Protocol ROV Workshop 21.-22.2.2012, Kiel

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Tuesday, 21st of February, 2012

1) Introduction

Participants: Fritz Abegg (Germany, GEOMAR), Colin Day (UK, NOCS-NMFSS), Dave Turner (UK, ISIS), Francis Mason (UK, NOCS-NMFSS), Tomas Lundälv (Sweden, Univ. Gothenburg), Svetlana Tsarichenko (Sweden, Univ. Gothenburg), Leif Austgulen (Norway, IMR), Reidar Johannesen (Norway, IMR), Jarle Wangensten (Norway, IMR) Willem Versteeg (Belgium, Univ. Gent), Chris Smith (Greece, HCMR), Jens Greinert (Netherlands, NIOZ), Nuno Lourenço (Portugal, EMEPC), Antonio Calado (Portugal, EMEPC), Volker Ratmeyer (Germany, MARUM), Martin Pieper, Hannes Huusmann, Patrick Cuno, Arne Meier, Jan Hennke, Matthias Bodendorfer, Inken Suck (all Germany, GEOMAR), Pierre Leon, Claude Leveque (France, IFREMER)

2) Introduction of existing ROV Systems

a. GEOMAR: short introduction ROV KIEL 6000 and ROV PHOCA

b. *UK/NOCS: ISIS rebuilt* – Short description of accident (ship's azimuth not operational, mid ship's tunnel thrusters were running during launch), description of first hand actions such as budgeting on board right after. Real figures for new foam/ foam repair, re-design of ROV-frame and tools sled, cutting costs by utilizing existing spare parts and combining them with new parts.

c. *Belgium/Univ. Gent*: Cherokee Genesis: entire system fits in one 20ft container, including TMS and winch

d. *Norway*: Norway is planning a new icebreaker capable of carrying a large ROV, so far they only got a small observation ROV, but are planning to get a larger one for scientific purposes

e. *Greece*: since 1990 6 different vehicles (one manned) of smaller size, except the DSSI Max Rover (2000m) which was acquired in 1999; short description of RV Aegaeo (65m, no DP, deck space of 1.5 containers); scientific as well as search and salvage

Have used Tracklink and Trackpoint for navigation– faced some problems with reliability ➔ signal lost at around 700m and have had a number of flooded transponders

f. *Sweden*: 3 vehicles, 2 by Ocean modules (2000 and 500m), 1 Sperre ROV (1000m); 2000m vehicle not tested yet (= prototype); use(d) OLEX navigation (3D display), now (in addition?) use customized OFOP

g. *Portugal*: 6000m rated ROV LUSO; use OLEX for navigation, mainly operated from naval vessel NRP Almirante Gago Coutinho; LUSO got lost in 2010, umbilical snapped off close to vehicle, in water depth around 120 m, due to negative buoyancy it sank to the bottom and was recovered nearly intact 10 days later

- **difficult at first to co-operate with the military ships officers who would not take commands – communication still not always perfect but obviously**

improving ➔ emphasizes the importance of a priori clarification of "command chain" and competencies

- **discussion on whether an ROV should be positively or negatively buoyant: main consent was to have it positively buoyant as most incidences occur at the surface during launch or recovery as the umbilical is most likely to snap close to the ROV – if it then sinks it will be very difficult to recover the vehicle; at the seafloor, especially in very fine sediments, it makes more sense to have a positively buoyant vehicle, as pushing up thrusters stir up a lot of sediment. The advantage of a negatively buoyant vehicle is that it may be easier located when lost. In any case it is crucial to watch the buoyancy throughout the dive as additional samples or dropping equipment will change it.**
- **Discussion on whether and where to attach floats to the umbilical, WITHOUT attaching a pinger at the end of the set of floats in order to always know where the umbilical is; possible solutions: use of a cable camera, checking on the depth, cable length paid out, distance from and orientation to/from the ship.**

h. *Bremen, MARUM*: Quest 5 and Cherokee (+ MeBo, Crawler, AUV) ➔ all operated from the same pool of about 20 technicians; MARUM team have established a training facility for their personnel, i.e. a dry manipulator slave arm.

