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

Annual Report 2013
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Cover photo of professor Ståle Nordgård and surgeon Daniel Bratbak, Clinic of Ear, Nose, Throat, Oral and Eye diseases. Photo: Geir Mogen
Summary

The Operating Room of the Future (FOR) is a research infrastructure facilitating research at our hospital. FOR is taking part in several research projects and several of them, but not all, are lead by FOR. In the present report we have included some projects where FOR and our staff have represented a prerequisite for the completion of the project. In these cases we have included the project leader/supervisor in the mention.

The Operating Room of the Future is 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 Department of Circulation and Medical Imaging, The Medical Faculty, NTNU. The Operating Room of the Future is an arena for research and development 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 teaching of health care personnel. The aim of FOR should fulfil these goals, Trondheim has a particular responsibility for research within the field of medical technology.

The principal activity at FOR is research to provide safer and better treatment, more efficient logistics and flexible architecture in the construction of new operating rooms. FOR has also become a center 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 Intervention Centre at the National Hospital, Oslo. In 2013 the two institutions received a research grant from the Norwegian Research Council of NOK 54 mill distributed over 5 years to improve clinical and technological research.

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 key-hole surgery of the abdomen (laparoscopic surgery) and endovascular therapy for diseases of the blood vessels. Minimally invasive therapy is now used in all surgical disciplines and FOR is now 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. October 1. 2013 we opened a new FOR operating room at the clinic for ENT diseases, Oral and Eye diseases. This prototype included visualisation according to the so-called “cockpit solution “where all important imaging is easily available for the operating surgeon.

FOR has now 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 multidisciplinary approach. Investigations are performed by PhD-candidates, scientists, students and clinicians. FOR with this technical equipment and design is perfect for teaching and education of students, doctors and nurses.

New methods of teaching have been tested, and transmission of images from the operating rooms with to-way communication has been used on several occasions. The educational part of the project should be continued. At FOR and NSALK several postgraduate courses for medical students are arranged annually. Our facility with integrated surgical lecture room is an excellent supplement to the teaching program used at these 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 of the application of electro-medical equipment has been an increasingly more important task for FOR.
Operating Room of the Future

St. Olavs Hospital HF

St. Olavs Hospital HF, University Hospital of Trondheim, is integrated with NTNU and owned by Central-Norway Regional Health Authority RHF. Most institutions are located in the centre of Trondheim at Øya, Østmarka, Bråset and Lian. St. Olavs Hospital has three district centres for psychiatry, two in Trondheim and one in Orkdal. Orkdal Hospital, New Røros Hospital and Hysnes Health Center are representing a part of the clinical activity at St. Olavs Hospital.

St. Olavs Hospital is the university hospital of Central-Norway, and local hospital for a population of about 302 755 inhabitants per December 2013. Treatment of patients, teaching of patients and their relatives as well as research and teaching of health care personnel are the main tasks of the hospital as defined in the specialist health care act. Our core values are integrity, equality, respect and co-determination, forming the background for our clinical activity and our students, colleagues and collaborators. St. Olavs Hospital is integrated with the Norwegian University of Science and Technology, NTNU, and students, teachers and scientists are representing natural parts of the hospitals activity. Within teaching and research we are collaborating closely with several other institutions in central Norway.

In 2013 we had;

- 9719 employees
- 747 beds (somatic - and including Orkdal Hospital and Røros Hospital)
- 45 operating rooms (In addition: 6 OR at Orkdal Hospital and 3 OR at Røros Hospital).
- 420672 somatic outpatient consultations
FOR, NorMIT and the future plans

For has been established as a very important infrastructure for research and development at the integrated University Hospital of Trondheim. FOR is facilitating patient-oriented clinical research while we are developing the medical technology of tomorrow which then can be offered to the patients today.

National infrastructure

FOR has, together with the Interventional Center at The National Hospital, Oslo University Hospital received a research grant to become a national infrastructure for research within future technology for image guided therapy. NorMIT is an abbreviation for “Norwegian center for Minimally invasive Image guided Therapy and medical technologies”. The grant of NOK 54 mill was given by The Norwegian Research Council and will be distributed over a 5-year period. This center for research and innovation has to nodes; one in Oslo and one in Trondheim. Both units have invested a significant quantity of own resources to establish and to run this center.

I am looking forward to observe that this establishment will improve the clinical and the technological research efforts leading to better competence and innovation and to improved safety for the patient. Although the main focus is image guided minimally invasive therapy, we will also have research projects within fields like logistics, work flow, communication, organisation and transmission of high quality images. Thereby we hope to achieve better treatment with less complications, shorter length of stay, shorter convalescence and improved patient satisfaction. In addition we hope the the treatment will be more cost-effective for the health care system as well as for the society as a whole.

NorMIT will strengthen our position as the headquarter of medical technology in Norway. I also hope that it will influence recruitment of professionals as well as scientists to our research group.

Professor Petter Aadahl MD, PhD
Director of Research
St. Olavs Hospital

Photo: St. Olavs Hospital
The Dean of the Faculty of Medicine, NTNU, Stig A. Slørdahl

Our health care system needs new solutions to meet the challenges of the future. This includes a need for new technology, new ways of cooperation for groups of health personnel and more knowledge to give the best possible health care.

In all these areas the Operating Rooms of the future can contribute. I recently went through documents that I wrote in 2004 in connection with opening of the FOR. We then had exciting and ambitious plans how FOR could be a center for both St. Olav's hospital and NTNU. At the time I had a feeling that we were a bit too optimistic about what we might achieve. Looking at our six operating rooms for various specialties with priority for research and the grant that we received together with the Intervention Center, The National hospital from the Norwegian Research Council, it all would then have been regarded as an unrealistic dream. The infrastructure which now has been established at FOR gives us unique opportunities to perform good clinical investigations which could improve the patient treatment. FOR will also contribute to innovation within the health care sector.

Those of us who are responsible for the medical research at our university have great expectations to the campuses at NTNU and St. Olav's Hospital that they will promote first class international research in collaboration with the research foundation SINTEF. Thus FOR should have a key role in national and international scientific collaboration

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 career 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 Medical Faculty, NTNU

Photo: Geir Mogen/NTNU
Organisation of the Operating Room of the Future

Overview over St. Olavs Hospital HF, University Hospital of Trondheim and the six operating theatres
Scientific advisory board

A important task for FOR is to improve the quality and quantity of clinical research. Therefore the scientific advisory board is going through all research protocols, giving advise to those who are doing projects under the direction of FOR. FOR has a special guideline for projects including the tasks of the scientific advisory board as well as a description how to make research protocols (Professor Per Farup). These documents are forming the basis for the collaboration between FOR and those who are conducting research projects there. In addition we are making separate agreements between FOR and the project leaders. In 2013 altogether 8 bachelor degrees, 2 master degrees and 2 PhD degrees were finished in collaboration with FOR. FOR will have several main subjects for medical students. Assistant professor Torbjørn Dahl became the new leader of the scientific advisory board from February 1. 2013

The scientific advisory board has the following members in the period 2009- 2013:

Assistant professor Torbjørn Dahl (leader)
Professor Hans Olav Myhre
Professor Jon Erik Grønbech
Professor Olav Haraldseth
Professor Toril N. Hernes
Professor Per Farup
Professor Olav Sellevold
Assistant Professor Ivar Rossvoll
Professor Ståle Norgård
The Staff of FOR

Hans Olav Myhre  
Emeritus professor of surgery

Jan Gunnar Skogås  
Biomedical engineer  
Managing director, FOR

Torbjørn Dahl  
Assistant professor  
Scientific adviser  
Chief, Department of Vascular Surgery

Ronald Mårvik  
Assistant professor  
Consultant surgeon  
Department of Gastroenterologic surgery

Therese Marken  
Surgical nurse  
Project coordinator

Marianne Haugvold  
Cand. Scient  
Project coordinator

Ketil Thorvik  
Cand. mag  
Project leader

Camilla Berge  
PhD - candidate  
Project coordinator

Jorid Øverdahl  
Cand. mag  
Project leader

Liv-Inger Stenstad  
Radiographer  
Project coordinator

Lisa Millgård Sagberg  
Research nurse  
Project coordinator
Highlights 2013

Innovation price 2013. Central Norway Regional Health Authorities

FOR received the innovation price for 2012 from Central Norway Health Authorities. This is the second time that the price of NOK 100 000 was handed out.

In their motivation the nomination committee mentioned that FOR had applied new treatment modalities and new technology for improvement of quality and effectiveness within minimally invasive treatment. In addition, they recognized that FOR had established a learning platform through the application of new medical and visualization technologies.

All the applications for the price this year were of high quality. FOR received the price since one had for many years worked systematically in the interphase between research and innovation and FOR has been recognized nationally as well as internationally.

Research, innovation and development are a prerequisite for minimally invasive therapy. FOR has several collaborators and local, national and international co-workers have been involved in the development of FOR to its present status. We are grateful for this support, and especially we want to thank NTNU, SINTEF and National Center for Image Guided Minimally Invasive Surgery.

