



Operating Room of the Future

St. Olavs Hospital HF, Department of Surgery
Faculty of Medicine, Department of Circulation and
Medical Imaging, NTNU

Annual Report 2011



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Summary

Operating Room of the Future (FOR), Department of Surgery, St. Olavs Hospital HF and the Medical Faculty, Department of Circulation and Medical Imaging, NTNU.

The Operating Room of the Future (FOR) is a collaboration between St. Olavs Hospital HF, University Hospital of Trondheim and the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. The management of the facility is a responsibility shared between Department of Surgery, St. Olavs Hospital and the Department of Circulation and Medical Imaging, the Medical Faculty, NTNU. The Operating Room of the Future is an arena for research and development with the operating rooms as workshops designed to develop, test and apply new technology and new treatment modalities. The tasks of the University Hospital is defined in the specialist Health Care Act and include treatment of patients, teaching of patients and their relatives as well as research and teaching of health care personnel. The aim is that FOR should fulfil these goals. Trondheim has a particular responsibility for research within the field of medical technology.

The principle activity at FOR is research to provide more safe and better treatment, more efficient logistics and flexible architecture in the construction of new operating rooms. FOR has also become a centre of competence for the construction of operating rooms outside St. Olavs Hospital. An agreement with our industrial partners has made it possible for the Health Care Trust of central Norway, St. Olavs Hospital and NTNU, to promote research and development in central Norway. FOR has a close collaboration with National Centre for Advanced Laparoscopic Surgery (NSALK), SINTEF and National Centre for Ultrasound and Image Guided Therapy. FOR is now on the national roadmap for research infrastructures in connection with the norMIT cooperation with the Interventional Centre at the National Hospital, Oslo.

FOR is a multidisciplinary project and an arena for clinical research and development with focus on medical technology. Prototypes can be developed and tested in safe and controlled environments. FOR is set up to promote a close collaboration between clinicians, technologists, researchers and industrial partners. State-of-the-art equipment is available at FOR. The operating rooms are equipped for image-guided minimally invasive therapy.

During the first years the main focus was keyhole surgery of the abdomen (laparoscopic surgery) and endovascular therapy for diseases of the blood vessels. The principle of minimally invasive therapy is now used in all surgical disciplines including ENT, orthopaedic surgery, gynaecology and neurosurgery etc. Minimally invasive therapy is less traumatic than traditional open surgery and will become more and more important in the future.

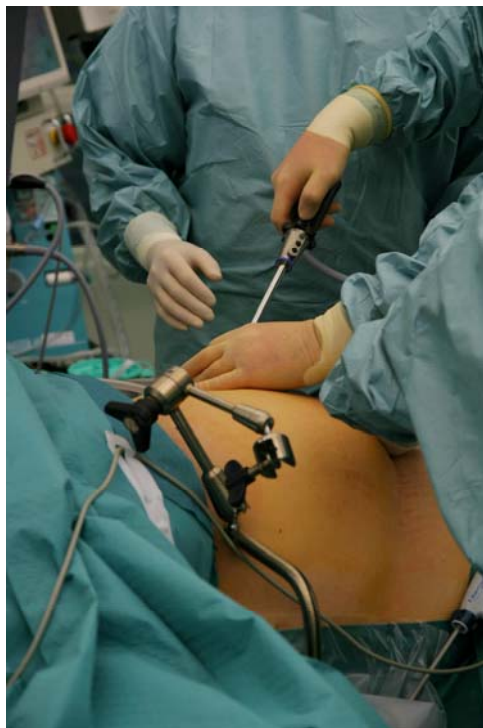
FOR has its basis in six operating rooms at the new St. Olavs Hospital; one at each of the operating departments. The FOR concept demonstrates synergy effects in letting

representatives from various disciplines and medical specialists use equipment, areas and competence together.

FOR has excellent facilities for research projects based on a multidisciplinary approach. Investigations are performed by PhD-candidates, scientists, students and clinicians. FOR with its technical equipment and design is perfect for teaching and education of students, doctors and nurses.

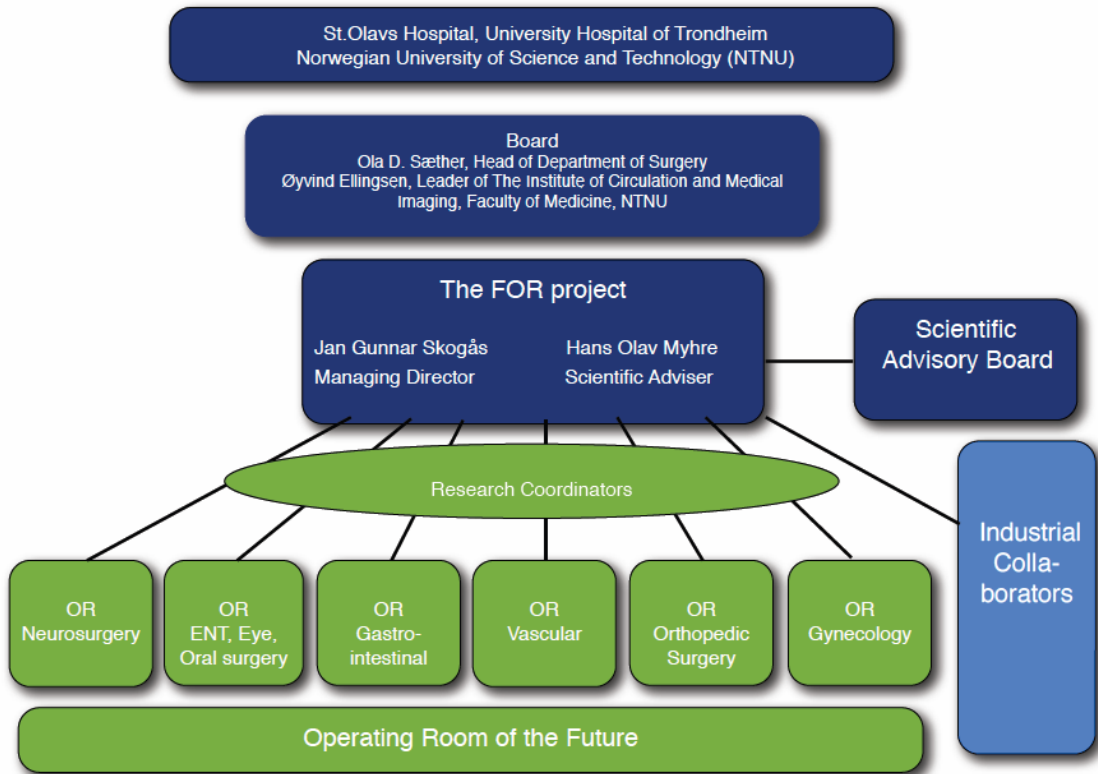
New methods for teaching have been tested and transmission of images from the operating rooms to the lecture room with two-way communication has been used on several occasions. This adds value to the teaching process and it is the intention to develop this part of the project further. At FOR and NSALK several postgraduate courses for medical students are arranged annually. Our facility with the integrated surgical lecture room is an excellent supplement to the teaching program used at such courses.

FOR is taking part in the development of visualisation and communication, which may be beneficial for diagnosis and treatment as well as for organisation of hospital units. Lecturing on the application of electromedical equipment has been an increasingly more important task for FOR.

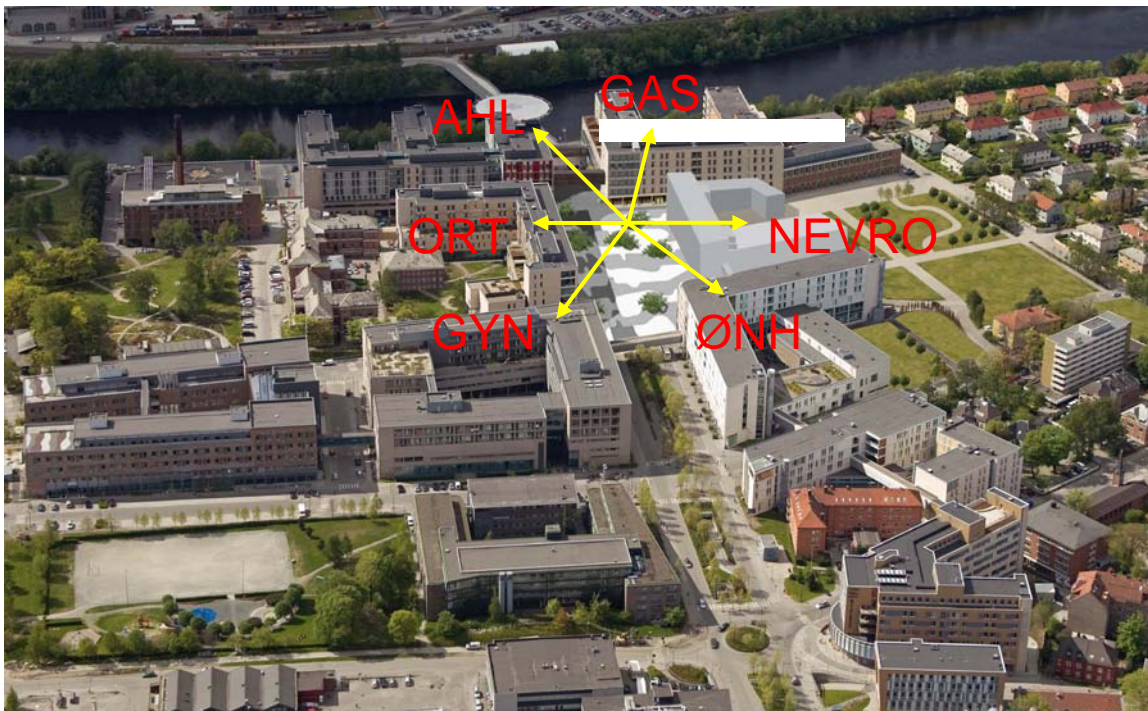


Minimally invasive image-guided treatment.

Organisation of the Operating Room of the Future



St. Olavs Hospital and the six FOR operating rooms



The staff at FOR



Hans Olav Myhre
Emeritus Professor of Surgery
Scientific adviser



Jan Gunnar Skogås
Biomedical engineer
Managing director



Ketil Thorvik
Bachelor of Arts
Project Leader AV-Arena



Anne Karin Wik
Operating Room Nurse
Research Collaborator
Gastro and Vascular



Therese Marken
Operating Room Nurse
Research Collaborator
Orthopaedic and Gynecology



Marianne Haugvold
Bachelor of Science
Research Coordinator
ENT, Neuro

AV Arena Norway

AV Arena Norway is a resource network within medicine and media technology that performs pilot projects as test beds for new usage of digital media to obtain medical and organizational benefits in the health care sector. The resource network is member financed. The network has members from research, industry and healthcare.

The resource network was established during the autumn 2010 to form a bridge between an ICT-based competence within digital media technology and the health care system. Operating Room of the Future, St. Olavs Hospital, took the initiative to form this "bridge" because we feel that digital media will be of great importance for the many challenges faced in the attempts to improve quality in health care. Teaching of employees is important for patient safety and quality. Teaching as well as cooperation with the patient also has high priority. This process includes the improved flow of information and improved logistics. These focus areas have high priority at St. Olavs Hospital's program for better service during the years 2011-2016. By establishing this resource network we have attracted new collaborators with a strong interest in media technology and ideas, experience and tools from oil and gas industry.

