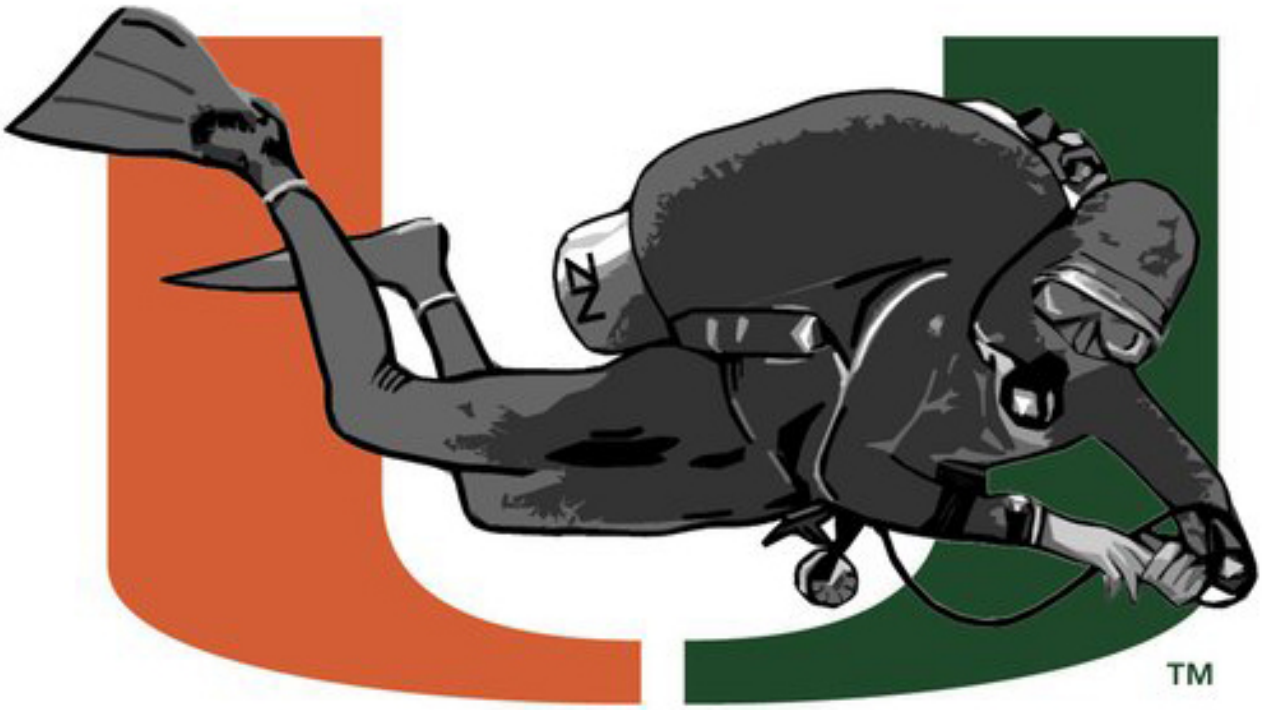
University of Miami Diving Safety Manual



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FOREWORD

Since the mid 1920s, University of Miami faculty, staff and students have ventured underwater in a quest to better understand it.

Since 1951 the scientific diving community has endeavored to promote safe, effective diving through self-imposed diver training and education programs. Over the years, manuals for diving safety have been circulated between organizations, revised and modified for local implementation, and have resulted in an enviable safety record.

This document represents the minimal safety standards for scientific diving at the present day. As diving science progresses so must this standard, and it is the responsibility of every member of the Academy to see that it always reflects state of the art, safe diving practice.

American Academy of Underwater Sciences

ACKNOWLEDGEMENTS

The Academy thanks the numerous dedicated individual and organizational members for their contributions and editorial comments in the production of these standards.

The University of Miami and American Academy of Underwater Sciences thank the numerous dedicated individual and organizational members for their contributions and editorial comments in the production of these standards.

Revision History
Available at www.aaus.org/About/Diving Standards

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Volume 1

Sections 1.00 through 5.00

Section 1.00 GENERAL POLICY

1.10 Scientific Diving Standards

Purpose

The purpose of these scientific diving standards is to ensure scientific diving that is conducted under the auspices of the University of Miami (UM) is done in a manner that will maximize the protection of scientific divers from accidental injury and/or illness. The purpose is also to set forth standards for training, authorization, and certification that will allow a working reciprocity between UM and other Organizational Members (OMs). Fulfillment of these purposes shall be consistent with the furtherance of research and safety, and facilitation of collaborative opportunities between AAUS OMs.

The AAUS manual sets minimum standards for the establishment of American Academy of Underwater Sciences (AAUS) recognized scientific diving programs, the organization for the conduct of these programs, and the basic regulations and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity between AAUS OMs that adhere to these minimum standards. The intention of the AAUS manual is to provide a foundation for OMs to build upon and expand. OMs are encouraged to exceed the minimal standards where they are able.

Throughout this manual, the University of Miami (UM) and the Rosenstiel School of Marine and Atmospheric Science (RSMAS) is used synonymously.

Historical Perspective

The AAUS manual, which is the basis for this manual, was developed and written by AAUS by compiling the policies set forth in the diving manuals of several university, private, and governmental scientific diving programs. These programs share a common heritage with the scientific diving program at the Scripps Institution of Oceanography (SIO). Adherence to the SIO standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1954.

This manual also reflects University of Miami program-specific policies and procedures, some of which were developed prior to the formation of AAUS and have since been refined to meet changes in techniques and technologies as scientific diving has evolved.

In 1982, OSHA exempted scientific diving from commercial diving regulations (29CFR1910, Subpart T) under certain conditions that are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). AAUS is recognized by OSHA as the scientific diving standard setting organization.

Scientific Diving Definition

Scientific diving is defined (29CFR1910.402) 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. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives."

Scientific Diving Exemption

The two elements that a diving program must contain as defined by OSHA in 29 CFR 1910

Subpart T 1910.401(a)(2)(iii) are:

a) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.
b) Diving control (safety) board, with the majority of its members being active divers, which must at a minimum 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 (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

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

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
2. The 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.

Notifications of Changes to this Manual

As part of UM's annual scientific diving program report, the University of Miami will notify AAUS of any changes or modifications to this manual.

1.20 Operational Control

University of Miami Auspices and Responsibilities

UM auspices include any scientific diving operation in which the University of Miami's Rosenstiel School of Marine and Atmospheric Science (RSMAS) is connected because of ownership of life support equipment used, locations selected, or relationship with the individual(s) concerned. This includes all cases involving the operations of authorized individuals of UM or auxiliary organizations, where such individuals are acting within the scope of their authorization. Recreational diving is not within the scope of these auspices.

It is UM's responsibility to adhere to the AAUS Standards for Scientific Diving certification, authorization, and operation of Scientific Diving Programs. The administration of the University of Miami's scientific diving program will reside with UM's Diving Control Board (DCB).

The regulations herein must be observed at all locations where UM scientific diving is conducted.

University of Miami Diving Safety Manual

Meeting AAUS minimum standards is a requirement for organizational membership in the Academy. The University of Miami must develop and maintain a diving safety manual that includes wording on how UM defines specific policies and procedures required for the proper function of a scientific diving program. This manual must address environmental and working conditions unique to the program's operations. This manual must meet or exceed the AAUS standards.

AAUS standards must be the foundation for the development of an OM's scientific diving safety manual. The order and formatting of the OM manual does not have to conform to the AAUS template. The information contained in Volume 1, Sections 1.00 through 5.00 and the Appendices are required for all manuals. Volume 2, Sections 6.00 through 12.00 are required only when the OM conducts the specifically referenced diving mode or activity. Deviations or significant changes to AAUS minimum standards require justification before approval is granted by the AAUS Standards Committee.

University of Miami Diving Control Board (UM DCB)

- The UM DCB must consist of a majority of active scientific divers. Voting members must include the Diving Safety Officer (DSO) and other representatives of the diving program such as qualified divers and members selected by procedures established by UM. A chairperson and a secretary may be chosen from the membership of the board according to UM procedure.
- The UM DCB has autonomous and absolute authority over the scientific diving program's operation.
- The UM DCB must:
  - Establish additional standards, protocols, and operational procedures beyond the AAUS minimums to address UM-specific needs and concerns.
  - Approve and monitor diving projects.
  - Review and revise the diving safety manual.
  - Ensure compliance with this manual and AAUS.
  - Approve the depths to which divers have been authorized to dive.
  - Take disciplinary action for unsafe practices.
  - Ensure adherence to the buddy system for scientific diving.
  - Act as the official representative of UM in matters concerning the scientific diving program.
  - Act as a board of appeal to consider diver-related matters.
  - Recommend the issue, reissue, or the revocation of diving authorizations.
  - Recommend changes in policy and amendments to AAUS and UM's diving safety manual as the need arises.
  - Establish and/or approve training protocols or standards through which the applicants for authorization can satisfy the requirements of this manual.
  - Suspend diving operations considered to be unsafe or unwise.
  - Establish criteria for equipment selection and use.
  - Recommend new equipment or techniques.
  - Establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
  - Ensure that UM's air station(s) meet air quality standards as described in Section 3.70.
  - Periodically review the performance of the DSO and program overall. The DSO will be made aware of votes pertaining to performance review and will recuse himself/herself from any vote(s) pertaining to DSO performance review(s).
  - Investigate diving incidents within UM's diving program or violations of this manual.
- The UM DCB may delegate operational oversight for portions of the program to the DSO; however, the UM DCB may not abdicate responsibility for the safe conduct of the diving program.

University of Miami Diving Safety Officer (UM DSO)

The UM DSO must be a member of the UM DCB. The UM DSO must vote in all voting matters.

The UM DSO is designated as one of the OM Representatives to AAUS. This person should have broad technical expertise and experience in research related diving.

Qualifications:

1. Must be an active scuba instructor from an internationally recognized certifying agency.
2. Must have logged a minimum of 500 dives, 300 of which are scientific dives.
3. Must be appointed by the responsible administrative officer or designee, with the advice and counsel of the DCB.
4. Must qualify as a Full Voting Member of AAUS as defined by AAUS Bylaws:
   a. "Holds a diving certification from a recognized national certifying agency or equivalent, and
   b. Has engaged in sustained or successive scientific diving activities during the past two years, or
   c. Has completed a course in scientific diving that meets the requirements as specified by the most current edition of the AAUS Standards for Scientific Diving."
5. Must attend an AAUS DSO Orientation within one year of accepting the DSO position, unless he/she has served as a DSO for another current AAUS OM within the last year.
6. Should have a minimum of 3 years experience as a DSO or Assistant DSO at a current AAUS OM within the past 10 years.

Duties and Responsibilities

1. Answers to the DCB and the appropriate administrative officer or designee, for the conduct of the scientific diving program.
2. The routine operational authority for this program rests with the DSO as assigned by the DCB. This operational authority includes, but is not limited to: training, diver authorizations, approval of dive plans, maintenance of diving records, and ensuring compliance with this manual.
3. May permit some duties and responsibilities to be carried out by a qualified delegate, with the approval of the DCB.
4. Must be guided in the performance of the required duties by the advice of the DCB, but operational authority for the conduct of the scientific diving program will be retained by the DSO.
5. Must suspend diving operations determined to be unsafe or unwise.

Assistant Diving Safety Officer (ADSO) / Instructional Personnel Qualifications

All personnel involved in diving instruction under UM's auspices must be reviewed and authorized by the DCB.

Lead Diver

For each dive, one individual must be designated as the Lead Diver who shall be at the dive location during the diving operation. To qualify as a lead diver, the diver must have a minimum of 50 career dives. Furthermore, no diver may lead a dive beyond his/her depth authorization. The Lead Diver is responsible for:

- Ensuring dives are conducted in accordance with Section 2.0.
- Ensuring all dive team members possess current authorizations and are qualified for the type of diving operation.
- Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- Ensuring safety and emergency equipment is in working order and at the dive site.

- Suspending diving operations if in their opinion conditions are not safe.
- Reporting to the DCB, through the DSO, any physical problems or adverse physiological effects including symptoms of pressure-related injuries.
- Leading dive briefing(s) (Section 2.20) and post-dive safety check(s) (Section 2.40).

Reciprocity and Visiting Scientific Diver

- Two or more AAUS OMs engaged jointly in diving activities, or engaged jointly in the use of diving resources, must designate one of the participating DCBs to govern the joint dive project. However, responsibility for individual divers resides with the home OM.
- A Scientific Diver from one OM must apply for permission to dive under the auspices of another OM by submitting to the DSO of the host OM a document containing all the information listed in Appendix 4, signed by the DSO or designee of the home DCB.
- A visiting Scientific Diver may be asked to demonstrate their knowledge and/or skills for the planned dive.
- If a host OM denies a visiting Scientific Diver permission to dive, the host DCB must notify the visiting Scientific Diver and their DCB with an explanation of all reasons for the denial.
- A letter of reciprocity (LOR) will not be issued unless all UM science diving requirements are current and up to date.
- A letter of reciprocity (LOR) is not equivalent to a verification of training letter (VOT). See Appendix 4 for a sample LOR template. An LOR confers insurance from the home institution to the scientific diver whereas the VOT provides proof of prior scientific diver training.

Waiver of Requirements

The UM DCB may grant a waiver for specific requirements including training, examinations, depth authorizations, and minimum activity to maintain authorizations. All options shall be exhausted to avoid using a waiver of requirements before the DCB considers waiving any requirement. The medical and insurance standards cannot be waived.

Divers requesting a waiver of a requirement may petition the DCB. To initiate this process, please submit in writing to the DSO a detailed description of the situation and justification for waiving a standard. The DSO will pass it on to the DCB for review. The DSO/DCB may contact the diver for additional information and to schedule a meeting if needed.

1.30 Consequence of Violation of Regulations by Scientific Divers

Failure to comply with the regulations of this manual may be cause for the restriction or revocation of the diver's scientific diving authorization by action of the DCB. Violations will be handled on a case-by-case basis.

1.40 Consequences of Violation of Regulations by Organizational Members

Failure to comply with the regulations of this manual may be cause for the restriction or revocation of UM's recognition by AAUS.

1.50 Record Maintenance

UM must maintain consistent records for its diving program and for each participant. These records include but are not limited to: diving safety manual; equipment inspection, testing, and maintenance records; dive plans (project and/or individual); records of dive (project and/or individual); medical approval to dive; diver training records; diver authorization(s); individual dive log; dive incident reports; reports of disciplinary actions by the DCB; and other pertinent information deemed necessary by UM.

Availability of Records:

- Medical records must be available to an attending physician of a diver or former diver when released in writing by the diver.
- Records and documents required by this manual must be retained by UM for the following period:
  1. Diving safety manual – Current document only.
  2. Equipment inspection, testing, and maintenance records – Minimum current entry or tag.
  3. Records of Dive – Minimum of 1 year, except 5 years where there has been an incident of pressure-related injury.
  4. Medical approval to dive – Minimum of 1 year past the expiration of the current document except 5 years where there has been an incident of pressure-related injury.
  5. Diver training records – Minimum of 1 year beyond the life of the diver's program participation.
  6. Diver authorization(s) – Minimum of 1 year beyond the life of the diver's program participation.
  7. Pressure-related injury assessment – Minimum of 5 years.
  8. Reports of disciplinary actions by the DCB – Minimum of 1 year beyond the life of the diver's program participation.

SECTION 2.00 DIVING REGULATIONS

2.10 Introduction

No person shall engage in scientific diving operations under the auspices of UM's scientific diving program unless they are authorized pursuant to the provisions of this manual.

2.20 Pre-Dive Procedures

Dive Plans

Before conducting any diving operations under the auspices of UM, a dive plan for the proposed project or dive must be formulated and submitted by the lead diver for approval by the DSO. Approval of a dive plan signifies that the dive may be conducted under UM auspices. Any diving conducted without the approval of a UM dive plan will not be considered a UM dive. Divers conducting dives without an approved dive plan or exceeding the parameters of an approved dive plan do so at their own risk and cannot hold the University of Miami, the UM DCB, the UM DSO, or the UM ADSO responsible in any way. Dives shall be planned around the competency of the least experienced/trained diver. The dive plan (project or individual) should include the following:

- Diving Mode(s) and Gas(es)
- Divers' authorizations
- Approximate number of proposed dives
- Location(s) of proposed dives
- Estimated depth(s) and bottom time(s) anticipated
- Decompression status and repetitive dive plans, if required
- Proposed work, equipment, and boats to be employed
- Any hazardous conditions anticipated
- Emergency Action Plan (Appendix 7)
- In water details of the dive plan should include:
  - Dive Buddy assignments and tasks
  - Goals and objectives
  - Maximum depth(s) and bottom time
  - Gas management plan
  - Entry, exit, descent and ascent procedures
  - Perceived environmental and operational hazards and mitigations
  - Emergency and diver recall procedures

Dive Plan Submission

In order to provide ample time to review and approve the dive plan to verify that all divers are qualified, current, authorized, and all paperwork is in order, dive plans shall be submitted to the UM DSO:

- 2 business days in advance for local dives (dives departing within 30 miles of RSMAS) consisting only of UM science divers.
- 2 weeks in advance for non-local dives (dives departing greater than 30 miles of RSMAS) consisting only of UM science divers.
- 1 month in advance for any dives including any non-UM diver, regardless of dive location.

Diver Responsibility and Refusal to Dive

The decision to dive is that of the diver. The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive, without fear of penalty, if in his/her judgment, conditions are unsafe or unfavorable, or if he/she would be violating the precepts of regulations in this manual.

No dive team member will be required to be exposed to hyperbaric conditions against his/her will.

No dive team member may dive for the duration of any known condition, which is likely to adversely affect the safety and health of the diver or other dive team members.

Pre-dive Safety Checks

- Prior to commencing the dive, the team must assure that every team member is healthy, fit, and trained for the type of dive that is being attempted.
- Scientific divers must conduct a functional check of their diving equipment in the presence of the dive buddy and/or tender. They must ensure the equipment is functioning properly and suitable for the type of diving operation being conducted.
- Each diver must have the capability of achieving and maintaining positive buoyancy at the surface.
- Environmental conditions at the site must be evaluated prior to entering the water.

Pre-dive Briefings

Before conducting any diving operations under the auspices of the University of Miami, the dive team members must be briefed on:

- Goals and objectives of the dive
- Unification of dive team – dive buddy assignments and tasks, positioning underwater, communication
- Exposure to hyperbaric conditions – maximum depth and bottom time
- Environment – perceived environmental and operational hazards and mitigations
- Decompression – entry, exit, descent, and ascent procedures
- Gas management plan – turn pressure and required surfacing pressure
- Equipment check – check mask, functionality of both second stages, hose routing, inflator functionality, OPV functionality, deflator functionality, starting tank pressure, fins, and any additional equipment necessary for the dive
- Emergency and diver recall procedures

Environmental Conditions

Before diving, environmental conditions must be assessed. It is the responsibility of the lead diver to do an environmental assessment before the day of the dive. The lead diver will monitor the weather and diving conditions and will notify divers ASAP of changes in the dive plan. The decision to dive or cancel the dive will sometimes have to be made the day of the dive. Guidelines for canceling dives based on environmental conditions are listed below:

- When diving offshore and winds are expected to be greater than 15kts and/or seas are expected to be greater than 2-4ft wave height, dives should be cancelled.
- Dives shall be cancelled when a small craft caution or greater is issued by NOAA.
- Other environmental conditions or hazards may also be cause for a cancellation of a dive(s).

2.30 Diving Procedures

Solo Diving Prohibition

All diving activities must assure adherence to the buddy system. This buddy system is based upon mutual assistance, especially in the case of an emergency. Solo diving is not permitted under the auspices of UM.

Decompression Management

- On any given dive, both divers in the buddy pair must follow the most conservative dive profile.
- A safety stop performed between 10-20ft during the ascent phase of the dive should be conducted on any dive that exceeds 30fsw (9.14m). Other ascent strategies (half stops, etc.) approved by the DSO may be used.
- Half stops are recommended for any dives deeper than 60ft.

Ascent Rate

The maximum ascent rate for diving under the auspices of the University of Miami is 30 feet per minute.

Alcohol Consumption

No dives shall be conducted for 12 hours after consumption of alcohol. UM recommends not consuming any alcohol within 12 hours of surfacing from a dive. When alcohol has been consumed within 24 hours of commencement of a dive, it is the diver's responsibility to do a self assessment for fitness to dive prior to diving.

Termination of the Dive

Any dive must be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including decompression time, or to safely reach an additional gas source at the decompression station.

It is the responsibility of the diver to terminate the dive that he/she considers unsafe, without fear of reprisal, in a way that does not compromise the safety of another diver already in the water.

Emergencies and Deviations from Regulations

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

2.40 Post-Dive Procedures

Post-Dive Safety Checks

After the completion of a dive, each diver must report any physical problems, symptoms of decompression illness, or equipment malfunctions to the Lead Diver, which shall then be reported to the DSO and/or DCB.

2.50 Emergency Procedures

The University of Miami has developed emergency procedures that follow the standards of care of the community and include procedures and implementation criteria for emergency care, recompression, evacuation, and incident reporting. The emergency action plan developed by UM

can be found in Appendix 7.

2.60 Flying After Diving or Ascending to Altitude (Over 1000 feet/304 meters)

The flying after diving regulations below have been adopted from recommendations developed by the Diver's Alert Network.

- Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours.
- Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.
- Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours.
- Before Ascending to Altitude Above 1000 feet (304 meters): Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

2.70 Record Keeping Requirements

Personal Diving Log

Each authorized scientific diver must log every dive made under UM auspices and is encouraged to log all other dives. Logs must be submitted in the online dive logging website in a timely manner (within one month of the date of the dive) and must remain in the diver's online file. The dive log should include at least the following:

- Name of diver and buddy
- Date, time, and location
- Diving modes used
- General nature of diving activities
- Maximum depth and dive time
- Diving tables or computers used
- Detailed report of any near or actual incidents

Required Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death must be reported to the UM DCB and AAUS in a timely manner. UM must record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section. UM must investigate and document any incident of pressure-related injury and prepare a report that is to be forwarded to AAUS during the annual reporting cycle.

If pressure-related injuries are suspected, or if symptoms are evident, the following additional information must be recorded and retained by UM, with the record of the dive, for a period of 5 years. Written descriptive report shall include:

- Name, address, phone numbers of the principal parties involved.
- Summary of experience of divers involved.
- Location, description of dive site, and description of conditions that led up to incident.
- The circumstances of the incident and the extent of any injuries or illnesses.
- Description of symptoms, including depth and time of onset.
- Description and results of treatment.

- Disposition of case.
- Recommendations to avoid repetition of incident.

In addition to requirements specific to the University of Miami, all diving incidents will be reported to AAUS. This report must first be reviewed and released by the DCB and at a minimum contain:

- Complete AAUS Incident Report.
- Summary of experience of divers involved.
- Description of dive site, and description of conditions that led up to incident.
- The circumstances of the incident and the extent of any injuries or illnesses.
- Description of symptoms, including depth and time of onset.
- Description and results of treatment.
- Disposition of case.
- Recommendations to avoid repetition of incident.

SECTION 3.00 DIVING EQUIPMENT

3.10 General Policy

All equipment must meet standards as determined by the DSO and the DCB. All equipment must be regularly examined by the person using it and serviced according to manufacturer recommendations. Equipment that is subjected to extreme usage under adverse conditions may require more frequent testing and maintenance. UM-owned equipment may only be used when diving under the auspices of the University of Miami as defined in Section 1.20.

3.20 Equipment

The UM DCB must establish the minimum equipment configuration for all dives.

