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## **Press Release: Functional Safety and Ambient Pressure Diving (APD) Ltd**

News that Deep Life's rebreather designs are meeting the requirements for both CE and full Functional Safety certification is sending waves through the industry. Deep Life notes the timing of some of the industry responses.

Deep Life's Lead Technologist, Alex Deas, PhD, FIEE, C.Eng, is named in a press release, dated 12<sup>th</sup> November, from Ambient Pressure Diving Ltd, a company making rebreathers. There is no connection whatsoever between Dr Deas and either of the two other parties named, other than they report to have suffered from faults Dr Deas pointed out in APD rebreathers and spoke out independently regarding their experience.

As stated in the APD press release, Dr Deas has raised concerns about the safety of the APD rebreathers. This was done first privately with APD then later publicly and in court.

Dr Deas's concerns relate to the fact that over a period of 10 years, less than 3300 APD Inspiration rebreathers were made, representing an average population of under 1650 in existence, using which, 80 divers died. APD failed when they sued to have Dr. Deas gagged on the basis that his published data on the number of units was so accurate that APD suggested it used APD confidential data. Dr Deas provided evidence obtained that his data was obtained by independent research. His data gives breakdowns of 2700 Inspiration rebreather sales by year.

The sales figures for Inspiration rebreathers are not widely known and in some quarters much higher figures have been suggested, with the effect of covering up the true level of risk.

Dr Deas has been called as an expert witness in two separate court cases implicating APD in the deaths of divers using APD rebreathers. In both cases use of formal methods indicate the most plausible cause is a Functional Safety failure. His evidence was based on technical investigations of APD equipment which had established a number of specific faults with mechanics, electronics and software which can result in death from hypoxia. A Senior UK HSE expert confirmed in court in IOM that they had observed the Functional Safety fault on the APD Inspiration rebreathers reported by Dr. Deas. Technical evidence is just one thread in the fabric that may determine the outcome of a legal case, albeit an important one.

Dr Deas's complaint against APD, referred to in the APD press release, relates specifically to the lack of Functional Safety Certification for its products or processes, as laid down by EU standard EN 61508. This complaint is not addressed in the recent press release from APD.

The certificates attached to the APD press release are a Certificate of Approval of the APD Quality Management System to ISO 9001:2008, relating to quality management procedures within the company, and Approval of Conformity Certificates relating to PPE Directive 89/686/EEC, as amended by Directives 93/68/EEC and 93/95/EEC, which covers primarily mechanical aspects of personal protective equipment. They are not Functional Safety Certificates certifying compliance with standard EN 61508, covering overall Functional Safety, including electronic and software components of equipment and their interaction.

The Approval of Conformity certificates presented in the APD press release have been issued by Lloyds Register, who are not competent to audit EN 61508. The only accredited EN 61508

auditors for this type of equipment or the processes that manage them are SIRA Certification and a specialist division of TUV.

The examination by the HSE referred to the letter from Andrew Burnside of Cornwall Council, is similarly not an examination for compliance with EN 61508: the HSE are not accredited EN 61508 auditors though do have some EN 61508 experts who have testified in court that serious functional safety issues have been reproduced by them. The Trading Standards Authority have never been accredited EN 61508 auditors,

It has not been industry practice for safety certification bodies to apply the directives and harmonised standards requiring EN 61508 for rebreather diving equipment, even though it is stipulated through the relevant harmonised standard. Dr Deas's complaint was intended to challenge this failure to apply EU law in the area of rebreathers, because there is evidence this failure is responsible for deaths of rebreather divers.

The press release by APD appears to be a continuation of a cover-up of serious safety issues which has been on-going for more than decade. This cover-up involves many parties.

The cover up starts with the secrecy surrounding the sales figures for APD Inspiration rebreathers. The fatal accident rate is almost unbelievable given the true sales figure. The APD Inspiration was nicknamed the YBOD, for "Yellow Box of Death" within a couple of years of its launch, even before Dr. Deas discovered some of the reasons why that title may be appropriate.