Main goals

The main goal is to establish a leading international arena for innovation within medicine and digital media technology, for medical and organizational benefit of the health care sector. This main goal will be realised through pilot projects in national and international settings.

Methods

The resource network is using pilot projects for testing new applications of digital media technology. The network will bring ideas to concrete projects. FOR is acting as a hub in this network and is monitoring all projects from our members. FOR will organize good processes for developing and building networks to improve our members' ability to properly design applications.

Result

The main result of our network is a portfolio of finished and ongoing projects. The success of the portfolio will be of major importance for the growth within the network in a national and international perspective.

Members

The partners in the network by the 31st of December 2011 are Nord-Trøndelag Elektrisitetsverk, Hospitality, Incita, Røros E-verk, Operating Room of the Future (FOR), St. Olavs Hospital, iBruk, T-vips, Uninett, At Work Systems and Parallell World Labs.

Pilot projects within three important focus areas

- Digital teaching network and workflow
- Digital teaching modalities
- Digital cooperation with the patient

After the starting phase 10 pilot projects have been initiated by the members of the network. All projects are designed to obtain medical and organizational benefits in the health care system. The portfolio fits well into the vision of establishing a digital medical learning and information platform to strengthen the quality management system in healthcare.

1. Pre-project: Digital patient collaboration at home

This pre-project was designed to survey the use of digital collaboration with patients at home (in everyday life) as well as understanding the different users. The pre-project was hosted by Nord-Trøndelag Elektrisitetsverk (NTE).

2. Pilot project: At Work

This pilot project focuses automatization of manual work processes. The pilot project was financed by the Norwegian Research Council. The Pilot project is finished. We are planning a next step in this evolution.

3. Pre-project: The St.Olavs Experience

This project was initiated by St.Olavs Hospital and the Medical Faculty at the Norwegian University of Science and Technology (NTNU). In the pre project we were planning a digital medical information and learning platform in the integrated University Hospital, St. Olavs Hospital. Operating Room of the Future was project manager in the pre project. The pre project is finished and the main project is now ongoing.

4. Pilot project: Digital patient collaboration and lifestyle changes

This pre project was initiated by NTNU, St.Olavs Hospital and Kommunenes Sentralforbund (KS). We did an application for a national programme but did not receive funding for a main project.

5. Pre-project: Digital collaboration at home

This pre project was initiated by the Operating Room of the Future and the Mid Norway Center for treatment of obesity. The pre project is financed and run by the innovation body of InnoMed. Operating Room of the Future, St. Olavs Hospital is the project manager. The focus is new digital tools for monitoring and collaboration with this patient group in the everyday life. The pre project is ongoing.

6. Pre project: Future of telemedicine in oil and gas industry.

This pre project expanded from collaborative discussions between key players in oil and gas industry and St,Olavs Hospital, NTNU and SINTEF. In this pre project we are focusing the use of new tools to improve diagnostics of patients `offshore` in addition to improved workflow between healthcare personnel offshore and medical expertise at St.Olavs and NTNU. The pre project is ongoing.

7. Main project: The “knowledge portal” of the integrated University Hospital.

This main project is the making of a digital medical learning and information platform in the integrated University Hospital, St. Olavs Hospital. The main project was financed by St.Olavs Hospital, NTNU and Helsebygg. The project manager of the main project is Helsebygg. The Operating Room of the Future is responsible for the content production part in the main

project. The pre project is ongoing.

8. Pre project: Digital medical learning solutions

This pre-project focuses the application for funding of a main project for establishing new innovative solutions for learning solutions in healthcare. In this pre project we have investigated digital learning solutions in different sectors, and the approach we are developing is strongly influenced by the field of integrated operations in oil and gas. The pre project is ongoing.

9. Pre project: Integrated workflow in the healthcare system

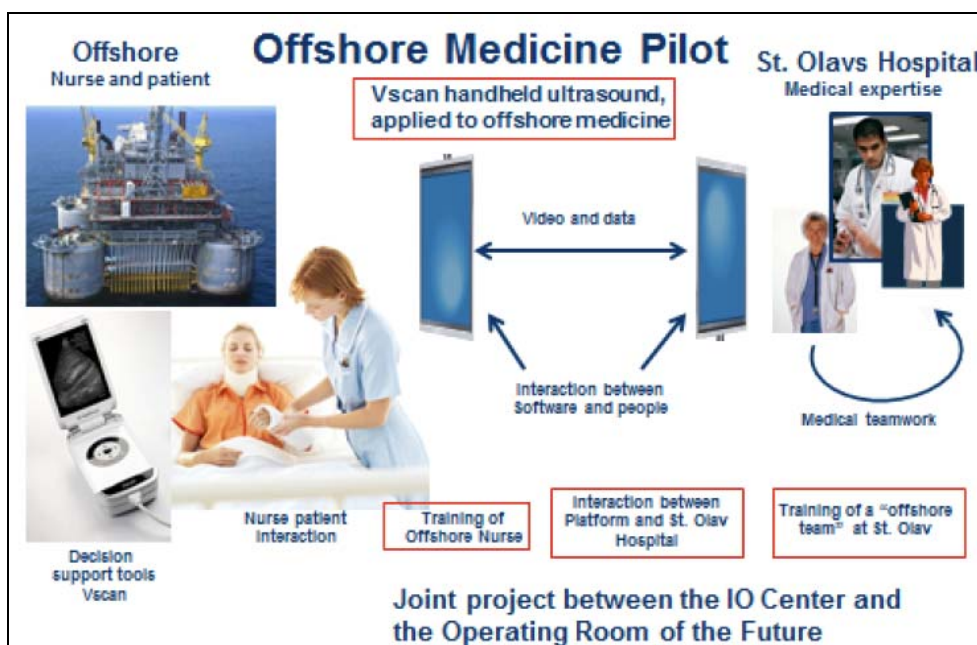
This pre-project is investigating the innovation space in the workflow between the University Hospital, the `village` doctor and the patient at home. More precisely we are focusing the optimal workflow in the strategic planning of several innovation projects to meet some of the major challenges of future healthcare. The pre project is ongoing.

10. Pilot project: Bio sensors

This project investigates the innovation space of monitoring the patient at home as part of an optimal workflow that has the patient in the center of the workflow. This pilot project is in the application process for funding.



In the St. Olavs Experience we are developing a digital medical archive based upon the knowledge production in the integrated University Hospital, St. Olavs Hospital. Content is developed to give meaningful learning experiences to patients and families, employees, students and other interested parties. We are setting up a technology platform to ensure wide distribution of content, and give the users interactive tools to explore content within the framework of `self directed learning`.



Offshore oil and gas platforms have very well developed communication infrastructure and use high quality video conference systems as telemedicine solutions. We bring into this space new tools for improving diagnostics and transmission of visual data as well as improving workflow between offshore healthcare personnel and medical expertise at St. Olavs Hospital.

FOR-Annual Meeting 2011

Operating Rooms of the Future arranged a two day seminar at Copperhill Mountain Lodge, Åre, Sweden, November 3-4. Altogether 61 participants attended from the clinics cooperating with Operating Rooms of the Future.

This Annual Meeting is an important activity to get the clinics together. The program included altogether 20 presentations with a broad spectre of topics. A review of the total activity of FOR is obtained at this meeting and networking, new projects and strategic positioning are important effects of the Annual Meeting.



Hospital Director Nils Kvernmo had a presentation;
"St. Olavs Hospital and FOR – Which challenges are we facing?"

The Director focused in his presentation on his expectations to FOR related to the new challenges observed as a result of the recent reorganisations within the health care sector. His paper gave a good background for discussing strategy at the seminar and they will form the basis for further discussion about new research initiative.

We plan a similar seminar during the autumn 2012.

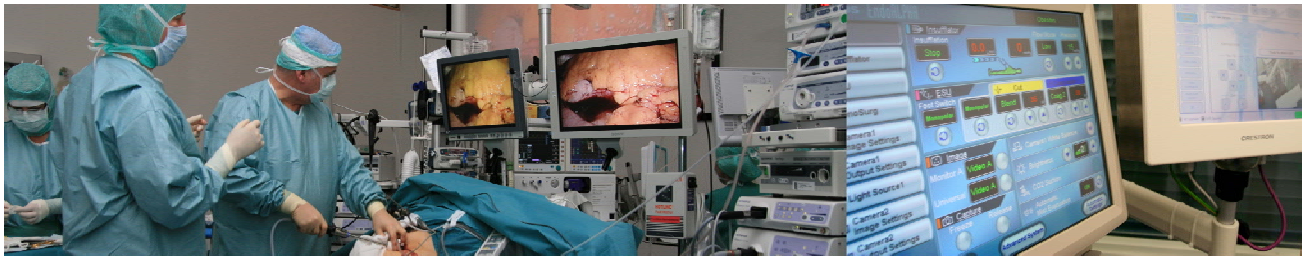
Department of Surgery

FOR is a high-tech department and a joint venture between St. Olavs Hospital and NTNU. It has now expanded to six centres with one operating room in each centre. FOR has become an organisation more than the physical operating rooms. Thus, since 2010 we have developed a decentralised organisational model of FOR. When planning the new hospital, different ways of developing FOR was discussed. We are happy with the resulting decentralised way of running the facility, seeing this as a significant improvement. We hope that the FOR organisation can continue to coordinate the collaborative efforts with our industrial partners. St. Olavs Hospital is today collaborating with about 20 Norwegian entities within health care technology through FOR. In addition we have projects with international companies and close collaboration with international hospitals and universities like Massachusetts General Hospital, Boston, New York Medical Centre, Technical University of Munich and Yonsei University Hospital, Seoul.

With the close cooperation with NTNU and industrial partners, St. Olavs Hospital has used FOR as a showcase for technological development within surgical therapy. Our intention is to use the FOR facilities for research and development for at least 50 % of the available time.

Ola D. Sæther, MD, PhD
Professor of Surgery
Head of Department of Surgery
St. Olavs Hospital





Clinical activity

Laparoscopic / endoscopic treatment

The Operating Room for endoscopic surgery has facilities both for laparoscopy and operations via flexible instruments from inside the bowel lumen. A combination of these two methods is also possible. Laparoscopic / endoscopic techniques give advantages for the patient and are fiscally beneficial since the stay in hospital and the recovery time is reduced. However, there may be challenges for the surgeon regarding identification of tumours, blood vessels and lymph nodes. Cooperation with SINTEF and Centre of Competence -Ultrasound and Image-Guided Therapy has made it possible to apply navigation and 3D-ultrasound to address these problems. One of our research fellows has developed an experimental tumour model making it possible by ultrasound navigation to identify an intra-hepatic tumour with great accuracy. CustusX is a navigation tool developed by SINTEF. It is today used in different surgical settings, including laparoscopic treatment of the adrenal glands and tumours of the posterior abdominal wall. This is part of a multicentre study together with Mesos Medical Centre, Utrecht, Netherlands.

FOR has also been used for the development and testing of a new laparoscopic instrument in cooperation with the University of Tübingen. The instrument has an ergonomic design, which is of great importance in minimally invasive surgery. FOR has also been taking part in a multicentre trial testing a new operative technique for the treating of morbid obesity. Electrodes have been attached to stimulate the vagus nerve (VBLOC) and the inclusion of patients is now completed. In cooperation with the Regional Centre for Morbid Obesity (RSSO) FOR has since 2005 been part of a study comparing surgery with lifestyle modification in the treatment of morbid obesity.

