

CHAPTER 6

Operational Planning

6-1 INTRODUCTION

6-1.1 Purpose. This chapter provides a general guide for planning diving operations.

6-1.2 Scope. This chapter outlines a comprehensive planning process that may be used in whole or in part to effectively plan and execute diving operations in support of military operations. The planning worksheets and checklists contained in this chapter are examples of U.S. Navy material. They may be used as provided or modified locally to suit specific needs.

6-2 GENERAL PLANNING CONSIDERATIONS

A successful diving mission is the direct outcome of careful, thorough planning. The nature of each operation determines the scope of the planning effort, but certain general considerations apply to every operation.

- **Bottom Time.** Bottom time is always at a premium. Developing measures to conserve bottom time or increase diver effectiveness is critical for success.
- **Preplanning.** An operation that is delayed due to unanticipated problems may fail. Preplanning the use of the time available to accomplish specific objectives is a prerequisite to success.
- **Equipment.** Selecting the correct equipment for the job is critical to success.
- **Environmental Conditions.** Diving operational planners must plan for safely mitigating extreme environmental conditions. Personnel and support facility safety shall be given the highest priority.
- **Diver Protection.** It is critical to protect divers from shipping hazards, temperature extremes, and dangerous pollution during all operations.
- **Emergency Assistance.** It is critical to coordinate emergency assistance from outside sources before the operation begins.
- **Weather.** Because diving operations are weather dependent, dive planning shall allow for worst-case scenarios.

6-2.1 Identifying Available Resources. The manner in which an operation is planned and conducted will depend upon variables outside the control of the diving team. In some operations, a mission-related time factor takes precedence, while in other operations the availability of equipment or personnel is a controlling factor. For all operations, the planning effort must identify available resources, which include

time, personnel, equipment, support or auxiliary equipment and supplies in order to:

- Ensure the safety of all personnel.
- Identify shortages or inadequacies that must be remedied.
- Accomplish the operational objectives in a timely and effective manner.

6-3 DEFINE MISSION OBJECTIVE

A clear and concise statement of the mission objective shall be established. If the officer planning the operation is unclear about the urgency of the mission objective, he or she shall obtain clarification from the tasking authority to determine acceptable risks.

Example: Locate, recover, and deliver lost anchor to USS SMITH at Pier A.

6-4 IDENTIFY OPERATIONAL TASKS

This section outlines the primary diving functions that may be identified in an operational task. These functions may be incorporated singly or in conjunction with others. Each task shall be identified and placed in the context of an overall schedule or job profile. Work items that must be coordinated with other support teams shall also be identified. The availability of outside assistance, including assistance for possible emergencies, from a diving unit or other sources must be coordinated in advance.

6-4.1 Underwater Ship Husbandry (UWSH). UWSH is the inspection, maintenance, and repair of Navy hulls and hull appendages while the hulls are waterborne. UWSH includes tasks such as patching, plugging, attaching cofferdams, waterborne hull cleaning, underwater weld repair to ship's hulls and appendages, propeller replacement, underwater hull inspection, and nondestructive testing (Figure 6-1).

6-4.1.1 Objective of UWSH Operations. The objective of all UWSH operations is to provide a permanent repair without drydocking the ship. When a permanent repair is not possible, temporary repairs are performed to allow the ship to operate until its next scheduled drydocking where permanent repairs can be accomplished.

6-4.1.2 Repair Requirements. All UWSH repairs shall follow strict Quality Assurance (QA) procedures to ensure underwater systems are properly repaired. Divers shall work closely with all other repair activities to ensure procedures comply with prescribed ship design and maintenance specifications. All relevant technical manuals shall be made available for dive planning, and individual diver background and expertise shall be considered when assembling dive teams. The *NAVSEA Underwater Ship Husbandry Manual* (S0600-AA-PRO-010) provides general guidance and specific procedures to accomplish many underwater repairs.



Figure 6-1. Underwater Ship Husbandry Diving.

- 6-4.1.3 **Diver Training and Qualification Requirements.** Many UWSH training requirements and qualifications are task specific. General training may be accomplished by:
- Formalized instruction as in First or Second Class Dive School
 - NAVSEA-sponsored training, e.g., Sonar Dome Rubber Window (SDRW) Repair
 - On the Job Training (OJT)
 - Personnel Qualification Standards (PQS)
- 6-4.1.4 **Training Program Requirements.** A proper training program should result in permanent repairs meeting the same tolerances and QA requirements as if performed in drydock. If there are any questions as to the qualifications required for a permanent repair, divers should consult with their command repair department or contact NAVSEA 00C5.
- 6-4.2 **Salvage/Object Recovery.** In a salvage or object-recovery operation, divers work to recover sunken or wrecked naval craft, submersibles, downed aircraft, human remains, or critical items of equipment to help determine the cause of a mishap. Salvaged items may include classified or sensitive materials (Figure 6-2).
- 6-4.3 **Search Missions.** Underwater searches are conducted to locate underwater objects or subsurface geological formations. Searches can be performed by various methods depending on the undersea terrain and purpose of the mission. Because using divers for an unaided visual search over a large area is time consuming and labor intensive, this type of search operation should incorporate

the use of sidescan sonar and other search equipment whenever possible. Remotely Operated Vehicles (ROVs) may be used to extend searches into deep waters and areas that are particularly dangerous for a diver. A reconnaissance dive may be conducted prior to other scheduled dives to gather information that can save in-water time and identify any special hazards of the dive mission.

6-4.4 Security Swims. Security swims are employed to search for underwater explosives or other devices that may have been attached to ships or piers. Ship security swims for ordnance may be conducted by non-Explosive Ordnance Disposal (EOD) divers only to locate the ordnance. Only EOD divers shall attempt to handle or dispose of underwater ordnance or improvised explosive devices. Once a task is identified as involving ordnance disposal, the area shall be marked, EOD support requested, and all personnel warned to avoid contact with the ordnance.

6-4.5 Explosive Ordnance Disposal. Divers perform Explosive Ordnance Disposal tasks including recovering, identifying, disarming, and disposing of explosive devices that must be cleared from harbors, ships, and sea lanes (Figure 6-3). Diving in the vicinity of ordnance combines the risks of diving and the explosive hazards of the ordnance. Diving to investigate, render safe, or dispose of explosive ordnance found underwater, regardless of type or fusing, shall be accomplished by qualified EOD divers only. Ship security searches for limpet mines or improvised explosive devices may be conducted by non-EOD divers for the purposes of location only (see paragraph 6-4.4). Only EOD divers shall attempt to render safe underwater ordnance or improvised explosive devices. Refer to Chapter 17 for more information on EOD operations.



Figure 6-2. Salvage Diving. Surface-supplied divers on an aircraft recovery mission.



Figure 6-3. Explosive Ordnance Disposal Diving. An EOD diver using handheld sonar to locate objects underwater.

- 6-4.6 Underwater Construction.** Underwater construction is the construction, inspection, repair, and removal of in-water facilities in support of military operations. An in-water facility can be defined as a fixed harbor, waterfront, or ocean structure located in or near the ocean. Pipelines, cables, sensor systems, and fixed/advanced-base structures are examples of in-water facilities (Figure 6-4).
- 6-4.6.1 **Diver Training and Qualification Requirements.** Seabee divers are specifically trained in the special techniques used to accomplish underwater construction tasks.
- 6-4.6.2 **Equipment Requirements.** Tools and equipment used include common underwater tools in addition to specialized ocean construction equipment. Specific tools and components for large ocean engineering projects are maintained in the Ocean Construction Equipment Inventory (OCEI) located at St. Julian Creek, Norfolk, Virginia.
- 6-4.6.3 **Underwater Construction Planning Resources.** References for underwater construction planning can be found in:
- *UCT Conventional Inspection and Repair Techniques Manual* NAVFAC P-990
 - *Expedient Underwater Repair Techniques* NAVFAC P-991

- *UCT Arctic Operations Manual* NAVFAC P-992
- *Design and Installation of Near-shore Ocean Cable Protection Systems* FPO-5-78

For more information on ocean construction, commands should consult NAVFAC Ocean Facilities Program.

6-4.7 Demolition Missions. Diving operations may include demolition duties to remove man-made structures such as barriers, sunken naval craft, and damaged piers. Demolition operations are conducted by blasting, freeing, flattening, or cutting with explosives. Divers may also be assigned to destroy natural formations, such as reefs, bars, and rock structures that interfere with transportation routes. All personnel involved in handling explosives shall be qualified in accordance with the OPNAVINST 8023.2 series.



Figure 6-4. Underwater Construction Diving.

6-4.8 Combat Swimmer Missions. Combat swimmers conduct reconnaissance and neutralization of enemy ships, shore-based installations, and personnel. Some missions may require an underwater approach to reach coastal installations undetected. Reconnaissance missions and raids may expose the combat swimmers to additional risk but may be necessary to advance broader warfare objectives.

6-4.9 Enclosed Space Diving. Divers are often required to work in enclosed or confined spaces. Using surface-supplied Underwater Breathing Apparatus (UBA) (MK 20 MOD 0 or MK 21 MOD 1), divers may enter submarine ballast tanks, mud tanks, or cofferdams, which may be in either a flooded or dry condition. Access to these spaces is normally restrictive, making it difficult for the diver to enter and exit. Enclosed space diving shall be supported by a surface-supplied air system. Refer to section 8-10.4 for more information on the hazards of enclosed space diving.

6-5 COLLECT AND ANALYZE DATA

Information pertinent to the mission objective shall be collected, organized, and analyzed to determine what may affect successful accomplishment of the objective. This process aids in:

- Planning for contingencies
- Developing the dive plan
- Selecting diving technique, equipment, and diver personnel
- Identifying potential hazards and the need for any special emergency procedures

6-5.1 Information Gathering. The size of the operation, the diving site location, and the prevailing environmental conditions influence the extent and type of information that must be gathered when planning an operation. Some operations are of a recurring nature, so much of the required information is readily available. An example of a recurring operation is removing a propeller from a particular class of ship. However, even for a standard operation, the ship may have been modified or special environmental conditions may exist, requiring a change in procedure or special tools. Potential changes in task requirements affecting work procedures should not be overlooked during planning.

6-5.2 Planning Data. Many operations require that detailed information be collected in advance. For example, when planning to salvage a sunken or stranded vessel, the diving team needs to know the construction of the ship, the type and location of cargo, the type and location of fuel, the cause of the sinking or stranding, and the nature and degree of damage sustained. Such information can be obtained from ship's plans, cargo manifests and loading plans, interviews with witnesses and survivors, photographs, and official reports of similar accidents.

6-5.2.1 Object Recovery. Operations involving the recovery of an object from the bottom require knowledge of the dimensions and weight of the object. Other useful information includes floodable volume, established lifting points, construction material, length of time on the bottom, probable degree of embedment in mud or silt, and the nature and extent of damage. This data helps determine the type of lift to be used (e.g., boom, floating crane, lifting bags, pontoons), indicates whether high-pressure hoses are needed to jet away mud or silt, and helps determine the disposition of the object after it is brought to the surface. Preliminary planning may find the object too heavy to be placed on the deck of the support ship, indicating the need for a barge and heavy lifting equipment.

6-5.2.2 Searching for Objects or Underwater Sites. When the operation involves searching for an object or underwater site, data gathered in advance helps to limit the search area. There are numerous planning data sources available to help supervisors collect data for the operation (see Figure 6-5). For example, information useful in narrowing the search area for a lost aircraft includes the aircraft's last known heading, altitude, and speed.; radar tracks plotted by ships and shore stations; tape recordings and radio transmissions; and eyewitness accounts. Once a general area is outlined, a side scan sonar system can be used to locate the debris field, and an ROV can identify target items located by the side scan sonar. Once the object of the search has been found, the site should be marked, preferably with an acoustic transponder (pinger) and/or a buoy. If time and conditions permit,

PLANNING DATA SOURCES

- | | | |
|---|---|---|
| <ul style="list-style-type: none"> ■ Aircraft Drawings ■ Cargo Manifest ■ Coastal Pilot Publications ■ Cognizant Command ■ Communications Logs ■ Construction Drawings ■ Current Tables ■ Diving Advisory Messages ■ DRT Tracks ■ DSV/DSRV Observations ■ Electronic Analysis ■ Equipment Operating Procedures (OPs) ■ Equipment Operation and Maintenance Manuals ■ Eyewitnesses ■ Flight or Ship Records ■ Flight Plan ■ Hydrographic Publications | <ul style="list-style-type: none"> ■ Light Lists ■ Local Yachtsmen/Fishermen ■ LORAN Readings ■ Magnetometer Plots ■ Navigation Text (Duttons/Bowditch) ■ Navigational Charts ■ NAVOCEANO Data ■ Notices to Mariners ■ OPORTERS ■ Photographs ■ Radar Range and Bearings ■ RDF Bearings ■ ROV Video and Pictures ■ Sailing Directions ■ Salvage Computer Data ■ Ship's Curves of Forms ■ Ship's equipment ■ Ship's Logs and Records | <ul style="list-style-type: none"> ■ Ship's Personnel ■ Ships Drawings (including docking plan) ■ Side-Scan Sonar Plots ■ SINS Records ■ SITREP ■ Sonar Readings and/or Charts ■ TACAN Readings ■ Technical Reference Books ■ Test Records ■ Tide Tables ■ Underwater Work Techniques ■ USN Diving Manual Reference List ■ USN Instructions ■ USN Ship Salvage Manual ■ Visual Bearings ■ Weather Reports |
|---|---|---|

Figure 6-5. Planning Data Sources.

preliminary dives by senior, experienced members of the team can be of great value in verifying, refining, and analyzing the data to improve the dive plan. This method saves diver effort for recovering items of interest.

6-5.2.3 Identifying Operational Hazards. Information must be collected to help identify hazards. For example, a diver working around a ship shall know the location and status of ship sea suction and discharge points, propellers, rudders, diving planes, and sonar transducers. If working on or near a vessel that has a nuclear propulsion system, the diver shall be aware of radiological hazards, rules for working on or near such a vessel, and the locations of the reactor compartment, discharges, etc. Most importantly, the diver shall be briefed on potential exposure and shall wear proper underwater radiological exposure detection instruments.

6-5.3 Data Required for All Diving Operations. Data involving the following general categories shall be collected and analyzed for all diving operations:

- Surface conditions
- Underwater conditions
- Equipment and personnel resources
- Assistance in emergencies

6-5.3.1 **Surface Conditions.** Surface conditions in the operating area affect both the divers and the topside team members. Surface conditions are influenced by location, time of year, wind, waves, tides, current, cloud cover, temperature, visibility, and the presence of other ships. Completing the Environmental Assessment Worksheet (Figure 6-6) helps ensure that environmental factors are not overlooked during planning. For an extensive dive mission, a meteorological detachment may be requested from the local or regional meteorological support activity.

