Boat #8

2025 University of Southern Indiana Solar Splash Technical Report

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Executive Summary

The University of Southern Indiana Solar Splash team is made up of multiple disciplines within the engineering department. In 2023, the team brought a new boat with a complete makeover of all subsystems within the boat. With these upgrades, the team was able to improve the ranking going 12th to 3rd place overall. In 2024 the team brought the same hull with multiple changes, in the hopes of performing as well as 2023. The team faced multiple setbacks during the 2024 competition, including the detachment of the drivetrain during the first sprint race, sinking the boat due to a turn fin tearing a hole in the boat, and flipping the boat during the final endurance race due to high winds.

The team found multiple areas that needed improvement within the system, which led to the construction of a new boat with a complete makeover of all subsystems within the boat. The team ultimately made the decision to build a new boat in hopes of improving the longevity of the hull. The team focused on improving the overall design of the hull, the drivetrain, steering, and stability.

The first improvement the team made with the new build was the hull. The team was very happy with the performance in sprint and slalom of the previous hull; however, the previous hull was unstable and uncomfortable during the endurance races. After extensive research and testing of multiple hull designs, the team settled on a trimaran hull. This hull tested to be more stable and comfortable without compromising the performance enjoyed about the previous hull.

The second improvement that the team made involved the drivetrain. The 2024 drivetrain was built around a Hangkai 6hp 2-stroke Outboard, the team then mounted the electric motors inside of the boat to create a chain drive. This outboard created issues for the team during the 2024 competition, including the detachment of the drivetrain on multiple occasions. This year the team modified a Lynch Bluefin II electric outboard, to fit the needs of the hull and the competition.

The third improvement that the team focused on was the solar panel mounting. During the 2024 competition the solar panels created multiple issues for the team, including flipping the boat during the final endurance round. The team decided to switch directions and move away from hard glass panels and use flexible panels. With the remodel of the hull, the team was able to build around the panels, including the way that the panels would be mounted. The team designed a custom frame for the panels that is mounted directedly to the front of the hull eliminating the risk of shadows from the driver.

The fourth improvement that the team made was the improvement of the steering system. The past two years the team has used a tiller arm for steering. This has worked well for the team as it was simple and easy to work with. Due to the depth and location of the seat in the new build, the team found that a tiller arm wouldn’t work. After assessing multiple options, the team settled on cable pedal steering, to maintain a light weight system with safety and reliability.

The final improvement that the team made was the addition of telemetry. In years past, the team has always made a goal of the addition of telemetry but never had time to implement it. This year the team specifically gave that subsystem to one of the team members for implementation. This year the owner of that subsystem researched the multiple data logging systems and selected the “RAPTOR VEECAN 320 DISPLAY” by New Eagle for the data display. Two DCT300-10B-24-S current sensors will also be used to monitor current flow to and from the boat’s battery box, allowing the telemetry system to accurately track battery charge and discharge levels in real time for better energy management during the endurance race.

To maintain project alignment and ensure timely progress, the team implemented month calendars displayed from August 2024 to May 2025. These calendars outlined key deadlines, meeting times, and project milestones. In addition, the team held weekly full team meetings, enabling members to focus on their individual subsystems while also contributing to others as needed. This collaborative approach ensured that all team members developed a comprehensive understanding of each subsystem and how they interconnect.

These improvements have provided what we expect to be an award-winning boat, representing months of hard work, dedication and ingenuity. Learning from past mistakes, best practices of previous years and even from our competitors, this boat represents a multi-year journey towards a solar powered craft that can be continuously improved for ongoing success in years to come. While the true test of our work will happen this summer in Ohio, the team feels prepared to meet any challenge that arise, excited to see how these engineering design changes perform amongst its competitors.

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I. Overall Project Objectives

The 2024 competition was a disappointment when considering that our team did not finish (DNF) or did not start (DNS) each event, however the lessons learned from 2024 set us on a course to overhaul nearly every subsystem, creating a newly designed boat for 2025. The goal of the team was not only to finish each event but to place well, offering a performance worth of our competitors. With this in mind, the below objectives were established:

A. *Solar System.*

This year the team's main goal was to implement a lighter more sustainable solar array, that teams in the future could continue to use.

B. *Electrical System.*

This year the team's goal was to improve the overall reliability of the system, along with making a system that was well documented and organized.

C. *Power Electronics System.*

The goal of the power electronics system is also to improve reliability and make the system easier to work on.

D. *Hull Design.*

The team set a large goal this year to build a new hull, one that would be better suited for the competition, along with creating a more comfortable space for the skipper.

E. *Drive Train and Steering.*

The goal of the drivetrain subgroup was to find and modify an electric outboard that would satisfy the requirements of the competition and the design of the hull.

F. *Data Acquisition and/or communications.*

The goal for this year is to set up the motor controllers to be easily debugged from the serial data port.

II. Solar System Design

A. Current Design.

Last year the solar system created an issue for the team during the second endurance round. The team had mounted three 25lb panels 2ft above the boat which made the boat unstable in high winds. During the last endurance round a gust of wind flipped the boat over leaving the skipper in the water as seen in ***Fig 1&2***. This year the decision was made to mount the aluminum frame directly to the topside of the boat to reduce the risk of flipping the boat again.

