

The Need for **SPEED**



Surveyors play a key role in the APBA Gold Cup races in Detroit.

BY MICHAEL F. H. DeDECKER, PS

When Chris-Craft co-founder Christopher Columbus Smith broke the 60 mph speed barrier with a Detroit-based hydroplane, the Miss Detroit, in 1915 to win the American Power Boat Association (APBA) Gold Cup on Manhasset Bay near New York City, he began a legend. Smith's victory brought the Gold Cup race to Detroit the following year. Today, Detroit is the boat racing capital of North America and is the sole location for the Gold Cup races. This year's historic race in July marked the 100th time the trophy has been awarded.

Race fans probably know most of these statistics. But what some of them might not know is that surveyors are an integral part of the event. Surveyors design the course, set the buoys and monitor their locations, and certify that the course is established according to the approved race chart for length and configuration. This is a unique job not only because it requires specialized techniques but also because it is performed by a volunteer workforce of professional surveyors and survey technicians on behalf of the Southeast Chapter of the Michigan Society of Professional Surveyors (MSPS).

Survey History

Course layout for the Detroit races was performed by a local surveying firm until around 1976. In 1979, Grant Ward, RLS, of Grant Ward Surveyors, heard that no speed records could be set that year because the length of the course was not certified. He quickly contacted several surveyors from the area and formed a team of volunteers that began work the following day. The initial group consisted of some of the most-respected land surveyors in the area; many of them, including Ward, remained involved in the following years. Although all the volunteers were affiliated



Karol Grove, PS, uses a Trimble Geodimeter 610 Pro robotic instrument to control an onshore survey station during the race. Photo by Reed Zapf.

dinate with them throughout the event. They are also charged with assembling a team of surveyors, making sure that they come equipped for the task at hand and ensuring that enough people are on the team during the event.

In any given year, 10 to 20 surveyors are involved in the project. Volunteers work from dawn to dusk in the days leading up to and during the event. The course is usually set up on Thursday morning to allow for practice, qualifying and racing from Friday through Sunday. Layout computations and informational packets are prepared for each of the workers. Those new to the work are given instructions or paired with a veteran, and adjustments to the work plan are made on-the-fly as conditions dictate. The chapter also maintains an assortment of radios and batteries designated for the event to facilitate communication between each of the volunteers and also with the judges stand.

Large, inflatable buoys are provided by the race sponsors with different colors designating various locations on the course. Providing the anchors for the buoys is the responsibility of the chapter. The original anchor design consisted of a Danforth anchor with a heavy chain lead and thick rope extending to the buoy. However, this arrangement proved cumbersome to set and difficult to adjust for location. The current configuration consists of 5-gallon buckets that are filled with concrete and include embedded pieces of bent rebar that serve as tie-off points for a new lightweight buoy rope.

The rope is pre-cut and marked to a variety of lengths on shore. Matching the length of the rope to the water depth for each buoy is critical. "If the rope is too short, the anchor remains suspended and is carried downstream by the current," Grove explains. "If it's too long, the buoy drifts away from the anchor in a circle, blown by the wind or carried by current from its intended location." In most cases, the buoys are first set with an empty detergent bottle as a marker buoy, and the inflatable buoy is added after the marker buoy is adjusted to the correct location.

1-mile-long course at one end for other boat classifications.

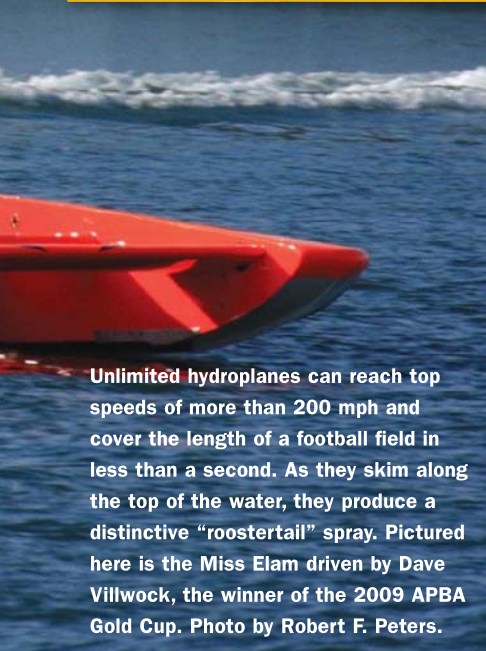
In addition to the course length, water depth is a consideration. Submerged obstacles are a safety hazard in shallow water, and pulling a driver from a capsized boat is further complicated if the rescue divers cannot reach the driver from below and remove the cockpit cowling.

Escape routes for the boats must be established, and buffer zones must be established between the course and the spectators, whether they are viewing from shore or by boat. The current two-course configuration consists of around 40 buoys, including 26 main inside buoys as well as a number of additional buoys marking the outer limits and safety zones.

