

**STANDARDS FOR SCIENTIFIC DIVING
CERTIFICATION AND OPERATION OF
SCIENTIFIC DIVING PROGRAM**

UNIVERSITY OF GUAM MARINE LABORATORY
UOG STATION, MANGILAO, GUAM 96923



(DECEMBER 1995)
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FOREWORD

The mission of the Diving Control Board (DCB) at the University of Guam Marine Laboratory is to ensure that all scientific diving is conducted in a manner that will foster safe, effective diving and minimize accidental injuries and/or illnesses. This manual was prepared to conform with the safety standards of the American Academy of Underwater Sciences (AAUS), and it is based upon the AAUS *Standards for Scientific Diving* (available at www.aaus.org). Diving techniques or diving equipment not listed in this manual are prohibited at the UOG Marine Laboratory. Additional diving techniques or equipment may be permitted only with the expressed approval of the DCB and only after the necessary safety guidelines are adopted by the DCB and incorporated into the UOG Marine Laboratory diving standards manual.

TABLE OF CONTENTS

Section 1.0	GENERAL POLICY	1
1.1	Scientific Diving Standards	1
1.1.1	Scientific Diving Definition	1
1.1.2	Scientific Diving Exemption	1
1.1.3	Liability	2
1.2	Operational Control	2
1.2.1	UOG Marine Laboratory Auspices Defined	2
1.2.2	UOG Marine Laboratory Diving Standards and Safety Manual	2
1.2.3	The Diving Safety Officer	2
1.2.4	The Diving Control Board	3
1.2.5	Instructional Personnel	4
1.2.6	Lead Diver (Person-in-charge)	5
1.2.7	Reciprocity and Visiting Scientific Diver	5
1.2.8	Waiver of Requirements	6
1.2.9	Consequences of Violation of Regulations by Scientific Divers	6
1.2.10	Record Maintenance	6
Section 2.0	DIVING REGULATIONS FOR SCUBA DIVING	6
2.1	Introduction	6
2.2	Pre-dive Procedures	6
2.2.1	Dive Plans	6
2.2.2	Pre-dive Safety Checks	7
2.3	Diving Procedures	7
2.3.1	Solo Diving Prohibition	7
2.3.2	Refusal to Dive	8
2.3.3	Termination of the Dive	8
2.3.4	Emergencies and Deviation from Regulations	8
2.4	Post Dive Procedures	8
2.4.1	Post-dive Safety Checks	8
2.5	Emergency Procedures	9
2.6	Flying After Diving	10
2.7	Record Keeping Requirements	10
2.7.1	Personal Diving Log	10
2.7.2	Required Incident Report	10
Section 3.0	OTHER DIVING TECHNIQUES	10
3.1	Blue Water Diving	10
3.2	Overhead Environments	10
3.3	Dry Suit Diving	11
3.4	Dive Computer Software	11
3.5	Pathogenic Environment Diving	11

Section 4.0	DIVING EQUIPMENT	11
4.1	General Policy	11
4.2	Equipment	11
4.2.1	Regulators	11
4.2.2	Breathing Masks	12
4.2.3	Scuba Cylinders	12
4.2.4	Backpacks Without Integrated Floatation Devices and Weight Systems	12
4.2.5	Gauges	12
4.2.6	Flotation Devices	12
4.2.7	Timing Devices and Depth\Pressure Gauges	12
4.2.8	Determination of Decompression Status: Dive Tables and Dive Computers	13
4.3	Support Equipment	13
4.3.1	First Aid Supplies	13
4.3.2	Diver's Flag	13
4.4	Equipment Maintenance	13
4.4.1	Record Maintenance	13
Section 5.0	DIVER-IN-TRAINING REQUIREMENTS	14
5.1	Requirements for the Diver-In-Training Certification	14
5.1.1	Medical Examination	14
5.1.3	Open-water Scuba Certification	14
5.1.4	Emergency Care Training	14
5.1.5	Written Evaluation	14
5.1.6	Open Water Evaluation	14
5.2	Diver-In-Training Permit Level	15
Section 6.00	SCIENTIFIC DIVER CERTIFICATION	15
6.1	Certification Types	15
6.2	General Policy	16
6.2.1	Prerequisites	16
6.2.2	Application	16
6.2.3	Medical Examination	16
6.2.4	Emergency Care Training	16
6.3	Requirements for the Scientific Diver Certification	16
6.4	Depth Certification	18
6.4.1	Depth Certification Levels	18
6.4.2	Progression to the Next Depth Level	18
6.5	Continuation of Certification	18
6.5.1	Minimum Activity of Maintain Certification	18
6.5.2	Requalification of Depth Certificate	19
6.5.3	Medical Examination	19
6.6	Revocation of Certification	19
6.7	Recertification	19

Section 7.0	MEDICAL STANDARDS	19
7.1	Medical Requirements of The UOG Marine Laboratory Divers	19
7.1.1	General	19
7.1.2	Frequency of Medical Evaluations	20
7.1.3	UOG Marine Laboratory Requirements for Diving Medical Examinations	20
7.1.4	Physician’s Written Report	21
Section 8.0	NITROX DIVING GUIDELINES	21
8.1	Prerequisites	21
8.2	Requirements for Authorization to Use Nitrox	21
8.3	Nitrox Training Guidelines	22
8.3.1	Classroom Instruction	22
8.3.2	Practical Training	23
8.3.3	Written Examination (based on classroom instruction and practical training)	23
8.4	Scientific Nitrox Diving Regulations	24
8.4.1	Dive Personnel Requirements	24
8.4.2	Dive Parameters	25
8.5	Nitrox Diving Equipment	28
8.5.1	Oxygen Cleaning and Maintenance Requirements	28
Appendix 1	—Definition of Terms	29
Appendix 2	—Monthly Scuba Diving Logsheet	32
Appendix 3	—Marine Lab Field Trip Request and Dive Plan Form	33

SECTION 1.0 GENERAL POLICY

1.1 Scientific Diving Standards

The purpose of the standards outlined in the UOG Marine Laboratory scientific diving program manual is to ensure that all scientific diving is conducted in a manner that will maximize the protection of scientific divers from accidental injury and/or illness. The standards in this manual meet or exceed the standards of the American Academy of Underwater Sciences (AAUS). The AAUS is recognized by OSHA as the diving standard setting organization.

