



Submersible Operators Group

SOG First meeting | Workshop Report

Avonmouth, UK
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Prologue

It was truly an honour for REV Ocean and DEEP to host the inaugural meeting of the Submersible Operators Group in Bristol. This meeting brought together operators, manufacturers, super users, certification bodies and pilots from all over the world.

The submersible community has a long history of safe operations spanning several decades and hundreds of thousands of dives from shallow coastal waters to the deepest trenches on our planet.

This record is, in no small part, preserved by those who attended the meeting and those who continue to support safe submersible operations at sea. It is also down to the giants of engineering and exploration upon whose shoulders we stand and whose lessons we heed.

The depths of our oceans have always captivated the human spirit. They have inspired explorers, scientists, and adventurers to safely push the boundaries of what is possible and, in the process, expand our knowledge of Planet Ocean.

Submersibles also play critical roles in defence, search and rescue and commercial activities. The increasing fleet size has allowed guests onboard cruise ships and yachts to experience a world they wouldn't have known existed.

While a bold statement, submersibles have also shaped modern society through contributions to highly successful programs such as Blue Planet, prompting the Blue Wave effect that has shaped many government policies and public perceptions.

Our community has a fine pedigree of safety and achievement that is embodied in the names of some of the industry's most iconic and successful vehicles: Trieste, Alvin, Nautilo, DeepSea Challenger, Limiting Factor, Shinkai and Pisces, to name just a few.

But with this fascination comes great responsibility. The safety of those who venture into the deep and those who support them is paramount. It is a responsibility that we all share - scientists, engineers, manufacturers, pilots, ship crews, classification agencies and operators.

Safety has always been - and will always remain – our first and foremost priority.

The measures in place, the expertise of our professionals and the advancements in technology have undeniably made our endeavours safer than ever before. But there is still more work to be done. In our ongoing mission for discovery and progress, we must remain steadfast. Our journey towards greater safety is unending and our dedication to this cause is

unwavering. While representing different organisations, we are a fraternity of submersible pilots and operators. Although we pilot different submersibles from different manufacturers, dive to different depths, possess varying degrees of experience and have contrasting mission objectives, we as pilots and the whole submersible community, benefit from open and frank discussions on safety and experiences.

While briefly acknowledging the events of the past six months, the increased spotlight on our community has highlighted its ceaseless drive towards safety that has been the bedrock of its existence and the mantra of its many champions. The first Submersible Operators Group workshop served as a platform for fostering meaningful connections and collaborations and provided a space where ideas could be exchanged and partnerships formed. I am deeply grateful for the active participation and valuable contributions of all participants to the first SOG workshop, which made this inaugural event a resounding success. Throughout the conference, enthusiasm, insightful questions and meaningful discussions added immense value to the sessions. The diverse perspectives and expertise brought to the table created an enriching environment for learning and collaboration. Witnessing professionals

of different backgrounds in the submersible community come together to share knowledge and experiences was truly inspiring, fostering a sense of community and mutual growth. Together, we explored innovative solutions, best practices, and the latest advancements in submersible safety, shaping the future of our field.

I am confident that the connections and knowledge exchanged during the conference will have a lasting impact. The community's commitment to enhancing safety standards and promoting excellence is commendable.

Today, we lay the foundations of the Submersible Operators Group, which we all own.



Leighton Rolley
REV Ocean

1.

Workshop objectives & organisation

1.1 Event facilitation

We want to create a psychologically safe and trusted environment where people are free to share, discuss, understand, and resolve complex problems. This is in the spirit of knowledge sharing being for the greater good of the industry as a whole. In order to facilitate this it is proposed that part or all of the event is conducted under the Chatham House Rule which is reproduced below, more information can be found here.

*“When a meeting, or part thereof, is held under the **Chatham House Rule**, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.”*

1.2 Workshop goal and objectives

The workshop aimed at bringing together sub operators, manufacturers, pilots, Captains and any other relevant parties related to submersible operations (Appendix 1 - Participants) to openly discuss and share experience in sub operations safety from a variety of backgrounds (Appendix 2 - Programme). The discussions centred around 6 topics (see below), in order to address 3 main objectives.)

- **Obj. 1.** Create a body to expand, improve and encourage knowledge sharing within the submersible operator’s community.
- **Obj. 2.** Discuss safety, training, and emergency response, whilst sharing experiences from operating at sea.
- **Obj. 3.** Provide a united voice for the community. This can be particularly important in an emergency response situation. We can have a louder voice as one, e.g. greater than the sum of the parts.

The workshop discussions were organised around 6 topics, discussed in small groups of 8-10 people. The discussions in each topic were led by two co-chairs and all participants contributed to all topics.

- **Topic 1.** Submersible dive preparations for safer operations. Co-chairs: Jeff Heaton (Nuytco) & Ofer Ketter (Submerge)
- **Topic 2.** How do we create better pilots and training? Co-chairs: Troy Engen (Axis) & Leighton Rolley (REV Ocean)
- **Topic 3.** How can we improve operational procedures? Co-chairs: Nils Baadnes (REV Ocean) & Taigh MacManus (M-Y Legend)
- **Topic 4.** Emergencies & Recovery. Ben Sharples (SMP) & Alan Green (Aqua Titans)
- **Topic 5.** Maintenance & Certification. Ionel Darie (DNV) & Jonathan Struwe (DNV)
- **Topic 6.** Improving external perception of submersibles. Alex Rogers (REV Ocean / Ocean Census) & Eva Ramirez-Llodra (REV Ocean)

The main discussion outcomes from each group were presented in plenary on the second day, followed by a general discussion and agreement on some key actions. These main points are summarised below, and the details of the discussions can be found on the Appendices.

2. Workshop main outcomes

2.1. Topic 1. Submersible dive preparations for safer operations.

Co-chairs: Jeff Heaton (Nuytco) & Ofer Ketter (Submerge)

As a general comment, it was noted that the challenges and needs that we are discussing for the SOG have been addressed and continuously developed by aviation for 30 years. We can learn from aviation and reduce time, but we should also accept that we cannot do it overnight.