Fig. 1 2024 Boat in water with panels

Fig. 2 2024 Boat Flipped due to panels

B. Analysis of Design Concepts

This year's solar system utilizes three BougeRv Arch 200-Watt Fiberglass Flexible curved solar panels, together supplying 600W of power and containing 5,403.3 in^2 of surface area. The team elected to make a custom frame for the panels that would allow for easier mounting of the panels. The frame is made up of 1inch aluminum square tubing connected by aluminum corner connections. The panels themselves came with mounting grommets that the team bolted into the aluminum frame. The system weighs 32.5lbs, which equals 18.461 watts per pound. This is an improvement from the last system which provided 8 watts per pound. ***Figures 3,4,* and *5*** show the frame construction, insulation and CAD models used during the design process.

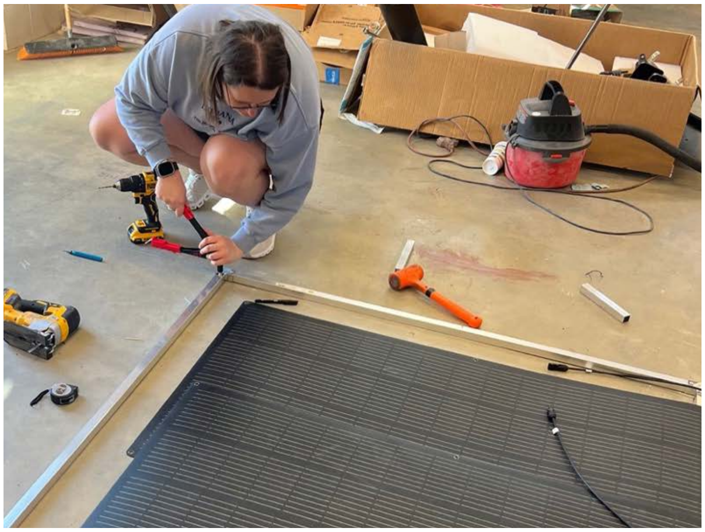


Fig. 4 Solar Panel frame construction

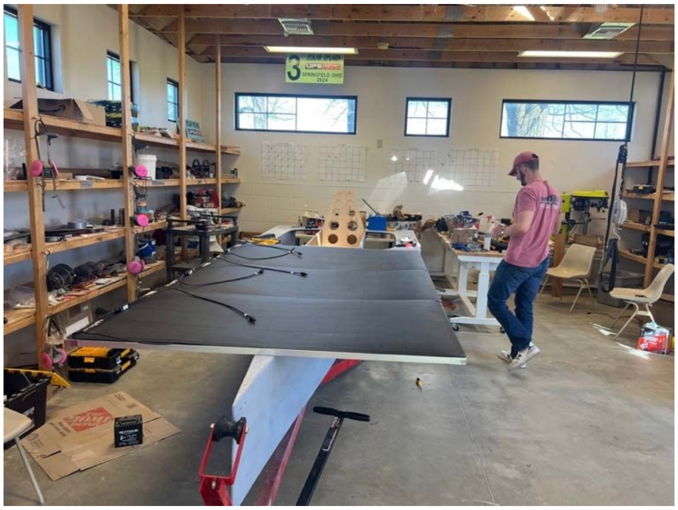


Fig. 3 2025 Hull Panels Installed

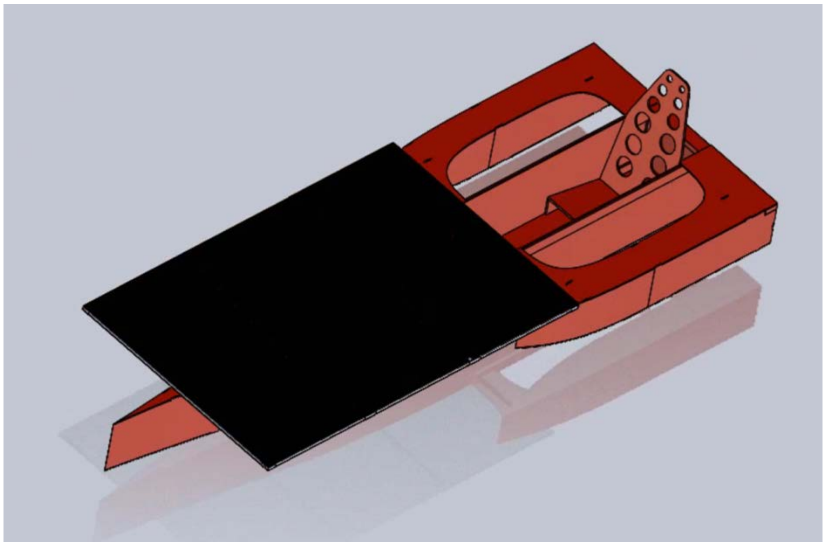


Fig. 5 CAD model with solar panel installation

To address one of the biggest problems the team runs into each year, this year the team decided to use the Genasun GVB-8 Lead-Acid 12 Volt MPPT to replace the BlueSky Solar Boost 1524iX boost charge controller. It is rated to withstand 8A of current and charge a 12 V battery. Utilizing a boost charger allows for continued power generation to occur when environmental conditions are unfavorable. Last year the team found that the BlueSky 1524iX worked relatively well for the team, but after the first sinking of the boat the MPPT was ruined. The team enjoyed the ease of use the BlueSky provided but found that it occupied a lot of space. This was critical since the solar system contains more than one charge controller wired in parallel with each of the batteries. While the Genasun is much smaller, it is only rated to withstand 8A where the BlueSky was rated to withstand 20A. With the change of solar panels, the team decided that it would no longer be necessary to have a charge controller that is rated as high.