The layout of the course, which must agree with the approved race chart for the event, is sent to the APBA in Seattle where it is reviewed and approved by the chief surveyor (currently Leo Eason II, PE).

Organizing the Volunteer Effort

Karol Grove, PS, owner of Alpine Land Surveying Inc. and a member of the MSPS board of directors, is the current chair of the chapter's Gold Cup committee, and David P. Smith, PS, president of David P. Smith and Associates Inc. and chapter treasurer, serves as assistant chair. In their roles on the race committee, Grove and Smith are required to attend several meetings with the race's organizers in the months leading up to the event and coor-



Unlimited hydroplanes can reach top speeds of more than 200 mph and cover the length of a football field in less than a second. As they skim along the top of the water, they produce a distinctive "roostertail" spray. Pictured here is the Miss Elam driven by Dave Villwock, the winner of the 2009 APBA Gold Cup. Photo by Robert F. Peters.

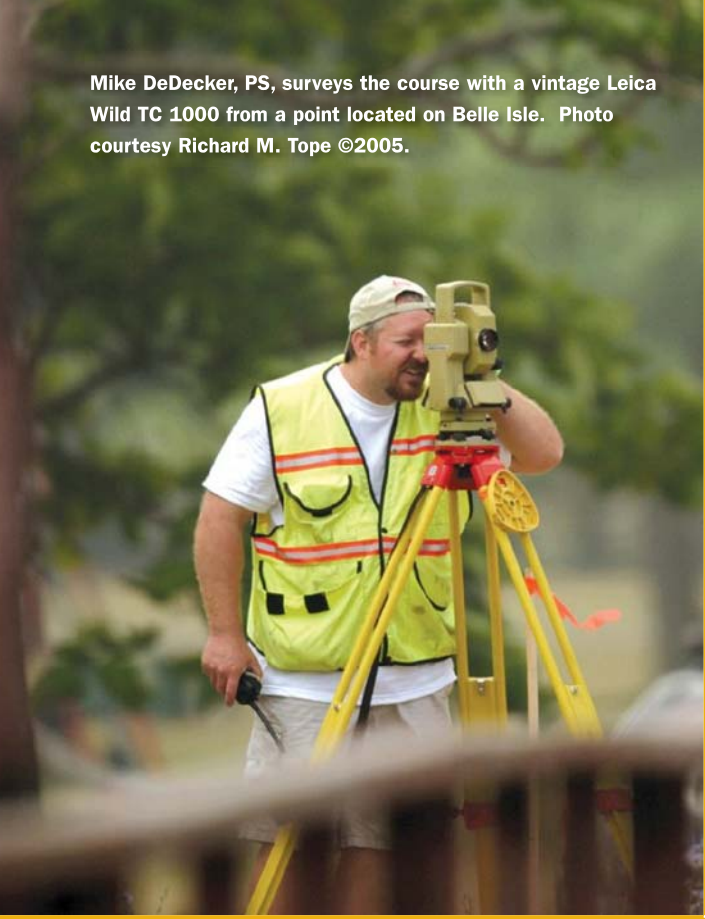
with the Southeast Chapter of MSPS, the event did not become an official chapter project until 2005.

Designing the Course

For the past three decades, the Detroit race course has been designed by Ward with several adjustments over the years. While safety is the primary consideration, speed, spectator visibility and access, and other factors are also important.

The Gold Cup is a 15-mile race; however, the length of each course varies. The current unlimited course is 2.5 miles in length and incorporates a shorter

Mike DeDecker, PS, surveys the course with a vintage Leica Wild TC 1000 from a point located on Belle Isle. Photo courtesy Richard M. Tope ©2005.



Placing the Buoys

The marker buoys are set using GPS observations. Joe Kapelczak, PS, of JCK and Associates has led this initiative for the last several years and uses an Ashtech GPS receiver to perform RTK measurements to navigate to the precomputed locations. The river's strong current makes this task challenging. If the points are not approached from directly downstream, the heading on the boat's compass can vary dramatically from the actual heading as displayed by the GPS unit because the boat is pointed further upstream to maintain a bearing but is heading across the current. Getting to the desired point requires working closely with the boat driver and takes a fair amount of practice. While traversing to the next point, lead lines of the correct length are secured between the marker buoy and the anchor, and the anchor is dropped about 15-feet upstream from the point to account for the actions of the current.

Relying on Triangulation

Precise positions for 10 onshore points have been previously established over the years by traversing and more recently confirmed with GPS observations. The group tries to use a minimum of four total stations for their work. Two total stations are required to determine a position by triangulation. However, it is often difficult to determine which buoy is being observed through the scope, so blunders are common. A third station confirms if an error has occurred, while the fourth station determines if any of the other

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stations are in error. Dope sheets for each station are prepared in advance and give the computed angles between each of the stations and the buoys as well as a number of reference points on the skyline. Each station obtains its reference orientation by backsighting another station or reference point on the horizon.

