ORIGINAL PAPERS

THE DEVELOPMENT OF THE SAFETY SAUSAGE

Bob Begg

THE BEGINNING

MARINE SEARCH AND RESCUE EXERCISE
SUNDAY 22 July 1984

This exercise was organised by the Marine Search and Rescue Advisory Committee with the object of involving the Navy's new Patrol boat "Moa" in a full scale Search and Rescue (SAR) Exercise.

I was involved firstly as training co-ordinator for the committee and secondly as one of the missing divers. I decided to be directly involved rather than an observer so that I could follow through the exercise and try out the system.

The plan was for two divers to be reported missing. They were to be found by an air search and dropped a liferaft then picked up by the Moa. As an extra part of the exercise one of the divers would have bends symptoms and would be transferred to hospital by helicopter and ambulance.

As it turned out, all went according to plan except that we really did get lost and it took two hours longer than it should have to find us.

We set out from Papanui Inlet on the seaward side of the Otago Peninsula about 0830 in fine calm conditions with a slight swell. We were in an Avon inflatable with a boatman, radio operator and two divers - myself and Colin Sutcliffe. We had two dives, one bounce dive to 80' then another 5 minute dive to 100'. On surfacing after the second dive we were about 50 m from the inflatable and they started letting off flares. The time was 9 am and conditions were still dead calm.

We gradually drifted away from the inflatable and after half-hour we could no longer see them although they could see us. At about this time 6 to 8 Dusky Dolphins arrived and swam around us for 15 minutes or so. At this stage we were unconcerned although we were starting to wonder why the plane had not arrived.

Between 1000 and 1030 we noticed the plane searching in an area well away from where we were. At this stage the inflatable moved away from our position as we did not want to make it too easy to find us!

At about the same time the wind came up, quickly increasing to around 15 knots from the South West. The plane was still searching the wrong area and we realised that we really were lost and were going to be very hard to find. By now we were about 15 km offshore and about 5 km north of where we entered the water.

The difference in our equipment were now starting to become important. I was still quite comfortable in my US Divers inflatable suit and cold water hood, new Moray gloves and Neptune Octi boots without zips. Colin was wearing a new Aquapro Topline 7 mm suit with cold water hood, Mitchell leather-palm gloves (not waterproof) and Mitchell hard sole boots with zips. His hands and feet were extremely cold and he was becoming cold all over. I was using a USD Proline compensator which I was able to take off and use as a raft. Colin was using a yoke type compensator which did not allow him to keep his head clear of the water, as I could. We took Colin's tank off and attached it to the jacket compensator. The water temperature was 11°C.

By about 1100 we could see the plane and a helicopter looking for us and we also saw the Moa had arrived although it was miles away from us. We decided to start swimming We realised it was pretty futile but it was something positive to do. By now we were almost due East of Taiaroa Head which is at the northern tip of the Otago Peninsula. The dolphins still swam around us occasionally but by now they had lost their appeal.

Over the next 30 minutes both the plane and the helicopter flew over us at least once each. As we saw one of them approaching we would put Colin's yellow tank on top of the jacket compensator and I would wave the yellow catch bag I had. It seemed unbelievable that they could fly over us and not see us. It was also extremely frustrating.

Colin was by now fairly concerned although I was reasonably confident that they would find us pretty soon. The biggest problem was the weather. It was blowing quite hard and low cloud was starting to form over the land.

However at about 1135 we saw the plane flying directly towards us. He circled around us and then we noticed a fishing boat about 30 m away. It turned out it was the fisherman who had found us and called in the plane. We did not even realise that he was in the area. The liferaft was dropped to us and very soon the Moa was also in the area. As we now had the helicopter and the plane flying above us and the Moa and a couple of fishing boats standing by - we no longer felt lonely.

We were taken on board the Moa and examined. It was decided that Colin had mild hypothermia but I was alright and decided that the exercise should proceed. George Lay was roped in as the "Bent" diver and we were flown to shore by scoop net under the helicopter and taken to hospital by ambulance.

