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ROYAL NAVAL DIVING magazine

"Royal Alien Navy" (*see page 9*)

Vol. 15 No. 2

2/-

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R.N. Diving Magazine

VOL. 15 SUMMER 1968, NO. 2

EDITORIAL STAFF

EDITOR'S NOTES

BETTER late than never. The late issue of the Summer Magazine is regretted and is due to the lack of material sent in.

What is not received, does not go into print, and the response to the Competition for Articles and Photographs has been disappointing to say the least. It is now intended to give more time to intending contributors, and the Closing Date for the Second Competition is now the 15th February, 1969. So how about it? You send it, and I'll print it. I will even send your photographs back.

If you didn't come to the Divers Dinner on the 17th, you missed a good night out. This was the general verdict of over two hundred who attended and heard the after dinner speeches of the well known speakers: Capt. Joe Blake and Harry Wardle, were introduced by Cmdr. P. White, S.O.D.

The bar organisation took the strain of 200 divers wanting a pint all at once very well, but as usual someone had to be last.

All I hope for next year is a few Earlier Bookings?

Never a Dull Minute

DURING a 9 month deployment east of Suez, H.M.S. *Cambrian*'s Diving Team has enjoyed an interesting and varied diet in places ranging the length and breadth of the Far East Station, including such ports as Simonstown, Mombasa, Rodriguez Is. (300 miles east of Mauritius), Gan, Geraldton, Aukland, Hong Kong, Singapore and the Isle of St. Helena.

In addition to a number of day and night 'Awkwards', the divers have answered the usual miscellany of cries for help (foul screws, blocked inlets, dome checks and so on).

During an unscheduled (well, the Captain's brother, twin at that, did happen to live there!) 13 day visit to Aukland, New Zealand, we were most impressed by the welcome shown to us, and we believe, to all other visiting R.N. ships, by the diving section of H.M. N.Z.S. *Philomel*. We were offered the free use of their very efficient and up to date equipment, including a trial of their wet suits, which are in general use in the R.N.Z.N., and which made us envious in view of the troubles we have experienced with our anything-but-dry suits in the Far East climate. Of course, the siting of our diving store atop No. 2 Boiler Room may have something to do with the rapid and almost total deterioration of these suits . . . !

Exped-wise, we have made the most of warm and clear waters, pursued crayfish and indulged in some interesting salvage.

During another unscheduled stop, (this time the Gulf tanker went 'crook' and had to limp back to Gib. instead of fuelling us on our way home) of six days at the historic and picturesque Isle of St. Helena, our services were co-opted by a small, but keen, local Sub-aqua Club led by the very genial Rhodesian Police Superintendent.

The idea was to rob a nearby wreck of her 3 ton, 4 bladed phospor-bronze propeller in order to acquire some petty cash for their club. The wreck was that of the N.Z. Shipping Company's *Papenui* which caught fire and sank in 40ft. of water.

A preliminary survey showed, apart from a gigantic looking propeller, which appeared to be very well secured on its 14 inch diameter shaft, a plethora of minor loot for the taking. Conveniently accessible was the ships store with many bottles of obviously well matured grog. Unfortunately, the 57 years of immersion had been too much for the corkage and the stuff was quite undrinkable. Also of interest was part of her cargo of coloured and embossed china tiles which have survived their ducking extraordinarily well.

The propeller looked atoug hish nut to crack, but the Captain, who has a little experience in the use of underwater explosives, thought it was worth a try. To cut a long and interesting story short, it took 3 'blows' to get the screw off the shaft using 20lbs., 25lbs., and 2lbs. of assorted fireworks to do so. If not handed to the islanders on a plate, we left them happily contemplating the raising of the, by now, 4 separate but complete blades of the propeller.

We return to the U.K. with jaundiced regard for the chill and gloom of a north European winter season, after what has been a memorable cruise.

The Team

Commander Canning, Lt. Scanes, Lt. Inskip, Mid. McClement, E.R.A.1 Hughes, Mech.1 Cook, L./S. Higginson, L.E.M. Henley, L.M.E. Thrower, A.B. Clithero and A.B. Jones.

News from the Far East Team

Royal Naval Armament Depot.

IN Singapore this year, the monsoon rains ended early and the month of February was one of the driest on record. As a result, a large number of bush fires, occurred. Firemen, trailing in the wake of one of these fires, discovered what they thought to be a mortar bomb. The F.C.D.T. were called in to investigate the find and discovered among other things a large quantity of Japanese picric cartridges and detonators. This picric was still in excellent condition and we established it was 'Ha Nai', explosive type 172 which had been manufactured in September 1939, for the Third Japanese Navy. It certainly went with a healthy bang!

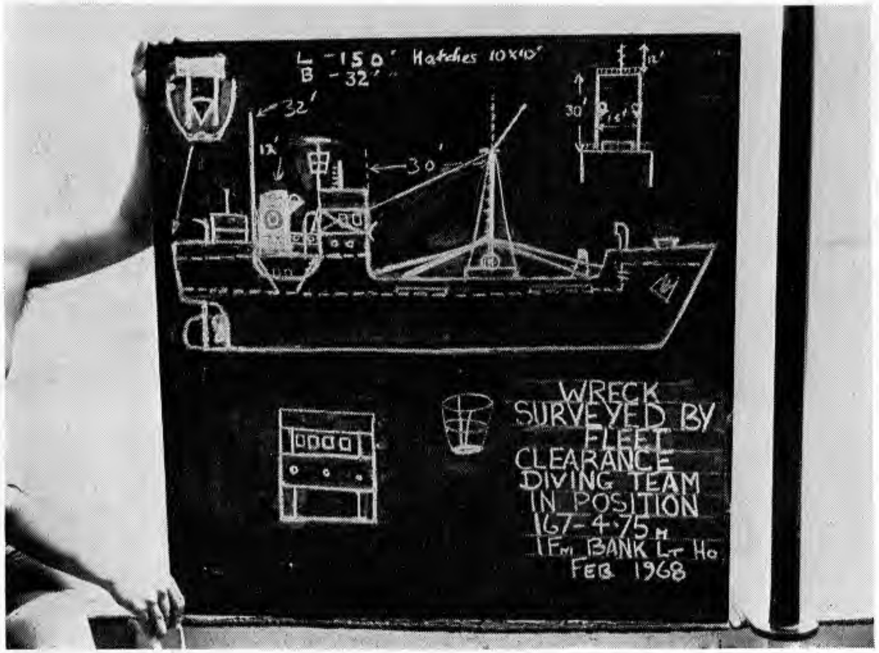
The whole area of jungle which the fire had laid waste was, in fact, strewn with gas masks, tin helmets, bayonets, thousands of tail pistols and a large number of Japanese Minesweeping floats.

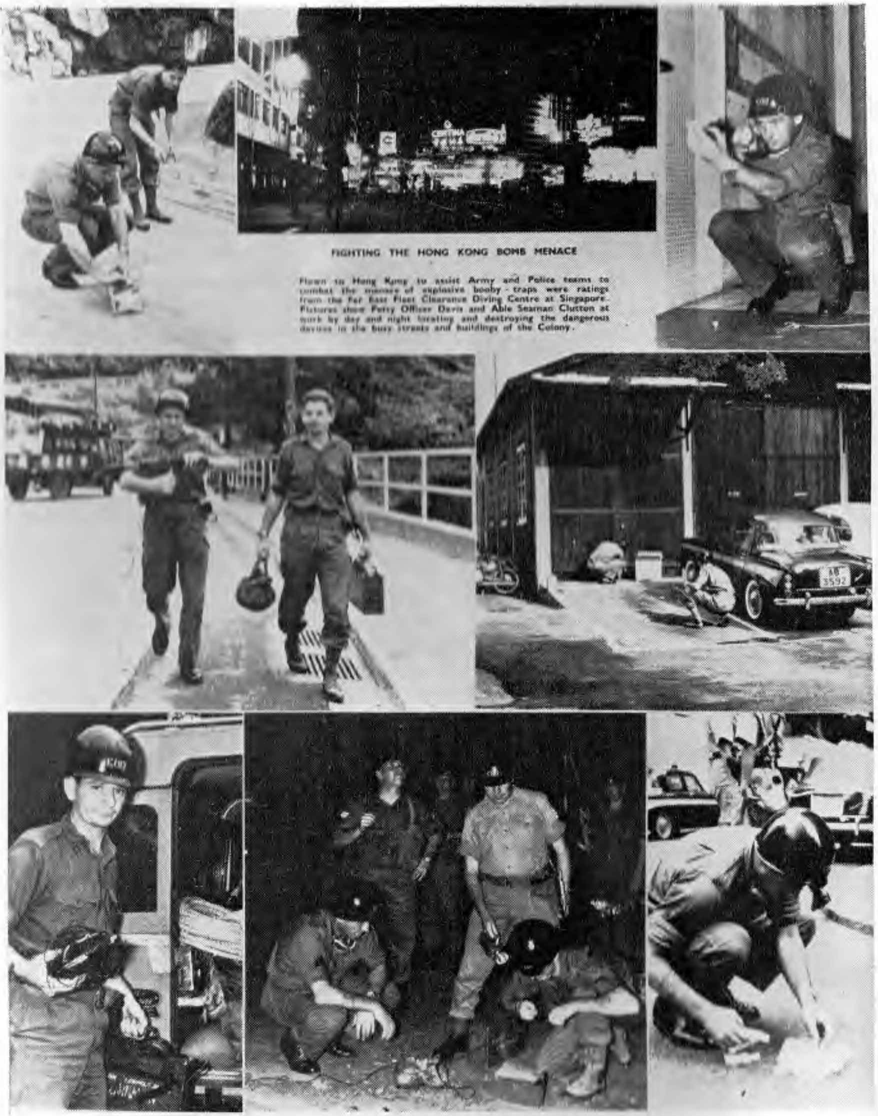
Ships Husbandry.

The team has not been neglecting its own backyard. In the last six months, we have carried out a variety of jobs in and around the dockyard area. The silent service frequently call on our services and for a couple of months the 'business' was a going concern.

Hong Kong.

Hong Kong has now quietened down, and with very few home made bombs still being placed, the team has now ceased to take an active part. All agree that the work up there was of immense value.





FIGHTING THE HONG KONG BOMB MENACE

Flown to Hong Kong to assist Army and Police teams to combat the menace of explosive booby-traps were ratings from the Far East Fleet Clearance Diving Centre at Singapore. Pictures show Petty Officer Davis and Able Seaman Clutton at work by day and night locating and destroying the dangerous devices in the busy streets and buildings of the Colony.

Jahore Bahru Grand Prix.

As part of the course ran alongside the waterfront, with a sharp bend at the end of the straight, the team volunteered to provide a unit to standby in case any of the competitors decided to take the plunge. We parked in the marshalling area and had a grandstand view of the races, which we all thoroughly enjoyed.

Putri Narrow.

The job has been with us for many years and we were recently requested to clear the foreshore near Tengah Yacht Club, of assorted ordnance, which had been dredged up illegally. In all, the team recovered nearly a thousand shells and primers. The value of mud runs suddenly became very apparent to a few—or perhaps we need more P.T.

Fairing Plates H.M.S. *Relentless*.

On arrival, *Relentless* found she had lost her dome fairing plates, so we were asked to make a pattern for a new set. (The blue-prints were not available.) To do this, a template was constructed of sheet alloy and rivetted whilst still in position on the dome housing. On completion, with the fairing plate angles correctly aligned, the template was sent to the dockyard. The new plates we are pleased to say after slight adjustment by us, fitted, much to everybody else's astonishment.

Wreck Alias Kien Kung.

In February, a few miles off Port Swettenham, we investigated a wreck, for the Singapore Government. A Chinese gentleman, who shall remain nameless, had 'pulled the plug out' and was now asking four million dollars compensation. *Sheraton*, who helped locate the wreck, laid claim to the bell, but regrettably we had to keep it, in case it was required as evidence.

Our main objectives were:—

(*a*) Identify the ship.
(*b*) Ascertain why she sank.
(*c*) Examine the cargo.

