The Undersea Medical Society Meeting, Miami, May 1979
Dr John Knight

The first day was practical and informative with a panel of divers and doctors who had a vast knowledge of the diving industry.

G Fahlman of Taylor Diving and Salvage spoke on "The Achievements and Plans of an Oilfield Diving Contractor". Taylor Diving have a name for underwater welding. They use bell type habitats which fit over the pipe to be welded. The pipe is fitted into an alignment frame, the habitat lowered and made watertight, or rather gas-tight, below the raised pipes, and then the habitat is pressurised with gas so that the welding can be done in the dry. The welders are divers. Even in the dry they wear positive pressure breathing apparatus in case noxious fumes are produced in the restricted space. It is possible to X-ray the welds before flooding the habitat. These outfits cost about $500,000 each to build. It is supported by a normal saturation complex and the divers travel to work in a "bell" (which is better described as a personnel transfer capsule). During a trial weld at 1000 feet off Norway one man wandered out of a television monitor range and when he was found he was dead. No cause of death has been finally decided on. The Norwegian authorities stopped the trial, but it was later completed off Scotland.

Taylor Diving have plans for a one atmosphere welding chamber called SAWS (for Single Atmosphere Welding System). It is much heavier and bulkier than the hyperbaric systems and would require a specialised support vessel. As it is estimated to cost about 510,000,000 to build and as the diving industry is in a mild recession it remains in plan form only.

RH (Dutchy) Holland of Oceaneering spoke on "A Diving Contractor's View of Medical Responsibilities". This was a sensible review of the problems of the medical and diving interface. He stressed the need for knowledge of diving medicine in the doctors, for co-operation with the diving supervisor and for safety above all.

David Youngblood, now ex-Oceaneering, spoke on "The immediate management of Commercial Diving Casualties". He was short and to the point. Immediate management depends on the other divers who are there at the time. They must be trained in first aid and more. The doctor should be consulted immediately but storms blot out radiotelephones and other traffic can cause teleprinter delays. Training of diver-medics is vital to safety.

Ralph Draper of Perry Ocean Engineering spoke on "Rescue Under Pressure". The North Sea oilfields are well away from shore. What should be done in the event of a fire, explosion or rig damage from collision for the men in saturation? There are a number of possible courses. Immediate decompression, which would probably be fatal, is not one of them, and must be avoided at all costs. Escape from the rig must be made under pressure. It is possible to put a bell or the chamber over the side and let it float away. The problems include seasickness of the occupants in any sort of sea, and accidents have a habit of happening in a rough sea, there is no control over the bell and it could get lost or even entangled in the rig. The "hyperbaric lifeboat" which is the Norwegian official solution, is a vessel containing a pressurised chamber which has its own motive power and so can be steered to safety.

This always supposed the man in saturation can get into the hyperbaric lifeboat and it can be launched, which can be difficult if the rig is listing. The British solution is to use helicopters to lift a portable chamber and decant the men into a chamber in Aberdeen at the end of the helicopter ride. There are problems with this approach too. The saturation chambers are not always very accessible, some are down a few decks from the helipad. So a 2 man carryable chamber which mates to the saturation chamber and to the 8 man helicopter chamber may have to be used as a taxi. The helicopter chamber mates with the deep (1000') chamber donated by International Underwater Contractors and the system can be used for men injured or ill under pressure which the hyperbaric lifeboat cannot.

