

The Association for Unmanned Vehicle Systems International (AUVSI) and the
U.S. Office of Naval Research (ONR)
Announce the

3rd Annual International Autonomous Underwater Vehicle Competition

**July 7-9, 2000
Disney's Coronado Springs Resort
Orlando, Florida**

(in conjunction with the "Unmanned Systems 2000" Symposium)

KEY MILESTONES:

Event	Due Date
Intent to Compete Form and Payment Due	April 14, 2000
Journal Paper Due	June 9, 2000
Teams Check-in Onsite	July 6, 2000 -- Noon
Static Judging and Safety Inspection	July 7, 2000 -- 8 am
Practice Time	July 7-8, 2000
Competition	July 9, 2000

GOAL:

The goal of this competition is to advance the state-of-the-art of Autonomous Underwater Vehicles (AUVs) by challenging a new generation of engineers to perform realistic missions in the remote underwater environment.

ARENA:

SITE The 2000 competition will take place in *Lago Dorado* (the "Arena") on the grounds of Disney's Coronado Springs Resort in Orlando, Florida. The dimensions and bathymetry of the Arena are shown in Figures 1-3.

BEACONS Before the competition, the organizers will have distributed a number of beacons around the bottom of the pond. Each beacon will be equipped with a pinger (an acoustic transmitter) and a light source.

The beacons are normally off. When an entry begins its mission, one beacon will be activated. When activated, the pinger will transmit a short acoustic signal on a pre-set frequency every 20 to 40 seconds. Similarly, every 20 to 40 seconds, the light will flash (the light may not be synchronized to the pinger).

In addition, each beacon will have a recovery marker (drawing not yet available). The recovery marker will consist of a loop of semi-rigid plastic tubing that has been wrapped with both types (hooks and loops) of Velcro™, or similar product. The plane of the loop will approximately lie in an East-West direction – that is, to pass

though the loop requires approaching from the North or South. Detailed dimensions of the loop will be released by the competition staff no later than Feb. 15, 2000.

STARTING POINT Each entry will be launched from a dock, the exact location of which is not yet determined.

MISSION:

1. The mission is for a self-propelled AUV to leave the starting position and locate the active beacon before time runs out. Points will be awarded for determining the ping rate of the beacon, determining the flash rate of the beacon, and returning with the recovery marker. In the case of a tie in total points, the entry that carries out the mission in the least time will win.
2. The AUV must perform this task autonomously, with no control, guidance, or communication from a person, or from any off-board computer.
3. Each team will have 45 minutes on the dock. The first 15 minutes are the preparation period. During this time the entry may not be deployed in the water. The 30-minute-long operations period immediately follows.

When the judge signals the start of the operations period, the team may ask to have the AUV deployed into the water and released it to perform the mission. Only tournament officials may deploy and recover the AUV. The time required to deploy and/or recover the vehicle does not count against the 30-minute limit. This is to prevent unsafe actions in an attempt to speed the deployment and recovery processes.

A team may attempt multiple runs during the 30-minute operations period. Once a team has the officials deploy their vehicle, all points earned in previous runs are lost. Only officials may retrieve a vehicle and return it to the dock. While the time spent recovering the AUV from the water onto the dock does not count against the 30 minute limit, the time taken by officials to retrieve a vehicle and return it to the dock does count against the 30 minute limit.

4. The mission ends when any of the following occur.
 - i) The 30 minute operations period ends.
 - ii) The Judges order the end of the mission.
 - iii) The Team Captain requests the end of the mission.

OFFICIAL RULES, SUBMISSIONS, and FEES:

The official source for all information concerning rules, interpretations, and information updates for the 2000 International Autonomous Underwater Vehicle Competition is the World Wide Web Home Page.

An Intent to Compete form is available on the web site, due no later than April 14, 2000.

The submission must be in English and is not considered official until the entry fee of five hundred U.S. dollars (\$500) has been received by the AUVSI. The host venue cannot handle an unlimited number of entries. Therefore, the organizers reserve the right to limit the total number of entries that are allowed to compete by declaring the competition closed to new entries before the due date above. As with all official information, this announcement (should it be necessary) will appear on the official web site.