Ronald Mårvik has in cooperation with SINTEF been medical advisor for the EU project VECTOR, where an advanced wireless endoscopic capsule makes therapy of localised disease processes possible from inside the gastrointestinal lumen. This device can also be navigated from the surface of the body.

Several surgeons from Norway, Denmark, Japan, The Netherlands and Germany have visited FOR in 2011. An excellent synergy between the training facilities at NSALK and the interactive lecture room at FOR has been established. The candidates who are attending courses can use simulators for practicing new laparoscopic and endoscopic procedures. In cooperation with NSALK we have arranged the new national course in endoluminal surgery for medical and surgical gastroenterologists. During the autumn 2011 we started a new master program in cooperation with RSSO. Ten students have started and some will base their master thesis on results following surgical treatment. These students will take part in the activity at the FOR Operating Room and they will also follow the patients at RSSO.

In 2011 altogether 138 operations have been performed at the laparoscopic operating room.

| Operative activity, laparoscopic surgery | | | |
|---|--------------|------------------------------|------------|
| Gastroenterologic surgery | Laparoscopic | Fundoplication | 18 |
| | " | Cholecystectomy | 32 |
| | " | Gastric bypass | 36 |
| | " | Gastric sleeve | 9 |
| | " | Hernia of the abdominal wall | 8 |
| | " | Hepatic resection | 2 |
| | " | Paraesophageal hernia | 5 |
| | " | Pancreas resection | 2 |
| | " | Splenectomy | 6 |
| | " | Gastric resection | 8 |
| | | Endoscopic mucosal resection | 1 |
| Endocrine surgery | Laparoscopic | adrenalectomy | 11 |
| Total | | | 138 |





Endovascular treatment

The latest FOR operating room at the Centre for Cardiovascular Diseases is a hybrid operating room equipped for open surgery as well as angiography/intervention. The operating room is equipped with the angiography unit “Artis Zeego” from Siemens.

Altogether 87 procedures for vascular diseases have been performed at the FOR operating room in 2011. 37 of these were for aneurysms (aortoiliac and thoracic), while 27 were combined procedures for other vascular diseases. Department of Cardiology / Cardiac Surgery did altogether 11 trans-apical implantations of aortic valves in this operating room. In 2 cases a patent foramen ovale was closed by minimally invasive technique.

Stable patients with suspicion of ruptured aortic aneurysm are now often investigated by CT-scan to explore whether they are anatomically fit for endovascular repair at the FOR operating room. For traumatic transection of the thoracic aorta stent-grafting is now our first choice.

Two PhD-candidates are about to finish inclusion of patients in scientific studies applying rotational angiography (DynaCT) in 2011. In addition other experimental operations applying navigation of stent-grafts have been performed. And finally a variety of acute operations are performed in this operating room.



The FOR-operating room for vascular/endovascular repair is equipped with Artis Zeego rotational angiography unit.

Clinical activity – endovascular operating room

| | |
|--|-----------|
| Stent-grafting of the abdominal/thoracic aorta | 37 |
| Combined procedures | 27 |
| TAVI | 11 |
| Closure of foramen ovale | 2 |
| Electrode for sacral nerve stimulation (SNS) | 4 |
| Experimental surgery | 2 |
| Other operations (stent in the oesophagus, PTA, aorta balloon pump, coiling) | 4 |
| Total | 87 |

In addition this operating room has been used for other operations, e.g. endocrine surgery, trauma etc.

Department of Ear, Nose and Throat Diseases, Oral Surgery and Eye Diseases

At FOR operating room is established for activity within ENT, oral surgery and eye diseases. FOR has in collaboration with industrial partners planned to implement new medical technology and this is planned to be finished in 2012.

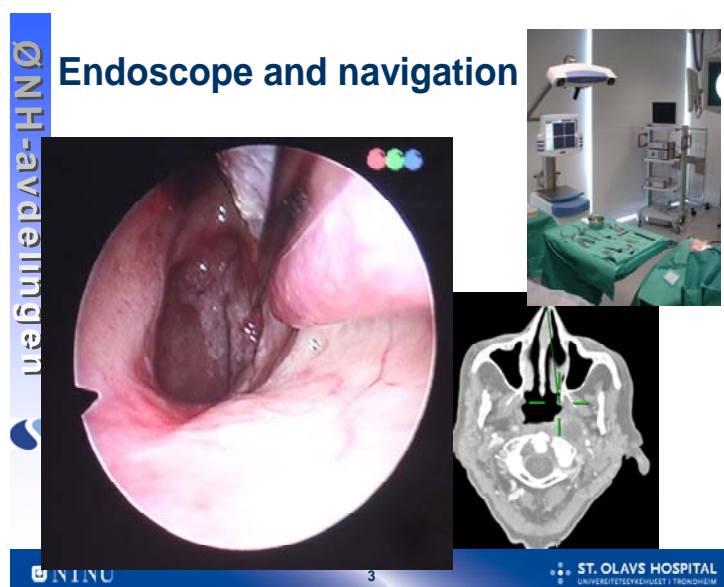
Employees from our clinical took part in a course organised by FOR regarding the use of Sony equipment at the operating rooms. Doctors at the clinic also followed a course in the application of electro-medical equipment, hospital hygienics etc. in 2011. This systematic program for operating doctors at St. Olavs Hospital is important to obtain an excellent quality in the patient treatment at our hospital.

In 2011 we tested out a new high-energetic platform. This will be used for major surgery of the head and neck. In this connection we started a project testing clinically bipolar techniques for better treatment and improved safety.

The clinic took part with 3 representatives in the Annual Meeting at Åre in November 2011. The seminar was an effective door-opener to collaborating units and inspired with creativity and new thinking. Professor of ENT diseases, Ståle Nordgård, MD, gave interesting presentations based on ongoing scientific projects at our unit.

The clinic has 4 protocols in collaboration with FOR that are expected to end up with PhD-degrees. The department of ENT was inspired to focus further on fast-track surgery after contact with the Department of Orthopaedic Surgery and we plan to start similar activity at our unit.

Mette Bratt
Head of Department
Clinic of ENT diseases, oral and eye diseases



Illustrations from the operating department, ENT

Department of Neurosurgery

The Department of Neurosurgery has one of the FOR operating rooms facilitating a high scientific activity. The most important research profile of the department is the application of ultrasound within image-guided minimally invasive neurosurgery. This technology in combination with navigation has been applied to several areas including surgery of the pituitary gland, neuroendoscopic methods as well for operation of spinal and brain tumours, AVM and hydrocephalus operations. Several of our projects are exploring the potential of navigation within these fields.

Our research has a background in clinical needs and through a multidisciplinary approach combining technological and clinical research. Less traumatic and safer treatment modalities are developed.

The research at Department of Neurosurgery is carried out in close cooperation with SINTEF and NTNU. Centre of competence Ultrasound and Minimally Invasive Therapy is a very important platform for our research activity.

The collaboration with the operating room of the future has been very positive. Experimental investigations have been planned as a cooperation between Department of neurosurgery and FOR. In 2011 a new platform for high-energy coagulation of blood vessels was available for our surgeons. FOR is also assisting in live-transmissions at the annual course for neurosurgeons “3D-ultrasound in neuronavigation”. Professor Unsgård and senior scientist Selbekk had presentations “What is new on 3D-ultrasound within neurosurgery” at the annual FOR seminar in Åre, Sweden, November 2011.

FOR is arranging compulsory courses in the application of electro medical equipment. Teaching, documentation and certification within this field is well established and all surgeons at our clinic are offered such courses at FOR.

Geirmund Unsgård
Chief of the Neuro Clinic



From the neurosurgical operating department

Department of Women and Children's Diseases

At the Department of women and children's diseases we have initiated a close collaboration with FOR. Our FOR operating room, is the first choice for all laparoscopic procedures. The equipment has been transferred from the old FOR operating department and include EndoAlpha and high-definition camera allowing live transmission of operating procedures. In 2011 we also received the high-energy platform, Force Triad, and are testing this intraoperatively for haemostasis.

In 2011 we started robotic surgery. At our clinic we are applying this technology both for general gynaecological surgery as well as for cancer operations. Thus, we will get a sufficient experience with this particular operating modality. Robotic surgery requires collaboration with the Department of urology for optimal use of the capacity of the daVinci robot. Robotic surgery fits well into the FOR concept; it is high-tech, innovative and has a great potential for the future. It is our goal to have our own daVinci robot at our FOR operating room, but so far we have enjoyed the good cooperation between surgeons, anaesthesiologists and operating room personnel at the Department of Surgery. One year after the start we have performed more than 100 operations. Robotic surgery will be an important research field in the near future. At the annual seminar in Åre in November, dr. Tingulstad gave a presentation "Robot assisted surgery in gynaecology".

FOR has been extremely useful in the training and certification of our personnel in the application of electromedical equipment. We think this is an important service to the operating clinics.

We have also arranged courses in hospital hygenics for all employees at our clinic in collaboration with FOR. This was an excellent course and we were able to fulfil the requirements given by the internal revision.

We are extremely pleased with the close collaboration with FOR and look forward to contribute with an increasing number of scientific projects.

Runa Heimstad
Head of the department
Clinic for women and children's diseases



Clinic for Orthopaedic and Rheumatologic Diseases

After moving into the new hospital the Clinic of orthopaedic surgery has a goal to focus on more research in the National Centre of Competence for Orthopaedic Implants (NKSOI). NKSOI is a section of the Department of Orthopaedic Surgery, Clinic of orthopaedic surgery and rheumatologic diseases. There is need for more competence and better facilities to do research related to orthopaedic implants.

So far, the main activity at the FOR operating room has been on process optimisation and innovation by establishing “fast track” surgery for patients needing various orthopaedic implants. We have established a quality register including data from the operation as well as follow-up data. We are also focusing on the possibility of improving operating room logistics.

The Operating Room of the Future has an excellent infrastructure and the operations can be transferred to the auditorium with two-way communication. This is very useful during courses and post-graduate training. FOR assisted at the course in knee surgery in April 2011 and also assisted a master student on a project with smoke from the cautery system applied during fast-track surgery.

During the annual meeting at Åre 2011, Østbyhaug gave a presentation about his experience with fast-track surgery. This inspired other clinics to start similar projects. The scientific advisory board, FOR, had a new member in 2011; Assistant Professor Ivar Rossvoll.

Vigleik Jessen
Head of the clinic
Clinic for Orthopaedic and Rheumatologic Diseases



FOR operating room, Department of orthopaedic surgery.

Developing and testing of medical technology

In addition to clinical activity the operating rooms at FOR have been used for experimental investigations as well as laboratory studies. In 2011 we have applied navigation for the deployment of stent-grafts with side-branches in an experimental model. Furthermore, we have used navigation in laparoscopic surgery and in pulmonary medicine.

Employees at SINTEF and PhD-candidates have used the FOR operating rooms for calibration, testing and mounting of navigational equipment. Also industrial partners have used FOR for testing of technological systems, for quality control, safety control and upgrading, as well as validation of medical technology.

