARENT COMPANY	
		TANGIBLE FIXED ASSETS			
		Fixed assets			
4 134 605	2 683 842	Furniture, equipment, etc.	3	2 521 736	4 016 044
4 134 605	2 683 842	Total fixed assets		2 521 736	4 016 044
		Financial fixed assets			
2 445 900	2 431 650	Investments in shares	12	-	-
-	600 000	Other receivables		-	-
-	-	Investments in subsidiaries	10	5 319 700	5 319 700
2 445 900	3 031 650	Total financial fixed assets		5 319 700	5 319 700
6 580 505	5 715 492	TOTAL FIXED ASSETS		7 841 436	9 335 744
		CURRENT ASSETS			
		Receiveables			
5 921 432	8 395 582	Accounts receivable		5 375 163	2 704 287
5 279 274	8 136 647	Other receiveables		8 233 296	4 122 220
11 200 706	16 532 229	Total receivables		13 608 459	6 826 507
15 687 502	17 191 949	Bank deposits	9	8 767 212	8 865 625
26 888 208	33 724 178	TOTAL CURRENT ASSETS		22 375 671	15 692 132
33 468 713	39 439 670	TOTAL ASSETS		30 217 107	25 027 876
		EQUITY			
		Paid-in equity			
1 500 000	1 500 000	Share capital	7,8	1 500 000	1 500 000
1 500 000	1 500 000	Total paid-in capital		1 500 000	1 500 000
		Earned equity			
6 764 927	6 983 968	Other equity	8	3 330 085	3 754 523
1 762 179	1 290 800	Minority Interests	8	0	0
8 527 106	8 274 768	Total earned equity		3 330 085	3 754 523
10 027 106	9 774 768	TOTAL EQUITY		4 830 085	5 254 523
		LIABILITIES			
		Short-term liabilities			
4 894 847	4 162 012	Accounts payable		7 157 257	9 234 249
692	678 430	Tax payable	13	0	0
5 843 950	5 886 290	Duties payable		3 143 853	2 569 674
12 702 118	18 938 170	Other short-term liabilities		15 085 912	7 969 220
23 441 607	29 664 902	Total short-term liabilities		25 387 022	19 773 353
23 441 607	29 664 902	TOTAL LIABILITIES		25 387 022	19 773 353
33 468 713	39 439 670	TOTAL EQUITY AND LIABILITIES		30 217 107	25 027 876

FINANCIAL STATEMENTS 2009

NOTE 1 – ACCOUNTING PRINCIPLES

The financial statements have been prepared pursuant to the regulations in the Norwegian Accounting Act of 1998. The statements have been drawn up in accordance with Norwegian accounting standards.

The main rule for the valuation and classification of assets and liabilities

Assets intended for permanent ownership or use are classified as tangible fixed assets. Other assets are classified as current assets. Receivables to be paid back within one year are always classified as current assets. The same criteria are applied to the classification of short- and long-term liabilities.

Fixed assets are valued at acquisition cost, but written down to their fair value if the reduction in value is believed to be of a permanent nature. Fixed assets are depreciated systematically over the useful life of the asset. Long-term liabilities are recognised at their nominal values on the date the debt was incurred. Long-term liabilities are not revalued to fair value in response to interest rate fluctuations.

Current assets are valued at cost or fair value, whichever is lower. Current liabilities are recognised at their nominal values on the date the debts were incurred. Current liabilities are not revalued to fair values in response to interest rate fluctuations.

Certain items are valued according to other rules, as explained below.

Foreign currencies

Assets and liabilities in foreign currencies are translated into Norwegian kroner at the mid-rates quoted by Norges Bank on the day of balance sheet recognition.

Tangible fixed assets

Tangible fixed assets are generally depreciated over the expected useful life of the asset. Depreciation is generally distributed on a straight line basis over the expected useful life of the asset.

Receivables

Accounts receivable and other receivables are recorded at nominal amounts less provisions for anticipated losses on bad debts. Provisions for losses are based on individual assessments of the recoverability of each receivable. In addition, if necessary, a general provision is made for anticipated bad debts on other receivables.

Pensions

A straight line earning profile is used to account for pensions and assumptions are made regarding expected salary upon retirement.

Taxes

The company has no tax expenses since its activities are not considered taxable.

