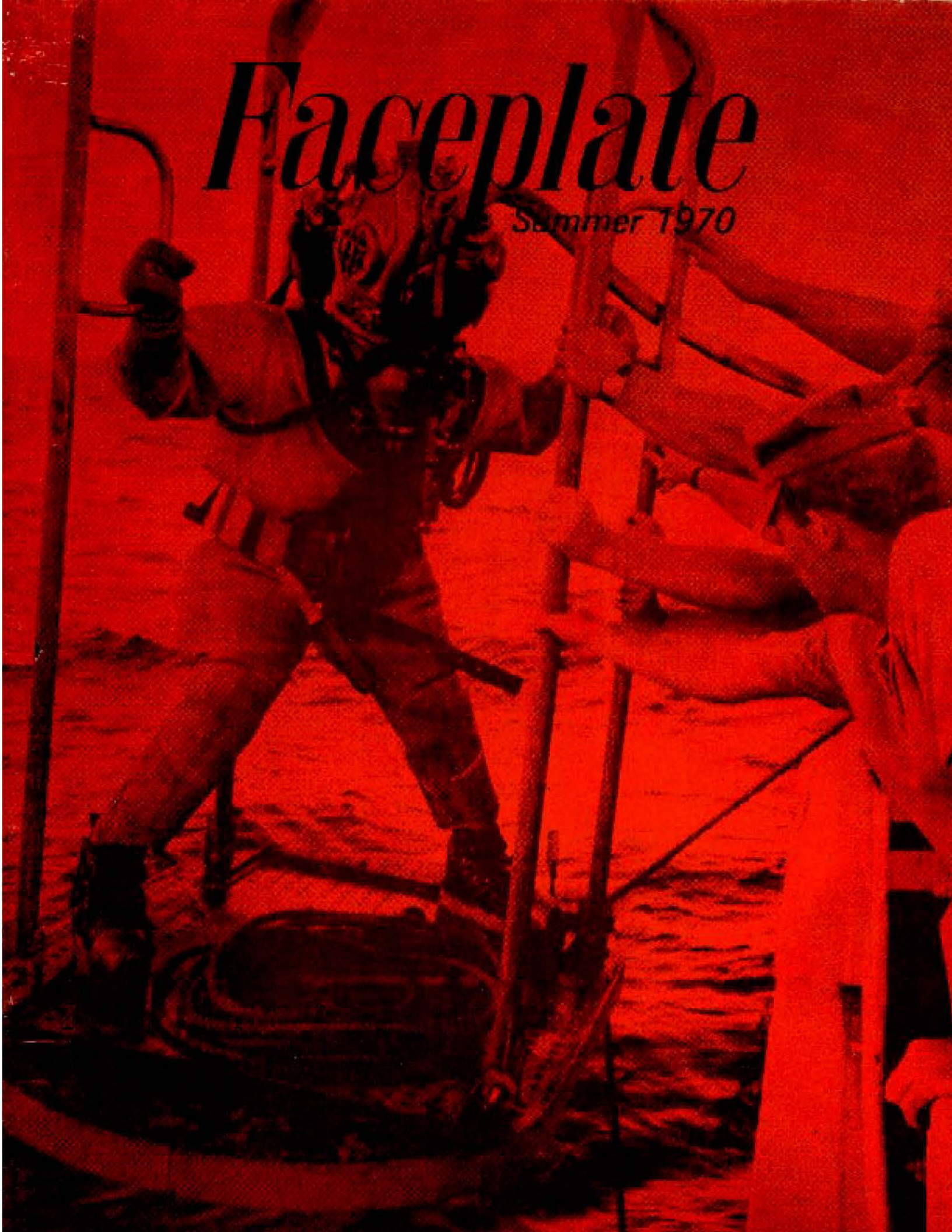
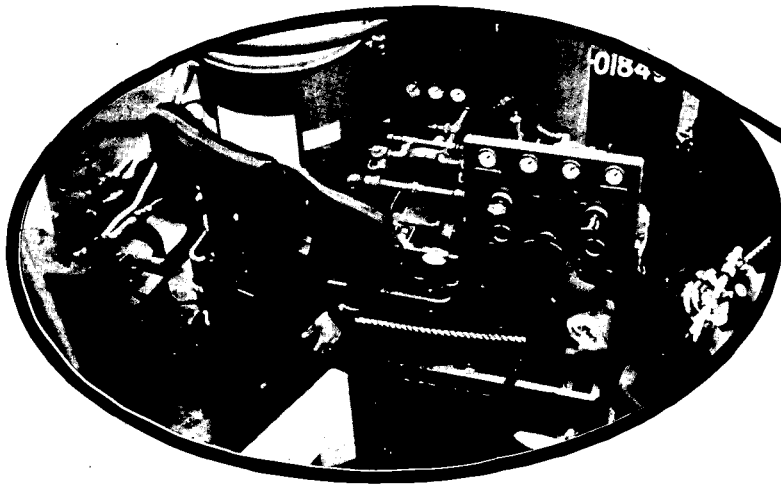


Faceplate

Summer 1970





(See "Keeping the Diver Warm . . ." page 10)



Faceplate



Vol. 1 No. 2

FACEPLATE is published quarterly by the Supervisor of Diving to bring the latest and most informative news available to the Navy diving community. Articles are presented as information only, and should not be construed as regulations, orders, or directives. Discussions or illustrations of commercial products do not imply endorsement by the Supervisor of Diving or the U.S. Navy.

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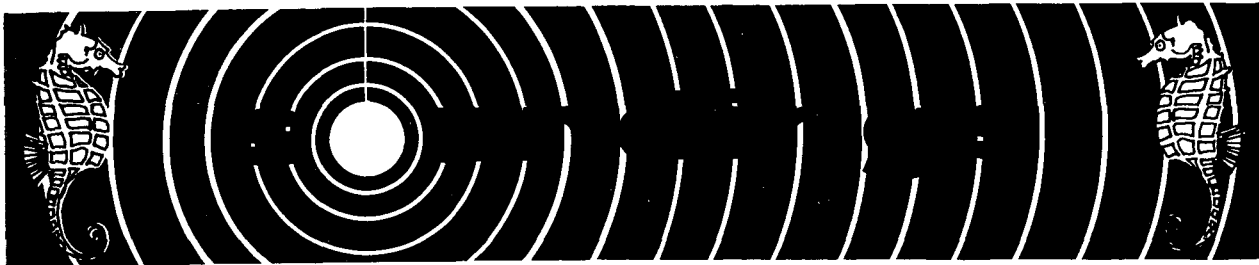
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Contributions from *FACEPLATE* readers are welcome. The right to make editorial changes to the material without altering the intended meaning is reserved. Send to *FACEPLATE*, Supervisor of Diving, Naval Ship Systems Command, Washington, D.C. 20360.



The deepest depth ever reached in the open sea by U.S. Navy men On 22 April 1970, M. T. Bell (DCC), D. C. Risk (BM1), F. L. Reanda (MR1), and L. K. Goacher (BMC) dove and worked at 650 feet for two hours, using the Mark I Deep Dive System. LCDR McDermott, PCO of *ASR-21*, was in charge; OPCON was under COMSERVGRU ONE, San Diego. Submarine/Diving Medical Personnel from EDU and SUBDEVGRU ONE were in attendance.

The dive was performed off the deck of the *USNS GEAR (ARS-34)*, moored in the lee of Anacapa Island off Port Hueneme, California. The divers, working at 650 feet, had no difficulty whatsoever. They were kept warm by hot water supplied from the surface to open-circuit hot water suits. Communications from divers to the Personnel Transfer Capsule (PTC) and to topside were excellent. The two working divers (one man tended from inside the PTC) wore newly developed life support equipment — one wore the Kirby-Morgan Band Mask; another wore the Mk 11 Mod 0 mixed-gas SCUBA. The divers were saturated at 600 feet before descending in the PTC. After the working dive, they were brought back up in the PTC and transferred into the Deck Decompression Chamber (DDC). At the time of this writing, they continue saturated in the DDC, under careful observation of medical personnel — awaiting more and possibly deeper dives.

A significant aspect of this dive is the total success of a deep working dive of this duration, but surface based and without the expense associated with bottom habitation.



Netherlands Navy Divers show a very keen interest in the Mk I Deep Dive System while their ship, *HNMS VAN GALEN F-803*, a frigate home ported in Den Helder, recently visited San Diego.

Diver Equipment Information Center As an aid to the design and use of diving and related equipment, a Diver Equipment Information Center has been established by the Supervisor of Diving. Located at Battelle Memorial Institute, Columbus, Ohio, the Center, maintained by professional infor-

mation specialists, presently consists of approximately 6,000 U.S. and foreign references. The references are abstracted on 5x7 cards which are filed by clue word, author, and organization. Comprehensive collections of reports; articles; patents; manufacturers' literature; pertinent military, federal, and industry specifications; and, equipment operating and maintenance manuals are maintained.