So far our experience with the angiography unit, Artis Zeego (Siemens), is indicating an excellent image quality and a larger field of view than the older Dyna-CT unit.

Resource centre for new hospitals

FOR is a resource centre for integrating operating rooms and for the implementation of new technology and new instruments. FOR has been used by several departments at St. Olavs Hospital. “The hospital development project for central Norway” has used knowledge from FOR both in phase 1 and 2, especially during planning and construction of new operating departments at our new integrated university hospital.



Managing Director Jan Gunnar Skogås (right) was proud to explain what sort of possibilities the new operating rooms represented for the new Røros hospital.

Foto: Inge Morten Smedås

Arbeidets Rett 29.04.11

Electro-medical equipment (EMU)

Courses in the use of electro-medical equipment

On behalf of the operating clinics FOR is conducting compulsory courses in the use of electro-medical equipment. In 1999 a new regulation regarding “use and maintenance of electro-medical equipment” was passed. This regulation has its background in law on medical equipment from 1995. According to paragraph 13 training and instruction in the application of such equipment is necessary for;

- Personnel, who are going to use electro-medical equipment, must have training and instruction in the application of such equipment.
- They should know potential side-effects connected to the application of electro-medical instruments and know how to prevent them.
- A training program must be systematic and include documentation.

The systematic training program must include;

- Training when new equipment is introduced.
- Training for new employees.
- Maintenance of the knowledge achieved during this training program.

The positive response we have from the various clinics has inspired us to improve this concept. At present the training program, including the documentation, is now well established in all operating clinics at St. Olavs Hospital. All surgeons including surgeons in training as well as staff surgeons are getting invitation to the courses as a part of the continuing medical education.

We want to develop further the concept with courses in electro-medical equipment. We therefore want to design courses using digital- based learning. This tool can be used by the candidate on their own as a supplement to regular courses. We also want to develop new systems for monitoring and recording of participants in the courses as well as reporting to the head of clinic. Thus, we are obtaining an automatisation of several work processes saving time. Simultaneously we are getting better reports regarding participants in the various activities.

Plans for courses in the use of electro-medical equipment for surgeons at St. Olavs Hospital

Course 1: High-energy equipment:

- Surgical cautery
- Ultrasound cutting

Course 2: Endoscopic equipment including:

- Rigid and flexible endoscopes
- Camera systems, light sources, insufflators and racks
- Navigation tools, microscopy

Course 3: Imaging technology:

- Irradiation protection
- C-arm x-ray
- Ultrasound machines

In addition we have arranged courses in hospital hygienics.

In 2011 the following courses have been arranged:

Course 1: High-energy equipment

- March 2nd
- April 5th
- September 20th

Course 2: Endoscopy

- February 16th
- May 25th
- October 4th
- November 2nd

Course 3: Protection against irradiation

- May 4th
- October 25th

Hospital hygienics

- March 23rd
- June 1st
- November 15th



Course in hospital hygienics and patient safety.

Other Courses arranged 2011

- March 3. Patient safety and hygienics. Course for employees at SINTEF
- April 13. Knee surgery, course in orthopaedic surgery
- Oct 20.-21. Patient safety, NSALK. Course for operating room nurses
- Dec 1.-2. Patient safety, NSALK. Course for operating room nurses

FOR has participated at the following courses in 2011:

- March 31. Good Clinical Practice
- April 6 – June 15 E-sak
- April 7. SONY
- April 27.-28. Endovascular Hands-on course
- June 15.-16. 3D Ultrasound and Neuronavigation
- September 14.-15. Course in process supervision , Levanger
- October 20.-21. Courses for operating room nurses at NSALK
- October 24. SPC and EQS
- November 15.-16. Course in process supervision , Levanger
- December 1.-2. Courses for operating room nurses at NSALK

Teaching

Staff

- Medical personnel affiliated to FOR is going through annual certification in compliance with national regulations on the use of maintenance of electro-medical equipment.
- All surgeons at St. Olavs Hospital are going through courses on an annual basis regarding electro-medical equipment.
- The personnel at FOR is contributing to training of personnel from other departments at St. Olavs Hospital as well as personnel from other institutions focusing on clinical procedures, research and application of medical technology.
- FOR has visitors from other hospitals and organisation and design of operating rooms has been one of the important focus areas.
- During a course in simulator training arranged by the National Centre for Advanced Laparoscopic Surgery, FOR has been used as an arena for transmission of operative procedures and for dissemination of information about integration of new equipment applied during these procedures.



Teaching of operating room personnel

Students

- On a regular basis operative procedures have been transmitted from the operating rooms to the lecture room in connection with teaching of medical students, nurses and radiography students as well as other professional groups at St. Olavs Hospital, Sør-Trøndelag University College and NTNU.
- Operating room nurses and anaesthesia nurses have been taking part in this educational and tutorial activity.
- Master students as well as PhD-students at St. Olavs Hospital / NTNU / SINTEF have a good opportunity to experience new medical technology and operations from the interactive surgical lecture room at FOR.

Conferences using live transmission 2011

- Fra FOR operating room, gynecology, to KBM65, were Anton Langebrekke, MD, is demonstrating a laparoscopic procedure, May 24th, 2011.
- International course for neurosurgeons "3D Ultrasound and Neuronavigation", Trondheim, June 15-16, 2011, transmission from FOR operating room neurosurgery to lecturer room NSU-01.
- International course in knee surgery, Department of orthopaedic surgery, April 13.-14., 2011, live transmission from FOR operating room orthopaedic surgery to BS31.
- Regular transmissions to medical students from Department of vascular and gastroenterologic surgery for teaching purposes.
- Transmission of operations at FOR in connection with visitors NSALK.
- Visitors at Centre of Competence 3D Ultrasound and Image-guided Surgery and National Centre for Advanced Laparoscopic Surgery (NSALK) at the new integrated university clinic (Centre of GI diseases).
- Regular live transmissions from operations at the FOR operating rooms to the lecture room at FOR and other lecture rooms. These demonstrations have mainly been for medical students, nursing students and radiography students at HiST and NTNU.
- Employees at St. Olavs Hospital have also been taking part in these transmissions.

Experimental surgery

All FOR operating rooms are authorised for experimental surgery including animal research. Such experimental procedures can be ordered at FOR who will organise these procedures. This arrangement is well established among clinicians and scientists. We have a package where FOR is organising and planning the animal experiments in collaboration with Department of comparative medicine. FOR has educated personnel assisting during the whole process.

Personnel who are planning or taking part in animal experiments must have courses regarding animal experiments, which is approved by the Norwegian Food Safety Authority. An

important part of this course is to understand laws and regulations connected to the use of animal in medical experiments. The regulation regarding animal experiments assumes that all person planning or performing animals should have passed the courses and be registered in the electronic system (FOTS) of the board for animal research. Both the responsible scientist and his co-workers involved in the practical performance of the animal experiments, including those who are taking care of the animals, should be included in the application and documentation that they have passed the course on animal experiments, category C should be documented.

In 2011 the following projects included animal experiments:

- **Anna Aasgaard Rethy**, PhD student.
"Navigation and intraoperative imaging in laparoscopic surgery".
- **Håkon Olav Leira**, PhD student.
"Application of Dyna-CT for bronchoscopy and endobronchial procedures".



From the FOR operating room, vascular surgery

Visitors

In 2011 several national and international groups have visited FOR. The visitors have been participants at meetings and courses or other visitors. The visits have been arranged as guided tours, lectures, meetings and courses with live transmission of operations. The groups have consisted of health care professionals, hospital planners, administrators, representatives from the industry, scientists, students etc. In addition, FOR has received several groups from St. Olavs Hospital and from "the hospital development project of Central Norway", as well as SINTEF and NTNU.

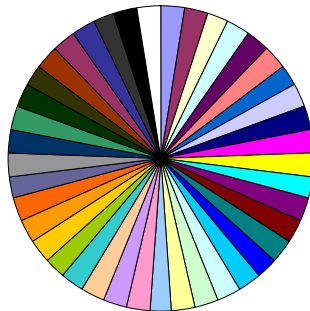
Since the establishment of FOR in 2005 we have had approximately 4500 visitors.

International cooperation has been an important part of FOR. Since 2006 we have had delegations from altogether 42 nations. Thus, FOR has a broad international network and we plan to exchange more PhD-students with international collaborators.



Guiding visitors at Centre of GI surgery

**Visitors at FOR 2006 – 2011
42 nationalities**



| | | | | | |
|----------------|----------|-------------|----------------|-------------|-----------|
| Australia | Austria | Belgium | Bulgaria | Canada | China |
| Czech Republic | Denmark | Dubai | Egypt | Estonia | Finland |
| France | Germany | Greece | India | Irak | Iran |
| Iceland | Israel | Italy | Japan | Latvia | Lithuania |
| Malta | Mexico | Netherlands | Norway | Poland | Portugal |
| Russia | Serbia | Slovenia | Spain | Switzerland | Sweden |
| South Korea | Thailand | Turkey | United Kingdom | Ukraine | USA |



Medical technology, FOR 2011

In 2011 there has been further development of IP-based communication for tele-medicine via FOR, and new IP technology has been applied through the research net – Uninett. As an example this has been used in connection with communication to various destinations in Asia, Europe and USA in 2011. We have also further developed fibre-optic communication from several of the FOR operating rooms, making live transmission in full high-definition possible.

We are also working together with Department of Medical Technology and HEMIT regarding a new infrastructure giving the possibility for live transmission to several of the meeting rooms and lecture rooms at the new hospital. This infrastructure is also a part of the planning for the new Academic Centre, which will be ready during the autumn 2013.

In collaboration with Covidien we have implemented a research-based platform for high energy medical equipment including cautery and an advanced technology for coagulation of blood vessels during surgery. This has been established in all six FOR operating rooms. The goal is to improve the safety during the application of high energy medical equipment. Together with the partners of FOR, 2011 was used for implementing new technology in the new FOR operating rooms. The new technology consists of:

- New HD technology in all six FOR operating rooms for live transmission to lecture rooms, seminar rooms and to other hospitals.
- New integrated angiography laboratory at the FOR operating room in the Center for Vascular and Cardiac diseases. The robot assisted Artis Zeego unit has been established and is giving excellent image quality and faster image processing.
- New EndoAlpha system for laparoscopic procedures at the FOR operating room Gastro centre June 2011.
- In cooperation with Olympus a new operating room concept with focus on integration and improvement of work-flow was installed at the FOR operating room, GI surgery. It includes video routing, special lightening and glass walls, making sanitation simpler. This is ready for implementation of EXERA 3, which will be installed in 2012.
- Gynaecology and laparoscopic procedures:
A cooperation between Departments of Urology, Gynaecology and Gastroenterology has been established. Both Department of Urology and Gynaecology have started using the technology; the daVinci robot, which is now used 3 and 2 days per week respectively. The interest for this technology is increasing and we are already short of capacity for application of this technology.

NORMIT

NorMIT - Norwegian centre for Minimally invasive Image guided Therapy and medical technologies is a common national research infrastructure for minimally invasive image guided therapy. NorMIT is consisting of Operating Room of the Future, St. Olavs Hospital, the Intervention Centre, the National Hospital and SINTEF Medical Technology. In 2011 NorMIT was formally integrated in the Norwegian roadmap for research infrastructure, the Norwegian Research Council. This was performed after a scientific evaluation performed by international experts and based on national strategy for research. Only 17 projects have been included in this national roadmap.