Ola D. Sæther, Head of Surgical Clinic, St. Olavs Hospital received the Innovation price on behalf of FOR

Photo: Hanne Sterten, Helse midt Norge HF

NorMIT

NorMIT is an abbreviation for “Norwegian center for Minimally invasive Image guided Therapy and medical technologies” This is a cooperation with The Interventional Center at Oslo University Hospital. Following a thorough evaluation by an international panel, FOR was by the Norwegian Research Council placed on the national “roadmap” for important Norwegian infrastructures for innovation and research. In 2013 this initiative lead to a research grant distributed over 5 years for the two institutions. The center for research and innovation has two nodes; one in Trondheim and one in Oslo.

The centers are in this aspect equal, but have somewhat different proficiencies. Thus, the research at FOR has been concentrated on the application of ultrasound as imaging modality during minimally invasive therapy. This establishment will improve the clinical and technological research activity and lead to better innovation and competence. It will also improve patient safety. Although the main focus is minimally invasive therapy, also topics like logistics, work flow, communication, organisation and transmission of high quality medical images will be addressed. An important research topic will be application of imaging modalities (Ultrasound, MR, CT etc) for the planning, treatment and post-treatment follow-up of the patient. In this way we hope to develop methods to improve the treatment by decreasing the risk of complications, to reduce the length of stay as well as the convalescence. In the long run this will be cost effective for the health care system and for the society at a whole. One important goal has been to reduce complications following the use of medical equipment.

Therefore FOR is organising a course in the use of electro medical instruments (EMU) and this program is now used by all operating units at St. Olavs Hospital.

The center will be of importance for the whole line from development of products, testing and access to the market. We will further focus on teaching and dissemination of knowledge nationally and internationally.
IHF Oslo 2013-The 38th World Hospital Congress

At the IHF Oslo 2013- The 38th world Hospital Congress with the main topic "Future Healthcare-The opportunities of new technology", FOR was active both in the expo area and not least with the spectacular live transmission of a neurosurgical operation to the conference center Oslo Spectrum.

New medical technology was demonstrated by our collaborators Siemens, Karl Storz, NTNU TTO, NTNU Med. Tek, Viju, National Center of Competence for Ultrasound and Image Guided Treatment and SINTEF. Our pavilion was well attended during the whole conference and we appreciated HM Crown Prince Haakon Magnus’ visit to our stand.

Thursday June 20 a full plenary session observed the live transmission from the Department of Neurosurgery, Trondheim to Oslo Spectrum. Professor Stein Kaasa introduced the session and Professor Geirmund Unsgaard was the operating surgeon. Professor Hans Olav Myhre was leading the session and focussed on good interaction between the operating room and the Oslo Spectrum. Jan Gunnar Skogås gave a presentation about FOR as a research infrastructure. FOR was also mentioned by Minister of Health Jonas Gahr Støre and Secretary General of WHO, Dr. Margaret Chan. The conference had altogether 1500 participants.

On behalf of FOR we want to thank all those who were involved, for assistance and cooperation before and during the conference.

Kronprins Haakon Magnus visits the FOR- pavillion
Foto: NTB

The National strategy plan for ICT 2013-2020

The Operating Room of the future is mentioned in the national plan for ICT 2013- 2022. The government has a strategy for research and development within ICT where they focus on important areas where they want to spend resources in the years to come.

ICT in combination with medical technology is becoming more and more widespread. To improve growth and formation of values we need strong ICT groups in Norway and we are dependent upon research and development within this area. Although much is going on internationally, we need our own national expertise within the field.

The government has pointed at three focus- areas of ICT research and development in the Years to come:

- ICT of high international quality
- Business development
- Social challenges

Link to: Nasjonal strategi- IKT-forskning og-utvikling.
FOR has moved to the Knowledge center
In November 2013, the administration of FOR moved from the MR center to the Knowledge Center, 4th floor, east wing. Visiting address: Olav Kyrresgate 10, 7006 Trondheim. Here you will also find the administration, the scientific advisory board and our research coordinators. Please contact jan.gunnar.skogas@stolav.no
www.stolav.no/for

New operating room at the Department of Ear-Nose-Throat, Eye and Maxillofacial surgery
October 1, 2013, a new FOR operating room was opened at the Department of Ear-Nose Throat, Eye and Maxillofacial surgery. This is the sixth and the latest FOR operating room at St. Olav’s Hospital. Here we have focused on technology, logistics, communication and modern equipment. This operating room is well suited for research and development as well as for standardisation of operative procedures. This new operating room is constructed according to the so-called “cockpit” solution with optimal access to all image based information in the field of operation. This concept is inspired by the cockpit in an air plane. In front of the operating table, 3 large screens give the operating team all necessary information from images which are necessary to complete the procedure. This concept is the first digital operating room and in the near future all necessary units will be integrated in the operating room. In addition the operating room has ergonomic light, which is convenient both for the operating team as well as for the patient. The company Karl Storz has been our industrial collaborator in this project.

“It is an important milestone for our clinic to get this modern arena for research and development. We are indeed looking forward to make use of it” said head of the department Mette Bratt on the inauguration day.

More about the opening of the new operating room at: http://www.stolav.no/no/Nyheter/---Det-er-heftig/125008/

More pictures from the opening of the operating room at the Department of Ear-Nose-Throat, Maxillofacial an Eye diseases at:
http://www.flickr.com/photos/stolavhospital/sets/72157636111389835/

Professor Ståle Norgård and consultant surgeon Daniel Bratbak,
Department of Ear Nose and Throat diseases.
Photo: Geir Mogen, NTNU

Head of the clinic Mette Bratt and managing director Jan Gunnar Skogås at the inauguration of the FOR operating room October 1th, 2013.
Photo: St. Olav’s Hospital
Operative activity in the FOR operating rooms

Surgical clinic

FOR has strengthened its position as an institution where an important goal has been to combine advanced imaging techniques with both traditional surgery and with minimally invasive techniques. There is great interest in using the two FOR operating rooms at the surgical clinic, not only for research purposes, but also for clinical use for several disciplines realizing the significance of intraoperative imaging with ultrasound or angiography.

Several bachelor students have finished their projects at FOR, and in addition the testing of new equipment from the industry is made in a systematic way. Under the leadership of FOR, animal experiments have been made possible. On this basis we have performed research projects regarding navigation technology, and steerable catheters and instruments.

I have great expectations to the NorMIT project which opens up for closer cooperation with the Interventional Center at The National Hospital, Oslo.

It is also important to disseminate information about FOR within our own clinic. Thereby more of our employees can observe the possibilities to test new ideas and new treatment modalities.

Birger H. Endreseth
Head of Surgical Clinic

Photo: St. Olavs Hospital
### Operative activity, FOR - operating room 4.
#### Department of surgery 2013

<table>
<thead>
<tr>
<th>Gastroenterologic</th>
<th>Laparoscopic operation suprarenal gland</th>
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<tbody>
<tr>
<td>surgery</td>
<td><strong>&quot;</strong> Fundoplication</td>
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<td></td>
<td><strong>&quot;</strong> splenectomy</td>
<td>12</td>
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<tr>
<td></td>
<td><strong>&quot;</strong> paraesophageal hernia</td>
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<tr>
<td></td>
<td><strong>&quot;</strong> Hellers myotomy</td>
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<td><strong>&quot;</strong> Door-fundoplikastion</td>
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<td><strong>&quot;</strong> cholecystectomy</td>
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<td><strong>&quot;</strong> Colectomy w. ileostomy</td>
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<td><strong>&quot;</strong> Right Hemicolecotomy</td>
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<tr>
<td></td>
<td><strong>&quot;</strong> Gastric resection</td>
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<td></td>
<td><strong>&quot;</strong> gastric bypass</td>
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<tr>
<td></td>
<td><strong>&quot;</strong> gastric sleeve</td>
<td>2</td>
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<tr>
<td>Endoscopic esophago-diverticulostomy</td>
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<td></td>
<td><strong>&quot;</strong> stenting of duodenum</td>
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<tr>
<td></td>
<td><strong>&quot;</strong> Mucosal resection of esophagus</td>
<td>5</td>
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<tr>
<td></td>
<td><strong>&quot;</strong> Submucosal gastric resection</td>
<td>15</td>
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<tr>
<td></td>
<td><strong>&quot;</strong> Mucosal resection duodenum</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><strong>&quot;</strong> Laser treatment duodenum</td>
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<tr>
<td>Diagnostic gastroscopy/ staging of cancer</td>
<td>285</td>
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<td><strong>Total</strong></td>
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<td>418</td>
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### Operative activity FOR - operating room 1.
#### Department of surgery 2013

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<table>
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<tbody>
<tr>
<td><strong>TAVI</strong></td>
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<tr>
<td>New stentgraft for AAA</td>
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<td>28</td>
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<tr>
<td>Endovascular repair</td>
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<td>2</td>
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<tr>
<td>Thoracic stent-grafts</td>
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<td>Thoraco-abdominal stent-grafts w/ side branches</td>
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<td>Combined procedures (open operation +PTA/stent)</td>
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<td>PTA/stent</td>
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<td>5</td>
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<tr>
<td>Various endovascular procedures</td>
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<td>New pacemaker</td>
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<tr>
<td>Removal of infected pacemaker</td>
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<tr>
<td>Implant. iv pump for medication in pulmonary hypertension</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>120</td>
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</table>
Department of Women and Children’s Diseases

At the Department of women and children’s diseases we have a close collaboration with FOR and our FOR operating room is the first choice for all laparoscopic procedures. The equipment has been transferred from the “old” FOR operating department and includes EndoAlpha and HD camera. In addition we have a high-energy platform Force Triad, and are testing this intraoperatively for haemostasis.