C. Design Testing and Evaluation.

This subsystem, as designed and constructed was integrated into the boat and tested during a series of campus lake test drives. As the subsystems performed as expected during these in water test, no further analysis was required.

III. Electrical System

A. Current Design.

Similarly to years past, the team has decided to us the LEM-200 95 permanent magnet motor from Lynch Motor. Unlike past years, the team has moved away from the 2x2 version of the motor. The 2x2 version of the motor provides two motors on the same driveshaft, the team found that this version of this motor was no longer needed as it pulled too much power for the system.

B. Analysis of Design Concepts.

This year the single version of the motor is being utilized, being controlled by the Alltrax SR48600 motor controller. These devices are powered by three ODYSSEY Extreme Series batteries which store energy transferred from the three BougeRv Arch 200-Watt Fiberglass Flexible curved solar panels via the Genasun GVB-8 Lead-Acid 12 Volt solar charger.

The team has used the Alltrax SR48600 motor controller for three years. This controller can handle up to 600 amps of continuous current and 1200 amps at peak current making it a great match for the Lynch LEM- 200 95 with a peak current of 400A. The Alltrax also supports a voltage range from 36v to 48v, which is suitable as the electrical system is run on 36V. The team also enjoys the programmability Alltrax offers. The Alltrax comes with a suite of PC-based software which allows the team to adjust various parameters like minimum and maximum voltage, minimum and maximum current, speed limit, and throttle curves.

The Yamaha 703-48207-15-10 Remote control Box is being utilized on the 2025 boat. The team decided to use this as it allowed the team the ability to utilize a key switch, a Deadman switch, and trim controls in one box. The Control box came with a 10-pin harness ***Fig 6*** which was customized to suite the team's needs found in ***Fig 7***.

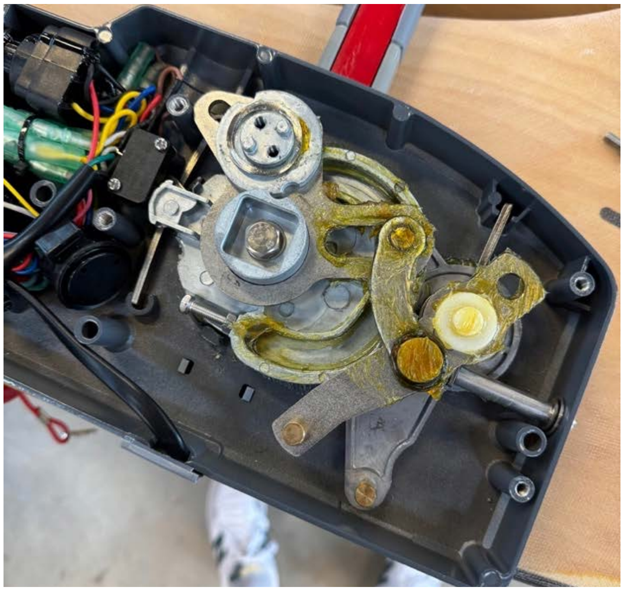


Fig. 6 Control Box Brand New

The team pulled out the key switch to be in compliance with the Solar Splash Rules that state that there needs to be a labeled “On and off Switch” in 10 mm font. The team found that the Deadman that came with this controller did not work easily with the system that is ran on the 2025 boat, the Deadman switch was also ultimately replaced as well. A 5k slide potentiometer was custom fitted in the box to allow the team to use the Alltrax system.

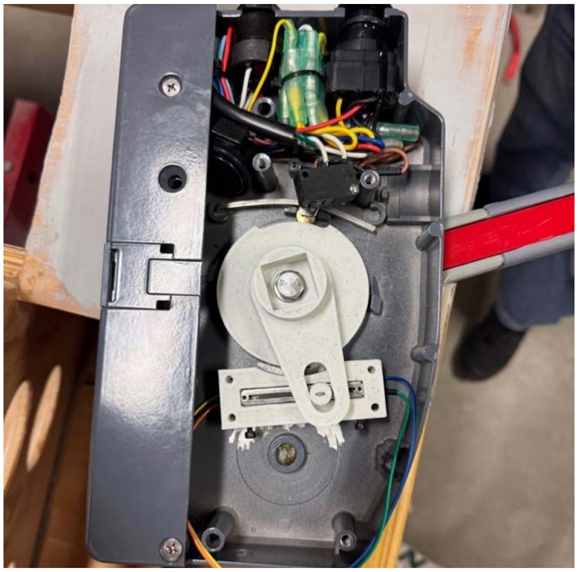


Fig. 7 Modified Control Box

The energy storage of the electrical system is composed of three ODYSSEY Extreme Series PC1100 batteries. These batteries are connected in series to provide a voltage of maximum voltage of 36V during operation. Additionally, they weigh 27.5 lbs. and have a capacity of 45 Ah. Due to their non-spillable, compact design, they are easy to mount and store as seen in ***Fig 8***.

A separate smaller battery is also included to power the required safety equipment of the boat. The functional block diagram for the electrical system as illustrated in ***Fig 9***.