Georges Arnoux, the Safety Officer of Comex UK, spoke on "The Rescue of the Unconscious Diver". This was possible because some other speakers had limited themselves so as to let Georges have some time. On the programme he and Dutchy were sharing a presentation. Out of the problems of Comex equipment has come an intelligent and relatively simple method of rescuing the unconscious diver. Comex bells have relatively small openings. To lift a diver into a bell one has to use a hoist. All deep divers wear a safety harness, to hold the umbilical and provide lifting points. If one hoists a man by the front his head drops back and his airway opens, but he cannot fit through the Comex hatch. If he is lifted from the back his head falls forward and his airway blocks off, but he fits through the bell opening. So he can now be got into the bell. It helps to flood the bell so that his weight is partly taken by the water, and then hoist him vertically. Bells are basically round and the only flat space is the lower door, which as we have seen is too narrow for a man suspended from the front of his chest to get through, a quite inadequate space to lie a man down. Pulling in the umbilicals and shutting the door would take time and it is better spent on artificial ventilation even with the patient vertical. Once the man is in the bell, and his head out of the water, his helmet mask is removed, an air way is inserted and an orthopaedic type plastic collar is put round his neck to hold his chin up. Then mouth to mouth respiration is relatively easy. External cardiac massage is difficult as there is no hard surface behind the diver, emptying the bell and closing the door will take time, so it is recommended that the rescuing diver put his arms around the unconscious man's chest and use his head as the pressure applicator. Does this work? No one knows but it may be better than doing nothing. The flooded chamber will help by pushing blood out of the legs and abdomen and into the chest due to the hyprostatic pressure gradient.

After lunch the meeting broke up into tutorials. I was in that taken by Art Bachrach on "The Potential Role of One Atmosphere Diving Systems". Art has been involved with the USN evaluation of "JIM". Jim grew out of the deep diving armoured suits of the 1930's, which almost all had the same problem. The arms and legs which moved nicely on land froze as the joints jammed under pressure. However Jim has been designed with joints that work under 2000' pressures. He is manshaped and moved with the arms and legs of his operator. His manipulators are controlled only by the operators fingers. He has advantages, he is easy to transport and assembles in a few hours, the operator is at atmospheric pressure so has no decompression problems, he can work to at least 1,500 feet. But there are snags, he is tethered by the lifting line and communication cable. The manipulators are not as sensitive as hands, and he is a bit clumsy as he moves about. The system has 24 hours endurance, rebreathing with fresh oxygen being added as necessary with the CO_2 being absorbed. Currents up to a knot do not inconvenience the operators and do not affect their performance, but with currents over this the performance levels drop, but so they do with divers

Other systems include WASP which has arms and manipulators but no legs, the system being moved by thrusters. Another system is really a small submersible with a man lying inside it.

During the first day NOAA (the National Oceanic and Atmospheric Administration) had a display of their portable recompression chambers. One was a middle sized two compartment chamber which could be lifted onto a truck and made mobile. The interesting exhibit was the experimental chamber, a Portable Inflatable Recompression Chamber or PIRC. The chamber is made of rubber coated Kevlar cloth with a large opening at the top through which the two occupants enter. It is then sealed and held shut with a great long skewer.

At either end of the cylinder is a window so that the occupants can see and observers can peer in. The chamber is 90" x 30" outside diameter. It weighs 95 lbs. The total weight of the system is 250 lbs. The volume of the package you have to transport is 20 cubic feet. The design operating pressure is 73 psi (165 fsw) and its proof test pressure is 110 psi (250 fsw}, while the burst pressure is 363 psi (825 fsw). The length of the access opening is 54". The view ports are 10.75 inches in diameter. It is fitted with CO_2 absorbers of sodalime which will last (in theory at least) three hours. The breathing gas is air which is supplied in 2 x 80 cu ft 5000 psi alloy and fibre glass cylinders. There is a capability for oxygen to be supplied to a rebreather circuit inside the chamber. Among other items of information we were informed that the chamber leaked 0.55 scfm at 60 fsw and 0.45 scfm at 165 fsw and that the chamber was designed for use between temperatures of 30°F and 120°F. I don't think I would like to be inside at that temperature as there is no medical lock to pass in drinks or other needs.

