Exploratory Workshop Scheme

Scientific Review Group for Life, Earth and Environmental Sciences

ESF Strategic Workshop on

Breakthrough Technologies To Advance Diving-Based Underwater Research In The Next Decade

Heraklion, Crete 17-19 March 2014

Convened by:
Martin Sayer ①, Maria Salomidi ② and Philipp Fischer ③

① Scottish Association for Marine Science, Oban, Argyll, UK
② Institute of Oceanography, HCMR, P.O. Box 712, P.C.19013, Anavyssos, GR
③ Alfred Wegener Institute, Kurpromenade, D-27498 Helgoland, DE

The European Science Foundation (ESF) was established in 1974 to provide a common platform for its Member Organisations to advance European research collaboration and explore new directions for research. Currently it is an independent organisation, owned by 67 Member Organisations, which are research funding organisations, research performing organisations and academies from 29 countries.

ESF is in a period of transition; the ESF Member Organisations (MO's) have indicated that they would like to wind down certain ESF activities, such as EUROCORES, RNP's, ECRP's and Forward Looks by the end of 2015, but ESF will continue to honour its existing commitments until the projects are finalised.

In 2013 the only research instrument that will have a call for proposals is the Exploratory Workshops. The focus of the Exploratory Workshops scheme is on workshops aiming to explore an emerging and/or innovative field of research or research infrastructure, also of interdisciplinary character. Workshops are expected to open up new directions in research or new domains. It is expected that a workshop shall conclude with plans for follow-up research activities and/or collaborative actions or other specific outputs at international level.

ESF is also currently exploring new areas where we could serve the science community. Services we have identified that would leverage our expertise and experience and provide added-value to the science community are: peer review, evaluation, research conferences and career tracking.

Please check our website (www.esf.org) for regular updates regarding ESF and its future developments.

European Science Foundation

1 quai Lezay Marnésia
BP 90015
67080 Strasbourg Cedex
France
Fax: +33 (0)3 88 37 05 32
http://www.esf.org

ESF Exploratory Workshops:

Jean-Claude Worms
Head, Science Support Office

Nathalie Geyer-Koehler
Administrative Coordinator
Tel: +33 (0)3 88 76 71 48

Isabelle May
Administrative Coordinator
Tel: +33 (0)3 88 76 71 46

Email: ew-office@esf.org
http://www.esf.org/workshops

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Convenor:

Dr. Martin Sayer
mdjs@sams.ac.uk

UK National Facility for Scientific Diving, Scottish Association for Marine Science, Oban, Argyll, UK

Co-convenors:

Dr. Maria Salomidi
msal@hcmr.gr

Institute of Oceanography, HCMR, P.O. Box 712, P.C.19013, Anavyssos, Greece

Prof. Dr. Philipp Fischer
philipp.fischer@awi.de

Alfred Wegener Institute, Kurpromenade, D-27498 Helgoland, Germany

Background:

Scientific diving is a high-quality and cost-effective research tool that supports a wide range of scientific disciplines. It has particular use in difficult research environments such as subtidal structurally complex substrates or urbanized habitats (marinas, wrecks, offshore wind farms, etc.) that are inaccessible for study by conventional methods. It can also add value to other observation platforms (e.g., gliders (EGO), moorings (EuroSITES, ESONET, EMSO), floats (ARGO)). Scientific diving is the main research tool employed to study Europe's underwater archaeology and cultural heritage.

In Europe, scientific diving as a whole has traditionally lacked consistent and targeted operational co-ordination and thus has tended to attract lower levels of funding than other research platforms. As a result of this, methods applied based on scientific diving have tended to lack standardisation and have often become established in isolation when it comes to technology development. Consequently, common technologies that are presently available to scientific divers have tended to be driven by the two main diving industry sectors: commercial and recreational diving. As well as lacking control in what is developed, the outcomes in terms of what is available or can be used by the science sector can either be over-engineered and over-designed (i.e. when coming from the commercial sector) or of limited general application when developed for a very specialised sector with specific locally-relevant requirements. In recent years, there have been a number of pan-European underwater science and archaeology initiatives that have been based on employing diving as the principal research tool. Partly as a result of these programmes, scientific diving has become more coordinated across Europe and is now at the stage where it can begin to explore and evaluate how diving as a research tool can be better managed and improved. The physical nature of the underwater environment dictates that many standard existing or cutting edge research technologies are not available to the diver underwater.

Main Objectives of the Workshop:

This exploratory workshop will evaluate what breakthrough technologies are available now to the scientific diver, examine what possible technologies are emerging, and identify possible technologies that don't presently exist but which would make a significant contribution to the volume and type of science that could be delivered from underwater research in the coming decade.

Workshop Agenda

The workshop will be divided into three main categories of scientific diving where breakthrough technologies may make or be making an impact. Those categories will be where the technologies:

1. are generic to use for the sector as a whole and can advance the quality of diving-based science delivery (e.g. underwater georeferencing; GPS does not work underwater and there have been a number of attempts to translate the above water signal into methods for sub-surface positioning);
2. are generic to use for the sector as a whole and can improve the operational capability of scientific divers (e.g. new generation closed-circuit rebreathers that can increase operational durations and depths for the diver); and
3. are specific to science disciplines (e.g. underwater hyperbaric chambers for in situ animal physiology studies).

For each category, the workshop will explore what is currently available and/or in use (i.e. this will include technologies that are commercially available and/or those that have been developed "in house" to address specific operational issues), explore what is being developed or is emerging, and then agree on technologies that the community would like to see developed within the next decade.

The workshop will also examine future potential funding routes to ensure that any advances identified can be further developed.

Report publication and dissemination

The workshop report will be published in both hard and electronic formats. It will consist of a "wish-list" of technological developments required to significantly advance the use of scientific diving as an essential future research tool. The list will be based on discussions to ensure that innovations remain realistic and achievable within a decadal timescale. In addition, there will need to be realistic cost considerations; where possible, innovation will be based on the adaptation of existing technologies. The outcomes of this workshop will be reported to the European Scientific Diving Panel of the European Marine Board (ESDP-MB). The ESDP-MB will facilitate mechanisms to ensure that the research activities and future collaborative actions are followed up. It will also offer the framework to disseminate the outputs of the workshop at the international level.

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PRELIMINARY PROGRAMME

Monday 17th March 2014

Afternoon	*Arrival at workshop hotel (Your Memories Hotel)*
20.00	*Informal meal at Hotel if required*

Tuesday 18th March 2014

09.00-09.40	**Welcome by Convenor** **Martin Sayer** (NFSD, Oban, UK) *Introductions; Outline of the workshop; Timetable and objectives*
09.40-10.00	**Presentation of the European Science Foundation (ESF)** **Sonja Lojen** (Scientific Review Group for Life, Earth and Environmental Sciences)
10.00-14.30	**Topic 1: Technologies to advance the quality of diving-based science delivery**
10.00-10.15	**Presentation 1 "Diving in the cold – what makes it safe"** **Piotr Kuklinski** (Institute of Oceanology,Polish Academy of Sciences, Sopot, PL)
10.15-10.35	**Presentation 2 "The CUDDY, an electronic/electric diving buddy"** **Donat Petricioli** (D.I.I.V. d.o.o., Zagreb, HR)
10.35-11.05	*Coffee / Tea Break*
11.05-11.20	**Presentation 3 "GPS Diving Computer"** **Arne Sieber** (SEABEAR GmbH, Leoben, AT)
11.20-11.40	**Presentation 4 "The use of tablet computers for scientific underwater data collection"** **Jouni Leinikki** (Tvärminne zoological Station, Hanko, FI)
11.40-12.30	**Discussion of Presentations**
12.30-13.30	*Lunch*
13.30-14.10	**Discussion of Future Developments**
14.10-14.30	**Agreed conclusions and actions for this Topic**

14.30-18.10	**Topic 2: Technologies to improve the operational capability of scientific divers**
14.30-14.50	**Presentation 1 "Potential of rebreather technology for scientific diving"** **Alain Norro** (Royal Belgian Institute of Natural Sciences, Brussels, BE)
14.50-15.10	**Presentation 2 "Head up displays"** **Arne Sieber** (SEABEAR GmbH, Leoben, AT)
15.10-15.30	**Presentation 3 "Dive methods adaptation and technique development for use of close-circuit rebreathers in Scientific Diving, to meet health and safety requirements"** **Maria Asplund** (Sven Lovén Centre for Marine Sciences- Kristineberg, Fiskebäckskil, SE)
15.30-16.00	*Coffee / tea break*
16.00-16.20	**Presentation 4 "Future of rebreathers"** **Arne Sieber** (SEABEAR GmbH, Leoben, AT)
16.20-17.10	**Discussion of Presentations**
17.10-17.50	**Discussion of Future Developments**
17.50-18.10	**Agreed conclusions and actions for this Topic**
20.00	*Dinner at local taverna*