Information on the use of the Center may be obtained by calling Mr. James S. Glasgow at Battelle, Area Code 614, 299-3151, Ext. 1161.

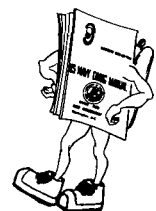
Another record-breaking recovery This time, a National Aeronautics and Space Administration (NASA) instrument package, weighing 400 pounds, was retrieved from 5,850 feet of water off the coast of Norfolk, Va.

The NASA rocket was sent aloft to gather data on the March 7th solar eclipse. After the eclipse, the parachutes, which controlled the rocket's return, opened too soon and the instrument package plummeted to the ocean floor.

The office of the Supervisor of Salvage pulled together the right combination of Navy activities and equipment to effect recovery. The *USS OPPORTUNE (ARS-41)*, commanded by LCDR D.C. Craft, was designated as the mother ship for Naval Undersea Research and Development Center's (NUC) brand new Cable-Controlled Underwater Research Vehicle (CURV III). A very rapid recovery had to be effected before exposure to sea water damaged the film in the instrument package. The instrument package was successfully recovered on 22 March, after the crew worked through the night on rough seas. This payload was the heaviest ever recovered by an unmanned vehicle from a depth greater than one mile.

World record in simulated deep dive On 6 March 1970, during part of a planned series of deep dives to probe the limits of man's underwater capabilities, two members of the Royal Naval Scientific Service, John Bevan and Peter Sharphouse, stayed 10 hours at a world record simulated depth of 1500 feet. The dive continues a long series of break-throughs in the field of underwater physiology and medicine by the Royal Naval Physiological Laboratory, Alverstoke, Hants, England.

The divers entered the chamber at 1030 on Tuesday, 3 March 1970. During the experiment they spent 24 hours at depths equivalent to 600 feet, 1,000 feet, and 1,300 feet, and an hour at 1,000, 1,200, and 1,400 feet while breathing an oxygen/helium mixture. They spent 5½ days at depths beyond 1,000 feet and 3½ days beyond 1,200 feet. Thorough scientific studies were made of any neurophysiological, respiratory, cardio-vascular, or biochemical changes occurring during the dive. The outstanding quality and quantity of scientific measurements obtained during the experiment permit the inference that man has not yet reached the physiological limits of deep diving.



U.S. Navy Diving Manual The new edition (NAVSHIPS 0994-001-9010, March 1970) of the *U.S. Navy Diving Manual* has been distributed. Although this new version is an improved manual, like any new publication, it contains some errors. Please notify the Supervisor of Diving about any errors you find.

THE HELVEY HOLDER

THE "Helvey Holder," an invention of Allan "Doc" Helvey, HM2 (DV) of Subic Bay, Ship Repair Facility, has simplified the problem of replacing underwater hull zincs at Subic.

In the past, the method of replacing hull zincs consisted of driving a wedge under an existing zinc to hold the new zinc in place while welding. This procedure had its limitations as far as placement of new zincs and the cumbersome holding procedure.

To offset these problems, "Doc" Helvey designed an aluminum frame which would hold the zinc in place by the use of two detachable hand magnets.

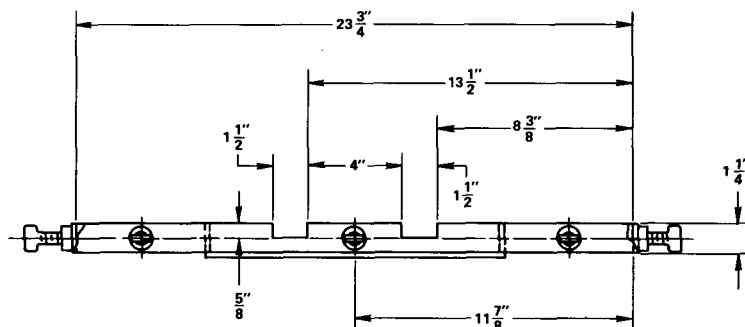
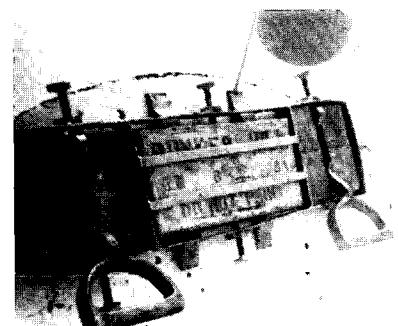
Since replacement of zincs is a repair job required by so many ships, we believe that the "Helvey Holder" might be a useful tool for all ashore and afloat facilities engaged in this sort of work. Although this idea was submitted as an SRF Subic Beneficial Suggestion, it may be some time before it reaches other repair facilities.

So, here it is — the "Helvey Holder" — if you like the idea — make one and try it.

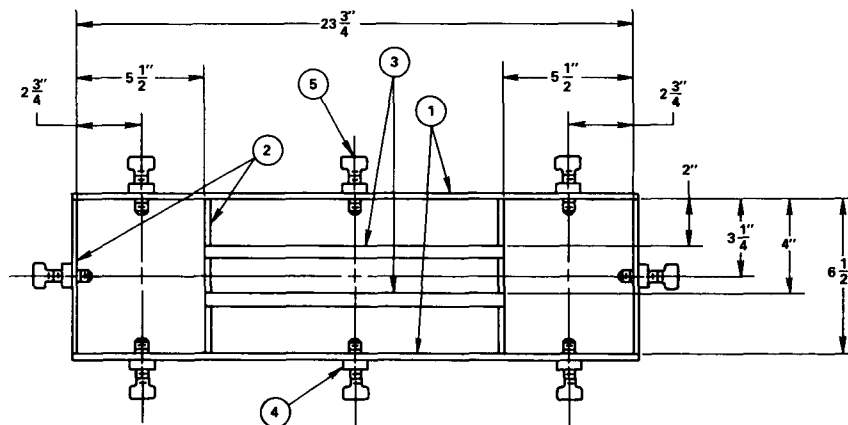


"Doc" Helvey with the dis-assembled Helvey Holder.

The Helvey Holder as installed under water.

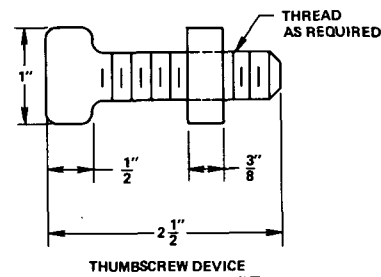


SIDE VIEW



TOP VIEW

LIST OF MATERIAL		
ITEM NO	REQD	DESCRIPTION
1	2	$\frac{1}{8} \times \frac{1}{4} \times 24$, ALUM PLATE
2	4	$\frac{1}{8} \times \frac{1}{4} \times 6\frac{1}{2}$, ALUM PLATE
3	2	$\frac{1}{8} \times \frac{1}{2} \times 12\frac{1}{2}$, ALUM PLATE
4	8	$\frac{1}{2} \times 1$ DIA, ALUM SPACER
5	8	$2\frac{1}{2}$ L, THUMB SCREWS



LEGION OF MERIT PRESENTED TO Captain Willard F. Searle, Jr., USN

THE Legion of Merit was awarded to Captain Willard F. Searle, Jr., USN, for his outstanding service as the Navy's Supervisor of Salvage from September 1964 to May 1969. The presentation was made by RADM Maurice H. Rindskopf, USN, on 24 February 1970 during the "Equipment for the Working Diver Symposium" held at Battelle Memorial Institute in Columbus, Ohio.

His citation states "... CAPT Searle contributed more than any other individual since World War II to the high state of readiness which now exists in the Navy's salvage and diving organization."

CAPT Searle was also cited for his significant contributions toward the development of programs to decrease the danger of oil pollution, and also his efforts in restoring the World War II concept of Harbor Clearance Units for application in Vietnam. Actions CAPT Searle initiated and guided were key factors in many successful salvage operations. Of particular importance was the salvage in late 1965 of the *USS KNOX (DDR-742)* after she had gone aground at Pratas Reef in the South China Sea. Cast-in-place salvage foam was used on a large salvage operation for the first time. Equally notable was the salvage of the 15,000-ton floating drydock *AFDM-2* which capsized and was carried three miles upstream when Hurricane Betsy passed over the Louisiana coast. CAPT Searle devised the detailed salvage plans, consisting of a complex twelve-step righting and refloating operation which proved successful after eight and a half months. Also cited among his accomplishments were his efforts



Captain W. F. Searle, Jr. (right), Project Manager of Mine, Service, Patrol Craft and Ocean Engineering Ship Acquisition Project Office, wearing the Legion of Merit, is shown with: (L to R) CAPT Searle's father; RADM Rindskopf; CAPT Searle's wife, Jean; and CAPT E. B. Mitchell.

which led to the development of the Navy's Mk I Deep Dive System. He demonstrated the Navy's ability to support deep recovery operations safely and quickly from a ship of opportunity.