As stated above, the press release by APD makes no mention of any Functional Safety certificate, the lack of which is the substance of Dr Deas's complaint. The press release tries to sidetrack the issue by referring to CE certificates relating primarily to the mechanical aspects of their products. APD rebreathers initially had mechanical problems resulting in Work of Breathing non-compliance. By 2008, APD had incorporated changes to their products to address this. However, the exclusions to EN 14143:2003 on page 2 of the APD CE certificates suggest the hoses still do not comply with EN 14143:2003 even though APD were involved in drafting the requirements for hoses in that standard. Nor do the products comply with the hydrostatic imbalance requirement, despite an error in the 2003 standard heavily favouring over-the-shoulder counterlungs that APD use.

Dr Deas has not made any significant complaints about these mechanical areas, as they involve the two subsections in the standard that contain errors: the Hydrostatic Imbalance limits in EN 14143:2003 Table 1 is incorrectly labelled Suprasternal Notch when the figures are actually Lung Centroid numbers, and the requirement that the diver can reach the mouthpiece is incorrectly stated as a maximum hose stretch.

The prime complaint is that there is no Functional Safety certificate, and no accredited body has confirmed the Functional Safety of APD's products. An additional complaint is that despite the proven existence of grave Functional Safety faults, there has been no recall of equipment already sold to correct the most serious of these, even although the discovery of these faults led to extensive changes in APD products sold after their discovery.

Dr. Deas made his initial complaint privately a decade ago, in 2000. His action in making this a public issue after witnessing APD's inadequate response, has been compared to kicking a hornets' nest. The result prompted one commentator to ask "if the criticisms have merely hit too close to home (and the pocket book) of powerful people in the close knit sports diving industry, that at times, seems incredibly resistant to change."

The APD responses to the questions raised by Dr. Deas are extreme and similar to that of the tobacco industry cover-up in the 1970s. APD's US lawyer has even created a web site to slander Dr. Deas. It is reported that this is because APD are very afraid of his testimony as an Expert Witness, aware that he wishes to demonstrate the issues live in court – something that has not been allowed so far.

The chronology of the scandal is summarised below.

Date	Event
April 2000	Dr. Deas purchased two APD Buddy Inspiration rebreathers on which he and Mark Reeves, his technical diving buddy, received training, including a tour of the factory where the Inspiration rebreathers were being made.
May 2000	Within 50 hours of use, one Inspiration controller hung underwater mid-dive, another jumped to random code, another reset underwater into a non-dive mode. All of these are critical failures that are immediately life threatening. Lab tests performed to find the reason why identified immediately a total lack of Functional Safety design in these units: no working brown-out circuit, no watchdog timer, no TTA architecture, mistakes in the dual redundancy, meaning there was no controller redundancy, serious power supply faults and software faults. Deas advised APD, provided the tests and test results, along with detailed information to enable APD to correct these faults.
June 2000	APD proposed to release backlit handsets to address 8 of the 11 faults identified by Deas. Concern was expressed by Deas that there no recall was planned, and that these mandatory safety improvements were at an additional cost for existing users so not all users would receive the corrections. Deas advised APD that if they were not going to fix the three remaining issues, Deas would develop a safe controller for his own use. At this point Deas had no commercial interest in rebreathers. The absence of any aggressive motives is attested by the fact that Deas even advised APD on the restructure of their business to protect it from the inevitable legal cases from these failings. APD implemented the measures suggested by Deas, dividing their business into three in 2001. Deas, a highly qualified electronics engineer and award-winning electronics designer with extensive Functional Safety experience, went on to develop a safe controller as he had advised APD. This was the starting point for subsequent commercial development of rebreather products by Deep Life Ltd in 2005.
June 2002	Other companies entered the rebreather market in response to widespread awareness of some of the safety issues with the Inspiration Classic, which were causing owners to look for an off-the-shelf solution such as the Hammerhead controllers. Dr. Deas discovered that the APD electronics and software was developed by Nigel Hester, understood to be a salesman without any engineering training, with Martin Parker acting as the Project Manager despite having had no formal education after the age of 16 and no engineering training. This created an environment where ignorance of Functional Safety allowed the APD rebreather faults to develop.
June 2005	Deas, alarmed at the continuing cover-up of Functional Safety issues by APD and rising death toll went public with some of the information. He decided to