This national roadmap is similar to other roadmaps made in several European countries. It is a direct response to the announcement “Climate for research”. The purpose is to visualise important infrastructures, which are necessary to fulfil important goals regarding research policy to solve challenges in the society and as a foundation for new knowledge. The roadmap is also used for planning of investments for research in the future.

The national roadmap will, together with the European strategy forum for research infrastructure (ESFRI), make it possible to be explicit regarding the needs and interest for common European priorities regarding important infrastructures of international character.

For NorMIT the position in the Norwegian roadmap for research infrastructure is a confirmation that the research and research groups with their infrastructure is of high international quality and relevance.



The leader of NorMIT, Professor Toril A.N. Hernes, NTNU, Research director, SINTEF

Bildeveiledet behandling bedre for pasient og samfunn

Ved Fremtidens Operasjonsrom ved St. Olavs Hospital og Intervensjonscenteret ved Oslo Universitetssykehus behandles dagens pasienter med morgendagens teknologi. Her flytter forskerne grenser og gir dermed pasientene tryggere behandling og sparer samfunnet og helsevesenet for store kostnader.



Prosjekt: NorMIT – Norwegian Centre for Minimally Invasive Image Guided Therapy and Medical Technologies

Mer informasjon:
Fremtidens operasjonsrom, St. Olavs hospital
Intervensjonscenteret, Rikshospitalet

Operasjonsrommene er i praksis moderne forskningslaboratorier som utvikler, tester og tar i bruk ny teknologi, nye behandlingsmetoder og nye medisiner. Samarbeid og arbeidsdeling skal gjøre de to enhetene til én nasjonal infrastruktur for bildeveiledet behandling og medisinsk teknologi.

Målet er å etablere bedre og tryggere behandling for pasienten, færre komplikasjoner, reduserte liggedøgn, samt kostnadseffektive løsninger for samfunnet og helsevesenet.

Eneste i Norge

Bildeveiledet behandling handler om å bruke bildeinformasjon fra medisinske avbildningsteknikker som ultralyd (US), magnetisk resonans (MR) og computertomografi (CT) til å planlegge behandlingen, veilede de kirurgiske

instrumentene, utføre behandlingen og til å evaluere resultatet. Moderne kikkhullsoperasjoner (laparoskopi), karkirurgi ved bruk av kateterintervensjon (endovaskulære metoder) og ultralydveiledet hjernekirurgi er eksempler på metoder som bruker moderne medisinsk teknologi. Resultatet er mindre traumer, mindre blødninger og færre komplikasjoner for pasienten. Forskningsmiljøene i Trondheim og Oslo representerer to av landets sterkeste miljøer på sitt felt, miljøer som har vært sentrale i utviklingen av metoder og teknologi innenfor dette fagområdet også i internasjonal sammenheng.

Intervensjonscenteret ved Oslo Universitetssykehus og Fremtidens Operasjonsrom ved St Olavs Hospital planlegger med NorMIT å bli ett felles forsknings- og innovasjonssenter, med to noder – ett i Oslo og ett i Trondheim.

Strategisk viktig investering

Prosjektet inkluderer en omfattende utstyrs pakke for å oppdatere og modernisere det vitenskapelige utstyret. Infrastrukturen vil styrke forskningen på flere områder med stor strategisk betydning for Norge: medisinsk teknologi, IKT, nanoteknologi, translasjonsforskning og helseinnovasjon.

NorMIT har mange potensielle brukere, og legger opp til et utstrakt samarbeid nasjonalt og internasjonalt mellom akademia, industrien og klinikken.

Partnere

Det er eierne av Fremtidens Operasjonsrom og Intervensjonscenteret, St. Olavs Hospital, Norges teknisk-naturvitenskapelige universitet (NTNU) og Oslo Universitetssykehus som i tett samarbeid med SINTEF, har søkt om å etablere den nasjonale infrastrukturen.

Finansiering

Prosjektet søkte i 2009 om 103 millioner kroner fra Forskningsrådet til å oppgradere og investere i nytt vitenskapelig utstyr for å utvide eksisterende infrastruktur ved Fremtidens Operasjonsrom og Intervensjonscenteret til et nasjonalt senter for forskning og innovasjon innen bildeveiledet behandling og medisinsk teknologi. Søkerinstitusjonene bidrar med en betydelig egenandel i finansieringen av prosjektet i tillegg.

Tidsplan

Bygningsmassen til Fremtidens Operasjonsrom, som i det nye St. Olavs hospital består av seks operasjonsstuer, var ferdigstilt ved åpningen av nye St. Olavs hospital den 12. juni 2010. Inventar og vitenskapelig utstyr til operasjonsstuene, samt en planlagt felles nasjonal plattform for forskning og utvikling innenfor bildeveiledet behandling, vil realiseres fortløpende så snart finansiering er på plass.

Nils Kvernmo, Director of St. Olavs Hospital

The Directors expectation to Operating Rooms of the Future is based on our role as a university hospital. The main tasks of the university hospital are treatment of patients, research and innovation, teaching and training of medical personnel. Our goal is to obtain the best possible quality in patient treatment. This quality should improve as new knowledge and better evidence based treatment is established.

Operating Rooms of the Future is an important arena at St. Olavs Hospital. It will contribute to the promotion of a high academic level, but also to see that the knowledge is used in clinical practice. The contribution of FOR can be quantified in publishing points and PhD-degrees and also building new bridges whereby knowledge can be used resulting in better quality of our patient treatment. FOR should also have a good relationship to industrial partners.

. The most important challenges for the specialist health care can be summarised as follows:

- The needs of the population are changing.
- Economic growth has stagnated within the specialist health sector (interaction reform)
- There will be need for more professional health care workers.
- There is need for a clear documentation of quality within our sector.

Operating Rooms of the Future should be active looking for new solutions for increased efficiency and improvement of our service and the hospital leadership should listen to active groups who want to take the challenges as they are coming.

Your courage and engagement is highly appreciated. It has given strong results in our patient treatment and I am sure that together we are going to conquer the future.

Nils Kvernmo
Director of St. Olavs Hospital



The Dean of the Faculty of Medicine, NTNU, Stig A. Slørdahl

It is a concern that the volume of clinical research in Europe might decline. At the same time there is a need for evidence-based health care and steadily improvement of surgical procedures. The Operating Rooms of the Future (FOR) has been a driving force for clinical research and innovation in Trondheim, but the potential is higher than we what are able to utilize at the present time.

The neighbourhood between the technology campuses at NTNU and SINTEF, six operating rooms representing various specialities and with research as a priority, close collaboration with the industry and not least co-workers at the Medical Faculty, St. Olavs Hospital, with good ideas and enthusiasm for research, make FOR the best place for surgical research in Norway. However, the success will not come by itself. Research must be given priority in the daily clinical activity. Time and resources are mandatory when new procedures and technology are going to be developed or tested.

Giving priority for research must be a part of the culture as it is at the old university hospitals like the National Hospital. If we succeed in creating the same attitude at St. Olavs Hospital, as we are about to do, then the success of FOR will continue.

I am convinced that the Faculty of Medicine and the hospital will give priority to FOR in the future. Together we will recruit co-workers who are willing to do a carrier within research. There is no doubt that FOR is important if we are going to succeed with clinical research in Central Norway.

Stig A. Slørdahl
Dean
The Faculty of Medicine, NTNU





Future plans / FOR in the new hospital

Our goal is to make FOR a research infrastructure of good international quality. We want to increase quality as well as quantity of research relevant for FOR.

FOR should be in the international front regarding image-guided minimally invasive therapy.

FOR has been running since 2005 and continued in 2011 in the new hospital structure with focus on all operating clinics. The core organisation is unchanged, but the research activity is now decentralised to the various operating centres. Altogether we have six operating rooms with a modern AV/ICT structure which is continuing the concept of “the interactive lecture/seminar room”. Thus it is possible to make live transmission and interactive communication in full high-definition (HD). The most important motivation for continuing FOR in the new hospital is to be a basis for good clinical research, but also to have a centre of competence for the building and organisation of operating departments. Today a lot of hospitals are constructed or on the planning stage in Norway as well as other European countries. The operating rooms are the most expensive part of the hospital and the operating departments are expensive to run. Often one has to do changes soon after the operating rooms are finished. We want to gain experience and to be leading within this field, thereby optimising the investments. We will focus on architecture, use of materials, ergonomics, ICT-solutions, logistics and health economy and hope to be able to build operating rooms at a lower cost and to organise them efficiently. It is important to do this in a systematic way, getting solid knowledge about operating departments.

FOR has a close relationship with many important collaborators, with industry, with clinical departments and with technological research groups. The most important agents involved in FOR are St. Olavs Hospital, the Medical Faculty, NTNU and SINTEF. Various centres of competence like; “Centre of competence, Ultrasound and Image Guided Treatment” and “National Centre of Advanced Laparoscopic Surgery” as well as University College of Sør-Trøndelag are important collaborators and it is important to preserve the synergy effect of this cooperation in the years to come.

We want to strengthen the international collaboration. Several international groups want to cooperate with FOR. So far we have focussed on Massachusetts General Hospital in Boston, Operating Room of the Future in Tübingen, Germany and a research group at Krakow University Hospital in Poland. Furthermore, we have cooperation via organisations like EAES and SMIT.

We have established cooperation with Yonsei University Health System, Seoul, Korea. Priority is given to the projects on geriatric medicine, the intelligent hospital and transmission of high quality medical information.

The PhD-candidates are financed through external funding. This has made it possible to obtain a good scientific activity in spite of a small annual budget. FOR has targeted 1-2 PhD-degrees and 1 Master degree per year. In the near future there will be an increasing demand for scientific work which forms the basis of Master degrees, and FOR can be a good platform in this work.

We want to refine and expand indications for stent-graft treatment of aneurysms, dissections and trauma of the arterial system. This can be achieved by using stent-grafts with side-arms for the renal and mesenteric arteries. One project is to apply navigation for deployment of such endoprotheses. Within laparoscopic surgery we also focus on navigation to make the procedures safer. New techniques for treating morbid obesity have been developed. An interesting principle is to apply a pacemaker to stimulate the vagus nerve in these patients. This work is organised as an international multicenter study. Within pulmonary medicine we have applied navigation for endoscopy and endobronchial procedures. Several projects have started within the fields of ENT surgery, oral surgery and neurosurgery. We look forward to extend our collaboration with these units.

In 2011 FOR has developed, established and implanted a teaching system for all doctors in surgical disciplines at St Olav within the use of electro-medical equipment. Focus areas are application of high-energy technology, application of C-arms and x-ray protection .Hospital hygienics has also been included in the program. Through the Health Academy of Regional Health Trust, collaboration has been established in order to expand this arrangement to all hospitals within Central-Norway.

Trondheim, March 2012



Jan Gunnar Skogås
Managing Director FOR



Hans Olav Myhre
Scientific adviser FOR

Research and development

In the following we give a review of scientific activities within committees, PhD's, master projects, ongoing studies and publications.

National and international committees

Hans Olav Myhre:

- Member of a committee evaluating the position as professor of vascular surgery, University of Odense, Denmark.
- Member of executive council. European society for nanomedicine
- Member of advisory board. The Clinam foundation
- Leader for the network FOR within medical technology, NTNU.
- Scientific adviser for FOR
- Responsible for vascular surgery in Centre of Competence, Ultrasound and Image-guided Treatment.