We soon built up a clear picture of the ship. It was intact, except for a slight crumple on the forward gunwhale. The wireless operators log indicated to us that it was a Japanese vessel, but we found more evidence of this in the Captains cabin—a large saki bottle—empty! As the engine room housed one very large grouper, we never did find out if the main engine room sea cocks were open!

Beach Clearance—Canoe Style.

Now that the blisters are healing and I can hold a pen again, a few words on a recent exercise. Someone said that divers can improvise with anything to acquire the desired result, and the two canoes that we outfitted lent truth to that statement. With each canoe carrying a very full load of very miscellaneous equipment, not to mention the reluctant canoeists, who, when dressed for the part looked like escapees from the 'Black and White Minstrels' the total effect was like 'Steptoes Cart.'

Four miles of paddling brought out the sweat-and blisters! But all went well until No. 2 entered the water with a 40 pound sinker. He then discovered just how fast you can run on the bottom in 10 feet of water carrying same. A slight miscalculation in depth—and Archimedes Principle!

Diving Accident

IT is with regret that we announce the death of 34 years old Ex-Shipwright Art Diver Trevor Taylor who was well known in the diving world and served in H.M.S. *Kingfisher* during his service.

He died while diving from the oil rig *Glomar IV*, off Fernando Po., Spanish Guinea in strange circumstances. According to the Diving Superintendent of the rig, the diver reported his air-line had become fouled and a scream and metallic noises came from the phone before it went dead.

The body was discovered at 180ft. with the arms outstretched and the diving suit inflated 'like a balloon' There was no sign of the divers weight belt. The coroner recorded an open verdict.

Royal Alien Navy

San Diego,
California, U.S.A.
July, 1968.

ON January 10th of this year, Lieutenant Cyril F. Lafferty, R.N., and I flew to Washington, D.C. to take part in the U.S. Navy Project, SEALAB III. We arrived at about 2200, and within a few hours had moved into apartments with our American counterparts. I was made welcome with a glass of Bourbon and a hot sandwich, a combination I would learn to enjoy in time.

Within the month, we were joined by the other members of the Alien Navy, Lieutenant-Commander L. M. La Fontaine, R.C.N., Leading Seaman (C.D.), W. P. Lukeman, R.C.N., and Lieutenant-Commander M. F. Shotter, R.A.N.

When we arrived at the Experimental Unit in Washington, they were in the middle of a saturation dive to 600 feet, in which they were carrying out various physiological studies, and after a couple of days to acquaint ourselves with the chamber and associated equipment, we joined the watch-bill.

We remained in Washington until late February, during which time two saturation runs were made; the first to 600 feet; the second with an excursion to 1,025 feet for thirteen minutes, which established a world record for depth.

The schedule for this dive was as follows:—

(*a*) 0–600 feet—15 hours
at 600 feet—27 hours
Excursion to 825 feet—20 minutes
Return to 600 feet for three hours
600–825 feet—5½ hours
at 825 feet—26 hours
Excursion to 1,025 feet—13 minutes
Return to 825 feet for 24 hours
825 feet to surface—8½days.

(*b*) The decompression routine was as follows:—
825–795 feet at 1 ft./min.
795–surface at 4 ft./hour
With 2 hour stops at 750, 600, 450 and 300 feet; and 4 hour stops at 150, 100 and 50 feet.

The dive was a complete success and the divers Lugo and Risk carried out their assigned tasks confidently.

On 25th February, the Alien Navy moved to the Underwater Swimmers School at Key West, Florida, for an acquaintance course with the United States Navy's Mk. Six Mixed Gas Diving Gear. Whilst at Key West, we met up with Lieutenant-Commander James Majendie, who was on course at the school. He was down from his Explosive Ordnance Demolition job at Indian Head, Maryland, which is near Washington, D.C.

The Americans are P.T. fanatics, and I actually saw him on the P.T. field (once or twice).

We spent three weeks at the Underwater Swimmers School, and it was a pleasant change from the freezing temperatures of Washington; the visit being marred by Lieutenant-Commander Shotter being involved in an automobile accident, resulting in his removal from the project. He is up and about at this moment, working with the Australian Naval Attache in Washington and doing well. We wish him all the best for his future and hope to see him again soon.

On our return to Washington, we had a week before Lieutenant Lafferty and I started our saturation dive; during which we had our pre-dive Medicals and took our base-line tests for the studies and tests we were to make on the dive.

Our dive started on Wednesday, 20th March, reaching 600 feet early Thursday morning. After spending twelve hours at depth, we made the excursion to 750 feet for one hour. We left 600 feet on Friday evening and reached surface 0730 Friday, 29th March. Unfortunately, I earned myself a further 18½ hours in the chamber because of a slight disagreement with my knee.

The weekend was spent saying farewell to friends in Washington prior to moving to San Diego on Tuesday, 2nd April.

Since arriving here we have been joined by Lieutenant R. R. Sutton, R.A.N., who takes Lieutenant-Commander Shotter's place. He had a pier head jump on completion of his M.C.D.O. conversion course, and arrived in Washington in time to participate in the last saturation dive with the Canadian complement of the Alien Navy.

We have spent a lot of time training in the equipment to be used during the SEALAB experiment. The training is broken into three phases:—

Phase I—

at San Diego with aquanaut equipment, and carried on till the end of July.

Phase II—

at San Francisco during August on the Habitat, Decompression Chamber Transfer Chamber and Support Ship.

The Royal Alien Navy at U.N. Swim School, Key West, Florida.

From Left to Right:

A Model on a Shark !!

P.O. C.D.1 Clark Lt. Lafferty C.D.O., R.N. Lt.Cdr. Shotter C.D.O., R.A.N. L.S.C.D. Lukeman R.C.N. Lt.Cdr. LaFontaine C.D.O., R.C.N.

Phase III—

at Long Beach during September on procedures, working up to a shallow water dress rehearsal with all systems.

At the time of this writing, we have just completed a month's training of the civilian participants, in which Lieutenant Lafferty and I were actively engaged on the training side, Lieutenant Lafferty being Assistant Training Officer.

The teams have been tentatively chosen, and Lieutenant Lafferty has got the job of Team Leader for Number Four Team. With him is Lieutenant Sutton; Lt.-Commander La Fontaine is on Team Number Five and Bill Lukeman and I are on the list of alternates.

Reference the article, 'Dip Chick in California' in Volume 15, Number 1; I would like Lt.-Commander Hickson to meet some of our U.S. Navy men. He would, I am sure, change his remark, 'The average U.S. Navy man participates in very little violent sport and eats extremely well'. A week of our 'mountain' and P.T. would soon change his mind; and if any of you could run on our mountain run, you too would call it a 'violent sport'.

Our normal daily routine usually goes like this:—

0700—Muster
0710—P.T. and Run
0815—Prepare gear for dive
0900–1400—Diving
1430—Lecture
1600—Secure.

The P.T., of course, is the hardest to get used to. It hurt when we started; it still hurts now, but it doesn't take one so long to recover.

We have been lucky enough to have our families join us over here, and each weekend, I don my tourist hat and take a look at some place one normally would only expect to read about: Disneyland, which has a lot to offer and not only for the kids; Marineland with its trained dolphins, whales and seals; then the inexpensive trip up into the mountains or to the desert; all within an hour's drive from San Diego.

We had a pleasant surprise in June when S.O.D. visited is with four British industrialists, amongst whom was the familiar figure of Harry Wardle, who was looking very prosperous. Unfortunately, the visit had to be short and sweet. Earlier, during mid-May, H.M.S. *Fife* paid a visit to San Diego, and I just happened to find myself aboard at the 'right time', and was made very welcome by a most sociable P.O's mess, amongst whom, who should I find but Vic Humphreys. I can assure you a pleasant couple of days were spent 'discussing Diving'. (hic). Vic hopes to be returning to the United Kingdom around Christmas via the States, and we hope to meet up in San Francisco, later this year.

Lieutenant Lafferty and I sent our regards to all, especially those in 'Jannerland', from whom we departed with such a hangover; or something.

Yours Aye,

NOBBY.

ACTING SUB-LIEUTENANT J. C. WRIGHT, R.N.

Ex-Clearance Diver 1 received a sword at the S.D. Officers School, H.M.S. St. George, for gaining the best marks on course. He also gained two book prizes in seamanship and navigation. His marks were the highest yet given to a candicate since the school opened five years ago.

Selab III.

OPERATION Selab III is due to commence in October 1968. It will consist of an underwater house (habitat) being lowered to 600ft. off San Clemente Island, near the coast of California. It is planned that 5 teams of 8 men will live in the habitat for 12 days each and each team will require about 7 days decompression.

By the extraordinarily generous invitation of the United States Navy, five foreign divers are taking part in this programme. There are two from Canada, one from Australia, and two, Lieutenant C. F. Lafferty and Petty Officer D. J. Clark, from England. Of these, it is expected that three will take part in the sea dives and the rest will be employed as surface support team members.

The five teams diving will each have specific tasks to perform and we expect them to be as follows:—

- Team 1 Physiological Tests.
- Team 2 Construction Programme.
- Team 3. Salvage Programme
- Team 4 Oceanographic Tests.
- Team 5 Animal Training and Tests.

The construction programme will test the feasibility of building temporary underwater refuges and working habitats to enable teams of divers to work on a job in a gas atmosphere. These habitats would be built round the job on hand and then evacuated of water.

The Salvage team will test methods of salvaging large objects, such as aircraft and submarines with modern techniques from these depths.

The Oceanographic team will undertake a large series of oceanographic and biological studies for various institutes.

The Animal team will work with a variety of animals—dolphins, seals and sea lions—to assess the value of animals to assist divers in their various tasks.

However, the overiding object of the whole experiment will be to see if man can function normally and perform useful functions for prolonged periods at these depths.

We have already undertaken several long 'saturation' dives in the compression chambers in Washington. The most outstanding of these was one in which 5 men 'saturated' at 825ft. and then two of the team went on down to 1,025ft. for 13 mins. This dive established a world record for chamber dives, though it was quickly followed by American and French teams to 1,100ft.

This dive was followed by one in which Clark and Lafferty saturated to 600ft. with the two of us 'excurting' to 750ft. for one hour with no stops on the way back to 600ft. The total length of this dive was 9 days which, believe me, is quite long enough to be stewed in a 'pot'!

For those of you who, like me, believed that wet suits were only useful in shallow water, have another think. I have seen them now in use at 1,025ft. After a few hours at depth, the rubber absorbs sufficient gas to re-assume its thickness to nearly normal size. A slightly larger suit than your normal size is advisable, and, because of the reduced thickness of the material, the insulating properties are not as efficient as normal. Because the temperature of the water at 600ft. is expected to be about 40 degrees F., we require added insulation. We will use various types of heated undersuits, including two types of hot water suits, one was originally designed as a cooling suit for astronauts. I have personally used it for 3 hours in 40°F. water and was if anything too warm. In addition, we have an undersuit, which is electrically heated, and works like an electric blanket.

There are several methods of heating the water for the suits to be used, but the most revolutionary method is one in which the diver will carry a small battery operated pump, which will circulate water through a small nuclear powered heater, which he will also carry with him.

One of our major problems has been masks for the divers, For some of the projects, good communications with the diver are going to be essential. So far, the most successful mask we have used is a helmet, which looks rather like a spacemans helmet. This employs an oral-nasal mask which allows the diver to speak freely without a mouthpiece, and which, despite its cumbersome look, is extremely comfortable.

Communications with helium, of course, is always a problem, and for this series of dives, several unscramblers have been developed. Their effectiveness is still rather limited as no diver has yet learned how to form words correctly while breathing helium, and, where it is easy to correct the note the diver produces, it is almost impossible to correct badly formed sounds. It seems to me that we are unable to adjust our speech to the fast flowing lighter gas and are trying to make the correct movements with lips, tongue and mouth after the gas has passed. However, the unscramblers do help a great deal, and in addition to this, we will be able to use an electronic writing pad, which will write our message on the surface as we write in the habitat. Of course, everything the diver does will be monitored over closed circuit television.

