## 2.2.11 Photogrammetry Diver

#### 2.2.11.1 Course Outcomes

GUE's Photogrammetry Diver course is designed to introduce divers to the skills and procedures for using underwater photogrammetry to make digital 3D models of dive sites.

#### 2.2.11.2 Prerequisites

Applicants for a Photogrammetry Diver course must:

- a. Submit a completed Course Registration Form, Medical History Form, and Liability Release Form to GUE HQ.
- b. Hold insurance that will cover diving emergencies such as hyperbaric treatment, e.g., DAN Master-level insurance or equivalent.
- c. Be physically and mentally fit.
- d. Be a nonsmoker.
- e. Obtain a physician's prior written authorization for the use of prescription drugs, except for birth control, or for any medical condition that may pose a risk while diving.
- f. Be a minimum of 16 years of age. Documented parental or legal guardian consent must be submitted to GUE HQ when the participant is a minor.
- g. Be a certified GUE Recreational Diver Level 1 or GUE Fundamentals diver.
- h. Have completed at least 25 non-training dives beyond either GUE Recreational Diver Level 1 or GUE Fundamentals certification.
- i. Have completed at least 75 non-training dives beyond autonomous scuba diver certification.

## 2.2.11.3 Course Content

The Photogrammetry Diver course is normally conducted over four days. It requires a minimum of three dives and at least thirty-two hours of instruction, encompassing classroom, land drills, and in-water work.

#### 2.2.11.4 Photogrammetry Diver Specific Training Standards

- a. Student-to-instructor ratio is not to exceed 8:1 during land drill or surface exercises; it cannot exceed 4:1 during any in-water training.
- b. Maximum depth of 100 ft/30 m or the limit of the student's certification, whichever is shallower.
- c. All dives must be within minimum decompression limits (MDLs), i.e., no required stops.
- d. A Photogrammetry Diver class can only be conducted using a rebreather if:
  - i. All students are GUE certified for the rebreather being used during class.
  - ii. All students have 25 logged dives beyond GUE rebreather certification.
  - iii. The instructor is an active GUE rebreather instructor for the unit being used during class.
- e. A Photogrammetry Diver class can only be conducted in an overhead environment if:
  - Students are all GUE Cave 2 certified.
  - ii. The instructor is an Active GUE Cave 2 instructor.
- f. When a Photogrammetry Diver class is conducted in an overhead environment:

- i. Student-to-instructor ratio is reduced to 6:1 during land drills and surface exercises; it cannot exceed 3:1 during any in-water training.
- ii. Dives must be conducted within Cave 1 limits.

## 2.2.11.5 Required Training Materials

GUE training materials and recommended reading as determined by the course study packet received via online download after GUE course registration.

#### 2.2.11.6 Academic Topics

- a. Introduction: GUE organization and course overview (objectives, limits, expectations).
- b. Photogrammetry basics
- c. Photo equipment specifics
- d. Video equipment specifics
- e. Processing of images using Agisoft Photoscan
- f. Post-processing, publishing, and uploading of 3D projects

#### 2.2.11.7 Land Drills and Topics

- a. Photo camera preparation and maintenance
- b. Video camera preparation and maintenance
- c. Photogrammetry with still images
- d. Photogrammetry with video images
- e. Lighting and lighting-diver positioning

#### 2.2.11.8 Required Dive Skills and Drills

- a. Demonstrate proficiency in safe diving techniques, including pre-dive preparation, inwater activity, and post-dive assessment.
- b. Demonstrate awareness of team member location and a concern for safety, responding quickly to visual indications and dive partner needs.
- c. Demonstrate a safe and responsible demeanor throughout all training.
- d. Demonstrate proficiency in underwater communication.
- e. Demonstrate basic proficiency managing GUE's base equipment configuration.
- f. Demonstrate safe ascent and descent procedures.
- g. Demonstrate good buoyancy and trim, i.e., approximate reference is a maximum of 30 degrees off horizontal while remaining within 5 ft/1.5 m of a target depth.
- h. Demonstrate proficiency in adjusting buoyancy while managing camera equipment.
- i. Demonstrate familiarity with required course equipment.
- j. Demonstrate the ability to capture predetermined imagery underwater.
- k. Must be able to swim at least 300 yds/275 m in less than 14 minutes without stopping. This test should be conducted in a swimsuit and, where necessary, appropriate thermal protection.
- Must be able to swim a distance of at least 50 ft/15 m on a breath hold while submerged.