When checking a buoy, each of the stations turns the angle to the designated marker. The crew then reports that the location is either acceptable or needs to be moved upstream or downstream or toward or away from shore depending on their vantage point. During the course setup and three-day event, buoys can move for a variety of reasons. If the anchor does not stick sufficiently to the river bottom, the buoy can be dragged downstream, rapidly or gradually, by the current. Varying wind conditions can also blow the buoy, with the movement exacerbated if the buoy line is too long. And, of course, it is not uncommon for a buoy to be hit by a race boat.



MSPS Southeast Chapter President Jim Hollandsworth, PS, uses a Leica TC 600 to verify the course from station five near the final turn while one of the unlimited hydroplanes performs a qualifying lap. Photo by Reed Zapf.

Because it is not practical or safe to visit each of the buoys with a GPS unit during the race, triangulation from shore is required to monitor the buoys before and during each race, particularly if a new course record has been established.

Triangulation can also be used to set the buoys, and it was used for that purpose on the course until GPS became the preferred method of the group in recent years. Two stations are designated based on strength of figure when setting a point, with the sight from each of the stations to the buoys as close to perpendicular to one another as possible. One station is designated to give line to the boat, while the other station is required to give the "drop." The line station turns the computed angle to the buoy. It then communicates with the boat to direct the driver to reach that line and then turn toward the station along the line. The station next instructs the driver by radio to turn left or right in order to stay on the line toward the station. In the meantime, the drop station tells the boat when it is approaching its line and ultimately gives the command to drop the anchor (allowing for a 15-foot lead due to the current) as the boat crosses the line. This method requires precise communication skills because the

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boat driver is typically several thousand feet from each of the stations and often does not know the locations of the shore stations that are giving directions.

The onshore stations also serve another important role. When an accident occurs, each of the stations records the measured angle to that location. This information can be used to later recreate the position and direct the divers where to begin their search for debris. "This is critical because the water is often murky and the visibility poor, requiring a tedious search," Grove explains. The group has helped divers locate an expensive cowling from one boat and, in another case, find a sunken boat, earning the respect and appreciation of the divers, boat teams and race sponsors.

Promoting the Profession

Participating in the APBA Gold Cup provides a number of benefits for the surveyors involved. First, it helps fulfill one of the group's goals in terms of promoting the profession to the public. The survey-

Acknowledgements: *A handful of people are mentioned in this article due to their role in a particular aspect of the project. However, many others have been involved, and some have participated year after year. Their contribution to the project is recognized, but there are too many to list individually. Thanks to Grant Ward, RLS, and Karol Grove, PS, for their contributions to this article. This article is dedicated to Don Ross, RLS, a member of the chapter who was an instrumental participant in the event from 1979 until his recent death.*

ors interact directly with the individuals organizing the race as well as the general public attending the event. The volunteers controlling the onshore survey stations have a prominent location in front of the crowd and have the opportunity to explain the role surveying plays in the race to many inquisitive racing fans. The announcer also typically spends several minutes on multiple occasions discussing the group's role in the event over the broadcast system, which educates those within earshot about the volunteer work performed by the MSPS and the importance of the group in providing a surveyed course.

Additionally, the project is a valuable fundraising tool. While the survey work has been performed free of charge for decades, the race survey committee in

the last few years has negotiated a large donation to the chapter from the Detroit River Regatta Association, the organizer of the event. This donation has allowed the chapter to annually offer generous scholarships to surveying students.

Finally, participating in the event provides volunteers with an exciting opportunity to be involved behind the scenes. Volunteers learn the ins and outs of a niche surveying activity. Most involved would not have the opportunity to survey a boat race course in their everyday surveying operations. Additionally, two of the survey stations in particular offer the best seat in the house for watching the race. Station five is located next to the pits and is the closest point on the course to the boats as they race around the final turn, sometimes coming frighteningly close to the station. Station four is located on top of the judges stand, offering the best view of the finish line. Spectators are envious of the view from the stations, and security often needs to escort photographers away from these restricted areas.

"It's a fun and rewarding job," Grove says. "The surveyors involved in the project might not have the chance to win the Gold Cup, but they have the satisfaction of knowing that their services make the race possible." ☺

Michael F.H. DeDecker, PS, is a project manager and associate for Spalding DeDecker Associates Inc., Rochester Hills, Mich., and has previously been involved in the Gold Cup race survey activities. He can be reached at MDeDecker@sda-eng.com. More information about the Gold Cup races can be found at www.gold-cup.com.

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Author's note: *In addition to the Gold Cup race on the Detroit River, the MSPS group has performed layout for Michigan hydroplane races on the St. Clair River, Pontiac Lake, Sylvan Lake and Stony Creek Lake. For more information about the MSPS, visit www.misocprofsurveyors.org.*