The diving set we are using is called the Mk. 8. It is a semi-closed circuit mixed gas set, and is, in effect, a highly sophisticated C.D.B.A. The diver will be supplied with gas primarily through an umbilical hose and his bottles will serve purely as an emergency reserve. They should, however, give the diver about 1 hour at 600ft. The set weighs 135lb., and it is large and difficult to handle, though surprisingly comfortable in the water. The divers breathing bags will be monitored in the habitat so that the gas content in the bags is known by the supervisor. In this way, the supervisor will know long before the diver if the CO_2 or He levels are rising and he can inform the diver to 'by-pass' or to recall him before an accident occurs. In addition, the set will, through the umbilical give the diver power for his communications, light and electrically heated suit, or hot water for his hot water suit.

This particular set is now being used because it is the most reliable and well tested set we have. In addition, it has to be used because, if an open circuit set were used, we would be unable to store sufficient helium at the diving site to supply the divers. However, there are other sets under development for future use. The most exciting of these is a closed-circuit cryogenic unit which only weighs 50lbs. It will supply a diver at 1,000ft. with gas for 7 hours and can be used at any depth. Its endurance at shallow depths is almost indefinite and it automatically supplies the correct gas mixture to suit the divers depth. In addition, the gas supplied is automatically purified and any foreign gas is eliminated. There are no moving parts, no danger of flooding, no CO_2 canister or breathing bags. I know it sounds like space fiction but I am assured it is all true.

Sealab III is not intended to be the ultimate experiment, but is just one in a long series of tests over the next few years, with depths of 1,000ft., and possibly more, well within the realms of possibility. It is an ambitious, imaginative and exciting programme, and it is a great thrill to be able to help to direct the future of diving into the modern, sophisticated world where ideas and equipment will be designed for the specific task in hand. Let us hope that with the foresight and skill displayed by the instigators of the Sealab programme such as Captain Walter Mazzone, M.S.C., U.S.N. and Captain George Bond, U.S.N. they have driven that dreaded sentence from the divers vocabulary 'Well it has worked for 20 years, why change it now.'

News from the Med.

Having taken over from John Gratton in March, I feel that it is time our readers were brought up to date on the Malta Clearance Diving Team, and also, to let you know what the team has been up to during the past few months.

Contrary to what many people think, the team is still based at Manoel Island, and in recent months the work load has increased tremendously, and, as a result, the team have done a great deal of travelling and undertaken a variety of diving jobs. We spend a good deal of time away from Malta on N.A.T.O. exercises, and, so far this year, have been to Italy and Crete, with Greece and Turkey yet to come. Other diving tasks have taken members of the team to Cyprus and Tobruk.

In Malta itself, the E.O.D. task is far from finished. Very rarely does a day pass when our searching does not produce some form of unexploded ordnance. Amongst items found last month were a 4,000lb. German 'Satan' and two German buoyant mines, a G.Z. and a G.T. Another task, that takes up much of our time and effort, is the removal of shells, depth charges and the like from the wrecks in Grand Harbour. At present, we are working on the wrecks of two destroyers near the harbour entrance, and, although work on one is nearly finished, the other will keep us busy for some time.

In the sporting field, we have decided that we shall compete at football and volleyball. Our first football match was played last week against one of the minesweepers and we ran out winners by 4-1. Volleyball, we have tended to play amongst ourselves, but as we have constructed our own pitch next to the store, there is ample opportunity to play.

It is generally well-known, that the future composition of the team is under review, but whatever decision is taken on this issue, there remains plenty of work to do in Malta and we hope that it will continue to be complemented as a Fleet Team.

The present team is as follows:—

Lt.-Cdr. Parry.
Lt. Bartlett.
P.O. C.D.1. Slingsby.
P.O. C.D.1. Newman.
P.O. C.D.2. Neave.
P.O. C.D.2. North.
P.O. C.D.2. Dadd.
L.S. C.D.2. Shea.
L.S. C.D.2. Flynn.
A.B. C.D.2. Curtin.
A.B. C.D.2. Roberts.
A.B. ShD. Bryant.

H.M.S. *Minerva*

ON completion of building and commissioning in Newcastle in May 1966 we moved down to Portsmouth for six weeks of acceptance trials. This period afforded a grand opportunity for welding together the nine members of the diving team. We sensibly began at Horsea Island, where we unpacked our hoses, connected up our S.D.D.E. and panels, charged up our S.A.B.A. sets and leapt into the water for a day of getting used to each other.

In October, we found ourselves in Portland for our work-up but by then we had been working together for some time and all went smoothly. We sailed from England on 30th January 1967 for a year in the Far East. Throughout the year, we had some excellent diving, particularly in Mombasa. In Subic Bay, we were able to get in a 120 feet dip and in Hong Kong, we just missed diving on an aircraft which had missed the runway. As luck would have it, the Far East C.D. team got there first. Our more operational dives included diving on *Nubian*'s wasp which ditched off Mombasa. *Minerva* being faster than *Nubian*, arrived at the scene first and the T.A.S. Officer, Lt. Harrison, went in to secure a rope around the rotor head and collect our wet mail that the pilot had carelessly left in the half submerged helicopter. *Nubian*'s team, complete, arrived eventually and took over for the lifting of the beast.

We had a similar job with *Ajax*'s wasp which ditched in the Johore Straits whilst ferrying our weeks mail. By the time we arrived, the beast had been underwater for an hour with the mail stowed inside. The depth was only 16 feet, but the helo was well broken and we spent two hours securing lifting strops and searching for bits and pieces whilst cursing the Air-arm and crying over the large bags of sodden mail.

In January, we returned to U.K. and vanished to Chatham, where we stayed for three months having a turbine change. During this period we all managed to keep in practice sawing through logs and piping in the mud and oil of No. 2 Basin. In May we again sailed from U.K. This time we finished up in the West Indies with a team of only six, now reduced to five. Diving here is superb in spite of the shark and evil looking baracuda.

St. Vincent has so far proved to be our best visit as far as diving is concerned. A charming blonde Marine Biologist, befriended by another equally charming resident blonde, were involved in diving for a bronze cannon believed to belong to the Man-Of-War *Cornwall*. On sight, we immediately offered our assistance and spent a glorious day diving, although we did not find the cannon. We did, however, find three clay smoking pipes which have subsequently been dated—one was 1730, another 1840 and the third is probably 1870. Some of the pottery recovered was the first glazed earthenware made in England in the late 1700's. We are due to return to St. Vincent later in the year and our diving blondes are going to be there to meet us.

In St. Lucia two of our divers were put down to recover a fishing net snagged on coral at 100 feet. They are rather valuable nets as the locals hire them and hardly ever manage to net enough fish to buy them from the government. Needless to say the locals were very relieved to get them back and rum and our two divers were flowing through the streets that night.

We have managed to dive in most places out here, and have been able to create a good deal of interest in this great 'sport' by way of exped. diving.

The other day, our equipment maintainer O.E.A. Tickner, shortly to join *Safeguard*, who was heard to say 'a pack of wild horses wouldn't get me under the water', had his first dip in 33 years. He stayed under, with controlled breathing, for a whole $5\frac{1}{2}$ minutes, and it is rumoured it was the wettest he had been, since the after bathroom flooded in the Iron Duke.

Our Honours list is as follows:—

Lt. Davison, Diving Officer and Blonde Liason.

Lt. Plumb Assistant Diving Officer thinking of his pension.

P.O. Farnell Ex. D.2. and story teller (flanneling B*****.)

L.S.A. Wilson, Stores fiddler.

L.S. Haywood, Dhobey Wallah and Assistant Blonde Liason.

R.O.2. Goff, Diving Yeoman and only member of the team fitted with gills instead of lungs. A future C.D. we hope.

G.S.D.

The following article is reproduced from the July issue of the Royal Naval Scientific Services Journal.

Safety and Medical Aspects of Deep Diving

by SURGEON LIEUTENANT-COMMANDER D. H. ELLIOTT, M.B., D.Phil., R.N.,
Royal Naval Physiological Laboratory.

THERE are many aspects to deep diving safety, but for the purposes of this brief review we are concerned with only the human aspects. I am not going to cover those associated with the problems of seamanship and of engineering. Before we outline the basic principles of safety, I think it would be wise just to summarize very briefly the hazards of diving.

THE HAZARDS

The Direct Effects of Pressure

The body behaves as a fluid, with the exception of those spaces which contain air. Therefore only the air-containing spaces are affected by pressure and provided that the body is supplied with gas compressed to the pressure of the depth of the diver, then no untoward effect will occur.

Compression Barotrauma. If for some reason an air space is isolated then during compression the gases within will obey Boyle's law and cause distortion of the surrounding tissues. This affects the sinuses, the teeth, the ears and, under particular conditions of standard diving, the entire chest, a 'squeeze'.

Decompression Barotrauma. On decompression there is an expansion of the gases in all the air-containing spaces and, again, provided the openings to these spaces are patent the expanded gas is able to vent from the body quite safely. If the gas is trapped in the lungs the effects can be fatal. It may rupture the lungs and may lead to intravascular bubbles of gas lodging in the brain and causing death.

Increased Gas Density. A third direct effect of pressure is the increased density of the gas. At 10 atmospheres absolute, 300 feet of sea water, the density of the gas is increased ten-fold and this puts an extra load upon the lungs. Bodily effort is limited by the breathing capacity of the individual and the secondary effects within the body lead to disorientation and possibly an accident.

Indirect Effects of Pressure

The second main category of hazards are the indirect effects of pressure, the effects of the so-called inert gases, nitrogen, helium and even hydrogen. Acute oxygen poisoning leads to epileptic fits and long-term oxygen posioning leads to damage of the lungs. You have also been told about the uptake of inert gas by the body and thus the importance of adhering to calculated decompression schedules. Decompression sickness will still occur in spite of such schedules, though to a lesser incidence than without them, following nearly all deep diving.

The final indirect effect of pressure is that prolonged exposure to pressure will cause an alteration in certain constituents of the blood.

Effects of Breathing Apparatus

The third group of hazards are those due to particular forms of breathing apparatus; here I am considering only the semi-closed re-breathing apparatus which is commonly used to conserve oxy-helium gas. We have used open-circuit apparatus because each exhaled breath is passed straight into the sea and each inhaled breath is therefore of pure, fresh oxy-helium. In the semi-closed apparatus however the carbon dioxide is removed by soda lime and a further flow of gas replenishes the oxygen used. In these forms of apparatus there are therefore additional hazards, carbon dioxide poisoning and, secondly, hypoxia which causes a loss of consciousness with no warning.

The Physical Effects

The physical hazards include *verbal communications*. There is not only a distortion effect due to pressure itself but also an effect which is specific to helium. Good verbal communication from the diver to the surface is essential. *Fire risks*, due to the high partial pressures of oxygen, need to be considered. *Neutral buoyancy* is not exactly a hazard and is most important because it affects the ergonomics of work underwater, but it is important as a contributory factor because if vertigo occurs underwater, particularly with the usual poor visibility, the seeming weightlessness gives the diver no bodly sensations of position and has, on occasion, led to disorientation and thus accidents. The final effect of the sea is that of *extreme cold* against which of course the diver must be protected. For dives of worthwhile duration it is necessary to discuss the designs of heated suits.

SAFETY

Before the Dive

Pre-selection Tests. Is there any value in pre-selection tests? Particularly for oxygen poisoning or bends? The answer, regretfully, is no. Most deep divers are chosen by the process of natural selection. From the divers with whom one has to deal the unsuitable candidates have already gone.

Annual Medical Examination. The diver must be fit enough to undertake hard physical exercise and he must also be fit to go under pressure. His teeth, sinuses, ears and chest X-ray must all be normal. There is also the need for psychological fitness, the ability to remain clear-headed under extremes of stress, but in my opinion there is no requirement for the medical practitioner to assess this. It is part of the natural selection which is already complete.