CAPT Searle's career in the Navy began when he graduated with distinction from the U.S. Naval Academy. He is planning to retire about 1 July 1970, after twenty-five years of Naval service.

This group photo, representing about 450 years of diving, salvage, and ocean engineering experience, was taken shortly after the award presentation. (L to R): front-LCDR Kunz, LT Childers, Mr. Greenstone; middle-LCDR Talarico, LCDR Thomas, CDR Brewer, CDR Moody, Mr. Lawrence, Mr. James, RADM Rindskopf, CAPT Mitchell, CAPT Searle, CPO Warren, MCPO Brown, CPO Roan, CDR Looney (behind Roan), CAPT McCloskey; back-LCDR Bladh, LCDR Evans, LCDR Kohl, Mr. Manlove, CPO Kitchens, SCPO Oranczak, CPO Shoaf, LT Naquin.



Equipment for the Working Diver

The expansion of underwater engineering and research to greater and more hazardous ocean depths, stimulated by the growing awareness of the oceans as a tremendously rich frontier, makes it essential that the working diver be provided with safe, efficient, reliable equipment of many kinds . . . He must be able to sense his environment accurately, complete his assigned tasks correctly and without excessive fatigue or discomfort, communicate clearly and quickly with his co-workers and support personnel, descending and returning safely. . . .

Equipment for the working diver must be designed on the basis of accurate knowledge of this environment, of the diver himself, and of the latest scientific and technological developments in materials, methods, systems, components, and services. . .

1970 Symposium

February 24-25
Battelle Auditorium
Columbus, Ohio

Sponsored by:

U. S. Navy, Supervisor of Diving
Battelle Memorial Institute, Columbus Laboratories
Marine Technology Society, Committee on
Man's Underwater Activities

PROGRAM



L-R: Dr. Faucett, Battelle's Toastmaster at the symposium banquet; RADM M.H. Rindskopf, USN, Deep Submergence Systems Coordinator; and, CAPT E.B. Mitchell, USN, Director of Diving, Salvage and Ocean Engineering.

THE 1970 Symposium on Equipment for the Working Diver brought together 450 users, designers, and manufacturers of diving equipment, both military and commercial, from all over the world, to share their knowledge and experience.

The symposium chairman was Captain E.B. Mitchell, USN, Director of Diving, Salvage and Ocean Engineering. The program for the symposium was developed by Mr. James S. Glasgow of Battelle and LCDR James L. Majendie, RN, of the U.S. Navy's Office of the Supervisor of Diving. The four technical sessions of the program, which included appropriate presentations, were chaired as follows:

- Equipment Design — Mr. A.J. Coyle,
Battelle-Columbus
- Advanced Breathing — Mr. Thomas B. Fifield,
DESCO
- Accessory Systems — Mr. W.T. Odum,
NAVSHIPS R&D Lab
- Diving Operations — LCDR W.I. Milwee, Jr., USN

PRESENTATIONS given at the symposium included a review by Mr. H. Hazard of Battelle on the new U.S. Navy Diving Gas Manual, which deals with the real-gas properties of helium/oxygen mixtures. LCDR James Majendie, RN, discussed diver heating. Also, LCDR

HIGHLIGHTS



A highlight of the symposium banquet — the presentation of the Legion of Merit to CAPT Searle (see article this issue, page 7). The banquet's keynote address was given by John P. Craven, PhD, from the Massachusetts Institute of Technology.



United States and Royal Navy representatives at the symposium — l-r: RADM M.H. Rindskopf, USN; CAPT E.B. Mitchell, USN; LCDR W.I. Milwee, Jr., USN; CDR A.P. White, RN; Surgeon CAPT J.S.P. Rawlins, RN; CDR J.H. Boyd, USN; CDR N. King, RN; LCDR J.C. Bladh, USN (Exchange Officer with RN); and, LCDR J.L.A. Majendie, RN (Exchange Officer with USN).

Majendie and Mr. L. Lady of General Electric described the design and use of the Mk 10 closed-circuit mixed-gas scuba. A presentation of the Interim Aquanaut System/Mk 11 Scuba was made by Mr. W. J. O'Neill of Westinghouse and Mr. T. D. Sanford of Deep Submergence Systems Project. The current development work on hydraulic tool systems for divers was outlined by Mr. John T. Quirk of the Naval Civil Engineering Laboratory. Mr. R. Chalmers of the FMC Corporation reviewed the design, construction, and operation of the Mk I Deep Dive System.

Other presentations stressed the need for increased participation of working divers in the design phase of new equipment, and identified the human factors that affect the diver in his work. A closed-circuit cryogenic scuba, which is a system controlled by temperatures developed with a counter-flow heat exchanger system, and an integrated life-support system for hyperbaric chambers, bells and submersibles were discussed. Available methods of removing carbon dioxide from closed-circuit underwater breathing apparatus were itemized, and then the efficiency of various canister designs and gas-flow patterns was discussed. The progress being made toward perfecting a miniature carbon dioxide monitor, mounted within the diver's breathing equipment, was explained. In response to the need for reliable underwater wireless communications, a system, which uses bone-conducting microphones and receivers powered by portable energy or energy from the surface, was explained. Other discussions summarized various undersea power supplies; and, emphasized the possibilities that could be realized between a lockout submersible and a diver. The concluding presentation introduced a low-cost pressurized sphere injector system which could be used at any depth. This system provided reusable spheres which could be pressurized in a chamber, delivered to an object to be lifted, and as the object rises, the spheres depressurize slowly to maintain ambient pressure balance.

In summary, the presentations given stressed the need for equipment design based on accurate knowledge of the water, the diver, and the latest scientific and technological developments in materials, methods, systems, components and services. The results can only mean improved equipment for the working diver.

Capitaine de Vaisseau F. LeBoucher (immediate right) reported on diving research and development in the French Navy.

Diving progress being made in the Royal Navy was summarized by CDR A.P. White, Superintendent of Diving, RN (far right), and Mr. R.P. Common of the Admiralty Experimental Diving Unit.



Keeping the Diver Warm...



A Problem to be Solved

This article is derived from the presentation, "Diver Heating," given by LCDR James Majendie, RN, at the equipment symposium held at Battelle Memorial Institute (see "Symposium" this issue, page 8). LCDR Majendie, an Exchange Officer from the Royal Navy, is on duty with Supervisor of Diving.

A FACT, as old as diving itself and becoming increasingly important as we go deeper for longer periods, is that heat must be provided for the diver. The object of any dive is to achieve useful work — a "worn out" state-ment perhaps, but let us never lose sight of the importance of the fact. A diver will only achieve useful work — safely and efficiently — if he is comfortable and to be comfortable, he must be warm.

Back in 1837, when August Siebe invented the closed-dress with the hard hat, he knew what he was doing. He kept the diver dry, and let him put on all the "woolies" he wanted to keep warm. However, as a result, the diver could not move around easily and certainly not with any speed. But back then, time was not so important; today, missions have changed. It is now necessary that the diver be very mobile and that he be able to complete his task as quickly as possible. To achieve this, the diver has been given his own portable gas supply and a streamlined diving dress. However, the dress provides only very limited insulation at shallow depths and almost none at all at deep depths.

To begin to understand what is involved in solving this problem, we must review some of the advantages and disadvantages of diver heating methods used today, as well as those methods being studied for future use. For the purposes of discussion, the problem may be divided into general areas — suit heat loss, heat sources, and Personnel Transfer Capsule (PTC) heating.

SUIT HEAT LOSS

The *wet suit*, probably the most widely used suit today, is usually made of foamed neoprene. Since the suit is normally custom-made, only a small amount of water can enter, and this is quickly warmed by the body. Heat loss is then restricted by the insulating properties of the neoprene.

Unfortunately, foamed neoprene compresses with increased depth and in doing so loses much of its insulating ability, thereby becoming less and less effective. There are some non-compressible materials being developed which are not affected by pressure or depth, and therefore would be ideal for keeping the diver warm, but their use as a wet suit is still in the experimental stage. At

present this material is rather bulky and heavy. Foamed neoprene has another disadvantage. In a helium environment under pressure, the nitrogen/oxygen diffuses out of the neoprene and is replaced with helium at a pressure equal to that of the environment, causing the neoprene to re-expand to about 65 percent of its original thickness. However, when the diver enters the water, the helium outgasses from the suit, but on return to the PTC or habitat there is no re-expansion as the pressure in the suit cells equals that in the PTC. Since this process is repeated with each excursion, the diver ends up with a very poor suit. In fact, at 600 feet the insulation is about one-quarter of that at the surface.

It goes without saying, the present wet suit is not suitable for deep dives and its use for prolonged shallow dives in very cold water should be carefully controlled. This suit has proved to be suitable for dives of short duration at shallow depths.