1.1.1 Scientific Diving Definition

Scientific diving is defined (29CFR 1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

1.1.2 Scientific Diving Exemption

OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (29 CFR 1910, Subpart T, Appendix B):

1. The Diving Control Board (DCB) shall consist of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation. The DCB shall additionally have the authority to approve and monitor diving projects, review and revise the diving safety manual, assure compliance with the manual, certify the depths to which a diver has been trained, take disciplinary action for unsafe practices, and assure adherence to the buddy system for scuba diving.
2. The sole purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

5. The scientific diving program manual must include at a minimum: Procedures covering all diving operations specific to the program; including procedures for emergency care, recompression, and evacuation; and the criteria for diver training and certification.

1.1.3 Liability

In adopting the policies set forth in this manual, the UOG Marine Laboratory assumes no liability not otherwise imposed by law. Each diver is assumed under this policy to be voluntarily performing activities for which he/she assumes all risks, consequences, and potential liability.

1.2 Operational Control

1.2.1 The UOG Marine Laboratory Auspices Defined

The auspices of the UOG Marine Laboratory includes any scientific diving operation in which the UOG Marine Laboratory is connected because of ownership of any equipment used, locations selected, or relationship with the individual(s) concerned. It is the UOG Marine Laboratory's responsibility to adhere to the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs. The administration of the UOG Marine Laboratory diving program resides with the DCB.

The regulations in this manual are to be observed at all locations where scientific diving is conducted under the auspices of the UOG Marine Laboratory.

1.2.2 UOG Marine Laboratory Scientific Diving Standards and Safety Manual

The UOG Marine Laboratory scientific diving manual has been designed to enable the UOG Marine Laboratory to meet the requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards.

1.2.3 Diving Safety Officer

The Diving Safety Officer (DSO) serves as a member of the Diving Control Board (DCB). This person should have broad technical and scientific expertise in research related diving.

a) Qualifications

1. Shall be appointed by the Director of the Marine Laboratory or designee, with the advice and counsel of the DCB.

2. Shall be trained as a scientific diver.
3. Shall be a full member as defined by AAUS.
4. Shall be an active underwater instructor from a internationally recognized certifying agency.

b) Duties and Responsibilities

1. Shall be responsible, through the DCB, to the Director of the Marine Laboratory or designee, for the conduct of the scientific diving program of the University of Guam Marine Laboratory. The routine operational authority for this program, including the conduct of training and certification, approval of dive plans, maintenance of diving records, and ensuring compliance with this standard and all relevant regulations of the UOG Marine Laboratory, rests with the DSO.
2. May permit portions of this program to be carried out by a qualified delegate, although the DSO may not delegate responsibility for the safe conduct of the local diving program.
3. Shall be guided in the performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the local diving program will be retained by the DSO.
4. Shall suspend diving operations considered to be unsafe or unwise.

1.2.4 Diving Control Board

The Diving Control Board (DCB) consists of a majority of active scientific divers. Voting members include the DSO, the Director of the UOG Marine Laboratory, a faculty representative, a marine technician representative, and a student representative.

The Diving Control Board (DCB):

1. Has autonomous and absolute authority over all aspects of the scientific diving program's operation.
2. Shall approve and monitor diving projects.
3. Shall review and revise the diving safety manual.

4. Shall assure compliance with the manual.
5. Shall certify the depths to which a diver has been trained.
6. Shall take disciplinary action for unsafe practices.
7. Shall assure adherence to the buddy system for scuba diving.
8. Shall act as the official representative of the UOG Marine Laboratory in matters concerning the scientific diving program.
9. Shall act as a board of appeal to consider diver-related problems.
10. Shall recommend the issue, reissue, and the revocation of diving certifications.
11. Shall recommend changes in policy and amendments to the AAUS and UOG Marine Laboratory scientific diving manual as the need arises.
12. Shall establish and/or approve training programs through which the applicants for certification can satisfy the requirements of this manual.
13. Shall suspend diving programs that it considers to be unsafe or unwise.
14. Shall establish criteria for equipment selection and use.
15. Shall recommend new equipment or techniques.
16. Shall establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
17. Shall ensure that the air station for UOG Marine Laboratory meets the AAUS air quality standards.
18. Shall periodically review the DSO's performance and program.
19. Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of the UOG Marine Laboratory dive manual.

1.2.5 Instructional Personnel

All personnel involved in diving instruction under the auspices of the UOG Marine Laboratory shall be qualified for the type of instruction being given.

1.2.6 Lead Diver (Person-in-charge)

For each dive, one diver shall be the Lead Diver. The Lead Diver must be approved by the DSO. He/she shall be at the dive location during the diving operation. The Lead Diver is responsible for:

1. Coordination with other known activities in the vicinity which are likely to interfere with diving operations.
2. Ensure all dive team members possess current certification and are qualified for the type of diving operation.
3. Briefing team members on:
 - a. Dive objectives.
 - b. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
 - c. Modifications to diving or emergency procedures necessitated by the specific diving operation.
 - d. Reporting to the DSO and DCB any physical problems or adverse physiological effects including symptoms of pressure-related injuries.
4. Ensure safety and emergency equipment is in working order and at the dive site.
5. Suspend the diving operation if in his/her opinion conditions are not safe.
6. Plan dives in accordance with section 2.21.