6-5.3.2 **Natural Factors.** Normal conditions for the area of operations can be determined from published tide and current tables, sailing directions, notices to mariners, and special charts that show seasonal variations in temperature, wind, and ocean currents. Weather reports and long-range weather forecasts shall be studied to determine if conditions will be acceptable for diving. Weather reports shall be continually monitored while an operation is in progress.

NOTE **Diving shall be discontinued if sudden squalls, electrical storms, heavy seas, unusual tide or any other condition exists that, in the opinion of the Diving Supervisor, jeopardizes the safety of the divers or topside personnel.**

6-5.3.2.1 **Sea State.** A significant factor is the sea state (Figure 6-7). Wave action can affect everything from the stability of the moor to the vulnerability of the crew to seasickness or injury. Unless properly moored, a ship or boat drifts or swings around an anchor, fouling lines and dragging divers. Because of this, any vessel being used to support surface-supplied or tended diving operations shall be secured by at least a two-point moor. Exceptions to diving from a two-point moor may occur when moored alongside a pier or another vessel that is properly anchored, or when a ship is performing diving during open ocean transits and cannot moor due to depth. A three- or four-point moor, while more difficult to set, may be preferred depending on dive site conditions.

Divers are not particularly affected by the action of surface waves unless operating in surf or shallow waters, or if the waves are exceptionally large. Surface waves may become a serious problem when the diver enters or leaves the water and during decompression stops near the surface.

6-5.3.2.2 **Tender Safety.** Effective dive planning shall provide for extreme temperatures that may be encountered on the surface. Normally, such conditions are a greater problem for tending personnel than for a diver. Any reduction in the effectiveness of the topside personnel may endanger the safety of a diver. Tending personnel shall guard against:

- Sunburn and windburn
- Hypothermia and frostbite
- Heat exhaustion

ENVIRONMENTAL CHECKLIST

Date: _____

Surface

Atmosphere

Visibility _____
 Sunrise (set) _____
 Moonrise (set) _____
 Temperature (air) _____
 Humidity _____
 Barometer _____
 Precipitation _____
 Cloud Description _____
 Percent Cover _____
 Wind Direction _____
 Wind Force (knots) _____
 Other: _____

Sea Surface

Sea State _____
 Wave Action: _____
 Height _____
 Length _____
 Direction _____
 Current: _____
 Direction _____
 Velocity _____
 Type _____
 Surf. Visibility _____
 Surf. Water Temp. _____
 Local Characteristics _____

Subsurface

Underwater & Bottom

Depth _____
 Water Temperature:
 _____ depth _____
 _____ depth _____
 _____ depth _____
 _____ bottom _____
 Thermoclines _____

 Current:
 Direction _____
 Source _____
 Velocity _____
 Pattern _____
 Tides:
 High Water _____ / _____ Time
 Low Water _____ / _____ Time
 Ebb Dir. _____ Vel. _____
 Flood Dir. _____ Vel. _____

Visibility

Underwater
 ft _____ at _____ depth
 ft _____ at _____ depth
 ft _____ at _____ depth
 Bottom
 ft _____ at _____ depth
 Bottom Type: _____
 Obstructions:

 Marine Life:

 Other Data:

NOTE: A meteorological detachment may be requested from the local meteorological support activity.

Figure 6-6. Environmental Assessment Worksheet. The Environmental Assessment Worksheet indicates categories of data that might be gathered for an operation. Planners may develop an assessment methodology to suit the particular situation. The data collected is vital for effective operations planning, and is also of value when filing Post Salvage Reports.

Sea State	Description	Wind Force (Beaufort)	Wind Description	Wind Range (knots)	Wind Velocity (knots)	Average Wave Height (ft)
0	Sea like a mirror.	0	Calm	<1	0	0
	Ripples with the appearance of scales are formed, but without foam crests.	1	Light Air	5-3	2	0.05
1	Small wavelets still short but more pronounced; crests have a glassy appearance but do not break.	2	Light Breeze	4-6	5	0.18
2	Large wavelets, crests begin to break. Foam of glassy appearance, perhaps scattered whitecaps.	3	Gentle Breeze	7-10	8.5	0.6
					10	0.88
3	Small waves, becoming longer; fairly frequent whitecaps.	4	Moderate Breeze	15-16	12	1.4
					13.5	1.8
					14	2.0
					16	2.9
4	Moderate waves, taking a more pronounced long form; many whitecaps are formed. Chance of some spray.	5	Fresh Breeze	17-21	18	3.8
					19	4.3
					20	5.0
5	Large waves begin to form; white foam crests are more extensive everywhere. Some spray.	6	Strong Breeze	22-27	22	6.4
					24	7.9
					24.5	8.2
					26	9.6
6	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind. Spindrift begins.	7	Moderate Gale	28-33	28	11
					30	14
					30.5	14
					32	16
7	Moderately high waves of greater length; edges of crests break into spindrift. The foam is blown in well marked streaks along the direction of the wind. Spray affects visibility.	8	Fresh Gale	34-40	34	19
					36	21
					37	23
					38	25
					40	28
8	High waves. Dense streaks of foam along the direction of the wind. Sea begins to roll. Visibility affected.	9	Strong Gale	45-47	42	31
					44	36
					46	40
9	Very high waves with long overhanging crests. Foam is in great patches and is blown in dense white streaks along the direction of the wind. The surface of the sea takes on a white appearance. The rolling of the sea becomes heavy and shock-like. Visibility is affected.	10	Whole Gale	48-55	48	44
					50	49
					51.5	52
					52	54
					54	59
	Exceptionally high waves. The sea is completely covered with long white patches of foam along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility seriously affected.	11	Storm	56-63	56	64
					59.5	73
	Air filled with foam and spray. Sea completely white with driving spray. Visibility seriously affected.	12	Hurricane	64-71	>64	>80

Figure 6-7. Sea State Chart.

6-5.3.2.3 **Windchill Factor.** In cold, windy weather, the windchill factor shall be considered. Exposure to cold winds greatly increases dangers of hypothermia and all types of cold injury. For example, if the actual temperature is 35°F and the wind velocity is 35 mph, the windchill factor is equivalent to 5°F (Figure 6-8). For information on ice and cold water diving operations, refer to Chapter 11.

Actual Air Temp °F (°C)	Wind MPH							
	5	10	15	20	25	30	35	40
	Equivalent Chill Temperature °F (°C)							
40 (4)	35 (2)	30 (-1)	25 (-4)	20 (-7)	15 (-9)	10 (-12)	10 (-12)	10 (-12)
35 (2)	30 (-1)	20 (-7)	15 (-9)	10 (-12)	10 (-12)	5 (-15)	5 (-15)	0 (-17)
30 (-1)	25 (-4)	15 (-9)	10 (-12)	5 (-15)	0 (-17)	0 (-17)	0 (-17)	-5 (-21)
25 (-4)	20 (-7)	10 (-12)	0 (-17)	0 (-17)	-5 (-21)	-10 (-23)	-10 (-23)	-15 (-26)
20 (-7)	15 (-9)	5 (-15)	-5 (-21)	-10 (-23)	-15 (-26)	-20 (-29)	-20 (-29)	-20 (-29)
15 (-9)	10 (-12)	0 (-17)	-10 (-23)	-15 (-26)	-20 (-29)	-25 (-32)	-25 (-32)	-30 (-34)
10 (-12)	5 (-15)	-10 (-23)	-20 (-29)	-25 (-32)	-30 (-34)	-30 (-34)	-30 (-34)	-35 (-37)
5 (-15)	0 (-17)	-15 (-26)	-25 (-32)	-30 (-34)	-35 (-37)	-40 (-40)	-40 (-40)	-45 (-43)
0 (-17)	-5 (-15)	-20 (-24)	-30 (-34)	-35 (-37)	-45 (-43)	-55 (-46)	-50 (-46)	-55 (-48)
-5 (-21)	-10 (-23)	-25 (-32)	-40 (-40)	-45 (-43)	-50 (-46)	-65 (-54)	-60 (-51)	-60 (-51)
-10 (-23)	-15 (-26)	-35 (-37)	-45 (-43)	-50 (-46)	-60 (-54)	-70 (-57)	-65 (-54)	-70 (-57)
-15 (-26)	-20 (-29)	-40 (-40)	-50 (-46)	-60 (-51)	-65 (-54)	-70 (-57)	-75 (-60)	-75 (-60)
-20 (-29)	-25 (-32)	-45 (-43)	-60 (-51)	-65 (-54)	-75 (-60)	-80 (-62)	-85 (-65)	-90 (-68)
-25 (-32)	-30 (-34)	-50 (-46)	-65 (-45)	-75 (-60)	-80 (-62)	-85 (-65)	-90 (-68)	-95 (-71)
-30 (-34)	-35 (-37)	-60 (-51)	-70 (-57)	-80 (-62)	-90 (-68)	-95 (-71)	-100 (-73)	-100 (-73)
-35 (-37)	-40 (-40)	-65 (-54)	-80 (-62)	-85 (-65)	-95 (-71)	-100 (-73)	-105 (-76)	-110 (-79)
-40 (-40)	-45 (-43)	-70 (-57)	-85 (-65)	-95 (-71)	-105 (-76)	-110 (-79)	-115 (-82)	-115 (-82)
-45 (-43)	-50 (-46)	-75 (-60)	-90 (-68)	-100 (-73)	-110 (-79)	-115 (-82)	-120 (-85)	-125 (-87)
-50 (-46)	-55 (-48)	-80 (-62)	-100 (-73)	-110 (-79)	-120 (-85)	-125 (-87)	-130 (-90)	-130 (-90)
-55 (-48)	-60 (-51)	-90 (-68)	-105 (-76)	-115 (-82)	-125 (-87)	-130 (-90)	-135 (-93)	-140 (-96)
-60 (-51)	-70 (-57)	-95 (-71)	-110 (-79)	-120 (-85)	-135 (-93)	-140 (-96)	-145 (-98)	-150 (-101)

LITTLE DANGER

INCREASING DANGER (flesh may freeze within one minute)

GREAT DANGER (flesh may freeze within 20 seconds)

Figure 6-8. Equivalent Windchill Temperature Chart.

6-5.3.2.4 **Surface Visibility.** Variations in surface visibility are important. Reduced visibility may seriously hinder or force postponement of diving operations. For operations to be conducted in a known fog belt, the diving schedule should allow for delays because of low visibility. Diver and support crew safety is the prime consideration when determining whether surface visibility is adequate. For example, a surfacing diver might not be able to find his support craft, or the diver and the craft itself might be in danger of being hit by surface traffic. A proper radar reflector for small craft should be considered.

6-5.3.3 **Depth.** Depth is a major factor in selecting both diving personnel and apparatus and influences the decompression profile for any dive. Operations in deep waters may also call for special support equipment such as underwater lights, cameras, ROV, etc.

Depth must be carefully measured and plotted over the general area of the operation to get an accurate depth profile of the dive site. Soundings by a ship-mounted fathometer are reasonably accurate but shall be verified by either a lead-line sounding, a pneumofathometer (Figure 6-9), or a high resolution sonar (bottom finder or fish finder). Depth readings taken from a chart should only be used as an indication of probable depth.

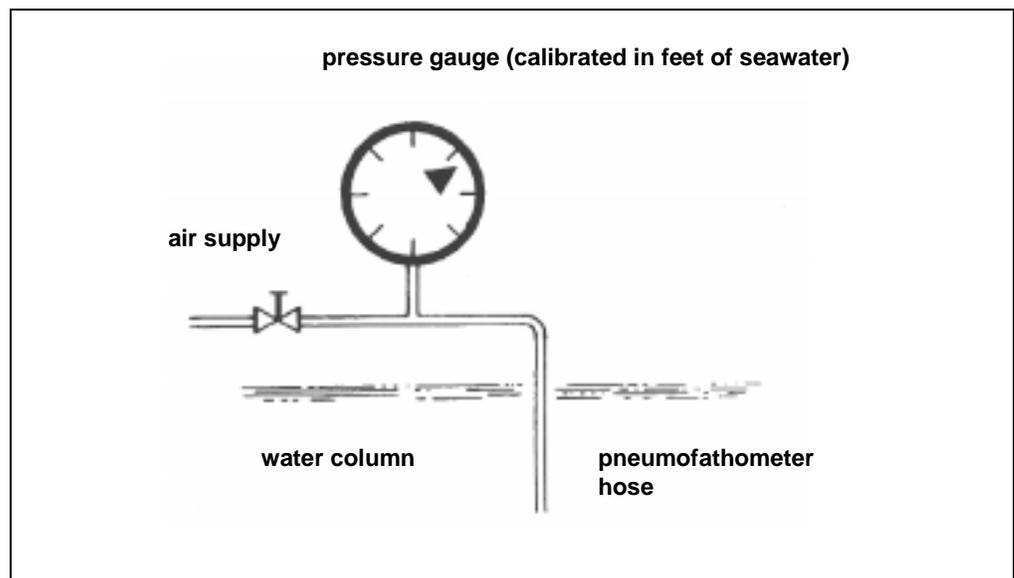


Figure 6-9. Pneumofathometer. The pneumofathometer hose is attached to a diver or weighted object and lowered to the depth to be measured. Water is forced out of the hose by pressurized air until a generally constant reading is noted on the pressure gauge. The air supply is secured, and the actual depth (equal to the height of the water column displaced by the air) is read on the gauge.

6-5.3.4 **Type of Bottom.** The type of bottom may have a significant effect upon a diver's ability to move and work efficiently and safely. Advance knowledge of bottom conditions is important in scheduling work, selecting dive technique and equipment, and anticipating possible hazards. The type of bottom is often noted on the

chart for the area, but conditions can change within just a few feet. Independent verification of the type of bottom should be obtained by sample or observation. Figure 6-10 outlines the basic types of bottoms and the characteristics of each.

TYPE	CHARACTERISTICS	VISIBILITY	DIVER MOBILITY ON BOTTOM
Rock	Smooth or jagged, minimum sediment	Generally unrestricted by dive movement	Good, exercise care to prevent line snagging and falls from ledges
Coral	Solid, sharp and jagged, found in tropical waters only	Generally unrestricted by diver movement	Good, exercise care to prevent line snagging and falls from ledges
Gravel	Relatively smooth, granular base	Generally unrestricted by diver movement	Good, occasional sloping bottoms of loose gravel impair walking and cause instability
Shell	Composed principally of broken shells mixed with sand or mud	Shell-sand mix does not impair visibility when moving over bottom. Shell-mud mix does impair visibility. With higher mud concentrations, visibility is increasingly impaired.	Shell-sand mix provides good stability. High mud content can cause sinking and impaired movement
Sand	Common type of bottom, packs hard	Generally unrestricted by diver movement	Good
Mud and Silt	Common type of bottom, composed of varying amounts of silt and clay, commonly encountered in river and harbor areas	Poor to zero. Work into the current to carry silt away from job site, minimize bottom disturbance. Increased hazard presented by unseen wreckage, pilings, and other obstacles.	Poor, can readily cause diver entrapment. Crawling may be required to prevent excessive penetration, fatiguing to diver.