The *dry suit* has certain advantages over the wet suit. Keeping a diver dry is particularly important in deep diving on return to the PTC where he will freeze if he is wet. Loss of heat is minimized by an insulating air gap and an undersuit next to the diver's skin. A constant volume regulation system maintains the air gap. If constant volume is maintained, insulation of the dry suit tends to remain unchanged with depth. Also, the dry suit may, when necessary, be worn with extra layers of underwear for added warmth.

(Continued on page 16)

This British-made, Dunlop Dry Suit is being used with nylon fur underwear by the Mk I Deep Dive Team. This gives adequate protection in very cold water at 600 feet for about 20 minutes.



The Black Fish ...

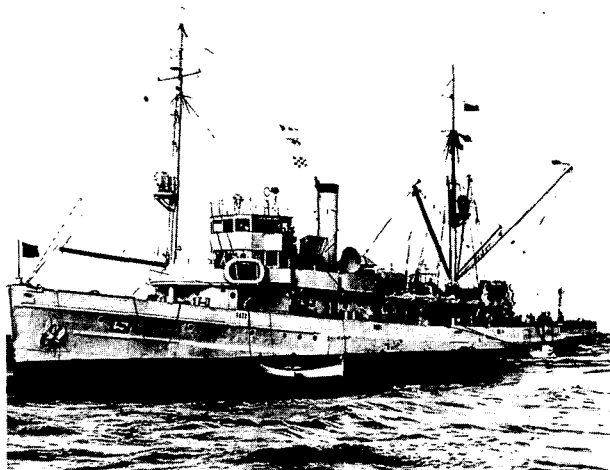
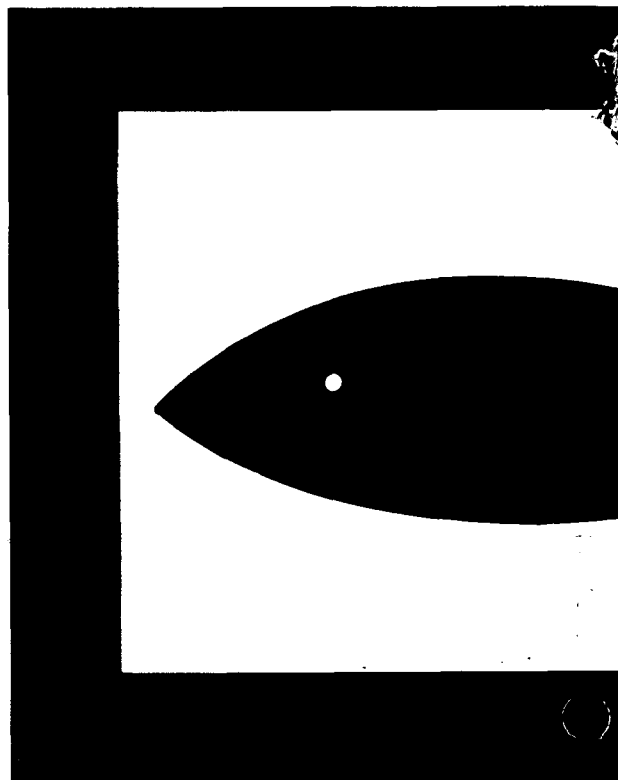
HOW did the "black fish," which is painted on the bow of only one type of ship in the U.S. Navy, the Submarine Rescue Ship (ASR), come to be used? What is the true history of this insignia?

Efforts to find answers to these questions have created quite a puzzle! No official directive authorizing this insignia can be located. After a search of Naval Historical Records, the files of the Submarine Force Library and Museum in New London, and Library of Congress, nothing more than a picture of one of the first commissioned ASR's could be found. Finally, bits and pieces of information, collected from some of those who had served on these ships, were put together to form answers. Although the following story is not recorded as a true documentation, it represents our facts collected on the events concerning the history of the "black-fish insignia." After you have read our version of this historical insignia, perhaps you will verify this or drop us a line and tell us your version.

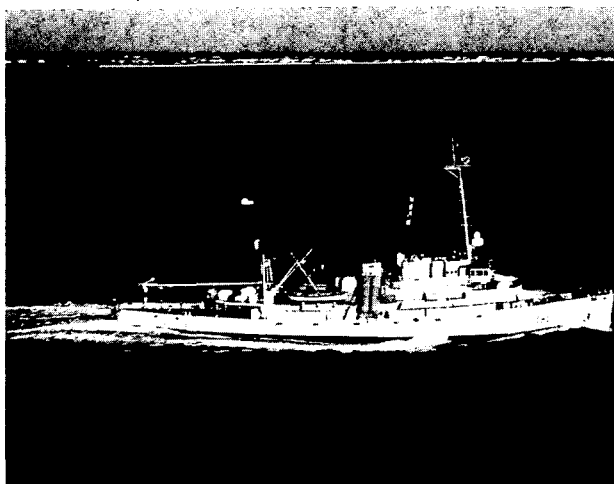
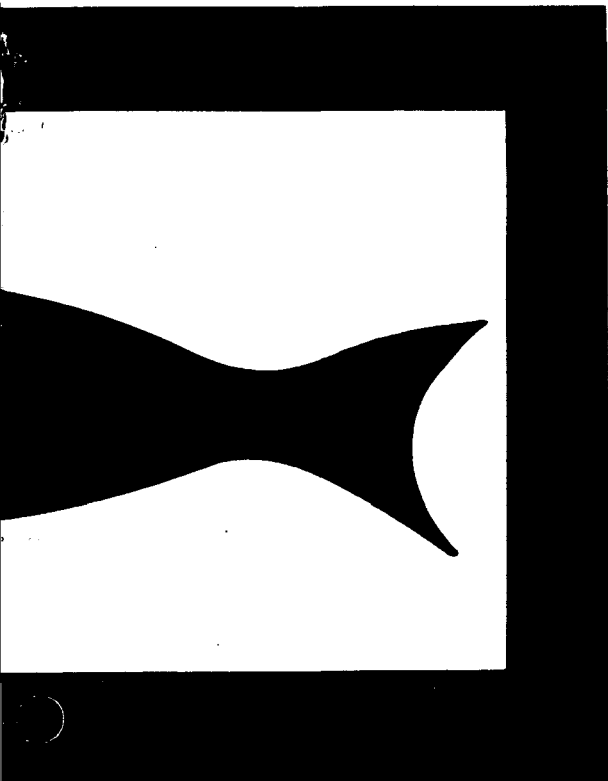
* * *

In 1882, a diving school was established at the U.S. Naval Torpedo Station in Newport, Rhode Island by a retired Chief Gunner's Mate, Jacob Anderson. At that time, the Chief trained volunteer divers by recovering practice torpedoes fired from the station's tubes. As the story goes, the divers devised and displayed a flag from their boat to signify the recovery of torpedoes. At first, this flag was a black torpedo-like symbol against a white background with a red border. It wasn't long after this that the divers called these torpedoes by the nickname "fish," because these "fish" were all over the bottom of the river, and they did resemble a long fish-like object. Logically, it follows that the symbol on the flag was replaced by a fish-like object, but still having a torpedo-like shape.

At the start of the twentieth century (about October 1900), our first submarine was commissioned as the *USS HOLLAND (SS-1)*. When the submarine went to sea to conduct trials, it was escorted by a small craft. The mission of this escort was: to standby in case of an emergency while the submarine was submerged;



The *USS ORTOLAN (ASR-5)*, ex *AM-45*, was one of the first six ships, commissioned on 12 September 1929, to serve as "guardian of submarines." Note that the "black fish" on its bow is pointing aft, and the number of the ship is painted over the insignia.



The USS KITTIWAKE (ASR-13), commanded by LCDR R. F. James, displays the insignia as it is seen on ASR's today.

to act as a safety vessel by patrolling the operational area to warn ships and other smaller craft to keep clear of the submarine operating area; and, to recover practice torpedoes fired by the submarine. At this time in history, there was no international flag signal to signify that a submarine was conducting operations. Seemingly, because of the lack of any other flag signal, the small submarine escort displayed the same "black-fish insignia" as was displayed at the Newport torpedo firing range.

When our Navy began to operate more submarines further and further from their home bases, we came to realize the need for Submarine Rescue Ships. These ships would have to range far and conduct submarine rescue and salvage operations whenever needed. To meet this need, the U.S. Navy converted six minesweepers (the AM type) and commissioned all six of them on 12 September 1929. As soon as these ASR's joined the Fleet, they assumed the role as "guardians of submarines," and they adopted the "black-fish insignia." It became traditional to paint this insignia on all the ASR-type ships.

During World War II and the years immediately after, this insignia stopped appearing on most of the ASR's probably due to the heavy work schedules during the war and the mass reduction of manpower that followed. The insignia began to reappear in the early 1950's. (A former officer on one of the ASR's remembered the insignia being repainted on the bow after a noticeable period of absence. He recalled the First Lieutenant finding guidance on the size and location of the insignia in the Painting Instructions for the ASR type.) A recent letter from the Commanding Officer of the USS KITTIWAKE (ASR-13), LCDR R.F. James, USN, advised that guidance for displaying the insignia is contained in the NAVSHIPS Technical Manual, paragraph 9190.152, and NAVSHIPS Plan No. S-2804-860-342.