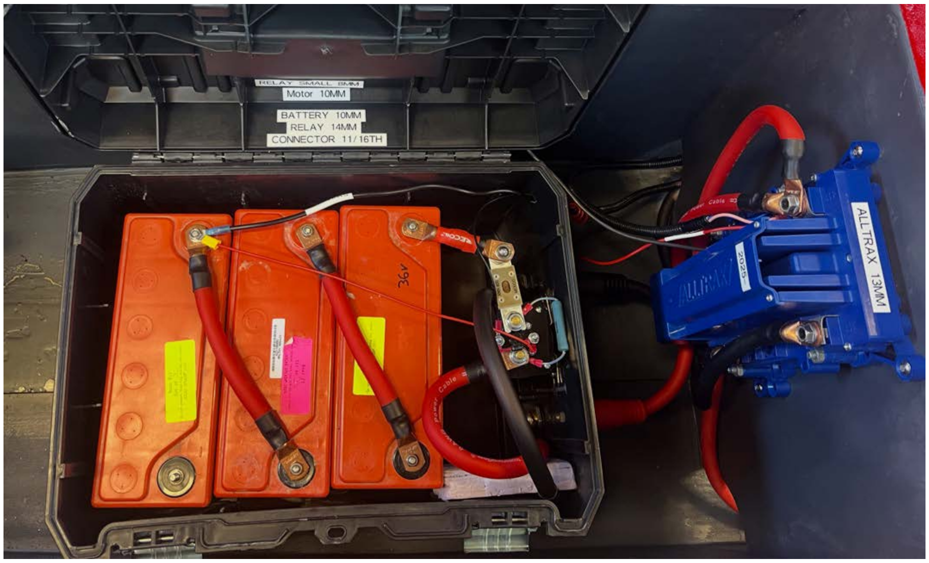


Fig. 8 2025 Battery Box

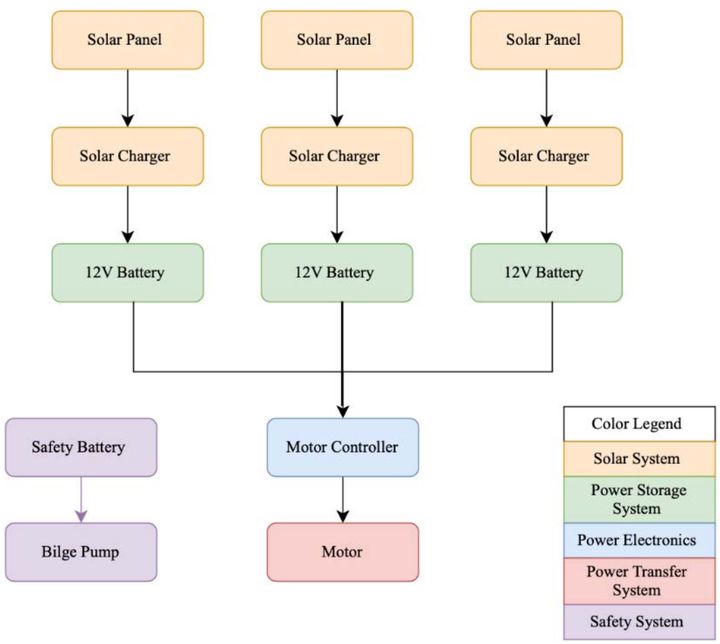


Fig. 9 Electrical functional block diagram

C. Design Testing and Evaluation.

This electrical system, as designed and was integrated into the boat and tested during a series of stand and campus lake test drives. The subsystem performed as expected during these in water test, no further analysis was required.

IV. Power Electronics System

A. *Current Design.*

In years past the team has used the 2x2 LEM-200 95 motor combination. This has worked well for the team as it allowed for two motors to be on one shaft as seen in ***Fig 10***. In terms of operation, the motor is a very important component of the electrical system, the 2x2 LEM-200 95 from Lynch motors had been selected due to its power and design flexibility. The team found that the 2x2 version of this motor pulls too much power for it to run at its maximum potential, each motor is designed to be run on 48 volts while the system that the 24' & 25' boat runs on is 36 volts, leaving both motors under powered.

Fig. 10 2x2 LEM-200 95 Motor used in 2023 and 2024

B. *Analysis of design concepts.*

The LEM-200 95 from Lynch motors was selected for the 2025 boat due to its power and flexibility. The motor can handle 18 kW of power at full load and draws up to 220 A of current. To utilize the full power capability of this motor, the motor controller had to be capable of handling at least 400 A of current for 5 minutes to be competitive in the sprint race. This proved to be a difficult design factor and required considerable time researching available options on the market. The Alltrax SR48600 was selected for the third year in a row.

The team made the decision to move away from the 2x2 version of the motor and use the single motor version of the LEM-200 95 system for the boat this year. One of the team's main goals was weight management. The 2x2 version of the LEM motor weighs 25kg (55.11lbs), while the single version of the motor weighs 11kg (24.25lbs). Switching to the single motor significantly reduced the overall weight of the system, cutting down 30.85lbs compared to 2x2 system. This not only improves the boats efficiency and handling, but also improves speed, making it an upgrade in both performance and practicality.

Fig. 11 LEM-200 95 Motor for 2025

C. Design Testing and Evaluation.

The Power Electronics System, performed as expected a series of campus lake test drives. As the subsystem performed as expected during these in water test, no further analysis was required.

V. Hull Design

A. Current Design.

In 2023 the team built a brand-new hull, being the first team in USI history to build a hull. The boat performed admirably during the 2023 competition allowing for the team to place 3rd overall and earned the award for best hull design. In the 2024 competition the hull was damaged during the slalom event when a turn fin tore out of the starboard hull leaving a hole. The hull took on water and submerged all the electronic components as seen in ***Fig 12 & 13***. The team was able to recover the boat with help from other teams and rebuild the systems in time for the next event. During the final endurance round the boat flipped over again leaving the hull saturated leading to further wood rot. This prompted the team to build a new hull from once during the 2024-25 school year.

Fig. 12 2024 hull

Fig. 13 2024 hull after sinking number 1

B. Analysis of design concepts

The hull design chosen is a flatbottom trimaran with a total length of 14 ft and a width of 5ft. The construction is of 1/4in marine plywood using a stich and glue method to achieve complex curves with simple fixturing. Each piece of the boat had tabs included to make alignment easier. The transom, sides, and bottom are covered with 6oz fiberglass reinforcement. The whole boat is waterproofed with epoxy resin and painted in Total Boat Wet Edge Topside paint. All mounting points through the hull have been reinforced with carbon fiber tubing epoxied into the holes for added strength and waterproofing. Figures ***14-18*** show the construction process of the hull.

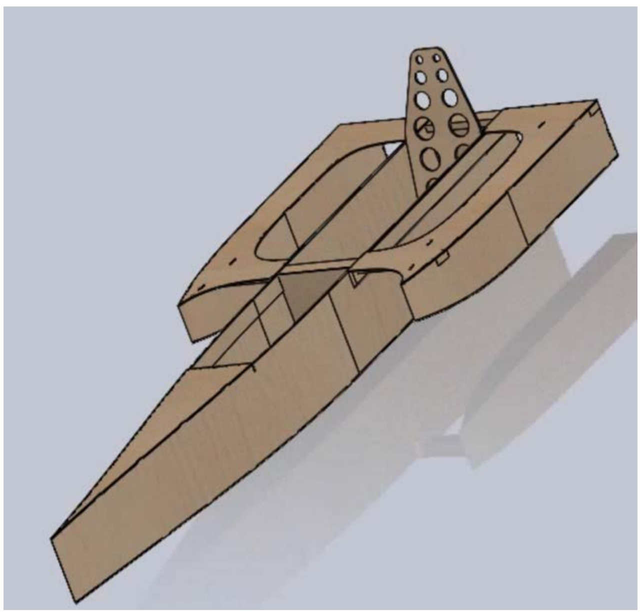


Fig. 14 2025 Cad Model

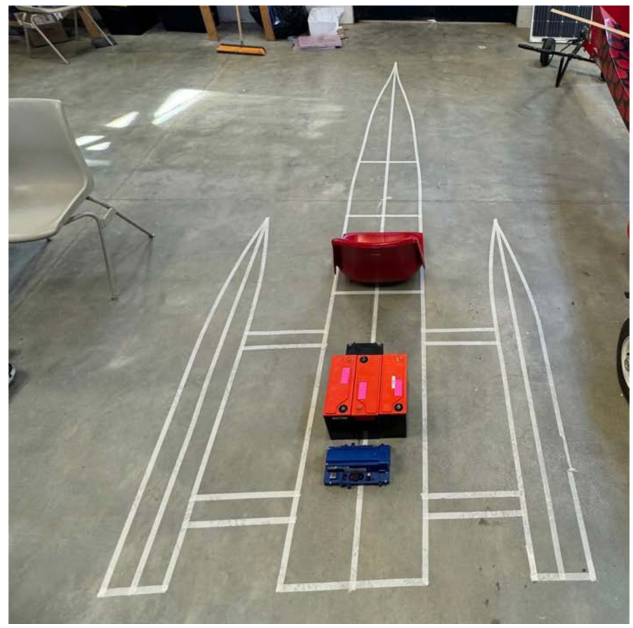


Fig. 15 taped out model of the boat

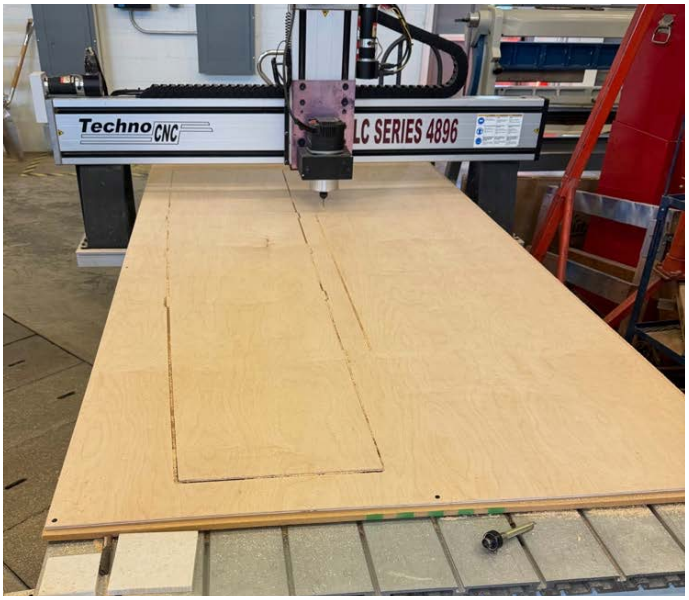


Fig. 16 plywood on router


Fig. 17 2025 USI Hull


Fig. 18 New build held together via tabs

The trimaran hull configuration was chosen because of its superior stability characteristics coupled with a high Length to Beam (L/B) ratio. The team considered stability a high priority because of the capsizing experienced in 2024. The increased deck area associated with the trimaran configuration allows the team. Due to the scoring configuration of the competition, efficiency in the endurance event is the most important design characteristic. That led the team to focus on high efficiency displacement hull design with planing characteristics as a secondary factor. This is reversed from our 2023 hull which was a high-speed planing hull with low-speed efficiency as a secondary factor. To achieve high efficiency at speeds around 10mph the team researched efficient displacement hull designs. A recurring design characteristic was high L to B ratios. We optimized our L to B ratio with our center hull being 14ft long and 1.5ft wide. To test hull designs the team used Autodesk Flow and 3D printed scale models.

