WRECK SURVEY TECHNIQUES

CURT BOWEN

From the massive *Edmund Fitzgerald* in the depths of the Great Lakes to the local tugboat, a special corps of wreck divers, finatical about detail, use their expertise to help solve the mystery of why a ship went down.

I've traveled from the frozen depths of Lake Superior to the warm crystal-clear waters of Cayman Brac to conduct and coordinate underwater surveys. You might say, it's my specialty, it's what I do for adventure.

I started producing maps of caves and wrecks many years ago when I first started diving. Being an artist by nature and a computer freak by heart, it kind of just fell together. As my diving and computer graphics skills advanced so did the complexity of the surveys. At first, I started with simple line drawings on standard paper, then I moved to computer drafting programs to produce highly accurate detailed maps to scale. Finally I have graduated into high-performance computer illustration programs to produce three-dimensional rendered graphics that can be turned in the computer and viewed from all angles. Of course, with the advance in technology also came the multiplication of hours spent to produce such illustrations and from just a few divers, James Cutway, Justin McNesky and myself, to teams of multiple divers needed to complete a job within a reasonable amount of time while on site.

There are many reasons to survey underwater wrecks, ranging from marine ecology, artificial reef studies and the preservation of our maritime history. Today's artificial reef committees utilize underwater surveys to conduct time/growth studies and fish population counts. These artificial reefs provide needed shelters for fish, attachment locations for mollusk and marine plants and they help rejuvenate high-tension fishing areas. Surveys conducted by amateur underwater archeologists also provide valuable information to local dive shops for proper dive planning, along with documentation of local dive sites.

The complexity of underwater surveys range from a simple line drawing completed in one dive to a highly-accurate, three-dimensional computer model taking a team of divers and graphic artists hundreds of hours both under and above the water.

Each survey is different and requires ingenuity from all team members. Factors determining the complexity of the survey are visibility, depth, size, environment, and condition of the wreck. Poor visibility will make any survey, even in shallow water almost impossible. Depth increases time restrictions, breathing gas volumes and decompression obligations. Larger wrecks require more time and additional planning just due to their size. Environmental conditions such as water temperature, marine life and currents will also come into play. The physical condition of the wreck will greatly complicate the survey process. Wrecks that are in one piece and in fairly

