

Team Submissions

2020 RoboBoat (Online)

www.roboboast.org

Thank you for your interest in participating in the online efforts for RoboBoat 2020! Although we will not have the opportunity to see your impressive systems performing in Florida this year, we can't wait to see all the work you've done this year.

Each team leader (or the individual that registered your team) will receive access in their Submittable account to additional forms for each of the following submissions, listed below. Only the team leader and RoboNation staff will have access to the teams' submissions. Each team leader is responsible for adhering to the instructions and deadlines listed below.

SUBMISSIONS

1. [Team Information | DUE May 22, 2020](#)
2. [Advisor Information | DUE May 22, 2020](#)
3. [Website | DUE June 7, 2020](#)
4. [Technical Design Report | DUE June 21, 2020](#)
5. [Video | DUE June 28, 2020](#)

OPTIONAL SUBMISSIONS

6. [Create A Task | DUE July 5, 2020](#)
7. [Systems Engineering Paper | DUE July 12, 2020](#)
8. [Resume / Curriculum Vitae \(CV\) | Rolling Deadline](#)

1 Team Information | DUE May 22, 2020

List each team member who has participated in developing your system for 2020 RoboBoat.

2 Advisor Information | DUE May 22, 2020

List each advisor who has assisted in developing your system for 2020 RoboBoat.

3 Website | DUE June 7, 2020

Teams have been asked to document their efforts leading up to the competition by building a website. All elements of the competition will be conducted in English.

Team websites have been collected upon registration but will not be judged until after the June 7 deadline. If you have any changes to your website url, please notify Julianna Smith (Band App: @Julianna Smith, Email: jsmith@robonation.org).

4 Technical Design Report (TDR) | DUE June 21, 2020

Each team is asked to submit a TDR that describes the design of their vehicle, as well as strategies for their approach to the tasks. The TDR should also include rationale for design choices. Teams must follow the official TDR instructions, provided below.

4.1 Paper Presentation Overview:

The format of the written paper shall adhere to the following guidelines:

- **10 page limit (excluding References and Appendices)**
- 8.5 x 11 in. page size
- Margins ≥ 0.8 in.
- Font: Times New Roman 12pt
- Header on every page including team name and page number
- Submitted in pdf format

Access all past competitor's papers on the Past Teams' page, roboboast.org/past-programs. (Click on the year you'd like to view and scroll down to the teams' section.)

4.2 Paper Contents:

The written paper consists of six mandatory Sections and one mandatory Appendix. Additional sections may be included; however, the overall limit of 10 pages applies (excluding References and Appendices). In general, the editorial style for IEEE Conference Proceedings should be followed: www.ieee.org/conferences/publishing/templates.html. The two-column format is optional. We recommend that papers be peer-reviewed prior to submission. You can utilize resources at your institution, teams entering other RoboNation competitions, or on the community forum for this peer-review. Professional editing services are also available: secure.aje.com/en/default/submitb/select.

1. Abstract

The abstract is a short summary of the main points in the paper. The paper should primarily describe the linkage between your overall competition strategy and your system architecture, design and engineering decisions.

2. Competition Strategy

This section should discuss how the team plans on approaching the course and how the vehicle design relates to this approach. The course consists of multiple tasks with associated points for accomplishment. The only required task is passing through the start gate. Other tasks are optional and can be attempted in any order. The more tasks a vehicle is designed and engineered to accomplish, the more complex the overall vehicle system will be. The discussion should include the team's consideration of the trade-offs between system complexity and reliability. For example, teams have a limited number of working hours to prepare for the competition; this time could be spent adding additional capabilities or testing and improving the reliability of an existing capability. As system complexity grows, changes in subsystems can propagate in unmanageable ways when time is limited. Clearly, the goal of a competition is to score more points than the other teams. There are many ways to do this. Studying past competitions may be instructive. Based on history and the system engineering talents of your current team, describe your strategic vision.

3. Design Creativity

Given your strategy for winning and your approach to managing complexity, describe the creative aspects of your system. Novelty may occur at component, subsystem, and/or integrated system levels. Describe your experience in making both architectural/design decisions and system engineering decisions. This section should **not** include detailed component descriptions and/or specifications not of original design. The latter should be described in Appendix A.

4. Experimental Results

This section should describe various tests accomplished to date and planned, both in-water and in simulation, including pre-qualifying runs. There is a strong correlation between in-water testing time and competitive performance in the arena. Given typical student time constraints, balancing creative design and system engineering with testing and experimentation can be a challenge. How did your team estimate the amount of testing required to meet your reliability goals? How did you balance the demands of design and engineering with those of testing and experimentation?

5. Acknowledgements

Participating in the competition, as in all research projects, involves marshalling resources and support beyond the efforts of individual team members. This support can take many forms, such as technical advice, labor, equipment, facilities, and monetary contributions. Acknowledging those who have underwritten your efforts is important.