VEHICLES:

1. Each team may enter one AUV into the competition. Each entry will be physically inspected by the competition judges. The judges may disqualify any entry that they deem to pose an unreasonable safety hazard. The judges will confer with representatives of the host facility and any entries that, in the opinions of the judges or of the representatives of the host facilities, pose an unreasonable risk to the integrity of the host facility will be disqualified. The AUVSI and the host organization, their employees and agents, as well as the organizing committee, are in no way liable for any injury or damage caused by any entry.
2. Each entry must be autonomous. While carrying out the mission, no communication between the entry and any person or off-board computer is permitted. Entries must compete solely on their ability to sense and maneuver in the Arena using on-board resources.
3. The mass of each entry must be less than 100kg.
4. All entries must be battery powered. All batteries must be sealed to reduce the hazard from acidic or caustic electrolytes. Batteries may not be charged inside of sealed vessels at any time while on the site of the competition and/or while engaged in the competition. The open circuit voltage of any battery in an entry may not exceed 60 VDC. If a team has any questions or concerns, they are encouraged to contact the organizing committee through the web site.
5. No materials (except for compressed air used to blow ballast) may be released by the entry into the waters of the Arena.
6. All entries must bear a clearly marked kill switch that a diver can readily activate. This switch must disconnect the batteries from all electrical and electronic components and devices in the AUV. All entries must be buoyant by at least one half of one percent of their mass when they have been shut off through the kill switch.
7. Each entry must carry a tracking beacon which will be provided by the competition.
8. No entry may have more than 16 square inches of Velcro™ (or similar product) exposed to pick up the recovery marker.

9. Teams may be comprised of a combination of students, faculty, industrial partners, or government partners. Students may be undergraduate and/or graduate students. Inter-disciplinary teams are encouraged. Members from industry, government agencies (or universities, in the case of faculty) may participate, however full-time students must comprise at least 65 percent of each team. Participants must be enrolled at their schools for at least 12 credit hours or more per quarter/semester during winter and spring 2000 to be considered "students". The student members of a joint team must make significant contributions to the development of their entry. **Only the student component of each team will be eligible for the cash awards.** One member of the team must be designated as the "Team Captain". The Team Captain, and only the Team Captain, will speak for the team during the competition run.

10. No team member is allowed to enter the Arena at any time (this includes wading, swimmers and diving as well as floats, boats, etc.). Competition officials will be responsible for recovering lost entries that cannot be safely reached from the starting point.

11. The officials will suspend the operation of a vehicle at any time they deem that such action is required by safety or security considerations. Teams may be required to submit technical descriptions of their entries to the officials in advance of the competition, with the goal of identifying potential safety concerns well in advance. When requested, such technical information submitted to the judges will be held in confidence until the end of the competition.

12. The officials will suspend the competition at any time they deem that it is required by safety or security considerations.

JOURNAL PAPER:

Each team is required to submit a Journal Paper that describes the design of their entry and the rationale behind their design choices. This paper may be no more than 10 pages long (including all figures, references, and appendices) and must include an Abstract of 250 words or less. The paper must be printed on standard 8.5" by 11" paper, with margins of at least 1" on all sides, and all text must be in 12-point or larger font. Each page must bear a footer with the page number and the team name. The Journal Paper will be evaluated as described below in the section on scoring.

The paper must be received not later than June 9, 2000. Teams that do not meet the submission deadline will not be allowed to participate in the competition.

STATIC JUDGING:

Each entry will be subject to static judging before being allowed to compete. During the static display time, each team will be visited by the judges. They will evaluate each entry for technical merit, safety and craftsmanship as described below in the section on scoring. These visits will be scheduled in advance. Each team is required

to have at least one member attending their entry throughout the static display period (not just during the scheduled visit by the judges). Teams are also strongly encouraged to make a poster describing the entry. The posters can be set up next to the entry during the static display period. Representatives of the press and of other organizations will be encouraged to visit each team during this time period. Some of these organizations may choose to offer prizes of their own, and this period will allow them to perform their own evaluations of the entries.

TEAM WEBSITES:

Each team is strongly encouraged to create a website for their AUV entrant and corresponding effort. In the months leading up to the event, the judges may choose to utilize your website for additional information. Please keep in mind that your website must be open to the public.