The placement of the side hulls was determined by the angle of the bow wave from the center hull. This angle is 19.47deg which is known as Kelvin's Wake, derived by Lord Kelvin [6] . On the 2025 hull the sidepods have been located just inside of this angle so they are always riding on or inside of the bow wave as seen in ***Fig 20***. We designed the bow in a "plumb" configuration because we are not concerned with sea keeping in waves. Traditional monohull boats have angled bows so that the bow is pushed above the wave to prevent waves breaking over the bow. In the conditions we will be boating, this is not a concern. Instead, we opted for the plumb bow which splits water to the sides instead of pushing it down under the boat which requires more energy. This type of design can be seen on boats like "Earth Race" [7] which was designed for piercing waves rather than riding over them to maintain a higher overall speed for circumnavigation. This was visually depicted in ***Fig 19***.

Fig. 19 Earth Race Trimaran

Fig. 20 Example of Kelvin's Wake

C. Design Testing and Evaluation

For safety the sidepods and a large section of the bow are filled with marine buoyancy foam. The foam volumes alone can support 646.94lbs of weight. Including the wooden volume of the hull with the foam volumes the emergency weight capacity increases to 843.8lbs. The fully loaded hull plus 150lb driver should weigh 467.5lbs lbs. in its final configuration. At this loading the waterline is expected to be 6in. This leaves 1ft of hull above the water, as seen in Figures ***21 & 22***.

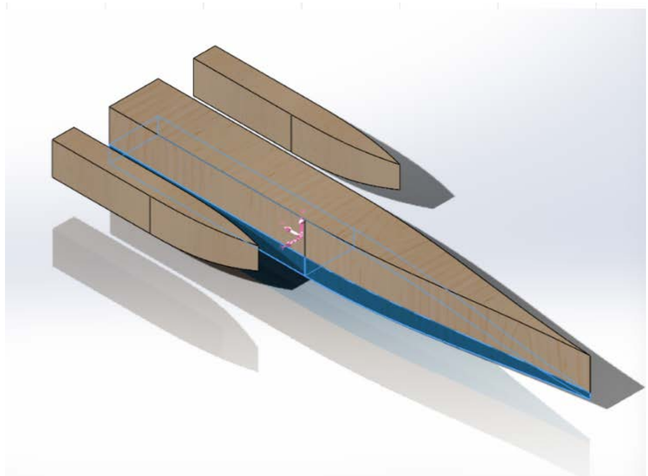


Fig. 21 Water line model

Fig. 22 Hull in water during testing

Note: The battery box is shifted back in ***Fig 22***, forcing the front end of the hull to stick out of the water. This trim level is what the team will use for the slalom even to increase maneuverability.

Fig. 23 Dimensions of 2025 boat

parts	Length (ft)	Width (ft)	Height (ft)
Main Hull	14	0.75	1.5
Side Pods	6	1.5	1
Overall	14	5	1.5

All are within the requirements of the competition, as seen in ***Fig 23***.

VI. Drive Train and Steering

A. Current Design

Building a lightweight and reliable drivetrain has always been a challenge for this team. Due to the low revolutions per minute of the Lynch Motors LEM 200, gearing and propellor selection is very important to create a winning boat. In past years the team has used gas outboards as a starting point and converted them over to electric. We found that our motor provider, Lynch, also produces an outboard drivetrain. Their unit is called the Bluefin II as illustrated in ***Fig 24***. They sell the drivetrain as a complete package with motor and their own motor controller included. They were able to sell us just the drivetrain and motor we needed. The stated weight for the drivetrain is 18kg, plus a 12kg motor controller. The other benefit of this drivetrain is that it has a widely standardized output shaft using the Flo-Torq II hub system. This meant that the team would have the widest range of propellor pitch and diameter options to choose from.

Fig. 24 Bluefin II Promotional Picture

When the team received the Bluefin II the team initially thought they had sent the wrong unit. The team weighed the parts and the drivetrain weighed 38.5kg without the motor, propellor, or oil. After going back to Lynch the team found that the lightest they had ever built one was 19kg using completely different parts. They shipped over some alternative parts that shortened the shaft to reduce weight. As it was, the drivetrain was far too heavy to be used on such a small boat without major penalty. The drivetrain subsystem group began devising methods for lightening the entire system.

B. Analysis of Design

1.) Electronic Trim Plate. Before purchasing the Bluefin II, we were provided with CAD models of the drivetrain and mounting plate. When the team received the parts, the mounting plate was entirely different from the models and was missing parts. In the original configuration from the CAD models the team had planned on adding a linear actuator so that the boat would have remote trim capabilities. With this new bracket this could not be done. The team elected to design a completely new mounting bracket from 6061 aluminum plates with room to accommodate linear actuators. The final version of this trim plate with the trim capacity is still lighter than the original bracket from Lynch Motors, and is pictures in ***Fig 25***.

Fig. 25 2025 Electric Trim Plate

2.) Hardware Weight Reduction. The Bluefin II is constructed differently from any other outboard drivetrain. It uses two 36in M16 stainless steel threaded rods to hold the main extrusion to the bottom gearbox. These two parts alone accounted for most of the weight in the drivetrain.