	offer the safer technology he had developed commercially to any party and founded Deep Life Ltd in order to do so. Deas was well aware from others that if he spoke up about the APD issues, APD would use the tobacco industry methods it used on others against himself, which would hurt his business: there was commercial pressure to keep silent.
By April 2007	APD addressed the WOB problem by mouthpiece changes, but again no recall was made. Concerned about the still rising death toll, Deas decided to support court cases where Functional Safety failings were implicated, subject to no component manufacturer being sued. APD made it clear they would sue widows who took them to court, ultimately getting charges on homes, even getting the allowances for a bereaved infant, despite these being less than the legal costs this involves: APD made the point not to argue with them, some other widows dropped their cases out of fear of being sued.
March 2008	A UK HSE Functional Safety expert reported to the IOM Coroner and testified in a fatal accident case that they found what appeared to be a serious Functional Safety fault with the APD Inspiration, after reviewing a complaint by Deas that the HSE person who investigated the rebreathers initially following fatal accidents was not competent to do so, as he had received no Functional Safety training.
April 2008	Deas decided to develop a sports rebreather, fully complying with all Functional Safety requirements, publish the data to promote good practice in the industry, and licence the products to an APD competitor. In a post to an internet diving forum, an authoritative party unconnected with Deas pointed out that, if successful, Deas's action would finish companies selling unsafe eCCRs unless they changed. APD commenced a virulent smear campaign against Deas and this extended to anyone who had encountered the problems Deas highlighted or spoke up about them. APD's US lawyer even created a smear site to slander Deas. It became known that Deas's advice was to demonstrate the Functional Safety faults in open court; this was prevented by lawyers, but APD are concerned that it will be done in the future.
March 2010	Deep Life received Functional Safety certification from SIRA for the entire rebreather lifecycle process established by Deas, showing it can be done for rebreathers. The EN 61508 safety certification even at the onerous level of SIL 3 was achieved faster and at less cost than obtaining PPE certificates which currently provide far less safety rigour or coverage of rebreathers. This EN 61508 route withstood audit checks after a 3rd party named on the APD press release formally challenged it with SIRA: questions about certifications are a proper cost of living in a democracy.
Nov 2010	Deep Life received a CE certificate to EN 14143:2003 for its commercial diving rebreather, including the ALVBOV, to 100m (the CE limit), and continue to seek total PPE certification of its other designs.

There has been considerable support for Deas's actions, despite a cabal seeking to cover up or discredit his actions. Some people can be bought or bullied, some cannot, and Deas is of the latter camp, as are many other staff in Deep Life Ltd. Deep Life is grateful for the support of divers who contact the company to support Deas's exposure of safety cover-ups, many relating their own experiences.

Deep Life would like the existing EN 14143:2003 standard to remain in force, but with the two items that are known to be errors corrected, so that at least in Europe rebreathers are required to have a minimum of Functional Safety to protect the end user. Deep Life is opposed to moves to evade Functional Safety requirements either by removing the references in EN 14143 to EN 61508, or even worse, by removing EN 61508 compliance requirements but creating an illusion by inserting extracts from EN 61508 into EN 14143 which would have the effect of removing competent Functional Safety auditors from the assessment loop.

Deep Life will continue our policy of open disclosure of information, adding to the great body of detailed safety information on best practice in rebreather design already on its web site at [www.deeplife.co.uk/or.php](http://www.deeplife.co.uk/or.php)

The application of Functional Safety within the dive industry is a major step forward. The size of the step can be judged by the size of the waves it is creating. This is what a paradigm shift looks like in an industry.