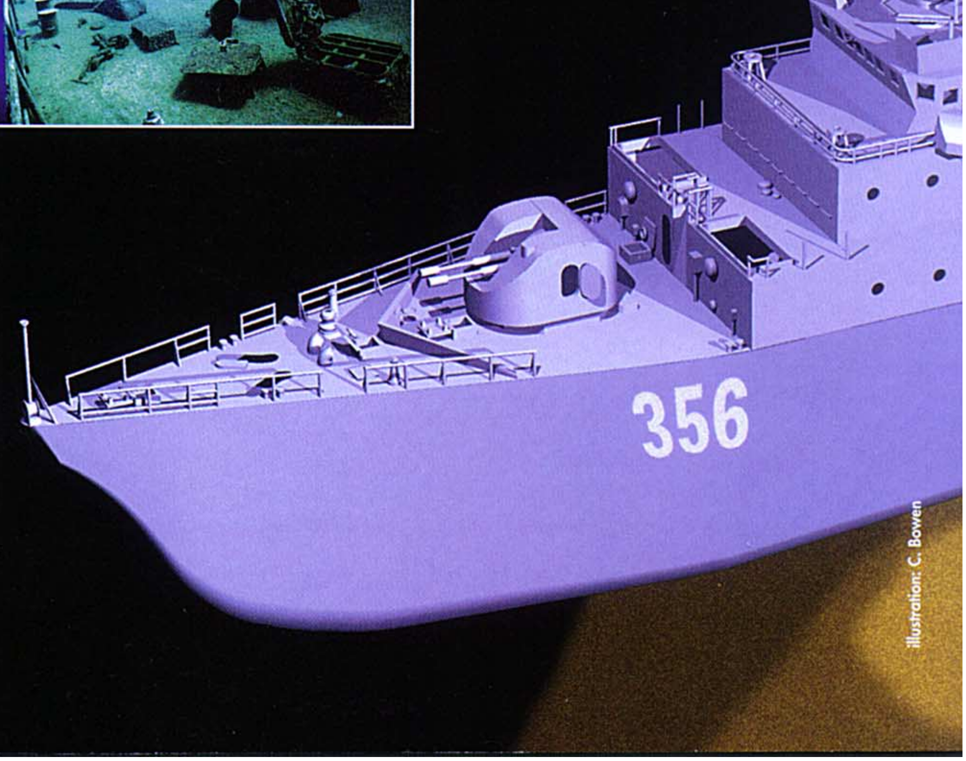

illustration: C. Bowen

good condition are much easier than those which are broken into several parts and scattered across the sea floor. A combination of any of these factors, such as a deep wreck in poor condition with low visibility and a slight current, can become a nightmare to survey, even to the professional.

Equipment Needed:

Equipment required for underwater surveys include underwater slates, compasses, cloth measuring tapes, lift bags, an underwater video camera and underwater photography equipment.

• Underwater Slates: Standard underwater slates usually work well, larger slates may be needed for debris fields and for extensive detail. I suggest making two photocopies of each slate after every dive and placing them in separate, safe locations. This will help prevent the loss of survey information.

• Compass: The larger the compass, the easier it is to read while at depth. Many models of digital compasses are also currently available.

• Cloth Measuring Tape: A 150-to 200-foot cloth measuring reel can be purchased at any hardware store.

• Lift Bag: A standard 50-to 100-pound lift bag works well for triangulation.

• Digital Depth Gauge: Any digital bottom timer or computer with accurate depth readings.

• Video Equipment: Standard underwater

SURVEYING RUSSIAN FRIGATE #356

Divi Tiara Resort of Cayman Brac and the Cayman Islands invited me and a team of divers to their tropical island to conduct an extensive survey of an artificial reef they had placed in 1996. The 330-foot-long decommissioned *Russian Frigate number 356* (illustrated below) was purchased from the Cuban government by the Cayman Islands for the purpose of sinking as an artificial reef.

Although not classified as a technical dive due to the fact that the deck is only at 54 feet, the survey was very complicated due to the size, complexity and high detail desired.

Because of the bottom time requirements needed to complete such a survey in only five days, team coordinator, Dr. Richard Jenkins arranged for 17 bank cylinders of medical grade oxygen to be sent prior to our arrival. Partial-pressure mixed nitrox fills and double 80s provided the team with enough gas volume and down times for up to 180 minutes of exposure.

The systematic survey method was used because of the pristine condition of the wreck and 100-plus-foot visibility. The ship was separated into five survey sections, the bow, midship starboard, midship port, stern and hull. Each day the team concentrate on one section.

SURVEY TEAM MEMBERS

Dr. Richard Jenkins - Coordinator
Curt Bowen - U/W Coordinator
Bill Turner - Equipment Logistics
Robin Gruters - Photographer
Rusty Farst - Videographer
Andrew White - Survey Assistant
Linda Bowen - Survey Assistant