2.1.1. Incident reports

This was a major topic discussed and the community sees this as the way forward to maintain and improve safe operational procedures. It is essential to learn from previous activities and there are good examples in other sectors (e.g. military) that incident reports contribute to safer operations. Incident reports need to be as a safe venue, so the operators feel safe to use them.

Reporting needs to be improved. If it is voluntary, it could be anonymous and deposited in the SOG. It is OK to own your mistakes. You can learn from incidents, but also from positive experiences (e.g. diving under ice).

Actions

- SOG would need to **develop guidelines for the format** of sub-related incident reports. Should it be different reports for the community, or a formal one for third parties? These guidelines should also provide information on what is considered an incident; what are the **criteria to define incidents** that need to be reported.

2.1.2. Training

Sub operations require a large team of professionals from different backgrounds and with different training and competence: sub team, bridge team, crew, surface officer (SO), professional users (e.g. scientists, archaeologists). It is thus important to consider the whole team, and not only the pilots. Even when the vessel is dedicated to sub operations, there are different actors that need to be involved (incl. shore-based).

Teamwork is essential during sub operations, but currently we do not train with all sides involved, but as individual parts of the operation. Usually this is because there is no time allocated to full-scale training as a team, involving all sides, from the vessel to the sub pilots.

During training practice we learn from doing it. But time between missions should be used to train and the importance of using this time needs to be communicated to the owners.

Currently, there is no standard for training.

Actions

- SOG can **develop a standard syllabus for training** as a base, which can be used by each operator and adapt it depending on sub type and dive activities.

2.1.3. Best practices

- Best practices are important. There is an evolution in the industry and the guidelines need to continue developing.
- Setting clear expectations to what is feasible and safe during a dive is essential, particularly when the client is paying for the experience. This will reduce pressure on the pilots/sub team.
- Strong and clear rules on “go/no go” for launching the sub are important. Each launch system will have specific requirements.
- Understanding the site (bathymetry, overhangs, wrecks, currents) is essential to choose diving sites.

Actions

- SOG can provide **guidelines on launch criteria for each LARS**, which will take pressure off the SO.

2.1.3. Rescue

The group discussed the pros and cons of a global operational rescue solution versus a self-rescue solution. There was support for both.

Self rescue procedures are something that everyone should have, including a rescue asset on board. A lot of focus is given in the rescue on the seafloor/under water, but it is essential to include as well procedures for rescuing the sub once it is on the surface.

Usually this is not trained in a self-rescue situation. If you don't train for it, assume you cannot do it.

More subs are being built, new pilots are being trained, new owners are going to acquire subs. The group is growing, and thus issues and challenges will continue to evolve and grow. We need to address them and pass on the knowledge so the sub operators community as a whole benefits from it.

The community represented during the workshop has the widest amount of knowledge on professional sub operations in the world. Different submersible types manage safety differently, but everyone wants to share or receive knowledge in the group.

Actions

- SOG would provide a safe **forum in which to exchange knowledge and experiences**. Maybe through a website as well?

2.2. Topic 2. How do we create better pilots and training?

Co-chairs: Anthony Gilbert (Viking Expeditions/WSM)
& Leighton Rolley (REV Ocean)

2.2.1. Pilot training

Training should include a matrix of skills. Safety during sub operations is not only down to the pilots, it is also dependent on the other parts of the operation (captains, crew, SO, medical, fire, etc).

It is important to train on recovery in different sea states. Weather can change while the sub is diving. It may be the case that recovery on board is not the best option and the sub needs to stay under the surface, or be towed.

Different regions have different environmental conditions: polar, fresh water, water transparency. Pilots and the team should be trained for the region they will be working in.

When an organisation buys a new sub, it should be best practice to invest in mentorship and training for the whole team.

Knowledge about the ocean environment is essential in training pilots and increasing their competence: habitat, currents, weather, marine ecosystems. Knowledge on personal performance are also important: oxygen consumption, breathing, management of passengers with panic attacks, first aid, pilot ethics.

All pilots should meet key objectives on training each year. This should be best practice. But we need to be careful with how many courses are necessary so they don't become restrictive.

What qualifies a pilot?

- What number of dives are necessary to be certified as a pilot?
- What are the different levels of skills/knowledge that pilots need to touch certain systems in the sub?
- Mentorship is important. A senior pilot trains new pilots to fully understand the sub they will be working with. Big organisations have this possibility, but it is not standardised.
- What are the criteria to ascertain that the pilots and subs are safe?

What makes a good pilot?

- Training
- Personalities
- Psychology/aptitude tests
- Medically fit
- Get new pilot to go in the sub to ensure that they like it before they go through the training
- How long is the pilot certificate valid if you are not diving?

What certificates should pilots have?

- STCW (Standards of Training, Certification and Watchkeeping for Seafarers) should be required
- Medical (e.g. ENG1)
- Drugs/alcohol policies
- Radio officer
- First aid training. Diver Medic? Other?

In relation to medicals, sub operators should be able to identify as a minimum if the passenger has a medical condition, and the pilots should be trained on at least a minimum set of medical/first aid skills.

Discussion on other key roles for sub operations

The Surface Officer, together with the Captain and crew, need to enact the recovery/rescue in case of emergency. This is a major role. These positions should also be part of the training syllabus.

Actions

- SOG to work with manufacturers to develop new or make aware of existing syllabus. If we develop a competency programme, the

community will not only attract the right people, but also be part of career development for existing and new pilots and sub crew.

- Scott Watters (Pisces) offered to share with the group the Pisces training manual that specifies everything needed from the guests to the trainer him/herself.
- SOG could develop best practices/guidelines for sub operations training. This should be the gold base approach and baseline document from which each sub operator can develop, depending on the submersible, type of operations, etc.
- SOG could develop a central database of certified pilots. This will be particularly valuable for the small or new organisations.

2.2.2. Rescue operations and 96 h emergency training

The group agreed that it would be worth doing a 96h emergency test in a submersible. The data would be very valuable to the community.

If doing a full 96h test is not feasible, we could do a series of exercises addressing different emergency issues that include the human factor.