SCORING:

Entries will be scored on performance measures and on subjective measures.

<i>Performance Measures</i>	<i>Max. Points</i>
Determine the ping rate of the beacon	100
Qualified entry that, fully autonomously, dives and travels at least 5 meters underwater in a controlled manner	200
Determine the flash rate of the beacon	300
Return the recovery marker	1000
Finishing the mission with T minutes (whole or fractional) remaining of the 30 minutes allotted for the task	$T * 50$
<i>Subjective Measures</i>	<i>Max. Points</i>
Technical Merit (from Journal Paper)	150
Written Style (from Journal Paper)	150
Safety of Design (From Static Judging)	100
Technical Merit (From Static Judging)	100
Craftsmanship (From Static Judging)	100
Team uniform (From Static Judging)	10
Discretionary Points (Awarded After Last Competition Run)	90

Technical Merit, Safety of Design, and Craftsmanship: These considerations will exclude any components of the design that are or could be (in the judges opinion)

commercially available or do not include a significant contribution by team members. In other words, if you use a well-built, well-designed, off-the-shelf computer, your team does not get points for the computer's good technical design, etc. You will get points for selecting a computer that is well-suited to the engineering needs of the design, in the opinion of the judges.

Travel and Dive Fully Autonomously: The judges will use their discretion in making their determination. Partial points may be awarded..

Return the Recovery Marker: The marker is considered recovered if it is attached to the AUV at the end of the mission. The judges will use their discretion in making their determination. Partial points may be awarded..

Determining the Flash and Ping Rates: Teams may connect a computer to the AUV and recover this information. They may do so during the operation time, or as soon as is practical after the 30 minute operation time expires. The judges will use their discretion in making their determination. Partial points may be awarded.

Unused time: The judges will record the time elapsed between the start of the 30-minute-long period allotted for vehicle operations and the end of the mission. Unused time (in minutes) will be rounded up to the nearest integer greater than or equal to the unused time (e.g. 0:01 will be rounded to 1 minute, 29:59 will be rounded to 30 minutes, 5:00 will be 5 minutes). The points for unused time will only be awarded if points are awarded for returning the Recovery Marker.

SEQUENCE OF EVENTS DURING THE COMPETITION:

Static Display Period. Each team will receive a scheduled visit from the judges during this period for the static judging. In addition, members of the public, the press, and representatives of other organizations will also view the entries and talk with team members.

Time slots announced for the day of the competition. Competition time slots will be awarded based on standings after the static judging. The team that is in first place will have first choice, etc. Ties will be broken by a coin toss or random draw.

Practice Runs. Practice time slots will be scheduled based on standings after the static judging. The team that is in first place will have first choice, etc. Ties will be broken by a coin toss or random draw. Each entry must be approved by the judges before it will be allowed into the Arena. It is our intent to provide as much practice time in the Arena as is practical. We expect to allow two entries in the arena simultaneously, on the condition that they not interfere with each other. We anticipate that each team should have approximately 2 hours of practice time.

Competition. Each team will be assigned a time slot. Twenty minutes before the beginning of their time slot, the team may enter the staging area near the launch site. At the beginning of their slot, the team may move to the launching site on the dock. The first 15 minutes are for preparation. During this time the entry may not be deployed in the water. When the 15-minute limit has expired the judges will

begin a 30-minute clock. These 30 minutes are for vehicle operations. Once this period has begun, the team may ask to have their vehicle placed in the water to begin its mission.

Vehicles will be put into and taken out of the water by tournament officials. The time required to do so will not count against the 30-minute limit. After the vehicle has gone into the water, the team may request that it be lifted onto the dock for repairs. Again, tournament officials will move the vehicle onto the dock, and (when requested) redeploy the AUV into the water. Again, the time required to do so will not count against the 30-minute limit. However, time spent by the team on the dock does count against the 30-minute limit.

The mission will continue until either the 30-minute limit has expired or the judges order the termination of the mission. The judges may order the termination the mission at their discretion. Once the judges order the end of the mission, no further points may be scored. The judges decisions on the termination of the run are final.

AWARDS:

Cash prizes totaling up to \$10,000 will be awarded at the discretion of the judges.

