Newsletter #22

December 2017

"Everything Should Be Made as Simple as Possible, But Not Simpler" - Albert Einstein

Open Safety's business is built on the technologies providing safe breathing gas in dangerous places. To do that we design and produce rebreathers, respirators, breathing gas monitors and gas controllers. This newsletter is specific to our rebreathers and associated product lines.

Contents

1. Shipping Status and Lead Times

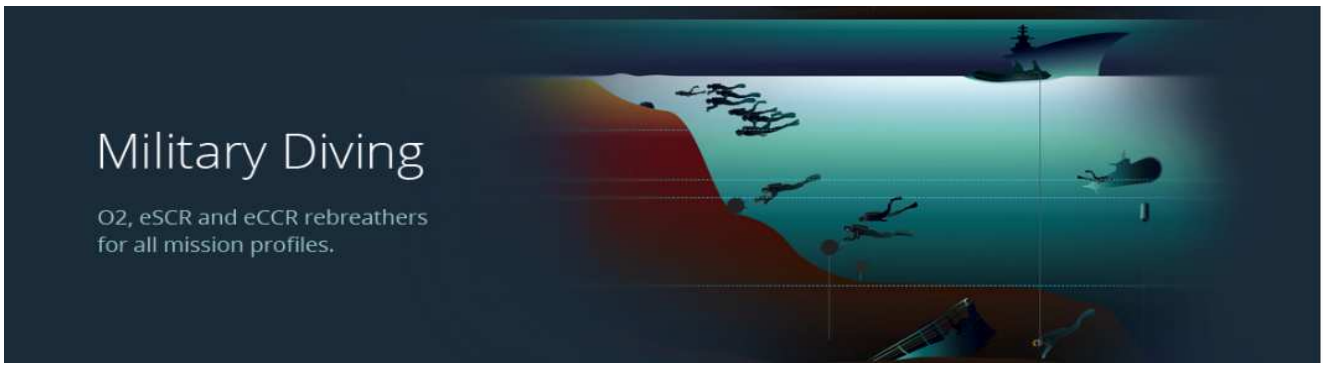
Commercial Umbilical Supplied Rebreather (rated for use to 350m):
We own all IP for our surface supplied rebreather, and hold large stocks of all main parts, enabling us to achieve delivery in 16 weeks for some model variants. It is the only fully certified umbilical rebreather for primary use: to EN 14143, NORSOK U101 and IEC EN 61508 at SIL 3.

Compliance and test services: Open Safety provide a compliance test service for new breathing systems.

In the past quarter, Open Safety have conducted respirator compliance testing of hyperbaric lifeboats, diving bells, and a series of sat chambers using our respiratory simulators. The process on each test was audited and accepted by DNV.

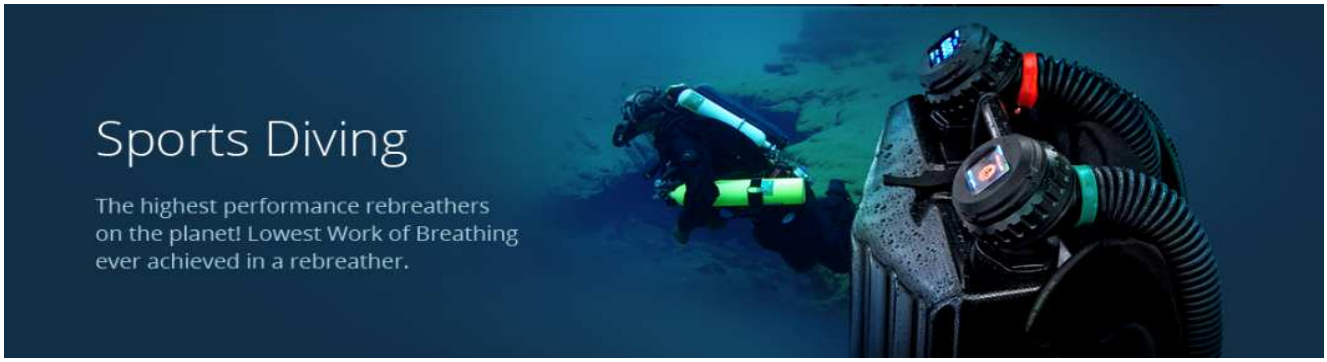
Respiratory Simulators: Our respiratory simulators are artificial breathing machines that can be taken into any test chamber and used dry or submerged.
For 2018, our respiratory simulator will support RS232 to allow data to be sent through any penetrator, removing the need for data-grade penetrators.

Above: Client's Sat complex under compliance test by Open Safety Aug 2017, using the Open Safety Respiratory Simulator. Our breathing simulators are available for purchase, or hire with supporting staff, onsite anywhere in the world.



Military rebreathers:

- OSEL build and offer five mission specific min-mag military rebreather models in the *Incursion* range available for immediate purchase or tender demonstration to approved clients through Apollo Military and their agents, including Northern Diver.
- Orders are fulfilled with standard lead times of 16 weeks.