Figure 6-10. Bottom Conditions and Effects Chart.

6-5.3.5 **Tides and Currents.** The basic types of currents that affect diving operations are:

- **River or Major Ocean Currents.** The direction and velocity of normal river, ocean, and tidal currents will vary with time of the year, phase of the tide, configuration of the bottom, water depth, and weather. Tide and current tables show the conditions at the surface only and should be used with caution when planning diving operations. The direction and velocity of the current beneath the surface may be quite different than that observed on the surface.
- **Ebb Tides.** Current produced by the ebb and flow of the tides may add to or subtract from any existing current.
- **Undertow or Rip Current.** Undertow or rip currents are caused by the rush of water returning to the sea from waves breaking along a shoreline. Rip currents will vary with the weather, the state of the tide, and the slope of the bottom.

These currents may run as fast as two knots and may extend as far as one-half mile from shore. Rip currents, not usually identified in published tables, can vary significantly from day to day in force and location.

- **Surface Current Generated by Wind.** Wind-generated surface currents are temporary and depend on the force, duration, and fetch of the wind. If the wind has been blowing steadily for some time, this current should be taken into consideration especially when planning surface swims and scuba dives.

6-5.3.5.1 **Equipment Requirements for Working in Currents.** A diver wearing a surface-supplied outfit, such as the MK 21 SSDS with heavy weights, can usually work in currents up to 1.5 knots without undue difficulty. A diver supplied with an additional weighted belt may be able to accomplish useful work in currents as strong as 2.5 knots. A scuba diver is severely handicapped by currents greater than 1.0 knot. If planning an operation in an area of strong current, it may be necessary to schedule work during periods of slack water to minimize the tidal effect.

6-6 IDENTIFY ENVIRONMENTAL AND OPERATIONAL HAZARDS

Underwater environmental conditions have a major influence on the selection of divers, diving technique, and the equipment to be used. In addition to environmental hazards, a diver may be exposed to operational hazards that are not unique to the diving environment. This section outlines the environmental and operational hazards that may impact an operation.

6-6.1 **Underwater Visibility.** Underwater visibility varies with depth and turbidity. Horizontal visibility is usually quite good in tropical waters; a diver may be able to see more than 100 feet at a depth of 180 fsw. Horizontal visibility is almost always less than vertical visibility. Visibility is poorest in harbor areas because of river silt, sewage, and industrial wastes flowing into the harbor. Agitation of the bottom caused by strong currents and the passage of large ships can also affect visibility.

The degree of underwater visibility influences selection of dive technique and can greatly increase the time required for a diver to complete a given task. For example, a diving team preparing for harbor operations should plan for extremely limited visibility, possibly resulting in an increase in bottom time, a longer period on station for the diving unit, and a need for additional divers on the team.

6-6.2 **Temperature.** Figure 6-11 illustrates how water temperature can affect a diver's performance, and is intended as a planning guide. A diver's physical condition, amount of body fat, and thermal protection equipment determine how long exposure to extreme temperatures can be endured safely. In cold water, ability to concentrate and work efficiently will decrease rapidly. Even in water of moderate temperature (60–70°F, 15.5–21.5°C), the loss of body to the water can quickly bring on diver exhaustion.

6-6.3 **Contaminated Water.** When planning for contaminated-water diving, medical personnel should be consulted to ensure proper pre-dive precautions are taken and post-dive monitoring of divers is conducted. Resources outside the scope of this

WATER TEMPERATURE PROTECTION CHART

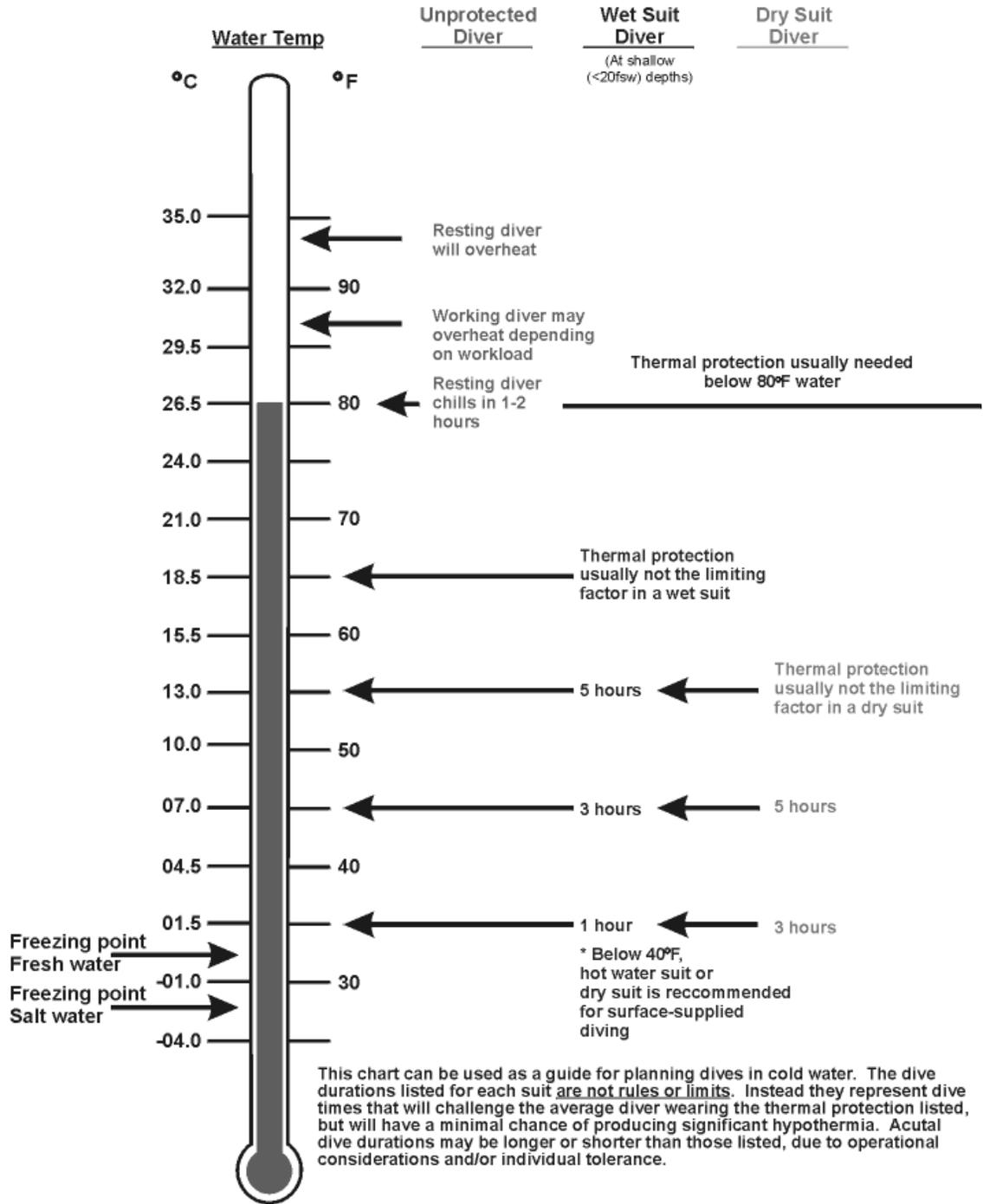


Figure 6-11. Water Temperature Protection Chart.

manual may be required to deal with nuclear, biological, or chemical contaminants. Resources and technical advice for dealing with contaminated-water diving conditions are available from the National Oceanic and Atmospheric Administration (NOAA) HAZMAT Department.

- 6-6.4 Thermal Pollution.** Divers may encounter a variety of forms of pollution that can cause problems. Divers may be required to work in the vicinity of a sewer or industrial outfall discharging high-temperature wastes. In such situations, the diver and topside personnel shall be particularly alert for the symptoms of heat exhaustion. To date, no practical dress has been designed specifically to protect the diver against unusually warm water although hot water suits may be used with cold water piped to the diver. A diver working near sewer outlets or industrial discharges may also be exposed to biological or chemical pollution hazards.
- 6-6.5 Chemical Contamination.** Oil leaking from underwater wellheads or damaged tanks can foul equipment and seriously impede a diver's movements. Toxic materials or volatile fuels leaking from barges or tanks can irritate the skin and corrode equipment. Diving units should not conduct the dive until the contaminant has been identified, the safety factors evaluated, and a process for decontamination set up. Divers operating in waters where a chemical or chemical warfare threat is known or suspected shall evaluate the threat and protect themselves as appropriate. The MK 21 UBA with a double exhaust and a dry suit dress assembly affords limited protection for diving in polluted and contaminated water. Refer to the *MK 21 UBA NAVSEA Technical Manual, S6560-AG-OMP-010-UBA-MK21/1* for more information on using the MK 21 UBA with a dry suit assembly.
- 6-6.6 Biological Contamination.** Scuba divers are especially vulnerable to ear and skin infections when diving in waters that contain biological contamination. Divers may also inadvertently take polluting materials into the mouth, posing both physiological and psychological problems. In planning for operations in waters known to be polluted, protective clothing and appropriate preventative medical procedures shall be taken. Diving equipment shall be selected that gives the diver maximum protection consistent with the threat. External ear prophylaxis should be provided to diving personnel to prevent ear infections.
- 6-6.7 Altitude Diving.** Divers may be required to dive in bodies of water at higher altitudes. Planning shall address the effects of the atmospheric pressures that may be much lower than those at sea level. U.S. Navy Air Decompression Tables are authorized for use at altitudes up to 300 feet above sea level without corrections (see paragraph 9-12). Transporting divers out of the diving area, which may include movement into even higher elevations either overland or by plane, requires special consideration and planning. The Diving Supervisor shall be alert for symptoms of hypoxia and decompression sickness after the dive due to the lower oxygen partial pressure and atmospheric pressure.
- 6-6.8 Underwater Obstacles.** Various underwater obstacles, such as wrecks or discarded munitions, offer serious hazards to diving. Wrecks and dumping grounds are often noted on charts, but the actual presence of obstacles might not be discovered until an operation begins. This is a good reason for scheduling a

preliminary inspection dive before a final work schedule and detailed dive plan is prepared.

6-6.9 Electrical Shock Hazards. Electrical shock may occur when using electric welding or power equipment. All electrical equipment shall be in good repair and be inspected before diving. Although equipped with test buttons, electrical Grounds Fault Interrupters (GFI) often do not provide any indication when the unit has experienced an internal component failure in the fault circuitry. Therefore, GFI component failure during operation (subsequent to testing the unit) may go unnoticed. Although this failure alone will not put the diver at risk, the GFI will not protect the diver if he is placed in contact with a sufficiently high fault current. The following is some general information concerning GFIs:

- GFIs are required when line voltage is above 7.5 VAC or 30 VDC.
- GFIs shall be capable of tripping within 20 milliseconds (ms) after detecting a maximum leakage current of 30 milliamps (ma).
- GFIs require an established reference ground in order to function properly. Cascading GFIs could result in loss of reference ground; therefore, GFIs or equipment containing built-in GFIs should not be plugged into an existing GFI circuit.

In general, three independent actions must occur simultaneously to electrically shock a diver:

- The GFI must fail.
- The electrical equipment which the diver is operating must experience a ground fault.
- The diver must place himself in the path between the fault and earth ground.

6-6.9.1 Reducing Electrical Shock Hazards. The only effective means of reducing electrical shock hazards are to ensure:

- Electrical equipment is properly maintained.
- All electrical devices and umbilicals are inspected carefully before all operations.
- Electrical umbilicals are adequately protected to reduce the risk of being abraded or cut when pulled over rough or sharp objects.
- Personnel are offered additional protection through the use of rubber suits (wet, dry, or hot-water) and rubber gloves.
- GFI circuits are tested at regular intervals throughout the operation using built-in test circuits.

Divers operating with remotely operated vehicles (ROVs) should take similar precautions to ensure the ROV electrical system offers the required protection. Many new ROVs use extremely high voltages which make these protective actions even more critical to diver safety.

NEDU has been tasked with repair and testing of the Daniel Woodhead company Model 1670 and 1680 GFIs. Woodhead GFIs needing repair or testing should be sent to:

Navy Experimental Diving Unit
Shipping and Receiving Officer
321 Bullfinch Road
Panama City, FL 32407-7015
ATTN: Code 03D1

Units should be sent to the above address with a DD-1149 and complete return address and written details of problem.

6-6.9.2 **Securing Electrical Equipment.** The Ship Repair Safety Checklist for Diving requires underwater electrical equipment to be secured while divers are working over the side. While divers are in the water:

- Ship impressed-current cathodic protection (ICCP) systems must be secured, tagged out, and confirmed secured before divers may work on an ICCP device such as an anode, dielectric shield, or reference cell.
- When divers are required to work close to an active ICCP anode and there is a risk of contact with the anode, the system must also be secured.
- In situations other than those described above, the ICCP is to remain active.
- Divers working within 15 feet of active systems must wear a full dry suit, unisuit, or wet suit with hood and gloves.
- All other underwater electrical equipment shall be secured while divers are working over the side.

6-6.10 **Explosions.** Explosions may be set off in demolition tasks intentionally, accidentally, or as the result of enemy action. When working with or near explosives, the procedures outlined in SWO 60-AA-MMA-010 shall be followed. Divers should stay clear of old or damaged munitions. Divers should get out of the water when an explosion is imminent.

WARNING **Welding or cutting torches may cause an explosion on penetration of gas-filled compartments, resulting in serious injury or death.**

6-6.11 **Sonar.** Appendix 1A provides guidance regarding safe diving distances and exposure times for divers operating in the vicinity of ships transmitting with sonar. This

appendix has been substantially revised from Safe Diving Distances from Transmitting Sonar (NAVSEAINST 3150.2A) and should be read in its entirety.

6-6.12 Nuclear Radiation. Radiation may be encountered as the result of an accident, proximity to weapons or propulsion systems, weapons testing, or occasionally natural conditions. Radiation exposure can cause serious injury and illness. Safe tolerance levels have been set and shall not be exceeded. These levels may be found in the *Radiological Control Manual*, NAVSEA 0389-LP-660-6542. Local instructions may be more stringent and in such case shall be followed. Prior to diving, all dive team members shall be thoroughly knowledgeable of the local/command radiological control requirements. All divers shall have a Thermal Luminescence Dosimeter (TLD) or similar device and be apprised of the locations of items such as the reactor compartment, discharges, etc.

6-6.13 Marine Life. Certain marine life, because of its aggressive or venomous nature, may be dangerous to man. Some species of marine life are extremely dangerous, while some are merely an uncomfortable annoyance. Most dangers from marine life are largely overrated because most underwater animals leave man alone. All divers should be able to identify the dangerous species that are likely to be found in the area of operation and should know how to deal with each. Refer to Appendix 5C for specific information about dangerous marine life, including identification factors, dangerous characteristics, injury prevention, and treatment methods.