6. References

As with any technical publication, original ideas and content not generated by the paper's authors should be properly cited. While there are many citation styles, the IEEE Conference Proceedings style should be used, found on the following link: www.ieee.org/conferences/publishing/templates.html.

Appendix A: Component Specifications

In the past, detailed descriptions of components constituted the bulk of many written paper submissions. Such detail often distracts from understanding the team's underlying strategic thinking, design and engineering decisions, or novel contributions. Teams should list only the components actually used in the vehicle in the table below. Where components were developed by the team versus purchased off the shelf, this information should be included. Also, if commercial off the shelf equipment was significantly modified this should be noted. This standardized table will help document and track trends in component (hardware and software) usage and team metrics. Under the column marked "Specs" you may provide a web link to the manufacturer's specifications. The form on the next page is generic and you should report all components you have included in your vehicle design.

Component	Vendor	Model/Type	Specs	Cost (if new)
ASV Hull form/platform				
Waterproof connectors				
Propulsion				
Power system				
Motor controls				
CPU				
Teleoperation				
Compass				
Intertial Measurement Unit (IMU)				
Doppler Velocity Logger (DVL)				
Camera(s)				
Hydrophones				
Aerial vehicle platform				
Motor and propellers				
Power system				
Motor controls				
CPU				
Camera(s)				
Autopilot				
Algorithms				
Vision				
Acoustics				
Localization and mapping				
Autonomy				
Team Size (number of people)				
Expertise ratio (hardware vs. software)				
Testing time: simulation				
Testing time: in-water				
Inter-vehicle communication				
Programming Language(s)				

Appendix B: Outreach Activities (optional)

A foundational purpose of RoboBoat has been to strengthen and enhance the community. Teams are encouraged to participate in educational outreach activities and describe those activities here. The static judging score includes points for educational outreach on all levels.

5 Video | DUE June 28, 2020

In lieu of the in-person RoboBoat Competition, students are asked to showcase the maturity of their system developed for RoboBoat 2020. This visual effort is designed to serve as a replacement for your team video and on-site competition presentation. This video will be scored and will be published online on the [RoboNation YouTube Channel](#).

5.1 Video Content:

Students should prepare a video representing the below categories:

1. Team Introduction

Team members presenting on the video should introduce themselves (name, academic discipline and level of education) and highlight their role on the team.

2. System Overview

This section should contain a brief overview of the Autonomous Surface Vehicle (ASV). Overview for mechanical, electrical and software sub-systems should be a summary of the details discussed in the Technical Design Report (TDR).

3. Competition Strategy

Teams should discuss their competition strategy, based on the system they have designed. This section should also discuss rationales for designing the system that you have designed and assign a confidence rating (for successful completion) for tasks the team is planning on attempting.

4. Development Testing

Realizing that teams have not been able to test their vehicles, this section should address the remote efforts that teams have exercised to continue development of their system. Describe the types of testing efforts during your development cycle (component, sub-system, software, and simulation).

5.2 Video Requirements:

1. Teams must abide by all applicable social distancing protocols.
2. Video must not be longer than 15 minutes.
3. Videos must be submitted in .MP4 format.

5.3 How-to: MPEG Streamclip

To compress the video, please use the following:

- Format: .MP4
- Compression: H.264
- Quality: 50%
- Sound: MPEG-4 AAC 128 kbps
- Frame Size: Unscaled

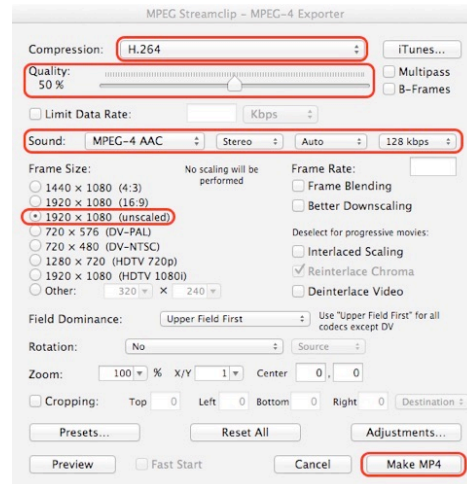


Figure 1: Example of MPEG Streamclip settings

6 Create a Task | DUE July 5, 2020

In lieu of hosting the onsite technology demonstration (RoboBoat), we would like to engage students to showcase their talents through online participation in several distance learning opportunities. To channel the creativity and passion of RoboBoat teams this activity challenges teams to design task(s) that spotlight autonomous behaviors for Autonomous Surface Vehicles (ASV). One or more of the competition tasks created may be featured at the 2021 RoboBoat Competition.