Recreational rebreathers:

- **Apocalypse Type II Expedition eSCR (Rated for use to 350m):** available to special order. All main parts are carried in stock. Back mounted. Lead time 16 weeks.
- **Apocalypse Type II Expedition mCCR (Rated for use to 100m profile for 10hrs using dual EAC scrubber):** available to special order. All main parts carried in stock. Lead time 16 weeks.
- **Apocalypse Type IV iCCR (Rated for use to 100m for 2hrs 45min):** Undergoing Functional Safety revision: details in Section 5 of this newsletter.
- **Apocalypse Type IV mCCR (Rated use 100m, diveable to 180m):** Shipping from stock. Back mounted. Lead time allows for all pre-shipping checks to be carried out. Lead time 6 weeks.
- **Apocalypse Type VII mCCR (Rated use 100m):** Shipping from stock. Lead time allows for all pre-shipping checks to be carried out. Chest or back mounted. Lead time 6 weeks.
- **ALVBOV:** Available from stock and will reduce the WOB of any rebreather on the market. Lowest tested and documented BOV WOB in both OC and CC modes. For professional use or for rebreathers with right to left gas flow only.

Functionally Safe Recreational PPO2 Monitoring options:

- **iCCR Monitor:** Incorporating solid-state O2 sensors alongside traditional galvanic O2 sensors and the only accurate end-tidal CO2 monitor on the market. Shipping status - see Section 5.
- **OSEL PPO2 POD with hardwired Celebri Dive Computer and HUD:**
  The electronics and software to enable a dedicated functionally safe mCCR option was completed in 2012. The functional safety process has been ongoing, continuously since then. The release date will be published when this process is complete. . We have had zero issues on either the electronics or the software throughout the test period - now covering five years, though we have made mechanical changes implementing improvements from the dive testing.

2. Customers' Photos since last newsletter



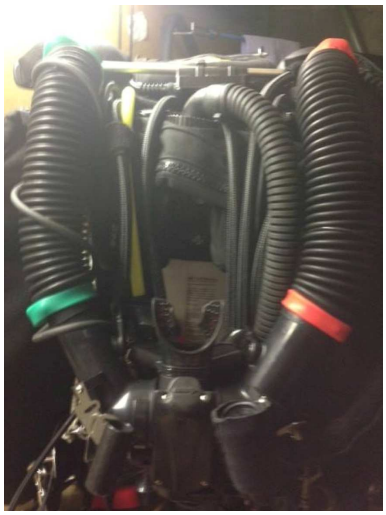
“Great weeks diving on my Apoc in Scapa Flow, faultless all week, more than I can say for a couple of the other makes of unit on the boat!”



Apocalypse Type IV mCCR with AV1f PPO2 Dive Computer and Narked at 90 HUD, at Stoney Cove. The orange cable is from a Metalsub canister torch, located on the right side of the mCCR, strapped to the side-rail mounted 3L Oxygen cylinder.

Customer diving his Apocalypse Type IV mCCR in the Sound of Mull, Scotland.

ALVBOV fitted to customer's home-build with side-mounted Counter Lungs. Upgrade of the WOB of any rebreather by fitment of the ALVBOV is fully supported by OSEL.



ALVBOV fitted to a customer’s rEvo with NERD and Dreams secured to the rigid breathing tubes. As this improves the rEvo’s WOB this performance upgrade can be safely offered.

The name Apocalypse for our sports rebreathers reflects the true meaning of the Greek and Latin roots, which mean to unveil, as it unveils the marine world to us. It is also a play on words, using the popular modern meaning, to remind us to take care – we are proud our users do that.

3. Quality Assurance

Open Safety was one of the first companies in Europe to transition from ISO 9001:2008 to ISO 9001:2015, and from ISO 14001:2004 to ISO 14001:2015. We are certified to these standards by TUV Rheinland. We are in the process of routine recertification to IEC EN 61508 at the moment, and will be in a position to release several new diving products as soon as that is complete.

ATEX and IEC Ex compliance is being applied to relevant products. In 2017 Open Safety completed a high powered contactor design and compliance package for a client, achieving ATEX and IEC Ex certification in October 2017. We have a suite of breathing gas monitoring products going through ATEX and IEC Ex certification currently.

Our certifications covered EC and US requirements. We broadened this in 2017 to include Russian standards and are looking at the emerging Chinese standards.

As some of the equipment we design is used by clients for medical applications, we are adding EN 13485 to our primary certifications: we already cover the EN 13485 requirements with our ISO 9001 and Functional Safety processes, so this is simply a mapping and certification activity, rather than new processes.

4. Questions and Answers about Open Safety (OSEL)

Why do OSEL exist? (i.e., what is the purpose of OSEL?)
Open Safety design and produce equipment to ensure the safety of breathing gas, including respirators, rebreathers, breathing gas monitoring and gas controllers. Offering Functional Safety certified products is our key differentiator from other companies in these markets.

Open Safety entered the dive rebreather market in 2008, offering products with the best breathing performance available: even 9 years later the Work of Breathing performance these offer, remains unbeaten. Our rebreathers use a modular breathing loop, which delivers far lower Work of Breathing (WOB) than any other rebreather on the market: a WOB of **1.44J/L** at 40m on Air at 75RMV. We were unique in publishing all the test data and the process. Open Safety offer the only diving products certified to a recognised Functionally Safety standard.