1.2.7 Reciprocity and Visiting Scientific Diver

When diving with another AAUS member organization, one of the organizations' DCB will be designated to govern the joint dive project. When requesting to dive under the auspices of another AAUS member organization, the diver must provide a letter of reciprocity from the UOG Marine Laboratory DCB. The host dive officer may request a visiting diver to perform a skill review before giving permission to dive. If a visiting diver is denied permission to dive, the host DCB must submit a written explanation to the diver and the UOG Marine Laboratory DCB.

1.2.8 Waiver of Requirements

The DCB may grant a waiver for specific requirements of training, examinations, depth certification, and minimum activity to maintain certification. Medical requirements cannot be waived.

1.2.9 Consequence of Violation of Regulations by Scientific Divers

Failure to comply with the regulations of this dive manual may be cause for the revocation or restriction of the diver's scientific diving certificate by action of the DCB.

1.2.10 Record Maintenance

The DSO maintains permanent records for each scientific diver at the Marine Lab. The file includes the diver's certification level, log sheets, results of current physical examination, waiver, reports of disciplinary action by the DCB, and other pertinent information. Medical reports are available for the diver's physician when released by the diver in writing. Dive records involving any pressure related injury, pressure related injury assessments, and physician's evaluations are kept on file for five years. Dive records of UOG Marine Laboratory scientific divers and qualified affiliates are kept on file as long as the scientific divers maintain their affiliation with the UOG Marine Laboratory.

SECTION 2.0 DIVING REGULATIONS FOR SCUBA DIVING

2.1 Introduction

No person shall engage in scientific diving operations under the auspices of the UOG Marine Laboratory unless he/she holds a current certification issued pursuant to the provisions of this manual.

2.2 Pre-dive Procedures

2.2.1 Dive Plans

Before conducting any dive under the auspices of the UOG Marine Laboratory, the Lead Diver of a proposed dive must fill out a dive plan and have it approved by the DSO. All dives will be planned around the competency of the least experienced diver. See dive plan sheet and safety information in Appendix 2.

2.2.2 Pre-dive Safety Checks

1. Diver's Responsibility:
 - a. Each scientific diver shall conduct a functional check of his/her diving equipment in the presence of the diving buddy or tender.
 - b. It is the diver's responsibility and duty to refuse to dive if, in his/her judgement, conditions are unfavorable, or if he/she would be violating the precepts of his/her training or this manual.
 - c. No dive team member shall be required to be exposed to hyperbaric conditions against his/her will, except when necessary to prevent or treat a pressure-related injury.
 - d. No dive team member shall be permitted to dive for the duration of any known condition which is likely to adversely affect the health of the diver or other dive members.
 - e. The diver shall terminate the dive while there is still sufficient cylinder pressure to permit the diver to safely reach the surface including any required safety stop. The diver shall exit the water with a minimum of 300 lbs. of cylinder pressure.
2. Equipment evaluations:
 - a. Each diver shall insure that his/her equipment is in proper working order and that the equipment is suitable for the type of diving operation.
 - b. Each diver shall have the capability of achieving and maintaining positive buoyancy.
3. Site Evaluation:

The environmental conditions at the site will be evaluated before each dive.

2.3 Diving Procedures

2.3.1 Solo Diving Prohibition

All diving activities shall assure adherence to the buddy system for scuba diving. This buddy system is based on mutual assistance, especially in the case of an emergency.

2.3.2 Refusal to Dive

1. The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty whenever he/she feels it is unsafe for them to make the dive (see Sec. 2.22#1).
2. Safety—The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in his/her judgement, conditions are unsafe or unfavorable, or if he/she would be violating the precepts of his/her training or the regulations in this manual.

2.3.3 Termination of the Dive

1. It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever he/she feels it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water. (See Sec.2.22 #1)
2. The dive shall be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including any required safety stop.

2.3.4 Emergencies and Deviations from Regulations

Any diver may deviate from the requirements of this manual to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage. A written report must be submitted to the DCB explaining the circumstances and justifications.

2.3.5 Dives Deeper Than 60 Feet

On any dive deeper than 60 feet, the diver shall stop at 15 feet for a minimum of five minutes when returning to the surface.

2.4 Post-dive Procedures

2.4.1 Post-dive Safety Checks

1. After the completion of a dive, each diver must report any physical problems, symptoms of decompression sickness, or equipment malfunctions.
2. If a dive violates no-decompression limits, the divers should remain awake for at least one hour after diving, and in the company of a dive team member who is prepared to transport him/her to a hyperbaric chamber if necessary. A written report must be submitted to the DCB explaining the circumstances. Decompression diving is

permitted at the UOG Marine Laboratory only with the permission of the DCB and the Director.

2.5 Emergency Procedures

1. In all cases involving a known or suspected diving accident, the following procedures shall be followed:
 - A. Conscious Person
 1. If, after a scuba diving excursion, a person is suspected of any kind of injury, they will be taken to the nearest medical facility to be examined by a medical doctor.
 2. If a person complains of symptoms of pressure-related injury such as dizziness, headache, numbness or tingling sensations oxygen shall be administered. The diver will then be taken to the Naval Station Recompression Chamber for examination by the medical doctor on duty.
 - B. Unconscious Person
 1. If a person is found or becomes unconscious, first aid/ CPR shall be administered along with pure oxygen. Arrangements should be made for emergency evacuation of the diver to the Naval Station Recompression Chamber. If on land, contact 911 to request an ambulance for transportation. If on a boat, the emergency VHF radio channel 16 should be used to arrange for medical transportation. In the event that no one can be reached on channel 16, channel 12 and 13, the Harbor Master, or channel 68, the local fishermen's channel, can be used to reach assistance.
2. Medical Facilities
 - A. For injuries not involving actual or suspected pressure-related injuries the following medical facilities can be utilized:
 1. Northern and Central Guam: Guam Memorial Hospital
 2. Southern Guam: Inarajan Health Center
 - B. For injuries involving actual or suspected pressure-related injuries, the diver(s) should be taken to the Ship Repair Facility Recompression Chamber.