Special Investigations. There are certain investigations required of every deep diver in order to have them available as a base line for some future occasion. The electroencephalogram, the audiogram and X-rays of the joints and long bones are needed.

Immediate Pre-Dive Check. One must ensure that the diver has no upper respiratory tract infection and is not suffering from the dehydrative effects of excessive alcohol. He should be in a good state of physical training and also, perhaps, in the state of diving 'work-up'.

During the Dive

Stand-by Diver. The first safety consideration is best illustrated by an actual incident. Using open-circuit apparatus, so there was no question of any CO[2] build-up due to the use of inadequate or inefficient soda lime, two divers were working extremely hard at about 360 feet on oxy-helium. Both suffered the same unusual effect, both became quite unable to help themselves particularly when they were to a certain degree fouled with their hoses. It took some minutes of rest before the divers were capable of assisting each other.

This demonstrated that when two men are sent down in a submersible chamber, one should go out to do whatever work is required and the second should remain within the submersible chamber ready to assist the first should he require it.

Communications. The second consideration, which on that occasion we had previously insisted upon, is that of efficient communications. When deep

diving is done there shall be at least a closed circuit television camera with a wide angled lens in the submersible chamber so that if surface control wishes to ask a question the divers can be seen to make a visual response. There is no doubt that the presense of this facility minimized the seriousness of this particular incident. Eventually electronic unscramblers will be available to reconstitute oxy-helium speech but until then we must rely on codes such as hammer taps and on visual communications.

pressure and 2 atmospheres pressure for short exposures, but since most deep diving is prolonged the upper limit of oxygen should be 0·4 atmospheres. Although a maximum partial pressure of carbon dioxide of 0·03 atmospheres is acceptable under certain conditions, nevertheless an upper limit of 0·01 atmospheres (*i.e.* 1% of one atmosphere, surface equivalent) is considered to be a reasonable limit to insist upon. This requires *an efficient scrubber*, the design of which presents some problems in an atmosphere which must be kept free of

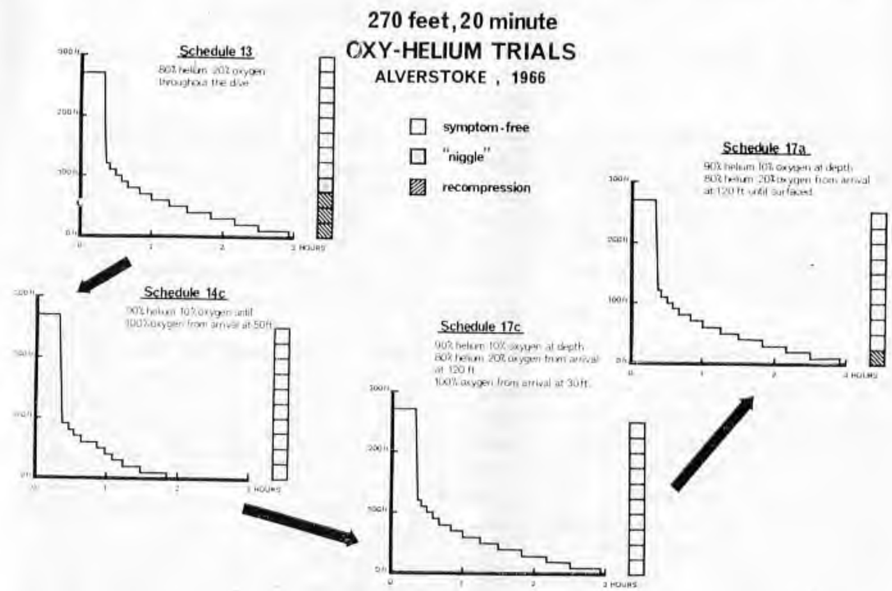


FIG. 1.

Atmosphere Control. When the diver is no longer in the water he discards his breathing apparatus and decompresses with his attendant, breathing chamber atmosphere. The engineers will describe in more detail with the principles of controlling an atmosphere within fine limits. At this stage it is merely necessary to point out that the oxygen should be between at least 0·2 of one atmosphere

electric motors. It also presents the problem of *accurate analysis* because it means that due to the expansion of a sample of gas from, for instance, 600 feet one must be able to analyse accurately 0·05% carbon dioxide. On prolonged decompressions we must also insist upon a controlled environmental temperature because oxy-helium has a very high thermal conductivity and less

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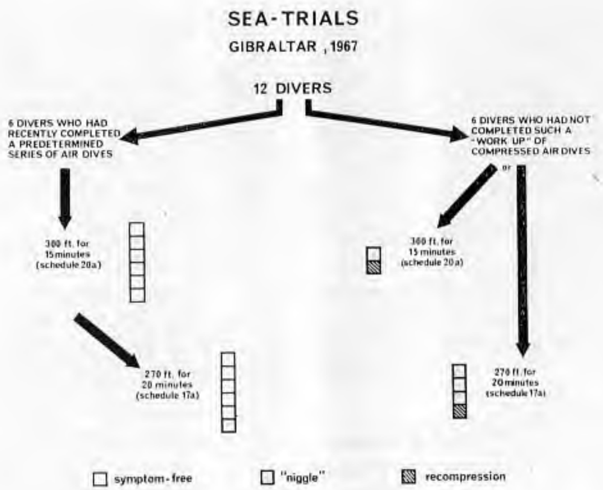


FIG. 2.

than 82°F. is considered by the divers to be cool. Humidity is therefore another factor which must be controlled and a compromise between man's requirement and the efficient scrubbing of CO^2, aims to achieve a relative humidity of around 75%.

Decompression Sickness

Contributory Factors. The design of decompression schedules has already been described and mention has been made of the inevitable incidence of decompression sickness on all dives below about three or four hundred feet. There are also some factors which are believed to influence this incidence and, of course, the estimate of depth must be accurate and the supervisor must adhere to the decompression table selected. The significance of the different factors which affect the safety of decompression schedules is illustrated in Fig. 1. Thus a three hour decompression from a 270 feet, 20 minute dive gave a 30% incidence of bends. By changing the various factors such as work-load, gas mixtures, water temperature and 'work-up' it was possible to decompress from the same exposure quite safely on a two hour schedule. Then, on another three hour schedule from the same exposure but using oxygen on the shallow stops, there was again no case of decompression sickness. The final dive of the group of four, 17a, shows the same schedule as was used originally, 13, in fact with a slightly greater partial pressure of inert gas, and only one bend out of 10 dives. The results show that variation of these other factors can affect the success of a given decompression time-course. Similar dives were taken to sea (Fig. 2) and six divers who had a predetermined 'work-up' of air dives had only one incident in 12 dives, whereas six other divers, who had not done the 'work-up' but who were subjected to the same conditions in the water, all had some kind of trouble. It is important to remind you that no matter how good any table, the variation between different divers is so great that there is inevitably a very small incidence of decompression sickness on every table.

Long Term Effects of Decompression. About aseptic bone necrosis we know little. From compressed air workers it is known to be more common in those who have been treated for decompression sickness than for those who have not. The incidence of bone necrosis in those who are deep sea divers is not yet known.

Treatment of Acute Decompression Sickness. If decompression sickness occurs then it is necessary to recompress the diver in order to shrink the size of the bubble causing the lesion and to bring the diver back to the surface very slowly in order to give the body time to get rid of the excess inert gas. The treatment must be thorough and the depth of recompression must be to at least the depth of complete relief of symptoms. Adequate treatment should ensure that the diver returns to the surface 100% fit. There are a number of cases, not of Royal Navy divers, in whom treatment has been inadequate and who now suffer from permanent paralysis or other damage. The correct treatment of decompression sickness is therefore very important but today we shall consider only the basic requirements of recompression therapy. If the bend begins on the surface the patient is recompressed with compressed air, breathing either the compressed air in the chamber or oxygen from a mask. The maximum depth which this is normally taken to is 165 feet although on occasions 230 feet have been used quite successfully. However occasionally such depths are inadequate to secure a complete cure and there are occasions when one would like to take the diver deeper. Compressed air is no longer suitable because it is toxic at greater depths. Therefore, for decompression sickness following deep dives, as well as for those cases of decompression sickness that may arise during the decompression while the diver is still on oxy-helium from his original dive, divers occasionally need to be recompressed breathing oxy-helium. One can breathe oxy-helium from a mask while sitting in the compressed air environment but 300 feet is considered to be the limit of this. This is because the mask cannot be tolerated for more than a few hours and because a patient with labyrinthine decompression sickness may vomit and therefore be unable to breathe from his mask. It is essential to be able to recompress the diver in a chamber at the surface to at least the depth of his original dive. This is the minimum requirement because there have been occasions when the diver has had to be recompressed to depths considerably in excess of his original dive, for instance, 450 feet depth of relief had followed a 400 feet dive.

Again with deep recompression therapy there is the need for complete and accurate *control of the oxy-helium atmosphere* within the chamber and the need for closed circuit television to supervise the diver. There is also the need for the recompression chamber or deck chamber and the submersible chamber to be able to withstand the maximum pressure to which the diver has been subjected.

Sea Trials of New Diving Tables. It is because of the risks of severe cases of decompression sickness that we must be meticulous about the careful trials of all proposed new decompression tables. It is the convention in the Royal Navy that we will accept a dive for testing in the sea only when 10 individuals have completed that dive successfully in a dry chamber or preferably in the wet section of a pressure chamber. The sample of 10 individuals is accepted as the minimum number only because of the difficulty in allocating men and time to this task. At least 30 divers are needed to achieve an answer that is going to be statistically significant and even with this number, biological variation is such that the results might still be inconclusive. On completion of the compression chamber trials the new tables are taken for trials at sea, and again at least 10 individuals must dive successfully on each selected dive of the table. These trial dives are very carefully supervised, making certain that the depths are accurately recorded, that the diver works to a certain physical standard, that the diver has fulfilled certain conditions of pre-dive 'work-up'. Nearly always it is found, for reasons which are not wholly understood, that trials which have been successful in the laboratory may give an unacceptedly high incidence of decompression sickness in the sea. It is for this reason that we insist that all new decompression tables must be tested not only in the laboratory but also *in the sea* before being released for operational use. It is also important that not only for trial dives but also for operational oxy-helium dives that a suitable recompression chamber, as already defined, is available.

Promotions and Advancements

To Sub.-Lt. (S.D.) (M.C.D.):

Sub.-Lt. Lusty
Sub.-Lt. Wright
Sub.-Lt. Pilling

To Chief Petty Officer:

C.P.O. Gibson, C.D.1
C.P.O. Atkinson, C.D.1
C.P.O. Haines, C.D.1

To A./Petty Officer:

P.O. P. Edge, C.D.2
P.O. N. Slingsby, C.D.2
P.O. C. Ballinger, C.D.2

To C.D.2:

P.O. J. Cook
R.O. M. Murphy
L.S. Hutchinson
A.B. K. Reynolds
L.S. B. Barnard
A.B. D. W. Stone
A.B. M. Ward
A.B. M. Kester
A.B. G. Hadley
A.B. P. R. Goldsmith
A.B. A. Lettice
A.B. M. Buoy
M.E. C. Coldwell
N.A. P. Plevey
A.B. J. Stevenson
A.B. Egginton
L.S. P. Still
L.S. A. Reed
A.B. J. B. Fisher
M.E. R. Eastman
A.B. I. Morrison
L.S. Prictor
A.B. C. Parker
A.B. R. C. Imray
L.S. D. Hilton
A.B. D. Howson
R.E.M. P. Robinson
N.A. D. Gillard
M.E. P. Heald

Historic Wrecks in the Solent Area

PART III

AFTER about 1650, information regarding warships from documentary sources becomes more frequent, and by 1700 is virtually complete. After that date, shipbuilders' plans and scale models are plentiful, and shortly afterwards, actual ships begin to be preserved, of which the *Victory*, laid down in 1759, is the earliest. Administrative records are also plentiful, ranging from gun-states to the names of all the officers and crew; and these are frequently amplified by narratives which tell us almost everything we want to know about life at sea at the relevant times. All we can expect to learn from ships wrecked after 1700 is some minor detail. There is only one possible exception locally.

