

## NAUI Trimix Diver – Levels I and II

### OVERVIEW

The NAUI Trimix program trains technical divers in the use of oxygen/helium/nitrogen gas mixtures while allowing them to gain supervised experience in the protocols of deep and extended range diving. The program also accentuates the logic behind the choices between different EANx, trimix, and oxygen decompression gases and it thoroughly introduces students to the most contemporary decompression theories and tables available, particularly the Reduced Gradient Bubble Model. Classroom work emphasizes advanced decompression theory and management, gas mixing, diving physics and physiology, oxygen exposure management and dive planning. Practical sessions include rigorous cultivation of proper equipment selection and configuration and technical diver skill execution. Finally, the program is very experience oriented and stresses the practical application of deep diving on mixed gases.

The Trimix I course trains divers to utilize helium-based gas mixes to depths up to 200 fsw. NAUI Trimix II training extends the maximum training depth to 250 fsw.

### ACADEMIC REQUIREMENTS

Classroom work emphasizes decompression theory and management, diving physics and physiology, oxygen exposure management, equipment, dive planning and emergency procedures. The NAUI Trimix course includes classroom work, equipment configuration work and skill drills in confined water, and six to eight or more progressively deeper dives.

Topics covered include the following: Introduction to Mixed Gases, Mixed Gas, Gas Properties, Specific Heat Capacity, Thermal Conductivity, Core Temperature, Suit Insulation, Ideal Versus Real Gas Behavior, Determining Best Trimix, Trimix Blending, Mixed Gas Decompression, Helium versus Nitrogen, Saturation/Desaturation, Halftime Comparisons, Equivalent/Effective Depth Formulas, Dissolved Gas Models, Free Gas Phase Models, Schedule Comparisons, Gas Selection, Normoxic Ranges; Decompression Mixes, Gas Switching Problems, Oxygen Window, Decompression Time, Mixed Gas Physiology, Human Responses to PO<sub>2</sub>, RMV and VO<sub>2</sub>; Metabolic Oxygen Consumption, Personal Limitations, Environmental Considerations, Physiological Problems, Dive Planning, Time Terminology, Descent/Ascent Rates, Dive Planning, Gas Utilization Calculations, Contingency Plans, Equipment, Procedures, Team members and Players, Surface Support, Agency Protocols, Accident Analysis, Rescue Responses, Emergency Responses, Omitted Decompression, DCS Signs and Symptoms, Neurological DCS,

The following texts shall be used (an asterik \* denotes recommended but not required texts):

“Technical EANx, Decompression Techniques and Extended Range” by Jan Neal

“NAUI Trimix Diver Student Workbook”

“NAUI RGBM Tables” by Bruce Wienke and Tim O’Leary \*

“Physics, Physiology and Decompression Theory for the Technical and Commercial Diver” by Bruce Wienke\*

### SCOPE OF COURSE

- The training depths for these dives are 100-200 fsw for Level I and 100-250 fsw for Level II. Maximum PO<sub>2</sub> is 1.2 atm for working portions of the dives and 1.6 atm for decompression.
- No dives may exceed an equivalent narcosis depth of 130 fsw; an END of 100 fsw or less is generally employed on the training dives.

- The in-water instructor to student ratio will never exceed 6 to 1 for the technical EANx portions of the dives and 4 to 1 for all other dives.