NOTE 2 – FINANCIAL MARKET RISK

The company has little exposure to financial market risk.

NOTE 3 – FIXED ASSETS

Simula Research Laboratory AS

	Computer equipment	Furniture/fittings, equipment, etc.	Total
Acquisition cost at 1 Jan.	6 246 537	7 549 064	13 795 601
Acquired 2009	421 583	115 702	537 285
Disposals 2009	1 675 113	-	1 675 113
Acquisition cost at 31 Dec.	4 993 007	7 664 766	12 657 773
Acc. depreciation	3 763 163	6 372 874	10 136 037
Book value at 31 Dec.	1 229 844	1 291 892	2 521 736
Ordinary depreciation	1 090 746	770 774	1 861 520
Depreciation in %	20–50%	20–33%	

Simula Research Laboratory AS – Group

	Computer equipment	Furniture/fittings, equipment, etc.	Total
Acquisition cost at 1 Jan.	6 435 836	7 549 064	13 984 900
Acquisitions 2009	154 331	115 702	270 033
Disposals 2009	-	-	-
Acquisition cost at 31 Dec.	6 590 167	7 664 766	14 254 933
Acc. depreciation	5 198 217	6 372 874	11 571 091
Book value at 31 Dec.	1 391 950	1 291 892	2 683 842
Ordinary depreciation	1 223 050	770 774	1 993 824
Depreciation in %	20–50%	20–33%	

NOTE 4 – PENSION COSTS

The Group has a pension plan that covers a total of 40 individuals in the parent company and 98 individuals in the Group. The pension plan provides defined future benefits. Pension benefits depend on the individual employee's number of years of service, salary level upon retirement age, and social security benefits. The collective pension agreement is funded by building up pension funds under the auspices of the Norwegian Public Service Pension Fund.
The company has taken out an pension insurance for the managing director expenced at 248 304.

NOTE 5 – COST OF LABOUR, NUMBER OF EMPLOYEES, REMUNERATION, ETC.

	Simula Research Laboratory AS		Simula Research Laboratory AS Group	
Cost of labour	**2008**	**2009**	**2008**	**2009**
Wages	29 327 448	30 333 002	54 505 046	58 339 479
National insurance payment	4 311 686	4 462 091	8 249 427	8 693 441
Pension expenses	1 485 421	1 825 164	3 026 044	2 998 600
Other benefits	2 262 104	2 826 157	2 354 760	2 929 602
SkatteFUNN	-	-	-	-388 240
Contribution, cost of labour SSRI	12 910 568	16 414 405	-	-
Total	**50 297 226**	**55 860 819**	**68 135 277**	**72 572 882**
Average man-years of labour	43,5	43,6	92,3	101,2

Benefits to top management		
	Simula Research Laboratory AS	Simula Research Laboratory Group
Director	1 449 831	-
Other remuneration, director	200 089	-
Pension expenses, director	53 400	-
The Board of Directors	187 000	303 000
Auditor	60 000	121 800
Others auditing services	43 800	72 100

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NOTE 6 – OPERATING REVENUE

	Simula Research Laboratory AS	Simula Research Laboratory Group
Research funding	49 000 000	55 000 000
Subsidies from the Research Council of Norway and the EU	21 487 250	22 965 250
Services for the subsidiary	-	-
Other income	5 639 739	21 735 789

NOTE 7 – SHARE CAPITAL AND OWNERSHIP STRUCTURE

The company's share capital consists of 1 000 shares with a nominal value of NOK 1 500 per share.
The shares are owned by:

The Norwegian state /repr. by the Ministry of Research and Education	80%
The Norwegian Computing Centre	10%
Sinvent AS	10%

NOTE 8 – EQUITY

Simula Research Laboratory AS

	Share capital	Other equity	Total equity
Equity at 1 Jan.	1 500 000	3 754 523	5 254 523
Correction VAT	-	3 042 293	3 042 293
Net profit for the year	-	-3 466 731	-3 466 731
Equity at 31 Dec.	1 500 000	3 330 085	4 830 085

Simula Research Laboratory AS - Group

	Share capital	Other equity	Minority Interests	Total equity
Equity at 1 Jan.	1 500 000	6 764 927	1 762 179	10 027 106
Corrections related to 2008		2 398 321	-	2 398 321
Net profit for the year	-	-5 221 574	-471 379	-5 692 953
Equity at 31 Dec.	1 500 000	6 983 968	1 290 800	9 774 768

The mother company has demanded a return on value-added tax (VAT) on NOK 3 042 293 relating to not returned deductible VAT for the period 2006 to 2008. This excise duty is added as correction of the equity.