Robotic surgery has now become routine at our department. We are applying this technology both for general gynaecological operations as well as for cancer surgery. Thus, we can obtain 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 Da Vinci robot. Robotic surgery fits well into the FOR concept; it is high-tech, innovative and has a great potential for the future. We are looking forward to continue the present good cooperation with surgeons, anaesthesiologists and operating room personnel at The Department of Surgery regarding the application of robotics. In 2012 a second Da Vinci robot was achieved at Orkdal hospital, indicating that this hospital is a significant part of the University Hospital. We are now doing robotic surgery 2-3 days per week; two days at St. Olavs hospital and 1-2 days at Orkdal Hospital.

Research at our clinic has concentrated on ovarian cancer (tumor reductive surgery) and on operative technique applied during hysterectomy. All robot-assisted operations are recorded prospectively in a register. During the 3-year period ending October 2013 altogether 390 such operations has been performed. 50 % of them were carried out for malignant or premalignant conditions (e.g. carcinoma of the endometrium or cervix) and 50% for benign conditions (hysterectomy for uterine haemorrhage, ovarian cysts, endometriosis, genital descent) We have obtained a shorter stay in hospital and less postoperative complications. With increasing experience, the operating time has been reduced and very few operations need conversion to open surgery. Our results were presented at the annual meeting of the Norwegian Society of Gynecology in October 2013 by Solveig Tingulstad who was invited speaker at this meeting. We are now conducting a research project exploring the importance of sentinel lymph nodes in cancer of the cervix and endometrium using a fluorescence camera connected to the Da Vinci robot. In 2013 a total of 158 robot-assisted operations were carried out; 96 at St. Olavs Hospital and 62 at Orkdal Hospital.

FOR has been extremely useful in the training and certification of our personnel in the application in electro medical equipment. This is an important service to the operating clinics. We have also arranged courses in hospital hygienic for all employees at our clinic in collaboration with FOR. This was an excellent course and we were thereby able to fulfil the requirements given by the internal revision.

In conclusion we are extremely pleased with close collaboration with FOR and look forward to continue it in the years to come.

Runa Heimstad
Head of department
Clinic of Women and Children’s Diseases

Photo: St.Olav Hospital
<table>
<thead>
<tr>
<th>Department of Women and Children's diseases 2013</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Maternity unit</strong></td>
<td>21 patients</td>
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<tr>
<td><strong>IVF</strong></td>
<td>41 patients</td>
</tr>
<tr>
<td><strong>Gyn Cancer</strong></td>
<td>30 patients</td>
</tr>
<tr>
<td><strong>Gyn General</strong></td>
<td>131 patients</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>223 patients</td>
</tr>
</tbody>
</table>

183 of the operations were elective.
Department of Neurosurgery

The Department of neurosurgery has one of the FOR operating rooms, which is 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, operations for brain tumours, arterio-venous malformations and hydrocephalus operations. Several of our projects are exploring the potential 3D-ultrasound and navigation within these fields.

Our research has a background in clinical needs and is 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 for Ultrasound and Minimally Invasive Therapy, which is a very important platform for our research activity. The collaboration with FOR has been positive and today we have several common projects including the Virtus project, which is developing a new application within spine surgery. Another project is "Picturing the Brain: Perspectives on Neuroimaging" where new methods for visualisation and imaging of the brain are explored. This project will result in two PhD-degrees at NTNU in 2014.

During the spring 2013 we were testing “SteriStay sterile operating instrument table” which is delivered by Toul Meditech AB. Air particles in the neurosurgery FOR operating room were measured. Another research project is the IO center- Center for Integrated Operations in the petroleum industry, NTNU and SINTE. This is a case study exploring how collaboration in a team might improve the way we work in an operating room. This could lead to better safety and effectivity. Observation and intervju of the operating team was performed during the spring 2014.

FOR was active with live-transmissions at the annual international course for neurosurgeons “3D Ultrasound and Neuronavigation” The transmission was made in full 3D and with two-way communication. This event received top rating from the participants. At the international health congress “Oslo 2013-38th World Hospital Congress “with the main topic “Future health care-The opportunities of new technology” 18-20 of June 2013, a plenary session included live transmission of a neurosurgical procedure by Professor Geirmund Unsgård. This live-transmission was commented by Minister of Health, Jonas Gahr Støre and by Secretary General of the WHO, Dr. Margareth Chan.

FOR has on behalf of the clinic arranged compulsory courses in the use of electro medical equipment (EMU). All doctors are trained in the use of electro medical equipment and the documentation is well established. These courses are fulfilling the demands within this area for all doctors at the department. We are looking forward to good collaboration with FOR in 2014.

Geirmund Unsgård
Professor of Neurosurgery
Head of Clinic for Neurosurgery

Photo: St.Olavs Hospital
Department of Ear-Nose-Throat, Eye and Maxillofacial Surgery

The most important event at our department in 2013 was opening of our new FOR operating room October 1, 2013. Marking of this day resulted in notice in the radio, TV and the journal “Gemini”. Since then there have been several delegations from other departments of St. Olav's Hospital and from other hospitals to study our FOR operating room with its elegant and ergonomic cockpit solution.

The new FOR operating room is pleasant both for the patients and the personnel with nice ergonomic lighting and great visualisation on large screens. This is important for the operating surgeon. In addition to several other FOR projects at our department, the Department of Eye diseases in 2013 started testing new equipment for vitrectomy. The intention is to obtain better quality of the treatment and better operating room logistics.

Doctors at our clinic have, also in 2013 followed the FOR course in the use of electro-medical equipment, hospital hygiene, etc. We have established an agreement with FOR to have separate courses for our clinic every 3rd year.

FOR is represented at the monthly meetings of our research committee and also takes part in the steering committee of the fast track rhinology project.

Our clinic has so far reported 8 research projects to the FOR scientific advisory board. Two of these were PhD projects and one was for a master degree. The other projects are dealing with the testing of new technology, new treatment modalities or quality registers.

We are looking forward to do more projects together with FOR, including testing of new equipment, and improvement in the logistics, hopefully as part of both master degrees and PhDs.

Mette Bratt
Head of Department
Ear, Nose and Throat Diseases, Maxillofacial Surgery and Eye Diseases

<table>
<thead>
<tr>
<th>Operations</th>
<th>No of operations - projects/ Quality registers</th>
<th>Numbers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional endoscopic sinus surgery</td>
<td>12</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Septal plasty</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Multiguide injections</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Tonsillectomy</td>
<td></td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Conchotomy</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rhinoplasty</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sphenotomy</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sialoscopy</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Adenotonsillectomy</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Biopsy</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Other operations on frontal sinus</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>22</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>
Clinic for Orthopaedic, Rheumatologic and Skin Diseases

The FOR operating room has to a large extent been used for implantation of joint prostheses within the fast-track project. This way of organising joint prosthesis surgery has spread to other hospitals and our department is arranging courses on this topic for health care personnel from all over the country.

Our clinic is about to start several research projects on the use of new technology, and here we are looking forward to cooperate with the personnel at FOR. We are also looking forward to receive more information from FOR regarding the concrete project support they are able to offer.

We have had excellent support from FOR regarding agreements for projects carried out in collaboration with the industry. FOR has the responsibility to arrange courses in the application of electro-medical equipment and hospital hygienic for all orthopaedic surgeons. We are appreciating this important service.

Vigleik Jessen
Head of Clinic

<table>
<thead>
<tr>
<th>Operative activity FOR operating room 8.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic of Orthopaedic Surgery 2013</td>
<td></td>
</tr>
<tr>
<td>Primary hip prostheses</td>
<td>77</td>
</tr>
<tr>
<td>Revision of hip prostheses</td>
<td>9</td>
</tr>
<tr>
<td>Knee prostheses</td>
<td>147</td>
</tr>
<tr>
<td>Other operations</td>
<td>101</td>
</tr>
<tr>
<td>Total</td>
<td>334</td>
</tr>
</tbody>
</table>

Mainly total prostheses of the knee are included in the fast-track project.
Technology in the FOR - operating Rooms

Medical technology, FOR 2013
In 2013 we have further developed the fiber and IP-based communication for telemedicine via FOR, and new IP technology has been applied through the research net – Uninett. This has been used in communication from FOR to various destinations in Asia, Europe and USA in 2013. We have focused on further development of fiber-optic communication from the FOR operating rooms, making live transmission in full high definition possible. We are cooperating with the Department of Medical Technology, MTA, HEMIT and Viju regarding a new infrastructure allowing live transmission to several of the meeting rooms and lecture rooms in the new hospital. Today it is possible to make live transmissions from all six FOR operating rooms to the Knowledge Center and the Knowledge Portal which were opened in 2013.

