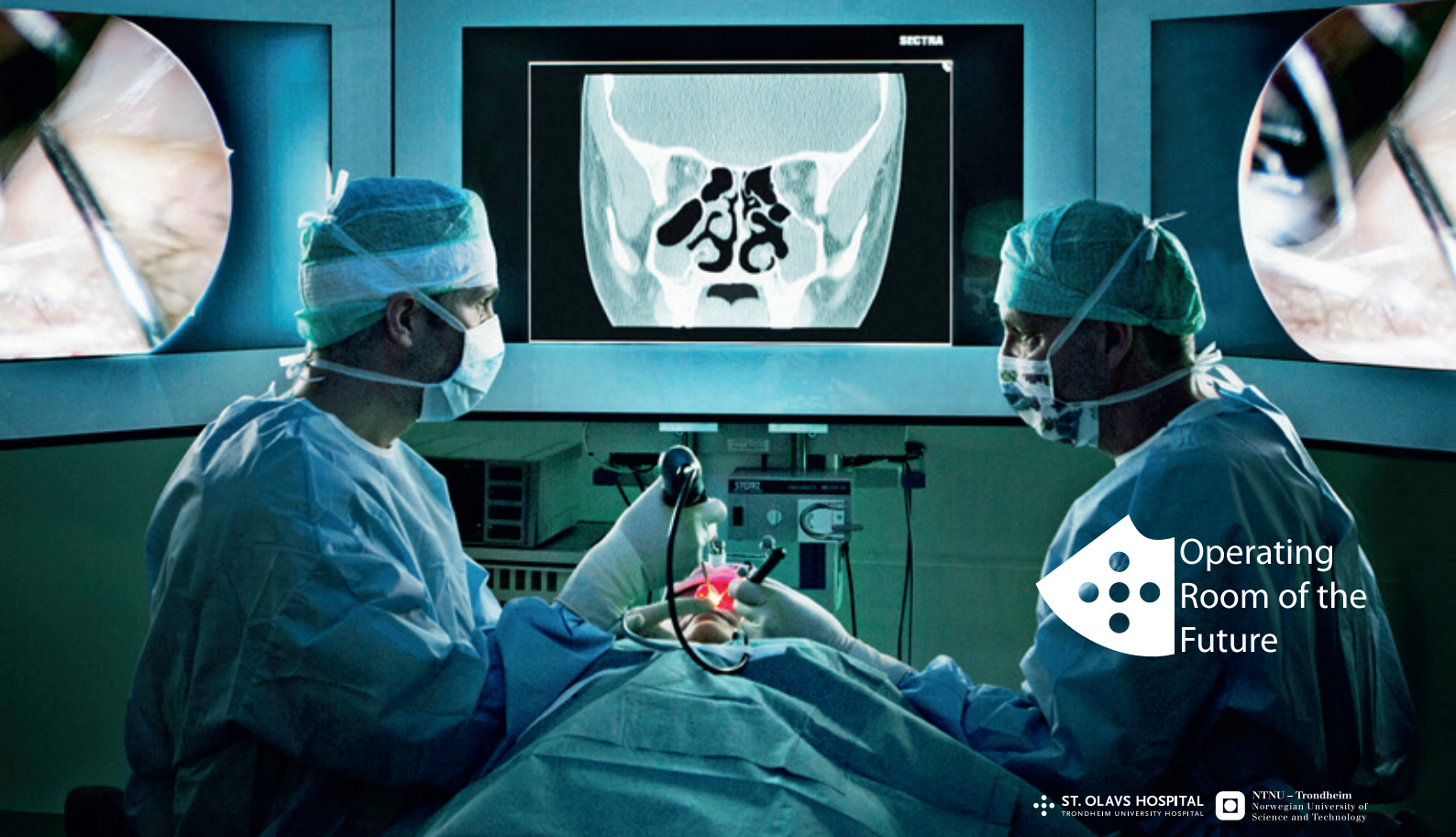


NORWEGIAN STATE OF THE ART
OPERATION FACILITIES
AT YOUR DISPOSAL



 Operating
Room of the
Future

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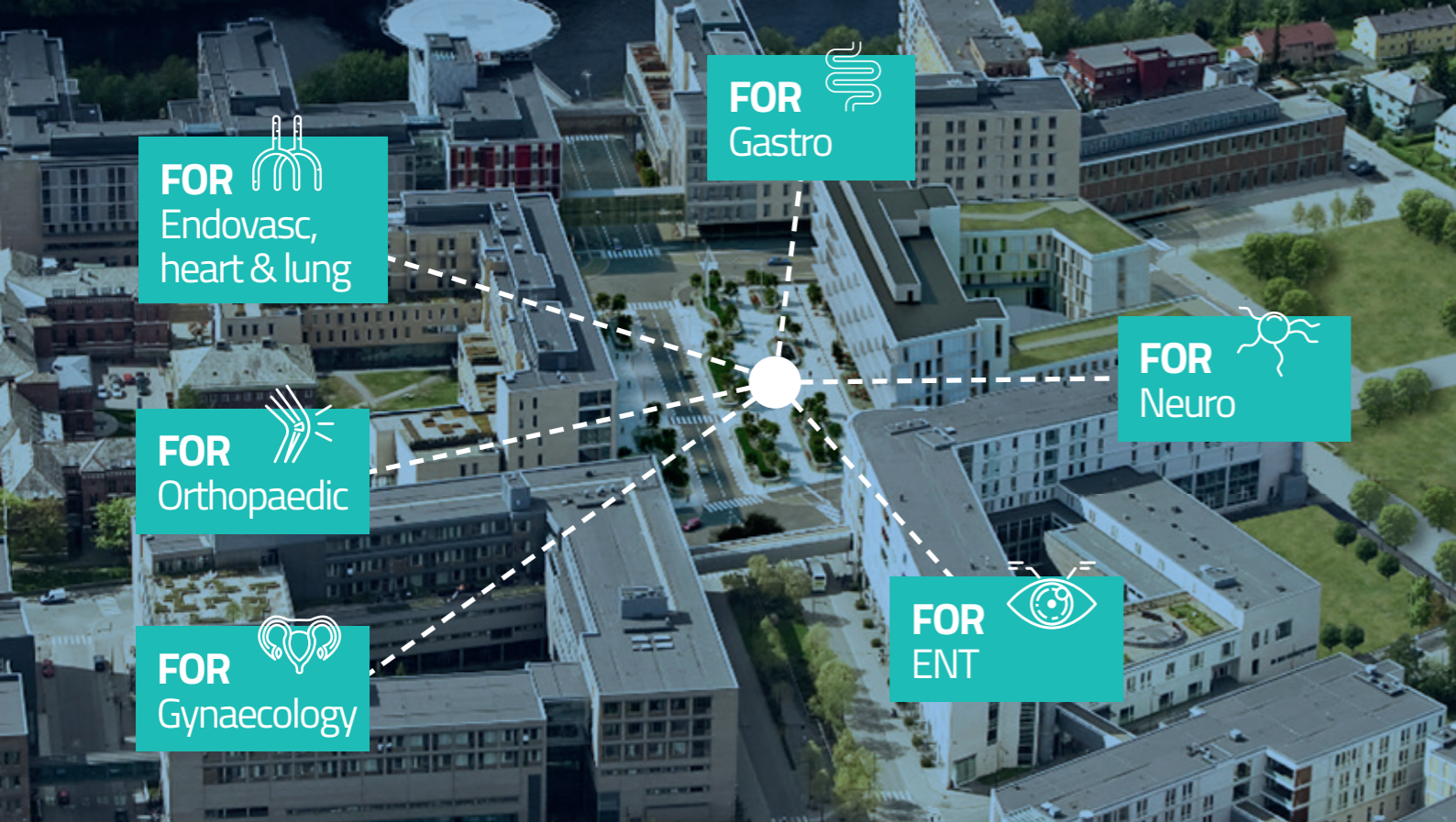
[More info at stolav.no/en/for](http://stolav.no/en/for)

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Operating Room of the Future (FOR)

- An arena for clinical research and development with emphasis on minimally invasive image-guided treatment since 2005.
- An interdisciplinary arena for medical technology related research, development and innovation.
- Six operating rooms with advanced imaging and navigation equipment at your disposal.
- Dedicated personnel helping researchers performing their studies.
- A resource network linking universities, hospitals and the industry.
- In close collaboration with national and international research partners.



FOR
Endovasc,
heart & lung

FOR
Gastro

FOR
Orthopaedic

FOR
Neuro

FOR
Gynaecology

FOR
ENT

Operating theatres, one at each operating department are run by FOR (Operating Room of the Future). All theatres can be hired for research.



Scandinavian trust

Scientists believe that our low corruption rate and general trust in people are generated through our high-quality governance of society. **All the same, it means that your research is safe with us.**

A photograph of an operating room with blue lighting. In the foreground, a patient is lying on a table covered with a white sheet. Several large, circular surgical lamps are suspended from the ceiling. In the background, there are medical monitors and equipment.

Quality and control
All research applications
undergo quality control
by the FOR Scientific
Advisory Board.

A photograph of the Trondheim Cathedral, a large Gothic-style stone building with multiple spires and intricate carvings. The image is in black and white.

Trondheim

Trondheim has been a vibrant city for visitors and inhabitants alike for over 1,000 years. Today we can offer Michelin restaurants, art & concerts and nearby breathtaking nature. So, climb a mountain, and then wine and dine before attending a jazz concert on your deserved day off?
Trondheim at your service.





Nobel prize
Trondheim is the home of many a great mind.
Not all of our great minds win Nobel prizes
(but some do).

NTNU is Norway's largest university and has become an international hub for education & science. Over 40,000 students provide the city with a vibrant edge.



NTNU Facts (2017)

- 40,181 students
- 7,135 person-years
- 362 doctoral degrees
- 9 billion annual budget

FOR

The Operating Room of the Future (FOR) is a research infrastructure facilitating research and development within the surgical disciplines. The main focus is image-guided minimally invasive therapy. However, FOR is also participating in research on work flow, visualization and communication technology.

FOR currently has its basis in six operating theatres at St. Olavs hospital; one at each of the operating departments. The operating theatres with the available research tools are actually research laboratories designed for development, testing and implementation of new technology and new treatment modalities. Here, prototypes can be developed and tested in safe and controlled environments.