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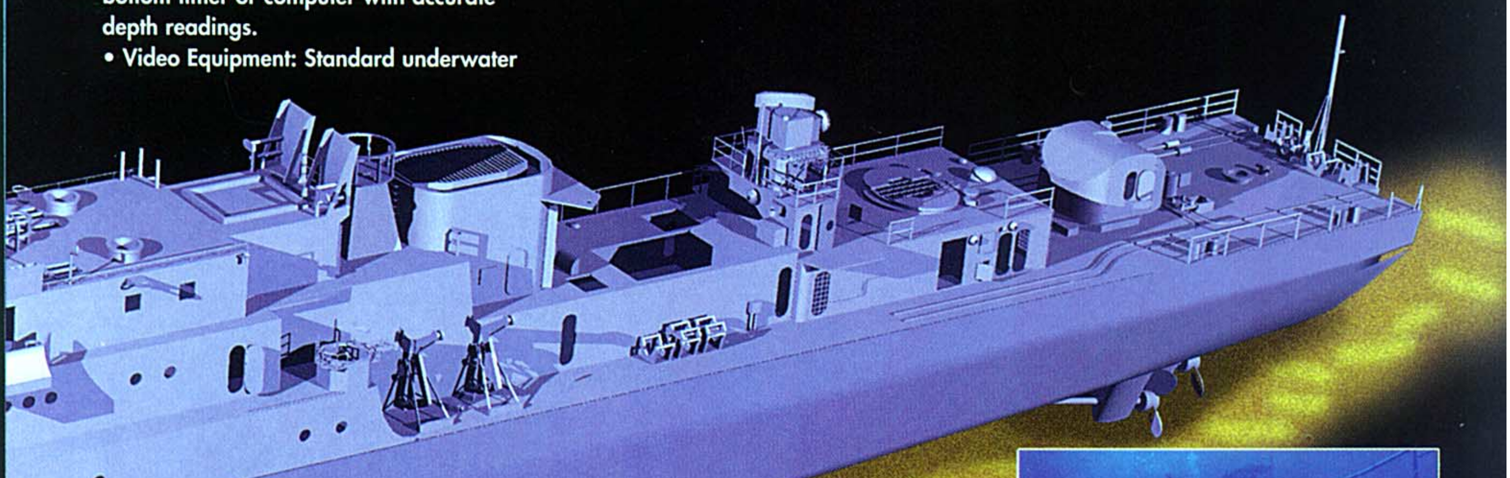
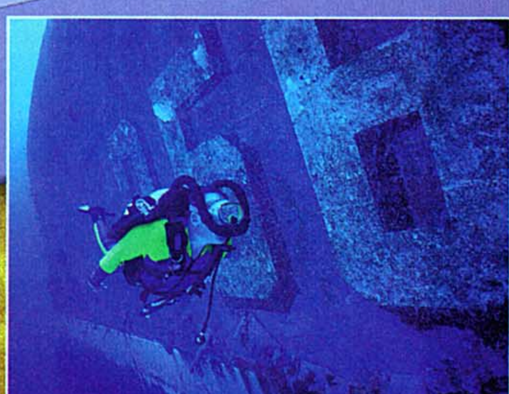




Surveying the Russian Frigate number 356 in the Cayman Islands resulted in this highly accurate 3-D drawing.

photos: Robin Gruters

housing and video equipment with a wide angle lens and ample lighting.

• Photography: Standard underwater camera with a wide angle lens and strobe. A large slave strobe given to another diver will illuminate larger areas.

Exploratory dives may need to be completed before a survey is started. These dives allow the dive survey coordinator to plan the required task, survey techniques, additional equipment, number of dives, decompression gases and safety divers needed to complete the survey in a quick and efficient manner.

There are two basic methods used to survey a wreck — systematic and triangulation.

Systematic Method

The systematic method is used for wrecks that are intact from bow to stern and are still in fair shape. All survey information and movement around the wreck is completed in a systematic way, such as starting at the bow, moving down the starboard side to the stern then back up the port side. As the team moves around the wreck, measurements, photos and video are recorded.