Regarding rescue, we can learn from the oil industry. Some procedures can be adapted to sub operations.

Consider training for the pilot having a medical issue while diving: ensure that passengers have clear instructions and a clear manual to contact the vessel and surface the sub if necessary.

It is important to include topside training for sub emergency recoveries. What is the decision making hierarchy?

Actions

- REV Ocean proposed to look into the possibility to organise a series of training and tests addressing different emergency aspects for the SOG community with DSV Aurelia (Triton 7k3) in Barcelona, Spain when the submersible is available. This could address different aspects of being stranded for long periods in the submersible, including medical issues, what medical toolkit should be available in the sub, what basic instructions should passengers have to surface the sub. Train SO, swimmers, etc as well.

2.3. Topic 3. How can we improve operational procedures?

Co-chairs: Nils Baadnes (REV Ocean)
& Taigh MacManus (M-Y Legend)

2.3.1. Procedures & Guidelines

Different submersible systems with different LARS, different mother vessels, different regions of operation, will need different operational and safety procedures. However, we can develop a common baseline for operations procedures, that is then further developed into sub- and ship-specific procedures.

There are existing procedures and operational guidelines (e.g. MTS, IMCA, IMO). Many of these are dormant, but they could be revised. It was suggested that SOG could go to these organisations (e.g. IMCA) and ask them to review available guidelines and update them. Avoid reinventing the wheel for certain issues. However, the group believed that the level of knowledge in the room should drive the updating of guidelines, based on existing ones. Rather than have IMCA or any other regulatory bodies impose regulations/guidelines on us.

Safe people, safe equipment, safe practice. Different subs go to different depths and different areas, with different complexities for operations, so the procedures should include consideration of these differences.

The group agreed that SOG should be leading the development of guidelines and, with time, regulations, to avoid that other organisations/governments potentially with less expertise of sub operations for science, communications and tourism, impose regulations upon the community.

Such guidelines and standards would also help the community when applying for diving permits for certain countries, particularly those that have no previous experience with subs diving in their national waters.

Actions

- SOG could develop a **common baseline for sub operations procedures**, as the minimum standard from which to create ship-specific procedures. These guidelines may, in the longer term, become regulations or used by regulators as the golden standard.

- As a SOG community, we would have a **standard that countries will recognise.**

2.3.2. Involvement of the team from vessel to sub

The Captains and marine crew should be more involved with the sub crew to get a better understanding of operations. Maybe learn from the oil industry as they have good procedures, check lists, etc.

There is a grey area of interaction between the sub as a platform and how the vessel crew engages with the sub crew to be fully integrated in the ship's system. This is very important for vessels with subs, as the subs are independent (i.e. not physically attached to the vessel as an ROV), but they need the vessel for recovery, for emergencies, etc. Vessel Captains and officers get special training for working in polar waters, helicopter operations, etc. But there is no specific certification (or best practice) for Captains regarding sub operators.

In relation to superyachts, there are issues related to the owner's expectations regarding where and when activities can take place.

Every dive is different. The SOG can gather information and learn from each other. Understanding limitations (weather, etc) is important. Sharing dive information amongst pilots (e.g knowledge of dive sites) would be beneficial too. Sub pilots want to have a group to join, for discussions, exchange of information, knowledge and experience.

Tourist operators can gather a lot of data for science.

Actions

- SOG could develop training or best **practice guidelines for Captains and crew in sub operations.**
- SOG could help **educate owners that the subs have limits of operational safety, based on standards.** It would help Captains and SO to argue their decisions of go/no go for launching the sub.

- SOG members could capture **sub operations/ training in time-lapse and produce short videos** that can be sent to operators as learning material.
- SOG could produce **small documents showing what is required**, at a minimum, for sub operations (team needed, assets, training, etc). This would help small and new organisations.
- SOG could provide a **platform for pilots** where they can meet, giving them a voice.
- SOG could facilitate **match-making between tourist operators and scientists** for acquisition and sharing of scientific data and samples (inc. through citizen science programmes on board).

2.3.3. Other safety related aspects to consider

The environmental aspect was not specifically discussed at this workshop. However, this is an important topic. For example, use of environmentally friendly oil in sub systems. Particularly when diving in/on Vulnerable Marine Ecosystems (VMEs) or sensitive regions (e.g. Arctic/Antarctic).

The sustainability of operations should also be considered in further discussions.

It is important too to improve the gender and equality aspect of the sub operators community, which has an increasing number of professionals (e.g. pilots, SO, Captains, marine crew) with different cultural, national and gender backgrounds. All should feel part of the community (e.g. avoid the use of “manned submersible”).

2.4. Topic 4. Emergencies & Recovery. Co-chairs: Ben Sharples (SMP) & Alan Green (Aqua Titans)

2.4.1. Available knowledge

The Swiss Cheese analogy: Safe sub operations are like a Swiss cheese. The holes in the cheese could be lack of training, short-falling procedures, etc. When two holes align, you can have an accident. It is important to identify the holes and make sure they never align. We don't want sticky plasters on the holes. We need to find ways to fill in the holes. There are fatigue monitoring tools, drug testing, psychological tests, etc. that can be used, as they are used in other industries (e.g. aviation).

There is available information on existing guidelines that needs gathering, consolidating, reviewed and updated.

Sharing thinking is key.

2.4.2. Guidelines & Procedures

Subs and operations vary, so there is no single solution. We need to issue guidelines in a way that they are useful and generic.

The group supported self regulation rather than waiting to be regulated.

In relation to rescue procedures, there are solutions/guidelines that already exist. Different subs have different safety arrangements. But there are limitations to those solutions and self rescue will be different for different assets and situations. There is no single solution.

Whatever we do, procedures should include go/no go criteria for sub launch.

What information do we need to gather to continuously ensure safe sub operations?

Don't think only about the submersible. Think about the whole system (inc. media, users, owners, etc).

Actions

- Could SOG **develop standards, codes of practice, procedures, frameworks** and share them in a cloud-based system?