Ronald Mårvik:

- Leader for the national task force responsible for the report "Work-up and treatment of morbid obesity in secondary health care"
- Member of Technology Committee and NOTES - Committee in European Associations of Endoscopic Surgery
- Member of Program Committee for EAES
- Member of the board Norwegian Bariatric Association and Norwegian Thoraco-laparoscopic Union.
- Member of the network Medical Technology, NTNU, Trondheim
- Member of the program committee for research within robotics at NTNU
- Editorial Board, Surgical Endoscopy

Torbjørn Dahl:

- Norwegian representative in ESVS, European Society for Vascular Surgery

- Norwegian representative in International Union of Angiology
- Responsible for vascular surgery within Centre of Competence, Ultrasound and Image-guided Treatment

PhD-theses, Master degrees, Bachelor degrees and other projects

Completed PhD in 2011

Tor Erik Evjemo, PhD, sociology

”Detaljene ved Pålitelighet: Kompleksitet, Interaksjon og Teknologier i Operasjonsstua”

An ethnographic research design used in studies for identifying work-related activities in areas of collaboration and communication. The work is focusing on modes of collaboration in technologically complex environments. A part of this study is focusing on video recording of communications / use of information in a high-tech setting. One of the papers is based on video recording of communication of employees at FOR. This work was published as a monography and Evjemo defended his thesis on January 22nd, 2011. Papers will be published later.

Ole Vegard Solberg, PhD, medical technology

”3D ultralyd for improved diagnoses and surgical guidance – reconstruction and integration on preoperative image data”.

This work was performed in close cooperation with Centre of Competence, Ultrasound in Image-guided surgery. Solberg defended his thesis on February 8th, 2011.

Anne Elisabeth Fløystad Isern, PhD,

”Breast reconstruction after mastectomy – Risk of recurrence after delayed large flap reconstruction- Aesthetic outcome, patient satisfaction, quality of life and surgical results: histopathological findings and follow-up after prophylactic mastectomy in hereditary breast cancer”. The thesis was defended April 28, 2011.

Supervisor Hans Olav Myhre.

Master degree

Anne Karin Wik, Master in health science.

"Quality of life and degree of leak in patients with anal incontinence before and after treatment with sacral nerve stimulation". Defended November 29, 2011.

Ongoing PhD studies

Frode Manstad-Hulaas, PhD, medicine/medical technology

“Endovascular stent-graft implantation using navigation technology”

The project has developed a navigation system based on electro-magnetic positioning and 3D-imaging for application during endovascular treatment of complex aortic aneurysm. This has been performed in an experimental model. The navigation system can visualise instruments in a 3D-image without the use of x-rays. The intention is to make it easier to treat patients with

complex aortic disease with image-guided minimally invasive therapy. The collection of data is finished. This work will be delivered for evaluation in 2012.

Berit Brattheim, MSc, Health/medical technology

“Aortic Aneurysm Network: Coordination support for trans-organizational care processes”. The work is focusing on patients with abdominal aortic aneurysm. Part of the study is describing workflow when selecting patients for possible stent-grafting. The project is studying how new technology will change patient flow and course following treatment, which may give challenges for coordination of the hospital stay. The work is focusing on patients with abdominal aortic aneurysm: selection of patients for EVAR treatment and postoperative follow-up after treatment. The need for ICT-based support is evaluated. The work is done at the Department of electronic patient records (NSEP) and is a part of the so-called COSTT-project. The candidate will finish her work in 2012.

Kari Ravn Eide, PhD, Health/medical technology

“Intraoperative DynaCT during implantation of stent-grafts for abdominal aortic aneurysm”. DynaCT is a technology where a C-arm linked to an angiography laboratory rotates and give CT- like images during the intervention. The whole angiography laboratory was integrated with an operating table for treatment of vascular diseases at FOR. Three papers on the accuracy of DynaCT during AAA repair have been published and the 4th paper regarding irradiation during the application of this equipment is under preparation.

Anna Aasgaard Rethy, PhD, Medical technology

“The role of navigation and intraoperative imaging in laparoscopic surgery”. Two articles have been published and the PhD-work will be finished in 2012.

Reidar Brekken, PhD, Medical technology

“Strain measurements in evaluation of abdominal aortic aneurysm (AAA)”
Strain in the aortic wall is investigated to evaluate the risk of rupture in these patients. One paper is discussing the methodology using ultrasound, while another one is evaluating strain before and after endovascular treatment of abdominal aortic aneurysm. A method for visualisation of strain in a 3D-anatomical model has been finished. Brekken’s PhD-thesis is a collaboration with FOR and Centre of Competence 3D-Ultrasound. He is planning to finish his work in 2012.

Conrad Lange, PhD, Clinical medicine

“Endovascular treatment of aortic disease”.
This work includes investigations of endovascular treatment of so-called inflammatory aortic aneurysms and is also evaluating EVAR in elderly patients; above the age of 80. These works are based on the EUROSTAR vascular register. Clinical results and long-term results following endovascular treatment of abdominal and thoracic aneurysms is part of the study. Three papers have been published and the 4th is under preparation. The project will be finished in 2013.

Camilla Berge, PhD

“Time-trends and results following treatment of abdominal aortic aneurysm”.
This investigation includes papers on time-trends in the treatment of abdominal aortic aneurysm. Furthermore, she has studied the long-term results following open surgery as well as endovascular therapy. Finally, she has investigated AAA in female patients. There are relatively few female patients treated for AAA compared to men. Also, the mortality, especially following rupture, is higher in women. Finally, AAA rupture at a lower diameter in women than in men. This project will be finished in 2012.

Geir Arne Tangen, PhD, Medical technology

“Enhanced Minimally Invasive Therapy”.

The goal is to develop methods for application in navigation technology within endovascular procedures. Today these procedures are dependent upon imaging technology like fluoroscopy for guiding and deployment of endovascular prostheses. Provided navigation technology can be applied during these procedures, one can receive more relevant information, and reduce the dose of irradiation and contrast material to the patient. This will improve the safety and reduce the complication rate. Geir Arne started his PhD during the autumn 2010.

Håkon Olav Leira, PhD Medicine

“The application of DynaCT for bronchoscopy and endobronchial procedures”.

The first part of this PhD investigation is experimental. The purpose is to apply navigation to increase the accuracy and safety of transbronchial procedures and endobronchial minimally invasive therapy. This work is organised by Department of Pulmonary medicine, St. Olavs Hospital. The thesis will be defended on September 18, 2012.

The following projects have also been approved by the Scientific Advisory Board, FOR :

Clinic for ENT diseases, oral surgery and eye diseases

Wenche Moe Thorstensen, PhD

“Symptoms from nose and sinuses in patients with asthma – United airways”.

The investigation is focusing on nasal symptoms in patients with asthma and on the effect on these symptoms when treating pulmonary function. Approved by REK. The first part has been presented and submitted as an article.

Daniel Fossum Bratbak, PhD

“Endoscopic resection of the sphenopalatine ganglion in chronic cluster headache”.

This is a new operating method for cluster headache. It is developed from the established radiowave (thermic) destruction of the sphenopalatine ganglion with infratemporal approach using fluoroscopy. By endoscopic transnasal surgery, one will use a direct approach to the ganglion in the pterygopalatine fossa to the posterior wall of the maxillary sinus for direct visual control during the procedure. The investigation is approved by REK.

“Intranasal and intraoral ultrasound-guided surgery”.

The intention is to explore the role of ultrasound endoprobes for navigation during ENT surgery. A similar approach is used at Department of Neurosurgery. Project leader Professor Ståle Nordgård.

“Sialoscopy in the diagnosis of salivary gland tumours”.

Sialoscopy is a term used for inspection of the salivary ducts by a thin flexible instrument. The project will evaluate the use of this method in the diagnosis of sialolithiasis, tumours and other conditions in the salivary glands. It is also the plan to compare sialoscopy with other diagnostic modalities like MRI. Project leader Christoph Ziegler.

Department of Neurosurgery

The research project “Picturing the Brain: Perspectives on Neuroimaging” is exploring new methods for imaging and visualisation of the brain, focusing on the role that these methods may have as images of visual tools within medicine and science. The goal is to improve the understanding how images will improve our knowledge about the brain by serving as a research tool, surgical tool or an important rhetoric instrument. The project is multidisciplinary and includes collaboration between scientists with background in media science, philosophy, media technology, medical imaging, neuroscience as well as artists. The project consists of three work packages focusing on how the new imaging tools will work within the areas of knowledge, surgery and rhetoric. A fourth work package will function as a project laboratory for testing of various ways of integrating science, technology and society through artistic intervention. The project has been financed by Norwegian Research Council and will be carried out during the period September 1st 2010 – December 31st 2013.

Project leader: Assistant professor Aud Sissel Hoel, Institute of arts- and media science, NTNU. Her team is consisting of professor Andrew Perkis (NTNU), assistant professor Liv Hausken (University of Oslo), senior researcher Annamaria Carusi (Oxford University), PhD-student Jordi Puig (NTNU) and one more PhD-student.

Cooperating partners are Centre for Quantifiable Quality of Service in communication systems (NTNU), Operating Room of the Future (St. Olavs Hospital), SINTEF, Medical Imaging Lab (NTNU) and TEKS – Trondheim Electronic Art centre.

Ongoing projects

- **Cooperation Support Through Transparency (COSTT)**. This is a 4-year research project organised by Norwegian Centre for Electronic Patient Records where FOR is a cooperating partner. The project is financed by the VERDIKT-program financed by the Norwegian Research Council. The goal of the COSTT project is to develop ICT based technologies supporting cooperation and coordination by giving an automated real-time view regarding status and on-going activities for relevant resources and patient courses. The project is running from September 2008 to September 2012. It has 4 PhD-candidates and 2 post.docs. For more information about COSTT, see www.costt.no In 2010 COSTT started a project to realise automatic communication of the activity at the gastro and vascular operating rooms at FOR. All the activities in the operating rooms are generating large quantities of data from ICT systems and other technologies. These data will indicate when relevant events are occurring and the data will be used for further analysis. A next step can be to develop technology which is forming the basis of an infrastructure for future ICT systems for process and decision support.
- Navigation and use of DynaCT during operations for anal incontinence. The main study started in 2008. Patients are still included.
- Evaluation of electromagnetic navigation during bronchoscopy. Completed PhD investigation.
- Investigating the accuracy of electromagnetic navigation in the operating room setting. The investigation is finished and one article is under preparation.

