Norwegian Defence Research Establishment (FFI) and Norwegian industry have developed HUGIN, one of the world’s most advanced autonomous underwater vehicles (AUVs).

HUGIN uses advanced control systems, sonars and navigation systems to detect mines much more efficiently than by other means. The AUV plays an important role nationally as well as in NATO.

The military HUGIN AUV has been developed to counter the threat from sea mines, and is normally operated from a mine hunter. The vehicle can operate in both shallow and deep water, and allows accurate detection, classification and localization of mines – while ship and crew remain at a safe distance. After HUGIN has completed its mission, the mine hunter can enter the area – with detailed knowledge of the mine threat.

Mine countermeasures
Norway has traditionally excelled in mine countermeasures. A long and treacherous coastline with deep, steep fjords and rocky seafloor makes mine hunting particularly challenging in our waters. Advanced technologies and skilled crews have always been a necessity to give our nation an effective defence against mines.

HUGIN is a natural extension of this tradition. The Royal Norwegian Navy tested HUGIN for the first time in 2001, from the mine hunter HNoMS Karmøy. Since then, the Royal Norwegian Navy has acquired two HUGIN vehicles, which has repeatedly been used in international exercises and NATO’s rapid reaction forces.
HUGIN is under constant development, and is a product of Norway's strong maritime traditions. Frequent testing at sea from very early on has played a key role in delivering systems at the very forefront internationally – and maintaining that lead.

A self-sustained industry has been established for development, production and support of the HUGIN AUVs. Norway's strength in the maritime sector along with a dual-use philosophy enables delivery of first class solutions at very competitive prices. The first models were tested at sea in the early 1990s. Today, HUGIN enjoys a strong domination in deep-water AUV surveys. The main task for HUGIN in the civilian sector is seafloor mapping and imaging for the oil industry.

Research activities at FFI
During the last 20 years, FFI has contributed substantially in research areas relevant for AUVs. FFI has developed power sources to cover different applications, including a fuel cell that allows up to 75 hours of AUV operation. FFI and Norwegian industry have also jointly developed a synthetic aperture sonar that provides better resolution and greater area coverage than other sensors. FFI has also developed tools for automated data analysis of the sensor data, including automated target recognition for mines. Development of integrated navigation systems is another focus area.

The AUV has to navigate independently of a mother ship, preferably without surfacing for several hours. No single technique will suffice for all scenarios. Therefore, a full toolbox of navigation techniques is developed.

Future trends
The future battlefield will contain more unmanned units both in the air, on ground, at sea, and under water. In the underwater domain, there are several reasons why AUVs will become more used. Two key reasons are increased safety by keeping manned platforms out of high risk areas and the possibility of performing covert operations with relatively large standoff ranges to the host vessel. In addition the AUV brings the sensors closer to the actual scene of interest, and thereby provide better data quality. The trend goes towards little or no human interaction during AUV operations and longer standoff distances. This implies that the vehicle must be able to adapt to the environment and the task in hand, and intelligently operate the sensors such that the best possible data are gathered. This pulls the technology towards better batteries, navigation, autonomy, sensors and automated data analysis – all key areas of research at FFI.

Military applications
Today, AUVs have a clear role in mine countermeasures operations. High performance AUVs such as the HUGIN AUV carries a suite of advanced sensors that may be used in a variety of military applications such as intelligence, surveillance and reconnaissance, rapid environmental assessment, and anti-submarine warfare. It may be carried by any host vessel or even deployed from shore, giving more flexibility in the use.

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