2.4.3. Rescue

Several distinct methods for rescue, but we should ensure that we have robust guidelines and procedures for major rescue systems/procedures. For example:

- Down to 1000 m, hook line to connect to the sub. The current sea state is critical, and there are many other issues to consider. Have an indicator buoy at the end of the line and do a circular sweep with the vessel to try to hook it down.
- Shallow water operations can have a line and a buoy to which you can hook to.
- Deeper operations would need another sub or ROV rescue. Having a rescue asset should be best practice.

Most incidents are during launch and recovery of the sub. It is essential to consider these critical procedures when reporting incidents, not only incidents underwater. If we had a year's worth of data, we may have a different vision of the issue and a wealth of information from which to further develop safe operations.

It was suggested that the ability of sub self rescue should be part of the Class rules (at least a minimum baseline).

Actions

- SOG could **gather case studies of rescues/drills** that the group could study. This could be done at the next meeting.

2.4.4. Capacity

If we are going to change this community, we need capacity, which means funding. In the mid-term, we may need to ask for paying memberships to gather funding for the work of the SOG group (e.g. developing guidelines, procedures, training material, sharing information platform, etc).

It is important to allocate resources and time to undertake sound trials and emergency training. The outcomes of such training can be shared within the SOG.

It is important to train for all aspects of emergencies, not only the easier aspects.

Actions

- Consider how a voluntary SOG could **evolve into a legal organisation with paying members** that would provide the necessary funding to continuously develop and update guidelines, procedures (potentially regulations, or influence regulations from regulatory bodies). The SOG would provide a stamp of safety standards to its members, that would be recognised by the community, operators, users and authorities.

2.5. Topic 5. Maintenance & Certification.

Co-Chairs: Ionel Darie (DNV) & Jonathan Struwe (DNV)

From all the discussions, there were two areas with consensus:

- Maintaining certification is essential: Certification during the newbuilding phase and periodic inspection of the submersible and its components during operation by the class society is essential
- Improvements are necessary in the maintenance of underwater technological systems across the industry.

2.5.1. Necessary improvements

It is important to plan maintenance systems and operational procedures (e.g. as it is done in the aviation industry).

It is essential to change the perception that all subs in commercial use are certified.

Record keeping is improving, but it needs further development and improvement.

Best practices and minimum requirements for certification and maintenance are essential.

It is important to change the perception that subs are jet skis. They are to be handled as a helicopter, not a toy. There is a need to educate owners.

It is important to develop education and training programmes for people involved in sub maintenance, in addition to, but linked with pilots' training.

Insurance companies are not asking for qualification or standards for sub operations. This may change.

Actions

- SOG could contribute to changing the perception with owners/yacht users that subs are not toys. They need to be handled as helicopters, not jet skis.

2.5.2. Baselines and maintenance

There is a clear lack of maintenance standards. Operators and manufacturers should ensure this exists.

The maintenance plan is subject of examination for the class society each year as part of the periodical survey program.

Operators should make a maintenance plan, rather than reactive maintenance. Many operators have such plans, digitally or on paper depending on the owner/operator.

The group agreed that the baselines should not be provided by Class, but be developed by the community (SOG).

There should be a minimum level of competence for all operators with different complexity levels for the technicians doing the maintenance.

Operators and Class should form a body that gathers information from the field: openly relay information from the field that will make operations safer.

When should Operators inform Class regarding changes in the sub. If a component is replaced by another component that is identical in terms of manufacture then this replacement shall be logged in the maintenance program and class society need not be informed. But if changes are made with different components, Class needs to be notified.

Class usually hands over a syllabus to the manufacturer, but the manufacturer is the first contact for the owner during the operating period of the submersible. There should be a 3-party consent (manufacturer, owner, Class) if modifications are made to the sub.

Actions

- SOG (with Class) could help Operators develop robust maintenance plans for their subs. Such plans could potentially be approved by a third party.

2.5.3. Sub team composition

Sub pilots are expected to maintain the sub. This is contrary to the aviation industry. E.g. No helicopter pilot would be expected to maintain the helicopter and then fly the next day.

Often, the sub teams are small and expeditions are often in remote places where it is difficult to fly people in. This is why pilots are involved in the maintenance. It is thus essential that the pilots have a robust technical background. If pilots are involved in maintenance after a day's dive, it may mean that the sub cannot dive the next day.

There should be a timesheet with rest hours for the sub team, to make sure the pilot diving is rested. These timesheets already exist in some vessels, but not all vessels use them. This should become best practice.

It may be difficult to have one system that fits all sub activities. It will depend on the team, the situation, etc. But general guidelines would be useful, with a reasonable team size and rest hours. Captains/owners often ask about what the minimum team should be. As a group, we can give guidelines of what that is, setting expectations from the start.

Actions

- SOG could provide guidelines for optimal sub group composition for safe operations in different scenarios: the sub needs to be maintained, pre-dived, dived, maintained.

2.5.4. Training

It is a requirement that the manufacturer trains the technicians, as the manufacturers are the only ones with the necessary expertise to train on each specific sub. However, the community (SOG) should ensure that there is a requirement in place for the minimum level of training that a manufacturer should provide.

Training guidelines should initially be voluntary, as they would be better accepted by the industry. It is possible that, in the mid-term, these guidelines could be incorporated as regulations.

Actions

- SOG could develop guidelines for the minimum level of training that a manufacturer should provide to sub operators.

2.6. Topic 6. Improving external perception of submersibles.

Co-Chairs: Alex Rogers (REV Ocean and Ocean Census)

& Eva Ramirez-Llodra (REV Ocean)

2.6.1. Issues and Challenges

Several issues were identified by the group in relation to the external perception of submersibles, particularly aggravated after the summer's events.

Issue 1: lack of understanding and miscommunication

The public's perception is driven by the media's lack of understanding of submersibles and sub operations. There is a negative perception of sub safety, which in parallel has opened a thrill-psychosomatic urge for rich people to go in subs. But scientists have declined to get in subs after this summer's events.

There is a lack of a clear point of contact in industry/operators for the media. This is particularly important in the case of an accident/serious issue with a sub, as these are the stories that the media want to report.

The sub industry has a low profile with governments and authorities. There is a lack of understanding.