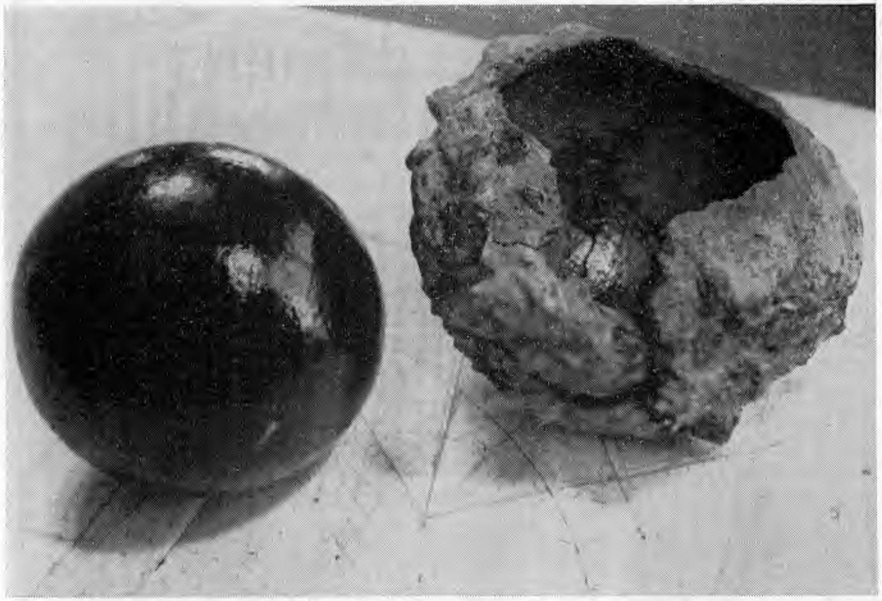
EDGAR, 70 GUNS, BUILT BRISTOL 1668, BLOWN UP AT SPITHEAD, 1711

While Tudor ships were severely functional, a note of gaiety being struck by means of paintwork and banners only, the European warship of the 17th century blossomed out with elaborate carvings and scrollwork, as evidenced by numerous paintings and of course the *Vasa*, built in 1628. These 'capital' ships are really large galleons, and the stern decorations are art concealing, not art, but the officers' latrines. The openwork of the beakhead at the bow served the same purpose, more uncomfortably, for the crew.

The end of the *Edgar* is a matter of some mystery, as she was destroyed by internal explosion while some important documents concerning the failure of an attempt upon French Canada were, surprisingly, still on board although the Admiral had gone to London to report. Between 400 and 500 lives were lost when she blew up on 16th October, 1711. Magazine explosions are of course always a hazard and the destruction is usually so complete that the cause is difficult to ascertain in retrospect.

For many years the wreck was buoyed and shown on Admiralty charts. the marked depths varying from 75 to 78 feet. Colonel Pasley had a nibble at her guns on several occasions, in the hope that they might be brass—alas, they were iron—and finally claimed to have destroyed the wreck in 1844. On 23rd May of that year, his divers located the main body of the wreck, which was the midships section, the bows and stern having apparently been blown off by the magazine explosions. The visibility was exceptionally good that day and Corporal Richard P. Jones was presented with the spectacle of the wreck standing two gundecks high, to a height of 13½ feet off the seabed. the muzzles of about a dozen guns arrayed in two tiers, pointing out from the ports 'as if ready for battle'. The woodwork was in a fragile condition, however, and the cannon could literally be hauled up straight through the docks. The guns were heavily covered in concretion, but were still in recognisable shape. At that time the ship had been under the sea for 133 years.

This seems extraordinary, when one recalls the dictums of the early pioneers in the Mediterranean, such as Cousteau and Dumas, who stated that wood did not last longer thean 20 yars, and iron, no more than 60 years. Even as recently as 1967, a science journalist, Angela Croome, writing in the *Daily Telegraph*, declared that 'all organic material will have vanished within 40 years'. Like the early French, she was doubtless thinking in terms of a standardised



32-pdr. iron cannonball and concretion recovered from the *Royal George* wreck dispersal area by Southsea BS-AC in 1965. The cannonball has been conserved and the concretion which surroundsed it has been re-assembled. (*Photo*: ALEXANDER MCKEE.)

'Mother Ocean', whereas there is no such thing. Sea areas differ very widely, and the Solent seems to be particularly kind to wrecks. As a check both on Corporal Jones and Miss Croome, I managed recently to identify one wood-and-iron wreck still in good condition, which proved to have been submerged for 87 years, and I therefore have no hesitation in deciding for Corporal Jones. West of the Isle of Wight, however, matters might be very different.

ASSURANCE, 44 GUNS, WRECKED ON THE NEEDLES, I.O.W., 1753

This ship was a 5th rate of the frigate class, i.e., not a 'capital' ship and roughly equivalent to a cruiser. At the time of her loss, there were more needles on the Needles than there are today, the tallest of them, Lot's wife, not collapsing until 1764, so the exact location of the site where the frigate grounded has not been established, although John McKie of Southampton B.S.-A.C. carried out a very thorough piece of research during 1966. No lives were lost, and at one time it was thought that the ship might be refloated. She was aground for a week before breaking up, and the £60,000 treasure on board, belonging to a passenger, the ex-Governor of Jamaica, was reported mostly saved, the rest 'stolen'. About half the guns seem to have been recovered. In spite of the obvious difficulties of the site, particularly the very fast tides combined with very short slacks, Southampton Branch proved that it was possible to dive there. On one occasion, however, a visibility of about 15 feet just below the surface gave way to a sudden and complete zero, caused by the mixing of fresh water from the chalk with the sea water, a condition which caused the Branch to dub the Needles 'Sea Area Clammy Death'.

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TORBAY (1758) AND *IMPETEUX* (1792): BOTH BURNT IN PORTSMOUTH HARBOUR

The *Torbay*, a British ship-of-the-line, caught fire after a magazine explosion; the event is depicted on the tombstone of one of the casualties in Warblington Churchyard. The *Impeteux* was a French 74 taken by Lord Howe on the Glorious First of June. The scenes inside the prize were shambolic; in particular, tons of loose gunpowder were lying on the floor of the magazine. Her captors flooded the magazine, turning the gunpowder into wet paste, and in this state, she arrived at Portsmouth where working parties were employed scooping up the powder into barrels, by the light of wire-caged lanterns. As oxygen was present the gunpowder did not explode, but it did catch fire, suffocating some of the men. She burnt for over a day before sinking. Eleven lives were lost.

ROYAL GEORGE, 108 GUNS, BUILT 1746-55, SUNK AT SPITHEAD, 1782

Similar to the *Victory*, the *Royal George*, 2,041 tons, was designed as a fleet flagship, that is, a 1st Rate. Principal dimensions: length—178ft.; breadth—51ft.; depth—21$\frac{1}{2}$ft. Structurally, she was in a bad state in 1782, but the dockyard patched her up in the hope that she would last another

Artifacts recovered from Spithead wrecks by John Deane and William Edwards 135 years ago. The bones are human bones from the *Royal George* and the white plate marked WARDROOM is probably also from that ship. The glass bottles are probably 18th century, whereas the 'witches cauldrons' could be any date. The original picture is a water-colour drawing from the recently discovered Deane Portfolio, an excellent example of early archaelological recording. (*Photo*: ALEXANDER MCKEE.)

24-pdr. brass gun recovered from the *Royal George* in 1834 by Charles Anthony Deane. Shown here by the Garrison Church, it has recently been moved to Southsea Castle.

(*Photo*: ALEXANDER MCKEE.)

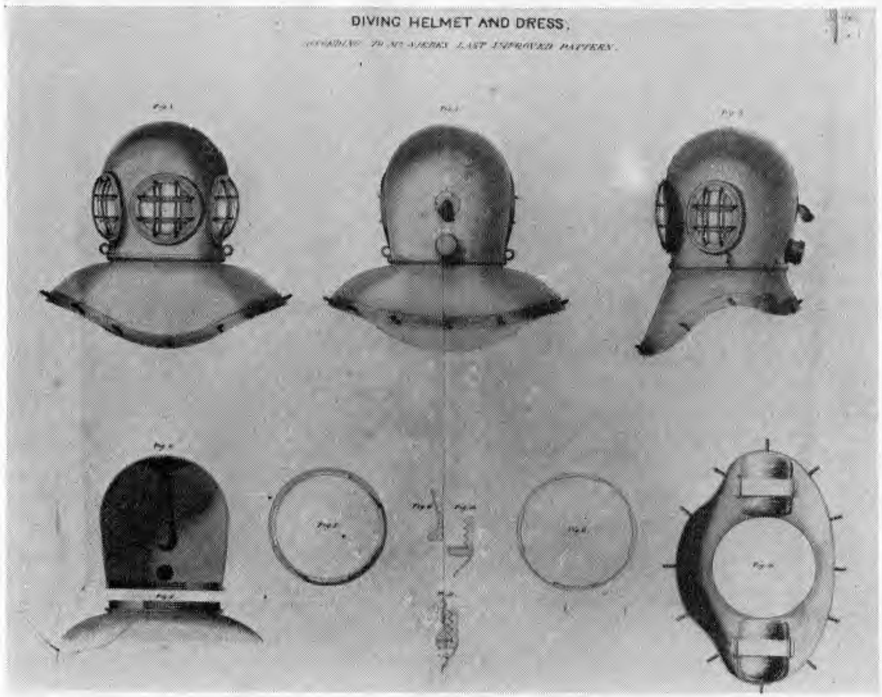
summer. She didn't. She sank while taking on stores at Spithead, among an assembled fleet, which was being despatched to resolve a crisis, which had arisen over Gibraltar. At the court martial, the findings of which were kept quiet at the time, the verdict was structural failure. But a well-known poet was allowed to state that she had been overset by a land breeze, because this impossibility was preferable to publishing abroad the straits to which the Royal Navy was reduced. We were then facing a combination of foreign powers, whose populations greatly outnumbered us by something like four or five to one.

The sinking of the *Royal George* still ranks as the greatest single disaster to occur at Portsmouth, 900 lives being lost. As seamen were not normally allowed ashore, for fear that they would desert, the amenities of the shore were brought out to the ships lying at Spithead, and these included both floating shops and the cream of the Portsea prostitutes, as well as wives, sweethearts, and children. It was customary for the Officer of the Watch to inspect boarding parties of prospective prostitutes and to reject those he considered unsuitable for the entertainment of the lower deck. Even this 'screening' did not prevent some unsavoury characters getting on board, such as the whore who climbed the mainmast and waved her drawers at the flagship.

Probably more diving has been done on the *Royal George* than on any other wreck. As the taffrail was only 2 fathoms under at low water, the poop 3 fathoms, and the forecastle 4½ fathoms, diving operations began almost at once and a number of items were recovered, including the ship's bell and sixteen guns. In 1817, an inspection by Dockyard diving bell showed that the hull was beginning to warp and collapse in places. John Deane of Whitstable who, with his brother Charles Anthony, invented the first practical diving helmet and dress, and wrote and published the first Diving Manual (in 1836), began salvage operations in 1832. He raised many guns, one of which may be seen in Southsea Castle, to the value of over £3,000, receiving half this sum as a salvage award. In 1839 Colonel I.W. Pasley, R.E., made a 'take-over bid' for the wreck, claiming that he could clear the Spithead anchorage of this obstruction in one year. It took him five years, and he did not really complete the job. Although a tremendously ambitious undertaking for the time, it revealed that Pasley had certain faults as a director of diving operations. Two of his divers ended up in the cemetery, many arrived at Haslar Hospital in a lamentable condition, and almost every man was 'bent' in some degree, the symptoms being passed off as being due to hard work, cold water, nervous exhaustion, etc. After the first year or so, no civilian diver would work for him and he had to employ Service personnel, all novices. What he wanted out of them was a four-hour day at around 70 feet, without decompression. Consequently, only a few exceptional individuals lasted any time at all.

