Project contract no. 036851

ESONET

European Seas Observatory Network

Instrument: **Network of Excellence (NoE)**
Thematic Priority: **1.1.6.3 – Climate Change and Ecosystems**
Sub Priority: **III – Global Change and Ecosystems**

**Project Deliverable D51**

Training and simulation

Due date of deliverable: Month 32
Actual submission date: March 2010

Start date of project: **March 2007**
Duration: **48 months**

Project coordinator: Roland Person
Organisation name: **Ifremer, France**

**Work Package 2**

Organization name of lead contractor for this deliverable: Ifremer-KDM
Lead author for this deliverable: Jean-François DROGOU – Volker Ratmeyer

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**Draft 1**

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EXECUTIVE SUMMARY

The complete achievement of this deliverable has been shifted to september 2010. The person in charge of this deliverable in Ifremer was severely injured in an accident, and this work will be taken over by KDM after May 2010, due to very tight schedule.

This draft is focusing on the works done during the two particular meetings on this subject during “Best Practises workshop 1 & 2.”
1. INTRODUCTION

The improvement of training procedures and simulation tools for ocean observatory installations are forming the basis for future coordinated operations at European level. Partners IFREMER and KDM will intensify the exchanges on best practices in this field. A selection of simulation tools will be completed and commonly defined operations will be implemented.

In the frame of ESONET NoE WP2, the final document will represent the D51 deliverable. It aims to provide the scientific users and operators with design recommendations for training, simulation and testing.

2. TERMINOLOGY

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3. APPLICABLE DOCUMENTS

- [A3] Proceedings of Best Practice Workshop n°2
- [A4] Draft programme of activities for the next 18 months – C.Waldman, April 2009
4. PRESENT STATE OF THE PRACTICAL WORKS

4.1 – General

The successful underwater installation, maintenance and recovery of observatory platforms and infrastructures require a shared operations scheme, allowing scheduled maintenance periods to be carried out independent of a single operations team and hardware platform. This will require a common understanding of both the process of dedicated intervention at a given structure as well as the underwater hardware interfacing, shared among different possible scientific ROVs and vehicle operators. To achieve such a common understanding, training will be necessary aside from seagoing cruises and expensive operations “on site”. The goal of training should be the assurance of a quality work at a comparative level between all participating operators, allowing the observatory missions and their associated science tasks to be carried out successful over long term deployment periods.

A training facility would allow the dedicated setup of training courses for the following tasks:

4.2 – Manipulating training

Manipulator training is essential for many kinds of operations not only regarding the topics discussed here. For intervention training, however, it is expected that the proposed standardization of specific hardware such as connectors, handles and tooling, similar manipulation tasks will emerge to maintain the periodical service at different sites and structures. This will allow the design of a repetitive training scheme, to be worked out i.e. as expert courses, and to be shared between different manipulation systems on existing and future ROVs.

4.3 – Virtual operations training and testing

In addition to the manipulation task itself, underwater observatory intervention needs to be comparable on a higher level. This may implement operational procedures from underwater vehicle piloting over large-structure localization and handling, to ships positioning and wire-guided tool deployments from surface. Today’s computer technologies allow the setup of virtual environments including the above components and can be used to design, test, verify and train operational procedures of such intervention especially for ROV pilots in marine science. In addition, the specification of a certain software platform for underwater simulation could allow a virtual “accommodation and guidance” throughout the process of technical development of observatories and platforms. This in mind, observatory structure development would be able to gain experiences from virtual in-situ handling already during the CAD design phase, and thus help reduce the risks of expensive design errors and later incompatibilities.

4.4 – Scientists operational training

Simulated underwater environments allow mission specific training and procedural testing, and thus also help scientists in charge of such missions to gain a higher level of understanding. Because all tasks discussed here are by definition dedicated to marine science,
overall mission planning and scheduling of increasingly complex, technology loaded expeditions requires higher levels of such operational awareness than only few years ago. Examples for operational constraints are specific task durations, payload limitations or environmental dependencies such as currents and weather. With the increasing use of remotely controlled vehicle platforms, observatory installations, real-time data networks and autonomous instruments, scientists increasingly need to have access to operational training to become prepared for realistic estimations of technical capabilities, needs of enhanced cruise planning, and finally decisions and design calls of large-scale scientific deep-ocean infrastructures in future.