We had drifted from about 3 km east of Papanui Inlet in a Northerly direction to a point about 5 km east of Taiaroa Head, a distance of about 8 km in two and a half hours, giving a drift rate of about 2 knots.

Lessons

1. Most important, divers are much harder to see from the air than one would expect. Both pilots and their observers were very experienced and said later that they could see seals, dolphins and bits of seaweed but could not see us. We were more visible than many divers with the yellow catch-bag and tank and jacket compensator floating on the surface.

2. Choice of suit and accessories is most important for extended periods in 11 degree water. While Colin had a very good suit his hands and feet were very cold fairly soon after entering the water. By the time we got out his hands and feet were blue and he was very cold. I was still quite comfortable and feel I could have stayed in the water for a much longer period.

3. All divers should review their safety procedures when there is any risk of becoming separated from their boat or the shore.

Suggestions

A. When the support boat is not anchored a weighted line and buoy should be placed at the point where the divers enter the water. This gives a reference point and is most important if a search is needed.

B. If possible the divers should either tow a float or carry a handspear or similar object and a flag or catchbag to signal the boat.

C. In high risk conditions a dye marker or waterproof smoke flare could be carried.

D. Some item of gear should be dayglow orange.

E. A chemical lightstick should be standard equipment on evening or night dives and can easily be carried at all times.

THE NEXT STEP

MARINE SAREX 19 MAY 1985

The object of the exercise was to test two hand held flares (supplied by Terry Corbett), one dye marker (supplied by Bob Begg) and another dye marker. One other object, a strip of orange tape, was also tried.

The exercise was carried out approximately 600 metres offshore from Tairoa Head, between 1000 and 1300. Weather conditions at the time were perfect, with no wind and clear skies. The tide had a northerly drift of approximately 2 knots. Underwater visibility was 3 to 4 m.

There was a swell of about a one metre .For safety reasons the divers held onto an anchor line and buoy to stop them drifting.

Paul Young and George Lay were the divers conducting the tests. Before the arrival of the plane, the orange tape was unrolled and tied to the anchor line.

When the plane arrived, the first dye marker was activated and appeared to be very poor. The plane turned and a pinpoint (light) flare was let off. Paul commented that he had trouble unscrewing the cap and that when the flare went off it let out a lot of noise. Also had the flare not been immersed to cool it down, severe bums would have resulted.

He waited approximately 45 seconds and then activated a smoke flare, which failed to fire. It should be pointed out that this flare had hairline cracks in the cap, and was not expected to fire. The plane then turned and the second pinpoint flare was set off, with no problems. Then the second smoke flare was let off. Both flares had been carried by Terry Corbett for some time and had been logged for each dive on duration and depth. Sealant had been used on one flare and this was found to be unacceptable to the divers. One of the caps that had been sealed had to be put into a vice to be opened! It appears that a sealant it not necessary as the O ring fitted should do the job, however further tests by Pains Wessex will confirm this. The expected life of these flares under diving conditions may not be 3 years as stated on the flare, as this time is for storing flares under optimum conditions. Flares are an essential survival aid of the diver. Trouble was encountered when trying to trigger the flares. One of the flares with sealant was very difficult to activate, and the trigger mechanism had to be dug out with a watch strap. Presumably if one was lost, by the time it took for someone to search in the general area, hands would be too cold to activate the trigger mechanism.

The second dye marker was then put into action and it worked reasonably well, but a lot of effort in agitating the package was needed to make it effective.

The first dye marker package was dropped while opening the second package, and sank very quickly. The colour of the dye blended well with the milky green colour of the water, and was not suitable for the conditions.

The whistle supplied on the Fenzy worked well and did not require much effort to operate.

Pilot's Comments

Don Macintosh was the pilot on this occasion. Because of the local Albatross Colony, a 1,500 foot lower limit had been imposed by the authorities.