Apart from this rather important point, however, the scientific background to the operations generally was first class. The deterioration of materials and also their inter-action when submerged, was scientifically studied, and records were kept. At one time, one diver was working in the wardroom area, while another diver was employed on the forecastle, and the interesting social contrasts in the nature of the artifacts which emerged from these two places, were noted. Wine bottles, good quality crocks, navigational instruments, candle-sticks and inkstands came up from aft. From foreward came a crudely-carved chequer-board for playing draughts, and 'a black earthenware teapot, much cracked, which must have belonged to some thrifty personage, as it is tied round and across with wire-string, not only at the top, but at the bottom, to prevent its falling to pieces; the handle also is tied on. The lid of this elegant affair is gone, but in its stead, another has been found, bearing on its top a very solemn lion for a handle'. There was also a woman's hat, the headlining 'slightly drawn together with a silk thread, where a neat handed person would have hemmed it', and two cloaks intertwined, one a woman's size, the other much smaller, clearly a child's. 'It is probable, from these cloaks being intertwined, that their wearers—perhaps mother and daughter—perished, at the same moment, in one another's arms', wrote Captain Basil Hall, R.N., naval correspondent of the *Hampshire Telegraph* at that time.

In 1843, Pasley declared the task completed, although 19 of the guns were missing and irate fishermen were complaining that the wreck was tearing their trawls to pieces. His final plan



An authentic picture of the Siebe helmet designed to make a closed seal with the suit, which was used in the later stages of Colonel Pasley's operations and is the basis of modern 'standard' gear. The picture is from a report on diving apparatus written by Pasley in December, 1840, and recently discovered in the Public Record Office (PRO/WO44/613). This was the third stage of development of Charles Anthony Deane's patent for a smoke helmet and dress (Patent Office A.D.1823—No. 4869), which became Deane's open dress and then Siebe's closed dress. The only major difference between the two types of diving dress was that in the former the suit came up to the chin and the helmet merely rested on the shoulders whereas, in the latter the helmet screwed on to the top of the suit. Deane pattern diving gear is still used in America for such shallow water jobs as feeding dolphins in Marinelands.

(Alexander McKee Collection.)

of the wreck site (based on soundings) shows an enormous mound between 2 and 3ft. high, and covering an area about four times larger than that of the ship in its complete state. Nowadays, trawlermen have 'marks' to miss the *Royal George*, and the remains consist of a mound some 5 to 6ft. high containing shingle ballast, bones, period pottery, concreted ironwork, and so on—not so much a wreck as a veritable compost heap of wreckage mixed with mud and clay. On top of this evidence of Pasley's exertions is a layer of modern surface litter, dating mostly from just prior to 1900 to the late 1950s. The genuine *Royal George* artifacts are usually either wholly or partly buried, part of the compost heap, whereas recent 'gash' is entirely on the surface.

In order to see what I mean, please proceed on a bearing of 189½ degrees for a distance of 1·94 sea miles from Portsmouth Cathedral. The wreck mound is aligned nearly, but not quite, along an East-West axis.

"Light" focuses on *Lusitania*

After 37 S.C.U.B.A. dives down to the ill-fated *Lusitania* which was sunk in May 1915 in 300 feet off the Old Head of Kinsale, Ireland, John Light, ex-U.S.N. diver decided that this historic wreck had something to offer. He may have even decided this before these impressive, personally executed dives, but the fact is that whatever he gleaned from these sorties, added no doubt, to the information he derived from others who dived with him, was sufficiently convincing to persuade his backers that further investigation, in a highly professional manner, was well worth while. In passing, he frankly admitted that these exploratory dives were somewhat 'awesome' on occasions, and those of us that heard of them in the press, doubtless formed the same impression. However, whatever the risks taken, he has certainly proved them worthwhile inasmuch that when I visited him at Kinsale at the end of July he had the most impressive *operational* assembly for deep diving that I have seen to date. To illustrate this I cannot do better than give you brief details of the equipment John has assembled for his venture:—

Diving Ship—'Kinvara':

380 tons
151 feet length
28 feet beam
16 feet draft
850 H.P. Diesel Main Engine
Crusing range 40 days at 12 knots.

Electrical Power:

150 K.W. 110v A.C. 3 phase generator
50 K.W. 110/220v A.C. single phase generator
6 K.W. 110v A.C. Single phase generator
25 K.W. 220v A.C. 3 Phase generator

Deck Power:

5 ton Diesel Winch
14 ton double Drum
Two 2 ton Winches

NAVIGATION:
- Radar
- Decca Navigator
- Two Radio Telephones
- Three Echo Sounders

Diving Tender 'Doonie Braes' — 96 feet

Deck Decompression Chamber (D.D.C.)
- 17 feet long
- 7 feet diameter
- 500 feet working depth
- Four CO^2 scrubbers
- Temperature and humidity control
- Four Internal fluorescent lights
- Three 4 inch diameter viewing ports, conical to give wide angle vision.
- 18 inch diameter hand lock
- 4 bunks — one dining table
- Two manifolds with four B.I.B.S. connections to each
- Two-way loud speaker communications backed by five-channel emergency system.

The D.D.C. is lagged overall externally with polyurethene foam injected through an external aluminium sheath which gives a very 'with it' finish, suggestive of space travel.

Man Lock:

A 5 foot sphere to faciliate transfer from S.D.C. to D.D.C. with much the same facilities as the D.D.C. but on a smaller scale to accommodate three men for 30 minutes. The shape enables three men to sit in comfort.

Submersible Decompression Chamber S.D.C.)
- 5 foot diameter
- f6 oot 4 inch height (internal)

Diver's Gas Supply:

From surface, or from three banks secured to a removable cage attached to the S.D.C.

S.D.C. Equipment:

2 CO^2 scrubbers

Loud Speaker communication with five-channel back-up emergency system.

External battery to power independent life support for 12 hours.

2 ton releasable ballast.

Doors:

All doors except the medical lock and top hatch of the S.D.C. are 30 inch diameter. The lower door of the S.D.C. is balanced and the upper door of the Man Lock, like the mating action, is operated hydraulically.

Control Room:

A well designed control panel brings the system within the control of a single operator in a sound proofed control and instrument room. The exclusive use of ball valves is an outstanding feature and Oxygen sensors coupled with an alarm system give warning of any deviation from the permissible oxygen content of the D.D.C. atmosphere.

The control room also contains a gas chromatograph analyser, T.V. monitoring with video recording and comprehensive communications.

Cryogenic System:

Two Units, each capable of cleaning 600 cubic feet of gas per hour. One unit runs for 24 hours before blocking.

Two Corblin Diaphragm pumps.

One Control panel so arranged that dirty gas can either be routed through the cryogenic system or dumped in a dirty bank to await processing.

Diving Apparatus:

Drager F.G.G. III sets.

U.S.N. Mk. VI sets.

Open circuit hot water diving suits.

Cameras:

T.V. with 360° training and 180° elevation.

70mm. still camera.

16mm. movie camera.

This equipment is all mounted on a framework with illumination by strobe and floodlight.

The T.V. camera is detachable to be held by the diver and quartz iodine hand lamps are also available.

Interior view of D.D.C. showing bunk and table arrangement.

Salvage Equipment:

Twelve inflatable pontoons of various sizes from 2—10 tons with couplings for doubling up.

Power velocity bolt gun outfit.

Oxygen cutting lance.

The chamber complex, its controls and cryogenic system were all designed and supplied by Hannes Keller from his headquarters at 'Unterwassertechnik', Aadorf, Switzerland. One could not fail to be impressed by the standard of workmanship, low cost and speed of delivery. To illustrate the last point I was assured that the S.D.C. was manufactured and delivered to the ship in six weeks. From the long discussions Lt. Bladh (he inspired the visit) and I had with Keller we were most impressed with his knowledge, keeness to explain things and of his design plans for the future. He did not speak of any future personal diving plans but appeared to be well and truly 'submerged' in diving design and engineering.

So much for the equipment, but what of the personnel to help John Light operate it! Hannes Keller has agreed to be there at the start of operations to ensure his equipment is functioning properly and in addition to his own personal possibilities John has engaged ex-Navy divers, a Diving Officer and I understand, since we were there, an ex-A.S.R. Skipper as the Master of *Kinvara*. Certainly those aboard at the time we were at Kinsale looked excellent material with the typical Jack-of-all-Trades approach that divers have, and led by Retired Navy Lieutenant, Jim Hazelwood, seemed bent on rebuilding the ship to their entire satisfaction. Jim's welding was that of an artist. Roger Hanson is John's shore-side business agent operating from an office in Kinsale with, I would guess, considerable effectiveness.

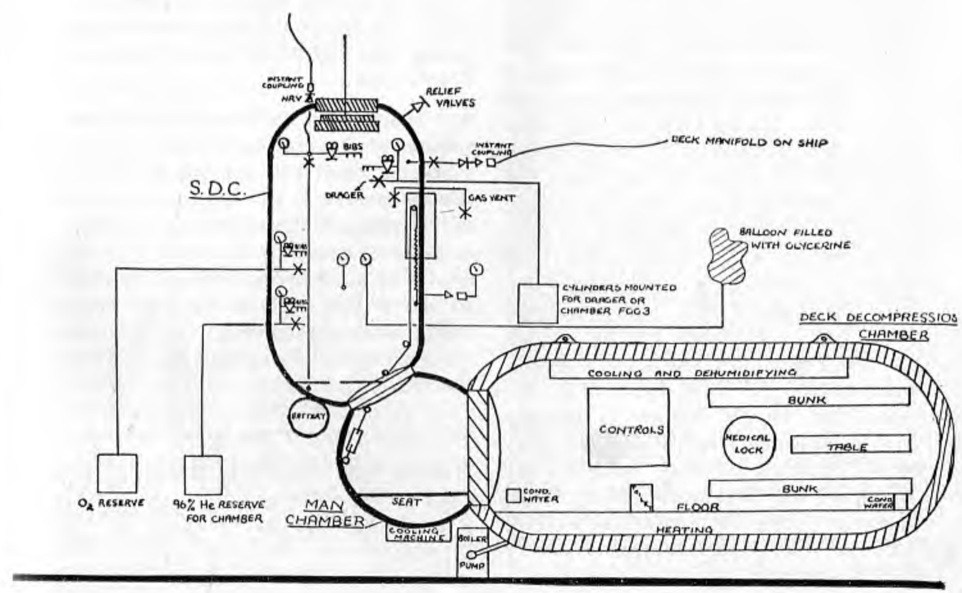
Incidentally, although somewhat out of context, I must just mention that the S.D.C. goes over the side on a gantry

with overhead travelling lift which I have always advocated for our own *Reclaim*. An outrigger scheme was also under construction and/or consideration for keeping the S.D.C. from making violent contact with the ship's side in rough weather. Both schemes have yet to be tested, but even at the stage of our visit served to show the serious professional approach to open water diving at deep depths. In similar vein, it was noteworthy that John was in the process of laying an eight point moor around *Lusitania* to enable him to locate and hold a precise position over the wreck. Divers who particpated in the 'sustained' deep diving operations of *Alaska* and later *Affray* will appreciate the need for pre-laid moorings for this type of work, the necessity being almost equal to the desirability of using O^2He, which unfortunately were we unable to do at the time.

The objectives of the venture and where the financial support comes from were not my concern and it would have been rude for me to have enquired out of sheer curiosity. It would appear from what I have read elsewhere however, that John has amassed, through considerable painstaking research and typical thoroughness, all the information and documents he requires to efficiently process his plans. I think he is basically a camera man so I see that film and T.V. rights may well play a financially significant part of the scheme and non-ferrous metals, including the four valuable propellors, could well be converted into a small fortune.

Whatever the outcome, and I personally feel it will be successful, John Light and his team deserve to succeed by virtue of the dedicated, honest professional endeavour that has been put into the project.

The exposed situation of the wreck suggests that this years' activities will be restricted to a thorough work out of men and equipment with perhaps a few pictures and token recovery to keep the backers happy.