DIAGRAMS:

Figure A: An overview of Disney's Coronado Springs Resort. Lago Dorado is the lake in the center of the property. The inlet on the NE of the main body of water -- between "G" and "I" on the map -- is the location of the Competition.



Figure B: An aerial view of the inlet with bathymetric overlay.

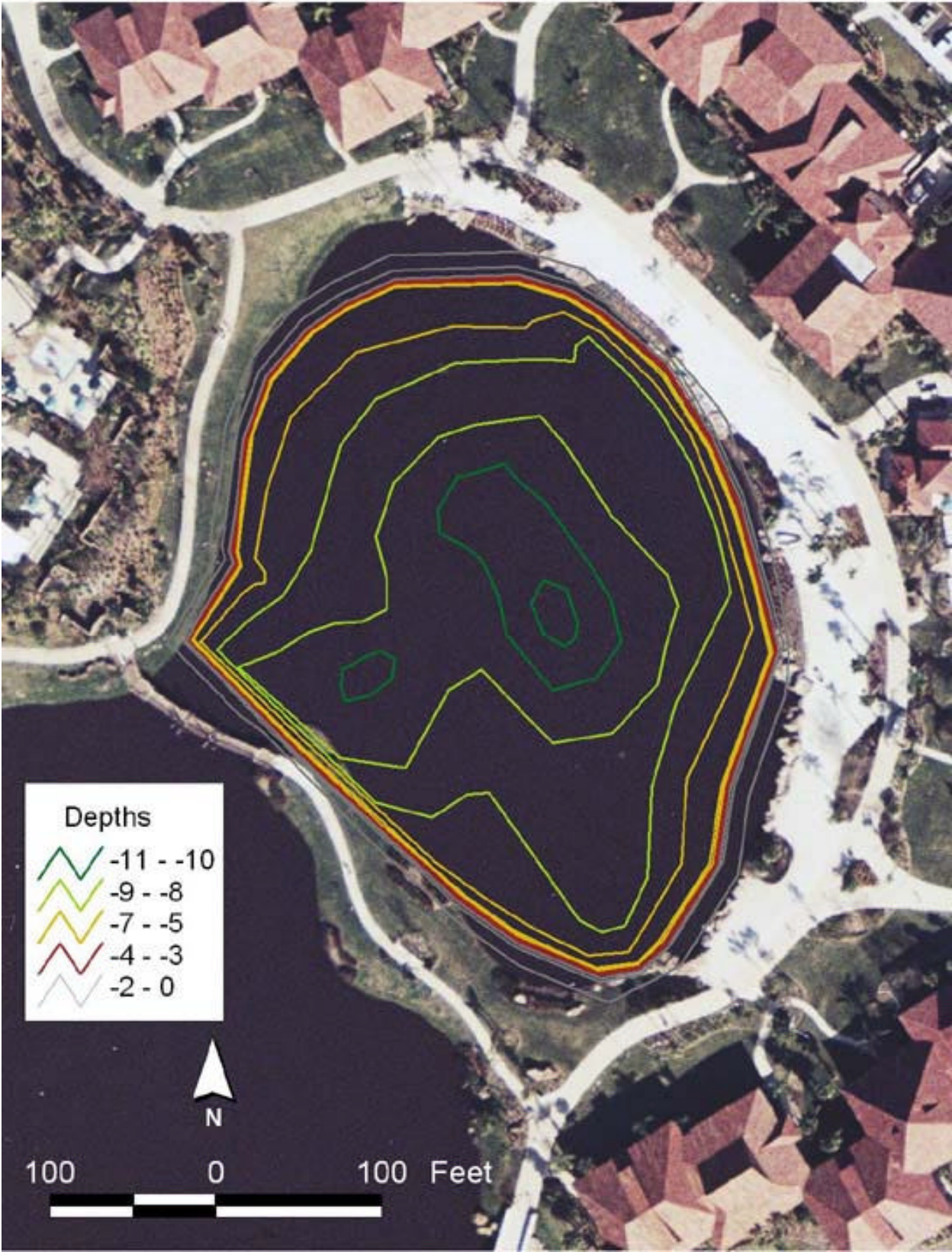


Figure C: Another aerial rendering:

