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

St. Olavs hospital FOR – NorMIT Infrastructure
Operating Room of the Future
ST. OLAVS HOSPITAL TRONDHEIM UNIVERSITY HOSPITAL
NTNU

# NEWSLETTER

Photo: Lars Bugge Aarset, NTNU

# Official opening of the operating room of the future at NTNU

Hospital-acquired infections are the most common complications in the health service, and unfortunately they happen very often. I am therefore pleased that Norconsult, St. Olav's hospital, NTNU and their partners want to contribute to reducing this type of infection. It is also extremely exciting and important to see how we can use new technology such as XR and machine learning to develop and improve our health service, and solve concrete challenges we face as a community. I support this type of initiative, says Ingvild Kjerkol, Minister of Health and Care.

The operating lab will be used to research how the risk of such infections can be reduced through the POSIred project.

In this project, many good minds have come together at NTNU, St. Olav's hospital and Norconsult. The good cooperation is a strength we will continue to build on. Because collaboration produces results. It is also appropriate to extend a big thank you to the Research Council and Norconsult, who have financed the lab, says Rector Anne Borg at NTNU.

Rector Anne Borg handed over the scissor to Minister of Health and Care Ingvil Kjerkol, who declared the laboratory opened. Trond Thorgeir Harsem, project manager at Norconsult, in the background. Photo: Lars Bugge Aarset / NTNU

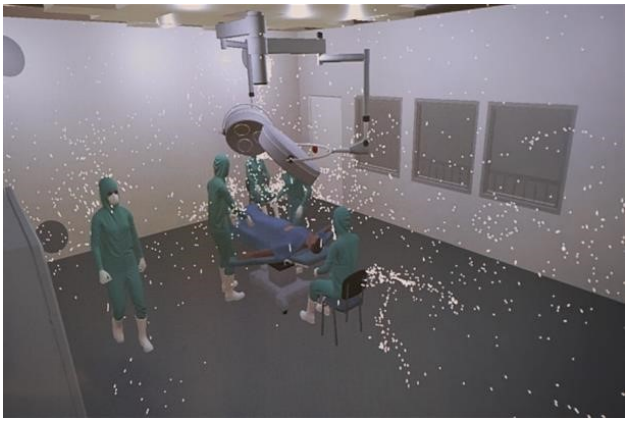
This work is very important. The project is in many ways only in the starting pit, but I would still like to thank everyone who is involved and contributes, including our own employees. Their knowledge and expertise is the most important tool in this project, says Egil Hogna, CEO of Norconsult, who is leading the project.

Ingvild Kjerkhol and Thorgeir Harsem watching the surgery simulation. Photo: Gunnar Gjeldnes, FOR

Tina Wik, head of the orthopedic department at St. Olavs hospital and ortopedic surgeon Håkon Langvatn performed the surgery simulation. Photo: Gunnar Gjeldnes, FOR

**Augmented reality**

The laboratory used in the project is designed as an operating room, with technology and equipment that make it possible to visualize ventilation currents and particles in the air, as well as stereo cameras that record the movement patterns of the healthcare personnel. An XR tool (augmented reality) is being built that captures the interaction between the movements of the healthcare personnel, virtual air currents and the distribution of particles in the room.



Real-time digitization of people and equipment in the operating room showing particle flows. Photo: Lars Bugge Aarset/NTNU

**Reduces the risk of infection with a ventilation lock**

An important part of the solution is to eliminate airborne contamination from outside the operating room. This has been solved by designing and building a special airlock, which the operating team must pass through to enter the operating room. They then have to pass a high-speed air stream, which prevents particles from following the staff into the airlock and further into the operating room. There are mainly four sources of infection that can cause post-operative infections in an operating room, namely the patient himself, operating staff, instruments and airborne infection that accompanies the staff. With this ventilation lock, the risk of infection from outside the room is reduced.