Further, a change of the accounts has been done for the previous years for two subsidiaries. The change has been charged directly against the equity of the group of a total of NOK 2 398 321.

NOTE 9 – BANK DEPOSITS

The company had locked-in bank deposits of NOK 1 942 173 in connection with signed leases and NOK 1 827 874 in restricted deposits relating to withholding taxes. The Group's tied-up withholding tax aggregated NOK 2 982 235.

NOTE 10 – SUBSIDIARIES

	Main office	Stake at 31 Dec.	Book Value	Company's equity at 31 Dec.	Company's profit/loss '09
Simula Innovation AS	Fornebu	100 %	4 356 300	4 923 443	614 670
Kalkulo AS	Fornebu	100 %	406 000	2 423 577	-776 831
SSRI AS	Fornebu	55.74%	557 400	2 917 364	-1 064 060

NOTE 11 – OUTSTANDING ACCOUNTS/INTRA-GROUP TRANSACTIONS

	2008	2009
Claims against Simula Innovation AS	642 833	3 795 512
Debt to Simula Innovation AS	287 314	352 729
Long-term claims against Kalkulo AS	-	-
Short-term claims against Kalkulo AS	306 571	397 683
Debt to Kalkulo AS	87 074	220 580
Claims against SSRI AS	395 323	623 483
Debt to SSRI AS	5 287 569	3 112 818
Subidies to Simula Innovation AS	2 583 000	2 373 000
Subsidies to SSRI AS	12 910 568	16 414 405
Acquisition of services etc. to Simula Innovation AS	328 436	124 773
Acquisition of services etc. to Kalkulo AS	457 043	751 785
Acquisition of services etc. to SSRI AS	474 618	-
Sale of services etc. to Simula Innovation AS	1 055 501	-
Sale of services etc. to Kalkulo AS	1 096 636	-
Sale of services etc. to SSRI AS	1 476 996	-
Interest income from Kalkulo AS	5 250	-

NOTE 12 – SHARES

	Number	Nominal value per share	Book Value
Insilicomed inc, USA	131 945	USD 1.80	1 220 755
Resiliens AS	39 900	1.0	42 894
World Besides AS	40 000	1.0	40 000
Symphonical AS	545 528	0.10	1 095 151
Lividi AS	30 750	1.0	32 850
			2 431 650

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NOTE 13 – TAX

Simula Research Laboratory AS does not engage in taxable activities. The subsidiary Simula School of Research and Innovation AS does not engage in taxable activities. The subsidiaries Simula Innovation AS and Kalkulo AS are liable to taxation.

Taxation for the year consists of:	
Tax payable	677 738
Change postponed tax	-601 679
Net total taxes	**76 059**

Tax payable for the year is calculated as follows:	
Group contribution paid	-86 102
Permanent differences	-369 556
Change in temporary differences	-2 876 153
Base tax payable	2 420 495
Tax payable on the profit for the year	**677 738**

Postponed tax advantage

	1 Jan	**31 Dec**
Fixed assets	-33 695	-7 405
Receivables	-	-2 662 575
Losses carried forward	-240 133	-
Other differences	2 400 000	1 920 000
Net postponed tax advantage	2 126 172	-749 981
Posponed tax/tax advantage, 28%	**595 328**	**209 994**

Postponed tax advantage is not incorporated.

NOTE 14 – LEASES

The company has signed leases for four photocopiers. The leases will all expire in 2013. The company also has three leases for coffee machines and an agreement for car leasing. NOK 355 848 were expensed for these leases in 2009.