Regulators, Gauges, and Computers

- Scuba regulators and gauges must be inspected and functionally tested prior to each use and serviced, at a minimum, according to manufacturer's recommendations.
- Standard open circuit (OC) regulator configuration is:
  - A first stage
  - Primary 2nd stage
  - Back up 2nd stage
  - Submersible Pressure Gauge (SPG)
  - Inflator hose for a Buoyancy Compensator Device
- A Full Face Mask may be used in place of the primary 2nd stage according to manufacturer's recommendations and pending approval by the DSO/DCB to use a full face mask.
- Divers may use dive computers to track depth and time of dives but any diver using a dive computer to control his/her dive profile must be approved to use that specific model. To be authorized to use a dive computer, divers must demonstrate understanding of UM dive computer policy by taking a written quiz and demonstrate mastery of the computer model through a practical evaluation of the DSO or designee.
- Any diver using a regulator hose longer than 36 inches must receive approval by the UM DSO.
- Divers are not permitted to use an upstream valve style second stage regulator.

Equipment for Determination of Decompression Status (Dive Computers and Dive Tables)

- Each member of the buddy team must have an underwater timing device and depth indicator, or dive computer. Timing devices and depth gauges must not be shared underwater. Dive computers must not be used to control the dive profile by more than one diver during any 18 hour period.
- To be authorized to use a dive computer under the auspices of UM, a diver must:
  - Review the online dive computer authorization Computer Based Learning (CBL) module in Blackboard.
  - Complete a written exam demonstrating understanding of basic dive computer principles and policies.
  - Review the owner's manual for the computer model to be used.
  - Complete a practical demonstration of knowledge and understanding of the specific computer model to be used, including all menus, functions, settings, buttons, icons, alarms, etc.
- A set of UM DCB approved dive tables must be available at the dive location.
- A dive computer must accompany a diver on every dive within an 18 hour period preceding any dive where the computer will control the dive profile.
- In an aquarium or other manmade structure of a known maximum obtainable depth:
  - A depth indicator is not required, except when a diver's decompression status must be taken

into consideration on repetitive dives.
  - Only one buddy must be equipped with a timing device.
  - The maximum obtainable depth of the aquarium must be used as the diving depth.

Scuba Cylinders

- Scuba cylinders must be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders.
- Scuba cylinders must be hydrostatically tested in accordance with DOT standards.
- Scuba cylinders must have an internal and external inspection at intervals not to exceed 12 months.
- Scuba cylinder valves must be functionally tested at intervals not to exceed 12 months.
- Scuba cylinder pressures should not drop below 500PSI during diving operations.
- Double cylinders – The use of double cylinders requires authorization through the DSO that shall include: a lecture, a training dive, and demonstrate proficiency diving with double cylinders on a checkout dive. When a diver presents equivalent training, only a checkout dive demonstrating proficiency may be required.
- Steel cylinders require redundant buoyancy. When diving in salt water in a wetsuit without redundant buoyancy, aluminum tanks must be used.

Buoyancy Compensation Devices (BCD)

- Each diver must have the capability of achieving and maintaining neutral buoyancy underwater and positive buoyancy at the surface.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must be equipped with an exhaust valve.
- These devices must be functionally inspected and tested at intervals not to exceed 12 months.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must not be used as a lifting device in lieu of lift bags.

Dive Weight

- The maximum amount of non-ditchable weight a diver may wear is 10 pounds. UM backplates account for 6 pounds of non-ditchable weight. Any amount of weight that exceeds 10 pounds must be able to be easily removed and released from the diver.
- When double aluminum tanks are used, the maximum amount of non-ditchable weight is 14 pounds.
- Weight belts must be worn so that the buckle is able to be released with the right hand.

3.30 Auxiliary Equipment

Handheld Underwater Power Tools

- Power tools and equipment used underwater must be specifically approved for this purpose.
- Tools and equipment supplied with power from the surface must be de-energized before being placed into or retrieved from the water.
- Handheld power tools must not be supplied with power from the dive location until requested by the diver.

3.40 Support Equipment

First Aid Supplies

A first aid kit and emergency oxygen appropriate for the diving being conducted should be available at the dive site.

Diver's Flag

A diver's flag must be displayed prominently in accordance with local regulations whenever diving is conducted under circumstances where required or where water traffic is probable.

Compressor Systems - UM Controlled

The following will be considered in design and location of compressor systems:

- Low-pressure compressors used to supply air to the diver if equipped with a volume tank must have a check valve on the inlet side, a relief valve, and a drain valve.
- Compressed air systems over 500 psig must have slow-opening shut-off valves.
- All air compressor intakes must be located away from areas containing exhaust or other contaminants.

Lift Bags

- Divers are not permitted to use lift bags with greater than 50 pounds of positive buoyancy.
- Divers must receive proper training and be authorized by the UM DSO to use a lift bag.
- Training must include a lecture from the DSO (or proof of formal academic training) and a checkout dive demonstrating proper safe use of lift bags.
- For any dive where a lift bag is intended to be used, divers must include the use of lift bags in dive plans.

Diver Propulsion Vehicles

DPVs are electronically powered device used to transport divers through the water. They are primarily used to benefit divers on large dive sites or sites with strong currents as an alternative to a diver swimming/finning. Divers interested in conducting dives using a DPV must at minimum:

- Be current UM scientific divers
- Attend a lecture by the DSO covering theoretical and practical considerations for DPV use
- Complete at least one DPV checkout dive with the DSO

Miscellaneous Support Equipment

Any equipment or equipment technique including but not limited to double cylinders, DPV's, etc. requires approval for use by the DSO.

3.50 Use of University of Miami Equipment

Divers are responsible for any and all UM equipment they borrow or are assigned. This includes the equipment care, maintenance, and return at the end of usage. If a piece of equipment is damaged, lost, stolen, or in any way returned in a condition other than the condition received from the DSO, divers will be financially responsible for its repair or replacement.

- Equipment is expected to be returned within a week of your last planned dive unless other arrangements have been made with the DSO.
- Divers are responsible for notifying the DSO of any equipment maintenance issues and bringing the equipment in need of repair to the DSO as soon as possible for repair or replacement.
- Divers-In-Training are not permitted to use DSO issued gear for proficiency dives until they are fully authorized.
- Using UM DSO issued gear for recreational diving is not permitted.

3.60 Equipment Maintenance

Record Keeping

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

- Regulators
- Gauges (SPG, Depth Gauges, Timers, and Dive Computers)
- BCDs
- Dry suits
- Scuba cylinders and valves
- Full Face Masks
- Compressors, air filtration systems, gas control panels, and storage banks
- Surface supplied equipment
- Rebreather systems
- Additional equipment categories as determined by the DCB

Compressor Operation and Air Test Records

Gas analyses and air tests must be performed on each UM-controlled breathing air compressor at regular intervals of no more than 100 hours of operation or 6 months, whichever occurs first. The results of these tests must be entered in a formal log and be maintained.

3.70 Air Quality Standards

Breathing Gas

Breathing gas must meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1; see table below).

CGA Grade E	
Component	**Maximum**
Oxygen	20 - 22%/v
Carbon Monoxide	10 PPM/v
Carbon Dioxide	1000 PPM/v
Condensed Hydrocarbons	5 mg/m3
Total Hydrocarbons as Methane	25 PPM/v
Water Vapor ppm	(2)
Objectionable Odors	None

For breathing air used in conjunction with self-contained breathing apparatus in extreme cold where moisture can condense and freeze, causing the breathing apparatus to malfunction, a dew point not to exceed -50°F (63 pm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.

Remote/Non-UM-Based Operations

For remote site operations using gas sources not controlled by UM, every effort should be made to verify breathing gas meets the requirements of this standard. If CGA Grade E gas is not verifiable, the DCB must develop a protocol to mitigate risk to the diver.

SECTION 4.00 SCIENTIFIC DIVER CERTIFICATION AND AUTHORIZATIONS

This section describes the training and performance standards for the University of Miami Scientific Divers and represents the minimum required level of knowledge and skills presented in a generalized format. AAUS requires OM diving programs to use the AAUS manual as the foundation of standards/policies in their programs. OMs are encouraged to expand upon, customize, and augment these requirements, develop or utilize appropriate educational materials, and optimize instructional programs to suit and reflect their specific needs. The University of Miami has followed this recommendation by AAUS.

4.10 Prerequisites

Administrative

The candidate must complete all administrative and legal documentation required by the OM.

Entry Level Diver (Recreational Certification)

The candidate must, at minimum, show documented proof of Diver Certification or equivalent from an internationally recognized training agency. When entering the UM scientific diving program, the diver candidate must present a dive log showing the successful completion of at least 10 dives, 2 of which must be within 12 months of the first day of science diver training. Entry level diver training is a prerequisite to scientific diver training and therefore no part of entry level training may be counted in any way toward scientific diver training.

[1] "Minimum Course Content for Open Water Diver Certification"- World Recreational Scuba Training Council (WRSTC), www.wrstc.com.

[2] "Safety related minimum requirements for the training of recreational scuba divers -- Part 2: Level 2 -- Autonomous diver". ISO 24801-2:2007- International Organization for Standardization (ISO) - www.iso.org.

Medical Examination

The candidate must be medically qualified for diving as described in Section 5.0 and Appendices 1-4 of this manual. AAUS medical standards may not be waived.

Swimming/Watermanship Evaluation

The candidate must demonstrate the following in the presence of the DSO or designee. All tests are to be performed without swim aids. However, where exposure protection is needed, the candidate must be appropriately weighted to provide for neutral buoyancy. Due to the physical fitness component, elements 1-5 of the swim test must be completed on the same day. Divers who pass less than 60% of the swim test (excluding transport of a passive person) will be asked to take it at a later date after they have had a chance to work on their swimming.

1) Swim 400 yards (366 meters) without swim aids except goggles in less than 12 minutes. This is a continuous swim so stopping is not permitted. Any stroke may be used.
2) Tread water for 15 minutes with no added swim aids or floatation.
3) Surface dive to 15ft. Goggles or mask are permitted.
4) Swim 25 yards underwater on a single breath. A diver candidate will receive a PASS for the U/W swim when completing 100% of the distance completely underwater.
   a) The underwater swim must be completed without pushing off the wall.
   b) Weights may be used for the underwater swim if needed to stay completely submerged. If

weights are used for the u/w swim, the diver candidate must use the same amount of weight for the 15 minute water tread.

c) Diver candidate may attempt the underwater swim 3 times before being asked to move on to the next element of the swim test.

5) Swim 400 yards (366 meters) in less than 8 minutes with mask, fins, and snorkel, but without the use of arms.
6) Transport a passive person of equal size a distance of 25 yards (23 meters) in the water. This element of the swim test may be completed at a later date.

4.20 Training

The diver candidate must successfully complete prerequisites, theoretical aspects, practical training, and examinations for a minimum cumulative time of 100 hours and a minimum of 12 open water dives. Theoretical aspects must include principles and activities appropriate to the intended area of scientific study. Formats for meeting the 100 hour training requirement include the UM scientific diver training course or a combination of formalized and on the job training. Under some conditions the DSO or qualified instructor designee may supervise in-water training from the surface after the fourth training dive as long as he/she is fit and equipped to enter the water to provide immediate assistance in case of an emergency. There should not be more than 6 students per DSO or qualified instructor designee (6:1 ratio) during any in-water diver training session. Regardless of how many DSOs or instructor designees are available, in-water training sessions must not exceed 12 diver candidates.

Due to the physical nature of dive training and related activities, physical contact is common. Instructors may need to make physical contact in order to correct diving technique or otherwise provide instruction. Divers shall understand that at times, for proper instruction and safety, physical contact is required and necessary.

When a diver's resume provides clear evidence of significant scientific diving experience, the diver can be given credit for meeting portions of the 100 hour course requirements. The DCB/DSO will identify specific overlap between on-the-job training, previous scientific diving training/experience and course requirements, and then determine how potential deficiencies will be resolved. However, the University of Miami cannot "test-out" divers, regardless of experience, when they have no previous experience in scientific diving.

Any candidate who does not convince the DCB, through the DSO, that he/she possesses the necessary judgment, under diving conditions, for the safety of the diver and his/her buddy, may be denied UM scientific diving privileges.

Theoretical Training / Knowledge Development	
Required Topics:	**Suggested Topics:**
Diving Emergency Care Training (DFAPro) • Cardiopulmonary Resuscitation (CPR) • AED • Standard or Basic First Aid • Recognition of DCS and AGE • Accident Management • Field Neurological Exam • Oxygen Administration • Bloodborne Pathogens	Specific Dive Modes (methods of gas delivery) • Open Circuit • Hookah • Surface Supplied diving • Rebreathers (closed and/or semi-closed)

• Hazardous Marine Life Injuries	
Dive Rescue • To include procedures relevant to UM specific protocols. (See water skills below)	Specialized Breathing Gas • Nitrox • Mixed Gas
Scientific Method	Small Boat Operation
Data Gathering Techniques (Only items specific to area of study required) • Transects and Quadrats • Mapping • Coring • Photography • Tagging • Collecting • Animal Handling • Archaeology • Common Biota • Organism Identification • Behavior • Ecology • Site Selection, Location, and Re-location • Specialized Data Gathering Equipment	Specialized Environments and Conditions • Blue Water Diving • Altitude • Ice and Polar Diving (Cold Water Diving) • Zero Visibility Diving • Polluted Water Diving • Saturation Diving • Decompression Diving • Overhead Environments • Aquarium Diving • Night Diving • Kelp Diving • Strong Current Diving • Potential Entanglement/Entrapment • Live boating
Required Topics:	**Suggested Topics:**
Navigation	HazMat Training • Chemical Hygiene, Laboratory Safety (Use of Chemicals)
HazMat Training • HP Cylinders	
Decompression Management Tools • Dive Tables • Dive Computers • PC Based Software (if used by divers)	Specialized Diving Equipment • Full face mask • Dry Suit • Communications • Dive Propulsion Vehicle (DPV) • SMBs/Lift Bags • Line Reels
AAUS Scientific Diving Regulations and History • Scientific Dive Planning • Coordination with other Agencies • Appropriate Governmental Regulations	
Hazards of breath-hold diving and ascents	
Dive Physics (Beyond entry level scuba)	Other Topics and Techniques as Determined by the DCB
Dive Physiology (Beyond entry level scuba)	
Dive Environments	
Decompression Theory and its Application	

Practical Training / Skill Development	
Confined Water	At the completion of training, the science diver candidate must satisfy the DSO or DCB-approved designee of their ability to perform the following, as a minimum, in

	a pool or in sheltered water: • Enter water fully equipped for diving • Clear fully flooded face mask • Demonstrate air sharing and ascent using a backup regulator, as both donor and recipient, with and without a face mask • Demonstrate buddy breathing as both donor and recipient, with and without a face mask • Demonstrate understanding of underwater signs and signals • Demonstrate ability to remove and replace equipment while submerged • Demonstrate acceptable watermanship skills for anticipated scientific diving conditions • Demonstrate how to treat a panicked diver at the surface • Demonstrate the proper way to tow a tired or unconscious diver on the surface • Demonstrate the rescue of an unconscious diver underwater • Demonstrate simulated in-water mouth-to-mouth resuscitation
Open Water Skills	The science diver candidate must satisfy the DSO, or DCB-approved designee, of his/her ability to perform at least the following in open water on all dives: • Participate in a pre-dive briefing in accordance with Section 2.20 • Enter and exit water while wearing scuba gear • Demonstrate the ability to maneuver efficiently in the environment, at and below the surface • Properly communicate underwater • Demonstrate ability to achieve and maintain neutral buoyancy while submerged • Demonstrate judgment adequate for safe scientific diving Skills listed below must be evaluated at some point during the training cycle: • Surface dive to a depth of 10 feet (3 meters) without scuba • Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit • Demonstrate proficiency in air sharing ascent as both donor and receiver • Demonstrate techniques of self-rescue and buddy rescue • Complete a simulated emergency swimming ascent • Demonstrate clearing of mask and regulator while submerged • Navigate underwater • Plan and execute a dive
	Rescue Skills: • Rescue from depth and transport 25 yards (23 meters), as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim • Removal of victim from water to shore or boat • Stressed and panicked diver scenarios • Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver – Appendix 9
	Successfully complete and log a minimum of one checkout dive and 9 additional open water training dives with the DSO in a variety of dive sites and at least two additional supervised open water dives for a minimum cumulative surface to

	surface time of 6 hours. Dives following the checkout dive(s) may be supervised by an active Scientific Diver holding the necessary depth authorization experienced in the type of diving planned, and with the knowledge and permission of the DSO
	The training dives (12 minimum) may be conducted over a variety of depth ranges when dives are directly supervised by the UM DSO. Any training supervised directly by any diver other than the DSO should not exceed 30ft. Depth progression must proceed shallower to deeper after acceptable skills and judgement have been demonstrated, and are not to exceed 100 feet (30 m) during the initial 12 dive cycle

Examinations	
Equipment	The science diver candidate will be subject to examination/review of: • Personal diving equipment • Task specific equipment • Function and manipulation of decompression computer to be employed by the diver (if applicable)
Written Exams	The science diver candidate must pass a written examination reviewed and approved by the DCB that demonstrates knowledge of at least the following. Overall passing score is 80%. Furthermore, divers must pass each section with a score of at least 80%. For any section that a diver does not pass with at least an 80% score, the diver will be given the opportunity to retake that section. A passing score of 80% is required on all retakes. • Function, care, use, and maintenance of diving equipment • Advanced physics and physiology of diving • Diving regulations • Applicable diving environments • Emergency procedures for UM-specific dive mode(s) and environments, including buoyant ascent and ascent by air sharing • Currently accepted decompression theory and ascent procedures • Proper use of dive tables • Proper gas management procedures • Hazards of breath-hold diving and ascents • Planning and supervision of diving operations • Navigation • Diving hazards & mitigations • Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism, hypercapnia, squeezes, oxygen toxicity, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia • Applicable theoretical training and knowledge development from the Required and Suggested Topics (above)

4.30 Diver Certification and Authorizations

Only a person diving under the auspices of an OM that subscribes to the practices of the AAUS is eligible for a scientific diver certification and/or authorization.

Diver-In-Training (DIT) Authorization

This is a temporary authorization to dive, usable only while it is current and for the purpose intended. This authorization signifies that a diver has completed and been certified as at least an

entry level recreational diver through an internationally recognized certifying agency and has the knowledge, skills, and experience necessary to commence and continue training as a scientific diver under supervision, as approved by the DCB. DIT status must only be used when the diver is on his/her way to becoming a scientific diver. While it is recommended for DIT's to have hands-on scientific diver experience during their training, the DIT status is intended to be a temporary authorization, not a substitute for Scientific Diver Authorization.

DITs may dive with a project to 30ft or shallower after completing a minimum of 10 dives with the DSO. The divers will be considered a DIT until all authorization and program requirements are satisfactorily met.

DITs may dive deeper than their authorization depth or be introduced to specialized equipment and techniques with the DSO during training to achieve training goals. These training/experience dives may not result in depth or specialized dive technology/technique authorization.

DITs are permitted to use UM owned gear for internships, project dives, etc. prior to final grade submission (if enrolled in the scientific diving course), pending approval of a dive plan.

UM Scientific Diver Authorization

Science diver authorization signifies a diver has completed all requirements in Section 4.20 and is authorized by the University of Miami to engage in scientific diving without supervision, as approved by the DCB through the DSO. Submission of documents and participation in aptitude examinations does not automatically result in authorization. To be authorized, the applicant must demonstrate to the DCB, through the DSO, that s/he is sufficiently skilled and proficient, and possess the necessary judgement for their safety and/or that of the dive team. Scientific Diver Authorization is only active when required elements are in place and current.

Scientific Aquarium Diver Certification

Scientific Aquarium Diver is a certification authorizing the diver to participate in scientific diving solely in the aquarium environment.

All requirements set forth for Scientific Diver certification must apply, except follows:

- Practical training must include at least 12 supervised aquarium dives for a cumulative bottom time of 6 hours.
- Training requirements for navigation and 400-yard (366-meter) surface swim in scuba gear may be waived at the discretion of the DCB.

Temporary Diver Authorization

Only a diver not under the auspices of an AAUS OM may be granted a Temporary Diver Authorization. The individual in question must demonstrate proficiency in diving and can contribute measurably to a planned dive. A Temporary Diver Authorization constitutes a waiver of selected requirements of Section 4.0 and is valid only for a limited time, as approved by the DCB. A Temporary Diver Authorization must be restricted to the planned diving operation and must comply with all other policies, regulations, and standards of this manual, including medical requirements. This authorization is not to be utilized as a repeated mechanism to circumvent existing standards set forth in this manual.

4.31 Ways to Become a UM Scientific Diver

Credited Scientific Diver Course RSM500 / RSM600

This 3-credit course offered at RSMAS meets or exceeds all AAUS training requirements. This is the preferred method to become a UM scientific diver.

Basic Diver Checkout Procedure

In the event a UM student, staff, or faculty member's need for diving authorization cannot wait for the next scientific diving course, the diver may be permitted by discretion of the DSO and DCB, to complete the Basic Diver Checkout Procedure on a one-to-one basis with the DSO or designee. Upon completing this procedure, the diver will be authorized to dive as a 30ft DIT with special provisions to be set by the DSO. This procedure is not to be utilized as a repeated mechanism to circumvent existing standards set forth in this manual; this individual will be required to enroll in and pass the next available scientific diving course. The diver will be authorized to dive as a 30ft DIT upon successful completion of all of the following:

- Demonstrate proficiency in UM scientific diving program policies and procedures
- Present a current dive physical approved by a physician (this cannot be waived)
- Submit a diver resume
- Provide proof of insurance for hyperbaric oxygen therapy (this cannot be waived)
- Sign and submit the Statement of Understanding
- Copy of dive log showing 10 open water dives (2 in the last 12 months)
- Proof of diver certification
- Current Emergency Care Training (ECT) qualification
- Consent to Treat and Medical History form (different than dive physical)
- Complete HazMat training
- Demonstrate ability to plan dives to UM standards
- Pass the swim test
- Pass a pool checkout dive at the discretion of the DSO/DCB demonstrating basic diving skills.
- Pass an open water checkout dive demonstrating the following:
    - Regulator recovery and replacement underwater
    - Mask removal and replacement underwater
    - BCD ditch and don underwater
    - Weight system removal and replacement underwater
    - Out of air procedures as both donor and receiver underwater
    - Proper entry and exit
    - Proper BCD use
    - Proper ascent/descent
    - Rescue procedures

- All underwater skills must be performed with satisfactory buoyancy, awareness, stability, and trim (BAST)

Experienced Diver Checkout Procedure

Experienced divers may qualify for this procedure in one of two ways. 1) Provide proof of at least 50 logged scientific dives or 2) provide proof of 50 logged dives in varying conditions with advanced recreational training. This procedure can be done one-on-one with the DSO or designee, or as part of a scientific diving course in progress. Divers that complete this procedure are not permitted to act as the Lead Diver for their first 12 scientific dives. The 11 dives after the checkout dive must be conducted under supervision of a qualified science diver under UM auspices. Upon completion, unlike the Basic Diver Checkout Procedure where the diver will be a DIT, a diver who completes the Experienced Diver Checkout Procedure will be authorized to the 30ft or 60ft level, based on the DSO's evaluation and the diver's past experience. In order to complete the Experienced Diver Checkout Procedure, the diver must:

- Complete all requirements listed above for Basic Diver Checkout Procedure
- Show proof of at least 50 total logged dives
- Pass a written exam which includes sections on equipment, physiology, physics, rescues, dive accident management, dive planning, dive tables, navigation, first aid, environment, and UM policies and procedures. Overall passing score is 80%. Furthermore, divers must pass each section with a score of at least 80%.

4.40 Depth Authorizations

Depth Ratings and Progression to Next Depth Level

The depth rating indicates the maximum depth in which a diver can conduct science and may supervise other divers holding a shallower depth authorization. A scientific diver requires a valid depth authorization to be considered active. Divers may not lead dives beyond the depth they are authorized to dive.

