Remote Survey and Inspection Developments for Unmanned Systems
16/11/2018

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What will the future look like?

**CONNECTED NETWORK**
Data collection, inspection and intervention will be conducted remotely, connected by a secure network to enable remote operation and supervision.

**CENTRALISED CONTROL**
Multiple assets controlled from a single location with qualified personnel making informed decisions based on real-time data.

**DISTRIBUTED RESULTS**
Global access to meaningful and detailed information to inform, support and feed future decision making.
What does unmanned really mean?
Operated, supervised and autonomous

OPERATED
Tasks with greater risk or where complexity outweighs proven autonomous capability

AUTOMATED/SUPERVISED
Follow a plan with communications links providing real-time feedback and limited capability to change tasks

AUTONOMOUS
Existing autonomous systems can follow a plan and minimize deviations, good for survey and simple inspection tasks

ADAPTIVE
System determines the best way to achieve an outcome based on conditions and sensor feedback: the next step

Mission Plan
Sensor Performance
Sensor Output
Adaptive Control
Situational Awareness
Safety Constraints
Sensor Output
Unmanned Survey
What has been achieved so far?

Autonomous Underwater Vehicles (AUVs) like the HUGIN AUV System are reliable data collection platforms for survey purposes.

For the HUGIN AUV System, it’s all about the data.
From goal-based mission planning to in-mission adaptive control and data handling the Hybrid Autonomy Layer (HAL) works as mission controller for AUVs and USVs

**Hybrid Autonomy Layer**

Developed in partnership with FFI
Force Multipliers
The efficient application of multiple systems.

Covering greater area in less time
Unmanned Surface Vehicle
Deploying Kongsberg Autonomy on Unmanned Surface Vehicles

K-MATE
K-MATE is the controlling software that enables the safe and efficient autonomous operation of USVs

DEVELOPMENT
Working in conjunction with FFI (The Norwegian Defence Research Establishment) we have developed advanced autonomy for USV

NEAR-SHORE
The Norsafe team have designed a USV for shallow water and near-shore use, controlled by K-MATE and equipped with KM sensor packages

TRANS-OCEAN
SEA-KIT has been developed by Hushcraft Ltd, GEBCO and the Nippon Foundation. It is controlled by K-MATE and equipped with KM sensor packages
Advanced Control for USVs

K-MATE includes waypoint and event based mission capabilities combined with advanced control for safe operation.
Combined Systems

USVs have been used to supervise AUV operations before, now we are working on a long range, over-the-horizon capability.
Connectivity
Digital Development
Kongsberg Digital is developing smart applications to improve safety, efficiency and data quality
Connectivity Enabling Remote Operation

The implementation of digital connectivity through KongnifAI enables mission supervision and data processing from anywhere.

Providing remote access to data
Visualise and Process Data

Payload data can be viewed instantaneously through Reflection and processed along with navigation data to produce meaningful results fast.

Rapid Visualisation
Unmanned Inspection and Intervention
The Eelume Story

Eelume was established in 2015 as a spin-off from the Norwegian University of Science and Technology (NTNU). After a decade of research on snake robots in collaboration with the research organization SINTEF, we decided to pursue industrial subsea applications of these amazing mechanisms.

The strategic partnership formed with Kongsberg Maritime and Statoil (LOOP product development program) in 2016 ensures that our unique vehicle concept is fused with leading subsea experience and technology. In addition, the support from the Research Council of Norway and Innovation Norway has been vital to our success.
- 500 m depth rating
- Ø200 mm diameter
- Onboard batteries
- Onboard computing (autonomy and machine vision)
- Improved thruster system
- Improved camera and light system
- Acoustic positioning (Kongsberg cNode)
- Subsea garage with TMS
Proving the Concept
Trials, demonstrations and qualification

2016
Prototype vehicle, tethered inspection capability in 150 m water depth proving confined space access

2017
EELY 500, tethered inspection and Class 4 torque tool operation in 500 m depths

2018
EELY 500, TRL4 qualification
One month subsea residency, battery powered for inspection and intervention (Class 4 torque tool)
The Future of Eelume
Rapid development and qualification of unique capabilities for Inspection, Maintenance and Repair

Q1 2019
Åsgard pilot, tethered from subsea garage, with shore control centre

2019
Autonomy, machine vision, mapping, subsea charging and tool exchange, acoustic communications

2019/2020
Live qualification of tetherless robot

2020
Pilot installation, tetherless autonomous robots. Pipeline inspection, near-template inspection and intervention
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