6-6.14 Vessel and Small Boat Traffic. The presence of other ships is often a serious problem. It may be necessary to close off an area or limit the movement of other ships. A local Notice to Mariners should be issued. At any time that diving operations are to be conducted in the vicinity of other ships, they shall be properly notified by International Code signal flags (Figure 6-12). An operation may have to be conducted in an area with many small boats operated by people with varied levels of seamanship and knowledge of Nautical Rules of the Road. The diving team should assume that these operators are not acquainted with diving signals and take the precautions required to ensure that these vessels remain clear of the diving area. Hazards associated with vessel traffic are intensified under conditions of reduced visibility.

NOTE When small civilian boats are in the area, use the civilian Sport Diver flag (red with white diagonal stripe) as well as “Code Alpha.”

6-6.15 Territorial Waters. Diving operations conducted in the territorial waters of other nations shall be properly coordinated prior to diving. Diving units must be alert to the presence of foreign intelligence-collection ships and the potential for hostile action when diving in disputed territorial waters or combat zones.

6-7 SELECT DIVING TECHNIQUE

The three main types of air diving equipment used in U.S. Navy diving operations are (Figure 6-13):

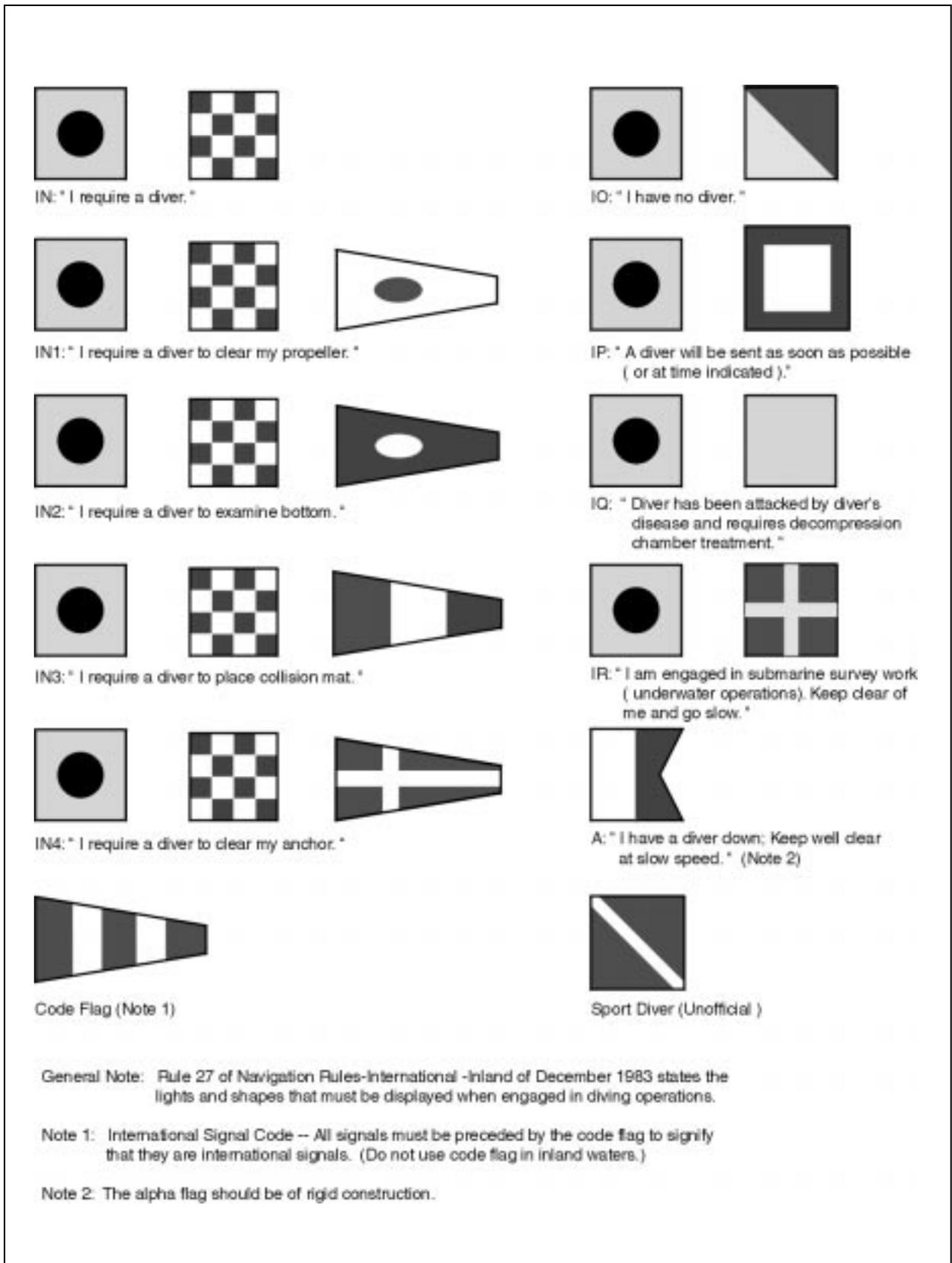


Figure 6-12. International Code Signal Flags.

1. Open-circuit scuba
2. MK 20 MOD 0 surface-supplied gear
3. MK 21 MOD 1 surface-supplied gear

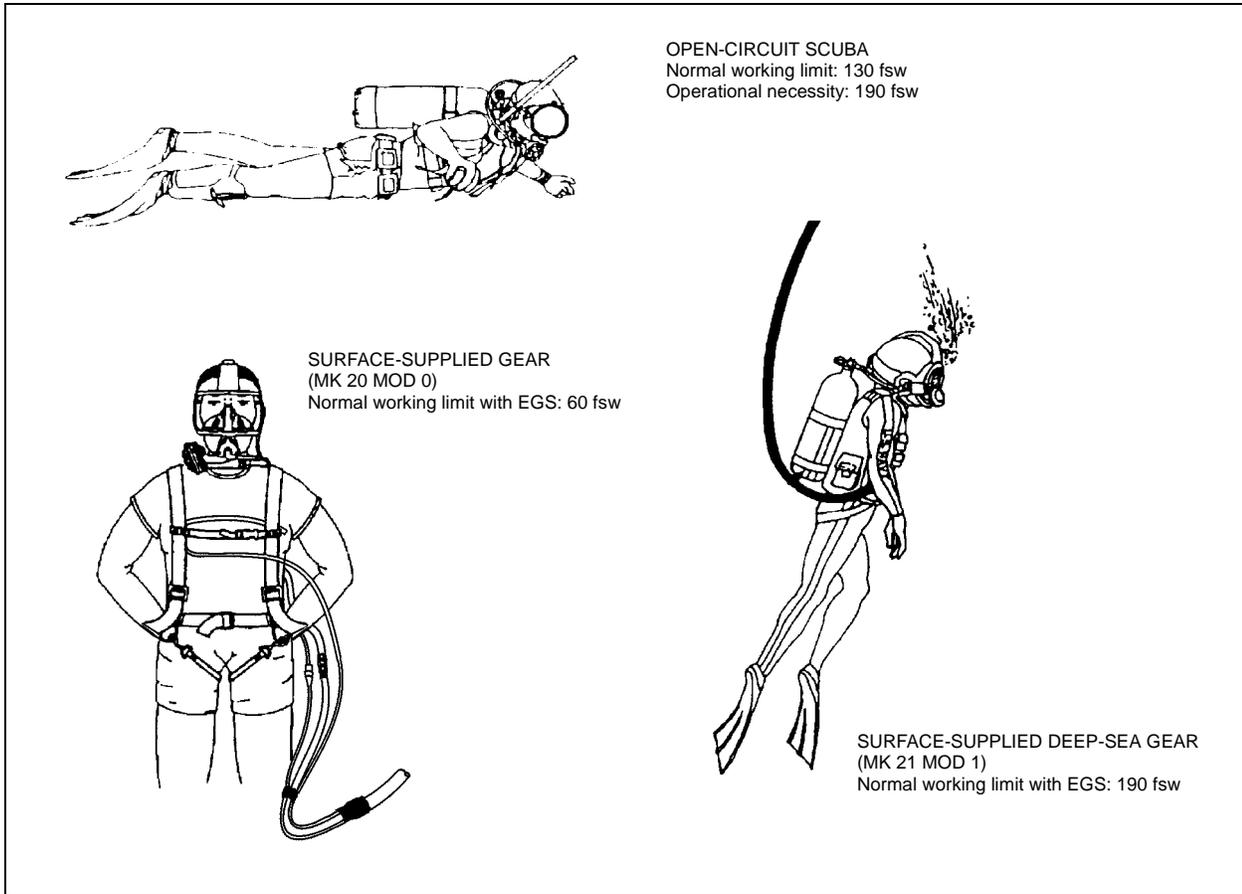


Figure 6-13. Air Diving Techniques. A choice of three air diving techniques are available: open circuit scuba, surface-supplied gear (MK 20 MOD 0), and surface-supplied deep-sea gear (MK 21 MOD 1).

6-7.1 Factors to Consider when Selecting the Diving Technique. When selecting the technique to be used for a dive, the following factors must be considered:

- Duration and depth of the dive
- Type of work to be performed
- Environmental conditions
- Time constraints

A dive of extended length, even in shallow water, may require an air supply exceeding that which could be provided by scuba. Specific depth limits have been established for each type of diving gear and shall not be exceeded without specific approval of the Chief of Naval Operations in accordance with the OPNAVINST 3150.27 series (see Figure 6-14).

NORMAL AND MAXIMUM LIMITS FOR AIR DIVING		
Depth fsw (meters)	Limit for Equipment	Notes
60 (18)	MK 21 MOD 0 diving equipment, maximum working limit without Emergency Gas Supply (EGS)	a
60 (18)	MK 20 MOD 0 equipment surface-supplied	a
60 (18)	Maximum depth for standby scuba diver using a single cylinder	
100 (30)	Open-circuit scuba with single scuba bottle	b
130 (40)	Open-circuit scuba, normal working limit	b
190 (58)	Open-circuit scuba, maximum working limit with Commanding Officer's permission	b, d
190 (58)	MK 21 MOD 1 (air) diving equipment with EGS, normal working limit	c, d, e
285 (87)	MK 21 MOD 1 (air) diving equipment with EGS, maximum working limit, exceptional exposure with authorization from the Chief of Naval Operations (N873)	c, d, e

General Operating Notes (Apply to all):

1. These limits are based on a practical consideration of working time versus decompression time and oxygen-tolerance limits. These limits shall not be exceeded except by specific authorization from the Chief of Naval Operations (N873).
2. Do not exceed the limits for exceptional exposures for the Standard Air Decompression Table.
3. In an emergency, any operable recompression chamber may be used for treatment if deemed safe to use by the Diving Supervisor.

Specific Notes:

- a. When diving in an enclosed space an EGS must be used by each diver.
- b. Under normal circumstances, do not exceed the limits of the No-Decompression Table. Dives requiring decompression may be made if considered necessary with approval by the Commanding Officer of the diving command. The total time of a scuba dive (including decompression) shall not exceed the duration of the apparatus in use, disregarding any reserves.
- c. A Diving Medical Officer is required at the site for all air dives deeper than 190 fsw, where the maximum working depth of the diving apparatus may be exceeded, and for exceptional exposure dives.
- d. All planned air decompression dives deeper than 130 fsw require a certified recompression chamber on site. **An on-site chamber is defined as a certified and ready chamber accessible within 30 minutes of the dive site by available transportation.**
- e. The Exceptional Exposure Tables, printed in red in the Standard Air Tables, have a significantly higher probability of DCS and CNS oxygen toxicity.

Figure 6-14. Normal and Maximum Limits for Air Diving.

The increase of air consumption with depth limits open-circuit scuba to 130 fsw for reasonable working dives. The hazards of nitrogen narcosis and decompression further limit open-circuit scuba to 190 fsw even for short duration dives. Surface-supplied equipment is generally preferred between 130 and 190 fsw, although open-circuit scuba may be used under some circumstances. Decompression scuba dives and scuba dives deeper than 130 fsw may be conducted when dictated by operational necessity and with the specific approval of the Commanding Officer. All open-circuit scuba dives beyond 100 fsw shall employ twin cylinders, with each having a capacity at least equal to a steel 72 cylinder (64.7 cubic feet).

In some operations there may be no clear-cut choice of which diving technique to use. Selecting a diving technique may depend upon availability of equipment or trained personnel. The following comparison of scuba and surface-supplied techniques highlights the significant differences between the methods and outlines the effect these differences will have on planning.

6-7.2 Operational Characteristics of Scuba. The term *scuba* refers to open-circuit air scuba unless otherwise noted. The main advantages of scuba are mobility, depth flexibility and control, portability, and reduced requirement for surface support. The main disadvantages are limited depth, limited duration, lack of voice communications (unless equipped with a through-water communications system), limited environmental protection, remoteness from surface assistance, and the negative psychological and physiological problems associated with isolation and direct exposure to the underwater environment.

6-7.2.1 Mobility. The scuba diver is not hindered by bulky or heavy equipment and can cover a considerable distance, with an even greater range through the use of diver propulsion vehicles (DPVs), moving freely in any direction. However, the scuba diver shall be able to ascend directly to the surface in case of emergency.

WARNING Scuba equipment is not authorized for use in enclosed space diving.

6-7.2.2 Buoyancy. Scuba equipment is designed to have nearly neutral buoyancy when in use, permitting the diver to change or maintain depth with ease. This allows the scuba diver to work at any level in the water column.

6-7.2.3 Portability. The portability and ease with which scuba can be employed are distinct advantages. Scuba equipment can be transported easily and put into operation with minimum delay. Scuba offers a flexible and economical method for accomplishing a range of tasks.

6-7.2.4 Operational Limitations. Divers shall adhere to the operational limitations contained in Figure 6-14. Bottom time is limited by the scuba's fixed air supply, which is depleted more rapidly when diving deep or working hard.

6-7.2.5 Environmental Protection. The scuba diver is not as well protected from cold or from contact with marine plants and animals as a diver in surface-supplied gear, and is more easily swept along by current.

- 6-7.3 Operational Characteristics of SSDS.** Surface-supplied diving systems can be divided into two major categories: lightweight full face mask (MK 20), and deep-sea (MK 21) gear.
- 6-7.3.1 **Mobility.** Surface-supplied gear allows the diver almost as much mobility as scuba. The primary use for deep-sea gear is bottom work in depths up to 190 fsw.
- 6-7.3.2 **Buoyancy.** The buoyancy associated with SSDS varies with the diving dress selected. Variable Volume Dry Suit (VVDS) provides the greatest buoyancy control (see paragraph 7-3.1.2), making it a desirable technique for working on muddy bottoms, conducting jetting or tunneling, or working where the reaction forces of tools are high.
- 6-7.3.3 **Operational Limitations.** Divers using surface supplied gear are restricted to the operational limitations described in Figure 6-14. Additional limitations of using surface-supplied gear includes additional topside support personnel and lengthy pre-dive and post-dive procedures.
- 6-7.3.4 **Environmental Protection.** Surface-supplied diving systems can offer the diver increased thermal protection when used with a Hot Water or VVDS. The MK 21 helmet can increase protection of the diver's head. Because the diver's negative buoyancy is easily controlled, an SSDS allows diving in areas with strong currents.