Using a custom extended socket, the team replaced both rods with two short bolts in the bottom of the gearbox, as seen in ***Fig 26***.

Fig. 26 inside of Drivetrain where Bolts are located

3.) Driveshaft Weight Reduction. The Bluefin II is designed with a stainless-steel driveshaft connecting the motor to the gear box through the extruded tube section. This driveshaft is overbuilt for our purpose. The output shaft of the motor is 19mm in diameter, and the driveshaft connected to the motor is 30mm. As weight is so important to smaller boats like this one, the team machined the driveshaft down to 19mm to match the motor output. We calculated that the minimum diameter the driveshaft could be is ~9mm, so our redesigned system will perform as needed without additional weight. The difference can be seen in ***Fig 27***.


Fig. 27 Factory driveshaft vs shorter lightened driveshaft

4.) Motor Mount Weight Reduction. As with the rest of the parts on the Bluefin II, the motor mount plate was made of thick steel and did not fit the design causing the team to make our own motor mount. The team used 5mm 6061 aluminum plate to cut out an adapter plate for installing the motor. The plate is attached to the lower unit with 4 bolts and then the motor is attached to the plate from the top using spacers for the bolts to tighten against. As seen in ***Fig 28.***


Fig. 28 Motor Mounting Plate

5.) Pedal Control Cable Steering. In years past the team has always intended on building a steering system with an actual wheel, but it has ended up being an afterthought. This year the team had the same intentions. Once the team started installing the throttle, we soon found out there was not much room left for a steering wheel in our 18-inch-wide cockpit. For this reason, we opted for pedal steering which allows for more space while retaining good steering control. The pedals are connected to bolts which have been anchored in wood blocks and epoxied to the floor. The pedals are then connected to braided stainless-steel cables which run back through the transom to the motor mount plate which the ends are connected to. The pedal steering works just like the yaw pedals of an airplane and are easily reversible to fit the driver's preference. This system is extremely light and reliable and depicted in ***Fig 29 & 30***.

Fig. 29 Steering Pedals

Fig. 30 Steering Cable Through Transom

The Alltrax motor controllers come equipped with serial data port for monitoring the motor during operation. This feature was appreciated during the testing of the electrical system, as it returned the perceived throttle rate from the potentiometer and error codes. This increased the debugging process by the acquisition of information from the motor controller regarding internal conditions and confirming or denying expectations of operation.

C. Design Testing and Evaluation.

The drivetrain was implemented as designed and integrated into the boat, evaluated through a series of in water test drives conducted at the campus lake. Performance during these tests met expectations, and no additional analysis was deemed necessary.

VII. Data Acquisition and / or Communications

A. Current Design.

For this season, we will be using a "RAPTOR VEECAN 320 DISPLAY" as we build our first data logging system. This device will be the backbone with the connections to our various sensors to allow us to bring in data and evaluate it for the first time. We will be monitoring the boat's charge status, speed, position, and behavior in various drivetrain configurations.

B. Analysis of Design and Concepts.

To measure battery voltage, we will be using additional circuitry to bring the voltages down to a safe level in the 0–10-volt analog inputs within Raptor display. The current from the MPPT chargers to the batteries and batteries to the motor will be measured using two DCT300-10B-24-S. We will also be adding a GPS module to allow tracking of our speed and position throughout the various events. The current sensors as well as the logger itself will be powered by 2X 12-volt auxiliary batteries in series.

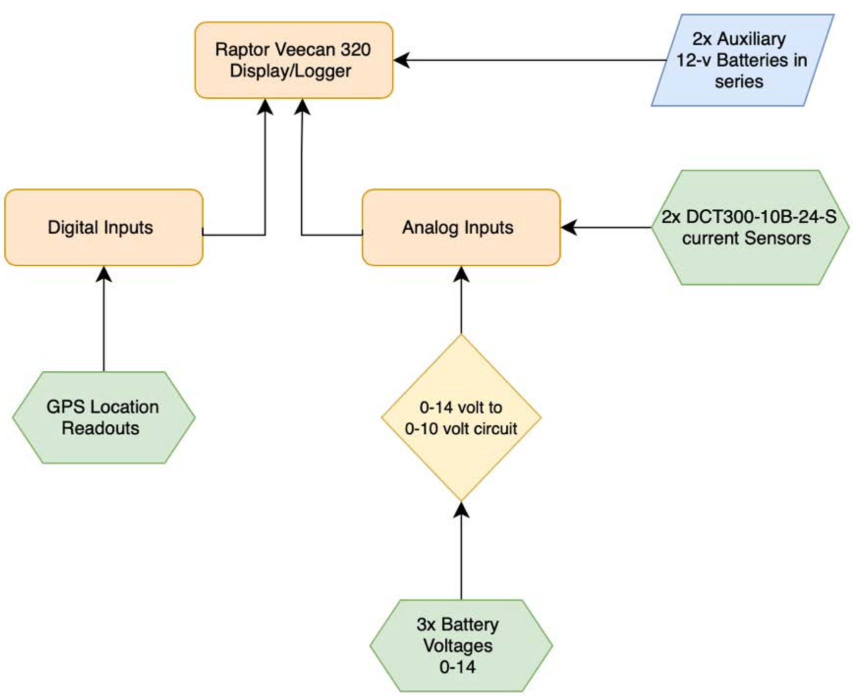


Fig. 31 General telemetry system breakdown

As of the time of writing, all these components are on order and will arrive soon. Once they arrive, they will be wired into the system as seen in ***Fig. 31*** and the logger display will be programmed accordingly to show vital information during the different events across the weekend. This way we can see how well the batteries may be charging at different points of the day, how much energy they have left, and power draw from the motor in the different drivetrain configurations. Logging this data with speed comparison will allow us to fully analyze the boat and learn where to improve for future iterations.