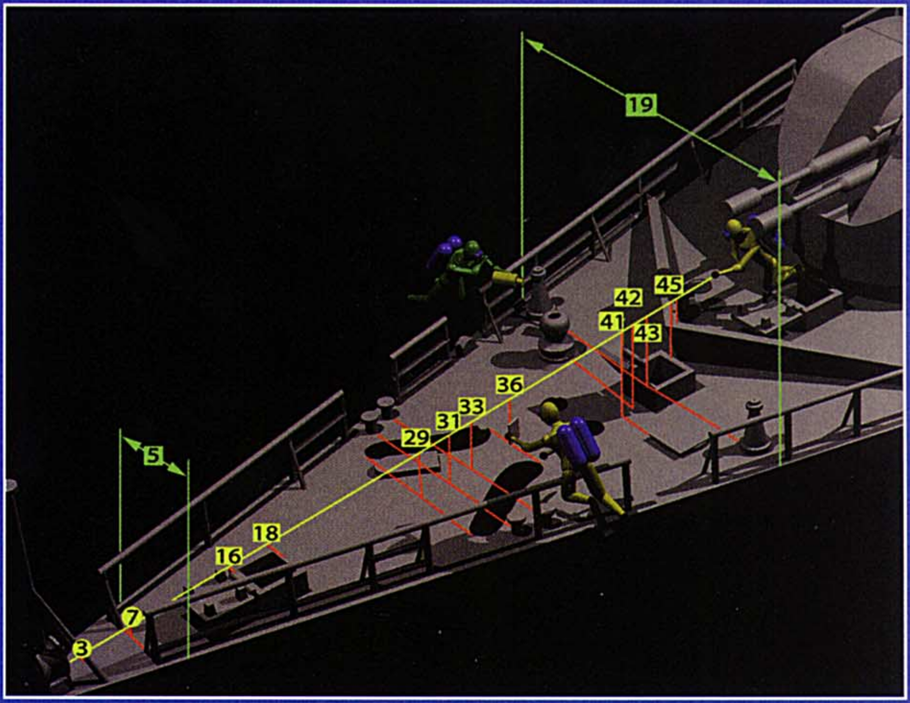
If the ship is rather large or depth and time restrictions require multiple dives, it should be divided into several sections. Standard sections will include the bow, stern, midship port, midship starboard, pilot house/cabins, superstructure and props. Each day the dive coordinator will assign a task that is to be completed. After each day's dive, the data gathered will be examined to determine the next day's assignments.

The interior rooms can also be surveyed systematically. Measurements of each room will consist of length and width along with depths at the ceiling and floor. Objects in the room, along with hatches, windows and doors should be sketched in. Interior video and photography is very important for added detail and to avoid missing objects. Many times, due to the silty conditions, restrictions and possible chances of entanglement, the interior is usually not surveyed extensively. A quick sketch of the rooms without measurements can be accomplished by one or two divers as they move carefully through the wreckage.

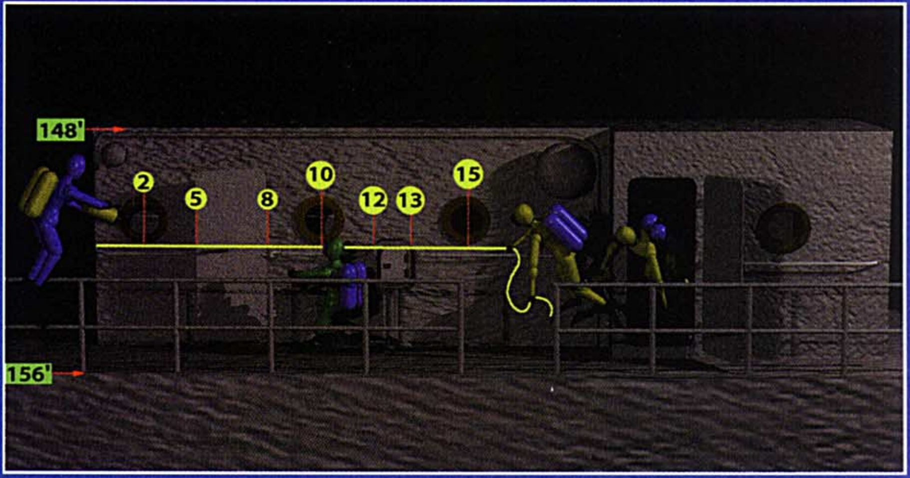
Triangulation

As wrecks deteriorate from the natural breakdown process they become large debris fields. A systematic survey from the bow to the stern is basically impossible due to the chaotic layout of the wreckage. A system termed "triangulation" was implemented to more efficiently survey such scattered debris.