6-8 SELECT EQUIPMENT AND SUPPLIES

- 6-8.1 Equipment Authorized for Navy Use.** Equipment procured for use in the U.S. Navy has been tested under laboratory and field conditions to ensure that it will perform according to design specifications. A vast array of equipment and tools is available for use in diving operations. The NAVSEA/00C Diving Equipment Authorized for U.S. Navy Use (ANU) list identifies much of this equipment and categorizes diving equipment authorized for U.S. Navy use.
- 6-8.2 Air Supply.** The quality of diver's breathing air is vitally important. Air supplies provided to the diver in tanks or through a compressor shall meet five basic criteria.
1. Air shall conform to standards for diving air purity found in sections 4-3 and 4-4.
 2. Flow to the diver must be sufficient. Refer to the appropriate equipment operations and maintenance manual for flow requirements.
 3. Adequate overbottom pressure shall be maintained at the dive station.
 4. Adequate air supply shall be available to support the duration and depth of the dive (see paragraph 7-4.1 for scuba; paragraph 8-2.2.2 for MK 21).
 5. A secondary air supply shall be available for surface-supplied diving.

6-8.3 Diving Craft and Platforms. Regardless of the technique being supported, craft used for diving operations shall:

- Be seaworthy
- Include required lifesaving and other safety gear
- Have a reliable engine (unless it is a moored platform or barge)
- Provide ample room for the divers to dress
- Provide adequate shelter and working area for the support crew
- Be able to carry safely all equipment required for the operation
- Have a well-trained crew

Other support equipment—including barges, tugs, floating cranes or vessels and aircraft for area search—may be needed, depending on the type of operation. The need for additional equipment should be anticipated as far in advance as possible.

6-8.3.1 Deep-Sea Salvage/Rescue Diving Platforms.

- **Auxiliary Rescue/Salvage Ship (ARS) (Safeguard Class).** The mission of the ARS ship is to assist disabled ships, debeach stranded vessels, fight fires alongside other ships, lift heavy objects, recover submerged objects, tow other vessels, and perform manned diving operations. The ARS class ships carry a complement of divers to perform underwater ship husbandry tasks and salvage operations as well as underwater search and recovery. This class of vessel is equipped for all air diving techniques. Onboard equipment allows diving with air to a depth of 190 fsw.
- **Submarine Tender (AS).** U.S. submarine tenders are designed specifically for servicing nuclear-powered submarines. Submarine tenders are fitted with a recompression chamber used for hyperbaric treatments. Submarine tenders support underwater ship husbandry and maintenance and security swims.
- **Fleet Ocean Tug (T-ATF).** T-ATFs are operated by the Military Sealift Command. Civilian crews are augmented with military communications and diving detachments. In addition to towing, these large ocean-going tugs serve as salvage and diving platforms.
- **Diving Tender (YDT).** These vessels are used to support shallow-water diving operations. Additionally, a wide variety of Standard Navy Dive Boats (SNDB), LCM-8, LCM-6, 50-foot work boats, and other yard craft have been fitted with surface-supplied dive systems.

6-8.3.2 Small Craft. Scuba operations are normally conducted from small craft. These can range in size and style from an inflatable rubber raft with an outboard engine to a small landing craft. If divers are operating from a large ship or diving float, a small boat must be ready as a rescue craft in the event a surfacing diver is in trouble some distance from the support site. A small boat used by scuba divers must be able to slip its moorings quickly and move to a diver needing assistance.

6-9 SELECT AND ASSEMBLE THE DIVING TEAM

When planning diving assignments and matching the qualifications and experience of diving personnel to specific requirements of the operation, a thorough knowledge of the duties, responsibilities and relationships of the various members of the diving team is essential. The diving team may include the Diving Officer, Master Diver, Diving Supervisor, Diving Medical Officer, divers qualified in various techniques and equipment, support personnel (tenders—qualified divers if possible), recorder, and medical personnel, as indicated by the type of operation (Figure 6-15). Other members of the ship's company, when properly instructed, provide support in varying degrees in such roles as boat crew, winch operators, and line handlers.



Figure 6-15. MK 21 Dive Requiring Two Divers. The team consists of one Supervisor, two divers, a standby diver, one tender per diver, comms and logs operator, and extra personnel (as required).

- 6-9.1 Manning Levels.** The size of the diving team may vary with the operation, depending upon the type of equipment being used, the number of divers needed to complete the mission, and the depth. Other factors, such as weather, planned length of the mission, the nature of the objective, and the availability of various resources will also influence the size of the team. The minimum number of personnel required on station for each particular type of diving equipment is provided in Figure 6-16. The minimum levels shall be maintained; levels should be increased as necessary to meet anticipated operational conditions and situations.

MINIMUM MANNING LEVELS FOR AIR DIVING						
	EOD Scuba		Scuba Operations		Surface-Supplied Operations	
	Single Diver	Buddy Pair	Single Diver	Buddy Pair	Diver's Helmet MK 21 MOD 1	MK 20 MOD 0
Diving Supervisor	1	1	1	1	1	1
Comms and Logs	(a)	(a)	(a)	(a)	1	1
Console Operator					(j)	(j)
Diver	1 (c)	2 (c)	1 (b) (c)	2 (b) (c)	1 (b)	1 (b)
Standby Diver	1 (c)	1 (c)	1 (c)	1 (c)	1 (k)	1 (k)
Diver Tender (b, c)	1 (d)		1		1	1
Standby Diver Tender	(i)	(i)	(i)	(i)	1	1
Total	4 (f) (h)	4 (f,h)	4 (e,g,h,i)	4 (h)	6	6 (g)
WARNING						
These are the minimum personnel levels required, below which diving operations are not permitted. Circumstances may require that these minimum personnel levels be increased so the diving operations can be conducted safely.						
NOTES:						
(a) Diving Supervisor may fill requirement for Comms and Logs for scuba operations.						
(b) Each additional surface-supplied diver or tended scuba diver will require an additional tender. The number of surface-supplied divers may be increased as necessary to the extent that the air system can support them.						
(c) Scuba divers, except SPECWAR divers and divers involved in Limpet operations (see paragraph 6-4.5 and paragraph 7-8.2 for more information), must be surface tended if direct ascent to surface is not available, such as when diving under the bilge keel. Situations may require that a diver be tended by a second diver situated at the bilge keel .						
(d) The EOD Diving Officer may authorize a single untethered EOD diver when disarming live ordnance in an operational (non-training) situation.						
(e) Submarines that have only three qualified scuba divers assigned are authorized to conduct dives with a non-diver Commissioned Officer acting as the Diving Supervisor. In all cases, submarines will endeavor to obtain the prerequisite number of qualified divers to support their mission. All other commands are to conduct all scuba diving operations with a minimum of four divers.						
(f) EOD Diving Officers are required for all EOD operations involving Render Safe Procedures (RSP).						
(g) Manning levels for Dilbert Dunkers and Device 9D5 pool pilot training that require safety scuba divers are covered by directives promulgated by NAWSTP Safety Diver Operations.						
(h) Chase boat is required for scuba diving operations when conditions exist where the diver could be displaced from the dive site (i.e. bottom search in a strong current or a long-duration swim).						
(i) If the standby diver is deployed, the Diving Supervisor shall tend the standby diver.						
(j) Comms and Logs may serve as Console Operator.						
(k) Standby diver can be deployed as a working diver in accordance with paragraph 6-9.8.2.						

Figure 6-16. Minimum Personnel Levels for Air Diving Stations.

- 6-9.2 Commanding Officer.** The ultimate responsibility for the safe and successful conduct of all diving operations rests with the Commanding Officer. The Commanding Officer's responsibilities for diving operations are defined and specific authority is confirmed by the provisions of U.S. Navy Regulations and other fleet, force, or command regulations. To ensure diving operations are efficiently conducted, the Commanding Officer delegates appropriate authority to selected members of the command who, with subordinate personnel, make up the diving team.
- 6-9.3 Diving Officer.**
- 6-9.3.1 Command Diving Officer.** The Command Diving Officer's primary responsibility is the safe conduct of all diving operations within the command. The Command Diving Officer will become thoroughly familiar with all command diving techniques and have a detailed knowledge of all applicable regulations and is responsible for all operational and administrative duties associated with the command diving program. The Command Diving Officer is designated in writing by the Commanding Officer. Although preferably a qualified diver, any commissioned officer, or in the absence of a PQS qualified commissioned officer, a Master Diver, may be assigned as the Command Diving Officer.
- 6-9.3.2 Watchstation Diving Officer.** Personnel assigned as the Watchstation Diving Officer are responsible to the Commanding Officer for the safe and successful conduct of the diving operation. The Watchstation Diving Officer provides overall supervision of diving operations, ensuring strict adherence to procedures and precautions. Although preferably a qualified diver, any PQS qualified commissioned officer or Master Diver may be assigned this watchstation. The Watchstation Diving Officer must be designated in writing by the Commanding Officer.
- 6-9.4 Master Diver.**
- 6-9.4.1 Master Diver Responsibilities.** The Master Diver is the most qualified person to supervise air and mixed-gas dives (using scuba and surface-supplied diving equipment) and recompression treatments (Figure 6-17). He is directly responsible to the Commanding Officer, via the Diving Officer, for the safe conduct of all phases of diving operations. The Master Diver manages preventive and corrective maintenance on diving equipment, support systems, salvage machinery, handling systems, and submarine rescue equipment. Training and requalification of divers attached to the command is conducted by the Master Diver, who also ensures that divers are trained in emergency procedures. The Master Diver recommends to the Commanding Officer, via the Diving Officer, which enlisted divers are qualified to serve as Diving Supervisors. The Master Diver oversees the efforts of the Diving Supervisor and provides advice and technical expertise. If circumstances warrant, the Master Diver shall relieve the Diving Supervisor and assume control of the dive station. In the absence of a Diving Officer, the Master Diver can assume the duties and responsibilities of the Diving Officer.

6-9.4.2 **Master Diver Qualifications.** The Master Diver has completed Master Diver evaluation course (CIN A-433-0019) successfully and is proficient in the operation of Navy-approved underwater breathing equipment, support systems, and recompression chambers. He is also trained in diagnosing and treating diving injuries and illnesses. The Master Diver is thoroughly familiar with operating and emergency procedures for diving systems, and possesses a working knowledge of gas mixing and analysis, computations, salvage theory and methods, submarine rescue procedures, towing, and underwater ship husbandry. The Master Diver shall possess a comprehensive knowledge of the scope and application of all Naval instructions and publications pertaining to diving, and shall ensure that logs and reports are maintained and submitted as required.



Figure 6-17. Master Diver Supervising Recompression Treatment

6-9.5 **Diving Supervisor.** While the Master Diver is in charge of the overall diving operation, the Diving Supervisor is in charge of the actual diving operation for a particular dive or series of dives. Diving operations shall not be conducted without the presence of the Diving Supervisor.

6-9.5.1 **Predive Responsibilities.** The Diving Supervisor shall be included in preparing the operational plans. The Diving Supervisor shall consider contingencies, determine equipment requirements, recommend diving assignments, and establish back-up requirements for the operation. The Diving Supervisor shall be familiar with all divers on the team and shall evaluate the qualifications and physical fitness of the divers selected for each particular job. The Diving Supervisor inspects all equipment and conducts predive briefings of personnel.

6-9.5.2 **Responsibilities While Operation is Underway.** While the operation is underway, the Diving Supervisor monitors progress; debriefs divers; updates instructions to subsequent divers; and ensures that the Master Diver, Diving Officer, Commanding Officer, and other personnel as necessary are advised of progress and of any changes to the original plan. The Diving Supervisor should not hesitate to call upon the technical advice and expertise of the Master Diver during the conduct of the dive operation.

6-9.5.3 **Postdive Responsibilities.** When the mission has been completed, the Diving Supervisor gathers appropriate data, analyzes the results of the mission, prepares reports to be submitted to higher authority, and ensures that required records are

completed. These records may range from equipment logs to individual diving records.

6-9.5.4 **Diving Supervisor Qualifications.** The Diving Supervisor may be commissioned or enlisted depending on the size of the operation and the availability of qualified personnel. When qualifying a Diving Supervisor, selection is based on knowledge, experience, level of training, and the competence of the available personnel in the following order:

1. Master Diver
2. First Class Diver/Saturation Diver/Seal Diver/EOD Diver
3. Diving Medical Technician
4. Second Class Diver
5. Scuba Diver

Regardless of rank, the Diving Supervisor shall be a qualified diver of demonstrated ability and experience. The Diving Supervisor shall be designated in writing by the Commanding Officer. Diving Supervisors under instruction shall stand their watches under the supervision of a qualified Diving Supervisor.

6-9.6 **Diving Medical Officer.** The Diving Medical Officer defines the proper course of medical action during medical emergencies. The Diving Medical Officer provides on-site medical care for divers as conditions arise and ensures that diving personnel receive proper attention before, during, and after dives. The Diving Medical Officer may modify recompression treatment tables, with the specific concurrence of the Commanding Officer. A Diving Medical Officer is required on site for all air dives deeper than 190 fsw, when the maximum working depth of the diving apparatus may be exceeded, or for exceptional exposure air dives.

6-9.7 **Diving Personnel.**

6-9.7.1 **Diving Personnel Responsibilities.** While working, the diver shall keep topside personnel informed of conditions on the bottom, progress of the task, and of any developing problems that may indicate the need for changes to the plan or a call for assistance from other divers. To ensure safe conduct of the dive, the diver shall always obey a signal from the surface and repeat all commands when using voice communications. The diver is responsible for the diving gear worn and shall ensure that it is complete and in good repair.

6-9.7.2 **Diving Personnel Qualifications.** Military divers shall be qualified and designated in accordance with instructions issued by the Naval Personnel Command (NPC) or as appropriate by USMC, U.S. Army, or U.S. Air Force orders. Civilian divers diving under military cognizance must meet the qualifications listed in Chapter 5. The diver selected for an operation shall be qualified for the diving technique used, the equipment involved, and for diving to the depth required. Diving personnel assigned to the Navy Experimental Diving Unit (NEDU) and Naval Submarine Medical Research Laboratory (NSMRL) are exempt from such requirements as they are assigned as experimental diving test subjects and may be employed in experimental dive profiles as required within approved test protocols.

6-9.8 Standby Diver. A standby diver with a tender is required for all diving operations. The standby diver need not be equipped with the same equipment as the primary diver (except as otherwise specified), but shall have equivalent depth and operational capabilities. Scuba shall not be used for the standby diver for surface-supplied diving operations.



