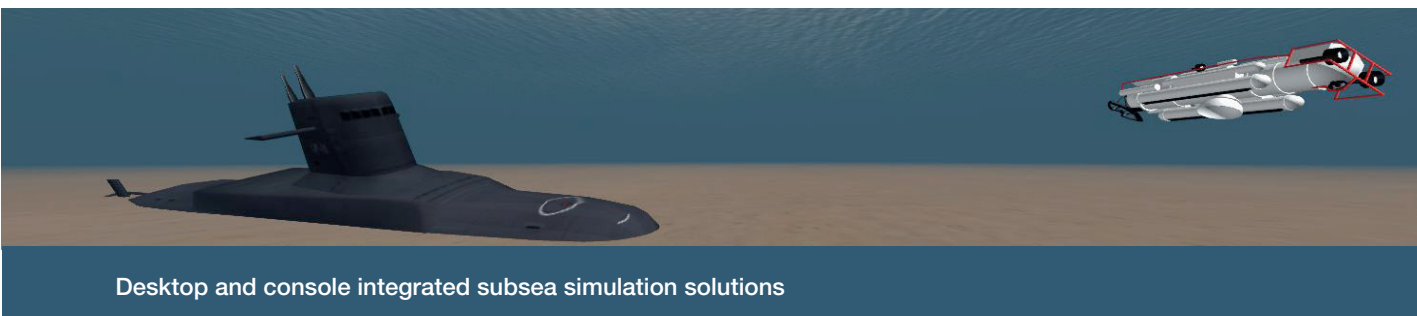# Distressed Submarine Rescue Simulation

Desktop and console integrated subsea simulation solutions

Planning and rehearsal of emergency rescue operations

Fugro are a leading global operator of Remotely Operated Vehicles (ROVs) and provider of subsea equipment including ROV support systems. ROV training simulators form an integral part of this work; the company has already developed a proven track record of submarine rescue simulation including designing submarine rescue vehicle (SRV) trainers for several of the world's naval forces.

Our new DeepWorks simulator provides improved mission planning, crew training and live visualisation for submarine rescue operations. DeepWorks offers true subsea physics-based simulation in a user-friendly package that can run on the desktop or be integrated with the SRV's own hardware control console. Fugro's LR5K SRV simulator was the world's first system capable of 3D simulation of rescue operations. Fugro also pioneered ray tracing which gives highly realistic sonar for navigation and altimeter based ranging for hatch mating, and pod-posting. Prototype trainers for specific models have already been developed including Perry Slingsby LR7 and for OceanWorks Merlion 500 and ADS 2000.

Recent developments to enhance DeepWorks for SRV operations training include:

- Navigation to the Distressed Submarine (DISSUB) using multiple camera views integrated with Kongsberg Maritime MS1000 sonar;
- Integration of industry standard 5 function manipulators for grab handles for vehicle stability;
- Integration of industry standard 7 function manipulator arm for planned and unplanned intervention tasks such as clearing debris and opening and closing valves;
- Crane lift and recovery operations in different sea states;
- Trim and ballast control and failures modes;
- Thruster modelling to determine safe operating procedures in complex currents.

Pop-out windows offer alternative viewpoints of rescue operation

SRV on final approach. Real-time feedback of position, speed, heading and flight dynamics helps pilot align with hatch
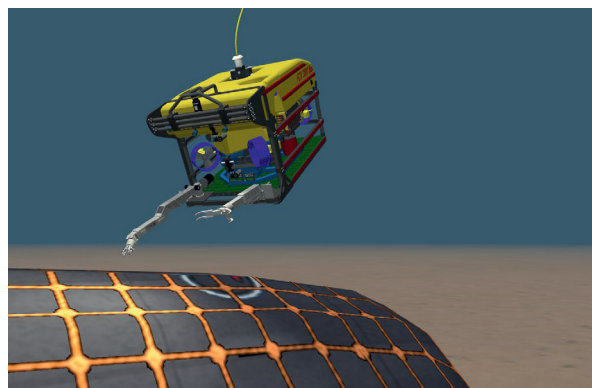
FCV 3000 ROV inspects netting snagged around emergency escape hatch before removing it with manipulators