2.6 Flying after Diving

The following surface intervals should be observed before flying after diving:

1. Less than two hours total accumulated dive time in the last 48 hours-12 hour S.I.T.
2. Multi-day, unlimited diving-24 hour S.I.T. [S.I.T. (Surface Interval Time) is the period of time elapsed since the last dive].

2.7 Record Keeping Requirements

2.7.1 Personal Diving Log

Each diver shall log every dive made under the auspices of the UOG Marine Laboratory, and is encouraged to log all other dives. Dives are to be logged on the standard forms available from the DSO. Logs must be submitted to the DSO on the last day of each month for inclusion in the diver's permanent file.

2.7.2 Required Incident Report

All diving incidents requiring recompression or resulting in moderate or serious injury or death shall be reported to the DCB and the AAUS at www.aaus.org.

SECTION 3.0 OTHER DIVING TECHNIQUES

Certain types of diving, some of which are listed below, require equipment or procedures that necessitate training beyond that required by the basic Scientific Diver certification at the UOG Marine Laboratory. Any equipment or procedures not listed below require approval by the DCB prior to their use or implementation.

3.1 Blue Water Diving

Blue water diving is defined as diving in open water where the bottom is generally >200 feet deep. It is a specialty that requires special training and the use of multiple-tethered diving techniques.

3.2 Overhead Environments

Overhead environments are those where direct access to the surface is limited or removed such as caven, cave, and wreck diving. This type of diving requires specialized training to protect both the diver and his equipment.

3.3 Dry Suit Diving

Dry suit diving requires specialized training. When diving with a dry suit, a buoyancy control device (BCD) is required.

3.4 Dive Computer Software

When using a dive computer, a diver must still use the maximum dive time according to the PADI dive tables and carry an additional timing device. (See Sec.4.28)

3.5 Pathogenic Environment Diving

Pathogenic environment diving requires specialized training and equipment. Special medical requirements may need to be met.

SECTION 4.0 DIVING EQUIPMENT

4.1 General Policy

All equipment must meet the standards of the DCB as outlined below and must be inspected by the DSO or his delegate prior to use in the UOG Marine Laboratory diving program. All equipment should be regularly examined by the person using them. Technical equipment should be regularly tested and maintained. Equipment used under adverse conditions and/or extreme usage should be tested and maintained more frequently.

4.2 Equipment

4.2.1 Regulators

1. Scuba regulators shall be inspected and approved by the DSO prior to their use in the UOG Marine Laboratory diving program.
2. Regulators must be serviced and tested by qualified personnel every 12 months. A copy of the service record should be submitted to the DSO.
3. Regulators will consist of a primary second stage and an alternate air source (such as an octopus or redundant air supply).

4.2.2 Breathing Masks

Breathing masks must have a readily and positively closing, non-return valve at the attachment point between the mask and hose, an exhaust valve, and a minimum ventilation rate capable of sustaining the diver at the depth to which he/she is diving.

4.2.3 Scuba Cylinders

1. Scuba cylinders shall be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders.
2. Scuba cylinders must be hydrostatically tested in accordance to DOT standards.
3. Scuba cylinders must have an internal inspection and be functionally tested in intervals not exceeding 12 months.

4.2.4 Backpacks Without Integrated Flotation Devices and Weight Systems

Backpacks without integrated flotation devices and weight systems shall have a quick release device designed to permit jettisoning with a single motion from either hand.

4.2.5 Gauges

Gauges shall be inspected and tested before use and at least every twelve months thereafter.

4.2.6 Flotation Devices

1. A buoyancy control device (BCD) is required for ascent control and emergency flotation.
2. Personal flotation systems, dry suits, and other variable volume buoyancy compensation devices shall be equipped with an exhaust valve.
3. These devices shall be functionally inspected and tested at least every twelve months.

4.2.7 Timing Devices and Depth\ Pressure Gauges

Both members of a diving pair must have a dive watch or other timing device, an approved a depth gauge, and a submersible pressure gauge.

4.2.8 Determination of Decompression Status: Dive Tables and Dive Computers

1. A set of approved dive tables must be brought to the site of every dive operation.
2. Dive computers may be used in lieu of the dive tables if both members of a buddy team have their own dive computer. If only one member of a dive buddy team has a computer, both divers should follow the PADI dive tables.
3. If a dive computer should fail while in use, the dive should be terminated immediately.
4. All dive computers must be approved by the DSO.

4.3 Support Equipment

4.3.1 First Aid Supplies

A first aid kit and DAN emergency oxygen kit must be available at each dive site.

4.3.2 Diver's Flag

A diver's flag shall be displayed prominently whenever diving is conducted. The flag should be flown only as long as divers are in the water.

4.4 Equipment Maintenance

4.4.1 Record Keeping

Each equipment modification, repair, test, calibration, or maintenance service shall be logged, including the date and nature of work performed, serial number of the item, and the name of the person performing the work for the following equipment:

1. Regulators
2. Submersible pressure gauges
3. Depth gauges
4. Scuba cylinders
5. Cylinder valves

6. Submersible breathing masks
7. Buoyancy control devices
8. Dry suits

SECTION 5.0 DIVER-IN-TRAINING REQUIREMENTS

5.1 Requirements for Diver-in-training Certification

5.1.1 Medical Examination

Applicants to the UOG Marine Laboratory Scientific Diving Program must be certified by a licensed physician to be medically qualified for diving before they may enter the water under its auspices.

5.1.3 Open-water Scuba Certification

Applicants to the UOG Marine Laboratory Scientific Diving Program must provide proof of current scuba certification by a nationally or internationally recognized diver training agency. Basic open-water certification is the minimum accepted certification, advanced open-water certification is recommended.