Triangulation is a basic survey technique which uses simple trigonometry to gain accurate measurements. A fixed location is located on the debris field, preferably closest to the center. A 50-pound lift bag with a 25-foot line is attached to the wreckage and inflated. This provides a sturdy center line to attach the measuring tape and a reference point for compass



Deck Survey — the quickest method to survey a ship's deck. In this illustration the survey line is attached to the bow point and run down the middle of the deck towards the stern. An assistant diver holds the survey line tight as the surveyor sketches and writes down the measurements of all the important items, in feet, from the bow. The distance from the center line towards the starboard or port side can either be measured or estimated to save time. The beam of the ship, at predetermined distances, should be obtained and recorded. Video and still photography should be taken to supply the surveyor with better detail.



Wall Survey — the quickest method to survey the ship's walls. In this illustration the survey line is attached to one end of the wall and run to the other. An assistant diver holds the survey line tight as the surveyor sketches and writes down the measurement of all important items in feet from the starting point. Portholes and other small objects can be measured in the middle while larger objects, such as doors and structural damage, should be measured on both sides. The depths at the top and bottom of the wall should also be taken. Video and still photography should be taken to supply the surveyor with better detail and to conserve time.

illustrations: C. Bowen

readings. Starting from the closest object to the center line, tape lengths, depths and compass headings are taken. Each recording is then classified as a station. Stations include major pieces of wreckage, artifacts, drastic changes in floor contour, cargo, etc.

The depth at which the measuring tape is attached must also be recorded. This allows the measuring tape to be placed high above the wreckage to help prevent entanglement while surveying. Caution must be taken not to allow the survey tape to become bent around an object as this will create an error in the survey data.

If time allows, increased accuracy can be obtained by using multiple stations for larger objects, such as the corners of large pieces of hull, cargo, shafts, mast, etc. If visibility allows, a photograph pointing straight down on top of each object with the survey line running through the photo should be taken. This will allow you to place the photos together later like a small puzzle. The line running through the photo will allow you to lay the object on its original angle from the center point. Also, a diver or a brightly colored yard ruler can be placed into the photo. This will enable the surveyor to better estimate the size of the objects in comparison.