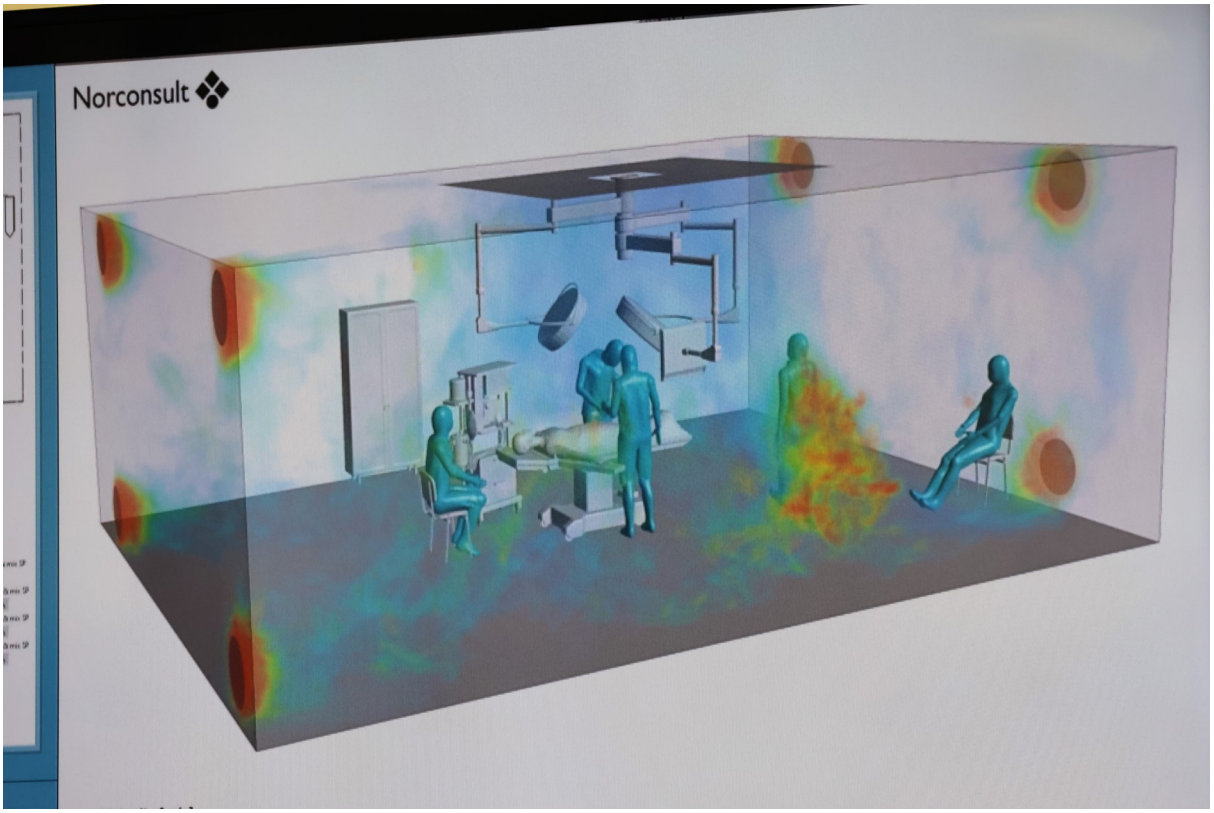



Photo: Lars Bugge Aarset/NTNU

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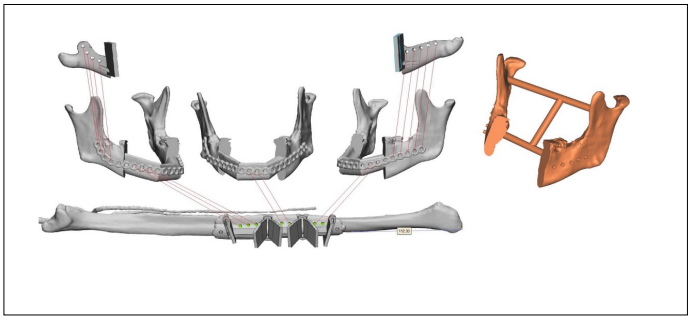
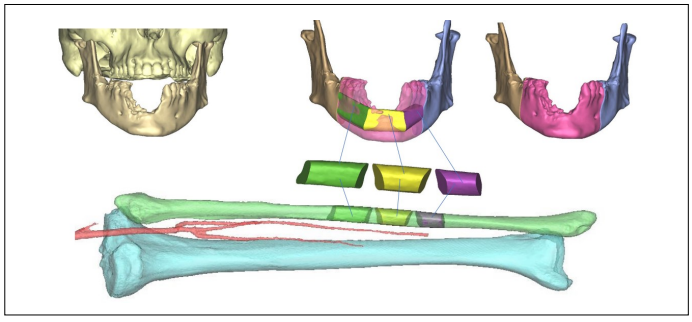
# 3D printing of anatomical models to aid in maxillofacial surgery