5.1.4 Emergency Care Training

Applicants must provide proof of current training in CPR, first aid, and emergency oxygen administration. Training is available at the Marine Lab, but must be completed before an applicant may dive.

5.1.5 Written Evaluation

Applicants must pass a written examination on general open-water scuba skills and one on the contents of this manual.

5.1.6 Open Water Evaluation

Applicants must satisfy the DSO or his appointee of his/her ability to:

1. Surface dive to a depth of 10 feet in open water without scuba.
2. Demonstrate proficiency in air sharing, including both buddy breathing and the use of alternate air source, both as donor and receiver.

3. Enter and leave open water or surf, or leave and board a diving vessel, while wearing scuba gear.
4. Kick on the surface 400 yards while wearing scuba gear, but not breathing from the scuba unit.
5. Demonstrate judgment adequate for safe diving.
6. Demonstrate, when appropriate, the ability to maneuver efficiently in the environment, at and below the surface.
7. Complete a simulated emergency swimming ascent from 10 feet.
8. Demonstrate clearing of mask and regulator while submerged.
9. Demonstrate ability to achieve and maintain neutral buoyancy while submerged.
10. Demonstrate techniques of self-rescue and buddy rescue.
11. Navigate underwater.
12. Plan and execute a dive.

5.2 Diver-in-Training Permit Level

After fulfilling the requirements of this section, the diver will be issued a diver-in-training permit. This permit allows a diver to make up to six dives per year under the auspices of the UOG Marine Laboratory. Further diving with the UOG Marine Laboratory requires completion of the UOG Marine Laboratory Scientific Diver training program.

SECTION 6.0 SCIENTIFIC DIVER CERTIFICATION

6.1 Certification Types

1. Scientific Diver Certification—This is a permit to dive with the UOG Marine Laboratory, usable only while current.
2. Temporary Diver Permit—This permit constitutes a waiver of Sec. 6.0 and is issued only following a demonstration of the required proficiency in diving. It is only valid for a specified time, as determined by the DSO.

The requirements of Sec.6.2 (except medical approval) and 6.3 may be waived if the person in question has the required diving proficiency and can contribute measurably to the planned dive. A statement of the temporary diver's qualifications shall be submitted to the DSO as a part of the dive plan. Temporary permits are restricted to the planned diving operation and shall comply with all other policies, regulations, and standards of this manual.

6.2 General Policy

No person shall engage in scientific diving under the auspices of the UOG Marine Laboratory until certified pursuant to the provisions of this manual.

6.2.1 Prerequisites

Applicants to the UOG Marine Laboratory Scientific Diver Certification Program must have fulfilled the requirements of Sec. 5.0 of this manual.

6.2.2 Application

An application for certification must be filled out and provided to the DSO.

6.2.3 Medical Examination

Each applicant for diver certification must submit a statement from a licensed physician, based on an approved medical exam, attesting to the applicant's fitness to dive.

6.2.4 Emergency Care Training

The applicant must provide proof of training in the following:

- Adult CPR (must be current).
- Emergency oxygen administration (must be current)
- First aid for diving accidents (must be current)

6.3 Requirements for Scientific Diver Certification

Certification in the UOG Marine Laboratory Scientific Diver program requires completion of training in theoretical aspects and practical skills totaling a minimum of 100 hours. Theoretical aspects shall include principles and activities appropriate to the intended area of scientific study.

A. Required topics:

1. Diving emergency care training
 - Cardiopulmonary resuscitation (CPR)
 - Standard or basic First Aid.
 - Recognition of DCS and AGE
 - Accident management
 - Field neurological exam
 - Oxygen administration
2. Dive rescue
3. Dive environments
4. AAUS scientific diving regulations and history
 - Scientific dive planning
 - Coordination with other agencies
 - Appropriate governmental regulations
5. Small boat operations
6. Complete 32 hours (actual) of approved coursework.

B. Recommended topics

1. Specialized breathing gas
 - Nitrox
2. Specialized environments and conditions
 - Bluewater diving
 - Zero visibility diving
 - Polluted water diving
 - Night diving
 - Strong current diving
3. Specialized diving equipment
 - Dry suit
 - Communications

6.4 Depth Certification

Diving is not permitted beyond a depth of 130 feet without specialty training and the permission of the DCB.

6.4.1 Depth Certification Levels

1. Certification to 30-Foot Depth

This is the initial certification, approved upon the successful completion of the requirements of Sec. 5.0.

2. Certification to 60-Foot Depth

A diver holding a 30-foot certificate may be certified to a depth of 60 feet after successfully completing 12 supervised, logged training dives to depths between 31 and 60 feet for a minimum total time of 4 hours.

3. Certification to 100-Foot Depth

A diver holding a 60-foot certificate may be certified to a depth of 100 feet by logging four dives near the maximum depth category. These qualification dives shall be validated by the signature of two authorized individuals who are divers certified to at least the same depth. Although AAUS certifies Scientific Divers to 130 feet, the University of Guam Marine Laboratory limits diving to 100 feet or shallower. All dives planned for depths between 100 and 130 feet must have the prior approval of the Diving Control Board.

6.4.2 Progression to the Next Depth Level

A UOG Marine Laboratory certified diver may exceed his/her depth certification only if accompanied by a diver certified to a greater depth. Under these circumstances, the diver may exceed his/her depth limit by one step.

6.5 Continuation of Certification

6.51 Minimum Activity to Maintain Certification

During any 12 month period, each certified scientific diver must log a minimum of 12 dives. At least one dive must be logged near the maximum depth of the diver's certification during each 6 month period. Failure to meet these requirements may be cause for revocation or restriction of certification.

6.5.2 Requalification of Depth Certificate

Once the initial certification requirements are met, divers whose depth certification has lapsed due to lapse of activity may be requalified after 2 dives to the previous certified depth.

6.5.3 Medical Examination

All certified scientific divers shall pass a medical examination at the intervals specified in Section 7.1.2. After each major illness or injury, as described in Section 7.1.2, a certified scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.