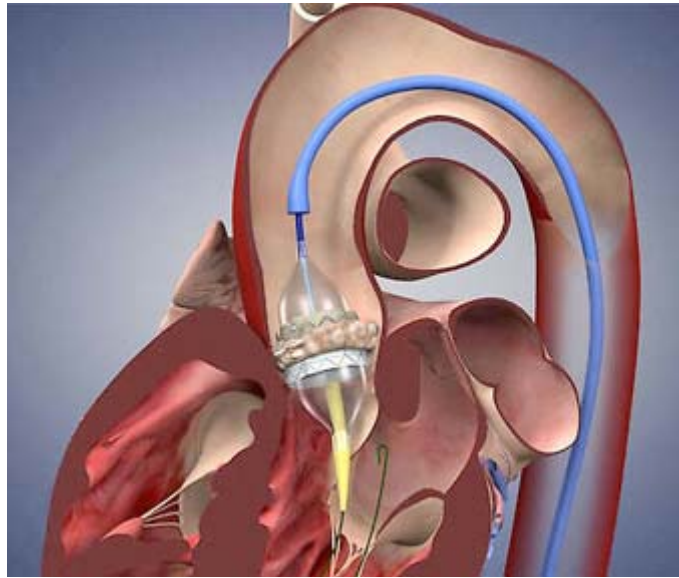
- Evaluation of algorithm for image to image recording (software) is being developed and application in clinical endovascular therapy is planned during the spring 2011.
- Electromagnetic positioning in the operating room. Data have been collected at the new FOR, Centre for Cardiac- and vascular surgery, to investigate the accuracy and robustness of electromagnetic positioning with a C-arm in various positions. We have applied a phantom from a cooperating partner in the United States. This phantom has a ringed field generator making it possible to do x-ray analysis in the centre.
- Clinical investigation regarding accuracy of optical- and electromagnetic navigation during stent-grafting for arterial disease.
- Animal model to investigate the accuracy and feasibility of electromagnetic navigation during implantation of stent-graft with side-branches to the renal and visceral arteries. Thesis will be delivered in 2012 (see Manstad-Hulaas, F.)
- The project “Endovascular stent-graft implantation during image-guided navigation technology” has been performed by a PhD-candidate Frode Manstad-Hulaas. This work will be continued by engineer Geir Arne Tangen, who is a fellow at NTNU, through the eMIT-project. The project will further develop electromagnetic navigation for endovascular procedures. The article "Endovascular image-guided navigation - validation of two volume-volume registration algorithms" has been published and the article "Three-dimensional endovascular navigation with electromagnetic tracking: ex-vivo and in-vivo accuracy" has been accepted.
- Stefanie Demirci from Chair for Computer Aided Medical Procedures & Augmented Reality, Technische Universität München, has been a visitor at FOR, Trondheim, in 2010-2011.
- “The effect of exercise before gastric bypass”. Tissue samples are retrieved pre- and intra-operatively to estimate whether the gene expression in the tissue is changed in patients as a consequence of preoperative physical training. The intra-operative sample is taken in connection with gastric bypass procedures, which are performed at FOR. This is collaboration between NTNU and Centre for Morbid Obesity at St. Olavs Hospital (RSSO), University Hospital of Trondheim.
- Prospective study comparing surgery (gastric bypass) with lifestyle modification in morbid obesity. This is a 5-year study being run by Centre for Morbid Obesity at St. Olavs Hospital. Patients included for operative treatment are operated at FOR.
- The application of navigation in laparoscopy is cooperation with Mesos Medical Centre, Utrecht, Netherlands. The protocol has been signed and this investigation will be carried out as a multicentre study.
- High-definition video in laparoscopy. This is a comparative study aimed at evaluating the clinical significance of high-definition versus standard definition images. The images will be acquired from the same trocar opening where both types of scopes will be pointing towards the same point. The images will then be compared by an independent observer.
- Olympus has developed a prototype for new operating light-source replacing traditional light. This is a collaboration between FOR and Olympus.

- Collaboration with the University of Tübingen concerning development of an ergonomic grip for laparoscopic instruments. Mårvik R.
- Collaboration with the University Hospital, Barcelona, regarding evaluation of the use of Olympus data technology in the operating room.
- EAES (European Association of Endoscopic Surgery). The Trondheim group has members in one of the NOTES committees.
- 3D-Ultrasound in laparoscopy. A solution based on micro-positioning and flexible ultrasound probe to be integrated in the navigation system CustusX is being developed. The ultrasound application has so far been tested in 2009-2010 under laboratory conditions to evaluate the degree of position. This work will be continued as laboratory experiments, primarily by comparing acquired ultrasound images with corresponding images acquired through DynaCT scans. The project will be included in two PhD-theses, one clinical and one technological and the latter will start in January 2011.
- IIIOS (Integrated Interventional Imaging Operating System) is an EU project, Marie Curie ITN project. Two fellows and one post.doc. position will be available for the Trondheim group. One PhD is going to work with ultrasound-guided laparoscopic surgery using FOR as arena for the investigation.
- The EU project VECTOR (Versatile Endoscopic Capsule for gastrointestinal Tumour recognition and therapy) is a large EU project with altogether 18 participants, including SINTEF and clinicians at St. Olavs Hospital through SMIT (Society for Medical Innovation and Technology). The project is focusing on the use of micro-technology for early detection and treatment of cancer in the gastrointestinal tract.
- NSALK is represented through Ronald Mårvik as member in the technology committee EAES, which is responsible for a European symposium each year. Through this work FOR is used as an arena to demonstrate new concepts as well as to establish procedures.
- Collaborative effort has been established in Sony Corporation; M. Kano, V. Liverød and J.G. Skogås, to investigate the application of holograms and 3D displays in operating rooms.
- “Micro-biological investigation of mobile equipment at operating departments”. This is a collaboration between St. Olavs Hospital, Department of hospital hygienics, Sør-Trøndelag University College and FOR. Measurement of the air quality has been carried out in our new operating rooms at St. Olavs Hospital and compared to facilities in the old operating department.
- A collaboration has been established with Massachusetts General Hospital (MGH), Boston in the field of logistics. One of our PhD-candidates (Andreas Seim finished his thesis in 2009) has been visiting MGH and we are planning to continue this collaboration with Warren Sandberg, MD, Department of Anaesthesiology, Vanderbilt University School of Medicine, Nashville, TN. He has been employed as professor II at Department of Circulation and Medical Imaging, NTNU.
- Safe Access and closure in trans-gastric natural orifice endoscopic surgery (NOTES). Project period 2009-2014. Suhail A, Mårvik R. Kuhry E.

- Adhesion formation after laparoscopic and open surgery. Project period 2009-2014. Kuhry E.
- Analogue simulator with electromagnetic tracking. Development of electromagnetic tracking equipment. Project completed. Mårvik R, Våpenstad C.
- The research project based on the NTNU game “World of NTNU, WoN”, by Q2S is working on a conceptual platform to integrating three research fields, medias in network, QoS mechanisms for dynamic net and quality measurements”.
The platform has a main goal to define integrating research activity in all three research fields by developing a main architecture based on serious games. The development phase for WoN is based on the architecture and is following a cyclic process where each stadium in the development is dependent upon and is influencing the previous one. The process has been chosen to explore new projects in various fields from architecture to medicine. The intention is to develop further a scenario for advanced surgery. The model is finished and will be implanted in the near future.
- Department of Thoracic Surgery and Cardiology as well as Departments of Anaesthesia and Medical Imaging have together started a minimally invasive treatment of patients with aortic stenosis. This treatment, TAVI (Transcatheter Aortic Valve Implantation), is an alternative to open surgical valve replacement in aortic stenosis of high-risk patients. The operative trauma is less than conventional surgery. The valve is implanted either via the femoral artery in the groin or through a mini-thoracotomy and further through the apex of the heart.



Aortic valves used for TAVI in patients with aortic stenosis



Schematic illustration showing deployment of aortic valve by the TAVI-technique

National and international collaborators

- FOR work closely with HIST (University College of Sør-Trøndelag), NSALK (National Centre for Advanced Laparoscopic Surgery), SINTEF – Department of Medical Technology and National Centre of Competence –Ultrasound and image guided treatment.
- Today there is a good cooperation with our most important industrial collaborators, SONY, Siemens, Olympus and Covidien.

Publications

Vascular/endovascular therapy

Publications in international journals with peer review

Brattheim B, Faxvaag A, Seim A.

Process support for risk mitigation: a case study of variability and resilience in vascular surgery.

J Qual Saf. Epub 2011 Feb 16. 2011;Aug; 20(8):672-9

Brattheim B, Faxvaag A, Toussaint P.

When information sharing is not enough. Stud Health Technol Inform. 2011;169:359-63

Eide KR, Ødegård A, Myhre HO, Hatlinghus S, Haraldseth O.

DynaCT in pre-treatment evaluation of aortic aneurysm before EVAR. Eur J Vasc Endovasc Surg. 2011 Sep;42(3):332-9. Epub 2011 Jul 22

Manstad-Hulaas F, Tangen GA, Gruionu LG, Aadahl P, Hernes TA.

Three-dimensional endovascular navigation with electromagnetic tracking: ex vivo and in vivo accuracy. J Endovasc Ther. 2011 Apr;18(2):230-40. PubMed PMID: 21521064

Manstad-Hulaas F, Tangen GA, Demirci S, Pfister M, Lydersen S, Nagelhus Hernes

TA. Endovascular image-guided navigation: validation of two volume registration algorithms. Minim Invasive Ther Allied Technol. 2011

Sep;20(5):282-9. doi: 10.3109/13645706.2010.536244. Epub 2010 Nov 24. PubMed PMID: 21091381

Leira HO, Amundsen T, Tangen GA, Bø LE, Manstad-Hulaas F, Langø T. A novel

research platform for electromagnetic navigated bronchoscopy using cone beam CT imaging and an animal model. Minim Invasive Ther Allied Technol. 2011

Jan;20(1):30-41. Epub 2010 Sep 27. PubMed PMID: 20874055

Leira HO, Tangen GA, Hofstad EF, Langø T, Amundsen T. A novel in-vivo method for lung

segment movement tracking. Accepted for publication in J Physics in Medicine and Biology. November 2011

Presentations at international conferences

Electromagnetic navigation technology in endovascular procedures – Navigation

Accuracy and initial experiences. Geir Arne Tangen, Frode Manstad-Hulaas. Proceedings of the 2011 SCATH Joint Workshop on New Technologies for Computer/Robot Assisted Surgery. 11-13 Juli, 2011, Graz, Austria

Eide, Kari Ravn: “Cone-beam CT imaging in the operating room during endovascular aortic

repair (EVAR)”. Oral presentation (invited speaker) at European Congress of Radiology 2011. Wien 06. Mars 2011

Vijayan Sinara, Langø Thomas, Hofstad Erlend F, Reinertsen Ingerid, Hernes Toril AN.

Vessel based registration of medical images for improved image guided interventions. Oral

presentation at the 3rd National PhD Conference in Medical Imaging, Oslo, 21-22 November 2011

Langø T et al. Image fusion and electromagnetic tracking for image guided treatment. Invited lecture at the 2nd conference on Interdisciplinary Treatment in Cancer, Arnhem, The Netherlands, February 10, 2011

Langø T et al. Image fusion and electromagnetic tracking for image guided treatment. Invited lecture at internal hospital seminar series, Netherlands Cancer Institute, NKI-AVL (Netherlands Kanker Instituut - Antoni van Leeuwenhoek Ziekenhuis), Amsterdam, The Netherlands, February 9, 2011

Mårvik R et al. Surgical simulation and Operating Room of the Future, NTNU-research days, September 24, 2011

Reynisson Pall Jens, Langø Thomas, Lindseth Frank, Hernes Toril AN. Medical image fusion for improved image guided therapy. Poster, 3rd National PhD Conference in Medical Imaging, Oslo, 21-22 November 2011

Book chapters

Brattheim B, Faxvaag A, Tjora A.
Part II Evidence in the Clinic
Communally-Based Evidence in the Emerging Practice of Aorta Implant Surgery.
Evidence-Based Healthcare in Context. Critical Social Science Perspectives. Edited by Alex Broom and Jon Adams. Ashgate. December 2011.