We are delivering comparable levels of innovation to breathing gas monitoring for industrial clients.

How do we behave? (i.e., what are the values of OSEL's business?)
A core part of our mission and values is appreciating the value of the gift of life and health. Often health is taken for granted, until it is lost. We appreciate that life is about the most important thing we have and treat it as sacred. We do whatever it takes to achieve the safest possible product.

Proactively, this means running the highest quality standards, including the Functional Safety "Gold Standard" IEC EN 61508. A single 61508 audit costs us more than thirty of our ISO 9001 audits: that cost reflects the rigour of this standard, and the audit cost is just the "tip of the iceberg" in terms of its impact within our company.

Reactively, we operate continuous monitoring of the market. Deep Life publishes the most extensive database available that tracks rebreather specific mortalities. As part of the IEC 61508 process requirements, we analyse that accident data, as well as data from testing, customer feedback, incident analysis, field trials and formal modelling, to identify every failure mode, to ensure the safest product.

Our management and staff are authorised to halt production, delay shipping and scrap a design, part or product if any safety critical weakness or potential weakness is identified by any of these processes.

What do you do? (i.e., what is the main function of OSEL's business?)
Open Safety seeks to guarantee the safety of breathing gas even in the most hazardous of environments: underwater, explosive environments (ATEX) and in contaminated spaces.
To that end, Open Safety produces rebreathers for Commercial, Military and Recreational markets.
We provide breathing gas monitoring equipment to industrial markets.

How will you succeed? (i.e., how are OSEL different than the competition?)
Our mission is to provide the safest possible equipment to our customers. Meeting the highest safety standards goes hand in hand with delivering outstanding performance. We believe there is a growing understanding of what benefits these safety standards offer, as well as the value of the performance those processes deliver.

5. iCCR Monitor Shipping Status

Our iCCR Monitor is the only product we have on hold – all other products that have passed certification are in production and are shipping.

Our iCCR is fully CE and Functional Safety certified. It is on hold simply because we identified an additional hazard in field data from accident analysis of recreational rebreather fatalities on a third party's rebreather. That hazard is the user ignoring a reported NO DIVE status and diving due to being in a remote location that has taken a lot of effort to reach, at high cost, along with a good measure of peer pressure. As a result of more than one of these incidents, we made the decision to upgrade the actuator mechanism in the ALVBOV to deal with this new issue, before we sent large numbers of iCCRs out. This has been done and we have been working through the rest of the functional safety process with regard to that change.

At this time we are anticipating that the iCCR Monitor fitted with solid state O2 sensors operating alongside traditional galvanic O2 sensors and end-tidal CO2 monitoring will resume shipping by the end of 2018.

We have refunded all iCCR Early Adopter (EA) who requested this. All iCCR EAs can also switch to any of our other products, at heavily discounted rates, just by contacting our support team.

6. Forthcoming Dive Products: Celebri Dive Computer and PPO2 monitor.

Our ***Celebri*** dive computer (prototype names: BIO350, DC100) and hardwired mCCR gas monitor has been progressing through certification tests. Images of the progression are on our Facebook gallery.

The Celebri is coded in SPARK Ada, the foremost language for high integrity systems. SPARK Ada allows each line of code to be validated and verified. This also includes verification of the decompression algorithms.

The ***Celebri*** has gone through several prototype iterations since 2012 to meet the Functional Safety requirements for the product - the latest of these iterations is currently in test. We will ship the ***Celebri*** when the test programme is complete, recognising that tests may require change and further test iterations.

7. Upgrades and Safety Notices

Our rebreather products in the field have performed very well over the past eight years of production and diving. We continue to monitor their use, and solicit feedback to learn from and share among our user community. Two items we would like to highlight in this newsletter are:

1) A couple of customers have reported that the ALVBOV may not smoothly transition from CC to OC on triggering a bailout under some conditions (low lubricant, and temperature change). This is rectified by the upgrade of the spring as required for the iCCR and is a warranty repair that is free of cost: we provide a lifetime free safety warranty on all our products, so when we find an improvement we supply it free of charge. The spring is fitted to all units returned for service.

2) A customer has had an Apoc oxygen injector fail twice - it has intrinsic safety features so this was not a safety issue in this case, but it curtailed diving. This problem was traced to use of contaminated oxygen. Rebreather divers generally take care to avoid contaminated gas or cylinders: it is a safety hazard. Oxygen cylinders must be free of detritus, including salt, rust,

and organic material. We also advise annual servicing of this key item.

8. Service Centre Changes

We moved our service centre from Glasgow in Q1 2017 in order to set up a dedicated Apocalypse Rebreather service facility. Service times were extended substantially during this move, but are now back on schedule. Normal service lead time for our recreational products is 6 weeks on recreational dive products and on professional products within the declared service times.

OSEL Support
For release December 2017

FACEBOOK: “Open Safety Equipment Ltd”
Web site, shop and contact details: www.opensafety.eu