6.6 Revocation of Certification

A diving certificate may be revoked or restricted for cause by the DSO or the DCB. Violation of regulations set forth in this manual, or other governmental subdivisions not in conflict with this manual, may be considered cause. The DSO shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present his/her case in writing for reconsideration and/or recertification. All written statements and requests, as identified in this section, are formal documents which will become part of the diver's file.

6.7 Recertification

If a diver's certification expires or is revoked, he/she may be recertified after complying with such conditions as the DSO or DCB may impose. The diver shall be given an opportunity to present his/her case to the DCB before conditions for recertification are stipulated.

SECTION 7.0 MEDICAL STANDARDS

7.1 Medical Requirements of UOG Marine Laboratory Divers

7.1.1 General

1. Diving under the auspices of UOG Marine Laboratory is permitted only with a current diving physical examination and a declaration by the examining physician of the diver's fitness to dive.

2. All medical exams required by this standard shall be performed by, or under the direction of a licensed physician of the applicant-diver's choice. It is recommended that the examining physician be trained in diving/undersea medicine.
3. The diver should be free of any chronic disabling disease and be free of any conditions for which restrictions from diving are generally recommended.

7.1.2 Frequency of Medical Evaluations

Medical evaluation shall be completed:

1. before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years (3 years if over the age of 40), the UOG Marine Laboratory has obtained the results of that examination, and those results have been reviewed and found acceptable by the DCB.
2. every 5 years after the initial exam until the age of 40, every 3 years after the age of 40, and every 2 years after the age of 60.
3. after any major injury or illness, or any condition requiring hospitalization for more than 24 hours. If the injury or illness is pressure related, then the evaluation must be performed by a physician trained in diving medicine.

7.1.3 UOG Marine Laboratory Requirements for Diving Medical Examinations

1. Initial examination and first examination over the age of 40:

Medical history, chest X-ray, 12 lead EKG, pulmonary function, audiogram, visual acuity, complete blood count (CBC), urinalysis, blood chemistry, and any further tests deemed necessary by the physician to qualify the patient for scuba diving.

2. Periodic re-examination (every 5 years until the age of 40, every 3 years thereafter):

Medical history, complete blood count (CBC), urinalysis, pulmonary function, audiogram, visual acuity, blood chemistry, and any further tests deemed necessary by the physician to qualify the patient for scuba diving.

7.1.4 Physician's Written Report

After a diving medical examination is completed, a written report containing the physician's opinion of the individual's fitness to dive and any recommended restrictions and limitations must be submitted to the DCB. A copy of this report will be available to the diver through the DSO.

Section 8.0 NITROX DIVING GUIDELINES

The following guidelines address the use of nitrox by scientific divers under the auspices of the UOG Marine Laboratory. Nitrox is defined for these guidelines as breathing mixtures composed predominately of nitrogen and oxygen, most commonly produced by the addition of oxygen or the removal of nitrogen from air.

8.1 Prerequisites

8.1.1 Eligibility

Only a certified Scientific Diver or Scientific Diver In Training diving under the auspices of a member organization is eligible for authorization to use nitrox. After completion, review and acceptance of application materials, training and qualification, an applicant will be authorized to use nitrox within their depth authorization.

8.1.2 Application and Documentation

Application and documentation for authorization to use nitrox should be made on forms specified by the Diving Control Board.

8.2 Requirements for Authorization to Use Nitrox

Submission of documents and participation in aptitude examinations does not automatically result in authorization to use nitrox. The applicant must convince the DSO and members of the DCB that they are sufficiently skilled and proficient. The signature of the DSO on the authorization form will acknowledge authorization. After completion of training and evaluation, authorization to use nitrox may be denied to any diver who does not demonstrate to the satisfaction of the DSO or DCB the appropriate judgment or proficiency to ensure the safety of the diver and dive buddy.

Prior to authorization to use nitrox, the following minimum requirements should be met:

Training

The diver must complete additional theoretical and practical training beyond the Scientific Diver In Training air certification level, to the satisfaction of the UOG Marine Laboratory DSO and DCB.

Examinations

Each diver should demonstrate proficiency in skills and theory in written, oral, and practical examinations covering:

- a) Written examinations covering the information presented in the classroom training session(s) (i.e., gas theory, oxygen toxicity, partial pressure determination, etc.);
- b) Practical examinations covering the information presented in the practical training session(s) (i.e., gas analysis, documentation procedures, etc.);
- c) Openwater checkout dives, to appropriate depths, to demonstrate the application of theoretical and practical skills learned.

Minimum Activity to Maintain Authorization

The diver should log at least one nitrox dive per year. Failure to meet the minimum activity level may be cause for restriction or revocation of nitrox authorization.

8.3 Nitrox Training Guidelines

Training in these guidelines should be in addition to training for Diver-In-Training authorization (Section 4.00). It may be included as part of training to satisfy the Scientific Diver training requirements (Section 5.0).

8.3.1 Classroom Instruction

- a) Topics should include, but are not limited to: review of previous training; physical gas laws pertaining to nitrox; partial pressure calculations and limits; equivalent air depth (EAD) concept and calculations; oxygen physiology and oxygen toxicity; calculation of oxygen exposure and maximum safe operating depth (MOD); determination of decompression schedules (both by EAD method using approved air dive tables, and using approved nitrox dive tables); dive planning and emergency procedures; mixing procedures and calculations; gas

analysis; personnel requirements; equipment marking and maintenance requirements; dive station requirements.

- b) DCB may choose to limit standard nitrox diver training to procedures applicable to diving, and subsequently reserve training such as nitrox production methods, oxygen cleaning, and dive station topics to divers requiring specialized authorization in these areas.

