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:
    i. 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, in-water 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.
l. 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.
l. 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.