A diver may be authorized to the next depth level after successfully completing the requirements for that level. A diver may exceed his/her depth authorization by one level when accompanied and supervised by a dive buddy holding a depth authorization greater or equal to the intended depth. Only in instances of science diver training when divers are being supervised by the UM DSO will divers be permitted to exceed their depth authorization by more than one level. Dives must be planned and executed with the permission of the DCB or designee.

In the event a diver within UM does not hold an authorization at the desired next level, the DCB has endorsed the procedure below based on AAUS standards for a diver to attain a deeper authorization. The total number of dives to obtain a given depth authorization must follow the cumulative number of dives listed below. To lead dives, a diver must have a minimum of 50 career dives. No diver may lead a dive beyond his/her depth authorization.

a) Authorization to 30 Foot Depth - Initial science diver depth authorization, approved upon the successful completion of training listed in Section 4.00. Cumulative minimum supervised dives: 12.
b) Authorization to 60 Foot Depth - A diver holding a 30-foot authorization may be authorized to a depth of 60 feet after successfully completing and logging 12 supervised dives to depths between 31 and 60 feet under supervision of a diver authorized by the DCB, for a minimum total time of 4 hours. Up to 4 dives between 31-40ft and up to 4 dives between 41-50ft may be counted

toward the 12 dives. Minimum total bottom time for dives between 51-60ft must be at least 1 hour. The supervised dives must be completed under the approval of a UM dive plan. The diver must also pass a written quiz demonstrating understanding of dive tables, dive planning, and UM diving policy. Under certain circumstances, divers new to the program may be initially authorized to this depth authorization. Cumulative minimum supervised dives: 24.
Additional authorizations for diving deeper than 60ft:

- Nitrox (recommended) Section 6.00

c) Authorization to 100 Foot Depth - A diver holding a 60-foot authorization may be authorized to a depth of 100 feet after successfully completing and logging 6 supervised dives to depths between 61 and 100 feet under supervision of a qualified dive buddy authorized by the DCB. Up to 2 dives between 61-70ft and up to 2 dives between 71-80ft may be counted toward the 6 dives. Minimum total bottom time for dives between 81-100ft must be at least 40 minutes. The supervised dives must be completed under the approval of a UM dive plan. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method by attending a lecture and passing a quiz that covers deep diving theory, gas management strategies, dive tables, dive planning, ascent strategies, and UM diving policy. The diver must then complete a checkout dive in depths between 80-130ft with the UM DSO. Diver must score at least 4 out of 5 on each buoyancy, awareness, stability, and trim (BAST) element. Cumulative minimum supervised dives: 30.
Additional authorizations for diving deeper than 100ft:

- Nitrox (strongly recommended) Section 6.00
- Mixed gas breathing mixtures (recommended) Section 9.00

d) Authorization to 130 Foot Depth - A diver holding a 100-foot authorization may be authorized to a depth of 130 feet after successfully completing and logging 6 supervised dives to depths between 100 and 130 feet under supervision of a qualified dive buddy authorized by the DCB and completing a checkout dive with the DSO. The supervised dives must be completed under the approval of a UM dive plan. Diver must score at least 4 out of 5 on each BAST element. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method. Cumulative minimum supervised dives: 36.
Additional authorizations for diving deeper than 130ft:

- Nitrox (strongly recommended) Section 6.00
- Mixed gas breathing mixtures (strongly recommended) Section 9.00
- Double cylinders (strongly recommended) Section 3.20
- Staged decompression (recommended) Section 8.00

Diving on air is not permitted beyond 130ft.

e) Authorization to 150 Foot Depth - A diver holding a 130-foot authorization may be authorized to a depth of 150 feet after successfully completing and logging 6 supervised dives to depths between 130 and 150 feet under supervision of a qualified dive buddy authorized by the DCB and completing a checkout dive with the DSO. The supervised dives must be completed under the approval of a UM dive plan. Diver must score at least 4 out of 5 on each BAST element in the gear configuration and the gear setup to be used unless diver is using a rebreather. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. Cumulative minimum supervised dives: 42.
Additional authorizations for diving deeper than 150ft:

- Mixed gas breathing mixtures (required) Section 9.00
- Authorization for decompression diving procedures (required) Section 8.00

- Double cylinders (required) Section 3.20
- Staged decompression (strongly recommended) Section 8.00

f) Authorization to 190 Foot Depth - A diver holding a 150-foot authorization may be authorized to a depth of 190 feet after successfully completing and logging 6 dives to depths between 150 and 190 feet under supervision of a qualified dive buddy authorized by the DCB and completing a checkout dive with the DSO. The supervised dives must be completed under the approval of a UM dive plan. Diver must score at least 4 out of 5 on each BAST element in the gear configuration and the gear setup to be used unless diver is using a rebreather. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. Cumulative minimum supervised dives: 48.
Additional authorizations for diving deeper than 190ft:
- Staged decompression (required) Section 8.00
- Rebreather (recommended) Section 11.00

g) Authorization to 250 Foot Depth - A diver holding a 190-foot authorization may be authorized to a depth of 250 feet after successfully completing and logging 6 supervised dives to depths between 190 and 250 feet under supervision of a qualified dive buddy authorized by the DCB and completing a checkout dive with the DSO. The supervised dives must be completed under the approval of a UM dive plan. Diver must score at least 4 out of 5 on each BAST element in the gear configuration and the gear setup to be used unless diver is using a rebreather. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.
Additional authorizations for diving deeper than 250ft:
- Rebreather (strongly recommended) Section 11.00

h) Authorization to 300 Foot Depth - A diver holding a 250-foot authorization may be authorized to a depth of 300 feet after successfully completing and logging 6 supervised dives to depths between 200 and 250 feet under supervision of qualified dive buddy authorized by the DCB and completing a checkout dive with the DSO. The supervised dives must be completed under the approval of a UM dive plan. Diver must score at least 4 out of 5 on each BAST element in the gear configuration and the gear setup to be used unless diver is using a rebreather. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.
Additional authorizations for diving deeper than 300ft:
- Rebreather (required) Section 11.00

i) Authorizations deeper than 300 Feet – Depth authorizations deeper than 300 feet progress in 50-foot depth/6 dive increments. A diver holding a 300 foot, or deeper authorization may be authorized to the next depth authorization increment after successfully completing and logging 6 supervised dives under supervision of a qualified dive buddy authorized by the DCB and completing a checkout dive with the DSO. The supervised dives must be completed under the approval of a UM dive plan. Diver must score at least 4 out of 5 on each BAST element in the gear configuration and the gear setup to be used unless diver is using a rebreather. The trim element will be scored according to the type of rebreather used. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.

4.50 Maintaining Active Status

Minimum Activity to Maintain Authorizations

In order to maintain an active UM science diver authorization, divers must do the following:

- Have a current physical exam on file consistent with intervals specified in Section 5.00.
- Have proof of current dive accident insurance on file.

- Pass HazMat training every 3 years to be able to handle scuba cylinders.
- Maintain current emergency care training (see below).
- During any 12-month period, each scientific diver must log a minimum of 12 scientific, scientific training, or proficiency dives.
- At least one dive must be logged near the maximum depth, as defined by the DCB, of the diver's authorization during each 6-month period. Divers authorized to 150 feet or deeper may satisfy these requirements with dives to 130 feet or deeper as long as divers are diving using the same equipment, techniques, and dive planning methods required for their max authorization depth. Divers authorized beyond 300 feet may satisfy these requirements with dives to 200 feet or deeper as long as divers are diving using the same equipment, techniques, and dive planning methods required for their max authorization depth.
- For specialized diving environments, modes, and authorizations, at least one dive in the environment or using the mode, must be logged during each 6-month period.
    - For nitrox divers, reference Section 6.20.
    - For rebreather users, reference Section 11.50 and Appendix 4.

Failure to meet these requirements will result in suspension, revocation, or restriction of authorization by the DSO under procedures established by the DCB.

Requalification of Authorization

Once the initial requirements of Section 4.00 are met, divers whose depth authorization has lapsed due to lack of activity may be requalified by the DCB/DSO after a review of the diver's authorization requirements. If a diver fails to meet the minimum diving requirements to stay active, then a checkout dive must be completed in order to become active again (except nitrox authorization – see Section 6.20). Divers that are more than 3 years out of currency in any given authorization may be required to complete additional requirements beyond a checkout dive to requalify. If a UM diver's authorization has lapsed by more than 5 years, the diver will be required to re-enter the program as a new diver to the program.

In the event of a medical condition, procedure, etc. where a diver is hospitalized overnight for any reason, the diver must obtain explicit written permission from a physician that he/she is medically fit and cleared for scuba diving.

Checkout Dive Procedure

During the checkout dive procedure, divers will be required to complete the pre-checkout dive preparation process. Checkout dives are conducted by the DSO. Details of this procedure can also be found on Blackboard. Divers shall:

1. Submit a dive plan online
2. Review the online modules and demonstration videos on Blackboard
3. Participate in a dive plan briefing
4. Have a discussion with the DSO about dive rescues
5. Perform skills during the dive (Section 4.31 Basic Diver Checkout Procedure)
6. Participate in a dive debrief

Underwater, divers are evaluated on their Buoyancy, Awareness, Stability, and Trim (BAST) over the course of the dive. Each BAST element is scored on a 1-5 scale. In order to pass, divers must earn a minimum score of 12. If the diver earns a score of 1 on any BAST element, the diver will not pass the checkout dive, the DSO will provide corrective feedback, and a remediation plan will be

developed.

Medical Examination

All scientific divers must pass a medical examination at the intervals specified in Section 5.0. A medically cleared diver experiencing any Conditions Which May Disqualify Candidates From Diving (Appendix 2) must receive clearance to return to diving from a physician before resuming diving activities. This medical examination requirement cannot be waived for any diver.

Emergency Care Training (ECT)

The scientific diver must hold current training in the following:

- Adult CPR and AED
- Emergency oxygen administration
- First aid for diving accidents
- Blood Borne Pathogens
- Hazardous Marine Life
- Neurological Exam

The UM DCB-approved course that meets the industry standard is the Diver's Alert Network Diving First Aid for Professional Divers (DFAPro). Details of this procedure can also be found on Blackboard.

UM science divers must maintain a current DAN DFAPro certification to stay active. Additionally, 12 months after the certification is issued, divers must refresh emergency care training skills with a quiz and a practical demonstration of CPR, AED, and oxygen administration.

4.60 Revocation of Authorization

An individual's scientific diver authorization can be restricted or revoked for cause by the DCB. Specific authorizations associated with an individual's scientific diver authorization may be restricted or suspended for cause by the DCB. Restrictions or suspensions issued by the DCB may be rescinded by the DCB; these issues will be reviewed by the DCB and the outcomes or actions resulting from this review will be documented in the diver's record. Violations of regulations set forth in this manual or other governmental subdivisions not in conflict with this manual, or demonstration of poor judgement, may be considered cause. The DCB or designee must inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present their case in writing to the DCB for reconsideration. Following revocation the diver may be reauthorized after complying with conditions the DCB may impose. All such written statements and requests, as identified in this section, are formal documents, and therefore part of the diver's file.

SECTION 5.00 MEDICAL STANDARDS

5.10 Medical Requirements

General

- All medical evaluations required by this manual must be performed by, or under the direction of, a licensed physician of the applicant-diver's choice, preferably one trained in diving/undersea medicine.
- The diver should be free of any chronic disabling disease and any conditions contained in the list of conditions for which restrictions from diving are generally recommended. (Appendix 2)
- UM must verify that divers have been declared by the examining medical authority to be fit to engage in diving activities.

5.20 Frequency of Medical Evaluations

Medical evaluation must be completed:		
Before Age 40	After age 40 Before Age 60	After Age 60
Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years	Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 3 years	Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 2 years
At 5-year intervals	At 3-year intervals	At 2-year intervals
Clearance to return to diving must be obtained from a healthcare provider following a medically cleared diver experiencing any Conditions Which May Disqualify Candidates From Diving (Appendix 2), or following any major injury or illness, or any condition requiring chronic medication. If the condition is pressure related, the clearance to return to diving must come from a physician trained in diving medicine.		

5.30 Information Provided Examining Physician

The diver being evaluated must provide a copy of the medical evaluation requirements of this manual to the examining physician. (Appendices 1, 2, and 3).

5.40 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in Section 5.20 must consist of the following:

1. Diving physical examination (Appendix 2). Modifications or omissions of required tests are not permitted
2. Applicant agreement for release of medical information to the Diving Safety Officer and the DCB (Appendix 1)
3. Medical history (Appendix 1)

5.50 Physician's Written Report

- A Medical Evaluation of Fitness For Scuba Diving Report signed by the examining physician stating the individual's fitness to dive, including any recommended restrictions or limitations will be submitted to the DSO for the diver's record after the examination is completed.
- The Medical Evaluation of Fitness For Scuba Diving Report will be reviewed by the DCB or designee and the diver's record and authorizations will be updated accordingly.
- A copy of any physician's written reports will be made available to the individual.

- It is the diver's responsibility to provide to the DSO a written statement from the examining medical authority listing any restrictions, limitations, or clearances to dive resulting from medical examinations obtained by the individual outside of their normal diving medical examination cycle. These statements will be reviewed by the DCB or designee and the diver's record and authorizations will be updated accordingly.

Volume 2

Sections 6.00 through 12.00

SECTION 6.00 NITROX DIVING

This section describes the requirements for authorization and use of nitrox for Scientific Diving.

6.10 Requirements for Nitrox Authorization

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

Prerequisites

Only authorized UM science divers and UM DITs are eligible 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 DCB through the DSO that he/she is sufficiently knowledgeable, skilled, and proficient in the theory and use of nitrox for diving.

Divers who hold a nitrox certification from an internationally recognized training agency must do the following in order to be authorized to use nitrox under UM auspices:

1. Submit a copy of recreational nitrox certification
2. Pass a written examination with a minimum score of 80%
3. Perform two nitrox checkout dives with the DSO or designee or submit a copy of a dive log showing proof of having completed two nitrox dives.

Any diver who has not been certified by an internationally recognized training agency to use nitrox must follow the training outlined below in order to be authorized as a UM nitrox diver.

Training

In lieu of writing/promulgating AAUS specific training standards for nitrox divers, AAUS references the standards for nitrox diver training as defined by the WRSTC and/or ISO. AAUS programs who wish to train nitrox divers may do so using one of the following options:

a) Under the auspices and standards of an internationally recognized diver training agency.

b) Under the auspices of AAUS using the minimum guidelines presented by the most current version of the RSTC/WRSTC and/or ISO nitrox diver training standards.

References:
"Minimum Course Content for Enriched Air Nitrox Certification" - World Recreational Scuba Training Council (WRSTC), www.wrstc.com.

"Recreational diving services- Requirements for training programs on enriches air nitrox (EAN) diving". ISO 11107:2009 - International Organization for Standardization (ISO), www.iso.org

Practical Evaluation

- Oxygen analysis of nitrox mixtures.
- Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.
- 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.
- Nitrox dive computer use may be included, as approved by the DCB.
- A minimum of two supervised open water dives using nitrox is required for authorization.

Written Evaluation

- Function, care, use, and maintenance of equipment cleaned for nitrox use.
- Physical and physiological considerations of nitrox diving (eg.: O_2 and CO_2 toxicity)
- Diving regulations, procedures/operations, and dive planning as related to nitrox diving
- Equipment marking and maintenance requirements
- Dive table and/or dive computer usage
- Calculation of: MOD, pO_2, and other aspects of nitrox diving as required by the DCB

6.20 Minimum Activity to Maintain Authorization

The diver should log at least one nitrox dive every six months or plan a series of nitrox dives every six months. Failure to meet the minimum activity level may be cause for restriction or revocation of nitrox authorization.

Requalification of Nitrox Authorization

Divers who have not met the minimum requirements to maintain nitrox authorization must complete a nitrox dive planning worksheet to be reviewed with the DSO, demonstrate understanding of gas analysis and cylinder labeling.

6.30 Operational Requirements

Oxygen Exposure Limits

- The inspired oxygen partial pressure experienced at depth must not exceed 1.6 ATA.
- The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected.
- 1.4 pO_2 is the recommended maximum for most diving applications. 1.6 may be used if approved by the DSO on a dive plan.

Calculation of Decompression Status

- A set of DCB approved nitrox dive tables should be available at the dive site.
- Dive computers may be used to compute decompression status during nitrox dives if the diver has been authorized to use the specific dive computer model. Manufacturers' guidelines and operation instructions as well as the guidelines in this manual must be followed.
- Dive computers capable of pO_2 limit and fO_2 adjustment should be checked by the diver prior to the start each dive to ensure conformity with the mix being used.

Gas Mixture Requirements

- Nitrox may be mixed by partial pressure, blending stick, or a membrane system.
- Nitrox gas mixtures range from 22-99%.UM personnel mixing nitrox must be qualified and approved by the DCB (through the DSO) for the method(s) used.
- Oxygen used for mixing nitrox should meet the purity levels for "Medical Grade" (U.S.P.) or "Aviator Grade" standards.
- In addition to the AAUS/UM Air Purity Guidelines outlined in Section 3.60, any air that may come in contact with oxygen concentrations greater than 40% (i.e.. during mixing), must also have a hydrocarbon contaminant no greater than .01 mg/m^3.
    - For remote site operations using compressors not controlled by UM where this is not verifiable, the DCB will develop a project-specific protocol to mitigate risk to the diver.

Analysis Verification by User

- Prior to a dive, each diver must analyze 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.

- Divers may not use any nitrox cylinder unless he/she has personally verified its contents using an oxygen analyzer.
- Individual dive log reporting forms should report fO2 of nitrox used, if different than 21%.

6.40 Nitrox Diving Equipment

Required Equipment

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

- Labeled SCUBA Cylinders in Accordance with Industry Standards
- Oxygen Analyzers
- Oxygen compatible equipment as applicable

Requirement for Oxygen Service

- All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen, should be cleaned and maintained for oxygen service.
- Any equipment used with oxygen or mixtures containing over 40% by volume oxygen must be designed and maintained for oxygen service. Oxygen systems over 125 psig must have slow-opening shut-off valves.

Compressor system

- Compressor/filtration system must produce oil-free air, or
- An oil-lubricated compressor placed in service for a nitrox system should be checked for oil and hydrocarbon contamination at least quarterly.

SECTION 7.00 SURFACE SUPPLIED DIVING TECHNOLOGIES

Surface supplied diving technologies include any diving mode in which a diver at depth is supplied with breathing gas from the surface.

7.10 Prerequisites

All surface supplied and hookah divers must be certified scientific divers or divers in training and have completed system specific training as authorized by UM.

7.20 Surface Supplied Diving

Surface Supply Definition

A mode of diving using open circuit, surface supplied, compressed gas delivered by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask, often with voice communications.

Procedures

- Each diver must be continuously tended while in the water.
- A diver must be stationed at the underwater point of entry when diving is conducted in enclosed or physically confined spaces.
- Each diving operation must have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.
- For dives deeper than 100fsw (30 m) or outside the no-decompression limits:
  - A separate dive team member must tend each diver in the water;
  - A standby diver must be available while a diver is in the water;
- A diver using Surface Supply may rely on surface personnel to keep the diver's depth, time and diving profile
- Surface supplied air diving must not be conducted at depths deeper than 190 fsw (57.9 m).
- The UM DCB is responsible for developing additional operational protocols

Manning Requirements

The minimum number of personnel comprising a surface supplied dive team is three. They consist of: a Designated Person-In-Charge (DPIC), a Diver, and a Tender. Additional dive team members are required when a diving operation or dive site is considered complex, or when the task loading of a dive team member is deemed excessive. It is the UM DCB's responsibility to define when the surface supplied dive team must be expanded beyond the minimum manning requirements.

Equipment

- The diver will wear a positive buckling device on the safety harness to which the umbilical hose will be secured. The attachment must be of sufficient strength to prevent any strain on the helmet/full face mask hose connections and equipment must be configured to allow retrieval of the diver by the surface tender without risk of interrupting air supply to the diver.
- Each diver must be equipped with a diver-carried independent reserve breathing gas supply containing sufficient volume to complete the ascent to the surface, including all required decompression and safety stops.
- Masks and Helmets

- Surface supplied and mixed gas masks and helmets must have:
  - A non-return valve at the attachment point between the mask/helmet and hose which must close readily and positively; and
  - An exhaust valve
- Surface-supplied masks and helmets must have a minimum ventilation rate capability of 4.5 actual cubic feet per minute (acfm) at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 atmospheres absolute (ATA) when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute
- Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment must be equipped with an exhaust valve

- Air supplied to the diver must meet the air quality standards outlined in section 3.60

Surface Supplied in Aquariums

- In an aquarium habitat where the maximum depth is known, a pneumofathometer is not required.
- The maximum obtainable depth of the aquarium may be used as the diving depth
- One tender may line-tend multiple divers, provided the tender is monitoring only one air source, there is mutual assistance between divers, there are no overhead obstructions or entanglements, or other restrictions as defined by the DCB.
- The DCB is responsible for developing additional operational protocols for surface supplied diving specific to the aquarium environment.

7.30 Hookah

Hookah Definition

Hookah is an open circuit diving mode comprised of a remote gas supply, a long hose, and a standard scuba second stage or full face mask. Hookah is generally used in shallow water (30 fsw or less), though the configuration has been used to supply breathing gas from a diving bell, habitat, or submersible/submarine.

Equipment Requirements

- The air supply hose must be rated for a minimum operating pressure of 130psi.
- Air supplied to the hookah diver must meet the air quality standards outlined in section 3.60
- Hookah supply systems must be capable of supplying all divers breathing from the system with sufficient gas for comfortable breathing for the planned depth and workload.
- Hookah system second stage shall be capable of being attached to the diver in a way to avoid pulling stress on the second stage mouthpiece and affords easy release if the diver must jettison the regulator and hose.
- An independent reserve breathing gas supply must be carried by each hookah diver:
  - When the diver does not have direct access to the surface or
  - At depths or distance from alternate breathing gas source determined by the DCB.

Operational Requirements

- Hookah diving must not be conducted beyond depths or distance from an alternate breathing gas source as determined by the DCB.
- A diver's independent reserve breathing gas supply, if worn, must contain sufficient volume to

allow the diver(s) to exit to the surface or alternate breathing gas source

- Hookah divers not supported by diving bell, or underwater habitat must not be exposed to dives that require staged decompression.
- The UM DCB is responsible for developing additional operational protocols.

Hookah Diving in Aquariums

- In an aquarium habitat where the maximum depth is known and planned for, a depth gauge is not required.
- The maximum obtainable depth of the aquarium may be used as the maximum diving depth.
- A hookah configured diver may operate without an in-water buddy in an aquarium provided the diver is tended from the surface; has visual, line pull, or voice communication with the tender; the diver carries an independent reserve breathing gas source containing sufficient volume to allow the diver to exit to the surface or alternate breathing gas source; and under other operational conditions as determined by the DCB.
- The DCB is responsible for developing additional operational protocols for hookah diving specific to the aquarium environment.

SECTION 8.00 STAGED DECOMPRESSION DIVING

Decompression diving is defined as any diving during which the diver cannot perform a direct return to the surface without performing a mandatory decompression stop to allow the release of inert gas from the diver's body.

Staged decompression diving is decompression diving where a diver uses various gas mixtures at different depths/stages during the ascent to increase safety and efficiency.

The following procedures must be observed when conducting dives requiring planned decompression stops.

8.10 Minimum Experience and Training Requirements

Prerequisites

1. 100ft UM Scientific Diver authorization according to Section 4.00.
2. Minimum of 100 logged dives
3. Should have experience in the depth range where decompression dives will be conducted.
4. Demonstrate a need for staged decompression training.
5. Demonstrate the ability to safely plan and conduct dives deeper than 100 feet.
6. Nitrox authorization according to Section 6.00.