In collaboration with Covidien we have implemented a research 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 and the system has been strengthened further in 2013. The goal is to improve patient-safety during the application of high-energy medical equipment. LigaSure is an integrated technology and it has been tested at FOR to observe whether this technique could decrease operating time and improve cost-effectiveness. The project will continue in 2014.

At the FOR Operating Room at Department of ENT, Maxillofascial and Eye diseases, a new type of visualisation was developed. The concept was inspired from the air plane industry. All important imaging can be visualised just in front of the operating surgeon with live imaging including navigation whenever needed. This is a prototype which is tested out in various surgical disciplines. We have also included a new steering-system and a communication system making it possible to control and serve electro medical equipment.

Implementation and maintenance of new technology at the FOR operating rooms
We are developing HD-technology for internal and external live transmissions. We have also developed a camera system for minimally invasive procedures within endoscopic disciplines with a focus on HD and 3D in combination.

Upgrading of software for ArtisZeego angiography laboratory for the FOR operating room, Cardiovascular Centre, which is giving better and faster image processing. We are also developing screen technology.

In cooperation with Olympus we installed EXERA 3 making 3D visualisation possible. A new high energetic platform with Thunderbit has been installed into the EndoAlpha system as a test project.

At St Olavs Hospital we have today two Da Vinci robots available. FOR has been taking care of investment regarding live transmission from the FOR operating rooms e.g. to meeting room G-37. These transmissions can be done internally and externally. Departments of Urology and Gynaecology have both excellent experience with the Da Vinci robot and several other surgical specialities are interested in implementing this technology. Therefore technology-time and operating room capacity is becoming a challenge for us. FOR is working together with the clinics to find a more permanent solution to these problems.
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 2013 six animal experiments have been performed. Navigation has been tested out in experimental neurosurgery and in connection with vascular procedures. We have applied navigation within pulmonary medicine and laparoscopic surgery. This technique has also been used within laparoscopic surgery as part of a PhD-project. A new treatment modality for ruptured abdominal aortic aneurysm has been tested out experimentally. The FOR operating rooms have been used for development and testing of prototypes and new equipment.

Employees at SINTEF and PhD-candidates have also used FOR operating rooms for calibration, testing and mounting of navigation equipment. Units from our own institution and industrial collaborators have used our platform during 16 weeks for the testing of technological systems, quality control, safety control, upgrading as well as validation.

Over the years FOR has received great assistance from Department of Medical Technical Equipment and Divisjon of Services, St. Olav Hospital.

Photo: St. Olav Hospital

The collaboration with the Department of Hospital Hygienic and from the Clinic of Radiology and x-ray. Protection is highly appreciated.

Photo: St. Olav Hospital
**Medicine and media technology**

**AV Arena Norway**

AV Arena Norway is a resource network within medicine and media technology. Operating Rooms of the Future, St. Olavs Hospital has since it started in 2005, had focus on the development of image guided surgery and image guided treatment in general. Digital media technology is important for the further development of this discipline. During the autumn 2010 FOR took the initiative to form a bridge between competence within digital media and health care. The network is financed by members and the focus area is to initiate projects to release medical and organisational benefits within the health care sector. Members of this resource network per 2013 are: Nord-Trøndelag E-verk, Incita, Røros E-verk, Operating Rooms of the Future, iBruk, Uninett and Parallell World Labs. The network will bring ideas to projects. FOR is acting as a hub in this network and is monitoring all projects from our members. FOR will organise good processes for developing and building networks to improve our members’ ability to properly design applications. All our projects are focusing on better communication within the health care sector. It fits well into the vision of establishing a digital medical learning and information platform to strengthen the quality management system in health care. Collaboration with the petroleum sector is important to develop future telemedicine.

**The Knowledge Portal**

This main project includes the establishment of a digital medical learning and information platform at the integrated university hospital St. Olavs Hospital. The main project was financed by St. Olavs Hospital, NTNU and Central Norway Regional Health Authority.

Within the Knowledge Portal there is a media-based archive founded on experience form St Olavs Hospital. The content of the archive is arranged in a way that makes it possible to provide learning for various disciplines within the health care sector which can be distributed internally as well as externally by the by The University Hospital St. Olavs Hospital. The content can be shown on a mobile phone, an i-pad, PC, in lecture rooms and on large interactive “walls of knowledge”.

In 2013 FOR had the responsibility of forming the content of the first phase. This included 5 digital stories (5 movies and 125 vignettes) to the large “Wall of Knowledge” and they can also be shown on the 22 mobile two-screen solutions (mini walls)

This project was fully financed and was finished December 31. 2013

Illustration: PWLabs

**Digital monitoring of obese patients**

This project is made to develop digital tools for effective and safe surveillance of and collaboration with obese patients in everyday life. The aim is to support changes in life style which have been introduced as treatment of these patients. The pre-project was ended January 2013 and was financed by Innomed. The pre-project was followed by the establishment of a so-called “public contract of research and development “(OFU) under
Innovation Norway. During the autumn 2013 we received a grant which will give financing of the project for 3 years, allowing us to develop and to market a new product.

Partners in this project are Mid Norway Center for Treatment of Obesity and The Intermunicipal Cooperation Body of the Værnes region consisting of municipalities of Stjørdal, Selbu, Tydal, Meråker Malvik and Frosta.

Telemedicine of the future - collaboration with the oil and gas industry

March first 2013, the project “The Future of Telemedicine in O&G” was completed. This pre-project introduced and demonstrated the application of a handheld ultrasound machine and evaluated the potential for telemedicine offshore. Phase 2 of this project will continue until June 2014. Partners in this project are: ConocoPhilips, Petrobras. IBM, St. Olav’s Hospital represented with FOR and The Emergency Department, Medical Imaging Laboratory NTNU, Albert Einstein Hospital, and Center for Integrated Operations in the petroleum sector at NTNU/IFE/SINTEF.

The project is studying the work-flow within telemedicine today and is exploring the future potential for telemedicine. Thus we are developing and demonstrating prototypes for new telemedical solutions. And we are investigating safety aspects as well as aspects of planning and implementation of new telemedical practice offshore. The project is developed together with representatives from Norwegian and Brazilian oil industry and will most likely influence telemedical solutions in the health care sector as well.

Operating Rooms of the Future is the project leader and 31. Of March 2014 the research report with preliminary results was presented and published at the “SPE Intelligent energy” conference in Utrecht, The Netherlands.

Illustrasjon: FOR
Desentralised professional network 2013-2015

Pre project: Decentralised network within dentistry
This is a project where the aim is to establish a decentralised network of competence for the Centre of Competence within Dentistry, Central Norway. First we wanted to explore the established workflow and an optimal workflow in collaboration with the odontologic expertise in central Norway. We wanted to establish an inter-disciplinary outpatient clinic as the core for a decentralised network of competence in central Norway. We also wanted to extend our experience to the national pilot project. The pre project was finished 31st of January 2013. This project was financed by the Centre of Competence for Dentistry, Central Norway.

Municipal Value-Added Competitiveness (KVEKK)

In the planning of the future health care system there is a tendency of centralisation within the specialist health care. On the other hand, the white paper from the Ministry of Health and Care Services from 2009, ”The Cooperation Reform”, is suggesting that more of the medical treatment should take place closer to the patients home. This puts the smaller local hospitals in a challenging intersection while they are also the mainstay in a local and regional context, making efforts to do whatever is right to preserve their ”own” hospital. These circumstances contribute to a significant potential for innovation and development at the hospitals. At the same time several smaller hospitals feel that there are barriers against creativity and innovation due to lack of experience and competence from innovation processes, and that the daily routine work and economic constraint is suppressing such activities.

The pre-project will establish the necessary knowledge and ownership to realise a common innovation system in the cooperation between hospitals, municipalities and trade and industry. Especially the pre – project should promote knowledge on how innovation and process improvement is created in small organisations and to strengthen methodology as well as process tools to obtain this.
Therefore the pre-project is focusing on two important questions:

What are the most important elements in the common innovation system which is used internally and in the interaction between the institutions to promote and support innovation in a busy daily routine?

Which data and influx of information are necessary to identify the right focus areas for innovation, and to support purposeful innovation in the routine work and in the cooperation between the institutions within these areas?