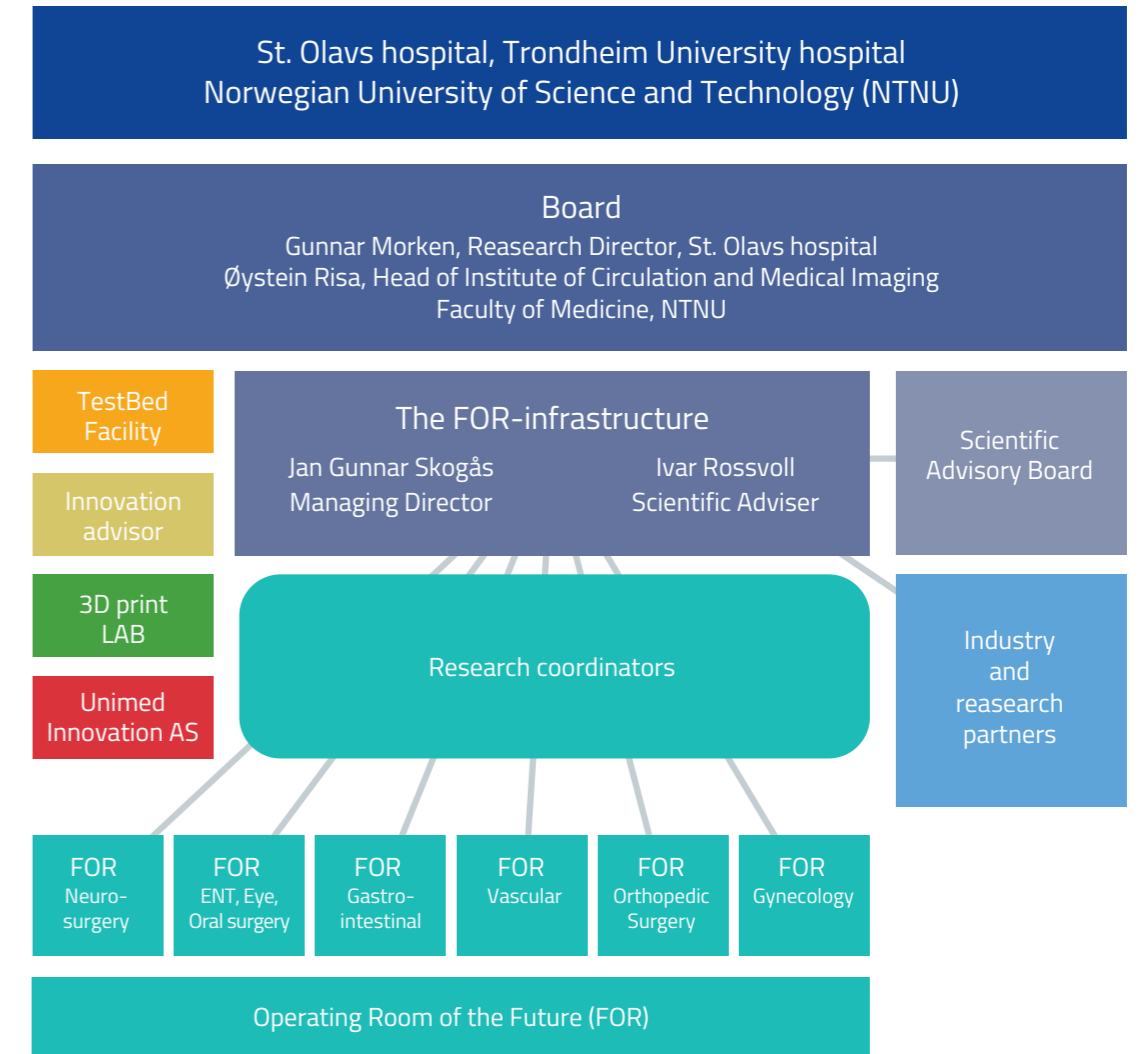
Recently, important research tools have become available at FOR through the NorMIT cooperation. FOR-NorMIT – Norwegian center for Minimally Invasive image-guided Therapy and medical technologies – is a collaboration between FOR and the Intervention Center at Oslo University Hospital (OUS). This infrastructure will contribute to improved technological and clinical research, which again will improve patient treatment nationally as well as internationally.

The Operating Room of the Future is a collaboration between St. Olavs hospital HF, University Hospital of Trondheim and the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. FOR is an interdisciplinary arena for clinical research and the development of medical technology.

FOR is set up to promote a close collaboration between clinicians, technologists, researchers and industrial partners who play a role in the development and innovation of the health care sector. FOR collaborates with internationally established research environments and industry. This collaboration is further elaborated in the present annual report.

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.

Organization



FOR demonstrates the synergy effects of allowing representatives from various disciplines and medical specialists use equipment, space and competence together.

3D printing is being tried and established at FOR. This technology offers exciting possibilities within the development of implants, instruments and planning of complicated interventions. Technological development in fields such as gene therapy, nanomedicine, artificial intelligence and big data will be reflected in diagnostics and treatment in the future. These are areas that FOR orientates itself towards through a multidisciplinary approach.

- All FOR operating theatres are authorized for experimental surgery including animal research. Requests for such experimental procedures can be made at FOR who will then undertake the organizing of them. This arrangement is well established among clinicians and scientists.
- Training and certification of doctors in using electro-medical equipment.
- Scientific collaboration – Post Doc. Staff, PhD candidates, Medical Students Research program from Faculty of Medicine and Health Sciences, NTNU, Master degrees and Bachelor degrees.
- The infrastructure of FOR currently consists of six operating theatres, with the overlay of an AV-ICT structure that enables live transfers and interactive communication in full 4K. FOR can run live transmissions from all operating theatres at St. Olavs hospital by using mobile productions systems – state-of-the-art broadcasting equipment. With access to high-speed internet, live surgery, along with other medical procedures, can be shared with colleagues internally as well on a global basis in full HD or 4K.



NorMIT

NorMIT is a national collaboration where the aim is to establish an infrastructure which will contribute to the improvement of technological and clinical research. It will also contribute to the building of competence and innovation and thereby lead to improved patient safety. Although the main focus area for the infrastructure is minimally invasive image-guided therapy, the research will also include topics like logistics, work flow, communication, organization and transmission of high-quality images.

