CAGE REPORTER

H3: AUTONOMOUS SYSTEMS

OPERATIONAL ANALYSIS AND OVERALL SYSTEM DESIGN

SEATONOMY describes a methodology that provides a structured approach for design, development and validation of mobile autonomous maritime operations and systems (Figure 1). The implementation of SEATONOMY methodology includes analyses to identify autonomous capabilities that the system must possess for the various operations related to A) FISHING CONDITIONS, B) CAGE INSPECTION and C) PRODUCTION ENVIRONMENT.

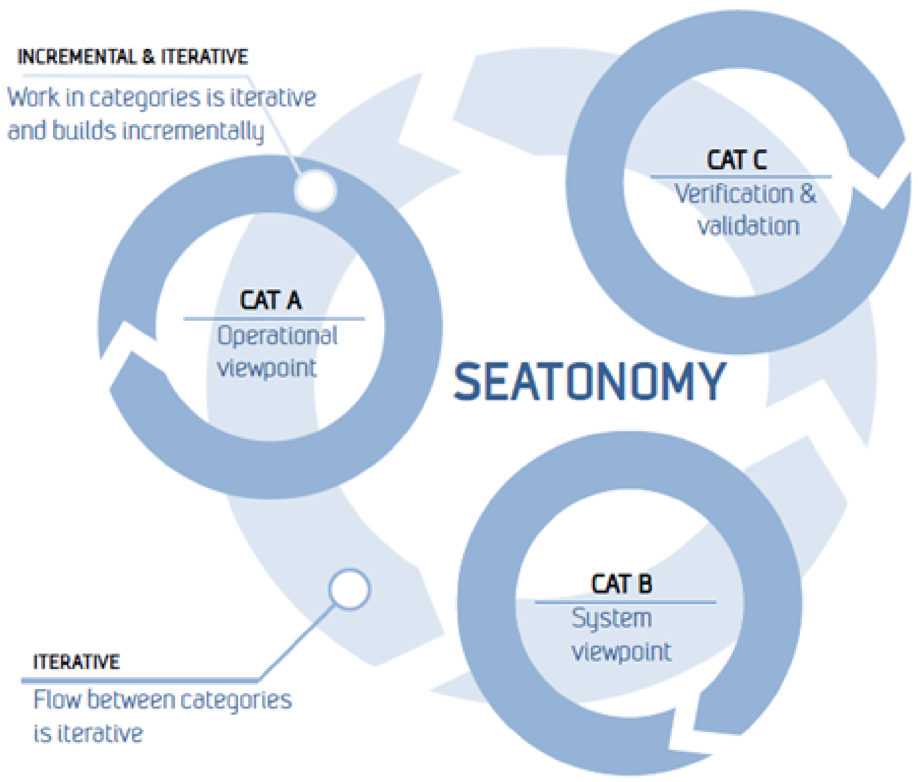

Figure 1: Seatonomy method.

BIOINTERACTIVE CONTROL FUNCTIONS

Autonomous functions are developed which, in conjunction with H3.1, give the vehicle biointeractive capabilities in order to perform high quality data capture of A) FISH CONDITIONS. The system uses information from H1.2, H2.2 and H2.3 for adaptive path planning and control of the vessel's position and speed to approach the fish without eliciting a flight response. Various strategies for path planning were considered where interesting areas should be investigated more closely and in interaction with the operator.

The model of the vehicle dynamics, the environmental disturbances, the proposed structural deformation concept and the developed bio-interactive control strategies have been developed in FhSim, which is a software platform developed and maintained by SINTEF Ocean. Further, FhSim will be interfaced with sensors and actuators in real-time, enabling the porting of control systems developed and tested in the simulation environment directly to field experiments. The developed control framework consists of three components: a) Estimation of cage structure and fish behaviour, b) path planning and c) path following control approach.

Potential case studies for full scale demonstrations are shown in Figure 2. For the cases presented in Figure 2, simulation results are obtained. For the first case, net deformation, a net following guidance strategy is implemented in FhSim, to track and inspect the entire cage area at a constant distance to the net (Figure 3). For the second case, biointeractive control functions have been developed to study the interaction of the ROV with the fish inside the fish cage during planned operations (Figure 4).