CASH FLOW STATEMENT

Simula Research Laboratory AS Group			Simula Research Laboratory AS	
2008	**2009**		**2009**	**2008**
		Cash flow from operating activites:		
- 3 870 300	- 5 692 952	Net profit for the year	- 3 466 731	- 2 733 778
2 140 790	1 993 824	Depreciation expence	1 861 520	2 085 340
-	-	Write downs on share investment	-	
- 3 242 268	- 6 567 335	Change in receivables	- 6 781 952	1 713 442
2 734 531	6 859 107	Change in short-term liabilities	5 613 669	4 861 708
4 247 289	- 3 407 356	Net cash flow from operating activites	- 2 773 494	5 926 712
		Cash flow from financing activites:		
- 2 582 847	- 543 060	Investments in production equipment, net	- 367 211	- 2 449 652
- 1 239 928	14 250	Investments in shares	-	-
- 3 822 775	- 528 810	Net cash flow from financing activites	- 367 211	- 2 449 652
		Cash flow from financing activites:		
-	5 440 615	Corrections equity	3 042 293	-
-	-	Change, long-term receivables	-	300 000
-	5 440 615	Net cash flow from financing activities	3 042 293	300 000
424 514	1 504 448	Net cash flow for the period	- 98 412	3 777 060
15 262 989	15 687 502	Cash reserves, 1 January	8 865 625	5 088 565
15 687 502	17 191 949	Cash reserves, 31 December	8 767 212	8 865 625

LIST OF PUBLICATIONS

Simula only reports publications where a significant part of the research has been funded by Simula. By this we mean that at least one of the authors of the reported publications must have his/her main affiliation with Simula, and has contributed to the publication as specified in Simula's publication guidelines. Publications from people in part-time positions at Simula are generally not counted unless the research is specifically performed as part of their employment at Simula. Such exceptions from the main rule are very few, and must in all cases be approved by the head of department.

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[176] A. Logg. Parallel Data Structures and Algorithms in DOLFIN. Talk at High-Performance Computing Workshop, Simula Research Laboratory, Oslo, 16 June 2009.