There is a general perception of subs as "toys", which undermines the need for robust guidelines, procedures, training and regulations.

Issue 2: Implications for operations

The process for the application for diving permissions is unclear and in many countries, the authorities do not know how to handle such applications for diving permits.

There is a lack of understanding and standard procedures for permitting for specific sub activities (e.g. science, archaeology, filming).

So far, there have been no major changes with insurance for subs. However, education and awareness raising for insurance companies will be necessary. Insurers are not sub experts. The insurers will look at each application on a case by case basis as the systems and operations are different, but raising awareness will greatly help.

The summer events are, however, having impacts on operators: an operator has lost 2 major salvage contracts. Scientists are refusing to dive in the sub during scientific activities. Large operators have had to adapt their dive operations after the summer: guests come on board, and before they go into a sub, they attend a briefing from the pilot with technical background that shows imagery, videos and the sub itself. Guests can ask questions and then decide if they want to go in for a dive.

Issue 3: Lack of transparency

There is a lack of cohesive communication/joint voice across the industry, including submersible operators.

There is no global collection of data on sub activities (e.g. number of subs, number of dives, number of hours underwater, etc) that can be used to show the overall level of safety of sub operations. It's very hard to see on SOME the number of dives from commercial operators. SOG can help collect and share this information, raising the perception of the industry with the public.

2.6.2. Solutions

Establish a Sub Operators association. Why?

- Standards of operations (guidelines for operators, pilots training)
- Avoid top-down regulations from Authorities/Governments/other Organisations
- Share information about operations
- Share information about permitting
- Collect industry data
- Have a point of contact for media
- Coordinate creation of content for good/positive stories for media (for education of public, media and governments)
- Representation at IMO?
- Representation on other industry bodies (e.g. IAATO, IRSO, IMAREST, etc)
- National contacts for sub operations (e.g. to help with permitting)

There are two potential ways forward for the creation of a SOG:

- Start a complete new organisation. This could be first a voluntary group that establishes the foundations of a future legal organisation with paying members.
- Form a special interest group at IMAREST or equivalent.

2.6.3. Common themes that were highlighted in the discussions

Creation of a SOG to improve safety perception with different actors

The creation of a SOG association that would ensure its members followed specific safety procedures, training, certification and maintenance was discussed. Being part of the association would provide a "stamp" of safety to the sub operators, which would be recognised by authorities, insurers and the public.

The need for guidelines were repeatedly mentioned with respect to pilot training and standards of sub operations. These would be the foundations for the SOG and its credibility on safety standards.

SOG can help to provide additional and well organised information to the corporate side of organisations, who are now requesting more information on what is going on, what the safety is, what the procedures are. Fundamentally, people (incl. guests, scientists, owners) want reassurance.

Storytelling

There is a need to improve the narrative/storytelling about subs, so subs and sub operations are seen by the public and authorities as a normal and exciting, but safe, activity. The example of NASA is useful: NASA focuses on scientific discovery, the people/personal stories and the vehicles and technology needed for space exploration and pushing the frontiers of knowledge.

An issue with accidents is that the industry does not control the narrative and often it is the people with reduced or no real knowledge on the topic that agree to comment publicly, escalating misinformation. SOG could be a central point of information for the media, with contacts for specific aspects. This would be very important in situations like this summer's accident.

Some associations have a media library, with images, videos, etc. SOG could create such a media library, so there is a continuously updated repository of good, exciting and vetted information ready for the media. Sub operators could create content to be delivered via SOG, with the necessary licensing attached.

In some cases, when large documentaries are being made, sub activities cannot be shared immediately in SOME. However, once released, large documentaries (e.g. Blue Planet) reach much larger audiences than operators SOME.

Get good people excited to be part of the industry. Reach out to the next generation: involve influencers, artists, well-known people.

Citizen science

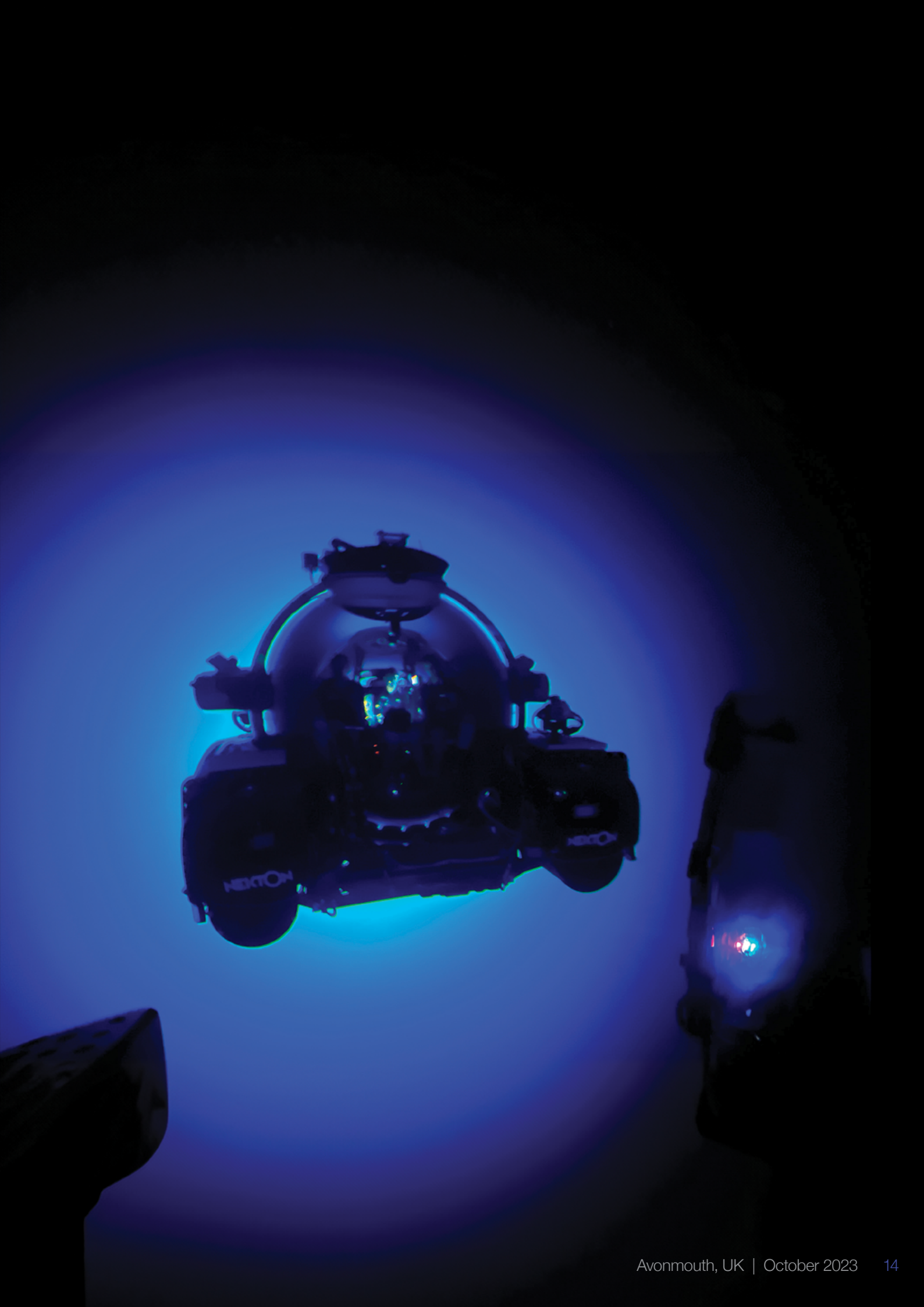
Some operators with guests ask their guests if they want to share their videos and images with the operator, to be used for SOME and also science (citizen science). This could go into a SOG library.