The operating rooms included in NorMIT are modern research laboratories for developing, testing and application of new technology, new treatment modalities and new pharmacological agents. The cooperation and different profiles of the centres will form them into one national infrastructure for image guided treatment and technology. The research units in Trondheim and Oslo represent two of the strongest research groups in Norway within their fields, and they play an important role in the development of methods and technology also from an international point of view.

The Intervention Center at Oslo University hospital and the Operating Rooms of the Future at St. Olavs hospital will make NorMIT one common infrastructure for research and innovation with two nodes; one in Trondheim and one in Oslo. This infrastructure will strengthen research significantly in several areas with great strategic significance for Norway: medical technology, ICT, nanotechnology, translation research and health innovation.

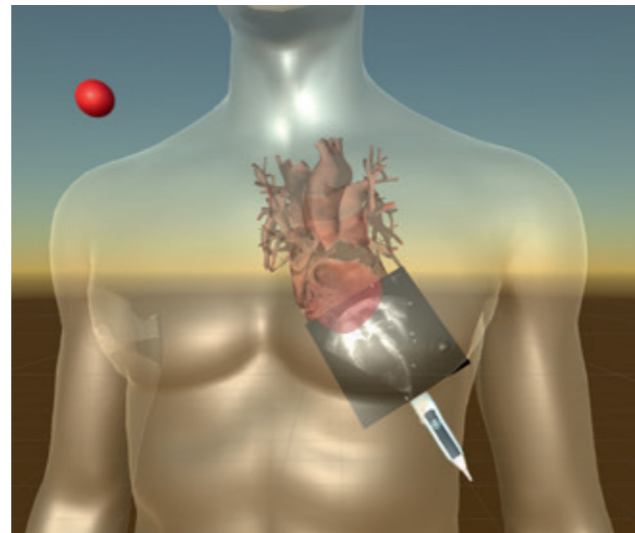


Augmented reality, AR and HoloLens – An example of an ongoing development project

To obtain a good ultrasound acquisition, detailed anatomical knowledge of the heart is required. Furthermore, during the acquisition the operator needs to be aware of the relationship between the anatomy of the heart, the current slice plane and the ultrasound probe movement required to refine it. FOR has generated an AR vision that contains an image of the whole scene, including the patient and the ultrasound probe, which will be augmented with the ultrasound image currently acquired and a detailed geometric model of the heart.



This heart model will illustrate its anatomy and resemble the depiction of the heart present in most anatomy manuals, with which target users should be familiar. As the operator moves the probe, or the patient changes position, the augmented vision is updated and kept consistent. Additionally, to increase the realism of the scene, a temporal registration must be added, to allow the virtual heart model to be depicted in sync with the beating heart of the subject imaged with ultrasound.



Operating Room of the Future at Department of Neurosurgery, St. Olavs hospital



The main focus onward is to test if it is possible to use augmented reality glasses in the operating room in order to display imaging data coming from different sources in either one selected field (surgical field view) or following the surgeon's movement. The idea is to study if augmented reality glasses are of benefit and can be used to fuse and display various image sources. Furthermore, FOR wants to test the feasibility of displaying several live streams in one scene and merge this with the navigation scene (i.e. CustusX) and the image of the surgical field and display the fused result on an off-the-shelf holographic device (i.e. Microsoft HoloLens). Four use cases have been identified as possible applications for our tool.

They include flexible endoscopy, gastroenterology including ultrasound imaging, complex ERCP (Endoscopic Retrograde Cholangio-Pancreatography) with treatment, bronchoscopy for lung cancer diagnostics and endovascular treatment. All these procedures are currently performed at St. Olavs hospital by one of FOR's clinical partners. In addition, FOR has an established collaboration with Haukeland, Bergen, exploring advanced flexible ultrasound guided endoscopic procedures in this project.



3D printing

3D printing enables surgeons to be better prepared for procedures than ever before. Patient specific 3D printed anatomical models provide a unique insight in the anatomical situation for the specific case and can be used to create a detailed plan for the treatment of the patient. Performing trial surgery on the model can validate the surgical plan, or reveal unforeseen obstacles, and the plan can be adjusted accordingly. Customized surgical guides can also be 3D printed to ensure that the surgical plans are executable with high precision. Patients benefit from such extensive

planning through the higher chance of a perfect result and shorter time spent in surgery, which in turn leads to fewer post-operative complications and less chance of infection.

