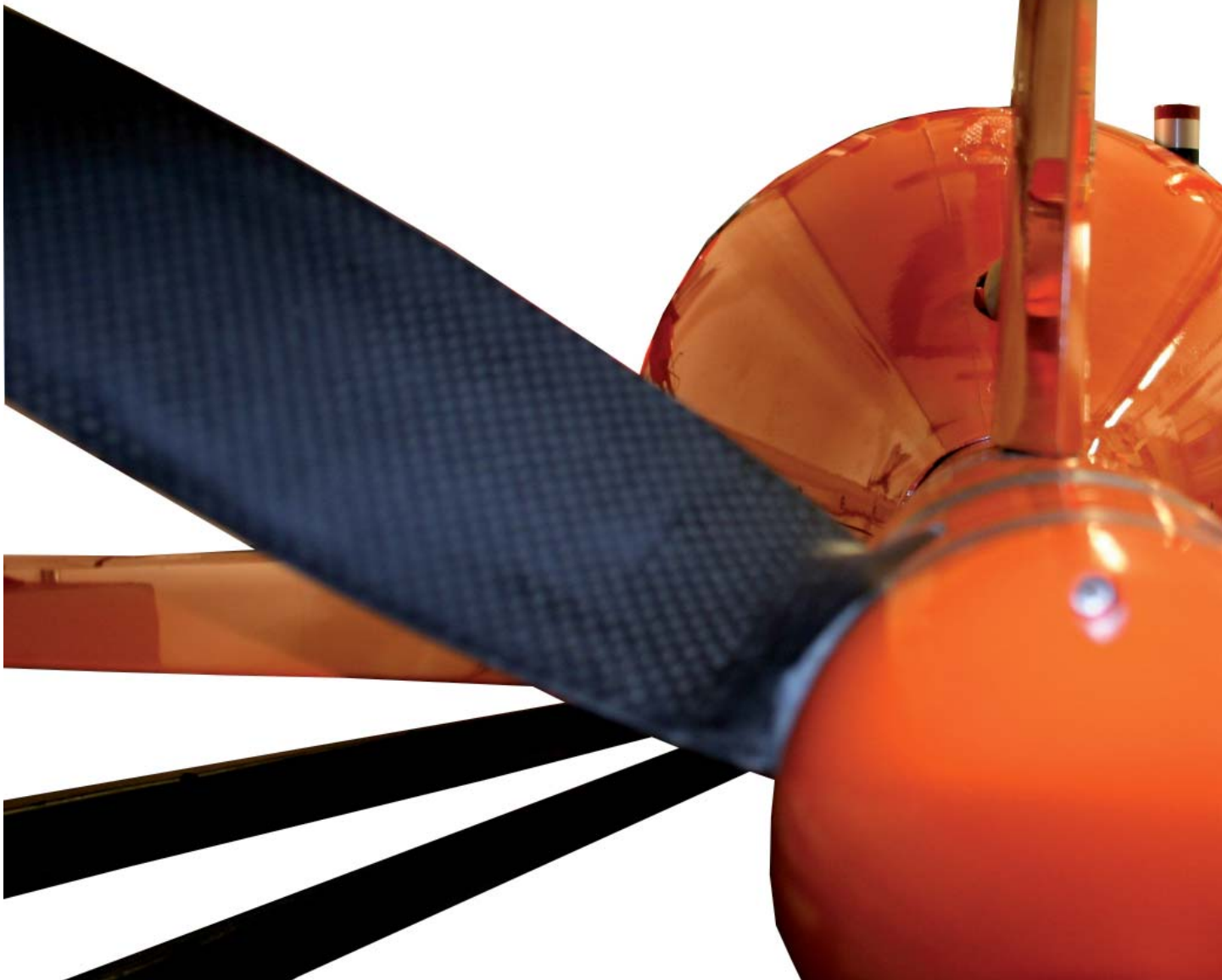


Kongsberg has developed a ultra-deepwater AUV to extend the depth range of its HUGIN family

AUV TECHNOLOGY

Deep, Deeper, Deepest



The Hugin AUV. A new version of the vehicle has been developed, rated at being able to work in 4500m of water