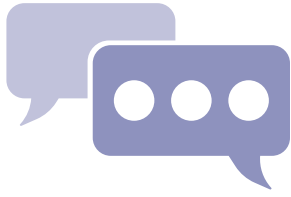
Global data on sub activities

There is a need to collect baseline evidence of safe operations in the industry. This means the coordinated collection of anonymised data, including number of submersibles, number of dives, number of hours underwater, near misses, etc.

Actions

- SOG can provide a central **point of communication for media**
- SOG could contribute to creating a **common repository for images, videos and stories** that the media can use.
- SOG (with Class) could contribute to **educate and raise awareness of sub safety with insurers.**
- SOG members can share **information on contacts/processes for permit applications**, particularly for remote diving locations.
- SOG could coordinate **collection of anonymised data** (number of subs, number of dives, depths, hours in the water) from operators, including near misses.





General discussion on the creation of the Sub Operators Group (SOG)

The group discussed three potential ways forward:

- Start simple, establishing a voluntary group (SOG) that can do the following:
 - Provide a platform of communication and sharing knowledge amongst sub operators
 - Create working groups to start addressing some of the identified actions (e.g. guidelines, training syllabus, media library, contacts repository, etc)
 - Convene regular e-meetings to exchange information and assess progress
 - Meet annually in person
- Create a new and independent Sub Operators' Association where members pay a fee that covers the establishment of a secretariat and the association's activities. Such an association would have minimum requirements in safety, training, etc for its members, providing the gold standard in safety for the community.
- Create a Special Interest Group with IMAREST or equivalent organisation, which would facilitate links to other organisations such as IMO.

Discussion

Linking the SOG to IMarEST (Institute of Marine Engineering, Science & Technology), IMCA (International Marine Contractors Association) or IMO (International Maritime Organisation) has benefits, but has also downsides. It was acknowledged that the group has so much knowledge, it may be best to start as a voluntary independent group, monitor its growth, and then assess if it should be tied to a larger group.

It was mentioned that, if SOG was merged with a larger organisation, it is essential that the organisation is international and represents the community well.

As the SOG develops (in whichever format) and guidelines are produced, members of the SOG would need to comply with such guidelines. If we want to continuously improve safety and be

seen as the golden standard, there has to be a set of minimum criteria that will define the SOG.

The Marine Technology Society (MTS) has organised a symposium in New Orleans (29 Nov-1 Dec), in parallel to the Boat Show International. The outcomes of the SOG workshop could be presented at this symposium.

There are competitors in the group (tourism, manufacturers) but safety is essential for all and has priority, so knowledge on safe operations should be shared.

Agreed way forward

As an immediate start, there was most support for the **SOG to be created as an independent voluntary group** that will start addressing identified key actions and facilitate communication within the community for the next 12 months.

REV Ocean (Norway) offered to take the lead for the first year and organise the next meeting.

The group needs to be organised: Chair, Board, working group leads, rotations? It is essential that everyone feels represented

and feels ownership of the SOG.

The SOG should start building strong foundations with incremental improvements, sharing of best practices, formalising these practices, training on them, collecting and updating/building upon available guidelines, etc. We should not aim at doing too much too quickly, particularly with a voluntary organisation.

Next steps

- Share the workshop report with all participants and others that were not able to join the workshop.
- Organise the SOG structure.
- Quarterly meetings on Teams and annual meetings in person to continue discussions.
- Next in person meeting in Norway in Q4 2024
- date to come
- Aspects to consider for the next meeting:
 - Ask the community to present exciting activities
 - Concept of operations: how do different operators do launch and recovery in different situations/ environments, training, team size, etc.
 - Pilot's bucket lists: where would you like to dive (it could be an evening event)
 - Invite insurers to join and listen in.
 - Invite port authorities to listen in. But be careful not to invite them before the SOG is mature.
 - Making a group like SOG inspirational is important for smaller operators. Push it forward with an easy point of access for smaller operators so they can join.