Langø T, Hernes TAN, Mårvik R. Navigated ultrasound in laparoscopic surgery. Book chapter In Press, InTech, Book title: Laparoscopic surgery, ISBN 978-953-307-766-6, Edited by Arshad M. Malik.

Endo-/laparoscopic surgery

Publications in international journals

Zijlmans M, Langø T, van Swol C, Rethy A. Towards navigated ultrasound in laparoscopic liver surgery – Determination of liver shift and deformation due to pneumoperitoneum in an animal model. Submitted Minim Invasive Ther Allied Technol (MITAT), December 2011.

Rethy A, Langø T, Mårvik R. Laparoscopic ultrasound for the liver: A review. Submitted to J Surg Endosc. September 2011.

Bø LE, Leira HO, Tangen GA, Hofstad EF, Amundsen T, Langø T. Accuracy of electromagnetic tracking with a prototype field generator in an interventional OR setting. J Med Phys, in press 2011

Langø T, Vijayan S, Rethy A, Våpenstad C, Solberg OV, Mårvik R, Johnsen G, Hernes TAN. Navigated laparoscopic ultrasound in abdominal soft tissue surgery - Technological overview and perspectives. Int J Comput Assist Radiol Surg (IJCARS), Online first, September 2011. DOI: 10.1007/S11548-011-0656-3.

Solberg OV, Lindseth F, Bø LE, Muller S, Bakeng JBL, Tangen GA, Hernes TAN. 3D ultrasound reconstruction algorithms from analogue and digital data. Ultrasonics 2011, 51(4):405-419.

Muller S, Langø T, Brekken R, Ystgaard B. Degree of adhesion after repair of incisional hernia. JSLS, 2011; 14:399-404.

Presentations at national and international meetings and conferences

Langø T et al. The importance of intraoperative imaging and navigation technologies in MIS. Invited lecture at European Science Foundation Exploratory Workshop on Image-guided Laparoscopic Therapies, Jesús Usón Minimally Invasive Surgery Centre (JUMISC) in collaboration with the Bioengineering and Telemedicine Centre from the Technical University of Madrid (GBT-UPM), Caceres, Spain, June 15-17, 2011

Langø Thomas et al. Navigert ultralyd i laparoskopi. Invited lecture at Annual meeting for the Norwegian Society of Diagnostics Ultrasound in Medicine (NFUD). Britannia Hotel, Trondheim, 30.03 – 01.04 2011

Mårvik R et al. Presentation at the Annual meeting of the European Association for Endoscopic Surgery (EAES), Torino, 16.-18. June, 2011. Talks: Future Operating Room at St. Olavs Hospital; Navigation in Laparoscopic Surgery; Nevromodulation in Bariatric Surgery, Training in laparoscopic surgery - Single port.

Mårvik R. Presentation at course in laparoscopic surgery, National Hospital, February 10.-11., 2011

Mårvik R. Presentation NTLF winter meeting Henningsvær, March 24.-25., 2011

Mårvik R. Presentation at NTLF-course laparoscopy for general surgeons, NSALK, Trondheim, May 11.-13., 2011

Mårvik R. Presentation at course in simulation for operating room nurses, NSALK, October 20.-21., 2011

Mårvik R. Leader of course in laparoscopic surgery NSALK, November 16. -18. 2011

Mårvik R. ISFIT New technology in MIS, NSALK, 16.02.11

Mårvik R. Ergonomy in laparoscopy, St. Marys Hospital London, 11.03.11

Mårvik R. Inv speaker; Navigation in laparoscopy surgery, VII Conference- Advanced Laparoscopic Surgery Gdansk, 14.-15.03.11

Mårvik R. Presentation on NSALK, Symposium Course Center in Lund, 03.03.11

Mårvik R. EAES Torino, Faculty and invited speaker, EAES Tech Committee Future Operating Room at St. Olavs Hospital, Navigation in Laparoscopic Surgery Nevromodulation in Bariatric Surgery, 16-18.06.11

Mårvik R. Volargrip in MIS, Symposium at Academic Center, Baisingstoke, UK, 17.06.11

Mårvik R. Faculty/Presentation on LSS course, Eindhoven, 03.10.11

Mårvik R. New trends in laparoscopic surgery, 1st EnGyn Europe Meeting for Endoscopic Gynaecology

Prices

Cecilie Våpenstad and Ronald Mårvik. The journal "Kirurgen" 1. price 2011 for the article "Training and quality assurance of motoric skill in laparoscopic surgery". Presented at the annual meeting of the Norwegian Surgical Association, October 27, 2011.

FOR- general

Presentations at international meetings and conferences

Myhre HO. Vascular surgery in Norway - a snapshot. Presentation at the 100 year anniversary, Norwegian Surgical Society, October 27th, 2011.

Myhre HO. Infrainguinal atherosklerose - Prevalence/risk factors, status in Norway. Course University of Oslo. November 23rd, 2011

Myhre HO. Operating Rooms of the Future – a research infrastructure. Presentation at Vascular Forum of Central Norway, Trondheim, November 25th, 2011

Skogås JG. Operating Room of the Future in orthopedics R&D Lecture, Brussel, July

Skogås JG. Operating Room of the Future, infrastructure R&D
Lecture, Vejle Hospital, Denmark.

Thorvik K. Paper presented at Technical session - SPE Intelligent Energy Conference 2012,
Utrecht, The Netherlands, 27-29.03.11

Publications

Kvam A, Aasland J, Skogås JG, Wik AK. Bacteriologic testing of mobile electro-medical equipment used at operating rooms. *Sykepleien Forskning* 2011;6(2) 20.06.2011. s. 114-122

Larsen S, Bjørkevoll KS, Gibson AK, Gunnerud V, Lien DO, Thorvik K, Nystad AN
A stack model capabilities approach investigate integrated operations across different industrial sectors - O&G industry versus aviation, military and medicine" (SPE-150431)
Society of Petroleum Engineers

Book chapters

Myhre HO.

Vascular surgery in Norway. In: *Surgery in Norway, Norwegian Surgical Society 100 years.* The Norwegian Surgical Society 2011 ISBN 978-82-8070-093-3. pp. 200-206

Myhre HO, Wesche J, Nyheim T.

Norwegian Society for Vascular Surgery. In: *Surgery in Norway, Norwegian Surgical Society 100 years.* The Norwegian Surgical Society 2011 ISBN 978-82-8070-093-3. pp. 207-209

Mårvik R, Myhre HO, Unsgård G.

Experimental Surgery in Trondheim. In: *Surgery in Norway, Norwegian Surgical Society 100 years.* Trondheim: The Norwegian Surgical Society 2011 ISBN 978-82-8070-093-3. pp. 128-131

Presentations, courses etc. FOR 2011

Wik AK. Operating Room of the Future –Representatives from Multidisciplinary Assessment of Technology Centre for Healthcare (MATCH) og SINTEF. 03.02.11

Marken T. Patient safety and hygienics. Course for SINTEF-employees. "Dressing and hygienics in operating rooms" March 3rd, 2011

Skogås JG. Patient safety and hygienics. Course for SINTEF-employees. "Technical equipment in the operating room" March 3rd, 2011

Skogås JG. Operating Room of the Future, research and development within minimally invasive treatment. The significance of modern ICT.
Presentation at HEMIT, Oppdal November 18th, 2011

Thorvik K. The conference for health industry

"Operating Room of the Future as an infrastructure for research and innovation of good international quality" August 23rd, 2011

Haugvold M, Marken T. "De e bare mæ" – A subjective observation regarding the promise of secrecy at St. Olavs Hospital. Presentation Røros Hospital. September 12th, 2011

Skogås JG. Operating Room of the Future. Presentation for operating room nurses and anaesthesia nurses. HiST. September 15th, 2011.

Haugvold M. "Operating Room of the Future". Seminar for the network infrastructure within research. October 10th, 2011

Wik AK. Injuries connected to positioning of the patient. Course for operating room nurses at NSALK, October 20th, 2011

Wik AK. Microbiological testing of mobile equipment in the operating room. Presentation for orthopaedic operating room nurses. October 28th, 2011

Wik AK. Injuries connected to positioning of the patient. Course for operating room nurses at NSALK, December 1st, 2011

Skogås JG. Presentations at course in the application of elektro-medical equipment: 16.02.11, 02.03.11, 05.04.11, 25.05.11, 20.09.11, 04.10.11, 02.11.11.

Participation at seminars/conferences

- Participation on the annual strategy meeting for Centre of Competence Ultrasound in Image-guided Therapy. Rica Nidelven, Trondheim, January 6.-7., 2011
- Educational exhibition, Trondheim Spektrum. FOR participated at the stand of St. Olavs Hospital for two days. An operating room and a simulator box for laparoscopic training were mounted. February 3.-4., 2011



- The conference for health industry, Rica Hell. FOR had a stand, August 23rd, 2011
Ketil Thorvik had a presentation at this conference.



- Conference on health and care, November 7th, 2011
FOR had a stand at this conference. The main topic was research and innovation for better quality and patient safety.

Media presentations

- Renewal within the Health sector, No. 9/March 2011
- Course in knee surgery, April 13th – Kilden.no
<http://www.stolav.no/no/Aktuelt/Nyheter/Pulsen/Advarer-mot-sterke-sener/>
- Adressa 30.04.11 – Opening of the new Røros Hospital 29.04.11
- Retten tidlig mai ifm. Opening of the new Røros Hospital 29.04.11
- Fjell Ijomen 04.05.11 - Ifm. New Røros Hospital
- Dagens Medisin 14/2011 01.09.11 - Ifm. Kurs i 3D Ultralyd innen Nevrokirurgi: "Vekker tredimensjonal oppsikt ute"
- St. Olavs Hospital – PULSEN – "Pasienthistorie blir film" 16.11.11 – Kilden.no
- Mention in Olympus EndoAlpha reference brochure
- Mention in IHF 2013 Oslo "a taste of Norway"
- Fornyelse av FOR brosjyre, roll ups, penner og visittkort våren 2011
- FOR movie no. 1 -



<http://www.youtube.com/watch?v=7KcwPwkdxyIPer> (tid 3:36)

- FOR movie no. 2 – with interview of Skogås and Myhre (tid 5:49)



<http://www.youtube.com/watch?v=7yi-2nXQWrc&feature=youtu.be>

- FOR movie no. 3 – English version



<http://www.youtube.com/watch?v=wWZJQyEYriU> (tid 5:36)



Economy

| 14011044 Assets | |
|----------------------------|-------------------|
| Assets 2011: | 1 547 000 |
| Accumulated assets | 1 527 624 |
| Accumulated internal costs | 52 413 |
| Overhead | 237 006 |
| Result | (-270 042) |

Project: 97201

| 14011044 - 3D Ultrasound | |
|---------------------------------|-------------------|
| Assets 2011: | 1 425 000 |
| Accumulated assets | 1 382 152 |
| Accumulated internal costs | |
| Overhead | 207 323 |
| Result | (-164 475) |



Movie Operating Room of the Future
<http://www.youtube.com/watch?v=7yi-2nXQWrc>

www.stolav.no/for