- **TRAINING of personnel (also discussed later): difficult to find the right way to train new personnel – needs to be balanced with the more experienced team as not to have to many draw backs regarding scientific and all other tasks, but is absolutely necessary also to keep up the level of all pilots. Portuguese team, for example, dedicate a certain time period per mission to training (by contract?); KIEL6000 team had 4 unexperienced team members during last cruise and concentrated on training their own staff.**
- **LED lighting (not tested yet) ➔ question arises whether anyone has made any experience with exclusive LED lighting especially regarding true colours, whether colour correction is possible. As the tendency is towards this kind of lighting (e.g. brighter and smaller then e.g. HMI lights), it is recommended to use a mix of HMI (warmer light) and LEDs. Another problem which needs testing yet is the possibly faster aging of LEDs may in contrast to HMIs or HIDs.**

i. *France, Ifremer: VICTOR 6000*: has been refitted in 2010 and accomplished 9 missions since then; the main goal, apart from the change of the obsolete equipments, was to optimized the operational cost. For those purposes the control room has been completely changed and the new ergonomy allows to reduce the pilot team (2 instead of 3); new HD Video system, other lighting (still use only HMI and HID), ccontrol room (better ergonomics), the control of the arms and the tether have been integrated.

j. *Marine Institute, Galway, Ireland*: although not being personally present, Aodahn Fitzgerald has sent a presentation of their ROV Holland 1, a 3000m rated hydraulically driven vehicle, manufactured by SMD. It has been adopted to be deployed with a tether management system but has also been used in the free flyer mode with fewer problems. The vehicle has been lost twice, its deepest recovery was

from 780m water depth. In general it is operated from the CELTIC EXPLORER but is going to be adopted to JAMES COOK.

k. *Mobile Marine Robotics Research Centre, University of Limerick, Ireland*: likewise not personally present, Daniel Toal has contributed a presentation of the ROV LATIS. It has been designed and build at the Univ. of Limerick. It serves either as carrier for new developed equipment as well as for flexible applications from inshore to 1000m water depth.

3) Interoperability

a. *Exchange of platforms* – complicated and time-consuming; interoperability depends on ships' capabilities (deck stability, SWL A-frame etc) and versatility of ROV system. Obviously, the conceptual design of the ROV system already defines the versatility to a certain degree, especially when considering large ROV systems. For instance, a control van consisting of two 20' containers which have to be merged will limit the number of usable platforms. In addition, LARS-systems extending the size of a 20' container are difficult to ship either on the road or on commercial cargo ships.

b. Idea of an **identical umbilical** to be installed on all (European) research vessels and to be used by all ROVs – seems not feasible as 1st very expensive, 2nd very different demands regarding power supply and telemetry of different vehicles, plus different depth ratings (let alone other equipment such as tow fish or OFOS to be used on the same cable); another possibility: similar/identical basic LARS systems – problematic due to very different dimensions of vehicles and capacities of ships ➔ discussion

c. *Exchange of equipment* – seems to be the least complicated and do-able especially for very expensive equipment which is not permanently used. Still, adaptation (e.g. Seanet Adapter Bottles) is usually necessary and smaller vehicles will often not be able to carry heavy equipment. Interoperability appears to be a question of time and money.

d. *Exchange of personnel*: also complicated as most vehicles are run on very different control systems, and it takes some time to learn and get used, but at least it could possibly be a chance to save money and to learn from other teams. However, the number of unexperienced team members should be limited (see above).

4) Incidents and Accidents

a. Presentation and videos of 2 accidents (and repairs) of ROV KIEL 6000, with an attempt to analyse the reasons –

- possibly a faulty thruster which irritated the central ROVs brain, the MRU, which as a consequence possibly commanded wrong values to all other thrusters ➔ **how calibrate an MRU at sea should it become necessary? May be possible when parking on the seafloor.**
- refusal of the ship's officer in charge to turn of the props during recovery resulting in the first incident ➔ **problem of ships without stable DP**: should we

refuse to go onto these? If not, we should be aware of a much smaller weather window, and the necessity to set up a command chain and to define competencies of WHO has the last word on whether a vehicle is launched and WHEN and HOW it is to be recovered – which in the last instance should always be the ROV-Team (unless the captain refuses any operations beforehand)

- **Communication lines**: should be firmly defined prior to the first deployment and kept to strictly throughout the mission. LUSO team always tries to have one ship's officer on deck during launch and recovery, and/or one team member on the bridge. KIEL 6000 team has only one communication line to the bridge during launch and recovery, plus the supervisor talking to the container. Container can hear what is said between deck and bridge but strictly does not interfere in any way.
  Radios seem to be the means of choice for most teams, with clear comms and telephone connections also being used at times; in most teams, only a limited number of scientists is allowed in the control room (exception: ISIS, with two 20" containers combined providing a large space for many scientists), this affords online broad-casting of video streams (etc.) to the labs (and the bridge if possible) on the ship, which possibly is not always the case (and necessary) for the smaller and very mobile ROVs i.e. when control consoles are put up within the labs. Communication between scientist is mostly also done by radio; chatting via internet is another possibility.