Figure 6-18. Standby Diver.

6-9.8.1 Standby Diver Qualifications. The standby diver is a fully qualified diver, assigned for back-up or to provide emergency assistance, and is ready to enter the water immediately. For surface-supplied operations, the standby diver shall be dressed to the following points, MK

20 or MK 21 MOD 1, with strain relief connected to the harness. Under certain conditions, the Diving Supervisor may require that the helmet be worn. A standby scuba diver shall don all equipment and be checked by the Diving Supervisor. The standby diver may then remove the mask and fins and have them ready to don immediately for quick deployment. For safety reasons at the discretion of the Diving Supervisor, the standby diver may remove the tank. The standby diver receives the same briefings and instructions as the working diver, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance. The scuba standby diver shall be equipped with an octopus rig.

6-9.8.2 Deploying the Standby Diver as a Working Diver. The standby diver may be deployed as a working diver provided all of the following conditions are met:

1. Surface-supplied no-decompression dive of 60 fsw or less.
2. Same job/location, e.g., working on port and starboard propellers on the same vessel:
 - Prior to deploying the standby diver, the work area shall be determined to be free of hazards (i.e., suction, discharges) by the first diver on the job site.
 - When working in ballast tanks or confined spaces, the standby diver may be deployed as a working diver, but both divers shall be tended by a third diver who is outside the confined space (also see paragraph 6-4.9).

NOTE The standby diver shall remain on deck ready for deployment when salvage operations diving is being done.

- 6-9.9 Buddy Diver.** A buddy diver is the diver's partner for a scuba operation. The buddy divers are jointly responsible for the assigned mission. Each diver keeps track of depth and time during the dive. Each diver shall watch out for the safety and well-being of his buddy and shall be alert for symptoms of nitrogen narcosis, decompression sickness, and carbon dioxide build up. A diver shall keep his buddy within sight and not leave his buddy alone except to obtain additional assistance in an emergency. If visibility is limited, a buddy line shall be used to maintain contact and communication. If scuba divers get separated and cannot locate each other, both divers shall surface immediately.
- 6-9.10 Diver Tender.**
- 6-9.10.1 **Diver Tender Responsibilities.** The tender is the surface member of the diving team who works closely with the diver on the bottom. At the start of a dive, the tender checks the diver's equipment and topside air supply for proper operation and dresses the diver. Once the diver is in the water, the tender constantly tends the lines to eliminate excess slack or tension (certain UWSH tasking may preclude this requirement, e.g., working in submarine ballast tanks, shaft lamination, dry habitat welding, etc.). The tender exchanges line-pull signals with the diver, keeps the Diving Supervisor informed of the line-pull signals and amount of diving hose/tending line over the side and remains alert for any signs of an emergency.
- 6-9.10.2 **Diver Tender Qualifications.** The tender should be a qualified diver. When circumstances require the use of a non-diver as a tender, the Diving Supervisor shall ensure that the tender has been thoroughly instructed in the required duties. If a substitute tender shall be employed during an operation, the Diving Supervisor must make certain that the substitute is adequately briefed before assuming duties.
- 6-9.11 Recorder.** The recorder shall be a qualified diver. The recorder maintains worksheets, fills out the diving log for the operation, and records the diver's descent time, depth of dive, and bottom time. The recorder reports to the Diving Supervisor the ascent time, first stop, and time required at the decompression stop. In scuba operations, the Diving Supervisor may assume the duties of the recorder. The recorder is required to have on hand a copy of the U.S. Navy Standard Decompression Tables being used. When decompression begins, the schedule selected by the Diving Supervisor is recorded on the chart and log. The recorder keeps all members of the team advised of the decompression requirements of the divers. In scuba operations, the Diving Supervisor may assume duties as the recorder.
- 6-9.12 Medical Personnel.** Diving Medical Officers and Diving Medical Technicians are given special training in hyperbaric medicine and in diving. They provide medical advice and treatment to diving personnel. They also instruct members of the diving team in first aid procedures and participate in diving operations when the presence of diving medical personnel is indicated, as when particularly hazardous operations are being conducted.

Diving medical personnel evaluate the fitness of divers before operations begin and are prepared to handle any emergencies which might arise. They also observe

the condition of other support personnel and are alert for signs of fatigue, overexposure, and heat exhaustion.

- 6-9.13 Other Support Personnel.** Other support personnel may include almost any member of the command when assigned to duties that support diving operations. Some personnel need specific indoctrination. Small-Boat operators shall understand general diving procedures, know the meanings of signals, and be aware of the mission objectives. Other personnel, such as winch operators or deck crew, might interact with the operation directly, but only when under the control of the Diving Supervisor. Engineering personnel may be directed to secure overboard discharges and lock the shafts; a sonar operator might be required to secure equipment and put a Do Not Energize tag on the power switch (see Figure 6-20a for a detailed Ship Repair Safety Checklist).

The Officer of the Deck (OOD) or Command Duty Officer (CDO) is responsible to the Commanding Officer for the operation and safety of the ship and crew during the watch. He shall be concerned with the activities of the diving team. The OOD/CDO shall stay informed of the progress of the operation, of any changes to the original plan and shall be notified as far in advance as possible of any special requirements. The Officer of the Deck or Command Duty Officer shall be alert for any shifting of the moor or changing weather/sea conditions. He shall inform the Diving Officer and/or Diving Supervisor of any changes in these conditions.

- 6-9.14 Cross-Training and Substitution.** Each member of the diving team should be qualified to act in any position on the team. Because it is probable that substitutions will be made at some point during a lengthy mission, dive plans and diving schedules should organize personnel and work objectives so that experienced personnel will always be available on site. All personnel who participate in the operation should be included in initial briefings.

- 6-9.15 Physical Condition.** Diving candidates shall meet the specific physical requirements for divers set forth by the Commander Naval Medical Command and pass a physical screening test as outlined in MILPERSMAN Article 1410380. Once qualified, the diver is responsible for maintaining good health and top physical condition.

Reference NAVMEDCOMINST 6200.15 (series) to provide guidance on suspension of diving duty of pregnant servicewomen.

Medical personnel assigned to a diving unit shall evaluate the day-to-day condition of each diver and the Diving Supervisor shall verify the fitness of each diver immediately before a dive. Any symptom such as cough, nasal congestion, apparent fatigue, emotional stress, skin or ear infection is reason for placing the diver on the binnacle list until the problem is corrected.

Physical condition is often best judged by the diver who is obligated to report to the Diving Supervisor when not feeling fit to dive. A diver who, for any reason, does not want to make a dive should not be forced. A diver who regularly declines diving assignments shall be disqualified as a diver.

6-9.16 Underwater Salvage or Construction Demolition Personnel. Underwater salvage demolition personnel are trained in underwater precision explosives techniques and hold Navy Enlisted Classification (NEC) 5375. Salvage/Construction Demolition Diver personnel shall be currently certified and designated in accordance with the requirements specified in the OPNAVINST 8023.2 series.

6-9.16.1 Blasting Plan. The senior Salvage/Construction Demolition Diver NEC 5375 is responsible for providing the Commanding Officer with a comprehensive and written blasting plan. At a minimum, the blasting plan contains:

- Demolition team organization
- Work description with alternatives
- Range standard operating procedures
- Prefiring procedures
- Postfiring procedures
- Area security plan
- Misfire procedures
- Personnel and equipment casualty procedures
- Blasting sequence of events

The NEC 5375 should direct all phases of demolition operations using only approved operating and safety procedures. The NEC 5375 shall ensure the operation is not allowed to proceed until receiving specific approval from the Diving Supervisor and shall take charge of all misfires, ensuring they are handled in accordance with the approved plan.

6-9.16.2 Explosive Handlers. All divers who handle explosives shall be trained and certified in accordance with the OPNAVINST 8023.2 series.

6-10 OSHA REQUIREMENTS FOR U.S NAVY CIVILIAN DIVING

U.S. Navy Civilian Divers are governed by the provisions of the U.S. Navy Diving Program, yet they must also comply with U.S. Government Occupational Safety and Health Administration (OSHA) diving standards, delineated in 29 CFR Part 1910 Subpart T; Subj: Commercial Diving Operations. U.S. Navy Civilian Divers are identified as all permanent Navy employees who have been formally trained at an approved U.S. Navy diving school as either a scuba diver, Second Class diver, or First Class diver. Commercial divers contracted by the Navy who are not permanent government employees are not subject to these provisions.

Most directives of the U.S. Navy Diving Program provide parallel requirements, or are similar enough not to be considered of substantive difference. Several requirements of OSHA do, however, exceed those delineated for U.S. Navy divers and must be identified to ensure compliance by USN civilian divers to both standards. Therefore, the following restrictions, in addition to all other requirements addressed in this manual, apply to USN civilian divers:

6-10.1 Scuba Diving (Air) Restriction.

1. Scuba diving shall not be conducted:
 - To depths deeper than 130 fsw
 - To depths deeper than 100 fsw unless a recompression chamber is on station
2. All scuba cylinder manifolds shall be equipped with a manual reserve (J valve), or an independent reserve cylinder gas supply with a separate regulator.
3. A scuba cylinder submersible pressure gauge shall be worn by each diver.

6-10.2 Surface-Supplied Air Diving Restrictions.

1. Surface-supplied air diving shall not be conducted to depths greater than 190 fsw.
2. Dives shall be limited to in-water decompression times of less than 120 minutes.
3. An emergency gas supply (come-home bottle) is required for any dive greater than 60 fsw planned decompression dives or for which direct access to the surface is not available.

6-10.3 Mixed-Gas Diving Restrictions. All mixed-gas diving shall be limited to:

- A maximum depth of 220 fsw
- Less than 120 minutes total in-water decompression time
- Having a recompression chamber on station

6-10.4 Recompression Chamber Requirements.

1. An on-station recompression chamber is defined as a certified and ready chamber on the dive site.
2. A recompression chamber shall be on station for all planned decompression dives or dives deeper than 100 fsw.
3. Civilian divers shall remain at the location of a manned recompression chamber for 1 hour after surfacing from a dive that requires a recompression chamber on station.

6-11 ORGANIZE AND SCHEDULE OPERATIONS

6-11.1 Task Planning and Scheduling. All phases of an operation are important. A common failure when planning an operation is to place excessive emphasis on the actual dive phases, while not fully considering pre-dive and post-dive activities. Another failure is to treat operations of a recurring nature with an indifference to safety that comes with overfamiliarity. In developing a detailed task-by-task schedule for an operation, the following points shall be considered.

- The schedule shall allocate sufficient time for preparation, transit to the site, rendezvous with other vessels or units, and establishing a secure mooring.
- Bottom time is always at a premium, and all factors that shall affect bottom time shall be carefully considered. These include depth, decompression, number of divers available, support craft size, and surface and underwater environmental conditions.
- The number and profile of repetitive dives in a given time period are limited. This subject is discussed in Chapter 10.
- Plans may include the option to work night and day; however, there is an increased risk of a diving mishap from fatigue.
- The level of personnel support depends on the diving techniques selected (see Minimum Manning Levels, Figure 6-16).
- In planning tasks, non-diving topside support personnel shall be selected carefully, especially those who are not members of the diving team.
- Any schedule must be flexible to accommodate unexpected complications, delays, and changing conditions.
- The Diving Supervisor shall anticipate difficulties and be prepared to either overcome them or find alternative methods to circumvent them.
- If divers have been inactive and operating conditions permit, work-up dives should be conducted in-water or in the recompression chamber.

6-11.2 Postdive Tasks. A diving operation is completed when the objective has been met, the diving team demobilized, and records and reports are filed. Time shall be allocated for:

- Recovering, cleaning, inspecting, maintaining, repairing, and stowing all equipment
- Disposing materials brought up during the operation
- Debriefing divers and other team members
- Analyzing the operation, as planned and as actually carried out
- Restocking expended materials
- Ensuring the readiness of the team to respond to the next assignment

6-12 BRIEF THE DIVING TEAM

6-12.1 Establish Mission Objective. The Master Diver or the Diving Supervisor shall brief the team on the overall mission and the aspects of the operation necessary to safely achieve the objective. Major points of discussion include:

1. Clear, brief statement of the mission objective
2. Dominant factors that may determine mission outcome (i.e., environment, enemy/friendly actions, and hazards)
3. All tasks required to accomplish the mission
4. Time factors that may prevail
5. Any changes or augmentations of the dive plan

Prior to starting a dive mission or dive day, coordination with other commands and/or shipboard departments shall be accomplished.

6-12.2 Identify Tasks and Procedures. A briefing may be elaborate or simple. For complex operations, briefing with charts, slides, and diagrams may be required. For most operations, the briefing need not be complex and may be an informal meeting. The briefing shall present a breakdown of the dive objective, primary tasks, diving procedures, and related work procedures for the mission or dive day. Prompt debriefing of divers returning to the surface provides the Diving Supervisor with information that may influence or alter the next phase of the operation. Divers should be questioned about the progress of the work, bottom conditions and anticipated problems. They should also be asked for suggestions for immediate changes.

6-12.3 Review Diving Procedures. Diving and work procedures to be used for the task at hand shall be reviewed during the briefing. The Diving Safety and Planning Checklist (Figure 6-19a), Ship Repair Safety Checklist for Diving (Figure 6-20a) and the Surface-Supplied Diving Operations Pre-dive Checklist (Figure 6-21a) support control of diving operations. These checklists may be tailored to specific missions and environmental circumstances.

6-12.4 Assignment of Personnel. All personnel assignments shall be reviewed and verified to ensure properly trained personnel are assigned to operations.

6-12.5 Assistance and Emergencies. In any diving operation, three types of assistance may be required:

1. Additional equipment, personnel, supplies, or services
2. Clarification, authorization, or decisions from higher command
3. Emergency assistance in the event of an accident or serious illness

DIVING SAFETY AND PLANNING CHECKLIST

(Sheet 1 of 4)

STEPS IN PLANNING OF DIVING OPERATIONS

Detailed, advanced planning is the foundation of diving safety.

A. ANALYZE THE MISSION FOR SAFETY.

- Ensure mission objective is defined.
- Determine that non-diving means of mission accomplishment have been considered and eliminated as inappropriate.
- Coordinate emergency assistance.
- Review relevant Naval Warfare Publications (NWP) and OPNAV instructions.

B. IDENTIFY AND ANALYZE POTENTIAL HAZARDS.

Natural Hazards:

1. Atmospheric:
 - Exposure of personnel to extreme conditions
 - Adverse exposure of equipment and supplies to elements
 - Delays or disruption caused by weather
2. Surface:
 - Sea sickness
 - Water entry and exit
 - Handling of heavy equipment in rough seas
 - Maintaining location in tides and currents
 - Ice, flotsam, kelp, and petroleum in the water
 - Delays or disruption caused by sea state
3. Underwater and Bottom:
 - Depth which exceeds diving limits or limits of available equipment
 - Exposure to cold temperatures
 - Dangerous marine life
 - Tides and currents
 - Limited visibility
 - Bottom obstructions
 - Ice (underwater pressure ridges, loss of entry hole, loss of orientation, etc.)
 - Dangerous bottom conditions (mud, drop-offs, etc.)