Today, the "black fish," which has existed "on" and "off" for almost a century in our Navy, can be seen on the ASR types. This insignia represents the proud heritage of our Navy divers from their earliest days in small boats to the ocean-going ASR types of the present.

OPSF - 1972

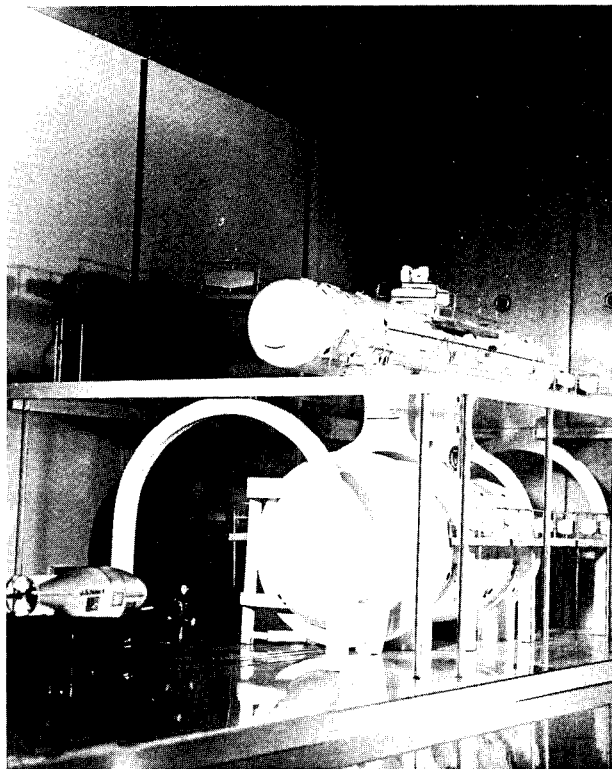
THE largest Ocean Pressure Simulation Facility (OPSF) of its type in the world is being constructed at the Naval Ship Research and Development Laboratory, Panama City, Florida. This \$7.4 million pressure facility, which will be able to test man and machine together in a simulated ocean environment to a depth of 2,000 feet, is expected to be operational by 1972.

The research facility will center around an arrangement of connected pressure chambers. This arrangement will consist of five dry chambers (60 feet long overall), and a lower wet chamber (15-foot diameter, 30-foot length). The chambers are arranged and interconnected so that they may be used in several combinations, with entrance and exit provided to each. All chambers can also be operated independently at different pressures and gas mixtures.

The temperature of the 53,000 gallons of fresh or salt water in the wet chamber can be controlled from 29°F to 90°F. The salinity, turbidity, and light level can be controlled to simulate any real ocean environment.

A control room, which will provide a central location for monitoring and controlling all aspects of the facility, is planned. Closed-circuit television will monitor all chambers. The television monitors and a large display screen will be visible to everyone in the control room.

Control of the pressure chamber complex can be manual or semi-automatic. A direct tie-in to a large already installed modern computer greatly enhances the facility capability by automating a part of the operation. The computer can provide control of the operation of valves, pumps, and blowers as well as continuously

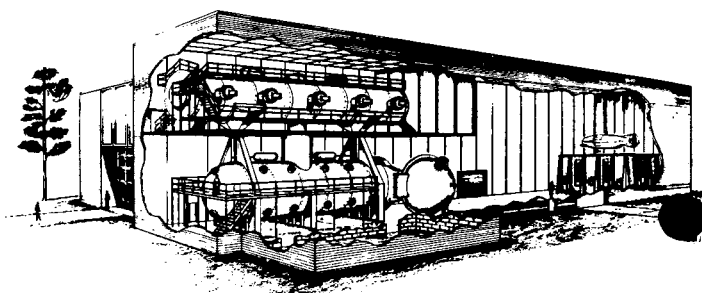


A scale model of the OPSF. Provision is made in the wet chamber (large bottom chamber) for operating the man-machine combinations anticipated. The size of this chamber will contain any known wet submersible and most two and three-man dry submersibles. A 30-ton bridge crane will handle equipment.

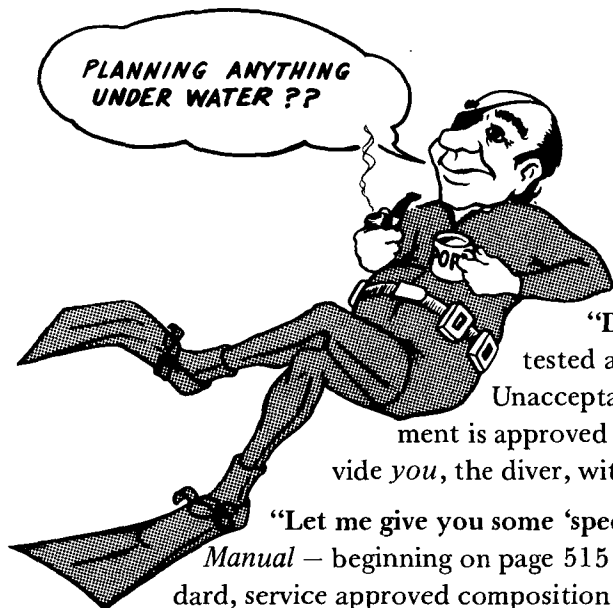
monitor and record for future analysis the values of all operational variables such as pressure, temperature, and flow. Perhaps the most interesting function of the computer will be to automatically control mission simulation. Such functions as diving decompression schedules and gas mixture can be automatically controlled during test missions. The computer will also collect and process engineering data resulting from tests in progress.

This unique facility will enable the U.S. Navy to develop, test, and evaluate underwater man-in-the-sea systems in a simulated real environment — all under laboratory control. The capability to predict the performance of man and machine, prior to actual ocean trials, will be a giant step forward for the U.S. Navy, the nation, and the entire spectrum of ocean technology.

The structure, shown in this sketch, that will house the OPSF will be a steel frame, masonry building, of approximately 22,500 square feet total area, with a three-story administrative section, a high bay area with mezzanine, a one-story mechanical room, and a testing pool. The complex, which also includes outside accessories, will cover approximately three acres.



The Old Master says . . .



"Believe me — you wouldn't believe the good number of 'cases' involving guys who did not use service approved equipment or modified existing equipment! If you could read all the accident reports I've read — you'd believe!

"Don't be a report! The Navy's diving stuff is tested and evaluated under operating conditions. Unacceptable 'things' are corrected before the equipment is approved for service use. All this is done to provide *you*, the diver, with the best and safest possible equipment.

"Let me give you some 'specificks'. First, the new *U.S. Navy Diving Manual* — beginning on page 515 — lists the standard, service approved composition of the outfits for deep sea diving and special HeO₂ diving, as well as composition for the lightweight outfit. Then, you'll find the composition of service approved SCUBA equipment, starting on page 567.

"In addition to equipment listed in the manual, the Navy, from time to time, issues NAVSHIPS Instructions which may authorize the use of certain equipments — if they meet military specifications and pass testing at EDU.

"Before closing, I'm gonna really get 'specifick' and quote from the new Navy Diving Manual:

Approved Equipment. Diving equipment will not be used operationally unless it has received official evaluation and *approval*. Approved operational equipment will not be altered, modified, or changed in any way unless such modifications have been officially evaluated and *approved*. Trials of experimental gear and modification of present equipment may be conducted only at designated activities such as the Experimental Diving Unit, or at others when specifically authorized by the Naval Ship Systems Command. When evaluating new or modified equipment, the diving supervisor will give special consideration to the safety of the personnel involved and will insure that all trials are properly supervised and safeguarded. . . ."



"I'd like to stick around to talk with you guys in every issue of *FACEPLATE*. But, I need to know what's going on in the Fleet. How about some of your good "sea stories" and a complaint now and then? I'll talk about anything!!"

(Continued from page 11)

However, the main disadvantage of this suit is that it does not always remain truly dry, and anyone who has dived in a wet dry suit knows the very unpleasant feeling of cold water creeping in! Also, when diving from a habitat or PTC in a helium environment, the air in the dry suit is replaced with helium which greatly reduces the insulating ability of the suit.

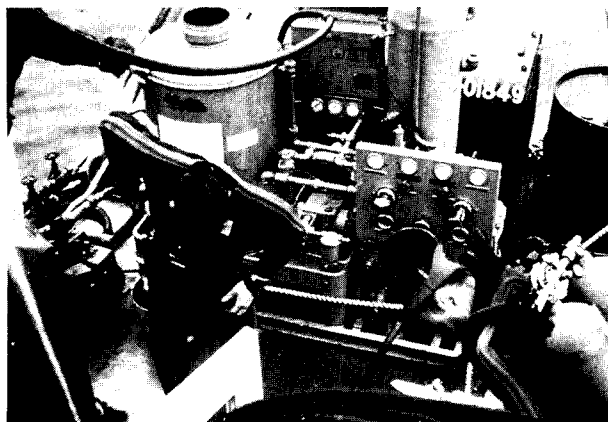
Heat Replacement

It is obvious from the examination of the two different types of suits, wet and dry, that a heat replacement system is necessary for deep dives and for prolonged shallow dives. At the present time, no suit alone is capable of keeping a diver in proper heat balance for very long periods of time. This heat must be provided from an external source.