#### 2.2.11.9 Equipment Requirements

GUE configuration as outlined in Appendix A, plus:

a. Photographic equipment: any digital photo camera suitable for underwater photography, preferably in a housing and able to sustain a minimum water pressure of

- 100 ft/30 m. An underwater flash is highly recommended (if not available, underwater video lights may be suitable). Manual adjustment (aperture/shutter) on the camera is preferred.
- b. Video equipment: any digital video camera suitable for underwater videography, preferably in a housing and able to sustain a minimum water pressure of 100 ft/30 m. An underwater video lighting system is highly recommended. Manual adjustment (aperture/shutter) on the video camera and a wide-angle lens with adapter is preferred.
- c. Computer system: any Windows or Mac-based computer with Agisoft Photoscan software (Demo, Standard, or Pro version) installed.
- d. For classes conducted using rebreathers, a GUE- approved rebreather must be used.

Prior to the commencement of class, students should consult with a GUE representative to verify equipment requirements and appropriateness of any selected equipment.

# **Appendix A - GUE Base Equipment Configuration**

The GUE base equipment configuration is comprised of:

a. Tanks/cylinders: Students may use a single tank/cylinder with a single- or dual-outlet valve. Students may also use dual tanks/cylinders connected with a dual-outlet isolator manifold, which allows for the use of two first stages. Dual tanks/cylinders connected with a dual-outlet, non-isolator manifold can be used, but only in recreational (no decompression) diving, and are considered an alternative for a single tank/cylinder. Consult course-specific standards and your instructor to verify size requirements.

#### b. Regulators:

- i. Single tank: The first stage must supply a primary second stage via a 5 to 7 ft/1.5 to 2 m hose. A backup second stage must be necklaced and supplied via a short hose. The first stage must also supply an analog pressure gauge, inflation for the buoyancy compensator (BC), and (when applicable) inflation for a drysuit.
- ii. Double tank: One first stage must supply a primary second stage via a 5 to 7 ft/1.5 to 2 m hose (7 ft/2 m hose is required for all cave classes), and inflation for the buoyancy compensator (BC). The other first stage must supply a necklaced backup second stage via a short hose, an analog pressure gauge, and (when applicable) inflation for a drysuit.

#### c. Backplate system:

- i. Is held to the diver by one continuous piece of webbing. This webbing is adjustable and uses a buckle to secure the system at the waist.
- ii. A crotch strap is attached and looped through the waistband to prevent the system from riding up a diver's back.
- iii. The continuous webbing must support five D-rings;
  - 1. The first placed at the left hip
  - 2. The second placed in line with a diver's right collarbone
  - 3. The third placed in line with the diver's left collarbone
  - 4. The fourth and fifth are placed on the front and back of the crotch strap when divers plan to use advanced equipment such as DPVs.

- iv. The harness below the diver's arms has small restrictive bands to allow for the placement of backup lights. The webbing and system retains a minimalist approach.
- d. Buoyancy compensation device (BC):
  - i. A diver's BC is back-mounted and minimalist in nature.
  - ii. It is free of extraneous strings, tabs, or other material.
  - iii. There are no restrictive bands or restrictive elastic affixed to the buoyancy cell.
  - iv. Wing size and shape is appropriate to the cylinder size(s) employed for training.
- e. At least one time/depth measuring device
- f. Wrist-mounted compass
- g. Mask and fins: Mask is low-volume; fins are rigid, non-split.
- h. Backup mask
- i. At least one cutting device
- j. Wetnotes with pencils
- k. Surface marker buoy (SMB) with spool: when required, the SMB should be appropriate for environmental conditions and deployed using a spool with at least 100 ft/30 m of line.
- I. Exposure suit appropriate for the duration of exposure

# Additional Course-Specific Equipment

- a. Where required, back gas and stage cylinders are marked in accordance with the GUE General Training Standards, Policies, and Procedures document and configured in line with GUE protocols.
- b. When drysuit inflation systems are applicable, they should be sized appropriately for the environment; small tanks are placed on the left side of the backplate with larger supplies affixed to the diver's left back gas tank.
- c. Underwater lights:
  - i. When required, backup lights should be powered by alkaline batteries (not rechargeable) and stowed on the D-rings at a diver's chest.
  - ii. Backup lights should have a minimal amount of protrusions and a single attachment at the rear.
  - iii. The primary light should consist of a rechargeable battery pack and be fitted with a Goodman-style light handle.
  - iv. When burn time requirements create the need for an external battery pack, it should reside in a canister mounted on the diver's right hip.
- d. Guideline devices, as required during cave diving activities:
  - i. A primary reel is required for all cave diving and provides a minimalist form factor with a handle designed to support a Goodman or "hands free" handle operation. The primary reel must contain at least 150 ft/45 m of line.
  - ii. A safety spool is required for each diver while cave diving and must contain at least 150 ft/45 m of line.
  - iii. A jump or gap spool is required during Cave 2 diving and must contain at least 75 ft/23 m of line.