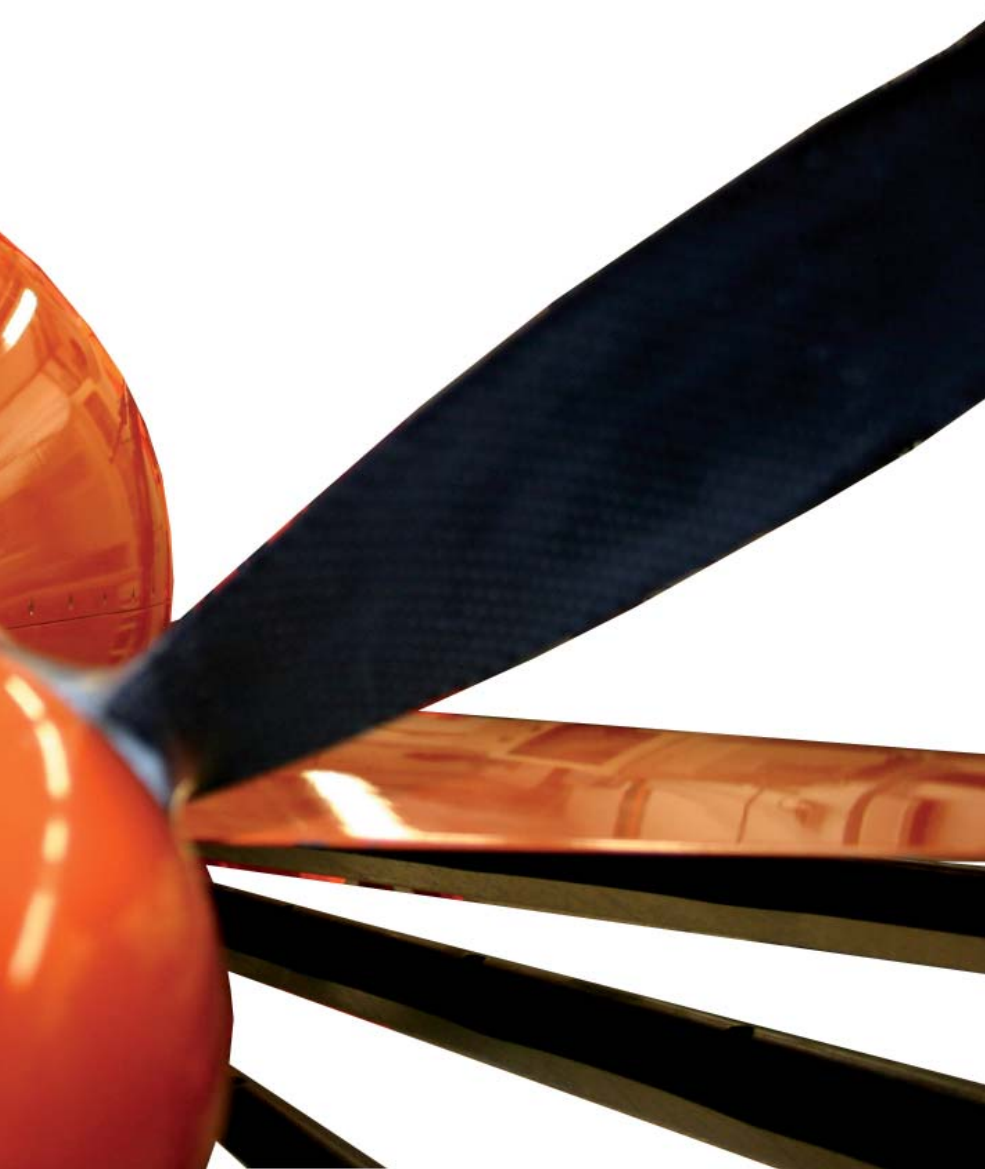
Kongsberg is entering the final development stages of its next-generation HUGIN autonomous underwater vehicle (AUV). For the first time, a version of this advanced family of vehicles will be able operate at 4500m water depths. At present, this deepwater vehicle is under final

assembly and testing, ready for an October 2006 launch.

'The HUGIN is a flexible, robust, hydrodynamic, stable, low-noise platform which provides a cost-effective alternative to conventional surface tow and ROV-mounted survey systems,'

said Karstein Vestgaard, Vice President of Kongsberg's AUV department. 'The HUGIN 4500 will literally bring the concept to another level.'

The vehicle will be 0.75m longer than the current HUGIN 3000 AUV. This has been necessary in order to



accommodate the increased battery capacity and the extended payload sensor configuration. It will employ the same Aluminium Oxygen fuel cell battery technology as the existing HUGIN 3000, but will incorporate a number of extra cells, which should give it a 30% greater battery life. This will allow an

operational life of 60-70h with full sensor deployment, at nominal speeds of 4kts.