How much heat is required? There are many factors to consider when determining the amount of heat required. These include, but are not limited to such things as the water temperature, depth, time, rate of work, as well as the type of suit being used. For a better idea of the amount of heat required, consider a diver in a "present-day" suit at 600 feet in 32°F water. This diver, using a closed-circuit system, will require an average of 1.2 KW/HR (the amount of heat energy required to light twelve 100-watt bulbs for one hour). The amount of heat needed will increase to 3.4 KW/HR with an open-circuit system. This is a significant amount of heat. It is also essential that the diver's skin not be exposed to water over 110°F, as it is possible to produce burns at 112°F over a prolonged exposure time.

The *open-circuit hot water system* consists of a hot water supply, either at the surface or at the habitat, and a piped supply to the diver who is wearing a loosely fitted wet suit designed with internal tubing to evenly spray the diver with a continuous supply of hot water. He is, for all practical purposes, in a bath of hot water which flushes to the sea. The system is inexpensive, easy to maintain, and reliable. For shallow dives, it is an excellent system.

However, for deep diving the system has several disadvantages. First, a great deal of heat is lost from the umbilical, which means that the temperature of the initial water supply must be very high. Second, the amount of heat required by the diver is greatly increased as the insulation of the wet suit decreases with depth. This means that the flow rate of the water must be increased, since the water temperature cannot be increased. Perhaps the most significant disadvantage to this system is that if the hot water supply should fail for any reason,



To supply hot water to the diver using the open-circuit hot water system, this surface boiler has been produced. The boiler is diesel oil fired and provides control of temperature from the surface. For shallow dives this is an excellent system. The Supervisor of Diving is providing these systems to some diving activities which have expressed a desire to have them.



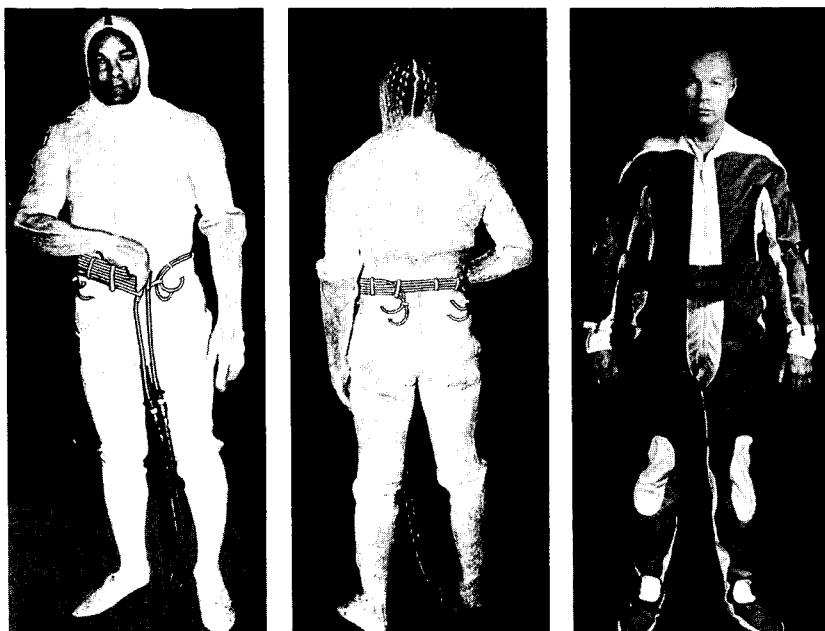
With this open-circuit hot water system, the divers, wearing wet suits designed with internal tubing, are evenly sprayed with hot water and the water supply flushes into the sea.

the diver will lose heat very rapidly. Heat loss may be speeded up by cold water flushing in from the sea. Last, but certainly not of least importance, the diver returns wet to his habitat or PTC.

The *closed-circuit hot water system* consists of a dry suit and an undergarment, composed of liquid loops (tubes). The hot water is pumped through these loops, and then returned to the heat source.

This system offers many advantages for deep diving. The diver is kept drier and warm, and as mentioned before, on return to the PTC this is of great importance. If the hot water fails, the diver will not lose heat immediately. (This was demonstrated during the Navy's 600-foot cold-water dive at Duke University. The diver was able to remain in 48°F water for 20 minutes after the hot water had been shut off.) Also, this system allows either the use of a heater carried by the diver or hot water supplied through an umbilical.

The main disadvantage of this system is that the present tubulated undersuit is not comfortable to wear because it is difficult for the diver to bend over.



This tubulated (liquid loop) undersuit (far left and center), developed for cooling astronauts in the Apollo Program, has been adapted for diver heating. This suit can be worn under a wet suit and has recently been adapted for use with the Dunlop Dry Suit. Another version of the "liquid loop" undersuit (immediate left) is a replacement for the Apollo suit. It will provide the diver with greater comfort and greater heat transfer. The system will be connected either to the diver-carried heater or to an umbilical supply.

HEAT SOURCES

There have been many ideas proposed for heating units; however, very few of these ideas have been turned into hardware.

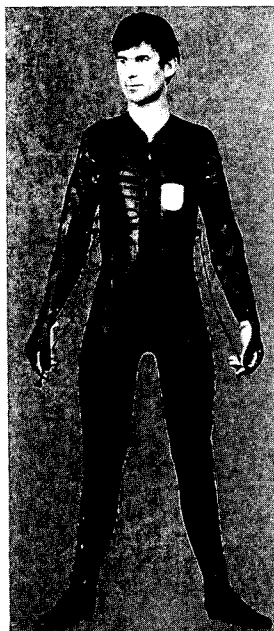
The ideal method of keeping a diver warm would be to use a self-contained heater unit. The requirements for this type of hardware are quite stringent. Free swimmers are limited by the size and weight of the heat source. The amount of heat required is so great that, if the heater is to be small enough to carry, the energy density of the material used to generate heat must be very high. Also, positive and accurate control of the heat provided to the diver is necessary, and the system must be fail-safe to ensure that the diver cannot be burned. For resupply and ease of operation, it is desirable that the fuel be cheap and readily available, and the system must be easily refuelable. No gaseous products can be permitted, and magnetic and acoustic properties must be considered for specific missions.

At first sight, *isotopes* appear to be a highly suitable heat source — a very high density energy source, a very long duration and a compactness without electronics. However, the cost is unreasonably high, and the system cannot be turned off, whether in use or not. In addition, a diver's time is limited by radiation absorption. Until an isotope such as Thulium 171 can be produced in quantity cheaply, an isotope heater is a dream.

Electricity offers an attractive method of heating a diver, as the conversion factor of energy utilized is high.

However, even with zinc/air batteries or salt water cells, the weight is more than the diver can cope with.

Loose fitting electrical underwear was the first diver heating system used with the old helium hard hat rig. This system was never widely accepted; it was difficult to use and produced burns. Other electrical suits have been built, but they have not as yet been very successful because of problems with conductor failure. Until the problem of underwater electrical shock has been truly resolved, diver confidence in this system of underwater heating will be marginal.



The French-manufactured, Piel Lambda 6 Suit uses capillary tubes filled with mercury as conductors. (The Piel Lambda 6 heating underwear is shown here.) The use of this suit by UDT/SEALS or deep dive teams is not feasible because of the restrictions on the use of mercury in enclosed environments such as submarines or deep dive teams.

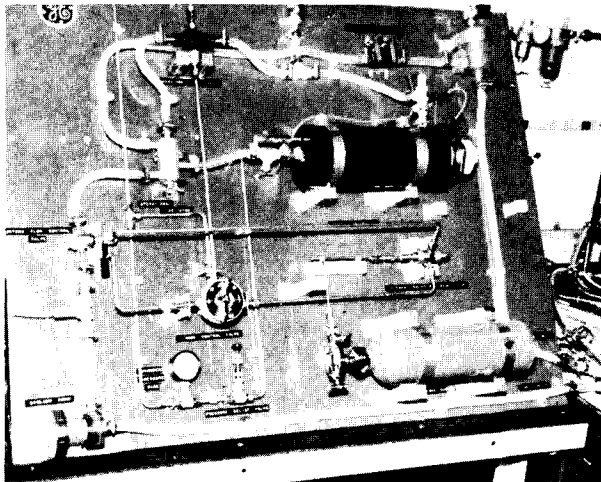


This neoprene vest is used to hold a lithium salt.