Training

Training must be appropriate for the conditions in which dive operations are to be conducted. Minimum Training must include the following:

1. A minimum of 6 hours of classroom training to ensure theoretical knowledge to include: physics and physiology of decompression; decompression planning and procedures; gas management; equipment configurations; decompression method, emergency procedures, and omitted decompression.
2. At least one training session be conducted in a pool or sheltered water setting, to cover equipment handling and familiarization, swimming and buoyancy control, to estimate gas consumption rates, and to practice emergency procedures.
3. At least 6 open-water training dives simulating/requiring decompression must be conducted, emphasizing planning and execution of required decompression dives, and including practice of emergency procedures. The first of the six dives will be a skills evaluation with the DSO. Diver must score at least 4 out of 5 on each BAST element (Appendix 4) in the gear configuration and the gear setup to be used unless diver is using a rebreather. Two of the six open water dives should be to maximum depths allowed by diver's authorization.
4. Progression to greater depths must be by increments and depth intervals as specified in Section 4.40.
5. No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
6. The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
    - Buoyancy control
    - Awareness of equipment, buddy, environment, tasks, etc.
    - Stability
    - Proper trim
    - Proper ascent rate
    - Proper depth control
    - Equipment manipulation

- Stage/decompression bottle use as pertinent to planned diving operation
- Buddy skills
- Gas management
- Time management
- Task loading
- Emergency skills

7. Divers must demonstrate to the satisfaction of the DSO or the DSO's qualified designee proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.
8. Upon completion of training, the diver may be authorized to conduct required decompression dives with DSO approval.

8.20 Minimum Equipment Requirements

1. In addition to the minimum required equipment listed in Section 3.20, the following equipment must also be used.
   a) When double cylinders are used, the valve and regulator systems for primary (bottom) gas supplies must be configured in a redundant manner that allows continuous breathing gas delivery in the event of failure of any one component of the regulator/valve system.
   b) Cylinders with adequate volume and proper configuration must be used.
   c) One of the second stages on the primary gas supply must be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
   d) Diver location devices adequate for the planned diving operations and environment.
   e) Aluminum cylinders shall be used as stage cylinders when they will be carried by the diver throughout all phases of the dive. Steel cylinders may be used but must be dropped off at a decompression station while the diver completes the bottom portion of the dive.
2. Redundancy in the following components may be required at the discretion of the DCB:
   a) Decompression Schedules
   b) Dive Timing Devices
   c) Depth gauges
   d) Buoyancy Control Devices
   e) Cutting devices
   f) Lift bags and line reels

8.30 Minimum Operational Requirements

1. The maximum pO_2 to be used for planning required decompression dives is 1.6 for open circuit. It is recommended that a pO_2 of less than 1.6 be used during bottom exposure.
2. Decompression dives may be planned using dive tables, dive computers, and/or PC software approved by the DCB.
3. Breathing gases used while performing in-water decompression must contain the same or greater oxygen content as that used during the bottom phase of the dive.
4. The dive team prior to each dive must review emergency decompression procedures appropriate for the planned dive.
5. If breathing gas mixtures other than air are used for required decompression, their use must be

in accordance with those regulations set forth in the appropriate sections of this manual.

6. Use of additional nitrox and/or high-oxygen fraction decompression mixtures as travel and decompression gases to decrease decompression obligations is recommended.
7. Use of alternate inert gas mixtures to limit narcosis is recommended for depths greater than 100 feet.
8. The maximum depth for required decompression using air as the bottom gas is 130 feet.
9. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DCB to return the diver(s) to proficiency status prior to the start of project diving operations are required.
10. Mission specific workup dives are recommended prior to any mission involving decompression diving.

SECTION 9.00 MIXED GAS DIVING

Mixed gas diving is defined as dives done while breathing gas mixes containing proportions greater than 1% by volume of an inert gas other than nitrogen.

9.10 Minimum Experience and Training Requirements

Prerequisites

1. Nitrox authorization (Section 6.00).
2. If the intended use entails required decompression stops, divers will be previously authorized in decompression diving (Section 8.00).
3. Divers must demonstrate to the DCB's satisfaction skills, knowledge, and attitude appropriate for training in the safe use of mixed gases.
4. 100ft UM scientific diver authorization
5. Minimum of 100 logged dives

Classroom Training

1. Review of topics and issues previously outlined in nitrox and required decompression diving training as pertinent to the planned operations
2. The use of helium or other inert gases, and the use of multiple decompression gases
3. Equipment configurations
4. Mixed gas decompression planning
5. Gas management planning
6. Thermal considerations
7. END determination
8. Mission planning and logistics
9. Emergency procedures
10. Mixed gas production methods
11. Methods of gas handling and cylinder filling
12. Oxygen exposure management
13. Gas analysis
14. Mixed gas physics and physiology

Practical Training

1. Confined water session(s) in which divers demonstrate proficiency in required skills and techniques for proposed diving operations.
2. A minimum of 6 open water training dives. The first of the six dives will be a skills evaluation with the DSO. Diver must score at least 4 out of 5 on each BAST element in the gear configuration and the gear setup to be used unless diver is using a rebreather.
3. At least one initial dive must be in 130 feet or less to practice equipment handling and emergency procedures.
4. Subsequent dives will gradually increase in depth, with a majority of the training dives being conducted between 100 feet and the planned operational depth.
5. Planned operational depth for initial training dives must not exceed the diver’s authorization limit.

9.20 Equipment and Gas Quality Requirements

1. Equipment requirements must be approved by the DCB. Equipment must meet other pertinent requirements set forth elsewhere in this manual.
2. The quality of inert gases used to produce breathing mixtures must be of an acceptable grade for

human consumption.

9.30 Minimum Operational Requirements

1. All applicable operational requirements for nitrox (Section 6.00) and staged decompression diving (Section 8.00) must be met.
2. The maximum pO2 to be used for planning required open circuit decompression dives is 1.6. It is recommended that a pO2 of less than 1.6 be used during bottom exposure.
3. Divers decompressing on high-oxygen concentration mixtures must closely monitor one another for signs of acute oxygen toxicity.
4. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DCB to return the diver(s) to proficiency status prior to the start of project diving operations are required.
5. Mission specific workup dives are recommended prior to any mission involving mixed gas diving.

SECTION 10.00 SPECIALIZED DIVING ENVIRONMENTS

Certain types of diving, some of which are listed below, require equipment or procedures that require environment-specific training. Supplementary guidelines for these environments are in development by AAUS. UM must have guidelines established by the Diving Control Board. Divers must comply with all scuba diving procedures in this manual unless specified otherwise.

Diving in environments not included in this manual also require approval from the UM DCB.

10.10 Blue Water Diving

Blue water diving is defined as diving in open water where the bottom is generally greater than 200 feet deep. It requires special training and the use of multiple-tethered diving techniques. Specific guidelines that should be followed are outlined in "Blue Water Diving Guidelines" (California Sea Grant Publ. No. T-CSGCP-014).

10.20 Ice and Polar Diving

Divers planning to dive under ice or in polar conditions should use the following: "PESH-POL_2000.08 Standards for the Conduct of Scientific Diving", National Science Foundation, Division of Polar Programs, 2015.

10.30 Overhead Environments

For any diving conducted where there is no direct unrestricted access to the surface, refer to Section 12.00.

10.40 Saturation Diving

If conducting saturation diving operations, divers must comply with the scientific diving community saturation diving guidelines.

10.50 Aquarium Diving (See Section 4.30)

An aquarium is an artificial, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research.

It is recognized that within scientific aquarium diving there are environments and equipment that fall outside the scope of those addressed in this manual. In those circumstances it is the responsibility of the DCB to establish the requirements and protocol under which diving will be safely conducted.

10.60 Night Diving

Night diving is defined as any diving that takes place between sunset and sunrise. Divers may be authorized to dive at night through the DSO. To be authorized, a UM diver must attend a night dive lecture and complete one night checkout dive with the DSO demonstrating understanding of night diving procedures and techniques, and use of night diving specific equipment.

10.70 Altitude Diving

Altitude diving is considered any dive that takes place at an elevation of 1,000ft or more above sea level. Divers interested in conducting dives at altitude must at minimum attend a lecture by the DSO covering theoretical and practical considerations for altitude diving. No altitude checkout dive is required.

SECTION 11.00 REBREATHERS

This section defines specific considerations regarding the following issues for the use of rebreathers:

- Training and/or experience verification requirements for authorization
- Equipment requirements
- Operational requirements and additional safety protocols to be used

Application of this standard is in addition to pertinent requirements of all other sections of this manual.

For rebreather dives that also involve staged decompression and/or mixed gas diving, all requirements for each of the relevant diving modes must be met. The UM DCB reserves the authority to review each application of all specialized diving modes, and include any further requirements deemed necessary beyond those listed here on a case-by-case basis.

No diver shall conduct planned operations using rebreathers without prior review and approval of the DCB.

In all cases, trainers must be qualified for the type of instruction to be provided. Training must be conducted by agencies or instructors approved by DSO and DCB.

11.10 Definition

1) Rebreathers are defined as any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open- circuit life support systems, in that the breathing gas composition is dynamic rather than fixed.
2) There are three classes of rebreathers:
   a) Oxygen Rebreathers: Oxygen rebreathers recycle breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity.
   b) Semi-Closed Circuit Rebreathers: Semi-closed circuit rebreathers (SCR) recycle the majority of exhaled breathing gas, venting a portion into the water and replenishing it with a constant or variable amount of a single oxygen-enriched gas mixture. Gas addition and venting is balanced against diver metabolism to maintain safe oxygen levels.
   c) Closed-Circuit Rebreathers: Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas. Electronically controlled CCRs (eCCR) replace metabolized oxygen via an electronically controlled valve, governed by oxygen sensors. Manually controlled CCR (mCCR) rely on mechanical oxygen addition and diver monitoring to control oxygen partial pressure (ppO2). Depending on the design, manual oxygen addition may be available on eCCR units as a diver override, in case of electronic system failure. Systems are equipped with two cylinders; one with oxygen, the other with a diluent gas source used to make up gas volume with depth increase and to dilute oxygen levels. CCR systems operate to maintain a constant ppO2 during the dive, regardless of depth.

11.20 Prerequisites for use of Any Rebreather

1) Active scientific diver status, with depth authorization sufficient for the type, make, and model of rebreather, and planned application.
2) Completion of a minimum of 50 open-water dives on open circuit SCUBA. The DCB may require increased dive experience depending upon the intended use of the rebreather system for

scientific diving.

3) For SCR or CCR, a minimum 60ft depth authorization is generally recommended. If the sole expected application for use of rebreathers is shallower than 30ft, a 30ft UM science diver may be allowed with the approval of the DCB.
4) Nitrox training. Training in use of nitrox mixtures containing 25% to 40% oxygen is required. Training in use of mixtures containing 40% to 100% oxygen may be required, as needed for the planned application and rebreather system.

11.30 Training

1) Divers entering the program with prior rebreather training and experience must at minimum show a proof of training and at least 12 open water dives totaling a minimum of 720 minutes underwater regardless of rebreather platform.
2) Divers entering the program with prior rebreather training and experience must also pass a checkout dive with the DSO demonstrating proficiency with the rebreather model they wish to be authorized to use.
3) Specific training requirements for use of each rebreather model must be defined by DCB on a case-by-case basis. Training must include factory-recommended requirements, but may exceed this to prepare for the type of mission intended (e.g., staged decompression or heliox/trimix CCR diving). (See training section for details.)
4) Successful completion of training does not in itself authorize the diver to use rebreathers. The diver must demonstrate to the DCB or its designee that the diver possesses the proper attitude, judgment, and discipline to safely conduct rebreather diving in the context of planned operations.
5) Supervised training dive guidelines are outlined in Section 11.60.

Individual Equipment Requirements

Individual Equipment Requirements			
Key: X = include, IA = If Applicable			
	O_2	SCR	CCR
DCB approved rebreather make and model	X	X	X
Bottom timer, and depth gauge	X	X	X
Dive computer (separate from rebreather unit)		X	X
Approved dive tables		IA	IA
SMB (surface marker buoy) and line reel or spool with sufficient line to deploy an SMB from the bottom in the training environment	IA	IA	IA
Access to an oxygen analyzer	X	X	X
Cutting implement	X	X	X
BCD capable of floating a diver with a flooded loop and/or dry suit at the	X	X	X
Bailout gas supply of sufficient volume for planned diving activities	X	X	X
Approved CO2 absorbent and other consumables	X	X	X

11.40 Equipment Requirements

1) General
   a) Only those models of rebreathers specifically approved by DCB shall be used.
   b) Rebreathers should meet the quality control/quality assurance protocols of the International Organization for Standardization (ISO) requirements: ISO 9004:2009 or the most current version,

AND successful completion of CE (Conformité Européenne) or DCB approved third party testing.

c) Rebreather modifications (including consumables and operational limits) that deviate from or are not covered by manufacturer documentation should be discussed with the manufacturer and approved by the DCB prior to implementation.

2) Equipment Maintenance Requirements
   a) Rebreathers should be maintained in accordance with manufacturer servicing recommendations.
   b) Field repairs and replacement of components covered in rebreather diver training is not annual maintenance and may be performed by the rebreather diver in accordance with DCB policy.
   c) A maintenance log will be kept and will minimally include:
      i) Dates of service
      ii) Service performed
      iii) Individuals or company performing the service

11.50 Operational Requirements

1) Dive Plan
   a) In addition to standard dive plan components, at a minimum all dive plans that include the use of rebreathers must include:
      i) Information about the specific rebreather model(s) to be used
      ii) Type of CO2 absorbent material
      iii) Composition and volume(s) of supply gases
      iv) Bailout procedures
      v) Other specific details as required by the DCB
2) Particular attention should be paid to using rebreathers under conditions where vibration or pulsating water movement could affect electronics or control switches and systems.
3) Particular attention should be paid to using rebreathers under conditions where heavy physical exertion is anticipated.
4) Respired gas densities should be less than 5 g·L-1, and should not exceed 6 g·L-1 under normal circumstances.
5) User replaceable consumable rebreather components should be replaced per manufacture recommendations or as defined by the DCB.
6) If performed, periodic field validation of oxygen cells should be conducted per DCB designated procedure.
7) Diver carried off-board bailout is not required under conditions where the onboard reserves are adequate to return the diver to the surface while meeting proper ascent rate and stop requirements, and the system is configured to allow access to onboard gas. These calculations must take into consideration mixed mode operations where an open circuit diver could require assistance in an out of gas situation.
8) Use and reuse of CO2 scrubber media should be per manufacturer recommendations and as defined by the DCB.
9) Planned oxygen partial pressure in the breathing gas must not exceed 1.4 atmospheres at depths greater than 30 feet, or 1.6 at depths less than 30 feet.
10) Both CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver. Exposure limits should be established by the DCB.
11) Divers must use a rebreather checklist for the assembly and functional testing of equipment prior to diving (divers may use the checklist in Appendix 4). Functional testing including a pre-breathe for at least 3 minutes is required prior to every dive.

12) All rebreathers must be disinfected at appropriate time intervals using a multi-spectrum disinfectant such as HBQuat.
13) All rebreather divers must perform a pre-breathe of at least 3 minutes prior to submersion.
14) Mixed mode diving is when two or more divers are using different diving modes or technologies, for example a rebreather diver diving with an open circuit diver. Mixed mode diving may be permitted at UM under some circumstances as approved by the DSO. When such an occurrence takes place, each diver must communicate to the team information regarding the technology or technique he/she is using. Information communicated must include operation of technology, safety considerations, emergency procedures, etc. Divers must be cross-briefed on basic system operations for establishing positive buoyancy, closing a rebreather diver's breathing loop, and procedures for gas sharing.
15) Dives performed using rebreathers will follow the same depth authorization guidelines as found in Section 4.40.
16) In order to maintain authorization as a UM scientific rebreather diver, divers must follow all the minimum procedures set forth in Section 4.50, which includes a minimum 12 rebreather dives per year, minimum cumulative rebreather dive time of 12 hours, and at least one rebreather dive during every 6-month period. To count, dives should be no less than 30 min in duration. A required element of maintaining proficiency is the periodic performance and reevaluation of skills related to in-water problem recognition and emergency procedures. At minimum, demonstrated skills included in the required training elements for the level of rebreather operation must be performed and reevaluated.
17) If a diver is not a current authorized UM rebreather diver, the diver may be required to participate in pre-operation workup dives. These dives should include the review and practice of emergency recognition and response skills, and management of task loading are required for operations defined by the DCB as beyond the scope of normal operating conditions.

11.60 Rebreather Training Section

Entry Level Rebreather Training

1. The training area for O_2 Rebreather should not exceed 20 fsw in depth.
2. Entry level CCR and SCR training is limited in depth of 130fsw and shallower.
3. Entry level CCR and SCR training is limited to nitrogen/oxygen breathing media.
4. Divers at the CCR and SCR entry level may not log dives that require a single decompression stop longer than 10 minutes.
5. Who may teach: Individuals authorized as a CCR, SCR, or O_2 rebreather instructor by the DCB; in all cases, the individual authorized must have operational experience on the rebreather platform being taught, and where applicable the individual being authorized should be authorized as an instructor by the respective rebreather manufacturer or their designee.
6. Maximum Student/Instructor Ratio: 4 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints.
7. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used.
8. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used.

Rebreather Entry Level Training Requirements			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	O_2	SCR	CCR
Required Training Topic			
Academic			
History of technology	X	X	X
Medical & physiological aspects of:			
Oxygen toxicity	X	X	X
Chemical burns & caustic cocktail	X	X	X
Hypoxia – insufficient O_2	X	X	X
Hypercapnia – excessive CO_2	X	X	X
Arterial gas embolism	X	X	X
Middle Ear Oxygen Absorption Syndrome (oxygen ear)	X	X	X
Hygienic concerns	X	X	X
Nitrogen absorption & decompression sickness		X	X
CO_2 retention	X	X	X
Hyperoxia-induced myopia	X	X	X
System design, assembly, and operation, including:			
Layout and design	X	X	X
Oxygen control systems	X	X	X
Diluent control systems		ISE	ISE
Use of checklists	X	X	X
Complete assembly and disassembly of the unit	X	X	X
Canister design & proper packing and handling of chemical absorbent	X	X	X
Decompression management and applicable tracking methods		ISE	X
Oxygen and high pressure gas handling and safety	X	X	X
Fire triangle	X	X	X
Filling of cylinders	X	X	X
Pre-dive testing & trouble shooting	X	X	X
Post-dive break-down and maintenance	X	X	X
Trouble shooting and manufacturer authorized field repairs	X	X	X
Required maintenance and intervals	X	X	X
Manufacturer supported additional items (ADV, temp stick, CO2 monitor, etc.)	ISE	ISE	ISE
Dive planning:			
Operational planning	X	X	X
Gas requirements	X	X	X
Oxygen exposure and management	X	X	X
Gas density calculations		X	X
Oxygen metabolizing calculations	X	X	X
Scrubber limitations	X	X	X
Mixed mode diving (buddies using different dive modes)	X	X	X
Mixed platform diving (buddies using different rebreather platforms)	X	X	X
Problem Recognition & Emergency Procedures:			
Applicable open circuit emergency procedures for common gear	X	X	X
Loss of electronics	ISE	ISE	X
Partially flooded loop	X	X	X

Fully flooded loop	X	X	X
Cell warnings		ISE	X
Battery warnings	ISE	ISE	X
High O_2 warning	ISE	ISE	X
Low O_2 warning	ISE	ISE	X
High CO_2 warning	ISE	ISE	ISE
Recognizing issues as indicated by onboard scrubber monitors	ISE	ISE	ISE
Recognizing hypercapnia signs and symptoms in self or buddy	X	X	X
Excluded O_2 cell(s)	ISE	ISE	ISE
Loss of Heads Up Display (HUD)	ISE	ISE	ISE
Loss of buoyancy	X	X	X
Diluent manual add button not functioning		ISE	ISE
O2 manual add button not functioning	ISE	ISE	ISE
Exhausted oxygen supply	X	X	X
Exhausted diluent supply		ISE	ISE
Lost or exhausted bailout	ISE	ISE	ISE
Handset not functioning	ISE	ISE	ISE
Solenoid stuck open	ISE	ISE	ISE
Solenoid stuck closed	ISE	ISE	ISE
ADV stuck open	ISE	ISE	ISE
ADV stuck closed	ISE	ISE	ISE
Isolator valve(s) not functioning	ISE	ISE	ISE
Oxygen sensor validation	ISE	ISE	X
CO_2 sensor validation	IA	IA	IA
Gas sharing	X	X	X
Diver assist and diver rescue	X	X	X
Other problem recognition and emergency procedures specific to the particular unit, environment, or diving conditions	X	X	X
Practical Training and Evaluations			
Demonstrated skills must include, at a minimum:			
Use of checklists	X	X	X
Carbon dioxide absorbent canister packing	X	X	X
Supply gas cylinder analysis and pressure check	X	X	X
Test of one-way valves	X	X	X
System assembly and breathing loop leak testing	X	X	X
Oxygen control system calibration	ISE	ISE	X
Proper pre-breathe procedure	X	X	X
In-water bubble check	X	X	X
Proper buoyancy control during descent, dive operations, and ascent	X	X	X
System monitoring & control during descent, dive operations, and	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Unit removal and replacement on the surface	X	X	X
Bailout and emergency procedures for self and buddy, including:			
System malfunction recognition and solution	X	X	X

Manual system control	ISE	ISE	ISE
Flooded breathing loop recovery	IA	IA	IA
Absorbent canister failure	X	X	X
Alternate bailout options	X	X	X
Manipulation of onboard and off board cylinder valves	X	X	X
Manipulation of bailout cylinders (removal, replacement, passing and receiving while maintaining buoyancy control)	ISE	ISE	ISE
Manipulation of quick disconnects, isolator valves, and manual controls specific to the unit and gear configuration	ISE	ISE	ISE
Proper system maintenance, including:			
Breathing loop disassembly and disinfection	X	X	X
Oxygen sensor replacement	ISE	ISE	ISE
Battery removal and replacement or recharging	ISE	ISE	ISE
Other tasks as required by specific rebreather models	X	X	X
Written Evaluation	X	X	X
Supervised Rebreather Dives	X	X	X

Entry Level Rebreather Training – Minimum Underwater Requirements

	Pool / Confined Water	Training / Supervised Open Water Dives
O2	1 Dive, 90 minutes	6 dives, 240 minute cumulative
SCR	1 Dive, 90 minutes	8 dives, 240 minute cumulative
CCR	1 Dive, 90 minutes	12 dives, 720 minute cumulative

Rebreather Required Decompression, Normoxic, and Hypoxic Mix Training

1) Required Decompression and Normoxic Training may be taught separately or combined.
2) Prerequisites for each of the following authorizations:
   a) Required Decompression – 25 rebreather dives for a minimum cumulative dive time of 25 hours
   b) Mixed Gas:
      i) Normoxic Mixes – 25 rebreather dives for a minimum cumulative dive time of 25 hours
      ii) Hypoxic Mixes – Rebreather Required Decompression Authorization and Normoxic Authorization and 25 decompression rebreather dives for a minimum cumulative dive time of 40 hours on dives requiring decompression
3) Who may teach: Individuals authorized as a CCR/SRC required decompression and/or Normoxic and/or Hypoxic Mix instructor by the DCB or their designee (this is in addition to the original authorization from Section 11.60)
4) Maximum Student/Instructor Ratio: 2 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints
5) Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used
6) Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model of the rebreather being used