A great challenge in the pre-project is to create an arena in the daily work at small institutions like Røros Hospital and The Municipality of Røros to stimulate innovation and improvement. The results from a main project can be used by other municipalities and smaller local hospitals and could have a significant potential in the form of cost savings due to more effective routines in the organisations.
Dissemination of knowledge

FOR annual meeting 2013

The annual meeting of FOR was arranged January 30-31 2014 at Røros Hotel. Invitation to the meeting was sent to all departments at St. Olavs Hospital, To Central Norway Regional Health Authority, The Medical Faculty, NTNU, SINTEF, to Industrial Companies and to relevant petroleum companies. The annual meeting is of great importance for FOR and our collaborators. The next meeting will be arranged January 22-23, 2015.

Courses arranged by FOR

In 2013 the following EMU courses were arranged:
02.01: EMU – course full day, Clinic for Orthopaedic Surgery, course 1 and 2, JGS  
(C-arm x-ray, Irradiation protection, hospital hygienic, high energy equipment, Endoscopy.
17.01: Clinic for neurologic diseases. Introduction EMU, TM
09.04: Hospital hygienic, c-arm x-ray, irradiation protection, Department of ENT. JGS, TM
15.11: EMU course for Department of ENT, JGS  
(Endoscopy, high energy equipment).

Other courses arranged by FOR

11.01: Presentation about FOR and FOU activities for representatives of Central Norway Regional Health Authority, JGS
15.11: Presentation about FOR for students in radiography at Sør-Trøndelag University College (HIST). Taking a Bachelor degree at FOR. MH, LIS
03.12: The Knowledge Portal, course in Opsigate for employees at NTNU and St Olavs Hospital. JØ
04.12: The Knowledge Portal, course in Opsigate for employees at NTNU and St Olavs Hospital. JØ
05.12: The Knowledge Portal, course in Opsigate for employees at NTNU and St Olavs Hospital. JØ

Courses in use of electro-medical equipment (EMU)

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 § 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.
- The training program must be systematic and include documentation.

Systematic training program must include:
- Training when new equipment is introduced.
- Training off new employees.
- Maintenance of the knowledge achieved during this training program.

At present the training program including the documentation is now well established at all operating clinics at St. Olavs Hospital. All surgeons including surgeons in training as well as staff surgeons are getting invitation to courses as part of the continuing medical education.
Course in hospital hygiene

Course in hospital hygiene can now be followed at the electronic network “kilden” of the hospital. It consists of 4 modules. After completion, documentation will be given by FOR that the course has been completed.

Staff

Medical personnel affiliated to FOR is going through annual certification in compliance with national regulations regarding use and maintenance of electro-medical equipment.

All surgeons at St. Olav’s 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. Olav’s Hospital as well as personnel from institutions focusing on clinical procedures, research and application of medical technology.

FOR have visitors from other hospitals. Organisation and design of operating rooms have been the most 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.

The personnel at FOR has during the last years had courses in leadership, scientific work and professional development.

Nurses in the oil and gas industry had courses in the application of the pocket-size ultrasound machine.

Students

Since 2005 FOR has had excellent cooperation with University College of Sør-Trøndelag (HiST). On a regular basis we have presentations for medical students, operating room nurses and anaesthesia nurses as well as radiography students and students within bio-engineering. This has resulted in several bachelor degrees, which have been performed as a cooperation with FOR in our operating rooms. We also have teaching for several of these students in the use of electro-medical equipment.

Master students as well as PhD students at St. Olav’s Hospital/ NTNU/ SINTEF have a good opportunity to experience new medical technology and operations from the interactive lecture room at FOR.
Visitors at FOR 2013

19.02: Visit from Karolinska Hospital, Stockholm, Sweden. Presentation and guiding. OR Vascular Surgery, AHL by JGS, TM, CL
11.03: Visit by NorCrin. Presentation and visit to the FOR operating room at AHL by JGS, TM, CL
20.03: Presentation for visitors to eHealth from Estonia. JGS and MH

23.04: R&D infrastructure. Operating room of the future, Telemedicine. Presentation for Petrobas from Brazil visiting St. Olav’s Hospital, JGS
04.05: Visit from NTNU Department of Biomechanics and Prof Poul Michael Fonss Nielsen, New Zealand. MH and TM
12.06: Visit from China, Capital Medical University Hospital, Beijing, visiting scientists. MH, TM, JGS
18.10: Visit to the new FOR Operating Room at Department of ENT from SINTEF and Operating Department, Neurosurgery
28.10: Visit from USA and UK. Andy Leather, Dr. Robert Merrifield, Håkon Boklan, Sturla Eik-Nes, Elin Dvergsdal. Operating Rooms at AHL center and ENT and orientation about the FOR infrastructure. LIS
02.12: Presentation and guiding about the “Knowledge Portal” for the Royal Norwegian Air Force Academy. JGS
**Experimental surgery**

All FOR operating rooms are authorised for experimental surgery including animal research. Such experimental procedures can be ordered at FOR who will then organise them. 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 trained and authorized personnel assisting during the whole process.

Personnel who is planning or taking part in animal experiments must have courses in animal experiments approved by the Norwegian Food Safety Authority. An important part of this course is to understand laws and regulations connected with the use of animals in medical experiments. The regulation regarding animal experiments assumes that all persons planning or performing such experiments 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 experiments, including those who are taking care of the animals, should be included in the application and have documentation that they have passed the course in animal experiments, category C.

During 2013 following experiments were completed:

- Use of navigation in the airways to improve the accuracy of lung biopsies.
- Application of “temporary stents” in the vascular system. The hypothesis is that this will give fewer complications than regular permanent stents.
- To study factors influencing the formation of neointimal hyperplasia after implantation of grafts in the vascular system.
- Fusion of x rays and navigation for the exact leading of wires and steerable catheters within the vascular system

![Photo: FOR-OR 1, project “Navigation in endobronchial procedures”.

Photo: FOR](#)
Research cooperation

National and international collaborating partners
SINTEF is FORs most important national research partner. Most of this collaboration is concentrated around “National Center of Competence for Ultrasound and Minimally Invasive Treatment”.

Together with The Intervension Center at The National Hospital, FOR received a research grant based on establishment of the national research infrastructure “NorMIT”- Norwegian Center for Minimally invasive Image guided Therapy and medical technologies.

FOR has an excellent cooperation with The University College of Sør Trøndelag-HIST.

FOR has also good cooperation with industrial partners like Sony, Siemens, Olympus and Covidien. Routines for such collaboration have been established together with legal expertise within the field.

FOR has an excellent cooperation with Vanderbilt University Medical Center, TN, USA. This hospital is organised in a similar way as St. Olavs Hospital. We are planning research projects on how new treatment modalities could influence technological solutions. We are also looking for cooperation on the use of ICT in the operating rooms to optimize organisation and patient flow. FOR is also cooperating with Massachusetts General Hospital, Boston, Operating Room of the future, Tubingen, Germany and groups at Krakow University Hospital, Poland. A cooperation has further been established with Yonsei University Health Center, Korea. Focus areas are here the health of the aging population, the intelligent hospital and transmission of high quality medical information.

FOR has collaboration with organisations like EAES (European Association for Endoscopic Surgery) and SMIT (Society for Minimally Invasive Therapy)

Research and development in cooperation with SINTEF

National Centre of Competence for Ultrasound
Operating Room of the Future is an arena and infrastructure for several ongoing research projects. One of the main activities during 2013 has been connected to National Centre of Competence for Ultrasound and Minimally Invasive Therapy. This is a national service established by the Department of Health and Human Services. The centre is using FOR as an arena for several clinical and technological research projects on medical technology, prototyping and clinical testing of new solutions to improve patient treatment. In 2013, 14 ongoing PhD-projects were running and 3 were finished. 21 scientific papers in peer reviewed journals were published.

Through user-controlled projects supported by the Norwegian Research Council, this service has been an important platform for innovation and cooperation with the industry. The competence centre has a broad national and international network and important activity connected to the development and dissemination of knowledge. Through participation in several EU projects (VECTOR, IIiOS Marie Curie training network, 3MICRON, FUSIMO, MISTELA) we have “imported” competence from international groups and have also contributed with competence both nationally and internationally.

The activity at the National Centre for Competence for Ultrasound and Image-guided treatment is a good example how Operating Room of the Future can support research, development and testing of new technology and thereby contribute to strengthen national and international cooperation. Research at this center of competence includes image guided minimally invasive surgery within vascular surgery, neurosurgery and laparoscopic surgery. New fields like pulmonary medicine and ENT have been included in our work. In addition to the use of ultrasound, navigaton has become an important research topic. The navigation system Custus X has been developed by SINTEF. The purpose is to improve accuracy of the diagnostic work.

Operating Room of the Future at St. Olavs Hospital/NTNU together with the Intervention Centre, the National Hospital, has through establishment of NorMIT
(Norwegian centre for Minimally invasive Image guided Therapy and medical technologies) has obtained status as a national infrastructure for research. NorMIT’s position on the Norwegian roadmap for research infrastructure is confirming that the research and research platform with its infrastructure has high international quality and relevance.