On-Site Hazards:

- Local marine traffic or other conflicting naval operations
- Other conflicting commercial operations
- High-powered, active sonar
- Radiation contamination and other pollution (chemical, sewer outfalls, etc.)

Mission Hazards:

- Decompression sickness
- Communications problems
- Drowning
- Other trauma (injuries)
- Hostile action

Object Hazards:

- Entrapment and entanglement
- Shifting or working of object
- Explosives or other ordnance

Figure 6-19a. Diving Safety and Planning Checklist (sheet 1 of 4).

DIVING SAFETY AND PLANNING CHECKLIST

(Sheet 2 of 4)

C. SELECT EQUIPMENT, PERSONNEL and EMERGENCY PROCEDURES.

___ Diving Personnel:

- ___ 1. Assign a complete and properly qualified Diving Team.
- ___ 2. Assign the right man to the right task.
- ___ 3. Verify that each member of the Diving Team is properly trained and qualified for the equipment and depths involved.
- ___ 4. Determine that each man is physically fit to dive, paying attention to:
 - ___ general condition and any evidence of fatigue
 - ___ record of last medical exam
 - ___ ears and sinuses
 - ___ severe cold or flu
 - ___ use of stimulants or intoxicants
- ___ 5. Observe divers for emotional readiness to dive:
 - ___ motivation and professional attitude
 - ___ stability (no noticeably unusual or erratic behavior)

___ Diving Equipment:

- ___ 1. Verify that diving gear chosen and diving techniques are adequate and authorized for mission and particular task.
- ___ 2. Verify that equipment and diving technique are proper for depth involved.
- ___ 3. Verify that life support equipment has been tested & approved for U.S. Navy use.
- ___ 4. Determine that all necessary support equipment and tools are readily available and are best for accomplishing job efficiently and safely.
- ___ 5. Determine that all related support equipment such as winches, boats, cranes, floats, etc. are operable, safe and under control of trained personnel.
- ___ 6. Check that all diving equipment has been properly maintained (with appropriate records) and is in full operating condition.

___ Provide for Emergency Equipment:

- ___ 1. Obtain suitable communications equipment with sufficient capability to reach outside help; check all communications for proper operation.
- ___ 2. Verify that a recompression chamber is ready for use, or notify the nearest command with one that its use may be required within a given timeframe.
- ___ 3. Verify that a completely stocked first aid kit is at hand.
- ___ 4. If oxygen will be used as standby first aid, verify that the tank is full and properly pressurized, and that masks, valves, and other accessories are fully operable.
- ___ 5. If a resuscitator will be used, check apparatus for function.
- ___ 6. Check that fire-fighting equipment is readily available and in full operating condition.
- ___ 7. Verify that emergency transportation is either standing by or on immediate call.

___ Establish Emergency Procedures:

- ___ 1. Know how to obtain medical assistance immediately.
- ___ 2. For each potential emergency situation, assign specific tasks to the diving team and support personnel.
- ___ 3. Complete and post Emergency Assistance Checklist; ensure that all personnel are familiar with it.
- ___ 4. Verify that an up-to-date copy of U.S. Navy Decompression Tables is available.
- ___ 5. Ensure that all divers, boat crews and other support personnel understand all diver hand signals.
- ___ 6. Predetermine distress signals and call-signs.

Figure 6-19b. Diving Safety and Planning Checklist (sheet 2 of 4).

DIVING SAFETY AND PLANNING CHECKLIST

(Sheet 3 of 4)

- ___ 7. Ensure that all divers have removed anything from their mouths on which they might choke during a dive (gum, dentures, tobacco).
- ___ 8. Thoroughly drill all personnel in Emergency Procedures, with particular attention to cross-training; drills should include:

Emergency recompression	Rapid undressing
Fire	First aid
Rapid dressing	Embolism
Restoration of breathing	Near-drowning
Electric shock	Blowup
Entrapment	Lost diver

D. ESTABLISH SAFE DIVING OPERATIONAL PROCEDURES

___ Complete Planning, Organization, and Coordination Activities:

- ___ 1. Ensure that other means of accomplishing mission have been considered before deciding to use divers.
- ___ 2. Ensure that contingency planning has been conducted.
- ___ 3. Carefully state goals and tasks of each mission and develop a flexible plan of operations (Dive Plan).
- ___ 4. Completely brief the diving team and support personnel (paragraph 6-12).
- ___ 5. Designate a Master Diver or properly qualified Diving Supervisor to be in charge of the mission.
- ___ 6. Designate a recorder/timekeeper and verify that he understands his duties and responsibilities.
- ___ 7. Determine the exact depth at the job-site through the use of a lead line, pneumofathometer, or commercial depth sounder.
- ___ 8. Verify existence of an adequate supply of compressed air available for all planned diving operations **plus an adequate reserve for emergencies**.
- ___ 9. Ensure that no operations or actions on part of diving team, support personnel, technicians, boat crew, winch operators, etc., take place without the knowledge of and by the direct command of the Diving Supervisor.
- ___ 10. All efforts must be made through planning, briefing, training, organization, and other preparations to minimize bottom time. Water depth and the condition of the diver (especially fatigue), rather than the amount of work to be done, shall govern diver's bottom time.
- ___ 11. Current decompression tables shall be on hand and shall be used in all planning and scheduling of diving operations.
- ___ 12. Instruct all divers and support personnel not to cut any lines until approved by the Diving Supervisor.
- ___ 13. Ensure that ship, boat, or diving craft is securely moored and in position to permit safest and most efficient operations (exceptions are emergency and critical ship repairs).
- ___ 14. Verify that, when using surface-supplied techniques, the ship, boat, or diving craft has at least a two-point moor.
- ___ 15. Ensure that, when conducting SCUBA operations in hazardous conditions, a boat can be quickly cast off and moved to a diver in distress.

___ Perform Diving Safety Procedures, Establish Safety Measures:

- ___ 1. Ensure that each diver checks his own equipment in addition to checks made by tenders, technicians or other support personnel.
- ___ 2. Designate a standby diver for all diving operations; standby diver shall be dressed to the necessary level and ready to enter the water if needed.
- ___ 3. Assign buddy divers, when required, for all scuba operations.

Figure 6-19c. Diving Safety and Planning Checklist (sheet 3 of 4).

DIVING SAFETY AND PLANNING CHECKLIST

(Sheet 4 of 4)

- 4. Take precautions to prevent divers from being fouled on bottom. If work is conducted inside a wreck or other structure, assign a team of divers to accomplish task. One diver enters wreck, the other tends his lines from point of entry.
 - 5. When using explosives, take measures to ensure that no charge shall be fired while divers are in water.
 - 6. Use safety procedures as outlined in relevant Naval publications for all U/W cutting and welding operations.
 - 7. Brief all divers and deck personnel on the planned decompression schedules for each particular dive. Check provisions for decompressing the diver.
 - 8. Verify that ship, boat, or diving craft is displaying proper signals, flags, day shapes, or lights to indicate diving operations are in progress. (Consult publications governing International or Inland Rules, International/Inland local signals, and Navy communications instructions.)
 - 9. Ensure that protection against harmful marine life has been provided. (See Appendix 5C.)
 - 10. Check that the quality of diver's air supply is periodically and thoroughly tested to ensure purity.
 - 11. Thoroughly brief boat crew.
 - 12. Verify that proper safety and operational equipment is aboard small diving boats or craft.
- Notify Proper Parties that Dive Operations Are Ready to Commence:**
- 1. Diving Officer
 - 2. Commanding Officer
 - 3. Area Commander
 - 4. Officer of the Deck/Day
 - 5. Command Duty Officer or Commanding Officer of ships alongside
 - 6. Bridge, to ensure that ship's personnel shall not:
 - turn the propeller or thrusters
 - get underway
 - activate active sonar or other electronics
 - drop heavy items overboard
 - shift the moor
 - 7. Ship Duty Officer, to ensure that ship's personnel shall not:
 - activate sea discharges or suction
 - operate bow or stern-planes or rudder
 - operate vents or torpedo shutters
 - turn propellers
 - 8. Other Interested Parties and Commands:
 - Harbor Master/Port Services Officer
 - Command Duty Officers
 - Officers in tactical command
 - Cognizant Navy organizations
 - U.S. Coast Guard (if broadcast warning to civilians is required)
 - 9. Notify facilities having recompression chambers and sources of emergency transportation that diving operations are underway and their assistance may be needed.

Figure 6-19d. Diving Safety and Planning Checklist (sheet 4 of 4).

SHIP REPAIR SAFETY CHECKLIST FOR DIVING

(Sheet 1 of 2)

When diving operations will involve underwater ship repairs, the following procedures and safety measures are required in addition to the Diving Safety Checklist.

SAFETY OVERVIEW

- A. The Diving Supervisor shall advise key personnel of the ship undergoing repair:
 - 1. OOD
 - 2. Engineering Officer
 - 3. CDO
 - 4. OODs of ships alongside
 - 5. Squadron Operations (when required)
 - 6. Combat Systems Officer (when required)
- B. The Diving Supervisor shall request that OOD/Duty Officer of ship being repaired ensure that appropriate equipment is secured and tagged out.
- C. The Diving Supervisor shall request that OOD/Duty Officer advise him when action has been completed and when diving operations may commence.
- D. When ready, the diving Supervisor shall request that the ship display appropriate diving signals and pass a diving activity advisory over the 1MC every 30 minutes. For example, "There are divers working over the side. Do not operate any equipment, rotate screws, cycle rudder, planes or torpedo shutters, take suction from or discharge to sea, blow or vent any tanks, activate sonar or underwater electrical equipment, open or close any valves, or cycle trash disposal unit before checking with the Diving Supervisor."
- E. The Diving Supervisor shall advise the OOD/Duty Officer when diving operations commence and when they are concluded. At conclusion, the ship will be requested to pass the word on the 1MC, "Diving operations are complete. Carry out normal work routine."
- F. Diving within 50 feet of an active sea suction (located on the same side of the keel) that is maintaining a suction of 50 gpm or more, is not authorized unless considered as an emergency repair and is authorized by the Commanding Officers of both the repair activity and tended vessel. When it is determined that the sea suction is maintaining a suction of less than 50 gpm and is less than 50 feet, or maintaining a suction of more than 50 gpm and is less than 50 feet but on the opposite side of the keel, the Diving Supervisor shall determine if the sea suction is a safety hazard to the divers prior to conducting any diving operation. In all cases the Diving Supervisor shall be aware of the tend of the diver's umbilical to ensure that it will not cross over or become entrapped by an active sea suction.

NOTIFY KEY PERSONNEL.

- 1. OOD _____ (signature)
- 2. Engineering Officer _____ (signature)
- 3. CDO USS _____ (signature)
- 4. OOD USS _____
- OOD USS _____
- OOD USS _____
- OOD USS _____
- 5. Squadron Operations _____
- 6. Port Services Officer _____

(Diving Supervisor (Signature))

Figure 6-20a. Ship Repair Safety Checklist for Diving (sheet 1 of 2).

SHIP REPAIR SAFETY CHECKLIST FOR DIVING

(Sheet 2 of 2)

TAG OUT EQUIPMENT

TAG OUT

SIGNATURE AND RATE

Rudder _____

Planes _____

Torpedo tube shutters _____

Trash disposal unit _____

Tank blows _____

Tank vents _____

Shaft(s) locked _____

Sea suction _____

Sea discharges _____

U/W electrical equipment _____

Sonars _____

Other U/W equipment _____

USS _____

(name of ship)

CDO _____

(signature of CDO)

Figure 6-20b. Ship Repair Safety Checklist for Diving (sheet 2 of 2).

SURFACE-SUPPLIED DIVING OPERATIONS PRE-DIVE CHECKLIST

(Sheet 1 of 3)

CAUTION

This checklist is an overview intended for use with the detailed Operating Procedures (OPs) from the appropriate equipment O&M technical manual.

A. Basic Preparation:

- 1. Verify that a recompression chamber, Diving Officer, and Diving Medical Officer shall be present on the diving station for dives of more than 190 fsw.
- 2. Verify that proper signals indicating underwater operations being conducted are displayed correctly.
- 3. Ensure that all personnel concerned, or in the vicinity, are informed of diving operations.
- 4. Determine that all valves, switches, controls, and equipment components affecting diving operation are tagged-out to prevent accidental shut-down or activation.
- 5. Verify that diving system and recompression chamber are currently certified or granted a Chief of Naval Operations (CNO) waiver to operate.

B. Equipment Protection:

- 1. Assemble all members of the diving team and support personnel (winch operators, boat crew, watchstanders, etc.) for a pre-dive briefing.
- 2. Assemble and lay out all dive equipment, both primary equipment and standby spares for diver (or standby diver), including all accessory equipment and tools.
- 3. Check all equipment for superficial wear, tears, dents, distortion, or other discrepancies.
- 4. Check all masks, helmets, view ports, faceplates, seals, and visors for damage.
- 5. Check all harnesses, laces, strain reliefs, and lanyards for wear; renew as needed.

C. MK 21 MOD1:

- Ensure that all Operating Procedures (OPs) have been completed in accordance with *UBA MK 21 MOD 1 Technical Manual*, NAVSEA S6560-AG-OMP-010-UBA-21/1.

D. MK 20 MOD 0:

- Ensure that all Operating Procedures (OPs) have been completed in accordance with *UBA MK 20 MOD 0 Technical Manual*, NAVSEA SS600-AK-MMO-010/MK 20 MOD 0.

E. General Equipment:

- 1. Check that all accessory equipment – tools, lights, special systems, spares, etc., – are on site and in working order. In testing lights, tests should be conducted with lights submerged in water and extinguished before removal, to prevent overheating and failure.
- 2. Erect diving stage or attach diving ladder. In the case of the stage, ensure that the screw pin shackle connecting the stage line is securely fastened with the shackle pin seized with wire or a safety shackle is used to help prevent opening.

F. Preparing the Diving System:

- 1. Check that a primary and suitable back-up air supply is available with a capacity in terms of purity, volume, and supply pressure to completely service all divers including decompression, recompressions and accessory equipment throughout all phases of the planned operation.
- 2. Verify that all diving system operating procedures have been conducted to properly align the dive system.
- 3. Ensure that qualified personnel are available to operate and stand watch on the dive system.

Figure 6-21a. Surface-Supplied Diving Operations Pre-dive Checklist (sheet 1 of 3).