The streamer tape laid out by the divers was very visible and seemed to be a very beneficial piece of equipment.

The light flares were easily seen, but smoke in this sort of weather was best seen.

Both buoyancy compensators were bright red. George had his compensator off and floating beside him, while Paul wore his in the usual manner. The compensator floating next to the divers was far easier to see from the air than the one worn. In fact although Paul's compensator was bright red, it did not show up from the air. Faces showed up well when the divers were looking at the plane, and an extra set of eyes in the plane would have been helpful.

The dye was not effective in the conditions. It was only visible flying towards the sun, and no good flying away from the sun. Although the dye was not useful in these conditions, it could well prove excellent on other occasions. Ground to air radio was absolutely useless and for the entire exercise Don was transmitting blind.

Land Base Comments

The divers were barely visible to the naked eye from the base when they were 600 metres off-shore. The base was approximately 150 feet above sea level. Whistles were heard and it was commented that these could be a handy piece of equipment for all divers to carry. However the whistles used on this exercise have now been superseded and a new whistle will soon be released. It was suggested that in a search the motor on the boat could be switched off now and then on the off chance that a whistle is being used, however, because of possible engine malfunction in rough weather the dangers of cutting the motor must be remembered.

The ground to air radios were hopeless. Two were taken and neither would transmit, however one received. Some serious thought should be put to finding a better radio. CB radio in the boat and on land was found to be invaluable. Giving bearings to land base via CB radio was good for fixing positions.

Boat Observer's Comments

When 200 metres from the divers Paul wearing his compensator, rather than George with his beside him, was more easily seen with the naked eye. Both were clearly visible when viewed through binoculars. At 400 to 600 metres using binoculars, shapes were found before colours registered. After colours were visible blue flippers stood out very well.

Both light flares were very good and burnt for approximately 20 seconds each. The orange smoke was excellent, and it was thought to burn for approximately 29 seconds, however a cloud hung above the divers for quite some time and was still discernible for some ten minutes afterwards.

The orange tape did not stand out from the boat.

When the second dye marker was activated, it was visible on the swell from a distance of 300 to 400 metres, but it was thought that if one did not know where to look it would not be seen.

The whistles was heard from the boat at a distance with the motors off.

Lessons

Flares are an essential survival aid of the diver.

The orange tape lying on the surface of the water was found to be an excellent additional piece of equipment and showed up very well from the air. This tape is used to show where buried electrical cables are, and if thought worthwhile further tests would have to be made with different colours to find the most suitable.

Although the dye markers were not satisfactory on this exercise, they should not be written off. The dye could be very effective in blue water.

The biggest trouble of this exercise was the performance of the radios.

THE FINAL STEP

SAREX 26 May 1985

Held to test inflatable plastic tubes for visibility from boats and aircraft. 2 plastic tubes, 1 orange and 1 dark red, each approximately 3 m long were tried.

At 1430 the weather was fine, calm, with high cloud covert. The sea was calm with 1.5 to 2 m swell. Two divers were put in the water on an anchored line with the tubes. The boats moved off until divers were only just visible when on the top of swells, about 200 m. Then the tubes were inflated. The tubes were found to be easily inflated and easily held vertical by holding the end down beside the diver at arms length underwater. The tubes were immediately visible when vertical and were often seen when the divers were invisible. The vertical tubes were easily seen from all angles although they were more difficult to spot when looking directly into the sun. They were still visible with the naked eye from half mile away, and were easily visible through binoculars at this distance. Even if the tube is holed it will still float and be of use in an air search.

The tubes were left flat on the water while the plane flew over. The pilot commented that the tubes were easily visible from 2,000 feet and that the divers were easily found. The divers appeared as dots at the end of the tubes. The divers would have been very hard to find otherwise.

As the conditions were calm more tests need to be done in windy and rough conditions.