Rebreather Required Decompression, Normoxic & Hypoxic Mix Training Requirements			
Key: X = include, IA = If Applicable, ISE = If So Equipped			
	Deco–Air Dil	Normoxic - Trimix	Hypoxic Mixes
Required Training Topic			
Academic			
Review of applicable subject matter from previous training	X	X	X
Medical & physiological aspects of:			
Hypercapnia, hypoxia, hyperoxia	X	X	X
Oxygen limitations	X	X	X
Nitrogen limitations	X	X	X
Helium absorption and elimination		X	X
High Pressure Nervous Syndrome (HPNS)			X
System design, assembly, and operation, including:			
Gear considerations and rigging	X	X	X
Gas switching	X	X	X
Dive planning:			
Decompression calculation	X	X	X
Gradient Factors	X	X	X
Scrubber duration and the effects of depth on scrubber function	X	X	X
Gas requirements including bailout scenarios	X	X	X
Bailout gas management – individual vs team bailout	X	X	X
Gas density calculations	X	X	X
Operational Planning	X	X	X
Equivalent narcosis depth theory		X	X
Gas selection, gas mixing and gas formulas		X	X
Problem Recognition & Emergency Procedures:			
Applicable open circuit emergency procedures for common gear	X	X	X
Flooded loop	X	X	X
Cell warnings	X	X	X
Battery warnings	X	X	X
Hypercapnia, hypoxia, hyperoxia	X	X	X
Practical Training and Evaluations			
Demonstrated skills must include, at a minimum:			
Proper demonstration of applicable skills from previous training	X	X	X
Proper manipulation of DSV and/or BOV	X	X	X
Proper descent and bubble check procedures	X	X	X
Proper monitoring of setpoint switching and pO2 levels	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Demonstrate the ability to manually change setpoint and electronics settings during the dive	ISE	ISE	ISE
Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet	X	X	X

Demonstrate controlled ascent with an incapacitated diver including surface tow at least 30 meters / 100 feet with equipment removal on surface, in water too deep to stand	X	X	X
Onboard and off board valve manipulation for proper use, and reduction of gas loss	X	X	X
Diagnosis of and proper reactions for a flooded absorbent canister	X	X	X
Diagnosis of and proper reactions for CO2 breakthrough	X	X	X
Diagnosis of and proper response to Cell Errors	X	X	X
Diagnosis of and proper reactions for Low oxygen drills	X	X	X
Diagnosis of and proper reactions for Flooded Loop	X	X	X
Diagnosis of and proper reactions for High Oxygen Drills	X	X	X
Diagnosis of and proper reactions for electronics and battery	X	X	X
Operation in semi-closed mode	X	X	X
Properly execute the ascent procedures for an incapacitated dive	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Demonstrate the ability to maintain minimum loop volume	X	X	X
Demonstrate comfort swimming on surface and at depth carrying a single bailout/decompression cylinder/bailout rebreather	X	X	X
Demonstrate ability to pass and retrieve a single bailout/decompression cylinder or bailout rebreather while maintaining position in the water column	X	X	X
Demonstrate ability to pass and receive multiple bailout/decompression cylinders or bailout rebreather while maintaining position in the water column	IA	X	X
Demonstration of the ability to perform simulated decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstration of the ability to perform decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstrate competence managing multiple bailout cylinders, including drop and recovery while maintaining position in the water column	IA	X	X
Demonstrate appropriate reaction to simulated free-flowing deco regulator	X	X	X
Gas share of deco gas for at least 1 minute	X	X	X
Demonstrate oxygen rebreather mode at appropriate stop depth		X	X
Complete bailout scenarios from depth to include decompression obligation on open circuit	X	X	X
Written Evaluation	X	X	X

Supervised Rebreather Dives		X	X	X
Minimum Underwater Requirements				
	Pool/Confined Water	**Supervised Open Water Dives**		
Deco	1 Dive / 60 min	11 Dives / 660 min		
Normoxic	1 Dive / 60 min	11 Dives / 660 min		
Deco/Normoxic Combined	1 Dive / 60 min	11 Dives / 660 min First 3 of 11 dives will use normoxic mixtures		
Hypoxic Mixes	1 Dive / 60 min	11 Dives / 660 min		

Rebreather Crossover Training

1) Crossover training to a new rebreather platform requires a minimum of 4 training dives for a minimum cumulative dive time of 240 min.
2) Advanced level certification on a new rebreather platform may be awarded upon successful demonstration of required skills using the new platform.

SECTION 12.00 SCIENTIFIC CAVE AND CAVERN DIVING

This section defines specific considerations regarding the following issues for Scientific Cavern and Cave diving:

- Training and/or experience verification requirements for authorization
- Equipment requirements
- Operational requirements and additional safety protocols to be used

Application of this standard is in addition to pertinent requirements of all other sections of this manual.

For cavern or cave dives that also involve staged decompression, rebreathers, and/or mixed gas diving, all requirements for each of the relevant diving techniques, modes, or gases must be met.

No diver must conduct planned operations in caverns, caves, or other overhead environments without prior review and approval of the DCB or designee. The diver must demonstrate that he/she possesses the proper attitude, judgment, and discipline to safety conduct cave and cavern diving in the context of planned operations.

If a conflict exists between this section and other sections in this manual, the information set forth in this section only takes precedence when the scientific diving being conducted takes place wholly or partly within an underwater cave or cavern environment.

12.10 Definition

A dive team must be considered to be cave or cavern diving if at any time during the dive they find themselves in a position where they cannot complete a direct, unobstructed ascent to the surface because of rock formations. In addition to blocking direct access to surfacing, underwater caves have additional environmental hazards including but not limited to:

- The absence of natural light.
- Current or flow that vary in strength and direction. Of particular note is a condition known as siphoning. Siphoning caves have flow or current directed into the cave. This can cause poor visibility as a result of mud and silt being drawn into the cave entrance.
- The presences of silt, sand, mud, clay, etc. that can cause visibility to be reduced to nothing in a very short time.
- Restrictions – Any passage through which two divers cannot easily pass side by side.
- Cave-Ins – Cave-Ins are a normal part of cave evolution; however experiencing a cave-in during diving operations is extremely unlikely.

12.20 Prerequisites

Prerequisites	Cavern: OC or Rebreather	Cave	Rebreather Cave
Active scientific diver status, with depth qualification sufficient for proposed training location(s)	X	X	X
Completion of a minimum of 50 open water dives.	X		
Cavern Diver Authorization		X	X

12.30 Training

Training	Cavern: OC or Rebreather	Cave OC	Rebreather Cave
Key: X = include, R = Review, IA = If Applicable, OC = Open Circuit			
Trainers must be qualified for the type of instruction to be provided. Training must be conducted by agencies or instructors approved by the DCB or their designee	X	X	X
Academic			
Policy for diving overhead environments	X	X	X
Environment and environmental hazards	X	X	X
Accident analysis	X	X	X
Psychological considerations	X	X	X
Required equipment and equipment configuration			
Familiarity with UM gear configuration(s)	X	X	X
Single cylinder with H or Y Valve	IA	IA	
Doubles with Isolation Manifold	IA	IA	
Side Mount	IA	IA	IA
No Mount		IA	IA
Stage Cylinder(s)	IA	IA	IA
Off-board Bailout	IA		X
Communications	X	X	X
Diving techniques			
Body control – BAST, Finning Techniques, etc.	X	X	X
Navigation and guidelines	X	X	X
Entry and Exit Protocols (Right of Way)	X	R	R
Use of line arrows and cookies	X	X	X
Line Systems Applicable to the Area and/or Cave System	X	R	R
Line Jumps		X	X
Circuits		X	X
Dive planning			
Rule of Sixths	X	R	R
Rule of Thirds	X	R	R
Gas Matching	IA	X	X
Decompression Theory	R	R	R
Dive Tables	R	R	R
Mixed Mode Diving	IA	IA	IA

Cave geology	X	R	R
Cave hydrology	X	R	R
Cave biology	X	R	R
Emergency procedures	X	X	X
Practical Training and Evaluation			
Land Drills			
Line Reel Use	X	R	R
Techniques and Considerations for Laying a Guideline	X	X	X
Guideline Following	X	R	R
Buddy Communication	X	R	R
Team Positioning for Normal Entry and Exit	X	X	X
Zero Visibility Drills			
Line Reel Use	X	R	R
Line and Line Arrow Identification and Following	X	R	R
Bump and Go		X	X
Emergency Procedures (Including lost line protocol)	X	X	X
How Far Can You Go Out Of Gas?	X	X	X
Team Positioning for Emergency Situations	X	X	X
In-Water			
Demonstrated skills must include, at a minimum:			
A minimum of four (4) cavern dives, preferably to be conducted in a minimum of two (2) different caverns	X		
A minimum of twelve (12) cave dives, preferably to be conducted in a minimum of four (4) different cave sites with differing conditions		X	X
Safety drill (S-drill) – Performed on every dive	X	X	
Review of Dive Plan and Turn Pressures	X	X	X
Essential Gear Identification, Positioning, and Function Check	X	X	X
Proper Valve Position Check	X	X	X
Bubble Check	X	X	X
Proper Buoyancy Compensator Use	X	X	X
Proper Trim and Body Positioning	X	X	X
Hovering and Buoyancy With Hand Tasks	X	X	X
Specialized Propulsion Techniques and Anti-Silting Techniques (modified flutter kick, modified frog kick, pull and glide, ceiling walk or shuffle)	X	X	X
Proper Light and Hand Signal Use	X	R	R
Proper Reel and Guideline Use	X	X	X
Ability to Deploy a Primary Reel and Tie Into a Main Line Under Different Conditions (Flow, Visibility, Bottom/Silt, etc.)	X	X	X
Proper Line Placement and Etiquette	X	X	X
Proper Use of Safety Reel		X	X
Proper Use of Jump/Gap Reel(s)		X	X
Proper Use of Drop/Stage Cylinders		IA	IA
Proper Placement and Retrieval of Cylinder(s) With Minimal Disturbance of Environment and Visibility		IA	IA
Ability to Deploy and Retrieve Cylinders With Minimal Loss		IA	IA

of Forward Progress			
Surveying	IA	IA	IA
Ability to Properly Critique Their Dives and Performance	X	X	X
Zero Visibility Drills	IA	X	X
Line Reel Use	X	R	R
Buddy Communication	X		
Line and Line Arrow Identification and Following	X	R	R
Bump and Go		X	X
Emergency Procedures			
Team Positioning for Emergency Situations	X	X	X
Lost Line		X	X
Lost Buddy	X	X	X
Gas Sharing While Following Guideline (Conducted with and without visibility, As Donor and Receiver)	X	X	X
Gas Sharing in a Minor Restriction Using a Single File Method As Donor and Receiver		X	X
Valve Manipulation	X	X	X
Proper Attitude, Judgment, and Discipline To Safely Conduct Dives In An Overhead Environment	X	X	X
Written Examination			
A written evaluation approved by the DCB with a minimum passing score of 80%, covering concepts of both classroom and practical training	X	X	X

12.40 Equipment Requirements

Equipment used for SCUBA in cave or cavern diving is based on the concept of redundancy. Redundant SCUBA equipment must be carried whenever the planned penetration distances are such that an emergency swimming ascent is not theoretically possible.

Minimum Equipment	Cavern OC	Rebreather Cavern	Cave OC	Rebreather Cave
Key: X = include, R = Review, IA = If Applicable, OC = Open Circuit				
At a minimum, a single cylinder with adequate volume and configured to allow divers to exit from farthest/deepest penetration while supporting self and dive buddy equipped with a “K” valve; standard OC regulator configuration (Section 3.20); and BCD	X			
At minimum, a single cylinder equipped with an “H” or “Y” valve Or an alternate gas supply with adequate volume and configured to allow divers to exit from farthest/deepest penetration while supporting self and dive buddy			IA	
Off-board/bailout gas supply of sufficient volume and configured to allow diver to exit from farthest/deepest penetration	IA	X	IA	X
A BCD capable of being inflated from the cylinder	X	X	X	X
Slate and pencil	X	X	X	X
A functioning primary light with sufficient burn time	X	X	X	X

for the planned dive				
Two functioning battery powered secondary lights	IA	IA	X	X
Two cutting devices	IA	IA	X	X
One primary reel of at least 350 feet (106 m) for each team	X	X	X	X
Safety reel with at least 150 feet (45.6 m) of line			X	X
Directional Line Markers			X	X
Cylinders with dual orifice isolation valve manifold Or independent SCUBA systems* with enough volume for the planned dive plus required reserve			X	
Two completely independent regulators, at least one of each having submersible tank pressure gauge and a low pressure inflator for the BCD			X	
One regulator to be configured with a five foot or longer second stage hose	X		X	
Rebreather		X		X
Off-board Bailout of sufficient capacity for the diver to exit to the surface		X		X
*Independent SCUBA systems must be configured to allow for monitoring of gas pressures in each cylinder				

12.50 Operational Requirements and Safety Protocols

Operational Requirements and Safety Protocols	Cavern	Cave
Diving must not be conducted at linear penetration distance into the overhead environment greater than 130 feet (40 m) from the water's surface, with a depth limit of 70 feet (21 m) (in accordance with NSSCDS Cavern Diving Manual)	X	
Dive teams must perform a safety drill prior to each dive that includes equipment check, gas management, and dive objectives	X	X
Each team within the overhead zone must utilize a continuous guideline appropriate for the environment leading to a point from which an uninterrupted ascent to the surface may be made	X	X
Gas management must be appropriate for the planned dive with special considerations made for; DPV's, siphon diving, rebreathers, etc.	X	X
The entire dive team is to immediately terminate the dive whenever any dive team member calls (terminates) the dive	X	X

12.60 Diving at Little Salt Spring (LSS)

Diving beyond the drop-off at LSS presents a unique overhead situation. For dives beyond the drop-off and deeper than 50ft, a checkout dive is required with the DSO. The diver must receive a BAST score (see Appendix 4) of 16 or higher (score at least 4 on all BAST elements).

Diving to the 90ft (27m) ledge requires completing the requirements in Section 12.60 and two checkout dives with the DSO to the ledge demonstrating comfort, appropriate finning techniques, dive light management, etc. or provide proof of cavern/cave certification and complete an orientation dive.

Appendices

Appendix 1 Through 8 Or Equivalent
Required For All Organizational Members

APPENDIX 1
DIVING MEDICAL HISTORY FORM

(To Be Completed By Applicant-Diver)

Name _____ DOB _____ Age _____ Wt._____ Ht. _____

Sponsor _____ Date _____/_____/_____
(Dept./Project/Program/School, etc.) (Mo. / Day / Year)

TO THE APPLICANT:

Scuba diving places considerable physical and mental demands on the diver. Certain medical and physical requirements must be met before beginning a diving or training program. Your accurate answers to the questions are more important, in many instances, in determining your fitness to dive than what the physician may see, hear or feel as part of the diving medical certification procedure.

This form must be kept confidential by the examining physician. If you believe any question amounts to invasion of your privacy, you may elect to omit an answer, provided that you must subsequently discuss that matter with your own physician who must then indicate, in writing, that you have done so and that no health hazard exists.

Should your answers indicate a condition, which might make diving hazardous, you will be asked to review the matter with your physician. In such instances, their written authorization will be required in order for further consideration to be given to your application. If your physician concludes that diving would involve undue risk for you, remember that they are concerned only with your well-being and safety.

	Yes	**No**	**Please indicate whether or not the following apply to you**	**Comments**
1			Convulsions, seizures, or epilepsy	
2			Fainting spells or dizziness	
3			Been addicted to drugs	
4			Diabetes	
5			Motion sickness or sea/air sickness	
6			Claustrophobia	
7			Mental disorder or nervous breakdown	
8			Are you pregnant?	
9			Do you suffer from menstrual problems?	
10			Anxiety spells or hyperventilation	
11			Frequent sour stomachs, nervous stomachs or vomiting spells	
12			Had a major operation	
13			Presently being treated by a physician	
14			Taking any medication regularly (even non-prescription)	
15			Been rejected or restricted from sports	
16			Headaches (frequent and severe)	
17			Wear dental plates	
18			Wear glasses or contact lenses	
19			Bleeding disorders	
20			Alcoholism	
21			Any problems related to diving	
22			Nervous tension or emotional problems	

	Yes	No	Please indicate whether or not the following apply to you	Comments
23			Take tranquilizers	
24			Perforated ear drums	
25			Hay fever	
26			Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose	
27			Frequent earaches	
28			Drainage from the ears	
29			Difficulty with your ears in airplanes or on mountains	
30			Ear surgery	
31			Ringing in your ears	
32			Frequent dizzy spells	
33			Hearing problems	
34			Trouble equalizing pressure in your ears	
35			Asthma	
36			Wheezing attacks	
37			Cough (chronic or recurrent)	
38			Frequently raise sputum	
39			Pleurisy	
40			Collapsed lung (pneumothorax)	
41			Lung cysts	
42			Pneumonia	
43			Tuberculosis	
44			Shortness of breath	
45			Lung problem or abnormality	
46			Spit blood	
47			Breathing difficulty after eating particular foods, after exposure to particular pollens or animals	
48			Are you subject to bronchitis	
49			Subcutaneous emphysema (air under the skin)	
50			Air embolism after diving	
51			Decompression sickness	
52			Rheumatic fever	
53			Scarlet fever	
54			Heart murmur	
55			Large heart	
56			High blood pressure	
57			Angina (heart pains or pressure in the chest)	
58			Heart attack	

	Yes	No	Please indicate whether or not the following apply to you	Comments
59			Low blood pressure	
60			Recurrent or persistent swelling of the legs	
61			Pounding, rapid heartbeat or palpitations	
62			Easily fatigued or short of breath	
63			Abnormal EKG	
64			Joint problems, dislocations or arthritis	
65			Back trouble or back injuries	
66			Ruptured or slipped disk	
67			Limiting physical handicaps	
68			Muscle cramps	
69			Varicose veins	
70			Amputations	
71			Head injury causing unconsciousness	
72			Paralysis	
73			Have you ever had an adverse reaction to medication?	
74			Do you smoke?	
75			Have you ever had any other medical problems not listed? If so, please list or describe below;	
76			Is there a family history of high cholesterol?	
77			Is there a family history of heart disease or stroke?	
78			Is there a family history of diabetes?	
79			Is there a family history of asthma?	
80			Date of last tetanus shot? Vaccination dates?	

Please explain any “yes” answers to the above questions.

_____
_____
_____
_____
_____
_____
_____
_____

I certify that the above answers and information represent an accurate and complete description of my medical history.
I authorize the release of this information and all medical information subsequently acquired in association with my diving at the University of Miami/RSMAS to the University of Miami/RSMAS Diving Control Board or Diving Safety Office.

Signature Date

APPENDIX 2
DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN

TO THE EXAMINING PHYSICIAN:

This person, _____, requires a medical examination to assess their fitness for certification as a Scientific Diver for the University of Miami. Their answers on the Diving Medical History Form (attached) may indicate potential health or safety risks as noted. Your evaluation is requested on the attached scuba Diving Fitness Medical Evaluation Report. If you have questions about diving medicine, you may wish to contact physicians with expertise in diving medicine, the Undersea Hyperbaric and Medical Society, or the Divers Alert Network. Please contact the UM Diving Safety Officer if you have any questions or concerns about the University of Miami diving standards. Thank you for your assistance.

UM Diving Safety Officer:
Rick Riera-Gomez
305-421-4107
umdso@rsmas.miami.edu

Scuba and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses, or lung segments do not readily equalize air pressure changes. The most common cause of distress is eustachian insufficiency. Recent deaths in the scientific diving community have been attributed to cardiovascular disease. Please consult the following list of conditions that usually restrict candidates from diving.
(Adapted from Bove, 1998: bracketed numbers are pages in Bove)

CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to autoinflate the middle ears. [5 ,7, 8, 9]
2. Vertigo, including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery. [11]
4. Recent ocular surgery. [15, 18, 19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression. [20 - 23]
6. Substance abuse, including alcohol. [24 - 25]
7. Episodic loss of consciousness. [1, 26, 27]
8. History of seizure. [27, 28]
9. History of stroke or a fixed neurological deficit. [29, 30]
10. Recurring neurologic disorders, including transient ischemic attacks. [29, 30]
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage. [31]
12. History of neurological decompression illness with residual deficit. [29, 30]
13. Head injury with sequelae. [26, 27]
14. Hematologic disorders including coagulopathies. [41, 42]
15. Evidence of coronary artery disease or high risk for coronary artery disease. [33 - 35]
16. Atrial septal defects. [39]
17. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying. [38]
18. Significant cardiac rhythm or conduction abnormalities. [36 - 37]
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]
20. Inadequate exercise tolerance. [34]

21. Severe hypertension. [35]
22. History of spontaneous or traumatic pneumothorax. [45]
23. Asthma. [42 - 44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

SELECTED REFERENCES IN DIVING MEDICINE
Available from Best Publishing Company, P.O. Box 30100, Flagstaff, AZ 86003-0100, the Divers Alert Network (DAN) or the Undersea and Hyperbaric Medical Society (UHMS), Durham, NC

- Elliott, D.H. ed. 1996. *Are Asthmatics Fit to Dive?* Kensington, MD: Undersea and Hyperbaric Medical Society.
- Bove, A.A. 2011. The cardiovascular system and diving risk. *Undersea and Hyperbaric Medicine* 38(4): 261-269.
- Thompson, P.D. 2011. The cardiovascular risks of diving. *Undersea and Hyperbaric Medicine* 38(4): 271-277.
- Douglas, P.S. 2011. Cardiovascular screening in asymptomatic adults: Lessons for the diving world. *Undersea and Hyperbaric Medicine* 38(4): 279-287.
- Mitchell, S.J., and A.A. Bove. 2011. Medical screening of recreational divers for cardiovascular disease: Consensus discussion at the Divers Alert Network Fatality Workshop. *Undersea and Hyperbaric Medicine* 38(4): 289-296.
- Grundy, S.M., Pasternak, R., Greenland, P., Smith, S., and Fuster, V. 1999. Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations. AHA/ACC Scientific Statement. *Journal of the American College of Cardiology,* 34: 1348-1359. http://content.onlinejacc.org/cgi/content/short/34/4/1348
- Bove, A.A. and Davis, J. 2003. DIVING MEDICINE, Fourth Edition. Philadelphia: W.B. Saunders Company.
- Edmonds, C., Lowry, C., Pennefather, J. and Walker, R. 2002. DIVING AND SUBAQUATIC MEDICINE, Fourth Edition. London: Hodder Arnold Publishers.
- Bove, A.A. ed. 1998. MEDICAL EXAMINATION OF SPORT SCUBA DIVERS, San Antonio, TX: Medical Seminars, Inc.
- NOAA DIVING MANUAL, NOAA. Superintendent of Documents. Washington, DC: U.S. Government Printing Office.
- U.S. NAVY DIVING MANUAL. Superintendent of Documents, Washington, DC: U.S. Government Printing Office, Washington, D.C.

APPENDIX 3
UM MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

Name of Applicant: _____ Date of Medical Evaluation: _____
(Print or Type) (Month/Day/Year)

To The Examining Physician: Scientific divers require periodic scuba diving medical examinations to assess their fitness to engage in diving with self-contained underwater breathing apparatus (scuba). Their answers on the Diving Medical History Form may indicate potential health or safety risks as noted. Scuba diving is an activity that puts unusual stress on the individual in several ways. Your evaluation is requested on this Medical Evaluation form. Your opinion on the applicant's medical fitness is requested. Scuba diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease (see references, following page). An absolute requirement is the ability of the lungs, middle ears and sinuses to equalize pressure. Any condition that risks the loss of consciousness shall disqualify the applicant. Please proceed in accordance with the AAUS Medical Standards (Sec. 5.00). If you have questions about diving medicine, please consult with the Undersea Hyperbaric Medical Society or Divers Alert Network.

TESTS: THE FOLLOWING TESTS ARE <u>REQUIRED</u>:

DURING ALL EXAMS:

- Medical history
- Complete physical exam, with emphasis on neurological and otological components
- Urinalysis
- Hematocrit or Hemoglobin
- Chest X-ray (initial exam only)
- Spirometry (initial exam only)
- Any further tests deemed necessary by the physician

ADDITIONAL TESTS FOR DIVERS OVER AGE 40:

- Chest x-ray (Required only during first exam over age 40)
- Resting EKG
- Assessment of coronary artery disease using Multiple-Risk-Factor Assessment[1]
  (age, lipid profile, blood pressure, diabetic screening, smoking)
  Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment[1]

PHYSICIAN'S STATEMENT:
I have evaluated the above mentioned individual according to the tests listed above. I have discussed with the patient any medical condition(s) that would not disqualify him/her from diving but which may seriously compromise subsequent health. The patient understands the nature of the hazards and the risks involved in diving with these conditions.