SURFACE-SUPPLIED DIVING OPERATIONS PRE-DIVE CHECKLIST

(Sheet 2 of 3)

- ___ 4. Compressors:
 - ___ a. Determine that sufficient fuel, coolant, lubricants, and antifreeze are available to service all components throughout the operation. All compressors should be fully fueled, lubricated, and serviced (with all spillage cleaned up completely).
 - ___ b. Verify that all diving system operating procedures have been conducted properly to align the dive system.
 - ___ c. Check maintenance and repair logs to ensure the suitability of the compressor (both primary and back-up) to support the operation.
 - ___ d. Verify that all compressor controls are properly marked and any remote valving is tagged with "Divers Air Supply - Do Not Touch" signs.
 - ___ e. Ensure that compressor is secure in diving craft and shall not be subject to operating angles, caused by roll or pitch, that will exceed 15 degrees from the horizontal.
 - ___ f. Verify that oil in the compressor is an approved type. Check that the compressor oil does not overflow Fill mark; contamination of air supply could result from fumes or oil mist.
 - ___ g. Check that compressor exhaust is vented away from work areas and, specifically, does not foul the compressor intake.
 - ___ h. Check that compressor intake is obtaining a free and pure suction without contamination. Use pipe to lead intake to a clear suction if necessary.
 - ___ i. Check all filters, cleaners and oil separators for cleanliness IAW PMS.
 - ___ j. Bleed off all condensed moisture from filters and from the bottom of volume tanks. Check all manifold drain plugs, and that all petcocks are closed.
 - ___ k. Check that all belt-guards are properly in place on drive units.
 - ___ l. Check all pressure-release valves, check valves and automatic unloaders.
 - ___ m. Verify that all supply hoses running to and from compressor have proper leads, do not pass near high-heat areas such as steam lines, are free of kinks and bends, and are not exposed on deck in such a way that they could be rolled over, damaged, or severed by machinery or other means.
 - ___ n. Verify that all pressure supply hoses have safety lines and strain reliefs properly attached.

H. Activate the Air Supply in accordance with approved OPs.

- ___ 1. Compressors:
 - ___ a. Ensure that all warm-up procedures are completely followed.
 - ___ b. Check all petcocks, filler valves, filler caps, overflow points, bleed valves, and drain plugs for leakage or malfunction of any kind.
 - ___ c. Verify that there is a properly functioning pressure gauge on the air receiver and that the compressor is meeting its delivery requirements.
- ___ 2. Cylinders:
 - ___ a. Gauge all cylinders for proper pressure.
 - ___ b. Verify availability and suitability of reserve cylinders.
 - ___ c. Check all manifolds and valves for operation.
 - ___ d. Activate and check delivery.
- ___ 3. For all supply systems, double check "Do Not Touch" tags (tags out).

Figure 6-21b. Surface-Supplied Diving Operations Pre-dive Checklist (sheet 2 of 3).

SURFACE-SUPPLIED DIVING OPERATIONS PRE-DIVE CHECKLIST

(Sheet 3 of 3)

I. Diving Hoses:

- 1. Ensure all hoses have a clear lead and are protected from excessive heating and damage.
- 2. Check hose in accordance with PMS.
- 3. Ensure that the hose (or any length) has not been used in a burst test program. No hose length involved in such a program shall be part of an operational diving hose.
- 4. Check that hoses are free of moisture, packing material, or chalk.
- 5. Soap test hose connections after connection to air supply and pressurization.
- 6. Ensure umbilical boots are in good condition.

J. Test Equipment with Activated Air Supply in accordance with approved OPs.

- 1. Hook up all air hoses to helmets, masks and chamber; make connections between back-up supply and primary supply manifold.
- 2. Verify flow to helmets and masks.
- 3. Check all exhaust and non-return valves.
- 4. Hook up and test all communications.
- 5. Check air flow from both primary and back-up supplies to chamber.

K. Recompression Chamber Checkout (Pre-dive only):

- 1. Check that chamber is completely free and clear of all combustible materials.
- 2. Check primary and back-up air supply to chamber and all pressure gauges.
- 3. Check that chamber is free of all odors or other "contaminants."
- 4. Hook up and test all communications.
- 5. Check air flow from both primary and back-up supplies to chamber.

Final Preparations:

- 1. Verify that all necessary records, logs, and timesheets are on the diving station.
- 2. Check that appropriate decompression tables are readily at hand.
- 3. Place the dressing bench in position, reasonably close to the diving ladder or stage, to minimize diver travel.

Figure 6-21c. Surface-Supplied Diving Operations Pre-dive Checklist (sheet 3 of 3).

Unexpected developments or emergency situations may be accompanied by confusion. The source and availability of any needed assistance and the method for obtaining it as quickly as possible, shall be determined in advance. The location of the nearest recompression chamber shall be identified and the chamber operators notified before the operation begins. The sources of emergency transportation, military or civilian, shall be established and alerted and the nearest Diving Medical Officer should be located and notified. Arrangements must be made to ensure a 24-hour availability for emergency assistance.

When a recompression chamber is required by Figure 6-14, the chamber shall be currently certified and within 30 minutes' travel time from the dive site. If a recompression chamber is required in an emergency, a non-certified chamber may be used if the Diving Supervisor is of the opinion that it is safe to operate.

Figure 6-22 is a suggested format for the Emergency Assistance Checklist that shall be completed and posted at the diving station to provide necessary information so that any member of the team could take prompt action.

6-12.5.1 **Notification of Ship's Personnel.** In the event of a diving casualty or mishap on dive station, calm must be maintained. Maintain silence on the side and take orders from the Diving Officer, Master Diver, and/or Diving Supervisor.

6-12.5.2 **Fouling and Entrapment.** Fouling and entrapment are more common with surface-supplied gear than scuba because of the ease with which the umbilicals can become entangled. Divers shall be particularly careful and watch their own umbilicals and those of their partners as well.

The surface-supplied diver may become fouled more easily, but will usually have an ample air supply while working to get free. The scuba diver may have no other recourse but to remove the gear and make a free ascent. If trapped, the scuba diver must face the possibility of running out of air before being able to work free.

The first and most important action that a trapped diver can take is to stop and think. The diver shall remain calm, analyze the situation, and carefully try to work free. Panic and overexertion are the greatest dangers to the trapped diver. If the situation cannot be resolved readily, help should be obtained. A new umbilical can be provided to the surface-supplied diver; the scuba diver can be given a new apparatus or may be furnished air by the dive partner.

Once the diver has been freed and returns to the surface, the diver shall be examined and treated, bearing in mind the following considerations:

- The diver will probably be overtired and emotionally exhausted.
- The diver may be suffering from or approaching hypothermia.
- The diver may have a physical injury.

EMERGENCY ASSISTANCE CHECKLIST	
<p>RECOMPRESSION CHAMBER</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>	<p>GAS SUPPLIES</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>
<p>AIR TRANSPORTATION</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>	<p>COMMUNICATIONS</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>
<p>SEA TRANSPORTATION</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>	<p>DIVING UNITS</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>
<p>HOSPITAL</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>	<p>COMMAND</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>
<p>DIVING MEDICAL OFFICER</p> <hr/> <p>Location</p> <hr/> <p>Name/Phone Number</p> <hr/> <p>Response Time</p>	<p>EMERGENCY CONSULTATION Duty Phone Numbers 24 Hours a Day Navy Experimental Dive Unit (NEDU) Commercial (850) 234-4351 (850) 230-3100 DSN 436-4351 Navy Diving Salvage and Training Center (NDSTC) Commercial (850) 234-4651 DSN 436-4651</p>

Figure 6-22. Emergency Assistance Checklist.

- A scuba diver may be suffering from asphyxia. If a free ascent has been made, gas embolism may have developed.
- Significant decompression time may have been missed.

6-12.5.3 **Equipment Failure.** With well-maintained equipment that is thoroughly inspected and tested before each dive, operational failure is rarely a problem. When a failure does occur, the correct procedures will depend upon the type of equipment and dive. As with most emergencies, the training and experience of the diver and the diving team will be the most important factor in resolving the situation safely.

6-12.5.3.1 **Loss of Gas Supply.** Usually, when a diver loses breathing gas it should be obvious almost immediately. Some diving apparatus configurations may have an emergency gas supply (EGS). When breathing gas is interrupted, the dive shall be aborted and the diver surfaced as soon as possible. Surfacing divers may be suffering from hypoxia, hypercapnia, missed decompression, or a combination of the three, and should be treated accordingly.

6-12.5.3.2 **Loss of Communications.** If audio communications are lost with surface-supplied gear, the system may have failed or the diver could be in trouble. If communications are lost:

1. Use line-pull signals at once. Depth, current, bottom or work site conditions may interfere.
2. Check the rising bubbles of air. A cessation or marked decrease of bubbles could be a sign of trouble.
3. Listen for sounds from the diving helmet. If no sound is heard, the circuit is probably out of order. If the flow of bubbles seems normal, the diver may be all right.
4. If sounds are heard and the diver does not respond to signals, assume the diver is in trouble.
5. Have divers already on the bottom investigate, or send down the standby diver to do so.

6-12.5.4 **Lost Diver.** In planning for an operation using scuba, lost diver procedures shall be included in the dive plan and dive brief. Losing contact with a scuba diver can be the first sign of a serious problem. If contact between divers is lost, each diver shall surface. If the diver is not located quickly, or not found at the surface following correct lost communications procedure, the Diving Supervisor shall initiate search procedures immediately. At the same time, medical personnel should be notified and the recompression chamber team alerted.

A lost diver is often disoriented and confused and may have left the operating area. Nitrogen narcosis or other complications involving the breathing mixture, which can result in confusion, dizziness, anxiety, or panic, are common in recovered lost

divers. The diver may harm the rescuers unknowingly. When the diver is located, the rescuer should approach with caution to prevent being harmed and briefly analyze the stricken diver's condition.

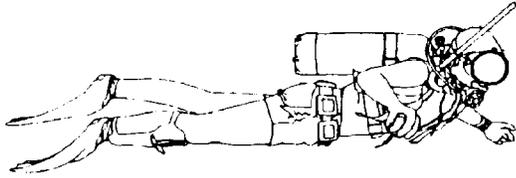
If the diver is found unconscious, attempts should be made to resupply breathing gas and restore consciousness. If this cannot be accomplished, the diver shall be brought to the surface immediately. Gas Embolism may occur during ascent and significant decompression may be missed and immediate recompression may be required. If it is possible to provide the diver with an air supply such as a single-hose demand scuba, the rescuer should do so during the ascent.

- 6-12.5.5 **Debriefing the Diving Team.** After the day's diving has been completed (or after a shift has finished work if the operation is being carried on around the clock), all members of the diving team should be brought together for a short debriefing of the day's activities. This offers all personnel a chance to provide feedback to the Diving Supervisor and other members of the team. This group interaction can help clarify any confusion that may have arisen because of faulty communications, lack of dive site information, or misunderstandings from the initial briefing.

6-13 AIR DIVING EQUIPMENT REFERENCE DATA

There are several diving methods which are characterized by the diving equipment used. The following descriptions outline capabilities and logistical requirements for various air diving systems.

Scuba General Characteristics



Principle of Operation:

Self contained, open-circuit demand system

Minimum Equipment:

1. Open-circuit scuba with J-valve or submersible pressure gauge
2. Life preserver/buoyancy compensator
3. Weight belt (if required)
4. Dive knife
5. Face mask
6. Swim fins
7. Submersible wrist watch
8. Depth gauge

Principal Applications:

1. Shallow water search
2. Inspection
3. Light repair and recovery

Advantages:

1. Rapid deployment
2. Portability
3. Minimum support requirements
4. Excellent horizontal and vertical mobility
5. Minimum bottom disturbances

Disadvantages:

1. Limited endurance (depth and duration)
2. Limited physical protection
3. Influenced by current
4. Lack of voice communication (unless equipped with a through-water communications system or full face mask)

Restrictions:

Work limits:

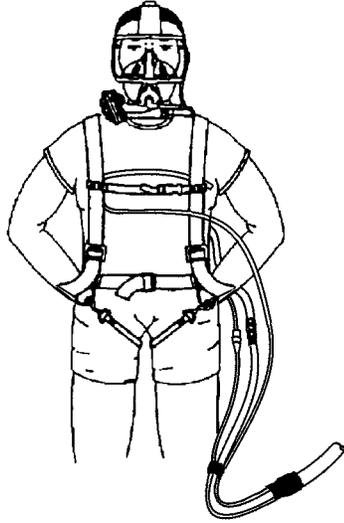
1. Normal 130 fsw
2. Maximum 190 fsw with Commanding Officer's permission
3. 100 fsw with single scuba bottle, twin bottles required below 100 fsw
4. Standby diver with twin bottles below 60 fsw
5. Within no-decompression limits
6. Current - 1 knot maximum
7. Diving team - minimum 4 persons

Operational Considerations:

1. Standby diver required
2. Small craft mandatory for diver recovery during open-ocean diving.
3. Moderate to good visibility preferred
4. Ability to free ascend to surface required (see paragraph 7-8.2)

Figure 6-23. Scuba General Characteristics.

MK 20 MOD 0 General Characteristics



Principle of Operation:

Surface-supplied, open-circuit lightweight system

Minimum Equipment:

1. MK 20 MOD 0 mask
2. Harness
3. Weight belt (as required)
4. Dive knife
5. Swim fins or boots
6. Surface umbilical

Principal Applications:

Diving in mud tanks and enclosed spaces

Advantages:

1. Unlimited by air supply
2. Good horizontal mobility
3. Voice and/or line-pull signal capabilities

Disadvantages:

1. Limited physical protection

Restrictions:

1. Work limits: 60 fsw
2. Current - Above 1.5 knots requires extra weights
3. Enclosed space diving requires an Emergency Gas Supply (EGS) with 50- to 150-foot whip and second-stage regulator.

Operational Considerations:

1. Adequate air supply system required
2. Standby diver required



MK 20 MOD 0 Helmet.

Figure 6-24. MK 20 MOD 0 General Characteristics.

MK 21 MOD 1 General Characteristics



Principle of Operation:

Surface-supplied, open-circuit system

Minimum Equipment:

1. MK 21 MOD 1 Helmet
2. Harness
3. Weight belt (if required)
4. Dive knife
5. Swim fins or boots
6. Surface umbilical
7. EGS bottle deeper than 60 fsw

Principal Applications:

1. Search
2. Salvage
3. Inspection
4. Underwater Ships Husbandry and enclosed space diving

Advantages:

1. Unlimited by air supply
2. Head protection
3. Good horizontal mobility
4. Voice and/or line pull signal capabilities
5. Fast deployment

Disadvantages:

1. Limited mobility

Restrictions:

1. Work limits: 190 fsw
2. Emergency air supply (EGS) required deeper than 60 fsw or diving inside a wreck or enclosed space
3. Current - Above 1.5 knots requires extra weights
4. Enclosed space diving requires an Emergency Gas Supply (EGS) with 50- to 150-foot whip and second stage regulator.

Operational Considerations:

1. Adequate air supply system required
2. Standby diver required



MK 21 MOD 1 Helmet.

Figure 6-25. MK 21 MOD 1 General Characteristics.