H.M.S. *Dingley* and after

by Lieutenant D. P. Selwood, R.N.,
Western Fleet Clearance Diving Team, H.M.S. Vernon

1. H.M.S. *Dingley* finally paid off in mid-summer 1966 and many people were needless to say sorry to see her go. She had been the home for the Home Station Clearance Diving Team for a number of years, during which time she had fulfilled many onerous operational and social tasks. Upon her paying off the Team became shore based and after juggling between temporary lodgings in the *Vernon* were finally housed in No. 28 Building, better known as the old Regulating Officer, where it will remain until the completion of the new Triton Building sometime in the 1970's. The completion of this building will then see under one roof the Portsmouth Command Clearance Diving Team and the Home Station Clearance Diving Team together.

2. In order to achieve the mobility required, after the passing on of *Dingley*, the Team was eventually fitted out with a converted 3-ton Bedford RL lorry, a long wheel-based landrover and a 10 cwt. trailer. On 1st October 1967 after having been worked up by the Plymouth Command Clearance Diving Team, the Home Station Team became operational to 250 feet in addition to their other normal C.D. tasks. The final degree of mobility was achieved when the 3-ton Bedford lorry finally modified to fit into a Hercules aircraft, which put the Team very much on a world-wide basis. As from September this year, the Home Station Clearance Diving Team (a name which has long been inaccurate anyway) becomes the Western Fleet Clearance Diving Team operated by Commander-in-Cheif, Western Fleet, but administered by H.M.S. *Vernon*.

3. The functions of the Team are many and varied and the essence is flexibility—'played off the cuff some say'. Frequent trips down to Portland for Flag Officer Sea Training occur as well as numerous trips to the wilds of Scotland either for 250 foot continuation dives or helping Flag Officer, Scotland and Northern Ireland, or exercising with Captain, M.C.M. Frequent trips to Malta for Western Fleet Exercises, plus helping out at the Deep Trials Unit, all go to keep the Team more or less fully occupied. All this amounts to little time in H.M.S. *Vernon*, lots of travelling, and some interesting jobs. Amongst the recent achievements have been the salvage of a Wessex off Portland, recovery of an engine from a Boeing 707 for B.O.A.C., an extended period in the Outer Hebrides for F.O.S.N.I., and backing up *Reclaim*'s divers for the Aer Lingus salvage, and tasks of this nature almost too numerous to mention.

4. Members in the Team fluctuate and it seems that no sooner is a new member worked up and fully capable of 250 foot diving than he is drafted to warmer or colder climates. Members in the Team at present: one C.D.O., one C.D.1 and 11 C.D.2's. Anyone with a draft chit to the W.F.C.D.T. in the near future can almost guarantee to be O^2 swimming at Portalnd one night and 250'ing the next.

Extract from Class Fair Book. . . . If a diver is not wearing suit inflation, he is also susceptible to Rupture of the Depths.

The following article is reproduced from the July issue of the Royal Naval Scientific Services Journal.

A paper presented by the Superintendant of Diving at a recent gathering of representatives of British Industry.

Techniques and Equipment of Deep Diving

by Commander P. A. White, M.B.E., R.N.
Superintendent of Diving, Royal Navy.

BEFORE the physiologists — engineers — scientists and doctors are let loose among you, I think it would be wise to commence with our feet firmly on the ground (well perhaps just in the water). I intend, therefore, to look a little into history, to review the present state of the art of the Royal Navy, and take a brief look into the future.

To those of you who are actually involved in commercial diving activities I apologise, and would ask them to bear with me if initially I cover basic ground. I consider this necessary, however, and I hope of value, because although many of you are involved in one or more aspects of underwater operations you may not necessarily see the diving problem as a whole.

If diving be defined, merely, as descending underwater and remaining there for a short period, then there have been divers in all ages. Man must have learned to dive almost as soon as he learnt to swim, but he must also have learned that his physiological structure, as an air breathing land creature, imposed very definite and narrow limits upon his activities underwater; limits which remained unaltered for many centuries and which have only been extended in recent times. Our first attempt to enter this foreign environment was confined to the limit of one deep breath, much the same as the Far East fishers today. This technique was probably followed by breathing through a reed or a piece of bamboo. It was not until the Middle Ages, loosely speaking, that we find attempts to supply air to a man underwater. Many odd devices and techniques were forthcoming until finally the copper helmet, standard, diving dress was evolved. The attendant problems of Nitrogen Narcosis, *Rapture of the Great Depths*—(*NARKS* to the R.N. diver), and Decompression Sickness accompanied the indroduction of this type of diving. These problems will be dealt with in detail later.

Throughout today you will frequently hear the term *Deep Diving* and *Saturation Diving* mentioned. It might be appropriate at this stage to explain the meaning of these terms:—

DEEP DIVING—This is regarded as any dive deeper than 30 fathoms.

SATURATION DIVING—Is considered to be a dive of such a duration that even if the diver remained at depth longer he would have to pay no extra penalty in decompression time. In other words, *SATURATION*, as the word implies, means that the body has taken up as much inert gas as possible. This is the technique employed in SEALAB and by several U.S. commercial firms.

History

Prior to 1933, diving in the R.N. was limited to depths of approximately 200 feet. Equipment used was the hard-hat standard dress, supported by hand-operated air pumps. In practice very

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little diving was carried out beyond 90 feet.

In 1933, the R.N. Deep Diving Committee recommended that the maximum depth limit be increased to 300 feet. At the same time mechanical air-pumps and the submersible chamber was introduced. It became evident then that the limit of air breathing had been reached. No real progress was then made until after 1946.

operational diving was no longer required to these depths and in this role. Diving in the R.N. was then limited to 180 feet.

Of the two R.N. Deep Diving ships—*Kingfisher* and *Reclaim*—*Kingfisher* was sold to the Argentine and *Reclaim* was saved from a similar, or worse fate, by the foresight of a staff officer in the Admiralty at the time. *Reclaim* was retained as a Minecountermeasures

Standard (copper helmet) diving dress

Support Ship (still keeping her deep diving equipment for possible future use). Without *Reclaim* today we would not be in the deep diving business. Captain Blake, the officer who foresaw this return to Deep Diving is now in the Directorate of Weapons (Underwater).

Oxy-helium trials were carried out between 1946 and 1948, as a result the R.N. diving capability was increased to 360 feet for a maximum time on the bottom of 20 minutes only. Further research was carried out and in 1954, still using hard-hat equipment, the maximum depth for work was extended to 410 feet for short periods. In 1956 one dive was achieved to 600 feet to prove that limited work could be carried out at this depth. In fact this dive was for a very short period and almost amounted to a bounce dive.

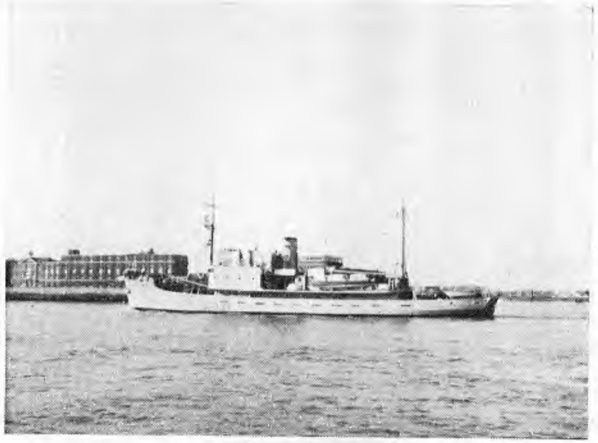
Because of a change in submarine escape policy to which the Deep Diving programme was allied and the introduction of the Free Ascent method for escape from a sunken submarine,

In 1962, deep diving trials recommenced with a five-year programme aimed at producing a Continental Shelf capability of 800 feet. To achieve this it was decided that a depth of 1,200 feet should be our goal.

A series of laboratory experiments, and sea trials, terminated in June 1965 when a total of 18 divers operated at 600 feet for periods of up to one hour. By this time the hard-hat standard

equipment had been replaced by lighter equipment designed by the Admiralty Experimental Diving Unit at Portsmouth.

Unfortunately this 600 feet capability represented the limit in depth set by the old equipment fitted in H.M.S. *Reclaim* and the decompression schedules could still only be regarded as experimental. No progress has since been attempted



H.M.S. *Reclaim*

towards the ultimate aim of this plan. There ended the first lesson.

R.N. Diving Structure and Equipment

I think at this point I will cover the diving structure in the R.N. and the equipment used by the various grades of divers and their capability. There are four grades of diver:—

Ship Diver
Part-time — anyone (officer/man, padre/cook). Four weeks training on compressed air. Duty — diving to 120 feet — bottom search (infernal machine placed by unfriendly natives).

Artificer Diver
A ship diver — extends his trade underwater — emergency repairs.

S.A.R. (Search and Rescue) Diver
Intrepid aviators — plane guard.

Clearance Diver
Full-time — professional — 250 feet on air.
Equipment — special.
Deep Diving — volunteer.
For Explosive Ordnance Disposal. Six months training — highly skilled.

Deep Diving — Present System and Techniques

In the Royal Navy, deep diving at present is based on a technique of employing a submersible compression chamber with transfer-under-pressure facilities at the surface. Divers are lowered to the working depth in the submersible compression chamber. During descent, the lower door of the chamber remains open, the ingress of water being prevented by filling the chamber with oxy-helium gas at the appropriate pressure. After completion of work outside the divers re-enter and the lower door is closed, and the chamber is winched to the surface where it is mated to the larger deck-mounted transfer-under-pressure cham-

The submersible compression chamber slung from H.M.S. *Reclaim*

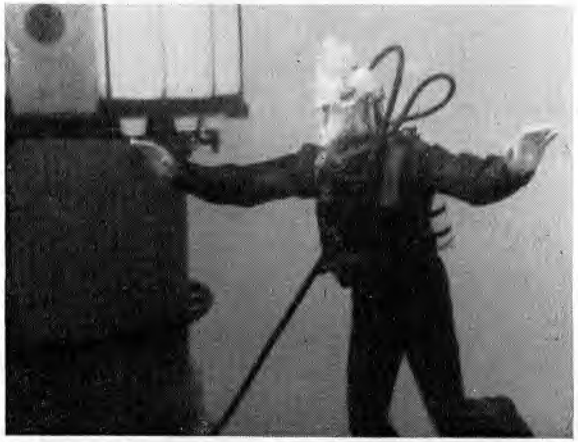
ber. Pressure between the two chambers is then equalized and the divers transferred to complete their decompression in relative comfort.

Ideally, the submersible compression chamber must be able to withstand an internal pressure equivalent to the maximum depth of dive in order that, in an emergency, the diver can be immediately brought to the surface, transferred to the larger compression chamber where he can receive medical attention should this be necessary.

During R.N. trials, it was essential to be sure of the precise gas mixture being breathed, and divers therefore used open-circuit breathing apparatus whereby the gas was exhaled directly into the sea. There is no doubt that a requirement exists for a semi-closed or completely closed circuit breathing equipment to conserve helium.

Techniques for operating divers from surface ships or installations must depend to a certain extent on the task. In general, the R.N. must anticipate the need to operate in open sea. This introduces a considerable seamanship problem, location, accurate mooring, precise plumbing of the submersible compression chamber over the task and finally, operating in tidal and/or bad surface conditions. Many of these problems are minimised or are not applicable when operating from an oil-rig.

In order to cover the problems of techniques and requirements for Deep Diving it would be wise to take 'an all round look in high power' — as they say in the Submarine Service — at the project as a whole. Experience has shown that only by complete team work throughout between the sailor, the scientist and the doctors can success be achieved. The most important aspect is co-ordination. This applies equally to a record dive or a comparatively simple task in shallow water. I propose to cover briefly the chapter of events that cluding the means of controlling the environment. In this, I include chamber panels, temperature control, CO² scrubbers, de-humidifiers, *etc*. They are also responsible for communication and closed-circuit television coverage.