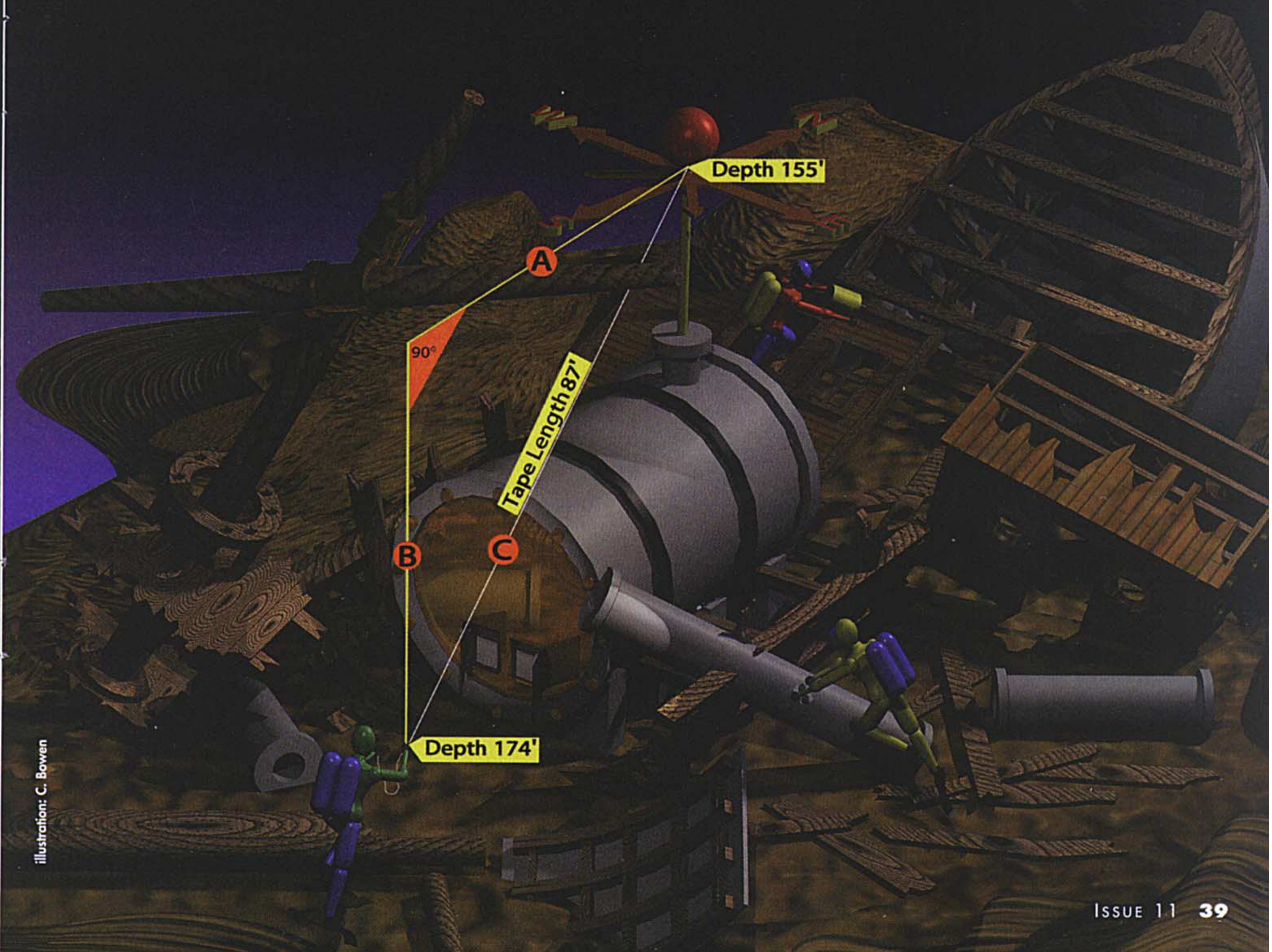
Video is a must for triangulation surveys. It is impossible to gather any real detail on a wreck that is in total disarray without the assistance of video. The video camera operator and photographer should follow the survey team around the wreckage. This will allow the survey leader to instruct the photographer and videographer on the angles at which he would like specific wreckage or artifacts to be shot.

Many times both the systematic and triangulation methods will need to be implemented on a shipwreck, such as in the case of a debris field scattered out from the main wreckage or if the ship has broken in half leaving a large field of wreckage and cargo between two sections.

Once the survey is completed a hypothesis of how the ship sank can be reached according to the structural damage and lay of the vessel. A severely damaged bow can indicate the ship plunged bow first. Badly bent props can indicate that they were still turning as the ship struck the bottom. Large pieces of steel beams or structural metal folding outward from the wreckage can indicate an interior explosion from a boiler or munitions. A broken mast or bent deck poles can indicate the angle that the ship initially sank as they were folded backwards by the water. Debris fields stretching out from the wreckage in one direction will indicate that the ship foundered for some distance before actually sinking. And, blown-in hatches and glass will indicate which way the air escaped or the water entered.

If all the team members concentrate on the structural damage while diving and the video and photographs are examined extensively, an accurate assessment of the ship's sinking can be made. DT

Curt Bowen is a founder of DeepTech, *TDI Mixed Gas Instructor, Computer Graphics Artist, and a Firefighter/EMT.*



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