b. In case of **LUSO**, **mechanical problems** caused the loss of ROV by umbilical snapping.
c. The Swedish ROV once started to spin due to a built-up **magnetic field** caused by wrong wiring.
d. Cables caught in ships' propellers (not spinning) a more regular experience – one solution was to cut umbilical on both sides of prop; KIEL 6000 managed to detangle the tether from the rudder and prop of RV Celtic Explorer using its manips.
e. During recovery of QUEST the latch failed and the ROV fell into the umbilical which broke. ROV has been recovered successfully…
f. Marine Institute lost its ROV Holland twice. Recovery has been executed in one case by a commercial salvage company, the costly action has been covered by the insurance.
g. Communication in general: after experiences of UK and Kiel Teams during JC66/67 : more intense communication between ALL participating groups before a cruise, actually before starting to plan the cruise is absolutely essential, especially between science party and ROV teams ➔ what do they want, what can be provided? Information papers could be sent out and signed by all parties, to try to make sure, that information has passed through everybody's brains. In case of problems at sea, these signed papers may be helpful to clarify responsibilities again.

5) Short tour to ROV KIEL 6000 and ROV PHOCA

6) **Platforms:** different propulsion systems with capability to completely stop stern thruster/s to turn or not. RV POLARSTERN, for example, can not realistically turn off the stern thrusters – turning them on and off takes too much time. Also the influence of defective or missing azimuth bow thrusters has been discussed.

Wednesday, 22nd of February, 2012

1) **3rd party gear, tools**: presentation of tools (GEOMAR owned and others) that have been integrated and used during past missions as well as of other tools used by KIEL6000. Discussion on design and functionality of KIEL elevator, designed and built at GEOMAR, as well as the Colossus elevator, designed and manufactured at the Max-Planck-Institute for Marine Microbiology in Bremen; the latter had severe problems when released in very soft sediments.

2) **New developments**
   a. 3D HD by Ifremer and MARUM, 2 very small cameras which may also be used separately as "normal" HD cams; two versions have been put together for different applications or users. The development was done within the EUROFLEETS programm. Cameras may become available within EUROFLEETS II.
   b. HROV = Hybrid ROV, no umbilical but just optical fibre, especially for under ice missions where long distances need to be covered and in case of entangling of the fibre, the vehicle shall be able to bust off the fibre and switch into AUV mode. Instead of compensation oil, newly developed housing containing silicon gel shall be used. MARUM is designing an HROV which will be able to collect samples both from underneath the ice (manip and cameras on topside) and the seafloor with manip and camera pointing downwards. IFREMER is designing an HROV for working as a 3000m ROV, but deployed on a small size Research Vessel (as Europe 20m).
   c. Further discussions aimed on application of a Vibrocorer on an ROV; it was pointed out that MBARI has already some experiences and would possibly be willing to share.
   d. A kind of a 'mini-drill' has been developed between the LUSO Team and a Norwegian company. There are still several technical issues to be solved to keep the application from becoming a nightmare (e.g. pinning down the ROV due to an uptight drill…)

      Intervention
      Several permanently installed complex ocean observatories have been installed and more are planned. Possible problems: handling during "normal" servicing, timing of servicing intervals, organizing ships' times and vehicles for servicing and maintenance ➔ strong cooperation between customers and service providers (=

ROV Teams) necessary. Is it possible and does it make sense to define standard procedures? Learn which standard procedures are used in the industry!

In general: standardisation of data output formats, calibration of probes

3) **Software**: Jens Greinert provided a demonstration of functionality of the software OFOP (Ocean Floor Observation Protocol) – those that didn't know it seem to be impressed and interested.

Final discussion was concentrated on how to share the results of the workshop. It was proposed to set up a webpage under the "umbrella" of the OFEG Tech group where authorised presentations and this protocol may be accessible. As the OFEG Tech is an open group, the 'non-members' should not be concerned to be pocketed.

Comments during the final discussions expressed the contentment of the participants taking part in a workshop with people talking the same ROV-language. All participants enjoyed the open atmosphere and it seemed that there is an interest to continue the exchange among the participants. This might be realised by any member by any time, the mail list might serve as the entrance.

Personal remark from Fritz: thanks to all participants, for their presentations and contributions. The workshop lived from the open atmosphere and the follow up discussions. Working on this protocol (which in fact is mostly produced by Inken, thanks) I found that there are many more topics to be discussed in the future!