_____ 01 I find no medical conditions that may be disqualifying for participation in scuba diving.
Diver **<u>IS</u>** medically qualified to dive for (check one): _____2 years (over age 60)
_____3 years (age 40-59)
_____5 years (under age 40)

_____ 02 Diver **<u>IS NOT</u>** medically qualified to dive

_____ MD or DO _____
Signature (circle one) Date

_____
Name (Print or Type)

_____
Address

_____ _____
Telephone Number E-Mail Address

My familiarity with applicant is: _____This exam only _____Regular physician for _____ years

My familiarity with diving medicine is: _____

APPENDIX 4
UM DIVER FORMS

Diving Resume
Statement of Understanding
Insurance Form
Consent to Treat/Medical History
Rebreather Checklist
BAST Explanation
Letter of Reciprocity Template
Authorization Requirements and Training Record

UNIVERSITY OF MIAMI/RSMAS SCIENTIFIC DIVING PROGRAM

DIVING RESUME

Name:	Today's Date:
Cell Phone:	Date of Birth:
Alternate Phone:	MPS Track/Degree:
Address:	Department/Division:
	C-Number:

Email Address: _____

Emergency Contact (give name, relationship, address, and day/evening phone numbers)

_____

_____

TRAINING: Please list relevant training below including year of certification. Also submit a copy of all relevant certifications on a separate page. Relevant certs include diving, first aid, swimming, boating, etc.

1. 4.
2. 5.
3. 6.

DIVING EXPERIENCE

Total career open water scuba dives: _____ Total dives in last 12 months: _____

Deepest dive in career (depth/location): _____

Deepest dive in last year (depth/location): _____ Date of last dive: _____

Indicate with the appropriate letter, your diving experience in the following environments/conditions:

E = extensive (75+) **M** = moderate (25 - 74) **L** = limited (1 - 24) **O** = no experience

_____ small boats	_____decompression diving	_____blue-water
_____ ships	_____cold water (< 45°F)	_____turbid water
_____ shore	_____ice diving	_____wreck
_____ heavy surf	_____cave diving	_____kelp
_____ mud/silt	_____fresh water lakes	_____night
_____ dry suit	_____strong currents	_____surface supply
_____ saturation	_____chamber operation	_____coral reef
_____ altitude	_____EMT/DMT	_____nitrox/trimix
_____ commercial	_____military	_____ocean/salt

DIVE LOG: Please submit a copy from your dive log of your last 10 dives.

STATEMENT: By signing below, I certify that the above information is correct and accurate.

_____

(Print Name) (Signature) (Date)

STATEMENT OF UNDERSTANDING

Name:

Standard: All areas of evaluation of this course are based on the question: "Will this person make a safe and reliable diver?"
Evaluation: You will be required to learn and demonstrate to the satisfaction of the diving safety officer, through written examination and physical performance, the following:

1. Applied Sciences: Physics, physiology, dive planning, medical aspects of diving, etc.
2. Diving Equipment: Knowledge of purposes, features, types and use of skin and scuba diving gear.
3. Diving Safety: Basic skill level of lifesaving, first aid, CPR and Diving Accident Management.
4. Diving Environment: Basic knowledge of physical and biological aspects, with emphasis on southeast Florida.
5. Safe Diving Skills: Competent knowledge and performance of skin and scuba diving, surface and underwater.

Authorization: You are not assured of authorization to dive for UM/RSMAS merely by attending the course, or even by completing and passing all of the areas of evaluation. The Diving Safety Officer will make a subjective decision at the end of the course, based on your total performance and attitude regarding safety. Possible initial authorizations are:

1. Diver-In-Training: Limited to a max depth of 30 feet and/or other restrictions as determined by the dive officer.
2. Scientific Diver 30ft: Authorized to dive up to 30ft as Lead Diver (if diver has at least 50 dives) and allowed to dive to 60ft maximum with a diver authorized to a depth of 60ft or more.
3. Scientific Diver 60ft: Authorized to dive up to 60ft as Lead Diver (if diver has at least 50 dives) and allowed to dive to 100ft maximum with a diver authorized to a depth of 100ft or more.
4. Requires additional training, as determined by the dive officer.
5. Rejection for diving authorization.

Responsibilities: You are responsible for the following:

1. Your own safety and others around you.
2. UM/RSMAS equipment – it is your responsibility to replace anything lost or damaged.
3. Your own gear and personal effects.
4. Be on time for all training sessions.

Grading: Your final grade will be based on the written final exam, in-water performance, and your attitude toward safe diving practices.

(Candidate Signature) (Date)

STATEMENT OF UNDERSTANDING (cont.)

Name:

Throughout all diving, dive training, and other operations as part of the UM scientific diving program…

1. Skin, scuba, and surface-supplied diving are physical activities involving heavy exertion. A diver must be in good general health, free from cardiovascular and respiratory disease, and have good exercise tolerance. Even momentary loss of consciousness underwater may be fatal.

2. While swimming or using skin, scuba, or surface-supplied diving equipment, the body is subject to a variety of influences that may become potentially hazardous. Some of these hazards include drowning, ruptured eardrums or sinuses, air/gas embolism, decompression sickness, and a variety of other barotrauma (pressure-related injuries).

3. There are organisms in the water that may bite, sting, claw, or inject substances in the body.

4. There are other water related problems that include reduced visibility, rough water, strong currents, and cold temperature.

5. When diving from a boat, a person may be subjected to bodily injury from carelessness due to activity, or related to equipment handling, or just from being present on a boat at sea.

6. The individual diver must realize that he/she is ultimately responsible for his/her own safety. It is clearly the diver's responsibility to refuse to dive if, in his/her judgment, conditions are unsafe.

7. The diver agrees to abide by all safety guidelines and policies put in place by the University of Miami diving safety program and Diving Safety Manual.

8. Due to the physical nature of diving, dive training, and related activities, physical contact is common. Instructors may need to make physical contact in order to correct diving technique or otherwise provide instruction. By signing below, the signatory understands that at times, for proper instruction and safety, physical contact is required and necessary.

9. Divers grant the University of Miami permission to use their likeness in a photograph, video, or other media in any and all of its publications, including web-based publications, pamphlets, brochures, presentations, etc. without payment or other consideration.

Statement: I am in good physical and mental health and I am fit to dive. I hereby voluntarily exempt and release Eliseo "Rick" Riera-Gomez, Albert "Robbie" Christian, and the University of Miami, its Trustees, officers, and employees from liability for personal injury, property damage, or death arising from diving instruction, diving activities, or any activities incidental to diving operations for the duration of my association with the University of Miami.

(Candidate Signature) (Date)

UM DIVER PROOF OF INSURANCE FORM

As of September 1986 all UM/RSMAS divers are required to have some type of medical insurance to cover their expenses in the event of a scuba diving accident requiring Recompression/Hyperbaric Oxygen Therapy, (recompression chamber treatment).

If you are diving as an employee, Worker's Compensation can be the mode of coverage. However, if you are diving in a non-employment situation such as students, some other insurance coverage is necessary. It is recommended that you check with your insurance provider to see if you are covered for hyperbaric oxygen therapy for scuba diving accidents.

THIS POLICY MUST COVER HYPERBARIC OXYGEN THERAPY IN A RECOMPRESSION CHAMBER.

Not all insurance plans cover hyperbaric treatment for diving accidents. If you have no policy meeting this requirement you can purchase one from the Diver's Alert Network. Even if you do have medical insurance covering hyperbaric treatment for diving accidents, it is strongly recommended you purchase DAN insurance. When selecting a coverage choose the "Master Plan" or higher. You can contact DAN on the web at www.DiversAlertNetwork.org See the Diving Safety Officer for details of this policy and application forms.

Complete the following and return to the Diving Safety Office at RSMAS.

Name_____

Insurance Company _____

Policy Number _____

Expiration Date _____

I certify this insurance policy covers Hyperbaric Oxygen Therapy in a recompression chamber for SCUBA diving accidents.

_____

(Diver's Signature) (Date)

CONSENT TO ADMISSION AND TREATMENT

In the event of injury to the undersigned,_____,
born _____ Social Security # _____,
I hereby authorize the University of Miami or representatives thereof, to admit me to a facility for emergency medical treatment as may be deemed necessary to my health or welfare.

I hereby consent to whatever medical treatment is deemed necessary. I, on my behalf, and behalf of my heirs, successors, assigns, and personal representatives, hereby release the University of Miami, its trustees, officers, faculty and employees from any and all claims arising from my admission to such a facility of from such treatment administered by such a facility.

_____	_____	_____
Date	Diver's Name (Print Clearly)	Diver's Signature

Insurance Information

_____	_____	_____
Insurance Company	Policy Number	Expiration Date

DAN – (Circle one) YES or NO If YES	_____	_____
	DAN Number	Expiration Date

In the event of an emergency, please contact:

_____	_____	_____
Name/Relationship	Best Phone # for contacting	Alternate Phone #

_____	_____	_____
Name/Relationship	Best Phone # for contacting	Alternate Phone #

Diver's Local Address: _____ Local Phone:_____

Permanent Home Address and Phone: (if different than local): _____

_____

MEDICAL HISTORY

PLEASE PRINT CLEARLY

List all medical conditions_____

_____

_____

Medications currently taking_____

_____

_____

List all allergies (environmental, food, and medical)_____

_____

_____

_____

Anything else EMS/doctors should know_____

_____

_____

REBREATHER CHECKLIST

Diver & Buddy		
Dive Site & Date		
DIVE PLAN		
Planned Depth 1 / Bottom Time 1		
Planned Total Runtime		
CCR BACK ASSEMBLY		
Pack Scrubber / Scrubber Time Remaining		
Install Scrims / Install Spider		
Install Scrubber Into Canister, Lube & Install O-Ring / Install Spacer		
Check Canister Head O-Ring / Install Canister Head		
Attach Blue Inhalation Hose / Attach Tan Exhalation Hose		
On-Board Oxygen Analysis O2% / Installed Right Side		
On-Board Diluent Analysis O2, HE% / Installed Left Side		
Attach O2 Supply Over Exhalation Hose / Secure Buzzer		
Inhalation Hose to T-Fitting / Exhalation Hose to T-Fitting		
CCR FRONT ASSEMBLY		
OCB Check / Breathing & 1-Way Directional Check		
Attach Mouthpiece Assembly / Mouthpiece Orientation		
Secure HUD / Secure OCB Hose to OCB		
Intermediate Pressure Check (O2: 7.5-8.0bar) / (Dil: 9.0-9.5bar)		
Attach Diluent Manual Add Valve / Attach O2 Manual Add Valve		
REBREATHER UNIT CHECKS		
Close OPV		
Positive Pressure Test / Negative Pressure Test		
Open OPV / Loop to Closed Circuit		
B1 Voltage / B2 Voltage		
Elapsed Time / Ambient Pressure		
C1 mV / C2 mV / C3 mV		
Sensors Calibration / Electronics Function Properly		
High Set Point / Switch Depth		
Low Set Point / Switch Depth		
Diluent % / Gradient Factors		
Set Backup Computer		

Reminder: Must Pre-Breathe 3-5 Minutes Before Diving

B.A.S.T. DEFINITION, IMPLEMENTATION, AND EXPLANATION

BAST is an acronym that stands for Buoyancy, Awareness, Stability, and Trim. These are the fundamental elements required of a scientific diver at the University of Miami. These elements are used during the evaluation process to evaluate a diver's readiness for scientific diving as a UM diver. Scientific divers diving under the auspices of UM are required to demonstrate each element to a satisfactory level.

Each BAST element is scored on a 1-5 scale and a total score is calculated by adding each of the four elements. A diver must earn a score of at least 12 points out of a maximum of 20 in order to pass. The diver does not pass the evaluation if any of his/her BAST scores receives a score of 1. If a diver receives a score of 1 on any element, the dive will be terminated. If a diver does not pass the BAST evaluation (<12 points total), corrective recommendations will be provided which shall include another BAST evaluation at a later date. BAST evaluation is scored over the duration of the entire dive. Although the UM DSO has developed this quantitative system for standardizing diver performance, this evaluation is subjective.

The overall BAST evaluation will follow the scoring rubric below (half points may be awarded).

- 5: a skill performed at a demonstration quality
- 4: a skill performed well but with some minor errors or omissions
- 3: a skill performed satisfactorily
- 2: a skill performed with considerable errors or omissions
- 1: a skill performed in an unsafe manner

Below is a description on how each element is evaluated during a checkout dive or other evaluation and what is considered a satisfactory performance level:

- Buoyancy – the diver must maintain neutral buoyancy within a target depth of +/- 3 feet at all times during the dive. To receive a 5, a diver must remain within +/-1ft of a target depth, with the majority of time spent at the target depth. A 3 will be awarded for a diver who remains within +/-3ft of a target depth, with the majority of time spent at the target depth. A 1 will be given to a diver who struggles with buoyancy, ascends or descends unintentionally, etc.
- Awareness – the diver must demonstrate awareness of his/her own equipment, team, surroundings, environment, etc. above and below the surface. A 5 will be awarded to a diver who demonstrates exceptional awareness of themselves, equipment, team, etc. A 1 will be given to a diver who fails to appropriately communicate with the team, loses contact with the team, demonstrates poor control of equipment, etc.
- Stability – the diver must remain in place without forward motion or the use of his/her hands. The diver must also demonstrate a reasonable level of comfort throughout the dive commensurate to the level of his/her authorization. To receive a 5, a diver must be able to hover in one position with no use of hands and no forward motion. A 3 will be awarded to a diver who uses minimal hand movement and minimal forward motion. A 1 will be given to a diver who relies on hands and forward motion for stability.
- Trim – the diver must remain horizontal (flat from shoulders to knees) throughout all parts of the dive. A 5 will be awarded to a diver who remains within 5º of horizontal throughout the entire dive. A 3 will be awarded to a diver who remains within 10º of horizontal. A 1 will be given to a diver who is unable to achieve and maintain a trim of 45º or less.

SAMPLE LETTER OF RECIPROCITY TEMPLATE

[Organization's Letterhead]

[DATE]

[Recipient]
[Recipient Organization Name]

This letter is to certify [Name of Diver] **is a currently authorized Scientific SCUBA Diver with the [Home Organization] Scientific Diving Program.** Our program is an Organizational Member of the American Academy of Underwater Sciences and has agreed to abide the AAUS diving standards.

The following is a brief summary of this diver's personnel file regarding dive status at [Home Organization].

Date of Original Authorization:	[Date]
Dive Physical due date:	[Date] (Old Standard)
Written Scientific Diving Exam Date:	[Date]
Max. Depth Rating:	[Depth] ft.
CPR Course Due Date:	[Date] (DAN DFA Pro)
Oxygen Admin. Course Due Date:	[Date] (DAN DFA Pro)
First Aid Course Due Date:	[Date] (DAN DFA Pro)
Total Number of Dives in Past 12 Months:	[Number of Dives]
Max. Depth in Past 12 Months:	[Number of Dives]
Date of Last Dive:	[Date]
Total Number of Dives, Career:	[Number of Dives]
Special Authorizations:	[Authorizations]
Equipment Service Due Date:	[Date]
Insurance Information:	[Workman's Compensation?]
	DAN# [XXXXXXX]

Emergency Contact Information: [Name] [Phone Number]

Diver's Name & Contact Info:

Sincerely,

[Home DSO Name]	[Date]
DSO NAME	Date

DSO Contact Information:

AUTHORIZATION REQUIREMENTS AND TRAINING RECORD

UM/RSMAS Scientific Diving Program

Name _____ Degree/Division _____
Date _____ Phone (Cell) _____ Phone (Office) _____
Email _____

Course taken: ILC*_____ EDC*_____ RSM500/600 _____ Other_____

***ILC = Intermediate Level Course EDC = Experienced Diver Checkout**

<u>BASIC DIVER CHECKOUT</u> – Minimum requirements for certified recreational divers to become UM/RSMAS authorized Scientific Divers in Training (DIT):

1. Complete the following forms and return them to the Diving Safety Office:

☐ Dive Resume	☐ Insurance	☐ Dive Log
☐ Physical	☐ State. Und.	☐ Copy of C-Card
☐ Med. Hist	☐ RSM500/600 SOP	☐ Field Trip/Consent
☐ Dive Log Registration		

2. Swimming test (date completed):_____

400 yd. swim time:_____ 400 yd. swim w/ MFS: _____

☐ 15 min. tread water ☐ 25 yd. u/w swim ☐ 15 ft Surface Dive

3. Personal equipment inspection. Date of Inspection:_____

4. Pool SCUBA Check Out: Date completed (if necessary): _____

5. OW Check Out Dive: Date Completed: _____ B: _____ A: _____ S: _____ T: _____

6. ECT/DFAPro completed within last 12 months Y/N (circle one). List date/agency below:

CPR/AED _____ FA _____

O2 _____ Neuro _____

7. UM Policies and Procedures – Date Passed (≥80%) _____

8. UM HazMat Training – Date Passed (≥80%) _____

<u>EXPERIENCED DIVER REQUIREMENTS</u> – Diver comes to UM with a minimum of 50 logged dives and/or has been trained as a science diver at another institution. Requirements include everything in Basic Diver Checkout plus the following:

VOT Received Y/N (Circle one) **Organization:** _____

9. UM Dive Planning – Date Passed (≥80%) _____

10. Science Diver Exam – If applicable, diver must pass written exam covering the topics listed below with a minimum score of 80% on each section.

Date: _____ Overall Exam Score: _____%

<u>RSM500/600 & ILC ADDITIONAL REQUIREMENTS</u> – To qualify as a fully authorized UM diver, all of the above must be completed AND the following lectures should be completed/attended. In addition to the above requirements, 12 OW training dives (see dive logs for details) must be completed.

Lecture Attendance/Completion (quiz date)

Pol & Pro: ______________________ DAN DFAPro: ______________________

Equipment: ______________________ Rescues: ______________________

Physics: ______________________ Dive Accident Management: ______________________

Physiology: ______________________ Environment/Navigation: ______________________

Dive Planning: ______________________

11. Subjective evaluation of students diving skills, water sense, safety attitude, mental and physical aptitude toward diving: ______________________

____

____

____

____

SCIENTIFIC DIVER AUTHORIZATION – Upon successfully completing the above requirements, the diver may be authorized to dive under the auspices of the University of Miami in one of the following categories depending on experience and ability:

______**Lead Diver Eligibility** – diver has logged at least 50 career dives and may be a Lead Diver to the depth level below. Divers with <50 dives may not lead dives.

______**Scientific Diver 30ft.** – authorization to dive to 30 ft. (max of 60ft. with a science diver authorized to a depth 60ft or deeper). May not lead dives beyond 30ft.

______**Scientific Diver 60ft**. – authorization to dive to 60 ft. (max of 100 ft. with a science diver authorized to a depth 100ft or deeper). May not lead dives beyond 60ft.

____

(Rick Riera-Gomez, UM/RSMAS Diving Safety Officer) Date

ΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘΘ

Additional Training/Authorization Record

Type of Training	**Date of Authorization**	**Comments**
Dive Computer		
Night Diving		
Nitrox		
60ft		
100ft		
DPV		

APPENDIX 5
DEFINITION OF TERMS

Active Scientific Diver – A UM student, staff, or faculty member in good standing with the University of Miami and that meets all requirements found in Section 4.50.

Air sharing - Sharing of an air supply between divers.

All Gas – A gas management strategy that allows divers to use all of their usable gas (see Usable Gas) during the dive.

Alternate Gas Supply - Fully redundant system capable of providing a gas source to the diver should their primary gas supply fail. See Independent Reserve Breathing Gas.

Arterial Gas Embolism (AGE) – A medical emergency that occurs when bubbles enter the bloodstream through damaged lung tissue obstructing the blood flow to an area of the brain, heart, or spinal cord.

Atmospheres Absolute (ATA) – , Total pressure exerted on an object, by a gas or mixture of gases, at a specific depth or elevation, including normal atmospheric pressure.

Auspices – The OM provides endorsement, protection, and support of the scientific diving program and scientific divers following the standards of the OM.

Authorization – An endorsement by an AAUS OM that a diver has met program requirements and is current, allowing the diver to dive under the auspices of the OM. If a diver's authorization has lapsed or is not complete or current for any reason, the diver is not permitted to dive under UM auspices. The DCB authorizes divers to dive using specialized modes of diving, and the depth they may dive.

Authorized Diver – A diver who has met and is current with all of the authorization requirements of an AAUS OM. See Authorization.

Awareness – The ability to directly know and perceive or be cognizant of events, equipment, gas pressure, surroundings, team, etc.

BAST – The acronym to describe the evaluation of a diver's Buoyancy, Awareness, Stability, and Trim.

Bottom Time – The time of a dive measured from the moment the diver submerges until the diver reaches the surface. Dives separated by a surface interval of less than 10 minutes will be counted as one dive and the time spent at the surface will not be included in the calculation of bottom time.

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

Bubble Check - Visual examination by the dive team of their diving systems, looking for O-ring leaks or other air leaks conducted in the water prior to entering a cave. Usually included in the "S" Drill.

Buddy Breathing - Sharing of a single air source between divers.

Buddy System -Two comparably equipped scuba divers in the water in constant communication.

Buoyancy – the ability or tendency to float in water. In the context of BAST, buoyancy is a measure of a diver's ability to remain at a target depth in the water column (+/- 1ft of target depth). See also: Neutral Buoyancy.

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

Cave Dive - A dive, which takes place partially or wholly underground, in which one or more of the environmental parameters defining a cavern dive are exceeded. If it is an overhead environment deeper

than 70ft or linear penetration more than 130ft from the entry point at the surface, it is considered a cave.

Cavern Dive **-** A dive which takes place partially or wholly underground, in which natural sunlight is continuously visible from the entrance. Caverns are shallower than 70ft and a cavern dive may not exceed 130ft of linear penetration from the entry point at the surface.

Certified Diver - A diver who holds a recognized valid certification from an AAUS OM or internationally recognized certifying agency. A diver with a valid "scientific diver certification" is not necessarily an active authorized science diver.

(Scientific Diver) Certification- A diver who has completed the training outlined in Section 4.0 at an AAUS member organization. Throughout this manual a certification, unless explicitly noted that it is for an internationally recognized training agency, simply means that a diver has completed initial science diver training. Divers must be authorized to be permitted to conduct diving under UM auspices.

Checkout Dive – A dive conducted by the DSO or designee to evaluate a diver's BAST performance, comfort, and general diving ability. The checkout dive allows divers to meet the minimum diving requirements (Section 4.50) to maintain active authorization.

Contingency Gas – The amount of gas required for a diver and his/her buddy to make a safe ascent to the surface (or next gas supply) including stops required by the predetermined ascent strategy, on one gas supply.*Controlled Ascent* - Any one of several kinds of ascents including normal, swimming, and air sharing 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 gases.

DCB – See Diving Control Board.

Decompression Illness (DCI) – An umbrella term describing all DCS and Lung Overexpansion Injuries.

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

Decompression Stop – The designated depth and time at which a diver must stop and wait during an ascent from a decompression dive. The depth and time are specified by the decompression table, computer, or software in use.

Deep Stops – An ascent strategy where divers make a one minute stop beginning at half of the maximum depth reached on the dive and then ascending by stopping every 10 feet for one minute at each 10ft increment all the way to the surface.

Designated Person-In-Charge – Surface Supplied diving mode manning requirement. An individual designated by the DCB or designee with the experience or training necessary to direct, and oversee in the surface supplied diving operation being conducted.*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 that 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 Location - A surface or vessel from which a diving operation is conducted.

