

Strategy

Department of Microsystems (IMS)

Faculty of Technology, natural sciences and maritime science

2023

Key information

The Department of Microsystems is located on the Vestfold campus and offers education and research in engineering and technology in close collaboration with the industry. The proximity to a rich business environment with exciting career opportunities for students and the need for advanced research gives the department strength and growth opportunities in the disciplines of **mechanics, micro- and nanotechnology, computer technology, biotechnology, electronics, and electrical engineering.**

The department offers education at the bachelor's, master's, and PhD levels and focuses heavily on innovation through its own innovation center and advanced lab facilities as part of Norway's infrastructure initiative for micro- and nanotechnology.

372

Students (2022)

5

Study programs BA,
MA and Ph.D studies

40

PhD students

79

Employes (2022)

Study programs BA and MA studies

Bachelor in engineering

- Computer Engineer - Cyber Security
- Electrical engineer – Electrical automation and robotics
- Electronics engineer – Micro and nanotechnology
- Electronics engineer - Electronic system design
- Mechanical engineer – Product design

Master's degrees

- Master in micro and nanosystem technology
- 3-year master in micro and nanosystem technology industrial master
- Joint International Master in Smart Systems Integrated Solutions
- E-business technology and cyber security

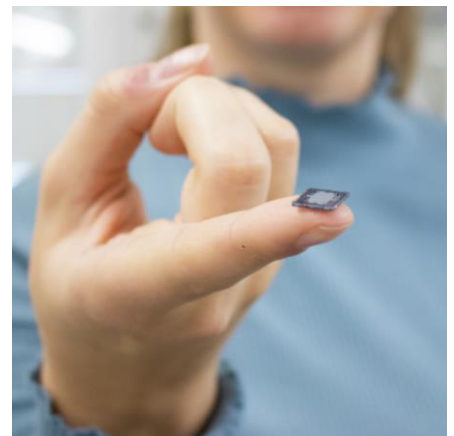
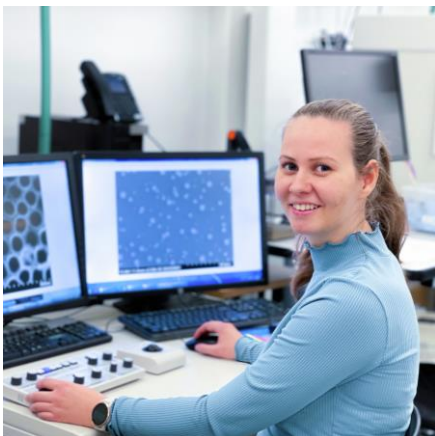
Continuing education activities

Develops and offers courses for remote operation of autonomous vessels in collaboration with the Department of Maritime Operations.

Priority research areas

The priority research areas are organized into research groups:

- BioMEMS
- Secure Distributed Systems
- Autonomy
- Materials and Microintegration
- Micro- and Nanoelectromechanical Systems



Research groups

BioMEMS

BioMEMS: Research that focuses on biological and biomedical microelectromechanical systems. It combines applied micro- and nanotechnology with biology, biotechnology, and bioelectronics to address challenges in health, environment, food production, and process industries.

Materials and Micro integration

Research group that works with packaging technology and system integration for microelectronics and medical components. Special focus on bonding in demanding environments, fabrication processes for ultrasound transducers, nanomaterials in microelectronics, and measurement and characterization of materials.

Micro- and nanomechanical systems

Application of micro- and nanotechnology, as well as process technology. Research activities to further develop electronic sensors, actuators, and systems for use in industry and for applications in environmental monitoring, health, maritime, and energy sectors.

Autonomy

Development and research related to digital work processes, maritime autonomous applications, human-machine interaction, operation centres for autonomous systems. The group also organizes an annual championship for autonomous vessels.

Secure Distributed Systems

Provides education, research, and development related to computing, infrastructure, hardware, software, and security.

Research- and innovation centre

USN Innovation centre – microsystems, nanotechnology and electronics

The Innovation Center offers expertise, services, development, and lab facilities to help companies realize and test-produce prototypes, products and systems. The center has full-time researchers and experts with close ties to national and international industry, universities, and other departments at USN.

Microsystem Technology Laboratory (MST-Lab, NorFab)

Laboratories and clean rooms for fabrication, processing, and characterization of micro- and nanosystems are part of Norway's infrastructure through the NorFab collaboration with NTNU NanoLab, UiO, and SINTEF MiNaLab. USN has received allocations of 50MNOK for this initiative, making USN a world leader in packaging technology for microsystems.

Bioelectronics and Biophysics Laboratories

Two wet labs with opportunities to study new technology in transducers, sensors, bioelectronics, and lab-on-a-chip. There are also opportunities to use heavier chemicals or gases.

Bio Technology Lab

Facilities for clinical and environmental testing, sterile handling of biological samples, cell cultivation, extraction and handling of DNA/RNA, sequencing, as well as observation and analysis using spectroscopy and fluorescent microscopy. Cryogenic storage at -150 degrees.