Later in the week NOAA had another chamber display, this time at their offices in Miami, where I was able to see the Dräger two man chamber. This is boot shaped and comes apart in the middle of the foot. First the attendant climbs in and sits with his head up the ankle part of the boot. There is a window over his head to admit light. Then the victim is loaded into the chamber on a stretcher. When positioned his head is on the attendant's lap. Then the foot end of the stretcher is closed in with the end of the chamber which locks with a bayonet fitting. The empty chamber can be lifted by four men (I've been one of them) so I expect the full one would need at least 8. It has been designed to mate with other Dräger chambers by putting the toe end of the portable chamber into the larger chamber locking the little chamber on by the bayonet mount provided and then pressurising the big chamber so allowing the toe cap to be removed, and the stretcher taken into the big chamber. This is fine with Dräger chambers but its shape probably precludes it being carried into any more common chamber.

My final comments are to record my impressions of the Keynote Speech given by Dr John Hayward of Victoria University, British Colombia, who is well known for his contributions on the effects of cold and protective garments. His topic was "Man in Cold Water" and it was an entertaining and informative address largely dealing with protection from cold water. A comparison of the amount of drop in the core temperature after 6 hours in the water, in men lying still, showed that dry suits were only slightly superior to a well fitted wet suit and much more uncomfortable. The trials were for the Canadian Armed Forces to select suitable clothing for aircrew likely to drop into the Arctic so the experimental subjects lay and floated in the water. The dry suit wearers complained of painful feet. Among the outfits tried was the UVic Thermofloat, Dr Hayward's design of a protective garment for yachtsmen and others who are likely to fall into the water. In spite of leaving the subjects legs exposed from mid-thigh the rate of core temperature drop was little more than the wet-suit wearer's.

The UVIC Thermofloat is a jacket designed to save life in the cold waters of British Columbia. It doubles as an insulator and a life jacket. The basic jacket is quarter inch neoprene foam with an outer and inner cover which results in a reasonably smart jacket. When I tried one in fresh water I floated with 6" of my chest out of the water.

Of course a jacket of neoprene will be an excellent insulator, keeping the wind off beautifully, but it won't be much use when the water is slopping in and out of the lower end. Dr Hayward gets over this problem by providing a beaver tail of neoprene which pulls down between the legs and up in front to make a shortie wet suit.

Hooks on the tail fit into rings in the pockets and the final fitting is with poppers round the legs. A flap of neoprene is provided inside the jacket to fold across the chest for extra insulation and the collar unzips to reveal a bright red-orange hood with reflective stripes.

Dr Hayward demonstrated all this, then produced from one pocket a small inflatable raft, which gets you put of the water except for the lower leg and heat loss from there is low due to the excellent counter current heat exchange between arteries and veins and vasoconstriction. Then he produced a fishing line, a light and a few more useful aids to survival including small paddles.

As an aside, a modified version of the UVIC Thermofloat is now in use with the RAAF for flights over cold water. The modifications include thinner insulation and a shorter jacket, with correspondingly longer tail, so that the pilot does not become too bulky.

DIVING SAFETY MEMORANDUM NO. 11 - CORROSION IN DIVING LIFE SUPPORT SYSTEMS

The following letter was recently issued by the Secretary of the Association of Offshore Diving Contractors to all the members:-

"I have just been advised that cases of extensive corrosion have been discovered in the hot water circuits to diving bells.

"In particular installations the corrosion occurred in 1" diameter "Penetrators or Bushings" which were used for piping hot water into the bells. Each of the penetrators was equipped with a male brass reducer fitting into a three quarter inch female. The severe corrosion occurred at the inner part of the penetrators.

"The reason for the corrosion is not clear but could have been caused by an electrical reaction between the brass reducer and steel penetrator; turbulences created by the flow of water hitting the edge of the reducer; corrosion properties of the hot sea water; or/ and the pressure of the hot water (as high as 1000 psi).

"All members are advised to check any similar installations as a matter of urgency."

There are also indications that corrosion can become extensive very quickly in pressurised "sanitary systems" in particular in the sanitary water top up tank and associated piping.