The move to 4500m water depth has meant a number of minor but fundamental changes in the internal design, with the use of denser syntactic foam

and the redesign of titanium pressure containers, as well as specifying higher performance payload sensor packages capable of withstanding the higher pressures. All payload and control system sensors are rated to 6000m or deeper.

This first vehicle has already been sold to Louisiana-based C&C Technologies. C&C was an early adopter of HUGIN AUV technology and has established strong links with the Norwegian manufacturers. A team of C&C specialists are presently working with the HUGIN team during final assembly and testing. In the past, this has proven to be beneficial to the partners by providing training and building personal relations, which proved very useful when field operations commenced.

'Our plans on the C-Surveyor III have not fully been ironed out yet, but we are in discussions with several operators worldwide to decide where to mobilise our third deepwater AUV,' said Jeff Fortenberry of C&C.

The equipment that will be installed as part of the C-Surveyor III's Payload Sensor Package includes:

- EdgeTech 4500-DF 220 kHz / 410 kHz dynamically focused side scan sonar – rated to 6000m
- EdgeTech full spectrum chirp sub-bottom profiler with 2X2 transmit array and 8 hydrophone receiver arrays – rated to 6000m
- Kongsberg Maritime EM2000 multibeam echo sounder – rated to 6000m
- Two SeaBird SBE 49 FastCAT CTDs – rated to 7000m
- Two Paroscientific depth sensors – rated to 7000m
- RDI WHN300 DVL – rated to 6000m
- Satellite/ GPS emergency call-in system for emergency location – rated to 6000m
- Wireless Ethernet link for control, monitoring and data transfer while on the surface – rated to 6000m

'HUGIN AUVs have been established as an industry standard for AUV

based offshore oil and gas surveying,' said Karstein Vestgaard. 'So far the number of accumulated survey hours have passed 100 000 km or approximately 15 000h of survey. The HUGIN survey operations have taken place from shallower horizons down to 3000m water depths and have been active in most significant offshore oil and gas areas across the globe.'

HUGIN 3000

Meanwhile in another part of the assembly workshops, a second HUGIN 3000 is being assembled for delivery to Fugro, also planned for launch by the end of this year. The first AUV, the *Echo Surveyor*, was delivered in late 2004.

The new-build HUGIN 3000 will be equipped to the same standard as the *Echo Surveyor* but will incorporate the modifications that have been already made to its predecessor, to enhance operational efficiency, and improve safety and environmental performance to meet Fugro's requirements.

The HUGIN 3000 is 5.35m in length

and a metre in diameter. While it weighs 1400kg in air, it is neutral in water. Due to its 45 kWh semi-fuel cell battery technology, the vehicles are repeatedly running survey missions up to 60h endurance with all payload sensors in operation simultaneously.

Such sensors typically comprise side scan sonar, sub bottom penetration sonar, multi beam echo sounder and sensor for measuring conductivity, temperature and depth. The vehicle control and navigation systems allow the vehicle to be safely operated in rough terrain and with high position precision in very deep water.

In the Navy

The end of the year will also see a delivery of a next HUGIN 1000 to the Royal Norwegian Navy (RNoN). The first HUGIN 1000 was delivered in 2004. The HUGIN 1000 is mainly directed towards military applications, particularly the mine reconnaissance program (HUGIN MRS), but also has potential in the field of marine research.

This smaller AUV has been developed in several phases with technol-

ogy, concept development and field evaluations in progress since 1998. This stage of the program included a number of HUGIN operations throughout 2002 and 2003, onboard the Norwegian mine hunter *HNoMS Karmoy*. These operations resulted in successful demonstrations and proof of the concept of the AUV in military operations.

The HUGIN 1000 is smaller at 4-5m in length depending on the central section which can be built in different lengths. It has a 0.75m maximum diameter and can travel at up to 6kts for up to 24h, depending on speed, battery and payload configuration.

The HUGIN 1000 is equipped with side scan or synthetic aperture sonar, multibeam echo sounder, and a state of the art integrated inertial navigation system. This new HUGIN 1000 for the RnoN will be equipped with the HISAS 1030, a high resolution Interferometric Synthetic Aperture Sonar developed in co-operation between Norwegian Defence Research Establishment (FFI) and Kongsberg Maritime.



Fugro's first AUV, the *Echo Surveyor*. The newbuild HUGIN 3000 will be equipped to the same standard