Infection control laboratory

BSL-2 laboratory at USN enables a wide range of research including small or large clinical and environmental studies of causes of deviations in nature or disease in both animals and humans. This facility helps to expand the institution's research portfolio and promotes interdisciplinary collaboration.

Ultrasound laboratory

Development and testing of ultrasound transducers, especially for medical and maritime applications. The laboratory is part of CIUS, Center for Innovative Ultrasound Solutions. Collaboration has been established with NTNU, the University of Oslo, and many industrial companies.



External financing:

The department has significant externally financed activity (BOA) (27MNOK, 2022) compared to grant-funded activities (36MNOK, 2022).

NRC projects accounted for over half of the BOA turnover (14MNOK, 2022). The projects that contributed the most to turnover were:

- NorFab national infrastructure for micro- and nanotechnology (5MNOK)
- Piezoelectrical devices (1.7MNOK)
- STEG sensor technology for aerospace (1.5MNOK)
- SFI CIUS ultrasound (1.4MNOK)
- AutoStrip capacity boost (1.2MNOK)
- Catch and Kill disinfection of air and water (1.1MNOK)
- Other projects in BIOMems, autonomy, condition monitoring, photonics, and acoustics (2.1MNOK)

EU projects (framework program and others) contributed with a turnover of 4.8MNOK (2022). The largest projects in 2022 were:

- Valkyries crisis response across countries (1.8MNOK)
- CarbonChem electrochemical splitting of water for H₂ production (1.4MNOK)
- SSIs Joint Master - European master program (1.4MNOK)
- METIS Microelectronics training and mobility (0.9MNOK)
- APPLAUSE Packaging technology for production in the EU (-0.8MNOK)
- Other projects in photonics, audio, and infection control, as well as self-financing on projects (0.1MNOK)

The category "Other contributions" had the third-largest turnover (5.4MNOK in 2022). The largest projects in 2022 were:

- Graftid EEA project on nanomaterials (1.2MNOK)
- ARMIN Neuroprosthesis (1MNOK)
- Gift professorship - Technology for better public health (0.6MNOK)
- Photored photochemical conversion of CO₂ to products (0.5MNOK)
- NORPART PaproNoVi education and research collaboration with Vietnam (0.4MNOK)
- SuPreM supercapacitors for power grids (0.4MNOK)
- National championship in Autonomous drones (0.3MNOK)
- ENT3R Vestfold Mentor and homework help (0.3MNOK)
- Other projects in maritime technology, international mobility, and environmental monitoring (0.7MNOK)

Commission projects contributed with a turnover of 2,3MNOK (2022). The largest projects were:

- CFRON Ultrasound front-end and transducers (1.4MNOK)
- MANTIS IR image sensor for new applications
- Sensor network for drinking water network (0.2MNOK)
- HiBAR Acoustic resonators (0.1MNOK)

Projects funded through the Regional Research Fund (RFF) had a turnover of 531kNOK in 2022. The largest projects in this funding scheme were:

- Cathodes for hydrogen production with non-noble metals (292kNOK)
- Lab-on-chip for follow-up of COPD patients (211kNOK)

In 2023, the trend continues with NFR projects having the highest turnover, followed by Contribution projects and EU projects. New areas of financing include:

- 5G security for critical communication
- Development of sensors with photosensitive proteins
- Computational X-ray microscopy
- How to avoid infectious diseases on passenger ships
- Lab-on-chip for disease detection
- Energy solutions for IoT systems
- Monitoring of ports

Strengths and strategic advantages

Department of Microsystems:

- Strong demand for education in the industry
- Industry-relevant education
- Good collaboration with world-leading industry in the vicinity
- Large proportion of laboratory work in teaching and lots of practical teaching
- Strong academic communities with professional breadth and good cooperation
- Laboratory facilities at an international level
- Large externally funded project and research activity



Vision, values and community assignment

Our vision

Regionally rooted
and internationally recognized.

Our values

Close to communities and working life, where people live and work

Sustainable

Innovative

Community mandate

The key to good social development is wise and knowledgeable citizens. USN will develop and disseminate new, boundary-breaking knowledge and offer education of high international quality.

The university's main profile is profession-oriented, working life-oriented and socially relevant educations. Both research and education are characterized by close interaction with social and working life in the region. Our eight campuses are a unique strength. With this presence, the university will make higher education and research more accessible. We shall be an active driving force for knowledge-based development in partnership with society and working life.

The university will focus on societal challenges and contribute to solving them through an interaction of applied research, basic research, education, artistic development work, communication, and innovation. Challenges related to climate, energy.

Long-term ambition / desired future vision

*“The Department of Microsystems develops **knowledge and competence** for future engineers that is unique in Norway and at a high international level»*

Future vision:

The department contributes to making the university a **preferred research partner** for regional and national society and business.

We offer attractive, future-oriented, and **work-integrated** engineering studies.