FOR NorMIT 3D print-lab enables point-of-care production of anatomical models and surgical guides that can be used for clinical treatment of patients. Additionally, the lab produces models for research purposes which in turn will lead to even better treatment for patients in the future.



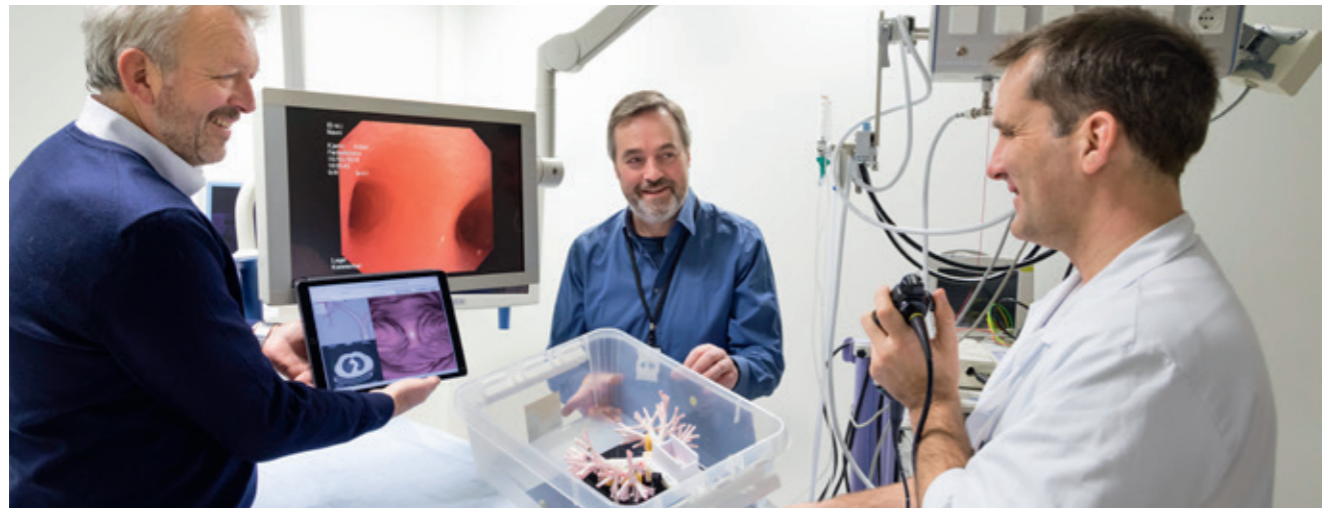
SINTEF

SINTEF and The Norwegian Advisor Unit for Ultrasound and image-guided therapy.

The Operating Room of the Future FOR is the arena and the provider of infrastructure for several ongoing research projects, including projects at the Norwegian National Advisory Unit for Ultrasound and image-guided therapy – USIGT (www.USIGT.org). USIGT is a collaboration between St. Olavs hospital, SINTEF and NTNU. USIGT uses FOR as the arena for a number of clinical and technological research, development and innovation projects ranging from technology development, prototyping and clinical trials/ studies of new solutions that improve patient care. Often, a technologist and a clinician work together on projects related to the same topic, which provides insight on the problem from both a clinical and a technical perspective.

The Advisory Unit USIGT, focuses on image-guided minimally invasive interventions and intraoperative imaging, with areas of interest related to surgery, neurosurgery, laparoscopic surgery, pulmonary medicine, interventional radiology, urology, ENT, anesthesia, sepsis, digital pathology and diagnostic ultrasound. In addition to the use of ultrasound and navigation, artificial intelligence (machine learning) is also an important field of research in the Advisory Unit USIGT.

The activity of USIGT is an excellent example of how the operating room of the future can support research, development and testing of new technology and methods, and strengthening national and international cooperation. In addition, FOR contributes with expertise related to courses and publishing popular science articles in close cooperation with SINTEF. SINTEF also brings considerable expertise into the collaboration and is using its funding base for strategic efforts to develop new technology for minimally invasive surgery/therapy.



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