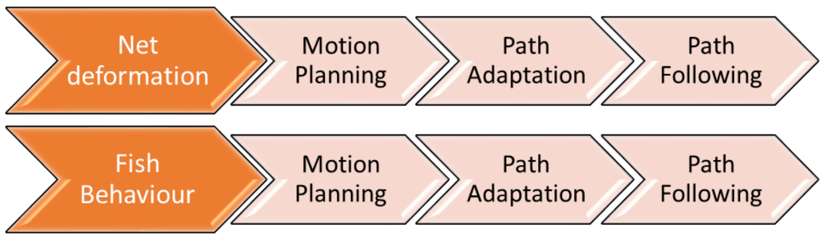

Figure 2: Potential case studies for full-scale demonstrations.

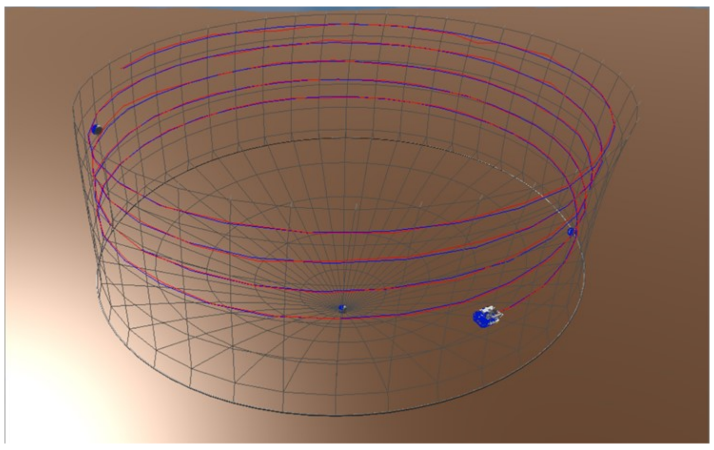

Figure 3: Autonomous navigation and net following.

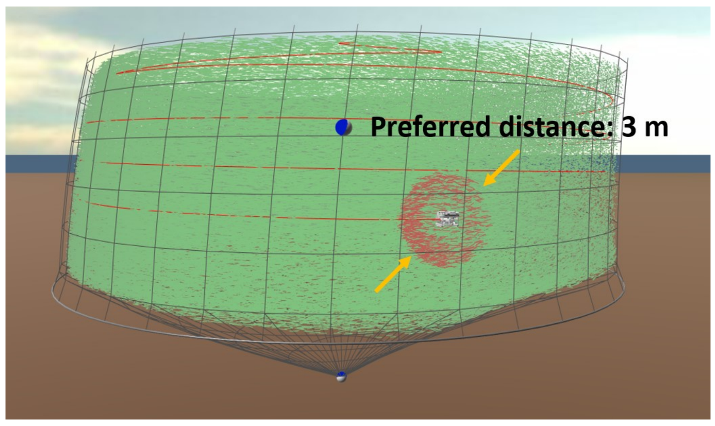

Figure 4 A: Simulation results for the fish behavioral responses toward ROV.

CONSTRUCTION INTERACTIVE CONTROL FEATURES

Autonomous functions are developed which, in conjunction with H2 and H3.1, enable the craft to perform high quality data capture towards B) CAGE INSPECTION. Cage inspection mainly includes data capture from the area of use. The system uses information from H1.2, H2.2 and H2.3 for path planning and re-planning to ensure that high quality images of the cage are taken while the area is systematically covered by the vehicle. Re-planning control concepts are simulated for the cases shown in Figure 5.

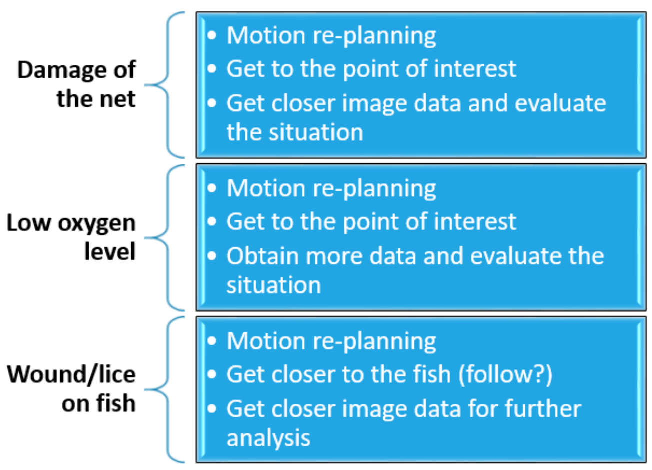

Figure 5: Re-planning case studies.

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