Appendix 1. List of Attendees

Name	Company	Job Title
Alan Green	AquaTitans	Projects/Operations Director
Aldo Kuhn	M/Y Legend	Submersible Operations
Alex David Rogers	REV Ocean & Ocean Census	Science Director
Andrea Filippo Nadir Schenato	Private	Submersible Pilot / ROV Supervisor
Anthony Tarantino	Woods Hole Oceanographic Institution	Operations Coordinator
Antony Gilbert	Viking Expeditions/WSM	Sub Operations Manager / Chief Pilot
Barry McGowan	Deep Research Labs	Sub Ops Lead
Ben Potter	SMP Ltd	Technical Director
Ben Sharples	SMP Ltd	Managing Director
Bryn Spencer	Viking	Sub Pilot
Charles Kohnen	SEAmagine Hydrospace Corp	President
Duncan Marsh	Cookson Adventures	Senior Project Manager and Technical Lead
Dylan van der Pluijm	U boat worx	Technical Operations Manager
Edward O'Brien	Woods Hole Oceanographic Institution	Dive Operations Manager
Elise Ciappara	Pelorus Yachting	Head of Yacht Expeditions
Eva Ramirez-Llodra	REV Ocean	Science Director
Ewan Macpherson	JFD Global	Principal Engineer - Submarine Escape and Rescue
Godfrey Johnson	Maritime Authority of the Cayman Islands	Lead Surveyor
Hector Sewell	IMarEST	Director Business Development
Ionel Darie	DNV	Principal Project Manager & Principal Inspection Engineer
Itaru Kawama	JAMSTEC	Group Leader
Jean-Yves Tous	GENAVIR	Director Submarines engines Department
Jeff Heaton	Nuytco Research Ltd	Operations Manager, Chief Pilot
Jeremy Fisher	Deep Research Labs	Technical Assurance Director
Johnathan Struwe	DNV	Head of Section Underwater Technology

Name	Company	Job Title
Kelvin Murray	Eyos	Head of Expeditions
Leighton Alexander Rolley	REV Ocean	Science Systems Manager
Les Annan	Independent	Captain
Lucy Penny	Deep Research Labs	Early Career
Marc Taylor	Ink Fish	CEO
Matthew Awty	Kraken Fleet	Submersible/ROV/Dive Operations
Montana McKinnon	Deep Research Labs	Pilot
Nils Baadnes	REV Ocean	Captain
Ofer Ketter	SubMerge	President
Oliver Steeds	Nekton	Chief Executive
Ralph Addison	Ocean X	Submersible Pilot / Surface Officer
Richard Wheatley	Deep Research Labs	Director, Deep Submersibles
Richie Enzmann	Ocean Robotics Planet Magazine	Editor-in-Chief / Managing Director
Rick Goddard	Deep Research Labs	Director, Deep Sentinels
Rob Colley	Deep Research Labs	Director, Deep Elite Performance & Training Services
Roger Moore	IMCA	Technical Advisor
Ryan Pope	JFD Global	Services Engineering Manager
Sarah Scriver	Seabourn Cruises	Expedition Leader
Scott Waters	Pisces VI Submarine, SL	President
Seb Coulthard	Seabourn Cruises	Pilot/Mechanical engineer
Stephen Hall	Society Underwater Technology & MTS	Consultant
Steve Abbott	Deep Research Labs	Asset & Technical Manager
Steve Etherton	Deep Research Labs	President
Steven Quigley	Wilhelmsen	Submarine Pilot
Stevie Toft	Deep Research Labs	Director, Deep Expeditions & Safety
Stig Vagenes	REV Ocean	Subsea Manager
Taigh MacManus	M/Y Legend	Captain
William Arthur	AquaTitans	Engineering Director
William Randle John Siddeley	Cookson Adventures	Senior Concept Designer

Appendix 2. Workshop Programme

Global Subsea Forum: Submersible Operators Group

First meeting, Avonmouth, UK

3-4 October 2023

Hosts: REV Ocean & DEEP

Dates: 3 & 4 October

Venue: Unit 4, Portside Park, Kings Weston Lane, Avonmouth, Bristol, BS11 8AR

Optional: “Inner Engineering and Human Performance workshop” – Monday 2nd October 15:00

Objectives

1. Create a formal body to expand, improve and encourage knowledge sharing within the submersible operator’s community.
2. Additionally discuss safety, training, and emergency response, whilst sharing experiences from operating at sea.
3. Provide an industry united voice for the community. This can be particularly important in an emergency response situation. We can have a louder voice as one, e.g. greater than the sum of the parts.
4. Written report with key outcomes from the meeting so that all attendees leave the event with clear understanding of what has been agreed and what the next actions of the group are (if any) where everyone has had an opportunity to steer (/have ownership) of the direction of travel.

The workshop will be organised around six stations (see below). Each station will focus on a specific topic which will be discussed in small working groups chaired by two experts on the topic, facilitating open dialogues and input from all. The discussion will be guided (but not limited) by predetermined questions. All participants will move from station to station allowing for input from everyone into all topics. The outcomes of each discussion group will be presented in plenary sessions and used to decide on the next steps by the group.

Event Facilitation

We want to create a psychologically safe and trusted environment where people are free to share, discuss, understand, and resolve complex problems. This is in the spirit of knowledge sharing being for the greater good of the industry as a whole. In order to facilitate this it is proposed that part or all of the event is conducted under the Chatham House Rule which is reproduced below, more information can be at: facilitator.school/blog/chatham-house-rule.

*“When a meeting, or part thereof, is held under the **Chatham House Rule**, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.”*

Workshops Stations

Station 1. Submersible dive preparations for safer operations. Co-chairs: Jeff Heaton (Nuytco) & Ofer Ketter (Submerge)

Topics to consider:

- a. Aspects that customers/passengers must know? E.g. Aircraft brief style
- b. What are the items that should be in every sub?
- c. LARS – is a universal checklist required? What should parameters be?
- d. Vessel considerations (e.g. trained crew on sub-operations)

Station 2. How do we create better pilots and training? Co-chairs: Troy Engen (Axis) & Leighton Rolley (REV Ocean)

Topics to consider:

- a. Standardised learning objectives in the training syllabus?
- b. What certification should pilots have (STCW, ENG1, Etc)
- c. Emergency Medical Response training
- d. Stress management, the importance of human factors?
- e. How could a 96 h sub-emergency experiment be useful? What aspects should be considered?