Though no ideas are bad ideas, engineers must work within a defined boundary. The guidance below is merely there to encourage your creativity, and not suppress it. The example below should provide both a visual and textual explanation of the task. Figure 2 is a RoboBoat task that will serve as an explanation for the requirements of this challenge and provide some account of what RoboNation considers when developing tasks for the competitions.

6.1 Paper Requirements:

The format of the written description of the task shall adhere to the following guidelines:

- **2 page limit (including graphics)**
- 8.5 x 11 in. page size
- Margins ≥ 0.8 in.
- Font: Times New Roman 12pt
- Header on every page including team name and page number
- Submitted in pdf format

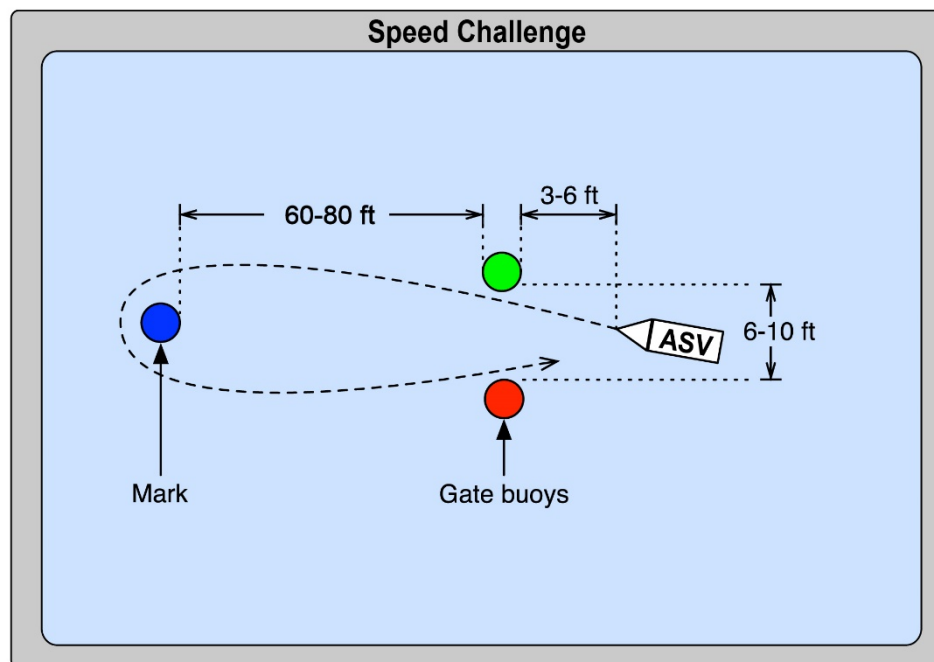


Figure 2: Sample task from RoboBoat

6.2 Create a Task Criteria:

When designing a task for this challenge, teams must consider the below evaluation criteria.

1. Demonstration of autonomy.

For example: In Figure 2, the task allows for a suite of sensors to be utilized for completing the challenge. The task could be completed by vision or LIDAR or GPS waypoints or a combination of these sensors/strategies.

2. Ability to increase the degree of difficulty.

For example: In Figure 2, the 'Gate buoys' could be less than 6 feet apart, the 'Mark' buoy could be moved (in any direction) etc.

3. Performance validation

Observation and validation of autonomous performance.

For example: In Figure 2, the autonomous task completion (as outlined by the dotted navigation line) could be distinguishable given the bright colored buoys. How easy would it be for a judge (some distance away), to observe and annotate what the vehicle has done?

4. Cost associated with parts of construction.

This is a consideration for the competition as well as the student teams being able to construct for testing at their respective locations.

For example: In Figure 2, the three buoys are a commercial product so their additive retail price would be a consideration here. Cost for the anchoring system (to hold the buoys in place) also needs to be considered.

5. Degree of difficulty in constructing the task.

For example: In Figure 2, since the buoys and anchors are all commercial products the degree of difficulty in constructing is minimal (securing the buoys).

6. Clarity of technical description.

Being able to communicate technical information in an efficient way is an artform. Use of simple graphics and simple text can be beneficial in delivery of your message.

For example: RoboBoat tasks are described with a graphic (on average) in one page.

7 Systems Engineering Paper | DUE July 12, 2020

Details coming soon!

7.1 Paper Requirements:

Coming soon!

8 Resume / Curriculum Vitae (CV) | Rolling Deadline*

Submit your team members' Resume or Curriculum Vitae (CV) as they are complete and ready to share with sponsors. RoboNation will collect these throughout the months leading up to competition to share with sponsors, to allow adequate time to review and prepare for seeing students at competition.

You may submit new versions of your resume leading up to competition, by notifying RoboNation of the new version or indicating on the file submission.

**Submission is open now and will remain open leading up to competition.*