Dive Site - Physical location of a diver during a dive.

Dive 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.

Diver – A person who stays underwater for periods of time by having compressed gas supplied from the

surface or by carrying a supply of compressed gas.

Diver-In-Training (Scientific Diver Candidate) - An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.

Diver Propulsion Vehicle (DPV, Scooter) – DPVs are electronically powered device used to transport divers through the water. They are primarily used to benefit divers on large dive sites or sites with strong currents as an alternative to a diver swimming/finning.

Diving Control Board (DCB) - Group of individuals who act as the official representative of the membership organization in matters concerning the scientific diving program (see Diving Control Board under Section 1.0).

Diving Mode - A type of diving required specific equipment, procedures, and techniques, for example, snorkel, scuba, surface-supplied air, or mixed gas.

Diving Safety Officer (DSO) - Individual responsible for the safe conduct of the scientific diving program of the membership organization (see Diving Safety Officer under Section 1.20).

DPIC – See Designated Person-In-Charge.

DPV – See Diver Propulsion Vehicle

EAD - Equivalent Air Depth (see below).

Emergency Care Training (ECT) – See Section 4.50.

Emergency Swimming Ascent - An ascent made under emergency conditions where the diver may exceed the normal ascent rate.

Enriched Air (EANx) - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term "nitrox" (Section 6.00).

Equivalent Air Depth (EAD) - Depth at which air will have the same nitrogen partial pressure as the nitrox mixture being used. This number, expressed in units of feet seawater or saltwater, will always be less than the actual depth for any enriched air mixture.

Flooded Mine Diving - Diving in the flooded portions of a man-made mine. Necessitates use of techniques detailed for cave diving.

fO_2 - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

FSW - Feet of seawater.

Functionality Test (Functionality Check/Inspection) – The evaluation of a piece of equipment or part to verify and demonstrate that it is in proper working order.

Gas Management - Gas planning rule which is used in cave diving environments in which the diver reserves a portion of their available breathing gas for anticipated emergencies (see Rule of Thirds, Sixths).

Gas Matching – The technique of calculating breathing gas reserves and turn pressures for divers using different volume cylinders. Divers outfitted with the same volume cylinders may employ the Rule of Thirds for gas management purposes. Divers outfitted with different volume cylinders will not observe the same gauge readings when their cylinders contain the same gas volume, therefore the Rule of Thirds will not guarantee adequate reserve if both divers must breathe from a single gas volume at a Rule of Thirds turn pressure. Gas Matching is based on individual consumption rates in volume consumed per minute. It allows divers to calculate turn pressures based on combined consumption rates and to convert the required reserve to a gauge based turn pressure specific to each diver's cylinder configuration.

GUEEDGE – Acronym for pre-dive briefing sequence. (See Section 2.20 for details)

Guideline - Continuous line used as a navigational reference during a dive leading from the team position to a point where a direct vertical ascent may be made to the surface.

Half Gas – A gas management strategy where returning to the entry point is desired but not required. Divers use half their usable gas (see Usable Gas) for the first half of the dive and the other half on the return to the exit point.

Half Stops – An ascent strategy where divers make a one-two minute stop at half of the maximum depth reached on the dive and then ascend at a rate not exceeding 30 feet per minute to 10-20ft and stay for 3-5 minutes before surfacing.

Hookah - While similar to Surface Supplied Diving in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for the monitoring his/her own depth, time, and diving profile.

Hyperbaric Chamber - See Recompression Chamber.

Hyperbaric Conditions - Pressure conditions in excess of normal atmospheric pressure.

Hypoxia – Insufficient partial pressure of oxygen in a diver's body.

Hypoxic Gas Mixes – A breathing gas mixture that contains less than 20% oxygen.

Independent Reserve Breathing Gas - A diver-carried independent supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another diver.

Jump/Gap Reel - Spool or reel used to connect one guide line to another thus ensuring a continuous line to the exit.

Life Support Equipment – Underwater equipment necessary to sustain life.

Lead Diver - Authorized scientific diver with experience and training to conduct the diving operation.

Letter of Reciprocity (LOR) – A letter from the home institution containing a scientific diver's scientific diving credentials including dates, agencies, special authorizations, insurance information, etc. The LOR establishes responsibility for the diver by the home institution.

Manifold with Isolator Valve - A manifold joining two diving cylinders, that allows the use of two completely independent regulators. If either regulator fails, it may be shut off, allowing the remaining regulator access to the gas in both of the diving cylinders.

Minimum Gas – See Contingency Gas.

Mixed Gas - Breathing gas containing proportions of inert gas other than nitrogen greater than 1% by volume.

Mixed Gas Diving – A diving mode in which the diver is supplied in the water with a breathing gas other than air.

Mixed Mode Diving – A dive where two or more divers are using different diving modes or technologies, for example a rebreather diver diving with an open circuit diver.

MOD - Maximum Operating Depth, usually determined as the depth at which the pO_2 for a given gas mixture reaches a predetermined maximum.

Neutral Buoyancy – A diver or an object that neither sinks nor floats at a given depth.

Nitrox - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term Enriched Air Nitrox, abbreviated EAN. (See Section 6.00)

Normal Ascent - An ascent made with an adequate air supply at a rate of 30 feet per minute or less.

Normoxic – A breathing gas mixture other than air (most commonly trimix) that contains 21% oxygen.

Organizational Member (OM) - An organization which is a current member of AAUS, and which has a program, which adheres to the standards of AAUS as set forth in this manual.

OTU - Oxygen Toxicity Unit

Oxygen Compatible - A gas delivery system that has components (O-rings, valve seats, diaphragms, etc.) that are compatible with oxygen at a stated pressure and temperature.

Oxygen Service - A gas delivery system that is both oxygen clean and oxygen compatible.

Oxygen Toxicity - Any adverse reaction of the central nervous system ("acute" or "CNS" oxygen toxicity) or lungs ("chronic", "whole-body", or "pulmonary" oxygen toxicity) brought on by exposure to an increased (above atmospheric levels) partial pressure of oxygen.

Penetration Distance - Linear distance from the entrance of an overhead environment used by a dive team to the maximum distance reached by the team during a dive. This distance is not measured from the surface.

pO_2 - Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

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.

Pressure Vessel - See cylinder.

Primary Reel - Initial guideline used by the dive team from open water to maximum penetration or a permanently installed guideline.

Proficiency Dive – A non-scientific (and non-scientific training) dive conducted under the auspices of UM. For a dive to be considered a proficiency dive, a dive plan must be submitted and approved and basic skills (BAST, finning techniques, etc.) must be performed/practiced during the dive.

Psi - Unit of pressure, "pounds per square inch."

Psig - Unit of pressure, "pounds per square inch gauge."

Reciprocity – Acknowledgement by diving programs that similar minimum standards are followed and qualifications have been met.

Recompression Chamber - A pressure vessel for human occupancy. Also called a hyperbaric chamber or decompression chamber.

Recreational Diving – Diving conducted solely for recreational, leisure, or enjoyment purposes or any diving outside the auspices of an AAUS OM.

Restriction - Any passage through which two divers cannot easily pass side by side while sharing air.

Rule of Thirds - Gas planning rule which is used in overhead environments in which the diver is required to return to the point of entry. When using the rule of thirds, divers use one third of their usable gas

going into the overhead environment, one third to return, and the final third for emergencies for themselves and buddies. .

Rule of Sixths - Air planning rule which is used in cave or other confined diving environments in which the diver reserves 5/6's of their usable gas supply (for DPV use, siphon diving, etc.) for exiting the cave or cavern.

Safety Drill - ("S" Drill) - Short gas sharing, equipment evaluation, dive plan, and communication exercise carried out prior to entering a cave or cavern dive by the dive team.

Safety Reel - Secondary reel used as a backup to the primary reel, usually containing 150 feet of guideline that is used in an emergency.

Safety Stop – A 3-5 minute voluntary pause at 10-20ft during the diver's ascent.

Saturation Dive – An exposure of sufficient duration so that gases in the diver's body reach equilibrium with the environment; once this occurs, the decompression time required at the end of the dive does not increase with the additional time spent at depth; the diver works out of a habitat or other pressurized chamber.

Scientific Diving - Scientific diving is defined (29CFR1910.402) 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.

Scooter – See Diver Propulsion Vehicle.

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

Servicing (Equipment Servicing) – The disassembly, cleaning, and replacement of parts and components performed by a qualified service technician. Equipment servicing must meet the manufacturer's specifications and guidelines.

Side Mount - A diving mode utilizing independent SCUBA system(s) carried along the sides of the diver's body; every system of which always has sufficient air to allow the diver to reach the surface unassisted.

Siphon - Cave into which water flows with a generally continuous in-current.

SMB – See Surface Marker Buoy.

Solo Diving – Any diving conducted where any diver is not in direct communication with a buddy. Solo diving is strictly prohibited under UM auspices.

Stability – The ability of a diver to maintain position in the water without forward motion and without the use of his/her hands.

Staged Decompression Diving - Decompression diving where a diver uses various gas mixtures at different depths/stages during the ascent to increase safety and efficiency.

Standby Diver - A diver at the dive location capable of rendering assistance to a diver in the water.

Surface Marker Buoy (SMB) – An inflatable device 3-6 feet in length made with a highly visible coloration that is carried by a diver and used to mark the diver's underwater location for team members on the surface.

Surface Supplied Diving - A mode of diving where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face

mask. The diver may rely on the tender at the surface to keep up with the divers' depth, time, and diving profile.

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

Tender - Used in Surface supplied and tethered diving. The tender comprises the topside buddy for the in-water diver on the other end of the tether. The tender must have the experience or training to perform the assigned tasks in a safe and healthful manner.

Trim – The ability of a diver to be horizontal/flat in the water from his/her shoulders to knees. In the context of BAST, proper trim is within 5º of horizontal.

Turn Pressure – The gauge reading of a diver's open circuit scuba system designating the gas limit for terminating the dive and beginning the exit from the water.

Umbilical - Composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies a diver or bell with breathing gas, communications, power, and/or heat, as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

Usable Gas – The amount of gas remaining after calculating Contingency Gas. Usable Gas is calculated by subtracting the Contingency Gas pressure from the starting pressure of a cylinder.

Verification of Training Letter (VOT) – A letter from the home institution containing a scientific diver's scientific diving credentials including dates, agencies, special authorizations, insurance information, etc. The VOT provides the receiving institution with the diver's credentials. The VOT does not address insurance requirements.

APPENDIX 6
RSM500/600 STANDARD OPERATING PROCEDURES

Course Prerequisites

Students must:

1. Be a student, staff, or faculty of the University of Miami.
2. Certified as a recreational diver with an internationally recognized certification agency.
3. Have completed at least 10 open water dives.
    a. 2 of those 10 dives must be within 6 months of course start date
4. Pass a diving physical exam.
    a. The exam must be completed using UM or equivalent dive physical form.
    b. All tests listed on the form must be reviewed and initialed by the physician conducting or overseeing the exam.
    c. A physician must sign the physical exam forms. Forms signed by other medical professionals will not be accepted.
5. Pass a swim test. All elements of the swim test must be completed on the same day, except for the underwater (U/W) swim. Students who pass less than 60% of the swim test will be asked to drop the class and/or take it another time after they have had a chance to work on their swimming.
    a. 400 yard unaided swim in 12 minutes or less. Students may use swim goggles or mask for the 12 minute swim. Any stroke may be used. This is intended to be a continuous swim so stopping is not allowed.
    b. Tread water for 15 minutes with no added swim aids or floatation.
    c. Surface dive to 15ft. Goggles or mask are permitted.
    d. Swim 25 yards underwater on a single breath. A student will receive a PASS for the U/W swim when completing 100% of the distance completely underwater.
        i. The underwater swim must be completed without pushing off the wall.
        ii. Weights may be used for the underwater swim if needed to stay completely submerged. If weights are used for the u/w swim, the diver candidate must use the same amount of weight for the 15 minute water tread.
        iii. Students may attempt the underwater swim 3 times before being asked to move on to the next element of the swim test.
    e. 400 yard swim in 8 minutes or less with mask, fins, and snorkel. Use of arms is not allowed. This is intended to be a continuous swim so stopping is not allowed.
    f. Transport a passive person of equal size a distance of 25 yards (23 meters) in the water. This element of the swim test may be completed at a later date.

General Student Expectations and Responsibilities

1. Students must abide by the University of Miami's Honor Code at all times. The Honor Code can be found at https://doso.studentaffairs.miami.edu/units/undergraduate-honor-council/honor-code/
2. Students are expected to act in a safe, responsible manner at all times.
3. Students are expected to be on time and ready to learn at the beginning of class.
4. Cell phone use is prohibited during class. Phones are to be silenced/turned off and put away during class.
5. Laptops are permitted only if used for taking notes. Using laptops for email, social media, or any other non-class related activity is strictly prohibited.
6. Students are responsible for transportation to all course activities.
7. Students are required to have insurance that covers hyperbaric oxygen therapy. This requirement can be met in one of two ways:
    a. Personal health insurance – students are responsible for verifying that their insurance covers this treatment.
    b. Join the Diver's Alert Network (DAN) and purchase dive accident insurance. The plan that meets this requirement is the Master Plan or higher.
8. Students are responsible for any information missed because of an absence, whether excused or unexcused.
    a. Rescheduling of exams will be handled on a case by case basis.
    b. There are no make-ups for missed quizzes: a missed quiz earns a 0.
    c. There are no make-ups for missed pool scuba sessions.
9. This class is a progression of steps in the classroom and in the pool so attendance is imperative. Students are requested to notify the DSO for any anticipated absences.
10. Students are strongly encouraged to come to the DSO throughout the semester to discuss and review course performance (includes academic and video review).
11. Students are responsible for any and all UM equipment they borrow or are assigned. This includes the equipment care, maintenance, and return at the end of usage. If a piece of equipment is damaged, lost, stolen, or in any way returned in a condition other than the condition received from the DSO, students will be financially responsible for its repair or replacement. Equipment is expected to be returned within a week of your last planned dive unless other arrangements have been made with the DSO.
    a. Students are responsible for notifying the DSO of any equipment maintenance issues and bringing the equipment in need of repair to the DSO as soon as possible for repair or replacement.
    b. Students are not permitted to use DSO issued gear during the semester for proficiency dives until they are fully authorized (final grades submitted).
    c. Using DSO issued gear for recreational diving is not permitted.
12. Students may dive with a project after completing a minimum of 10 dives with the DSO. The student will be considered a Diver in Training (DIT) until all authorization and course requirements are satisfactorily met. For more information about diving authorizations, refer to Section 4.30 of the UM Diving Safety Manual (DSM).
    a. Students are permitted to use DSO issued gear for internships, project dives, etc. prior to final grade submission (pending approval of a UM dive plan).
13. During the semester, the DSO will continuously monitor the weather and diving conditions and will notify students ASAP of changes in the semester syllabus. The decision to dive or cancel the dive will sometimes have to be made the day of the dive.
    a. When diving offshore and the forecasted winds are greater than 15kts and/or seas greater than 2-4 ft wave height, dives will be cancelled.

    b. Dives will be cancelled when a small craft caution or greater is issued by NOAA.
    c. Other environmental conditions or hazards may also be cause for cancellation of a dive(s).
14. Students are responsible for logging all open water dives on the dive logging website in a timely manner.
15. If a student is not confident in his/her health, fitness, or readiness to dive, he/she is responsible for withdrawing from diving activities.
16. Students may dive deeper than their authorization depth or be introduced to specialized equipment and techniques with the DSO during this course to achieve training goals. These training/experience dives may not result in depth or specialized dive technology/technique authorization.
17. Due to the physical nature of dive training and related activities, physical contact is common. Instructors may need to make physical contact in order to correct diving technique or otherwise provide instruction. By registering for this course, the student understands that at times, for proper instruction and safety, physical contact is required and necessary.
18. The DCB/DSO expressly reserve the right to prohibit any student from taking the class.
19. During the semester, a student may be asked to not participate in in-water activities at any time due to unsafe behavior above or below water, lack of participation, absences, or any other conduct/action deemed inappropriate by the DCB/DSO.

Academics and Authorization

Academic Grades:

Academic grade will be made up of 2 grades:

1. Written Exams grade (50%) - There will be 2 written exams and some quizzes. The exam and quiz grades will be combined to make up the final written grade.
    a. Quiz grade (5%) Quizzes cover the Computer-Based Learning (CBL) modules from the first part of the semester. A missed quiz earns a 0. All quizzes combined make up 5% of the overall grade.
    b. Mid-term diving exam (25%) The midterm exam will be on the SCUBA topics that we cover during the first half of the course. To qualify for UM/RSMAS diving authorization, a diver candidate must receive a minimum grade of 80% on each section of the mid-term diving exam.
    c. Final science techniques exam (20%) The final exam will cover the topics discussed after the mid-term exam as well as the readings posted on Blackboard. The final exam is not a cumulative grade. The final written exam will be conducted underwater in the pool. Details will be discussed in class.
2. Scuba Skills grade (50%) – This part of the course grade is an evaluation of scuba skills students learn and practice throughout the semester. Students are evaluated on 20 skills with each skill graded on a 1-5 scale (5 being the highest possible score) with half-point increments. DSOs score each diver and each skill individually and students receive the average of both instructors' scores. This grade is subjective and based on diver safety, ability to perform skills, attentiveness, effort, and ability to follow directions. Students must receive a score of 80% or higher by all DSOs to be authorized as UM Scientific Divers. Below are the point values awarded for skill performance.
    a. 5: a skill performed at a demonstration quality
    b. 4: a skill performed well but with some minor errors or omissions
    c. 3: a skill performed satisfactorily

d. 2: a skill performed with considerable errors or omissions
e. 1: a skill performed in an unsafe manner

Students unable to complete the scuba skills portion of the course for any reason may receive an academic grade for their transcripts but will not receive authorization as a UM Scientific Diver until all the authorization requirements are met.

This is not a recreational dive course, the goals are not to achieve certifications, so do not expect recreational certification cards for this course.

UM Scientific Diver Authorization:

To be authorized as a UM Scientific Diver, ALL authorization requirements have to be satisfactorily completed. Students may earn an academic grade without attaining UM science diver authorization. For more details refer to the UM Diving Safety Manual. Enrolling in and completing the course does not automatically guarantee UM science diver authorization. Authorization must be earned!

During this course, there are two primary objectives students will be working to achieve:

1. Academic grade for transcripts
2. UM scientific diver authorization

Media Waiver:

Students voluntarily give the Diving Safety Office and the University of Miami consent to use photos, videos, and likeness on the Dive Office website, facebook, Instagram, posters, newsletters, brochures, UM/RSMAS website, and any other publication that the Diving Safety Office, or the University of Miami may choose. If a student does not agree to this, he/she must submit a dissent in writing (printed or electronic) to the Dive Office.

Situations not covered in this SOP will be handled on a case-by-case basis in accordance with the UM Diving Safety Manual.

APPENDIX 7
EMERGENCY ACTION PLAN

Introduction

The information contained in this manual is a simplified system of identifying and stabilizing diving accident victims and facilitating entry into the hyperbaric trauma care system. Divers may ignore their own mild symptoms of Decompression Illness (DCI) in the early stages and by doing so they may develop more serious symptoms. Although primarily intended as a treatment guide for University diving operations in the field, this manual can also be used to insure that paramedics, physicians, Coast Guard and other assisting personnel understand and perform the specialized procedures for handling diving accident cases.

A diving accident victim could be any person who has been breathing compressed gas underwater regardless of depth. It is essential that emergency procedures are pre-planned and that medical treatment is initiated as soon as possible. It is the responsibility of the University of Miami to develop procedures for diving emergencies including evacuation and medical treatment for each dive location.

General Procedures

Depending on and according to the nature of the diving accident:

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway (B)reathing (C)irculation or (C)irculation (A)irway (B)reathing as appropriate
3. Stabilize the victim.
4. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).
5. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians. Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.
6. Call **DAN (919-684-9111)** for contact with diving physician and recompression chamber, etc.
6. Notify DSO or designee according to the Emergency Action Plan of the OM.
7. Complete and submit the University of Miami Incident/Accident form found online at https://business-services.miami.edu/departments/risk-management/forms/new-accident-form-september-2016.pdf.
8. Complete and submit Incident Report Form (www.aaus.org) to the UM DCB and AAUS (Section 2.70 Required Incident Reporting).

GENERAL POLICY

Introduction

1. Development of exact procedures to cover all possible emergency situations can not be accomplished in this manual because of the immense number of variables involved (e.g., differences in diving location, personnel, available medical facilities, transportation, etc.).
2. This section is intended to serve as a planning guide for University divers to formulate specific procedures for their operations. Supervisory personnel, under direction of the Diving Safety Officer, must use judgment in selecting procedures which best suit the nature of their operation.
3. Detailed accident management and first aid techniques may be found in the NOAA Diving Manual, Red Cross manuals, DAN First Aid manual, and many other approved publications.

Preparedness

1. All supervisors and team members must be prepared to respond properly in the event of an accident. Prompt emergency procedures can reduce the residual effects on the victim and can possibly save a life.
2. Periodic retraining and routine practice are essential elements in emergency preparedness; emergency drills are encouraged.
3. The importance of prevention through operations planning, following safety regulations, and using common sense cannot be overemphasized.

ON-SITE ACCIDENT MANAGEMENT

Rescue/first aid

1. The persons nearest the victim (in scuba & usually the buddy), will initiate rescue/recovery procedures.
2. The rescuer will signal for assistance (voice, whistle, flare, etc.)
3. If the victim is not breathing, the rescuer should consider providing two initial rescue breaths. Rescuer will tow the victim to the appropriate extraction point.
4. Once on a suitable platform, resuscitation must be continued with a minimum of interruption and not be discontinued until the victim resumes breathing, is turned over to a higher authority, or is pronounced dead by a physician.
5. The Lead Diver, next senior diver, or ship's captain will take charge of the scene and delegate tasks to other responsible individuals. Other team members, if available on site will be dispatched by the Lead Diver to assist in the rescue efforts.
6. If a gas embolism or decompression sickness is suspected and the victim is breathing, immediately begin prescribed first aid (supine position, administer oxygen, fluids (water) if conscious and alert, treat for shock, and keep under constant observation).

Summoning Aid: Miami area

1. Divers in the Miami area should radio US Coast Guard on VHF channel 16 or local EMS by cellular phone (911) and indicate that you have a "scuba diving emergency and need a recompression chamber".
2. Inform the USCG/EMS that you are evacuating the victim to the nearest accessible dock, where that dock is, and they should contact the South Florida Hyperbaric Medical Center 1 800 NO BENDS to activate the recompression chamber.
3. Monitor your VHF or keep your cellular phone on and stay in contact with the USCG/EMS for the duration of the emergency.
4. The USCG/EMS may direct you to take the victim somewhere besides the place you indicated. Cooperate with them.
5. Attempt to contact the RSMAS Diving Safety Office via VHF or cellular phone.
6. If unable to contact USCG on VHF or cellular phone, use VHF marine operator on channel 24 or 25 to place a telephone call to South Florida Hyperbaric Medical Center 1 800 NO Bends or the Dade County Fire Rescue at 911.

At Sea on Research Vessels:

1. Divers:
    a. Immediately advise ship's Master of the situation and request assistance as needed.
    b. Administer first aid to victim (oxygen, supine position, fluids (water) <u>if conscious and alert</u>, treat for shock, monitor vitals).
    c. Consult emergency plan for instructions.
    d. Keep ship's captain comprised of the situation as it progresses.
    e. Conduct neurological exam on patient, if possible, and record results on exam form.

