

3.4 Underwater Cave Surveying

3.4.1 Purpose

The purpose of the Underwater Cave Surveying specialty course is to introduce the trained cave diver to the basic fundamentals of surveying underwater caves while under the direct supervision of a qualified Underwater Cave Surveying Specialty Instructor.

This course is intended to motivate more divers to survey caves, encourage the use of cave maps in dive planning and increase the quantity and quality of published cave maps. Additionally, this program is designed to assist in promoting standardization for all survey projects.

The course material reviews early surveys and the development of standards and procedures. The seven phases of the survey process, from conception to completion of a survey, are discussed. Topics covered in full detail include accuracy standards, composition of the survey team, use and fabrication of special tools, survey techniques and methodology, safety considerations, data manipulation and mathematical calculations, symbology, cartography, copyright and publication.

3.4.2 Program Duration

Approximately two days.

3.4.3 Prerequisites

NSS-CDS Cave Diver level of training or equivalent.

3.4.4 Knowledge Development

- A. History of surveys.
- B. Motivations to survey.
- C. The survey process, including dive planning and survey dives.
- D. Accuracy.
- E. The survey team including communications.
- F. Special tools, equipment and techniques including compass reading and compass errors.
- G. Techniques including tie-off/station selection, vertical surveying, large chambers, long passages, radial surveys and sketching.
- H. Safety.
- I. Reducing data including verification and data preparation.
- J. Cartography including single line maps and higher grade maps.
- K. Copyright and publication.

3.4.5 Land Drills

Practical application of the techniques and mathematical procedures presented in the classroom will be conducted on dry land.

3.4.6 Cave Dives and Skills

At least two cave survey dives are required. The instructor may require more than two cave survey dives.

3.4.7 Equipment Requirements

- A. Note pad, pen and pencils.
- B. Graph paper.
- C. Scaling ruler.
- D. Circular protractor.
- E. Basic calculator (can square and extract square roots) or scientific calculator.

3.4.8 Course Texts and References

Basic Underwater Cave Surveying by John Burge, NSS-CDS, 1989.

3.4.9 Limits of Training

- A. Penetration limited to one-third or less of twin diving cylinders and one-third or less of stage cylinders.
- B. Minimum starting gas volume of 3,100 L/110 ft³.
- C. Depths not to exceed 40 m/130 ft.
- D. 20 ft/6 m. minimum starting visibility.
- E. No equipment removal in cave (except for decompression cylinder).
- F. No diver propulsion vehicles in caves.

3.4.10 Instructor Requirements

- A. To conduct this level of training an NSS-CDS instructor shall be an Active Status Cave Diver Instructor for at least one year and meet the following criteria:
 - 1. The instructor shall have completed teaching at least four complete Cave Diver courses.
 - 2. The instructor shall have logged at least 20 non-training related survey dives.
 - 3. Have at least 200 logged cave dives.

4. Been a principal or key individual with at least one underwater cave survey project (name should be listed on final map), having displayed the resulting cave map at an NSS-CDS Workshop, published it in “Underwater Speleology,” donated it to the NSS-CDS or entered it in competition at the national NSS Cartography Salon.
- B. Approval of Training Chairman based on approved Standards and Procedures requirements.
- C. Please refer to Section 4 of Standards and Procedures for general procedures and requirements regarding NSS-CDS Specialty Instructor ratings.