Wednesday 19th March 2014

08.30-12.30	**Topic 3: Technologies that are specific to science disciplines**
08.30-08.50	**Presentation 1 "Stereogrammetry in underwater assessments: a methological assessment"** **Philipp Fischer** (Alfred Wegener Institute (AWI), Helgoland, DE)
08.50-0910	**Presentation 2 "Simple 3-d imaging"** **Martin Sayer** (NFSD, Oban, UK)
0910-09.30	**Presentation 3 "Potential use of hyperbaric chambers for empirical experiments and technology development in aquatic research"** **Maria Asplund** (Sven Lovén Centre for Marine Sciences- Kristineberg, Fiskebäckskil, SE)
09.30-09.50	**Presentation 4 "Technologies for ecology"** **Massimo Ponti** (Università di Bologna, Ravenna, IT)
09.50-10.10	**Presentation 5 "Underwater iPhone to the rescue of field marine ecologists"** **Yiannis Issaris** (Hellenic Centre for Marine Research, Anavyssos, GR)
10.10-10.40	*Coffee / Tea Break*
10.40-12.10	**Discussion**
12.10-12.30	**Agreed conclusions and actions for this Topic**
12.30-13.30	*Lunch*

13.30-16.00	**GENERAL DISCUSSION: Identifying opportunities - now and the future**
13.30-14.00	**Discussion: immediate opportunities**
14.00-14.30	**Discussion: realistic emerging technologies**
14.30-15.00	**Discussion: "wish list" for the next decade**
15.00-15.30	Coffee / tea break
15.30-16.00	**Discussion: opportunities for implementation**
16.00-18.00	**GENERAL DISCUSSION: Follow-up activities**
16.00-16.30	**Discussion: identifying future research**
16.30-17.00	**Discussion: identifying future collaborations**
17.00-17.30	**Discussion: dissemination activity**
17.30-18.00	**Open discussion on any other issues**
16.30	*End of Workshop and departure*

European Science Foundation

Objectives of the ESF Scientific Review Group for the Life, Earth and Environmental Sciences

The main objectives of the **ESF Scientific Review Group for Life, Earth and Environmental Sciences are**:

1. to identify and promote emerging scientific topics and high quality science deserving special attention in Europe;
2. to manage a wide ranging portfolio of activities of the European Science Foundation;
3. to examine and report on issues of strategic scientific importance within its fields of competence.

This Scientific Review Group's sphere of activities comprises the broad field of life, earth and environmental sciences:

- Biology
- Biotechnology
- Agriculture
- Earth sciences
- Climate research
- Glaciology
- Oceanography
- Environmental sciences, etc.

ESF supports a limited number of **Exploratory Workshops** each year. These workshops allow leading European scientists to explore novel ideas at the European level with the challenging aim to "***spearhead***" new and preferably inter-disciplinary areas of research. Further details are available on the internet at http://www.esf.org/workshops.

ESF Life, Earth and Environmental Staff

Paola Campus
Senior Science Officer

Barbara Weber
Administrative Coordinator

Tel: +33 (0)3 88 76 71 35
Email: lee@esf.org
Website : http://www.esf.org/lesc

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Provisional List of Participants

Convenor:

1. **Martin SAYER**
National Facility for Scientific Diving,
Scottish Association for Marine Science,
Oban, Argyll, PA37 1QA
UK
mdjs@sams.ac.uk

Co-Convenors:

2. **Maria SALOMIDI**
Institute of Oceanography,
HCMR, P.O. Box 712,
P.C.19013, Anavyssos,
Greece
msal@hcmr.gr

3. **Philipp FISCHER**
Alfred Wegener Institute,
Kurpromenade,
27498 Helgoland,
Germany
philipp.fischer@awi.de

ESF Representative:

Sonja LOJEN,
Jožef Stefan Institute,
Department of Environmental Sciences,
Jamova 39, 1000 Ljubljana,
Slovenia
sonja.lojen@ijs.si

Participants:

4. **Maria ASPLUND**
Sven Lovén Centre for Marine Sciences-Kristineberg,
University of Gothenburg,
Kristineberg 566,
451 78, Fiskebäckskil
Sweden
maria.asplund@bioenv.gu.se

5. **Thanos DAILIANIS**
Institute of Marine Biology, Biotechnology & Aquaculture,
Hellenic Centre for Marine Research (HCMR)
Gurnes Pediados P.O. BOX2214
71003, Heraklion, Crete
Greece
thanosd@hcmr.gr

6. **Volkan DEMIR**
Institute of Marine Sciences and Management,
Istanbul University,
Istanbul Unv. Deniz Bilimleri Enstitusu
Muskule Sok No17 Vefa/Fatih
34134 Istanbul
Turkey
volkandemir@istanbul.edu.tr

7. **Jean-Piere FERAL**
Institut de Biodiversité et d'Ecologie marine et continentale
Aix-Marseille Université
CNRS
IMBE - UMR 7263, Station Marine d'Endoume, Chemin de la Batterie des Lions
13007 Marseille
France
jean-pierre.feral@imbe.fr

8. **Yiannis ISSARIS**
Institute of Marine Biology, Genetics and Aquaculture,
Hellenic Centre for Marine Research,
46.7 km Athens-Sounio Ave.,
19013 Anavyssos,
Greece
issaris@hcmr.gr

9. **Andrej JAKLIN**
Center for Marine Research,
Ruder Boškovic Institute,
G. Paliaga 5,
52210 Rovinj,
Croatia
jaklin@cim.irb.hr

10. **Connie KELLEHER**
Underwater Archaeology Unit
National Monuments Service
Department of Arts, Heritage & the Gaeltacht
Room G19, New Road,
Killarney Co. Kerry
Ireland
Connie.Kelleher@ahg.gov.ie

11. **Lyubomir KENDEROV**
Biology Faculty
Sofia University
Dragan Tsankov blvd, 8
1164 Sofia
Bulgaria
lubomir.kenderov@gmail.com

12. **Piotr KUKLINSKI**
Institute of Oceanology
Marine Ecology Department
Polish Academy of Sciences
ul. Powstancow Warszawy 55
81-712 Sopot
Poland
kuki@iopan.gda.pl

13. **Jouni LEINIKKI**
Finnish Scientific Diving Steering Association
Tvärminne zoological Station
Helsinki University
J.A. Palménin tie 260
10900 Hanko
Finland
jouni.leinikki@alleco.fi

14. **Laurent LEVEQUE**
Service Mer & Observation
Station Biologique de Roscoff
Université Pierre et Martie Curie
Organisation, CNRS
Station Biologique, Place Georges Teissier, 29682 Roscoff
France
leveque@sb-roscoff.fr

15. **Melina MARCOU**
Department of Fisheries and Marine Research (DFMR)
Ministry of Agriculture, Natural Resources and Environment
101 Vithleem Street
1416 Nicosia
Cyprus
mmarcou@dfmr.moa.gov.cy

16. **Alain NORRO**
Marine Ecology and Management,
Operational Directorate Natural Environment,
Royal Belgian Institute of Natural Sciences,
Gulledelle, 100
1200 Brussels
Belgium
alain.norro@mumm.ac.be

17. **Alexandra NUNES**
Interdisciplinary Centre for Marine and Environmental Research
University of Porto
CIIMAR-UP, Rua dos Bragas 289
4050-123 Porto
Portugal
anunes@fc.up.pt

18. **Preslav PEEV**
Bulgarian National Association of Underwater Activity
Marine Geology and Archaeology
Institute of Oceanology
Parvi Mai 40 Str., P.O. Box 152
9000 Varna
Bulgaria
peev@io-bas.bg

19. **Donat PETRICIOLLI**
D.I.I.V. d.o.o.
Obala Petra Lorinija bb,
23281 Sali Trnsko 12
10020 Zagreb
Croatia
diiv@zg.t-com.hr

20. **Wanda PLAITI**
Institute of Marine Biology, Biotechnology and Aquaculture
Hellenic Centre for Marine Research
Gurnes Pediados P.O. BOX2214
71003 Iraklio
Crete, Greece
wanda@hcmr.gr

21. **Massimo PONTI**
Dipartimento di Scienze Biologiche, Geologiche e Ambientali
Scuola di Scienze - campus di Ravenna
Alma Mater Studiorum Università di Bologna
Via S. Alberto 163
48123 Ravenna
Italy
massimo.ponti@unibo.it

22. **Arne SIEBER**
SEABEAR GmbH
Peter Tunner Strasse 19
8700 Leoben
Austria
arne.sieber@seabear-diving.com

23. **Mats WALDAY**
Section for Marine Biodiversity
Research Centre for Coast and Ocean
Norwegian Institute for Water Research
Gaustadalléen 21
0349 Oslo
Norway
mats.walday@niva.no

24. **Noemie WOUTERS**
European Marine Board
Wandelaarkaai 7 (entrance 68)
8400 Oostende
Belgium
NWouters@esf.org