Thomas Langø
Head of Research, Department of Medical Technology
SINTEF

Use of the navigation platform Custus X during bronchoscopy (left) and during laparoscopy (right) at FOR
Photo: FOR

Cooperation with Institute of Circulation and Medical Imaging, DMF, NTNU

It is now almost 10 years since the opening of The Operating rooms of the Future-FOR. This has been an interesting period where we have experienced how we can use infrastructures like FOR to promote good clinical research. Through their day to day work, health care personnel will accumulate valuable practical experience and competence. Simultaneously we know that the need for knowledge changes as we introduce new technology and new methods. An active scientist can become ajour with the research front through own research work, regular reading of scientific articles, being active in research network and through the participation in scientific conferences nationally and internationally. For a scientist, import and export of knowledge is a continuous process. We also want the Norwegian patients to have the benefit of such knowledge. Therefore FOR is just as important for the patients as for the health care personnel.

A good infrastructure on the “road map” of the Norwegian Research Council

Support and infrastructure is mandatory whenever the clinicians are using research to strengthen their own competence. The Operating Rooms of the Future has in 2013 been an excellent support for several PhD projects as well as for research and development in general. We have also several examples that knowledge obtained through these projects has changed the clinical routine.

Good infrastructure is important to enhance excellence within research and teaching as well as in clinical practice. Therefore it is not surprising that European countries including Norway have focused on the establishment of infrastructures to support innovation and excellent research. We are happy that The
Operating Rooms of the Future, after a thorough evaluation by international reviewers, was placed on the so-called roadmap for important Norwegian infrastructures for research and innovation by the Norwegian Research Council. Together with The Intervention Center at Oslo university Hospital, we will through establishment of NorMIT-Norwegian Center for Minimally Invasive Image Guided Therapy and Medical Technologies- start a collaboration to improve clinical practice, improve quantity and quality of research and innovation. I look forward to the years to come and I feel confident that one will receive the best medical treatment possible in Norway because the knowledge of our health care personnel is up to date and will form a basis for excellent patient care.

Toril A. Nagelhus Hernes  
Professor of medical technology  
Leader of Institute for Circulation and Medical Imaging, DMF, NTNU

Photo: NTNU
FOR in the future

FOR has been running since 2005 and continued in 2013 in the new hospital with focus on all operating clinics using image guided minimally invasive treatment. 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 of interactive communication in full high-definition (HD). The most important motivation for continuing FOR in the new hospital is to form 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 on the planning stage in Norway as well as in other European countries. Operating rooms are the most expensive part of the hospital and the operating departments are expensive to run. 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 we 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. There is need to do testing of new equipment and new techniques in a systematic way. FOR will continue to support this through the formation of contracts, the accomplishment and the evaluation of the projects. The new FOR operating room at the Department of ENT is representing an innovation. The background is the concept and design of an air plane cockpit where we have received ideas how imaging should be presented to the operating surgeon. In this way we can also remove technological equipment from the operating room. We are also planning a new FOR operating room at the Department of Pulmonary Medicine where research and development of navigation and image guided procedures is important. We want to refine and develop further the technique and to expand the indications for stent-grafting for aneurysmal disease, dissections and trauma of the vascular system. In one project we are using navigation for exact deployment of the implants.

Our 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 one 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.

Our collaboration with SINTEF regarding navigation technology and ultrasound continues, and we have projects exploring the application of steerable wires in combination with catheters for endovascular treatment. In pulmonary medicine we have applied navigation for endoscopy and endo-bronchial procedures. Robotic surgery is a field of high priority for FOR. Further we are developing new techniques for the treatment of patients with morbid obesity. We are expanding the cooperation with the Department of Radiology focusing on the application of ultrasound in the surveillance of patients treated with stent-grafting for abdominal aortic aneurysm.

Image guided minimally invasive treatment is one of the most important fields of innovation within the specialist health care system. Such procedures are important to give a less traumatic and more efficient treatment of the patients. It may lead to shorter convalescence, reduced need for intensive care, less complications and often better results of the treatment. Several surgical procedures can now be performed as day surgery and the patient will need shorter time to get back to everyday activities and work. The elderly part of the population is increasing and open surgery in elderly patients may include certain challenges. Thus the risk of complications is higher than in younger patients and the convalescence is generally longer. Whenever the situation allows it, minimally invasive therapy may be the preferred treatment modality in elderly patients.

In 2012 FOR has developed, established and implemented a teaching system within the use of electro-medical equipment for all doctors in surgical disciplines at St. Olavs Hospital. Focus areas are the application of high-energy technology, application of C-arms and x-ray protection. Hospital hygienic is also included in the program. Our plan is to develop courses using digital learning. One advantage is that the students then can use this material any time. In collaboration with “at work” we have developed digital based interactive reports. This is a prototype of a completely new type of course registration and approval. The system can be integrated with other systems. Through the health academy of Regional Health Trust, collaboration has been established in order to expand this arrangement to other hospitals within Central Norway.
FOR has close collaboration with several other institutions like international industrial companies, clinical departments, and technological groups. Our closest collaborators are The Medical Faculty, NTNU and SINTEF, Department of Medical Technology. Other important collaborators are “Center of Competence for Ultrasound and Image Guided Therapy”, “National Center for Advanced Laparoscopic Surgery”, University College of Sør-Trøndelag-HIST, NTNU Technology Transfer and Center for Interdisciplinary Research in Space (CIRIS).

Our goal is that FOR should be a research infrastructure of excellent international quality. Quantity as well as quality of research relevant for FOR should be improved. And FOR should be at the international forefront in image guided minimally invasive treatment. Today FOR is involved in research projects and quality improvement programs in such treatment within most surgical disciplines.

The infrastructure-project NorMIT (Norwegian Center for Minimally Invasive Image guided Therapy and Medical Technologies) has been developed together with The Intervention Center at The National Hospital. Economic support has been given by The Norwegian Research Council. The aim is to improve patient treatment and to strengthen research and innovation. We therefore look forward to this collaboration in the years to come.

Jan Gunnar Skogås
Managing Director
Operating Rooms of the Future
Scientific work 2013

PhD degrees 2013

Frode Manstad-Hulaas, PhD, medicine/medical technology
“Navigation Technology in Endovascular Aortic Repair“.
The project has developed a navigation system based on electro-magnetic positioning and 3D imaging for application during endovascular treatment of complex aortic aneurysms. The navigation system is visualising instruments in a 3D scene 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 thesis was defended February 28. 2013 Supervisors: Petter Aadahl, Toril A. Nagelhus Hernes, Torbjørn Dahl

Berit Brattheim, PhD, medical technology, health informatics
“Aortic Aneurysm Network: Coordination support for trans-organizational care processes“.
The project is focusing on how new medical technology is changing the 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. This work is carried out at the Department of electronic patient records (NSEP) and is a part of the so-called COSTT project. The thesis was defended January 25. 2013. Supervisors: Arild Faxvaag, Jon Harald Kaspersen, Andreas A. Seim, Pieter J Toussaint.

Ongoing PhD studies

Wenche Moe Thorstensen
“Symptoms from nose and sinuses in patient with asthma - United airways“.
This investigation is focusing of nasal symptoms in patients with bronchial asthma and on the effect of these symptoms when improving the pulmonary function during treatment. Three studies have been completed, and two of them are published in international journals. Supervisors: Sverre Steinsvåg, Vegard Bugten, Malcolm Sue Chue.

Daniel Fossum Bratbak
“Endoscopic resection of the Sphenopalatine ganglion in chronic cluster headache“.
The project is describing a new method for treating cluster headache. The idea is to block the sphenopalatine ganglion in fossa pterygopalatina using endoscopic transnasal surgery with direct approach to the ganglion. The navigation tool “Multiguide” is patented and developed in collaboration with TTO and Department of Medical Technology. This work is a cooperation between Department of Neurology and Department of Radiology. Supervisors: Erling Tronvik, Ståle Norgård.