2. Ship's Master:
    a. Contact the Divers Alert Network (DAN) and be specific about the accident: "this is a scuba diving accident requiring a recompression chamber". DAN will provide nearest operational chamber info. and will help coordinate transportation.
    b. Stay in contact with divers and get neurological exam results from them on the patient.
    c. Give physician at DAN as accurate a description as possible about the condition of the patient.
    d. Make plans for possible evacuation of patient to chamber, whether it be helicopter evac or steaming to port.
    b. Obtain important information from the victim, i.e., passport, consent to treat form.
3. Persons/organizations to be notified:
    a. Victim's family (to be notified by UM authorities)
    b. DAN (for medical advice, evacuation procedures)
    c. UM/RSMAS authorities (Diving Safety Officer)
    d. Recompression chamber

<u>On-site Care of Diving Casualty</u>

1. If an asymptomatic emergency is managed at the scene & hospitalization or professional medical attention are not required:
    a. Provide victim with emergency numbers for diving physician, local medical facility, etc.
    b. Do not let the victim drive or be alone for the next six hours.
    c. In the event of a drowning, the victim must be taken to a hospital as soon as possible for further evaluation by a medical professional.
2. Any person resuscitated at the dive site must be transported to a medical facility for follow up examination/treatment, preferably by a hyperbaric physician.

Additional On-Site Procedures While Awaiting Aid/Transport:

1. Recall all divers in the water, terminate all diving operations, secure equipment, be certain all dive team members are accounted for.
2. Non-involved dive team members shall stand by and not interfere with emergency efforts.
3. Diving operations shall not resume until the appropriate emergency equipment and personnel are back at the dive site.
4. Designate team members to control crowds or bystanders, keep non-essential personnel away from the victim and first aid providers, instruct dive team members not to mingle with bystanders and not to discuss the accident with anyone (especially in a beach/shore operation), do not allow any dive team members to leave until dismissed by the Lead Diver or Diving Safety Officer. In fatal or serious accidents, authorization from local law enforcement officers will be required for dismissal of witnesses.

EMERGENCY EVACUATION GUIDELINES

General: The following medical evacuation information should be forwarded with the patient. If possible, take time to explain the following steps to the physician or paramedic. Do not assume they understand the reasons why procedures such as administration of oxygen to a diving casualty must be performed. Call the Divers Alert Network (919) 684-9111 (you can also call South Florida Hyperbaric Medical Center 800-662-3637 (800 NO BENDS)) for medical consultation if doubt exists that the physician/hospital possess the competence to handle a diving accident.

1. Maintain breathing and heart functions, ensure an open airway. If CPR is being administered, there must be an absolute minimum of interruption during transfer.
2. Keep patient on oxygen and in supine position during transport.
3. Ensure paramedics/physician understand why the patient must be taken to a recompression chamber, and why #2 is important.

4. Do not stop giving oxygen to patient unless there is a need to reopen the airway, or patient show signs of oxygen convulsions.
5. Treat for shock (lay patient supine, elevate patient's legs, keep patient comfortable).
6. Do not give any pain killing drugs.
7. Instruct flight crews to fly as low as possible (below 1000 ft. is preferred).
8. If possible, the dive buddy should also be transported with the victim because he/she may also need recompression and can give valuable information about the dive profile.
9. A complete history of all events leading to the accident should be forwarded with the patient.
10. Victim's dive gear should be properly tagged and sent with the victim or at least set aside without tampering, especially if the accident was fatal.

Evacuation by Air: Each helicopter evacuation presents unique problems. Knowing what to expect and the procedures to follow, however, can save time, effort, and perhaps a life.

1. Request a helicopter with a medic crew and oxygen.
2. Try to establish communications with the helicopter.
3. If possible, maintain a speed of 10-15 knots into wind about 20 degrees off the port bow.
4. Put all antennas down, if possible, without losing communications.
5. Secure all loose objects on or around the decks because of the strong winds generated by the helicopter.
6. Make sure the patient is ready in advance of the transfer.
7. Signal the pilot when all is ready, using hand signals in daylight and flashlight signals at night.
8. Do not secure the trail line, basket, or any cable from the aircraft to the boat.
9. Always let the lifting device (stretcher) touch the boat before handling it, to prevent electric shock.
10. Place a lifejacket on patient and tie them in basket face up.
11. Attach personal information such as name, address, age, next of kin, what happened, medication administered, drug allergies.

LEGAL CONSIDERATIONS

Responsibility: Serious accidents and fatalities often lead to legal actions. Each diver has a responsibility as a representative of the University, to act in a responsible manner, both for the benefit of the University and him/herself.

Guidelines for serious accidents:

1. Contact local law enforcement authorities
2. Be polite but firm regarding interviews and questions. If approached, simply indicate that information will be made available through the University's Diving Safety Office. Remember that any statement made under stress may later cause considerable problems for members of the dive team including yourself, University, and victim.
3. The Lead Diver should serve as spokesman for the group if necessary.
4. Give only factual information to authorities. Avoid expressing opinions or conclusions under stress.
5. Have each dive team member prepare a detailed written statement of the facts. Do it as soon as possible the day of the accident.
6. The Lead Diver should complete the Accident Report form for the Diving Control Board as soon as possible.

EMERGENCY ASSISTANCE PHONE NUMBERS FOR THE MIAMI AREA

RECOMPRESSION CHAMBERS:

At Mercy Hospital (Miami, FL)	1-800-NO BENDS
Mercy Hospital Hyperbaric Dept.	305.854.0300
	305.854.2466
Mercy Hospital Emergency Room	305.854.4400
Dade County Fire Rescue	911
Diver's Alert Network (DAN) Emergency	1.919.684.9111
Diver's Alert Network (DAN) Non-Emergency	1.919.684.2948

HOSPITALS:

Mercy Hospital Hyperbarics Dept.	305.854.0300
UM/Jackson Memorial Hospital Emergency Room	305.585-1111

AMBULANCE:

Dade County Fire Rescue	911

AIR TRANSPORTATION:

US Coast Guard, District Operations Off., Miami, FL	305.536.5611
VHF Radio	channel 16
USCG Emergency Phone, Miami, FL	305.535.4313

POLICE:

General, Miami	911
Key Biscayne police (non- emergency)	305.365.3013
Key Biscayne police (24 hrs.)	305.585.6666

UNIVERSITY OF MIAMI:

RSMAS Diving Safety Office	305.421.4107
Rick Riera-Gomez	305.338.1445
Marine Dept.	305.421.4880

CARE FOR THE INJURED DIVER

Decompression Illness (DCI) which includes arterial gas embolism (AGE) and decompression sickness (DCS), are the two most frequent serious scuba-related accidents. AGE, also known as air embolism, occurs when bubbles entering the bloodstream through damaged lung tissue obstruct the blood flow to an area of the brain, heart, or spinal cord. DCS, also known as the "bends", is the syndrome of joint pains (the bends), paralysis, numbness, and other symptoms resulting from insufficient decompression or surfacing too rapidly from a dive. If not treated, both conditions can be fatal.

A diving accident victim may be any person who has been breathing a compressed gas underwater regardless of depth or time. Gas embolism can occur in as little as four (4) feet of water if one ascends holding his/her breath. Even a well-trained diver may encounter problems because of respiratory problems. Asthma, broncholithiasis, congenital or acquired cysts, emphysema, fibrosis, tuberculosis, infection and obstructive lung diseases may result in air-trapping in the alveoli during ascent. The expansion of trapped air may be sufficient to rupture air spaces and escaping air may cause emphysema of the lungs, mediastinum or neck. More serious problems of pneumothorax or arterial gas embolism may also result.

Decompression sickness can occur in any individual who violates the decompression tables either willingly or unintentionally when surfacing from depths greater than 30 feet. Cases of DCS have also been reported where divers were diving within the no-decompression limits.

To insure a successful treatment, instructors, dive masters, paramedics, emergency room personnel, and physicians must be able to recognize the problem and begin the proper treatment while arranging entry into the hyperbaric trauma system.

In any situation suggesting a diving accident, the primary question is "Did the subject breathe compressed gas underwater?" If the answer is "yes", or if the victim is unconscious then the subject must be regarded as a diving accident victim. The treatment procedure must be initiated immediately. This includes basic life support, administering oxygen, supine position, and immediate evacuation to the recompression chamber complex.

LUNG OVEREXPANSION INJURIES

Arterial Gas Embolism (AGE)

As a diver surfaces without exhaling, air trapped in the lungs expands and may rupture lung tissue releasing gas bubbles into the circulatory system where they may be distributed to the body tissues. The ascending diver is normally in a vertical position and the bubbles tend to travel upward toward the brain, eventually reaching a small artery blocking circulation. The effects of halting circulation to the brain are critical and require immediate treatment. Symptoms of embolism may be present when the victim reaches the surface or within a few minutes afterwards.

CAUSES: Holding breath during ascent while breathing compressed air

Lung disease causing air trapping

	Diving with cold, chest congestion
	Airway obstruction from foreign object in the mouth; gum, etc.
SYMPTOMS:	Unconsciousness within 5 minutes of surfacing from a dive
	Dizziness, staggering
	Visual disturbances
	Paralysis
	Bloody froth from the mouth/nose
	Respiratory arrest

***Note**: Symptoms usually appear within 15 minutes after surfacing.*

PREVENTION:	Always breathe normally during ascent
	Get a periodical medical examination by a hyperbaric physician
	Do not dive with cold or chest congestion
	Do not chew gum, tobacco, etc. while diving
TREATMENT:	Supine position
	Administer 100% oxygen
	Administer fluids(water), to conscious, alert victim only.
	Do initial neurological exam
	Evacuate to recompression chamber/hospital ASAP
	DO NOT ATTEMPT IN-WATER TREATMENT

Pneumothorax

Air enters the chest cavity causing lungs to collapse.

CAUSES:	Same as Gas embolism
SYMPTOMS:	Shortness of breath
	Sharp pain in chest
SIGNS:	Rapid shallow breathing
	Blueness of skin, lips, fingernails
	Lungs sound different from one side to the other
PREVENTION:	Same as Gas embolism

TREATMENT:	ABC's, give O2, treat for shock, Do NOT use recompression without a chest tube. Physician will insert chest tube to with draw air and re-inflate lung

Mediastinal Emphysema

Air released into tissues surrounding the heart.

CAUSES:	Same as Gas embolism
SYMPTOMS:	Faintness
	Shortness of breath, difficulty breathing
	Pain under breastbone
PREVENTION:	Same as Gas embolism
TREATMENT:	ABC's
	Observe for other problems
	Administer oxygen
	Treat for shock
	Seek medical advice from hyperbaric physician

Subcutaneous Emphysema

Air trapped under skin around neck.

CAUSES:	Same as AGE
SYMPTOMS:	Feeling of fullness around neck
	Change in voice
	Swelling in neck
	Crackling sound when skin is pressed
PREVENTION:	Same as AGE
TREATMENT:	Check ABC's
	Call the Diver’s Alert Network
	Administer oxygen
	Treat for shock
	Seek medical advice from hyperbaric physician

Note: If any doubt about injury being more complicated than just Subcutaneous Emphysema, treat as Gas embolism.

DECOMPRESSION SICKNESS

Decompression sickness (bends) is the result of inadequate decompression following a dive. While immediate recompression is not usually a matter of life or death as with air embolus, the quicker recompression is initiated, the better the rate and extent of recovery. The body tissues absorb gas in proportion to the surrounding pressure (depth) and as long as the diver remains at pressure (depth), the gas presents no problem. If the pressure is released too quickly (surfacing too rapidly or omitting required decompression), the inert gas comes out of solution and forms bubbles in the tissues and blood stream.

Mild DCS (USN Classification Type I)

Mild symptoms may respond to oxygen treatment at the scene. Fatigue (mild), skin rash, and weakness are considered a minor symptom and may require recompression.

If the diver surfaces from a dive and behaves in an unusual manner, appears confused, or has fatigue, weakness or skin rash, he/she may have early symptoms of a diving accident.

Immediately place the diver in a position of comfort and administer oxygen. Oxygen treatment often relieves the symptoms or prevents them from getting worse. The injured diver may deny signs and symptoms of having a problem and might refuse oxygen. Good judgment should prevail and the diver should receive treatment. If the symptoms appear relieved after an interval of oxygen treatment, do not remove the oxygen immediately as the symptoms may recur. The victim should continue to receive 100% oxygen for as long as the supply will last.

Severe DCS (USN Classification Type II)

Severe symptoms consisting of joint pain, weakness or paralysis, staggering, respiratory difficulties or unconsciousness require immediate treatment and evacuation to the nearest appropriate medical facility. CPR will be required if the victim has no pulse or respiration. If a person at any time within 24 hours after a dive shows any severe symptoms, immediately provide the victim with oxygen and place in a position of comfort. Monitor pulse and respiration until evacuation to the recompression chamber has been accomplished.

It is important to remember that because these signs and symptoms can develop hours after diving, the patient may show up in a hospital emergency room or other medical facility in the community. For this reason, it is important for paramedics and physicians to recognize the symptoms and to understand this problem so that the proper procedure can be initiated. It is also extremely important that any person delivering a diving accident patient to a medical facility.

CAUSES: Inadequate decompression caused by-

Rapid ascent, exceeding 60 ft./minute

Omitted decompression stop

Ignoring predisposing factors, i.e., obesity, dehydration, cold-arduous dives, flying too soon after diving, over-heating or overexertion after a dive.

SYMPTOMS: Joint pain (Type I)

Extreme fatigue (Type I)

Skin rash (Type I)

Paralysis, numbness (Type II)

Unconsciousness (Type II)

Dizziness, staggering (Type II)

Other neurological deficiencies (Type II)

Note: Symptoms usually occur within 6 hours after the dive, but can be delayed for up to 24 hours.

PREVENTION: Do not dive if dehydrated, hungover, intoxicated, overly fatigued

Conservative use of dive tables, including safety stops on ascents.

If overweight be even more conservative in planning and conducting dives

Avoid exertion and over-heating after a dive, (hot showers, pulling anchor)

TREATMENT: Supine position/legs elevated

Administer 100% oxygen

Administer fluids(water), to conscious, alert victim only.

Do initial neurological exam

Evacuate to recompression chamber/hospital ASAP

DO NOT ATTEMPT IN-WATER TREATMENT

HYPERCAPNIA

An excess of carbon dioxide is retained in the body.

CAUSES: Over-exertion

Skip breathing

Hyperventilation; improper breathing pattern

Loss of air supply

SYMPTOMS: Labored or rapid breathing

	Headache, dizziness, weakness, nausea
	Unconsciousness
PREVENTION:	Stop, rest, breathe normally, surface if breathing becomes labored
	Avoid causes listed above
TREATMENT:	Give oxygen
	ABC's, CPR, if required

STINGING INJURIES

CAUSES:	Sponges, Corals, Jellyfish, Man-O-War, Fire Worm
SYMPTOMS:	Itching, Burning
	Redness and swelling, welts, (such as with poison ivy)
PREVENTION:	Avoid marine organisms with stinging potential
TREATMENT:	Use hot water or vinegar to deactivate nemomatcysts
	Remove tentacles carefully with forceps
	Wash the affected area with soap and fresh water and then treat symptoms
	To combat allergic reactions, use of diphenhydramine is encouraged
	For severe injuries the victim should seek medical advice

BASIC STEPS FOR MANAGING DIVING ACCIDENTS

1. **Stop** what you are doing. Pause and think before acting.
2. **Assess** the scene for any hazards or dangers. If the scene is unsafe, try to make the scene safe. If a scene cannot be made safe, do not enter the scene – call 911 immediately and stay away.
3. **Find** any relevant resources. Depending on the circumstances, this could either be finding and collecting necessary resources or simply making a mental note of where relevant resources are.
4. **Exposure** protection – apply personal protective equipment such as gloves.
5. **Check** the victim for level of responsiveness using the acronym AVPU.
    a. A – Injured diver is aware and oriented to him/herself, the time, and the location.
    b. V – Injured diver gives a response when presented with a verbal stimulus.
    c. P – Injured diver gives a response only when presented with a painful stimulus.
    d. U – Injured diver is completely unresponsive and shows no mental function.
6. **Call** EMS (911). If the injured diver is not A on AVPU scale or if there is any question whether EMS may be needed, call 911. After calling 911, it may be prudent to also call the Diver's Alert Network.
7. **Care** for the victim. Care for the victim comes in many forms depending on the situation but always prioritize the diver's airway, breathing, and circulation (ABC's/CAB's). If the diver is not conscious, then the first step of care is to look, listen, and feel for breathing and a pulse. If a

pulse is present without breathing, rescue breaths are appropriate. If neither pulse nor breathing are present, follow the steps for CPR below:

a. Position the injured diver on his/her back.
b. Give 30 compressions about 2” deep on the center of the sternum at a rate of 100-120 compressions per minute.
c. Open victim's airway with head-tilt, chin-lift method.
d. Provide two breaths orally, with the MTV100, or with a BVM.
e. Continue this pattern of 30 compressions to 2 breaths for 2 minutes (about 5 sets of 30:2).
f. Look, listen, and feel for signs of life every 2 minutes.
g. Continue this process as long as possible.

8. For most diving accidents, provide the diver with the highest percentage of oxygen available for as long as it will last. The first choice of oxygen delivery equipment for any injured diver is the MTV100. If the MTV100 is not available, the first choice is the demand inhalator valve. For multiple injured divers, see the recommendations below:
    a. The diver with the most serious suspected injury should breathe from the MTV100.
    b. The diver with a less severe suspected injury should breathe from the demand inhalator valve if the diver is breathing hard enough to activate the valve.
    c. The diver with the least severe suspected injury should breathe from the nonrebreather mask set to a flow rate of 10-15 liters per minute.
    d. A non-breathing diver should be given respirations via the MTV100 (first choice), bag valve mask, or oronasal resuscitation mask with supplemental oxygen set to a flow rate of 10-15 liters per minute.
9. Treat for shock by:
    a. Maintaining the diver’s temperature .
    b. If possible, place the injured diver supine with legs elevated 10-12” (if head, neck, or back injury is not suspected). If this is not possible, place diver in position of comfort.
    c. Provide oxygen.
    d. Do not administer fluids orally.
10. If the diver is responsive and alert and circumstances permit, conduct a neurological exam once every 15 minutes for the first hour and then every hour thereafter.

APPENDIX 8
AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS

COLLECTION CRITERIA:

The "Dive Time in Minutes", The Number of Dives Logged", and the "Number of Divers Logging Dives" will be collected for the following categories.

- Dive Classification
- Breathing Gas
- Diving Mode
- Decompression Planning and Calculation Method
- Depth Ranges
- Specialized Environments
- Incident Types

Dive Time in Minutes is defined as the surface-to-surface time including any safety or required decompression stops.

A Dive is defined as a descent underwater utilizing compressed gas and subsequent ascent/return to the surface with a minimum surface interval of 10 minutes.

Dives will not be differentiated as open water or confined water dives. But open water and confined water dives will be logged and submitted for AAUS statistics classified as either scientific or training/proficiency.

A "Diver Logging a Dive" is defined as a person who is diving under the auspices of your scientific diving organization. Dives logged by divers from another AAUS Organization will be reported with the diver's home organization. Only a diver who has actually logged a dive during the reporting period is counted under this category.

Incident(s) that occur during the collection cycle: Only incidents that occurred during, or resulting from, a dive where the diver is breathing a compressed gas will be submitted to AAUS.

DEFINITIONS:

Dive Classification:

- Scientific Dives: Dives that meet the scientific diving exemption as defined in 29 CFR 1910.402. Diving tasks traditionally associated with a specific scientific discipline are considered a scientific dive. Construction and trouble-shooting tasks traditionally associated with commercial diving are not considered a scientific dive.
- Training and Proficiency Dives: Dives performed as part of a scientific diver-training program, or dives performed in maintenance of a scientific diving certification/authorization.

Breathing Gas:

- Air: Dives where the bottom gas used for the dive is air.
- Nitrox: Dives where the bottom gas used for the dive is a combination of nitrogen and oxygen percentages different from those of air.
- Mixed Gas: Dives where the bottom gas used for the dive is a combination of oxygen, nitrogen, and helium (or other inert gas), or any other breathing gas combination not classified as air or nitrox.

Diving Mode:

- Open Circuit SCUBA: Dives where the breathing gas is inhaled from a self-contained underwater breathing apparatus and all of the exhaled gas leaves the breathing loop.
- Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to monitor the divers' depth, time and diving profile.
- Hookah: While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for monitoring his/her own depth, time, and diving profile.
- Rebreathers: Dives where the breathing gas is repeatedly recycled in a breathing loop. The breathing loop may be fully closed or semi-closed. Note: A rebreather dive ending in an open circuit bailout is still logged as a rebreather dive.

Decompression Planning and Calculation Method:

- Dive Tables
- Dive Computer
- PC Based Decompression Software

Depth Ranges:

Depth ranges for sorting logged dives are: 0-30, 31-60, 61-100, 101-130, 131-150, 151-190, 191-250, 251-300, and 301+. Depths are in feet seawater (when measured in meters: 0-10, >10-30, >30-40, >40-45, >45-58, >58-76, >76-92, and >92). A dive is logged to the maximum depth reached during the dive. Note: Only "The Number of Dives Logged" and "The Number of Divers Logging Dives" will be collected for this category.

Specialized Environments:

- Required Decompression: Any dive where the diver exceeds the no-decompression limit of the decompression planning method being employed.
- Overhead Environments: Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- Blue Water Diving: Openwater diving where the bottom is generally greater than 200 feet deep and requires the use of multiple-tethers diving techniques.
- Ice and Polar Diving: Any dive conducted under ice or in polar conditions. Note: An Ice Dive would also be classified as an Overhead Environment dive.
- Saturation Diving: Excursion dives conducted as part of a saturation mission are to be logged by "classification", "mode", "gas", etc. The "surface" for these excursions is defined as leaving and surfacing within the Habitat. Time spent within the Habitat or chamber must not be logged by AAUS.
- Aquarium: An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research (Not a swimming pool).

Incident Types:

- Hyperbaric: Decompression Sickness, AGE, or other barotrauma requiring recompression therapy.
- Barotrauma: Barotrauma requiring medical attention from a physician or medical facility, but not requiring recompression therapy.
- Injury: Any non-barotrauma injury occurring during a dive that requires medical attention from a physician or medical facility.
- Illness: Any illness requiring medical attention that can be attributed to diving.
- Near Drowning/ Hypoxia: An incident where a person asphyxiates to the minimum point of unconsciousness during a dive involving a compressed gas. But the person recovers.
- Hyperoxic/Oxygen Toxicity: An incident that can be attributed to the diver being exposed to too high a partial pressure of oxygen.
- Hypercapnea: An incident that can be attributed to the diver being exposed to an excess of carbon dioxide.
- Fatality: Any death accruing during a dive or resulting from the diving exposure.
- Other: An incident that does not fit one of the listed incident types

Incident Classification Rating Scale:

- Minor: Injuries that UM considers being minor in nature. Examples of this classification of incident would include, but not be limited to:
    - Mask squeeze that produced discoloration of the eyes.
    - Lacerations requiring medical attention but not involving moderate or severe bleeding.
    - Other injuries that would not be expected to produce long term adverse effects on the diver's health or diving status.
- Moderate: Injuries that UM considers being moderate in nature. Examples of this classification would include, but not be limited to:
    - DCS symptoms that resolved with the administration of oxygen, hyperbaric treatment given as a precaution.
    - DCS symptoms resolved with the first hyperbaric treatment.
    - Broken bones.
    - Torn ligaments or cartilage.
    - Concussion.
    - Ear barotrauma requiring surgical repair.
- Serious: Injuries that UM considers being serious in nature. Examples of this classification would include, but not be limited to:
    - Arterial Gas Embolism.
    - DCS symptoms requiring multiple hyperbaric treatment.
    - Near drowning.
    - Oxygen Toxicity.
    - Hypercapnea.
    - Spinal injuries.
    - Heart attack.
    - Fatality.

APPENDIX 9
RECOMMENDATIONS FOR RESCUE OF A SUBMERGED UNRESPONSIVE COMPRESSED-GAS DIVER

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