A diver at depth alongside the S.C.C.

go into the production of any new operational technique, or piece of Deep Diving equipment, after the naval staff division have laid down the requirement and the aim.

I, as the Superintendent of Diving—the user—co-ordinate the many apsects and diverse talents that go into producing the new operational techniques—and, I am finally charged with the responsibility of accepting it into service.

It is the naval diver who is the human subject and the naval doctors who supply the medical coverage throughout.

The engineers within the Royal Naval Scientific Service together with the naval diving officers—again the user—who provide the design of breathing equipment, ashore and afloat chambers, submersible compression chambers and transfer-under-pressure complexes, including the means of controlling the environment.

The production of Decompression Schedules for trial by humans are calculated and issued by scientists of the Royal Naval Scientific Service, from the Royal Naval Physiological Laboratory at Alverstoke.

To summarize, it is the Admiralty Experimental Diving Unit that produces the equipment — the Royal Naval Physiological Laboratory that gives us the Decompression Schedules, the R.N. medical officers who provide the coverage for any therapy that may be required and the R.N. divers that produce the operational 'know-how' and have the responsibility for trials and acceptance into service . . . and it is I who sits at the end of that long Court Martial table should things go wrong..

H.M.S. *Reclaim*, today has an emergency capability to diving to approximately 400 feet using oxy-helium breathing mixtures. You may recall that a ditched Buccaneer aircraft was recovered from a depth of 370 feet 10 miles south of the Lizard in 1966. The schedules used then are still not completely Bend free and should not be used without adequate precautions which will be covered later.

deep diving techniques, not the least of which is the now accepted fact that one cannot produce a safe diving schedule to cater for everybody, including one's granny! There is no doubt, in my mind, that some men make better and safer divers than others. It is also a fact that an 'in practice' deep diver is less likely to get into trouble than one who is out of practice. Within this trouble I also include 'bends'. I also personally believe that the deeper one goes the higher percentage of incidents one will have to accept.

A model of H.M.S. *Reclaim*'s existing arrangements

Deep Trials Unit

Situated within the confines of the Royal Naval Physiological Laboratory at Alverstoke, the Royal Navy has a Deep Trials Unit which consists of a complex of chambers with a 'wet' section. This installation, which I administer for the Director General of Weapons, is capable of simulating 'wet' dives to a depth of 1,200 feet. It is also possible to simulate all types of climatic conditions within the chambers. All new diving schedules are first tried in this complex before being taken to sea. Unfortunately, there are indications that although the pressure conditions and the temperature conditions can be exactly simulated within the Deep Trials Unit, some difficulties arise when the diver actually goes into the sea.

Personnel

Various problems have shown themselves in the practical application of

Keeping the diver warm presents quite a problem. In addition to the obvious difficulties of diving in cold water, beathing helium exaggerates the body heat loss. Obviously, there is a very real requirement for heated suits. At present, the R.N. is making do just adequately with nylon for underwear. These have been proved to be far superior to the normal standard woollies

Communications

Good communications present quite a problem with all deep diving and in particular, when the diver is breathing a helium mixture. Various organisations

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throughout the world are experimenting with the problem of converting the noise that comes back from the diver to something intelligible. It may be possible in the future, to unscramble this noise.

General Points

Experience has shown that if a diver contracts a bend it is sometimes necessary to recompress to the maximum depth of the dive to obtain relief. Because of this, the R.N. considers that it is essential to have a transfer-under-pressure system capable of transferring from the maximum depth of the dive.

Whilst carrying our experimental diving on a new schedule, it has been found necessary to have a helium atmosphere capability in the chamber inboard.

The provision of a simple, closed-circuit television to observe the diver during his dive has proved invaluable, especially in saving the grey hairs of the supervisor.

The problem of diving in a tideway still has to be solved.

I also appreciate that a submarine-type vessel with a diver lock-out capability is undoubtedly the best diving platform for deep diving activities.

Future

I think that it is now common knowledge that the Royal Navy intend to return to Deep Diving trials. H.M.S. *Reclaim* has been saved — yet again — from a fate worse than death — she will be with us for another seven years. In broad terms this means concentrating initially, in the 600 feet area and will include saturation diving. There would appear to be no major reason why this should not be achieved by 1971 or 1972.

Now — a final observation — there is no doubt that without the keen co-operation of the engineer, physiologist, medical officers, scientists and sailors the production of any new diving technique or equipment would not be possible. With such team-work, we know, that (given the right facilities) diving to almost any depth can eventually be achieved. It must be remembered that diving is neither a straightforward engineering, physiological, or medical science. It is basically a seamanship problem, supported by all these sections of science. And we would be foolish indeed to ever forget *the greatest single factor* in our efforts to plumb greater depths for longer periods, is the diver himself—the man in the sea, on the end of an air pipe feeling cold and very alone. Without his skill, determination, faith and courage — we would all be wasting our time.

INSTRUCTOR OFFICERS QUALIFIED AS SHIP'S DIVING OFFICERS

It is intended to produce a list of all Instructor Officers, **who have** qualified as Shallow Water Divers, or Ship's Diving Officers.

Any Instructor Officers, who have qualified, are requested to inform:—

Instructor Lieutenant-Commander
S. J. Walton, R.N.,
H.M.S. 'Vernon',
Portsmouth.

Including in their letter the following particulars:—

Name, Initials, Rank, type of service (S.S. or G.L.), date of qualification, where qualified, and present appointment.

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'I must confess I didn't anticipate *this* particular complication with helium bends.'

Book Reviews

FARMING THE SEA

NOT withstanding anything which follows, this book serves an important function in putting over the message that the fantastic potential of the seas is not being exploited adequately due to lack of research, finance and endeavour.

It is regrettable, that in the process of putting over this message, the author has tended to decry the professionals—the scientists, the doctors, the biologists and the professional fisherman and divers. I would have thought that these were the people whom he should attempt to get on his side, since the successful outcome of his proposed developments must largely depend on them.

On page 40, he says:—'All that is required is *one* full scale open water experiment to prove the extra profitability of the farming principle, sufficient publicity to make known the results', (the italics are mine) —'and the trawlermen will either be queuing up for farm work or cannily calculating how they could launch a similar project.' One swallow may make a summer to an amateur diver, but it certainly does not to a Norwegian purse-seiner.

He regrettably derides the doctors on page 14, calling them 'those old women of the medical profession'. It is unfortunate that the subject in question—'a lung squeeze'—can be a source of real danger to the inexperienced amateur, with little or no knowledge of the physics and physiology of diving.

In the field of marine biology, the author becomes a little inconsistent. On page 29, while trying to show little value can be obtained from laboratory experiments, the author makes it clear that he believes that the colouration of the plaice has an important camouflage role to play, both in defence and offence. However by pages 30 and 31, he is claiming that vision is of little importance to a fish, since it detects its predators and prey by hearing and pressure sensors.

It might be as well for the author to consider the market value of a *blue*-spotted plaice! The biologist carrying out laboratory experiments on plaice colouring may well have been worrying about a very real problem on which the finances of some future farming project may founder. The conservative British housewife buys plaice because she recognises the red spots and may well be put off by blue spots!

The value of this book lies in the history of fish farming which is covered in considerable detail. Photographs are excellent and provide much useful information. Nevertheless, it must be appreciated that although stocks of certain types of fish can be increased by artificial means in areas which would normally be unproductive of the species, any large scale change in the balance of nature in areas of the sea, caused by intensive husbandry, is liable to bring financial disaster through disease or other freaks of nature.

The list of 'Do's and Don't' of lobster catching contained in Appendix II could well include one other:—

'Don't rob other people's pots, creels or traps'. This would help to improve the present rather strained relationships between the divers and the conventional fishermen.

THE UNDERWATER BOOK

Edited by KENDALL McDONALD for the B.S.A.C.

THIS book contains a collection of contributions by members of the B.S.A.C. From the Foreword by H.R.H. the Duke of Edinburgh to the last chapter by Colin McLeod it is a book of extreme interest to all who dive and to the millions of others who are just interested in diving.

Within the book a variety of subjects are covered in a variety of different literary techniques. Throughout, it is well written and the photographs are of the highest standard.

The book dispels the widely accepted theory that diving in Britain is dull, cold and uninteresting and shows that we have a vast underwater Utopia of interests and activities.

I believe that this book should be in every diver's bookshelf.

JACKIE WARNER.

F.E.C.D.T. Heard in the Section.

Local Expert: I'm all about on diving. How deep can you go?

C.D.2 (Modestly): Well, I'm operational to 180 feet, but can go deeper if required.
Local Expert (Knowingly): Don't tell me; then you come up by stages and decompose on the way. T.G.

AMENDMENT TO VOL. 14 NO. 1, PAGE 9.

Belated recognition of such and many thanks. Anyone with the slightest sign of gills is welcome. The only difference being the caravan is once more on the move, but you are welcome at the Ox & Gate (no comment), Oxgate Lane, Cricklewood, N.E.2.

Dispensary opens—normal hours—for patients without prescriptions but cash.

Mine Host—TAFF PACKER.

Personnel 'Bar-red'	*Expected*
W. Filer	Jas. Honour
J. Warner	Hooky Walker
All the 'Horaces'	Wm. Morris
	Wm. Soper

And any fool that wants to take a chance!!!!!

FROM THE DIVING OFFICER

H.M.S. *DEVONSHIRE*.

TO WHOM IT MAY CONCERN

IN answer to H.M.S. *Hermes*' remark in Magazine No. 15-1, I'm glad to say that the S.S. *Electric*, the wreck on the reef off Masirah Island—is now safe for all divers, as the fish population has been decimated (and very tasty they were too) and the 8ft. grouper scared off. The biggest we could catch was only 5ft!

I would like to add that in the way of a diversion that the near side of the reef was cleared (at the time) of all life-size crayfish—the largest being an average sized 4½ pounder.

This was during and just after *Hermes* time in the area so by now it should be worth another visit. I wish all other sportsmen, Good Hunting!!

Recreation

Reprinted from TIME MAGAZINE, of June, 1967

Cryogenic Scuba.

The big limitations for scuba divers is not how deep they can go but how long they can stay under. Conventional compressed-air breathing units, which weigh 36lbs. are generally exhausted after one hour. Soon, according to *Skin Diver Magazine*, Aquanauts will be able to submerge for six or even eight hours at a time with a back pack that weighs only half as much as usual.

The secret is liquid air—a mixture of oxygen and nitrogen supercooled to 318 Degrees F. It is pumped into vacuum insulated tanks, sophisticated thermos bottles that protect the icy liquid from the warmth of the surrounding water and at the same time keep the divers back and shoulders from freezing. From the tanks, the liquid air is piped through warming coils that heat it until it expands into a breathable gas. Only hazard; since liquid air allows the diver to stay under far longer, he must surface slowly, in stages, to avoid the bends.

The breathing system is called cryogenic scuba, for the science of supercooling which has been used to fuel spacecraft with liquid oxygen and, in medicine, to freeze everything from ulcers and tumours to tonsils and cataracts. The new scuba rig was pioneered by Jim Woodberry, 23, a Miami diver who has successfully tested a prototype for a total of 400 hrs. at depths up to 200ft. He plans to have it on the market before years end. Anticipated price 250 Dollars to 300 Dollars for the apparatus, plus 3-50 Dollars for each refill of liquid air.

E.O.D. TIES—HONG KONG

1. A tie is being produced which it is intended will be worn exclusively by personnel who were engaged on E.O.D. duties in Hong Kong last year.

2. The design is based on the R.A.O.C. tie. However each alternate red stripe is omitted and in it's place is substituted a design of a yellow Hong Kong Dragon studing a red 'anarchist' type home made bomb, in it's raised front 'paws'. The overall colour of this tie has yet to be decided.

3. The cost of this tie will be approximately 18/–, and this includes postage. They will be available from the Far East Fleet Clearance Diving Centre on application.

AND HE SAID—

Professor Sir Julian Huxley in a speech at Harvard University advocating the exploration of 'inner space'.

'. . . and, frankly, I should much rather see the sea's bottom than the moon's behind.'

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