Station 3. How can we improve operational procedures? Co-chairs: Nils Baadnes (REV Ocean) & Taigh MacManus (M-Y Legend)

Topics to consider:

- a. How do we produce an internationally recognised programme?
- b. What should a checklist for Port Authority include for permissions to dive?
- c. What should be the guidelines or regulations for diving in international waters?
- d. Point of view from vessel Captains

Station 4. Emergencies & Recovery. Ben Sharples (SMP) & Alan Green (Aqua Titans)

Topics to consider:

- e. Global Rescue Response?
- f. How could we introduce mass produced kit that can be used on any submersible which makes it a rescue asset?
- g. What tracking/locating equipment should be standard? (AIS/Iridium/Radio Beacon/Pinger etc.)
- h. What should be considered in a 96 h sub-emergency experiment (e.g. medical kit, psychological aspects, breathing/relaxation techniques guidelines, physical considerations for male and female divers, etc) What activities external to the sub should be included during the experiment (e.g. regular diver visits? Communications? Documentary?)
- i. Vessel considerations

Station 5. Maintenance & Certification. Ionel Darie (DNV) & Jonathan Struwe (DNV)

Topics to consider:

- a. Standardised documentation & procedures? IMCA D04 & D018 style? How often?
- b. How do we promote culture change?
- c. Safety flashes – Incident & near miss experiences shared within group

Station 6. Improving external perception of submersibles. Alex Rogers (Ocean Census) & Eva Ramirez-Llodra (REV Ocean)

Topics to consider:

- a. Collaboration with Maritime Traffic Management Systems?
- b. How can we vocally stand against un-classed Submersibles?
- c. How can we show the public, charterer and guests that submersibles are safe?
- d. Providing permitting authorities with the necessary documentation and confidence that submersible operations in their water is a benefit and not a “high risk” activity.

Programme

Day 1 - SOG Forum

Time	Activity	Chairs	Comments/Objectives
07:30	Car pick-up from hotel	All using accommodation	Cars will be outside the hotel to bring you to our warehouse
08:00	Breakfast	All participants	Breakfast will be served before the start of the event
09:00	Submersible Operators Group (SOG): The Shape of Things	Steve Etherton (President, EMEA) Leighton Rolley (Science Systems Manager, REV Ocean)	Welcome Vision for the potential formation of a Collective SOG. <ul style="list-style-type: none"> • Why are we here? Objectives? • What is a great outcome of this collective? KPIs? • What would a failure look like and why?
09:30	Introduction of Workshop dynamics & Chairs	Eva Ramirez-Llodra (Science Coordinator, REV Ocean)	All 6 workshops to run in parallel. Chairs to lead conversation / promote topics Attendees to make sure they spend time at all stations Delivery team taking minutes
09:45	Station discussions	See Co-chairs for stations above	Each station discusses for 45 min, then participants move to the next station. Discussion slot 1: 09:45-10:30
10:30	Coffee break		Tea / Coffee / Snacks
11:00	Station discussions continue	See Co-chairs for stations above	Discussion slot 2: 11:00-11:45 Discussion slot 3: 11:50-12:35
12:45	Lunch		
14:00	Station discussions continue	See Co-chairs for stations above	Discussion slot 4: 14:00-14:45 Discussion slot 5: 14:50-15:35
15:35	Coffee break		Tea / Coffee / Snacks

Day 1 - SOG Forum

Time	Activity	Chairs	Comments/Objectives
16:00	Station discussions continue	See Co-chairs for stations above	Discussion slot 6: 16:00-16:45
16:45	Wrap-up Day 1	Leighton Rolley & Mike Taylor	Wrap up of discussions Inform of plan for Day 2 Inform plan for evening social
17:00	End of day 1		
18:00	Social Event / Dinner		
21:00	Car pick-up from warehouse	All using accommodation	Cars will be outside the warehouse to bring you to your hotel

Day 2 - SOG Forum

Time	Activity	Chairs	Comments/Objectives
07:30	Car pick-up from hotel	All using accommodation	Cars will be outside the hotel to bring you to our warehouse
08:00	Breakfast	All participants	Breakfast will be served before the start of the event
09:00	Kick-off Day 2	Steve Etherton (President, EMEA)	Welcome and recap of main discussion points from day 1 Introduction to day 2 Plenary programme: Present and discuss main points from day 1's discussions with expert panels.
09:15	Topic 1: Submersible dive preparations for safer operations	Eva Ramirez-Llodra (Science Coordinator, REV Ocean)	Report from day 1 – Jeff Heaton/Ofer Ketter Plenary discussion with panel
10:15	Topic 2: How do we create better pilots and training?	See Co-chairs for stations above	Report from day 1 – Troy Engen/Leighton Rolley Plenary discussion with panel

Day 2 - SOG Forum

Time	Activity	Chairs	Comments/Objectives
11:15	Coffee Break		Tea / Coffee / Snacks
11:30	Topic 3: How can we improve operational procedures?	See Co-chairs for stations above	Report from day 1 – Nils Baadnes/Taigh MacManus Plenary discussion with panel
12:30	Topic 4: Emergency & Recovery		Report from day 1 – Ben Sharples/Alan Green Plenary discussion with panel
13:30	Lunch		
14:30	Topic 5: Maintenance & Certification		Report from day 1 – Ionel Darie/Jonathan Struwe Plenary discussion with panel
15:30	Topic 6: Improving external perception of submersibles		Report from day 1 – Alex Rogers Plenary discussion with panel
16:30	Next steps & recommendations	Leighton Rolley	Do we formalise the SOGs? Do we organise regular meetings? Annual presentational meeting? Digital meetings? What are next actions?
17:15	Closing remarks	Eva Ramirez-Llodra & Steve Etherton	Wrap up and closing remarks
17:30	End of workshop		

Meeting Compliance Statement: On Oct 3 & 4 we are meeting to discuss the Submersible Operators Group. We take anti-competition law seriously. Our discussions can cover matters that we all feel are of interest to our industry, but we cannot discuss or exchange sensitive commercial information.

If at any time at the Submersible Operators Group you think our discussion may be in breach of competition laws, please inform the Chair. The Chair may close the meeting at any time if they believe that discussions have breached competition rules.