### **SKILL REQUIREMENTS**

- For each dive students will define oxygen limits based on PO<sub>2</sub> of 1.2 atm or less for the working portion of the dive and 1.6 atm or less for decompression stops.
- For each dive students will analyze all gas mixtures and label each accordingly with mix and MOD.
- For each dive students will complete a Technical Diver Plan and a Team Planner
- Set up personal scuba systems for each dive satisfying all training, environmental, and physiological constraints.
- Establish safety and emergency procedures, contingency strategies, abort and bailout plans.
- Demonstrate proper buoyancy control and trim during dives and deco stops.
- Turn around or begin the ascent at the predetermined back gas pressure or bottom time.
- Demonstrate proper underwater communications.
- Shut down failed regulator and isolate for catastrophic gas loss ( $\leq 15$  sec).
- Shutoff and switch over to redundant regulator.
- Gas sharing, simulate out-of-gas scenario over a distance of 30 feet.
- Remove/replace stage bottles in timely fashion.
- Conduct planned gas switches.
- Lost visibility – maintain contact with team and continuous line to the surface.
- Equipment failure management drills.
- Demonstrate team cooperation skills.
- Missing diver search procedures.
- Rescue skills.
- Ascend with reel and lift bag and execute drift decompression.
- Execute staged decompression stops.
- Demonstrate mastery of emergency procedures (abort plan, omitted deco protocols, emergency first aid).
- Demonstrate proper descent and ascent rates and depth, time, and gas management.

### **EQUIPMENT REQUIREMENTS**

Each student must own and be familiar with all of the following equipment. Care should be exercised when purchasing new gear, however, in order to avoid buying inadequate or unsafe equipment. Much of the so-called technical diving gear that is marketed today is inappropriate for serious technical diving. Please contact us before making any new gear purchases.

Cylinders:

- Double cylinders with a dual manifold and isolation valve. DIN valves are mandatory. Your cylinders may be steel or aluminum; aluminum cylinders are recommended if diving in a wetsuit. You should be able to physically manage your choice of cylinders.
- At least 2 stage cylinders of 40 ft<sup>3</sup> or greater for decompression gas with stage rigging. The cylinder should be oxygen clean. Use of steel stages is prohibited. DIN valves are recommended.
- For Trimix Level II candidates, an additional 80 ft<sup>3</sup> AL cylinder rigged as a stage is required (bottom stage)
- Argon and/or air inflation systems for drysuit diving are necessary. Helitrox is inappropriate for suit inflation. Six to 13 ft<sup>3</sup> aluminum/steel cylinders are acceptable for this purpose.

Regulators:

- Back cylinder configuration: two first stages with each supplying one second stage. The primary regulator's first stage is attached to the right post of the manifold and has a 7-foot hose leading to the second stage.

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The low-pressure inflator to the BCD wings should come off of the primary first stage (right post). The back up regulator is attached to the left post and supports the one SPG (no consoles).

- Oxygen cleaned regulator and SPG for the stage bottle.
- Argon regulator: first stage must have an over pressure relief valve.

#### Buoyancy Compensators:

- A buoyancy control device capable of carrying your bottom mix and deco gases is required. Standard single bladder wings of 55-lb lift are adequate for most individuals. NAUI discourages the use of overly large, dual bladder wings and the bungee cord used to control them. A stainless steel or aluminum backplate is recommended.

#### Instrumentation:

- Each diver needs one depth device and one timing device. A wrist mounted digital bottom timer/depth gauge is the best choice for technical diving.
- Compass

#### Exposure Suits:

- A dry suit with a separate suit inflation system is required. The inflation first stage must be equipped with an over pressure relief valve.

#### Other Equipment:

- Mask/fins (no snorkel).
- One cutting device required, with two recommended.
- Underwater writing device such as a slate or wetnotes.
- Two lift bags (50 to 100 lb lift) and one primary reel with at least 200 ft of line.
- One safety reel or spool with at least 100 ft of line.
- Two lights (3 lights if in wreck penetration standards)
- Hardware for rigging stage and decompression bottles.
- Stage bottle leash

### **PREREQUISITES FOR ENTERING THE COURSE**

**Age.** Minimum is 18 years. **Certification:** NAUI Technical Diver **or equivalent level.** If enrolling in Trimix Level II course only, Trimix Level I certification is required. These requirements can be modified or amended during pre-course interview and/or screening dive. Additional requirements include:

- Medical clearance and physically fit (nonsmoker)
- Minimum of 100 logged dives with at least 20 decompression dives (beyond certification) as a Technical Diver.

For pricing see the NAUI Training Rate Sheet.