The Navy has investigated the possibility of using the *latent heat of crystallization* to maintain heat balance. A salt has been sandwiched between two layers of neoprene. The suit is placed in hot water immediately prior to the dive and heated above 84°F to turn the salt into a liquid. The insulation of the suit is thereby increased. However, for deep diving this is an unrealistic system, and has the added

disadvantage that when the suit eventually cools down the salt returns to a solid state. For future thought, the right salt, properly packed, offers many advantages: no maintenance, no refueling, no control problems, and very inexpensive. Just plug it in before entering the water!

Also under investigation is a diver-carried *oxidation* system whereby a metal is burned in pure oxygen. About 6 KW/HR of heat can be provided for the diver who will be fully protected from burning. An experimental version has been tested and satisfactory results obtained.

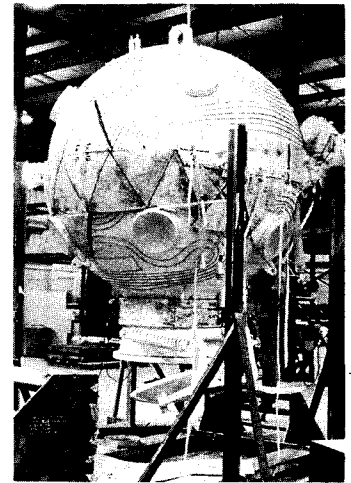


This breadboard is of the oxidation heating system. An experimental version has been tested and satisfactory results obtained.

PTC HEATING

Another aspect of diver heating, which must be discussed, is heat for the Personnel Transfer Capsule (PTC). For a safe dive, divers in the PTC must be kept warm

while on the bottom waiting to enter the water, and on the way to and from the work site. In the Mk I DDS, the PTC has heating elements cemented to the outside of the hull, using a cement with a high heat conductance,




Heating elements are cemented to the Mk I PTC hull.

and a 1-inch layer of syntactic foam over that. The electrical heating elements are contained in pressurized copper tubing, and in the event of short circuit, each element is protected so that no shock hazard to the divers is possible. This method of providing heat to the PTC provides a number of advantages. No extra space is required inside the PTC, and if power should fail the hull takes several hours to cool down, thus giving the divers heat for a considerable time. If the power to the heating elements is required to be used for other services, it can be diverted for considerable periods of time. The system has been successfully used to 650 feet at sea.

* * *

To conquer the most severe single problem facing the diving community — that of providing heat for divers under various diving conditions — suitable hardware must be developed. It becomes obvious that one of the main problems of providing heat to the diver is in the packaging, i.e., making the heating unit small enough to be portable. Technology has provided suitable hardware to enable the diver to go deeper, but the goal of sustaining him for long periods of time in the ocean depths has not yet been reached.

"OPERATION AIRCRAFT"



What's happening at Naval Ship Repair Facility, Guam? The pace continues to quicken as additional units are pulled back from Vietnam; shipyard diving continues to take up much of the divers' time. But, *FACEPLATE* takes a look at one of their more interesting jobs — the salvage of a B-52 aircraft

ON 28 July 1969, a B-52D aircraft fully manned and loaded with 500-pound bombs, crashed into the sea off the northeast coast of Guam. Naval assistance was immediately requested by telephone from the 3960th Strategic Air Wing at Andersen Air Force Base to the Commander, Naval Forces Marianas.

Within minutes of being notified, divers at the Naval Ship Repair Facility (SRF), Guam, loaded their diving gear on *YTB-795* and departed for the crash site. Upon arrival at the scene, divers began recovering small pieces of floating aircraft wreckage and parts of human remains. Later that first day, however, poor weather conditions set in, making further searching impossible.

Bad weather continued for three days. During this period, the SRF Diving Officer, the *USS PROTEUS* (AS-19) Diving Officer and Master Diver, and the *USS GRASP* (ARS-24) Diving Officer met to discuss recovery operations. It was agreed that a pool of divers would attempt to locate and salvage the major portion of the underwater wreckage when weather conditions allowed.



Beach where right wing landed (circled area). The sharp coral precluded entry by land — the only access to the beach area was by helicopter. Sea recovery teams embarked from U.S. Naval Station, 35 miles away.

Because of the location of the crash, the recovery site was inaccessible by land, and the nearest practicable embarkation point by sea was from Apra Harbor, 35 miles away. On 1 August, LT H. J. Henderson of *PROTEUS* took a team of divers to the crash site aboard the *YTB-795*. Their survey disclosed that sections of the wreckage were scattered over an underwater area of about 500 yards at depths ranging from 90 to 125 feet. On 2 August, *YTB-795* and *PROTEUS* divers recovered a wing section from the aircraft. The following day, recovery operations were continued using the Coast Guard Cutter *MALLOW* (WLB-396). A fuselage



YTB-795 with SRF divers aboard, shown on first day's rescue/recovery attempt. One hour after this picture was taken the seas built up to a height of 12 feet with the breakers completely engulfing this area of the beach.

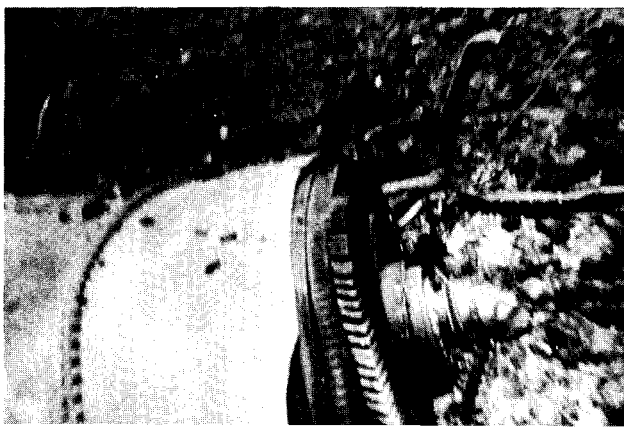
section and three bodies were recovered. Then, again, due to bad weather, no recovery operations could be conducted for two days. On 6 and 7 August, *YTB-777* and *PROTEUS* divers recovered classified material, a second wing section, a section of landing gear, and an aircraft engine. Difficulty was encountered in raising the discovered wreckage, as the only lifting gear aboard was a capstan.

On 8 August, *YTB-796* was used to recover an additional section of fuselage, and the ordnance was located. Andersen AFB requested EOD assistance and COMNAV-MARIANAS declared a formal salvage operation in effect. LCDR R. A. Bornholdt, SRF Diving Officer, took charge of "Operation Aircraft."

On 9 August, EOD divers from Naval Magazine, Guam, inspected the crash area using a Boston Whaler launched from a beach two miles from the site. The next day, they relocated and buoyed off the bombs.

SRF, *PROTEUS*, and EOD divers on board *AVR-1* got underway for the site on 11 August. The purpose of this day's operation was to locate certain items, buoy off (two engines and several hatches were located and

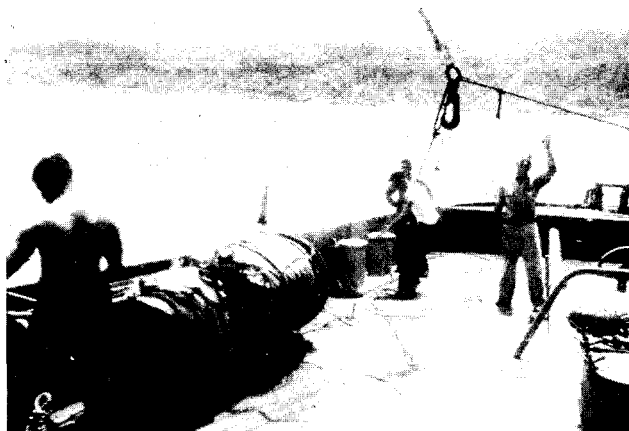
Underwater photo of B-52 engine taken at 125 feet in natural light.



marked), and then return to the scene with a vessel which had a lift capability. Divers returned to the crash site aboard *USS WANDANK (ATA-204)* on 13 August.



Underwater photo, taken at depth of 125 feet in natural light, shows SRF diver attaching wire strap to B-52 engine.



B-52 engine being loaded aboard *USS WANDANK (ATA-204)*.

After recovering two aircraft engines, operations were terminated because of heavy seas. *WANDANK* returned to port to off-load the engines.

WANDANK returned to the site again on 14 August. This time, divers recovered a hatch, ducting, and miscellaneous parts of the aircraft. Again, operations were terminated by bad weather. The Air Force, satisfied that they had enough of the wreckage, decided to reduce remaining efforts to body search and bomb disposal. However, the salvage/search efforts were delayed by bad weather for 10 consecutive days.

When efforts were resumed on 25 August, EOD divers launched the Boston Whaler from Taraque Beach, and then resurveyed and buoyed off an area in which thirteen 500-pound bombs were located, 90 feet deep. The next day, *AVR-1* with SRF and EOD divers located

and marked deep water ordnance at 120 feet and 130 feet. Defective det cord resulted in failure to shoot the shallow water (90 foot) ordnance. Then, sharks were observed! A new det cord trunk line was set on the 27th, but failed to shoot past the first tie-in to the first 500-pound bomb. Heavy seas and sharks again caused cancellation of the day's operations.