Nils Petter Fossland, senior physician at Department of Maxillofacial Surgery St.Olav university hospital

**Maxillofacial surgery is a medical specialty with roots in both dentistry and medicine. Specialists in maxillofacial surgery have often passed both medical and dental official exams, although the latter is not a formal requirement. Maxillofacial surgery encompasses a wide range of surgical treatment of conditions in the jaws and face, and is a specialty that performs procedures that border on dentistry, plastic surgery and ENT.**

It has been a tradition in our field to use plaster models and casts of the bite for planning movements of the upper and lower jaw in case of bite disorders, so-called orthognathic surgery. Over the past 20 years, there has been a shift to intraoral scans that are transferred in STL format and used in virtual planning and production of 3D printed guides and patient-specific implants. This is a quantum leap in the planning and execution of complicated surgery. This has been continued in other surgery in our field that requires preparation and planning preoperatively, especially in reconstructive surgery for microvascular reconstruction of bony defects in the face. Point of Care, "POC", 3D printing and digital planning are increasingly used internationally, while currently only a few hospitals in Norway have this. POC production of surgical templates is less widespread, while POC production of implants is only done in a few hospitals internationally. The Department of Maxillofacial Surgery at St. Olav's Hospital collaborates with Fremtidens Operasjonsrom (FOR) on preoperative planning of surgical interventions. FOR contributes with 3D printed anatomical models, 3D digital planning of





*Mandibel reconstruction using bone from tibia*

The collaboration has largely been linked to orthognathic surgery, but also in the planning and execution of the bone reconstruction of defects in the upper and lower jaw.

The service provides better user-friendliness for healthcare personnel in that good planning increases predictability and the prerequisite for a successful surgical result. The operating time is also reduced. In addition, good planning provides the opportunity for better communication with the patient, and the opportunity to show the patient planned movements by showing the operation plan before surgery.

Surgery in the facial region often has both a functional and an aesthetic aspect. Improved communication gives the patient a better basis for deciding on their own treatment. It is desirable to expand the service so that more complex orthognathic cases as well as reconstruction cases can be treated with the same precision and predictability.

To achieve this, it is desirable to produce patient-adapted surgical templates (for invasive use), and possibly patient-adapted plates (implants) through 3D printing locally at the hospital.

There is currently no hospital in Scandinavia that has this service, but we believe that it is only a matter of time before titanium printers and approved workflows become so widespread that it will be economically possible for the larger hospitals to produce their own patient-specific templates and implants in titanium . Until then, the focus is to develop the workflow to become increasingly accurate and efficient, and to spread information about the possibilities inherent in virtual planning and production of anatomical models and surgical templates that can be used during surgical interventions.

*The 3D-print lab at FOR's facility consist of 6 printers, using 4 different print technologies. The latest addition is an SLS printer used to print state-of-the-art surgical guides*

Contact information 3D print
Jan Magne Gjerde
*Email: jan-magne.gjerde@stolav.no*

# Center for Medical Devices, Technology and Innovation

MiDT – Norwegian National Research Center for Minimally Invasive and Image-Guided Diagnostics and Therapy

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**3D printing laboratory**

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**Research and Innovation projects**

On-going: Ablation of renal cancer (ACUS), NUL-Fat, Aviant, Posired, MIREIA, IDEAR, LungGuide, NaviCAD, MEDITATE, Lung Cancer Cockpit, In-Motion, HumanIC

Collaborative partners SINTEF NTNU Hospitals Universities Industry International

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**Chief Editor: Jan Gunnar Skogås**
**Editorial assistance: Gunnar Gjeldnes**

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