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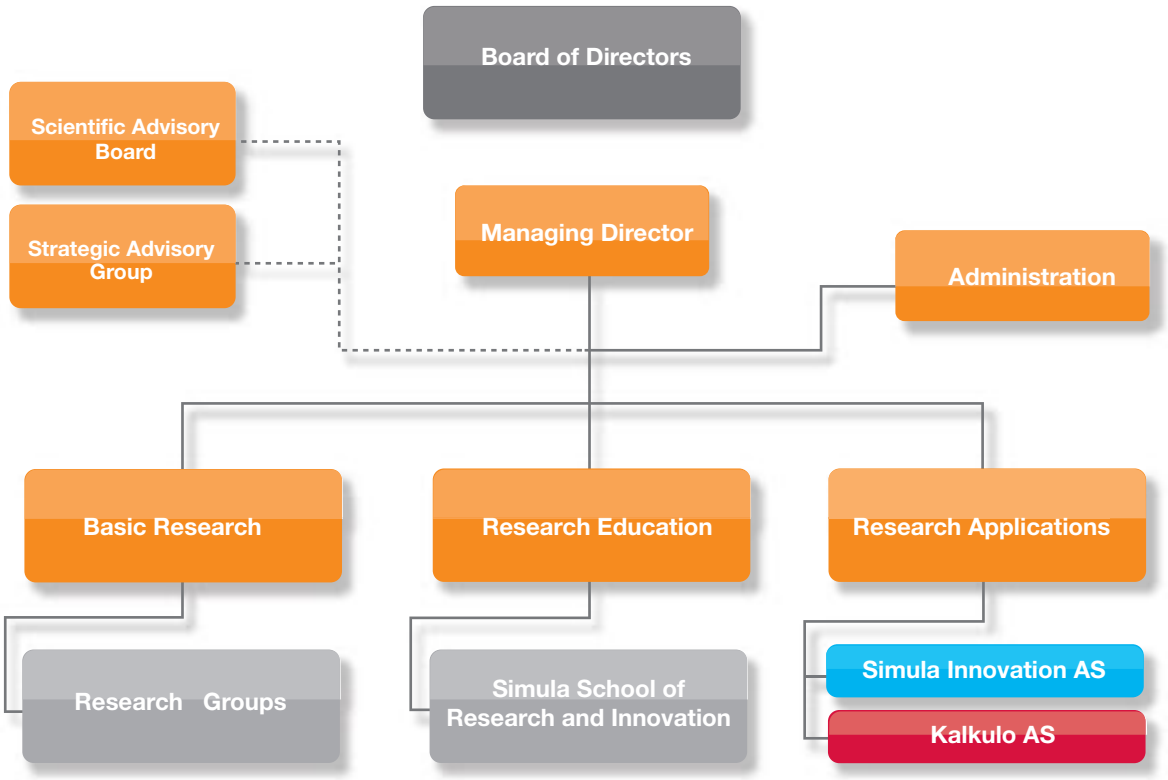
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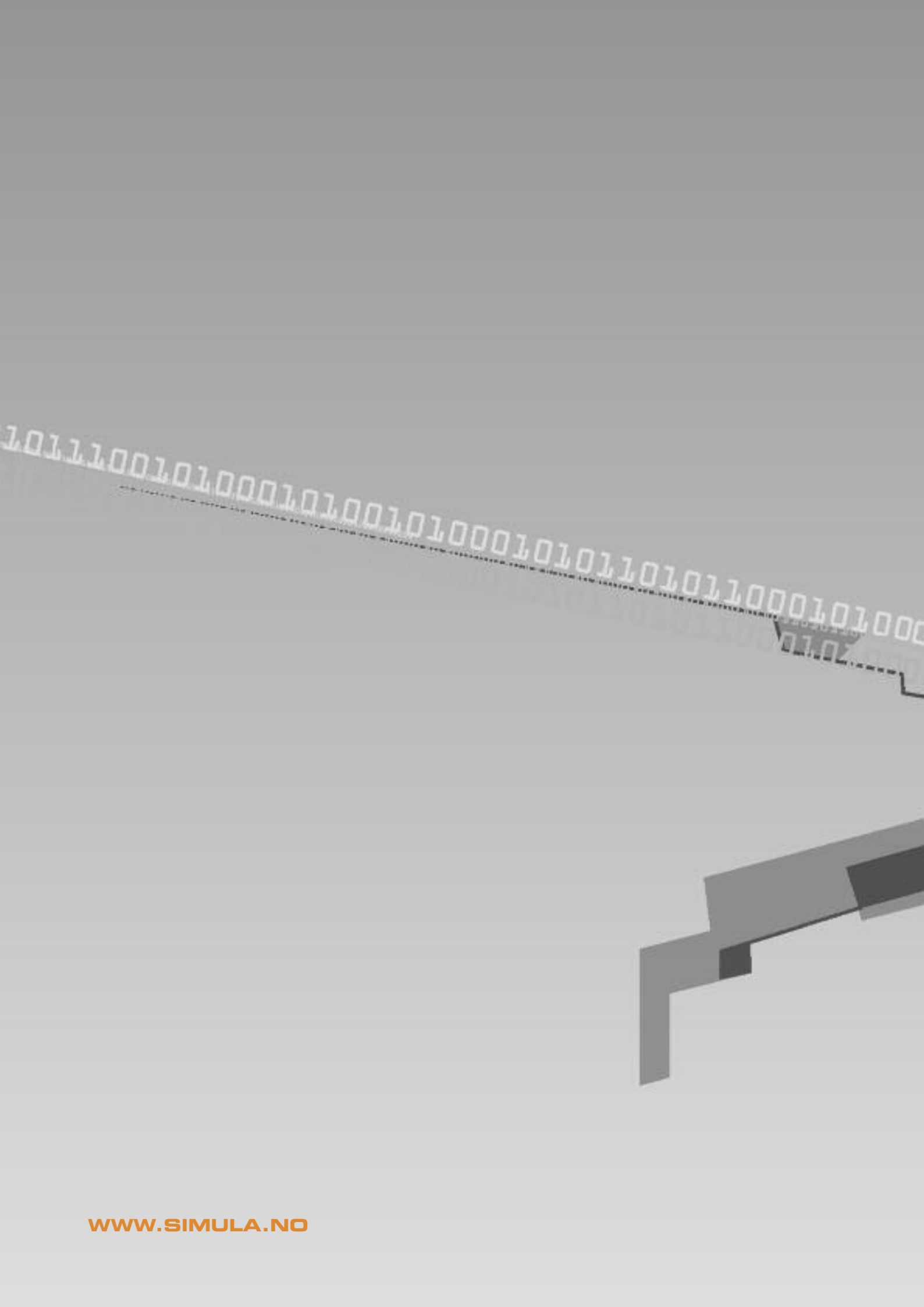

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