8.3.2 Practical Training

The practical training portion will consist of a review of skills as stated for scuba (Section 4.00), with additional training as follows:

- a) Oxygen analysis of nitrox mixtures.
- b) Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.
- c) Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables, as approved by the DCB.
- d) Nitrox dive computer use may be included, as approved by the DCB.

8.3.3 Written Examination (based on classroom instruction and practical training)

Before authorization, the trainee should successfully pass a written examination demonstrating knowledge of at least the following:

- a) Function, care, use, and maintenance of equipment cleaned for nitrox use.
- b) Physical and physiological considerations of nitrox diving (ex.: O₂ and CO₂ toxicity).
- c) Diving regulations and procedures as related to nitrox diving, either scuba or surface-supplied (depending on intended mode).
- d) Given the proper information, calculation of:
 1. Equivalent air depth (EAD) for a given f_{O_2} and actual depth;
 2. p_{O_2} exposure for a given f_{O_2} and depth;
 3. Optimal nitrox mixture for a given p_{O_2} exposure limit and planned depth;
 4. Maximum operational depth (MOD) for a given mix and p_{O_2} exposure limit;

5. For nitrox production purposes, percentages/psi of oxygen present in a given mixture, and psi of each gas required to produce an fO_2 by partial pressure mixing.
- e) Dive table and dive computer selection and usage;
- f) Nitrox production methods and considerations.
- g) Oxygen analysis.
- h) Nitrox operational guidelines (Section 7.40), dive planning, and dive station components.

8.3.4 Openwater Dives

A minimum of two supervised openwater dives using nitrox is required for authorization. The mode used in the dives should correspond to the intended application (i.e., scuba or surface-supplied). If the MOD for the mix being used can be exceeded at the training location, direct, in-water supervision is required.

8.4 Scientific Nitrox Diving Regulations

8.4.1 Dive Personnel Requirements

- a) Nitrox Diver In Training - A Diver In Training, who has completed the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox under the direct supervision a Scientific Diver who also holds nitrox authorization. Dive depths should be restricted to those specified in the diver's authorization.
- b) Scientific Diver - A Scientific Diver who has completed the training and authorization sections of these guidelines, may be authorized by the DSO to use nitrox. Depth authorization to use nitrox should be the same as those specified in the diver's authorization.
- c) Lead Diver - On any dive during which nitrox will be used by any team member, the Lead Diver should be authorized to use nitrox, and hold appropriate authorizations required for the dive, as specified in AAUS Standards. Lead Diver authorization for nitrox dives by the DSO and/or DCB should occur as part of the dive plan approval process.

In addition to responsibilities, the Lead Diver should:

1. As part of the dive planning process, verify that all divers using nitrox on a dive are properly qualified and authorized;
2. As part of the pre-dive procedures, confirm with each diver the nitrox mixture the diver is using, and establish dive team maximum depth and time limits, according to the shortest time limit or shallowest depth limit among the team members.
3. The Lead Diver should also reduce the maximum allowable pO_2 exposure limit for the dive team if on-site conditions so indicate.

8.4.2 Dive Parameters

a) Oxygen Exposure Limits

1. The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA. All dives performed using nitrox breathing mixtures should comply with the current *NOAA Diving Manual* "Oxygen Partial Pressure Limits for 'Normal' Exposures."
2. The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected. The DCB should consider this in the review of any dive plan application, which proposes to use nitrox. The Lead Diver should also review on-site conditions and reduce the allowable pO_2 exposure limits if conditions indicate.
3. If using the equivalent air depth (EAD) method the maximum depth of a dive should be based on the oxygen partial pressure for the specific nitrox breathing mix to be used.

b) Bottom Time Limits

1. Maximum bottom time should be based on the depth of the dive and the nitrox mixture being used.
2. Bottom time for a single dive should not exceed the NOAA maximum allowable "Single Exposure Limit" for a given oxygen partial pressure, as listed in the current *NOAA Diving Manual*.

c) Dive Tables and Gases

1. A set of DCB approved nitrox dive tables should be available at the dive site.
2. When using the equivalent air depth (EAD) method, dives should be conducted using air dive tables approved by the DCB.
3. If nitrox is used to increase the safety margin of air-based dive tables, the MOD and oxygen exposure and time limits for the nitrox mixture being dived should not be exceeded.
4. Breathing mixtures used while performing in-water decompression, or for bail-out purposes, should contain the same or greater oxygen content as that being used during the dive, within the confines of depth limitations and oxygen partial pressure limits.

d) Nitrox Dive Computers

1. Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operations instructions should be followed.
2. Use of Nitrox dive computers should comply with dive computer guidelines included in the AAUS Standards.
3. Nitrox dive computer users should demonstrate a clear understanding of the display, operations, and manipulation of the unit being used for nitrox diving prior to using the computer, to the satisfaction of the DSO or designee.
4. If nitrox is used to increase the safety margin of an air-based dive computer, the MOD and oxygen exposure and time limits for the nitrox mixture being dived should not be exceeded.
5. Dive computers capable of pO_2 limit and fO_2 adjustment should be checked by the diver prior to the start each dive to assure compatibility with the mix being used.

e) Repetitive Diving

1. Repetitive dives using nitrox mixtures should be performed in compliance with procedures required of the specific dive tables used.

2. Residual nitrogen time should be based on the EAD for the specific nitrox mixture to be used on the repetitive dive, and not that of the previous dive.
3. The total cumulative exposure (bottom time) to a partial pressure of oxygen in a given 24 hour period should not exceed the current *NOAA Diving Manual* 24-hour Oxygen Partial Pressure Limits for “Normal” Exposures.
4. When repetitive dives expose divers to different oxygen partial pressures from dive to dive, divers should account for accumulated oxygen exposure from previous dives when determining acceptable exposures for repetitive dives. Both acute (CNS) and chronic (pulmonary) oxygen toxicity concerns should be addressed.

f) Oxygen Parameters

1. Authorized Mixtures - Mixtures meeting the criteria outlined in Section 8.4 may be used for nitrox diving operations, upon approval of the DCB.
2. Purity - Oxygen used for mixing nitrox-breathing gas should meet the purity levels for “Medical Grade” (U.S.P.) or “Aviator Grade” standards.

