



Proposal Summary

The Auburn University Hovercraft Team proposes to design, build and race a hovercraft for the remainder of the 2010 academic year, and years to follow. Our goals are to contribute to the education, experience, and professional development of team members and to increase the educational value of Auburn University. Specifically, this project will:

- Attract more students to Auburn University's technical majors due to exposure the project attracts from the media and key automotive, fiber, marine, industrial, and composites companies.
- Enhance the education of each team member through practical, hands-on experience
- Raise public awareness of the quality of education at Auburn University
- Inform students of valuable opportunities for student involvement, self-improvement, and professional development while attending AU
- Develop productive relationships between corporate sponsors and student engineers, with the goal of creating career opportunities and life-long relationships
- Provide visibility and publicity for our sponsors

The Auburn University Hovercraft team is composed of many talented students and advisors from a variety of disciplines in engineering and industrial design. We have the potential to be the most successful Auburn team. Our goals are to:

- Design and build a race-worthy hovercraft with the capacity for one person
- Minimize the craft weight and drag by optimizing the hull and cockpit design and materials used
- Incorporate a variety of sensors (pressure, speed, rolling, pitching) with portable data logging system to monitor the craft performance
- Provide an extensive program for craft driving
- Introduce an automatic remote control system to the craft in order to enhance its dynamic performance and stability

We strongly believe that these goals are attainable and should put Auburn University in a position to win a competition in the following years. With your help, we will be able to achieve our goals and show the excellence of Auburn Engineers.

Everyone involved with the Auburn University Hovercraft Team would like to thank you for your time and consideration of this proposal. As you can see, we have set high standards for ourselves. With support from individuals, major corporations, and organizations such as yours, we are confident that we can achieve our desired results.



Project Objectives

The primary objective of this project is for students to experience cross-disciplinary teamwork – how their knowledge in different fields can be combined to produce a working vehicle.

The main engineering fields and topics used in this project will be:

- **Design and build the craft from high-performance fibrous composite materials**
- Fluid Dynamics
- Finite element analysis
- Solid Modeling
- Imbedded Control Systems

In this project the students will learn and participate in the following:

- 1) Physics behind the hovercraft operation (lift, thrust, control)
- 2) Design of the craft components for a specific size and payload (theoretical calculations)
- 3) Modeling the hovercraft geometrically using CAD system (Solid Edge and Autodesk Inventor)
- 4) Analysis of the aerodynamics and stresses using finite element packages (Ansys)
- 5) Generation of workshop detailed drawings
- 6) Design and fabrication of hull and console using fiber composites**
- 7) Design and manufacture of the hovercraft skirt using non-permeable fabrics
- 8) Selections of engines with their blades
- 9) Design and analysis of steering mechanisms of the hovercraft
- 10) Design, analysis, and implementation of an imbedded controller
- 11) Assembly and testing

Target Specifications:

Payload	≥460 lbs
Total Length	Apx. 9ft
Total Width	Apx. 5ft
Empty Weight	<300lbs.
Water Speed (Max. Wave of 0.5 feet)	>45 mph
Engine Power	85 hp



Hoverclub of America Racing Regulations Formula S, Formula 2, and Formula 1

The Auburn University Hovercraft Team participates in the annual Hoverally competition. The competition consists of races that are on land and water and consist of sharp turns and straight sections. **The current hovercraft is qualified for three of the six classes, Formula S, 2, and 1.**

Formula S Design Regulations

The machines are restricted to a single fan, single engine, and single duct. The engine displacement has no limit.

Formula 2 Design Regulations

The machines can have any number of engines, fans, and ducts as long as the engine displacement does not exceed 500cc.

Formula 1 Design Regulations

The machines have no restrictions. Any number of engines, fans, and ducts can be used, no displacement limit, and are expected to be the fastest and best machines.



Sponsorship Benefits

Our 2010 sponsors will be a valuable part of our successful effort. Sponsorship opportunities vary greatly. Some of our sponsors have made a cash donation and/or product contribution, while others have offered materials or discounts on their product used in construction.

Your sponsorship will provide contact and possible relationship with potential future employees while enhancing their education and professional experience. These are the people who will be tomorrow's engineers designing with and specifying your projects for tomorrow's innovations.

The benefits of sponsorship will be far-reaching. Sponsors will benefit from the team's competitions, public appearances, press releases, website, and news coverage. Platinum and gold level sponsor logos will be displayed on the hovercraft. The craft will travel nationally for competition, where engineers and students from around the world will see them. These racing events are sponsored by the Hoverclub of America.

We hope you will join us for our 2010 season. Your help with materials and discounts will be included in determining sponsorship level.

Silver

- **\$500-\$1000 donation**
- Framed team photograph
- Full race report
- Company logo and link of the Auburn Hovercraft website
- Your company's name of the 2010 craft
- Your company's name on the team casual t-shirt

Gold

- **\$1000-\$2500 donation**
- *Includes Silver package*
- Your Company's logo on the 2010 craft
- Your Company's logo on the team casual shirt
- Invitation to attend a one day demonstration of the 2010 Hovercraft

Platinum

- **\$2500-up donation**
- *Includes Gold Package*
- Your Company's logo on our race trailer
- High-Profile placement of logo on the 2010 hovercraft.
- Promotional appearance of the 2010 craft at your location

Donations below the \$500 level will receive a full race report, shirt and picture.

We will be happy to work with donations of all kinds, large and small. We want your sponsorship to benefit your company as much as possible. Let us know what we can do to make your donation easier. Donations should be made payable to "Auburn University Foundation" designated "for the Hovercraft Team" and mailed to Dr. Peter Schwartz, 115 Textile Engineering Building, Auburn University, AL 36849-5327.

Auburn's federal tax I.D. is 63-6022422.



Expenses

Referencing previous years expenses, total cost of production is expected to be \$20,000. These expenses include the material used in construction (carbon fiber, epoxy resin, foam, paint, glue, skirt material, etc.), tooling and shop equipment, supplies, engineers, fan, propeller, trailer and traveling expenses of the team for competition.

We believe that we can do well on a small budget but may not be able to meet our goals without your help.

Our intent is to be in the upper echelon of competitive universities. Your participation in this exciting and challenging educational experience will be greatly appreciated and used with accountability to our advisers and Auburn University.

For more information about our project, please visit our website at:
<http://www.eng.auburn.edu/organizations/hovercraft/>

If you have any questions or comments, please don't hesitate to contact us:

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Background Principles

What is a Hovercraft?

During the 1950s, Englishman Christopher Cockerell developed and patented the first hovercraft. Soon after, British Hovercraft Corporation developed the first commercial hovercraft for passenger transport across the English Channel. With the ability to carry up to 400 passengers and 50 automobiles, these craft still function today.

A hovercraft is an amphibious vehicle that is supported by a cushion of slightly pressurized air. Although often seen as a mysterious, even bizarre mode of transportation, it is conceptually quite simple with dynamics that are more closely related to aircraft than to boats or automobiles.

Hovercraft float on a cushion of air that is forced under the craft by a fan, causing the craft to rise or lift. The amount of lift can range from 6" to 108" (152mm to 2,743mm) depending on the size of the craft. The amount of total weight that a hovercraft can raise is equal to the cushion pressure multiplied by the area of the hovercraft. To make the craft function more efficiently, the air cushion is confined by a fabric skirt that allows a deep cushion of air for easy clearance of obstacles. Skirts vary in style ranging from bags to cells to separate fingered sections called segments.

Once "lifted" or "on cushion", thrust is created to move the hovercraft forward. Some craft use a separate engine for this purpose; others rely on the same engine that provides the lift.

Steering is achieved through the use of a system of rudders behind the fan, controlled by handlebars up front, or by the use of body weight displacement -- a skill which is achieved after practice. Other machines utilize patented, reverse thrust buckets for control - a system that enables the driver to reverse at speed, maintain cushion at speed, regulate speed going downwind, to brake (a must on ice), and to hover while stationary.

Hovercrafts applications are as diverse as the people who use them. They are often used to reach areas that are inaccessible on foot or by conventional vehicles. A partial listing of present uses includes:

- Navigating shallow and narrow waterways that cannot be reached by boat
- Rescue work on ice, snow, mud flats, deserts, in wetlands, shallow water, swamps, bogs, marshes and floodwaters
- Transport in environmentally sensitive areas where habitat, erosion and soil compaction are a concern
- Wildlife research and conservation
- Military services



- Dive recovery teams
- Retrieving birds from tailings ponds at mining sites
- Water management
- Port authorities/drug enforcement
- Agricultural spraying
- Survey work
- Forestation
- Heavy load movement across difficult surfaces
- Mosquito abatement
- Environmental testing
- Charter operations
- Oil spill clean up
- Removing leaves from Pecan farms
- "Island-hopping" or transportation with clients for real estate purposes
- Fishing anywhere...including on ice
- Affordable and a safe way to fly without a pilot's license
- Entertainment at Disneyworld water shows