Existing Infrastructure
Existing “dry” manipulator testing installations may be used for the design and implementation of training courses:

- IFREMER, Toulon (existing Cybernetix 7P proportional electro-hydraulic arm test setup and positioning and control software simulator). Among different objectives, the new CETSM (European Center of Marine technologies) will make functional simulations for sciences software interfaces.
- MARUM, Bremen (existing Schilling Orion 7PE proportional electro-hydraulic arm training setup with 2 proportional Pan/Tilt camera heads). Marum Bremen is currently in the process of evaluating different software solutions to setup a virtual test and training simulator environment, and intends to setup a combined hard- and software based facility with the capability of interfacing to different vehicles and proposed observatory platforms in the near future.
- Others ??:

The slides in Appendix are illustrating the identified actions and steps.
LIST OF FIGURES

- Training and testing: need for facilities
- Training and simulation recommendations
- Existing infrastructures: Ifremer – CETSM
- Platform architecture for Victor 6000
- Software simulation platform (1)
- Software simulation platform (2)
- Simulation and virtual procedure training
- Hardware and Manipulation training
- MARUM ROV operations simulator approach
- Main objective: true networking platform
- Future?: Telepresence and 3d Immersive Vision
- Output
Training and testing: need for facilities

- Navigation training
- Pilot / Copilot interactive operation training
- Manipulator training

Such a facility
- shall provide hard- and software for „dry“ training
- shall be open for setup training courses in cooperation and for use by partner institutions/facilities
- will have a potential for display to the public

Needs are identified for:

Virtual underwater platforms for procedure evaluation and exchange:
- Training procedures for piloting and maintenance to enhance tech. crew exchange
- Team training on intervention operations
- Testing of possibilities to migrate offshore tools and procedures
- Future implementation of AUV and Hybrid Platforms
- Enhanced communication between operators via WWW during dedicated sessions
- Rapid 3D construction model testing of structures, nodes, elevators etc.

Scientists training to enhance efficient use of platforms:
- train awareness of space and time limitations
- Navigation training and positional error processing
- minimize adaptation time of exchangeable payloads
Existing infrastructures Ifremer - CETSM

- Electro-hydraulic arm test setup and positioning and control software simulator (Cybernetix 7P proportional E-H)
- Victor Simulation Platform:
  - Real Time integration & validation –
  - Mission management...
Software Simulation Platform

Hardware and Manipulation training

„Augmented“ control of ROV tools
(i.e., utilize C-Manip for defined environments)

Setup dry training facilities
(for pilots, scientists and engineers)

ESONET Best Practices
Brest, Oct 8, 2009

Volkert Ratmeyer, Jean Francois Drogou

Underwater Intervention
Marum ROV operations simulator approach

**Authoring:** commercial 3D engine with C++ dlls for physics, networking, display

**Input from:** 3dMax (models), ArcGIS (bathymetries), QUEST5 control system
potential: realtime data (replay and real mission display)
Main objective: true networking platform

Virtual environment server
Marum, Bremen

Instructor,
i.e. Bremen

WWW / WAN

Client 1: Pilot
i.e.: Toulon

Client 2: Co-Pilot
i.e.: Bremen

Client 3-6: Sonar
i.e.: NOC & Bremen

Client 5-xx:
Sci. Observers
i.e.: Ifremer, Bremen, Tromsø, Texel, others

Future?: Telepresence and 3D Immersive Vision
Output

- **Scientific community:**
  - Common template for payload specification
  - Training offers tbd
  - Capability informations on possible procedures

- **EUROFLEETS**
  - Provide infos for: Specification templates for payloads and vessel adaption (WP4, WP6, WP7)
  - Training and simulation possibilities for education (WP 6)
  - Share ESONET expertise in JRA WP’s (WP10, WP11)

- **Operators:**
  - Identify communication platforms for procedure and crew exchange