In addition to the AAUS Air Purity Guidelines, the following standard should be met for breathing air that is either:

- a. Placed in contact with oxygen concentrations greater than 40%.
- b. Used in nitrox production by the partial pressure mixing method with gas mixtures containing greater than 40% oxygen as the enriching agent.

Air Purity:	CGA Grade E
Condensed Hydrocarbons	5 mg/m ³
Hydrocarbon Contaminants	No greater than 0.1 mg/m ³

g) Gas Mixing and Analysis for Organizational Members

1. Personnel Requirements
 - a. Individuals responsible for producing and/or analyzing nitrox mixtures should be knowledgeable and experienced in all aspects of the technique.

- b. Only those individuals approved by the DSO and/or DCB should be responsible for mixing and/or analyzing nitrox mixtures.
2. Production Methods - It is the responsibility of the DCB to approve the specific nitrox production method used.
3. Analysis Verification by User
 - a. It is the responsibility of each diver to analyze prior to the dive the oxygen content of his/her scuba cylinder and acknowledge in writing the following information for each cylinder: fO₂, MOD, cylinder pressure, date of analysis, and user's name.
 - b. Individual dive log reporting forms should report fO₂ of nitrox used, if different than 21%.

8.5 Nitrox Diving Equipment

All of the designated equipment and stated requirements regarding scuba equipment required in the AAUS Standards should apply to nitrox scuba operations. Additional minimal equipment necessary for nitrox diving operations includes:

- * Labeled SCUBA Cylinders
- * Oxygen Analyzers

8.5.1 Oxygen Cleaning and Maintenance Requirements

- a) Requirement for Oxygen Service
 1. All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen at pressures above 150 psi, should be cleaned and maintained for oxygen service.
 2. Equipment used with oxygen or mixtures containing over 40% by volume oxygen shall be designed and maintained for oxygen service. Oxygen systems over 125 psig shall have slow-opening shut-off valves. This should include the following equipment: scuba cylinders, cylinder valves, scuba and other regulators, cylinder pressure gauges, hoses, diver support equipment, compressors, and fill station components and plumbing.

APPENDIX 1 DEFINITION OF TERMS

Bounce Dive—A dive of relatively short duration. Generally less than 10 minutes.

Bottom Time—The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins a direct ascent to the surface.

Breath-hold Diving—A diving mode in which the diver uses no self-contained or surface supplied air or oxygen supply.

Buddy Diver—Second member of the dive team.

Buoyant Ascent—An ascent made using some form of positive buoyancy.

Burst Pressure—The pressure at which a pressure containment device would fail structurally.

Certified Diver—A diver who holds a current UOG Marine Laboratory diver-in-training or scientific diver permit.

Controlled Ascent—Any one of several kinds of ascents including normal, swimming, buddy breathing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent.

Cylinder—A pressure vessel for the storage of gasses.

Decompression Chamber—A pressure vessel for human occupancy. Also called a hyperbaric chamber or recompression chamber.

Decompression Sickness—A condition with a variety of symptoms which may result from gas and bubbles in the tissues of divers after pressure reduction.

Decompression Table—A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures. (Also called dive tables.)

Dive—A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.

Dive Computer—A microprocessor based device which computes a diver's theoretical decompression status, in real time, by using pressure(depth) and time as input to a decompression model, or set of decompression tables, programmed into the device.

Dive Time—Total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver returns to the surface.

Diver—An individual who uses apparatus which supplies breathing gas at ambient pressure.

Diver-in-training—An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.

Diving Control Board (DCB)—The group of individuals who act as the official representatives of the UOG Marine Laboratory in matters concerning the scientific diving program.

Diving Safety Officer (DSO)—The individual responsible for the safe conduct of the scientific diving program of the UOG Marine Laboratory.

Hyperbaric Chamber—See decompression chamber.

Hyperbaric Conditions—Pressure conditions in excess of normal atmospheric pressure at the dive location.

Lead Diver—The certified scientific diver with experience and training to conduct the diving operations.

No-Decompression Limits—The depth-time limits of the “no-decompression limits and repetitive dive group designations table for no-decompression air dives” of the PADI recreational dive tables.

Normal Ascent—An ascent made with an adequate air supply at a rate of 60 feet per minute or less.

Pressure-Related Injury—An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure. Examples include: Decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardrum.

Recompression Chamber—See decompression chamber.

Scientific Diving—Diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

Scuba Diving—A diving mode independent of surface supply in which the diver uses open circuit, self-contained underwater breathing apparatus.

S.I.T.—Surface interval time, the period of time elapsed since the last dive.

Swimming Ascent—An ascent which can be done under normal or emergency conditions accomplished by simply swimming to the surface.

Working Pressure—The normal pressure at which a system is designed to operate.

APPENDIX 3—MARINE LAB FIELD TRIP REQUEST AND DIVE PLAN FORM

Date of Field Trip: _____ Depart Lab _____ hrs
Project: _____ Estimated Return _____ hrs

Boat Requested: _____
Primary Dive Site: _____
Secondary Dive Site: _____
(i.e., bad weather site)

Dive Plan

Dive 1:
Depth _____ Time _____ SI _____

Purpose: _____

Dive 2:
Depth _____ Time _____ SI _____

Purpose: _____

Dive 3:
Depth _____ Time _____ SI _____

Purpose: _____

Approved: _____
Diving Safety Officer

Personnel Onboard

Helmsman: _____

Dive Leader: _____

Dive Team(s): Depth Certified

1. _____

2. _____

3. _____

4. _____

5. _____

Equipment Needed: _____

Approved: _____
Director

Remarks: _____