Cecilie Våpenstad
Tools and methods for skills training in minimally invasive surgery-using simulators, ultrasound and navigation Technological PhD candidate.
Evaluating how simulation and the use of simulators can improve surgical skill and surgical team work. The aim is also to develop tools for using navigation and ultrasound. Supervisors: Toril A. Hernes. Ronald Mårvik, Petter Aadahl.
Geir Arne Tangen
"Enhanced Minimally Invasive Therapy". Technological PhD candidate.
The goal is to develop methods for application of navigation technology within endovascular procedures.
Today these procedures are dependent upon imaging technology like fluoroscopy for guiding and deployment of endovascular implants. Provided navigation technology can be applied during these procedures, one can achieve more relevant information and reduce the dose of irradiation and contrast material to the patient. This will improve patient safety and reduce the complication rate. Geir Arne started his PhD during the autumn 2010 and the project will be finished in 2014.
Supervisors: Toril A. Nagelhus Hernes, Petter Aadahl

Anna Aasgaard Rethy,
“Navigated 3D ultrasound in the treatment of liver tumours.” Clinical PhD candidate.
She is studying the use of laparoscopic ultrasound during surgery for primary tumours and metastases of the liver. One is also investigating changes in anatomical position of solid organs while insufflating gas into the peritoneum during laparoscopy and how navigation technology can be used in this situation. Finally she is studying multimodal models of the liver to simulate and test multimodal imaging and training with laparoscopy and navigation instruments. This project will be finished in 2014.
Supervisors: Ronald Mårvik, Thomas Langø

Conrad Lange, clinical medicine
“Endovascular therapy of aneurysms”.
The work is in including 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 treated at St. Olavs hospital is another part of the study. Four papers have been published. The thesis will be defended in 2014.
Supervisors: Erney Mattsson, Hans O. Myhre

Camilla Berge, PhD, Health science
“Abdominal Aortic Aneurysm in women – Results after surgery”
The investigation is studying long-term results following open surgery as well as endovascular therapy. She has also investigated AAA in female patients since the mortality, especially following rupture, is higher in women and AAA rupture at a lower diameter in women than in men. The inflammatory response in patients with abdominal aortic aneurysm—and its influence on mortality, has been studied. Two papers have been published.
Supervisors: Torbjørn Dahl, Anne E. Hagen

Rita E. Nilsen
Supervisors: Aud Sissel Hoel, Liv Hausken, Annamaria Carusi

and

Jordi Puig
“Visualisation for neuroscience”
Supervisors: Andrew Perkis, Aud Sissel Hoel

“Mapping Brain plasticity”.
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 work packages focusing on how the imaging tools will work within the areas of knowledge, surgery and rhetorics. An additional package will function as a project laboratory for testing of various ways of integrating science, technology and society through artistic intervention.
Ongoing Master Projects

Marit Furre Amundsen
“General and local quality of life after surgery for chronic rhinosinusitis”.
Chronic rhinosinusitis and acute recurrent sinusitis (CRS) are among our most common diseases of the airways. One common cause of CRS is obstruction of the sinal ostia which may interfere with drainage of the sinuses. Whenever conservative treatment is insufficient, endoscopic surgery of the sinuses (FESS) is a possibility. The goal is then to remove the obstruction and to improve the drainage. There are indications that the quality of life is improved after surgical treatment of CRS. However there may not always be a good correlation between the patient’s health related quality of life and findings on CT scan or endoscopy.

In 2012 St. Olavs Hospital started a quality register for patients undergoing endoscopic sinus surgery. The register will be used in the present investigation.

The aim is to explore whether generic and disease-specific quality of life is changing during 6 months after endoscopic sinus surgery in patients with CRS.

Ida Leirheim Fagerli and Cecilie Liseth
“Safety in the operating room”
This project is carried out by the students Cecilie Liseth and Ida Leirheim Fagerli in collaboration with The Operating Rooms of the Future (FOR) and NTNU. The main supervisor at NTNU is Karin Laumann and the co-supervisor is Gunhild Sætren. The project will lead to a master degree in work and organisational psychology. We want to study the culture regarding safety at Norwegian operating departments. And we want to evaluate this culture comparing with new knowledge and theory within this field.

We want to investigate how various factors may influence safety in the operating rooms and how theories regarding safety might improve this. We want to study the attitude towards personal failures and how such failures influence routines and procedures in operating rooms. We also wanted to study how the hospital is organising the operating rooms to maintain safety and we want to compare the routines with relevant organisations. This could give information that may lead to changes of the actual organisation and thereby improve safety and reduce the risk for the patients.

The data-collection of this investigation is consisting of nine interviews of employees at the operating department and observation of two operations. The master project will be finished in May 2014.
Bachelor degrees finished in 2013

**School of bioengineering, HIST:**
“Could microorganism in the operating room cause wound infection after caesarean section? A study of air quality, microorganism of the wound surface and examination of surgical instruments.”  
Candidates: Kristine Nordli, Lena Jansen and Lena Marie Gruner.

**School of radiography, HIST:**
“The quantity of irradiation from patients who have undergone isotope-based medical examinations.”  

**School of nursing, HIST:**
“Safe surgery: The use of check lists in surgical routine”  
Candidates: Marianne Rauholm, Martin Vang, Rita Vågsvær.

**Ongoing Projects**
By establishing NorMIT the Norwegian Research Council realized that FOR have methods and systems to work effectively together with industrial companies and clinical centres’ to generate new knowledge and to promote innovation. The Norwegian Research council as well as The Frame Program of the European Union have recently stressed the importance of use of research results is an important criterion when allocating research grants. We regard the support of the NorMIT as a recognition of our focus on new applications and innovation. This is important in our future strategic orientation to programs for research and development.

In 2013 FOR had collaboration with several industrial companies like Sony, Covidien, Intuitive, Siemens, Nice Design, Incita, Parallel world Labs, Kantega, Stryker, IBM, Petrobas, Dorc, ConocoPhilips, Olympus, Medtronic, Nord Trøndelag E-verk and Karl Storz. We also have excellent cooperation with NTNU Technology Transfer regarding ideas and patents developed by FOR or our close collaborators.

**Quality Register for ENT sinus surgery and “Fast-track”**
All endoscopic and open surgical procedures within this field are recorded consecutively regarding type of procedure and results. The register started in 2013 and so far 420 patients have been included. The register is forming the basis of several research projects.
“Fast track” refers to a standardised course for patients having undergone certain types of nose-sinus surgery including instruction of the patients, planning of the patient visits at the hospital and organisation of work to obtain an optimal and cost effective treatment. This is included in the quality register “Intranasal and intraoral ultrasound guided surgery”

**“Sialoscopy as an aid in the diagnosis of salivary gland tumours.”**
Sialoscopy is a term used for inspection of the salivary ducts by thin flexible instruments. The project evaluates 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 imaging modalities like MRI. New equipment for sialoscopy including rack to testing has been acquired. Leader of the project: Professor Christoph Ziegler.

**Balloon sinoplasmy in chronic sinusitis**
We are testing equipment for balloon dilatation of the orifice of the frontal and maxillary sinus for minimally invasive reestablishment of drainage from the sinuses in selected patients. Preliminary testing has been performed and a RCT study is planned. Leader of the project: Assistant Professor Vegard Bugten.

**Arthroscopy of the mandibular joint**
So-called cranio-mandibular dysfunction might affect 5-10% of the population. In several cases of primary joint-related pathology, arthrocentesis or arthroscopy can be used for diagnosis or therapy. The present project is exploring the effect of arthroscopy in general anaesthesia on function (chewing) and on subjective discomfort (pain) for the patient.  
Project leader: Professor Christoph Ziegler.
**Project at the department of Eye diseases.**
This project is focusing on the situation where it is necessary to operate on the retina and for cataract simultaneously. Today we need one type of equipment for each operation which means that we have to change equipment during the operation. This situation is also occupying space in the operating room. We will now test out kombi-equipment allowing us to perform both operations without having to change equipment. We hope that this also might increase the capacity for this type of surgery at our department.

**FLYT - a digital tool for mobile information and communication**
Kantega and FOR agreed in 2013 to do this pre-project together. The aim was to make a solution which might improve availability and quality of information about the patient flow for those working in the Center for GI diseases. This could also make the administration of the ward more effective. The project started by a short workshop with employees at the Gastro-department to explore needs and specific challenges. Thereafter two persons from Kantegas spent one day at the same department for quality assurance supported by interviews and observation. The concept was presented for FOR and representatives from the Gastro Department.

**Case study, ORF-IO. Clinic of Neurosurgery, Røros Hospital and FOR.**
The objective with the case study is first to explore commonalities and differences between sensemaking and safety in technology-supported collaborative work in medical operating rooms and onshore rig teams. Based on such comparative studies we will develop further the understanding of the more generic properties of and preconditions for sensemaking in this type of expert centres and collaborative work. The second objective is thus to provide recommendations for facilitating improved interdisciplinary sense-making in collaborative work. The utility value for both the health and petroleum industries is more robust work practices in safety-critical team work.