The department is characterized by **good leadership, good finances, and high well-being**, where the employees deliver high-quality academic offerings and all students succeed in their education.

Department of Microsystems values related to USN’s values:

Department values	
Work-life integration	In the department, knowledge and competence development occur through research and development in collaboration with regional, national, and international actors. The study programs have a clear connection to the working life.
Future-oriented	The department educates candidates who contribute to sustainable development within our fields of expertise. Our students and employees engage in major societal challenges and are a resource for transformation.
Innovative	The department stimulates curiosity and the development of new mindsets, practices, and solutions. Through academic collaboration, students develop creative and innovative skills.

USN's overall goals

Ministry of education and research's (KD) sector goals

High quality in education and research

Sustainable social development, welfare, and innovation

Good access to education and skills throughout the country

Goals in the development agreement between KD and USN

To be an open University that offers work-life-integrated and flexible education.

To be a future-oriented university that contributes to a knowledge-based critically reflected and sustainable social development in collaboration with society and working life.

To be an innovative multi-campus university that collaborates with community and working life in the region.

USN's institutional

- 1 Research-based and work-life-integrated educations of high international quality that promote critical reflection and strengthen innovative skills.
- 2 Several outstanding and internationally competitive professional environments, and research at a high international level.
- 3 Student-active learning processes and digital competence in all educations.
- 4 Flexible courses for lifelong learning.
- 5 New knowledge, insight and solutions with relevance for social and working life in the short and long term.
- 6 Partnership with community and working life and become a role model for such cooperation.
- 7 Competence and knowledge for green transition and sustainable economic, social, and cultural innovation.

Department goals:

<p>Goal 1</p>	<p>The department offers attractive, work-integrated, and relevant bachelor's and master's engineering programs with at least 3 qualified applicants per study place.</p>	<p>Based on business goal no. 1 Research-based and work-integrated education of high international quality that promotes critical reflection and strengthens innovative skills.</p>
<p>Goal 2</p>	<p>The department has an excellent learning environment, and the completion rate of study programs is among the best at USN.</p>	<p>Based on business goals no. 1 and 3 Research-based and work-integrated education of high international quality that promotes critical reflection and strengthens innovative skills. Student-active learning processes and digital competence in all education programs.</p>
<p>Goal 3</p>	<p>The department has well-funded research projects with research production at a high international level.</p>	<p>Based on business goal no. 2 Several outstanding and internationally competitive academic communities, and research at a high international level.</p>
<p>Goal 4</p>	<p>The department will increase turnover in development and innovation projects with society and business by at least 8% per year.</p>	<p>Based on business goal no. 5 New knowledge, insight, and solutions with relevance for society and working life in the short and long term.</p>
<p>Goal 5</p>	<p>Each research group and study program communicates popular science at least once every six months.</p>	<p>Based on business goal no. 6 Partnerships with society and business and being a role model for such cooperation.</p>
<p>Goal 6</p>	<p>Research groups, the innovation center, and study programs establish a strategic plan for further development (performance improvement) of their own activity.</p>	<p>Based on business goal no. 2 Several outstanding and internationally competitive academic communities, and research at a high international level.</p>

Selected focus areas

Regional collaboration

The department increases **recruitment** through collaboration with university schools, municipalities in the Technology Triangle, and business networks.

The department uses **study programs**, **research groups**, the **Innovation Center**, and the **MST lab** to increase external interaction and project development both regionally, nationally, and internationally.

The department develops **work-integrated** elective courses, specializations, and master's programs and provides employees with time resources and administrative support for coordination and development.

The department's employees are encouraged and supported in their work on profiling and **visibility** towards society and business with activities, events, and competitions.

Internationalization

- The department further develops teaching and research laboratories to maintain a high international level.
- The department further develops the Erasmus+ program Joint international master in Smart Systems Integrated Solutions
- The department establishes **alumni groups** to increase the visibility of the competence "created" at USN and strengthen the recruitment of international students.
- The department strengthens the **mobility** of students and employees through international partnerships and collaborative networks such as **YERUN, EDUC, and EPoSS**
- Employees publish and conduct high quality research dissemination in international journals and conferences.
- The department seeks and participates in EU projects

Interdisciplinary initiatives

Internally in the department:

- Establish common meeting points for competitions and other social learning activities that create networks and enthusiasm.
- Facilitate student-driven project activity, hacker-space, and interdisciplinary bachelor's theses.
- The research groups and the innovation centre collaborate on research and link it to the study programs.

Across departments:

- Strengthen cooperation with the Department of Maritime Operations within maritime technology.
- Create an interdisciplinary research environment where research groups collaborate within a new doctorate program in technology.
- Organize joint career fairs and activities

Across faculties:

- Develop research and education collaborations within USN's strategic research areas in Energy, Climate and Environment, Future Health and Welfare Services, and Regional Value Creation.
- Strengthen cooperation with USN School of Business beyond the joint master's program in E-business Technology and Cybersecurity.
- Strengthen cooperation with the Faculty of Health and Social Sciences in health technology and infection control