Lessons

Inflated plastic tubes standing vertically in the water are easily seen regardless of colour. Red tubes lying on the water are easily seen from the air. These tubes would be a worthwhile piece of equipment for every diver. They are cheap, easy to make and easily carried.. They are simple, have no valves, are easily blown up using a regulator or by mouth. They are very visible from a boat, so preventing divers getting lost, and from the air. However some care is needed in storage.

CONCLUSION

These tubes are now available as Safety Sausages from TL Begg and Sons Ltd, PO Box 5216, Dunedin, New Zealand. The Australian distributor is Diving Security (a branch of RJ Knight Pty Ltd), PO Box 6298, Melbourne VIC 3004.

Bob Begg's address is TL Begg and Sons Ltd.

TWO POWERLESS CHAMBERS CASE REPORTS

Douglas Walker

These two cases, taken from very widely separated sources, illustrate that arrival at a recompression chamber is not necessarily the end of the accident phase for the victim, and that chamber operation is not immune from the effects of Murphy's Law.

Case 1

While a naval diver was making a working dive to change a vessel's propeller he was crushed when it unexpectedly, and for some unknown reason, slid forwards. His tender quickly recognised that he was in trouble and the stand-by diver was sent down. He managed to pull the propeller off the victim, who was now unconscious. The victim started to sink as soon as he was freed. He was quickly hauled to the surface by his lines by the topside crew and brought into the dive boat. He was unconscious, fitting, and had suffered physical injuries so he presented them with a very urgent, serious, and difficult management problem. He was transported to a naval hospital and the staff of the recompression chamber were alerted.

His condition was deteriorating rapidly so it was decided to recompress him in the chamber despite it being unready for use because of maintenance work. The moisture separators were out of the compressed air system so it was not possible to refill the high pressure air bank by the usual means. However, the air bank had been topped up to 3,000 psi (43,050 scf) and was holding the equivalent of 1 at IATA, so it was possible to commence treatment. From here on problems plagued the operation.

An operation call for assistance brought divers from several ships. This was not an unmixed blessing as they had never practiced together for such an emergency situation. There was a malfunction of an O-ring in the high pressure valves which made it impossible to ventilate the chamber. While this was being replaced two surface supply umbilicals were rigged from a dive boat to the gauge stop in the chamber's control panel to supply low pressure air to the chamber. This proved adequate. As a precaution the local fire brigade was asked to lend their high pressure compressor, used for filling their emergency air breathing apparatus cylinders. This compressor was attached to the chamber's emergency air supply.

The treatment also was not routine, the scenario being as follows. The victim was recompressed to 50 msw (165 fsw), to where he showed a limited response. As he had not obtained a complete response by 30 minutes it was decided, by the master diver and two medical officers, to bring him to 18 msw (60 fsw) and place him on 100% oxygen. This decision was based on the uncertainty concerning the extent of his internal injuries. Two minutes after commencing on this treatment he began to improve. The treatment table was extended by three additional 25 minute periods at 18 msw (60 fsw) as he continued to show progress. Upon arrival at 9 msw (30 fsw) the patient was asymptomatic except for chest pain on inspiration.

After completing the chamber treatment the patient was transported to hospital for a complete medical examination. The chest x-ray revealed the presence of a right haemopneumothorax, mediastinal emphysema, which extended into the fight upper quadrant of the abdomen, and a pneumopericardium, so he was transferred to the care of a cardio-thoracic surgeon at another hospital. Four days after the accident a further x-ray examination revealed multiple fractured ribs and a fractured sternum. The degree of recovery he achieved from these injuries is unknown.

Case 2

The patient, a 56 year old diver, was being treated for a spinal bend when a power failure occurred. As a result the chamber operators were unable to prevent a build-up of carbon dioxide in the chamber. Through the police they contacted the diving team at a naval establishment and were supplied with a two-ton generator complete with crane. This source of emergency electrical power took 4 hours to arrive and in the meantime the diver had been given an emergency resuscitation set. Mains electricity was restored 1 hour later.