In depth knowledge about sensemaking in medical operating rooms, where unexpected, ambiguous and possibly time-critical situations occur, will give insight to further develop recommendations for frameworks, aids and ICT designs to enhance collaborative sensemaking in both domains.
Scientific articles


**Book chapters**


**Popular science**


"Kortere liggetid, mindre stress”. Stein Risstad Larssen. Magasinet Helse nr. 2/2013

"Operasjon styres via cockpit”. Jørn Wad. Effektiv IT 02/2013

"Bli med inn i fremtidens operasjonstue”. Odd Richard Valmot. Teknisk ukeblad, 23.11.13

"Operasjon cockpit” Lars Martin Hjorthol. Gemini 2, desember 2013

**Presentations at conferences**

11.01: Foredrag om FOR og FoU-aktiviteter til representanter Helse Midt-Norge. JGS
17.01: Felles introdusjonsdag Nefroklinikken - Innlegg om EMU. TM
19.02: FoU-infrastruktur FOR og operasjonstuer – foredrag på Karolinska Universitetssjukhuset. JGS
19.03: Foredrag HIST – Viderutdanning. sykepleierutdanningen. TM og MH
20.03: Foredrag til eHealth besøk fra Estland. JGS og MH
05.-07.03: Langø T, Rethy A, Mårvik R. Realistic organ phantoms for image-guided therapy research development and training. Presentation at the ISMIT (International Society for Medical Innovation and Technology) congress, Baden-Baden, Germany
03.04: FOR som forskningsinfrastruktur med fokus på IKT. – Konferansen IT for liv og helse, Rica Hell. JGS
17.04: FOR som forskningsinfrastruktur med fokus på IKT. – Konferansen IT for liv og helse, Ålesund. JGS
22.-24.04: Trondheim, Norway”. Invited lecture for the “Surgical Simulation and Planning” course Bioengineering and Telemedicine Centre, ETSI Telecomunicacion, Universidad Politecnica de Madrid
23.04: R&D infrastructure, Operating Room of the Future, telemedicine. Foredrag Petrobras fra Brasil, besøk St.Olav. JGS
22.-24.04: Langø T et al. “The National Competence Centre for Ultrasound and Image-Guided Therapy Trondheim, Norway”. Invited lecture for the “Surgical Simulation and Planning” course Bioengineering and Telemedicine Centre, ETSI Telecomunicacion, Universidad Politecnica de Madrid
06.-08.05: Lange T, Márvik R. Research and development for improved laparoscopic surgery - Innovation based on close collaboration between technological and clinical scientists. Invited lecture at The 8th Nordic health research and Innovation (NRI) networks conference

06.05: NTNU Medisinsk Teknik, Foredrag og overføring, TM og MH

07.05: Rikshospitalet København, Operating Room of the Future. JGS

08.05: Workshop NRI Forskningskonferanse, FOR som forskningsinfrastruktur, Bergen, HOM og JGS

12.-15.05: Tobias Preusser, Mario Bezzi, Jenny Dankelman, Jürgen Jenne, Thomas Langø, Yoav Levy, Michael Müller, Giora Sat, Christine Tanner, Calin Tiu, Matthias Günther, Andreas Melzer. Patient-specific modeling and simulation of FUS in moving organs: The VPH Project FUSIMO. Presentation at the International Society for Therapeutic Ultrasound Symposium, Shanghai, China

23.05: Foredrag, Gløshaugen Akademiske Klubb, Operating Room of the Future. JGS

24.05: Temadag Steriforsyning Helse Midt-Norge, Operating Room of the Future. JGS

04.06: Presentasjon om FOR i forbindelse med. Med besøk fra NTNU Biomekanikk og prof. Poul M. F. Nielsen, New Zealand. MH og TM

12.06: Besøk gjesteforskere - Capital Medical University Hospital, Beijing. Foredrag JGS, omvisning TM og MH

20.06: Foredrag, Operating Room of the Future, IHF 38th World Hospital Congress, Oslo 2013, JGS

25.06: Foredrag, Telemedicine, operating room of the future, St.Olav Hospital and NTNU, Petrobras, and Einstein Hospital, Brasil. JGS

26.-29.06: Langø T, Hofstad EF, Leira HO, Sorger H, Amundsen T. Automatic registration of CT images to patient during the initial phase of bronchoscopy - a clinical pilot study. Oral presentation at the 27th International Congress of CARS – Computer Assisted Radiology and Surgery, Heidelberg, Germany

25.07: Foredrag, FOR en forskningsinfrastruktur ved St.Olav Hospital og NTNU, NORDPLAN 90-gruppen, samfundsplanleggere fra Norden (30 deltager) JGS

05.-07.09: Lange T, Rethy A, Márvik R. Realistic organ phantoms for image-guided therapy research development and training. Presentation at the iSMIT (International Society for Medical Innovation and Technology) congress, Baden-Baden, Germany

05.-07.09: Lange T. et al. Feasibility of 4D ultrasound-based motion tracking in FUS therapy of tumors in moving abdominal organs. Invited lecture at the iSMIT (International Society for Medical Innovation and Technology) congress, Baden-Baden, Germany


16.09: Foredrag, Operating Room of the Future, infrastructure R&D minimal invasive surgery. Innovasjon Norge sine verdenskontor (30 deltager). JGS

22.09: Workshop: MICCAI-STENT. The 2nd MICCAI-Workshop on Computer Assisted Stenting. MICCAI, Nagoya, Japan


26.09: R&D infrastructure, Operating Room of the Future, telemedicine. Workshop og foredrag med Petrobras og IO-center. JGS

26.09: Presentasjon av Kunnskapssporretalen for kommunikasjonsavdelingen på St. Olavs Hospital. JØ

02.-03.10. Tangen GA, Manstad-Hulaas F, Ødegård A, Hernes TAN. Maneuvering devices inside the blood vessels – guiding endovascular procedures by integration of navigation technology – An update from the Trondheim research group. Presentation at the The 5th National PhD Conference in Medical Imaging, Tromsø, Norway

02.10: Presentasjon av Kunnskapssporretalen for institutt for elektronikk og telekommunikasjon. JØ


17.10: Foredrag basalkurs i laparoskopisk kirurgi, NSALK. JGS

23.10: Presentasjon av Kunnskapssporretalen for Redaksjonsgruppen på DMF, NTNU. JØ

24.10: Presentasjon av Kunnskapssporretalen for FUE Sekretariatet. JØ

25.10: Foredrag, Operating Room of the Future, Høstmøte, Norsk Forening for Otorhinolaryngologi Hode- og halskirurgi, Oslo 2013. JGS

05.11: Presentasjon av Kunnskapsportalen for styret ved NTNU. JØ
07.11: Foredrag, Operating Room of the Future, Eldre Lægers Forening, avd.Trondheim. JGS
11.11: Foredrag om FOR for Radiografitutdanningen, HIST. LIS og MH
15.11: Foredrag og om FOR og kompetansemiljøene. Besøk fra toppledelsen Sony, Japan og Europa, ved deres besøk ved St.Olavs Hospital. Heldagsmøte. JGS
15.11: Presentasjon av Kunnskapsportalen for toppledelsen fra SONY. JØ
27.11: Foredrag om FOR, Kompetansesenteret, NorMIT. Nettverk fra NTNU, CiRIS og ulike forskningsmiljøer. Halvdagsseminar ved St.Olavs Hospital FOR, (27 deltagere) JGS.
27.11: Presentasjon og omvisning av Kunnskapsportalen for CiRIS. JØ
02.12: Foredrag om FOR forskningsinfrastruktur, synergi og fellestrekk. Luftkrigsskolen, halvdagsseminar ved St.Olavs Hospital FOR, (30 deltagere). JGS
02.12: Presentasjon og omvisning av Kunnskapsportalen for Luftkrigsskolen. JØ
03.12: Kunnskapsportalen, kurs i Opsigate for ansatte v/NTNU og St. Olavs Hospital. JØ
04.12: Kunnskapsportalen, kurs i Opsigate for ansatte v/NTNU og St. Olavs Hospital. JØ
05.12: Kunnskapsportalen, kurs i Opsigate for ansatte v/NTNU og St. Olavs Hospital. JØ
10.12: Presentasjon av Kunnskapsportalen for Nasjonalt nettverk for innovasjon i universitetssykehusene. JØ
2013: Tobias Preussser, Mario Bezzi, Jenny Dankelman, Jürgen Jenne, Thomas Langø, Yoav Levy, Michael Müller, Giora Sat, Christine Tanner, Calin Tiu, Matthias Günther, Andreas Melzer. FUSIMO – Patient-specific modeling and simulation of FUS in moving organs. Annual Meeting of the Society for Thermal Medicine, 2013
2013: Langø T et al. “The National Competence Centre for Ultrasound and Image-Guided Therapy

FOR visiting Petrobras in Rio De Janeiro, Brazil, discussing the project “Future telemedicine in the offshore oil and gas industry”.
Photo: FOR
Live transmissions FOR 2013

06.05: Overføring Urologi i forbindelse med studenter v/ NTNU Medisinsk Teknikk
05.06: Kurs i nevrokirurgi. "3D ultralyd og nevro-navigasjon"
20.06: Overføring fra Nevrokirurgisk operasjonsavdelingen til Oslo Spektrum i forbindelse med IHF Oslo2013 – The 38th World Hospital Congress

Media presentations


Div. media ifm Oslo 2013 – NTB, sosiale medier (Facebook, Twitter)
Kongehuset.no - http://www.kongehuset.no/nyhet.html?tid=116565&sek=26939


Kildens.no 02.10.13 - http://www.stolav.no/Nyheter--Det-er-heftig/125008/ - ifm. åpning av den nye FOR stuen ØNH