On 28 August, new charges were set with a new trunk line, but with the same results. A small test charge was made up prior to rigging the main trunk line. The charge was taken well out of the area, but was set off in only 40 feet of water. It was suspected that the water depth coupled with the aged det cord had been the cause of failures to date. Another attempt was not considered safe, as the area was well-populated with aggressive white-tip sharks!

SRF and EOD divers set a new shelf-life, wire-reinforced det cord on 29 August. This resulted in the destruction of the thirteen 500-pound bombs. Operations were then terminated until clearance was obtained to shoot the remaining eleven bombs at the 125-foot level. The destruction of these remaining bombs on 3 September ended this EOD/salvage operation.



EOD diver disarming one of the 500-pound bombs. The diver removed tail and nose fuzes. SRF divers then rolled bombs in a pile in preparation for shooting.

During this salvage operation, divers made a total of 130 dives. Bottom time for each dive varied from five to thirty-five minutes at depths of 90 to 125 feet.

The Ship Repair Facility, Guam, is commanded by CAPT J. T. Reed, USN. LCDR R. A. Bornholdt, USN, is the Diving Officer.

A Year of Action . . .

THE Diving and Escape Department at Fleet Submarine Training Facility, Pearl Harbor, saw 1969 as a year of action and activity! The main tasks of the department were: to train submariners in Free, Buoyant, and Steinke Hood ascents from a 50-foot level; to conduct a school for 2nd class and SCUBA divers (the schools consist of both lectures and open sea diving experience); and, to treat civilian and military "bends" cases. (Trainees are not restricted to members of the U.S. Fleet. We have trained men from Australia, Canada, Japan and New Zealand as well as other branches of the U.S. Armed Forces.)

We conducted escape training for over 3,800 personnel within the last year, and in addition to this figure have managed to log over 3,500 manhours of repair diving for the Submarine Base, Pearl Harbor. Thirteen "bends" cases were treated in the recompression chamber (6 civilians, 4 military divers, and 3 cases of high altitude "bends" from the low pressure chamber at NAS Barbers Point).

We recently assisted the Deep Submergence Systems Project Office and the Submarine Medical Center in evaluating the British Submarine Escape Immersion Equipment. This project involved several hundred test ascents from the Escape Training Tank, as well as at-sea tests to evaluate and determine the seaworthiness of the British equipment. Also dur-

ing this period, an evaluation of the proposed training plan involving the British equipment was made.

Community relations also play an important role in the Diving and Escape Department, with emphasis in the area of water safety. These projects include lectures on safety precautions of diving, presentations on the various types and methods of diving, as well as tours and demonstrations of the tank. These presentations are made available to various civic organizations, diving clubs, diving classes, and the State Fair.

The tank has 31 qualified Navy divers assigned on a full time basis, under the direction of LCDR A.C. Akerson, Jr., USN.

*CAPT J.E. Magee, USN
Fleet Submarine Training Facility,
Pearl Harbor*

Flying Divers!

ASIDE from working an average of eight diving jobs a day, SRF divers are taking advantage of the many training opportunities available both Navywide and locally. Currently there are two men attending HCU-1's ADS-IV program, and two men attending Sea Air Rescue training at NAS Cubi Point. With regard to the latter, SRF already has two qualified jumpers. At this rate it would appear that the next asset to our diving equipment will have to be a helicopter as it is getting increasingly difficult to get these underwater "airdales" to ride in a boat! To make riding a boat more attractive we decided that we needed a new diving craft, as the old YDT-10 has seen its day and takes a lot of "TLC" to keep up. On a recent in-country shopping trip it

was discovered that certain craft were in excess and could be had for the asking and justification. We have passed that stage and are now anxiously awaiting the arrival of the YFU-67. The configuration of the new craft will approximate that of our next door neighbors HCU-1's YLLC's with regard to diving stations and shear legs. The major difference between the YFU and the YLLC will be the installation of a high capacity electrical plant and the extensive salvage equipment of the YLLC.

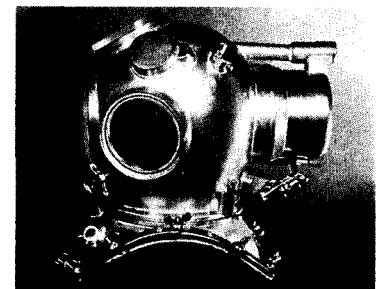
The interest in our scuba and second class diving has guaranteed us full classes and generated a waiting list. Our classes generally run about 30 students.

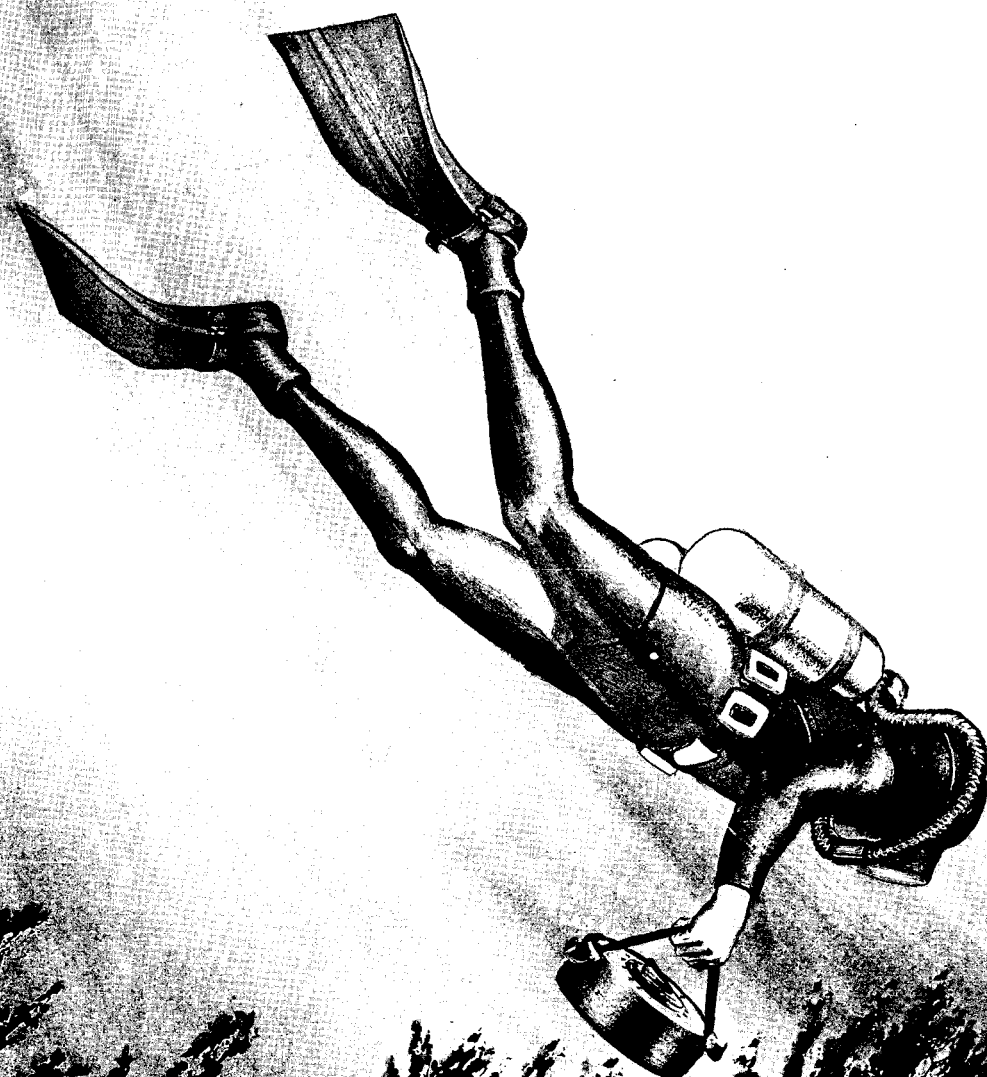
For you fleet divers who happen to be in the Subic area and want to use our services, stop in and see us. Some of our new services include: equals, chamber runs, O2 tolerance tests, regulator repair, and spare parts service (if we have them). We also try to maintain an up-dated collection of instructions.

*LCDR J. M. Ringelberg, USN
Diving and Salvage Officer
Ship Repair Facility,
Subic Bay*

Correction

On page 13 of the Spring issue of *FACEPLATE*, the illustration described as a side view of the DESCO Helium-Oxygen Helmet is, in fact, a side view of a Kirby-Morgan Helium-Oxygen Helmet. The DESCO helmet is shown below - Ed.





These days, the best way UP is DOWN!
Join the select group of Navy men
working in the ocean the world over. . .

BE A NAVY DIVER!

CONTACT YOUR DIVISION OFFICER