C. Design Testing and Evaluation.

Despite the system not being complete yet, there are ideas that may be implemented in the future. We are discussing adding the motor controller's throttle percentage as well as drivetrain position into the system. These will both be done simply using potentiometers and using the resistance in various positions to map their locations. These systems will be safely used and tested for the first time before competition to allow the collection of data for the USI Solar Splash team.

VIII. Project Management

A. Project Planning and Schedule.

To ensure the team stayed on track, calendars for each month from August 2024 to May 2025 were made on separate posterboards and taped to the walls of our meeting space. Due dates, meeting times, and project goals were written down for accountability and keeping better track of time. Another element was meeting as a full team weekly. This gave each member time to work on their own subsystem, help with other subsystems, and take on any other necessary tasks. Each team member was, therefore, familiar with all the subsystems and how each would integrate with the others.

B. Team Member and Leadership Roles.

Below are the team members and their roles with the team:

Jacob Mills – Team Leader, Hull Lead, Motor Mount, Solar Mount, and Drive train Lead
Zoe Tucker – Team Leader, Hull, Graphics design, Electrical Lead, and Solar Lead
Kyle Echart – Drive Train, and Hull
Mariah Fulton – Hull
Jacie Graber – Electronics, and Hull
Lucas Hoffman – Hull, and Steering
Charlie Jackson – Hull, Drive Train, and Telemetry Lead
Josh O'Brian – Electronics, and Hull
Ethan Payne – Hull, and Steering
Reinard Stanislaus – Hull, Drive Train, and Steering Lead

C. Financial and funding

Alltrax and New Eagle both assisted financially to the project by providing discounts and donations of necessary components. Their company logos are placed on the hull to show our appreciation for their support. The USI Engineering Department foundation provides funding through support obtained from alumni corporate sponsors and other sponsors. Finally, the Pott College Endeavor Award Scholarship aids in supporting student travel cost for competition. Our success is dependent on their generous donations.

D. Strategy for team continuality and sustainability

The boat was divided into five main subsystems: electrical (Solar panels, switches, motor testing, etc.), telemetry, motor mount/ drivetrain/ propeller, steering, and hull; each of which was assigned to one of a few team members. In years past the team's main goal was to try to pick up where the last team left off as in the past the team turnover rate was high. This year the team's main goal was to recruit and retain more members as the team will lose some members due to graduation.

E. Discussion and Self-Evaluation

Our team has learned both from previous success and our more recent failures. Together, we work to pursue excellence in both our engineering design and creative problem solving. Having team members collaborating on multiple subsystems ensures success of the boat as a whole. In future years a focus on team cohesion and learning from past experiences will provide a sustainable mechanism for sustained improvement.

IX. Conclusions and Recommendations

The University of Southern Indiana Solar Splash team has had a busy year of making changes to all systems after the 2024 competition. The team went into the academic year ready to recruit and rebuild the whole boat, and finding a team that feels is the best fit to for 2025 competition. This team has been able to make major changes to not only the hull but also the main subsystems.

Following the 2024 Solar Splash event, the University of Southern Indiana team gathered some lessons learned to guide future improvements. Based on this reflection, the team decided to make several key changes for this year's development goals. The progress made leading up to the 2025 Solar Splash event, focused primarily on scoring higher in the endurance event as it is weighted higher than the other events. The main changes are listed below.

- Built a new hull focusing on a high length to beam ratio while focusing on stability for caring a large solar array.
- A solar array redesign for ease of mounting and support, that also achieved a 27.5lb weight reduction and an 18.46 watt to pound ratio.
- The redesign of the Bluefin II, with a weight reduction while increasing functionality by the addition of the trim plate.

- Replaced tiller arm steering with a pedal operated steering system to improve driver positioning and ease of control, along with improve handling during endurance and slalom runs.
- Upgraded from a small potentiometer to a full-sized marine throttle to improve durability, enable smoother acceleration, and provide a more intuitive control.
- Integrated a real time telemetry system to monitor key performance metrics such as voltage, current, charge status, speed, position, and behavior in various drivetrain configurations.

We are confident these improvements will lead to success in the 2025 solar splash competition and look forward to learning from our competitors as each year sparks ideas for the next competition season.

References

[1] Morehouse, Jeffrey H. *Rules of SOLAR SPLASH® 2022 World Championship of Collegiate Solar Boating*. SOLAR SPLASH, 2021. Print. September 2021.

[2] “Past Events.” SOLAR SPLASH, https://solarsplash.com/event-results/.

[3] “Guidelines for Writing the Solar Splash Technical Report.” Solar Splash, 17 June 2017, https://solarsplash.com/wpcontent/uploads/2014/10/TechReportGuidelines_2017_06_17.pdf

[4] “Solar Splash Technical Report.” UPRM Solar Boat, https://solarsplash.com/wp-content/uploads/2022/06/1-UPRM-Solar-Boat-Technical-Report-2022.pdf

[5] “Technical Report 2022.” Stony Brook Solar Racing Team, https://solarsplash.com/wp-content/uploads/2022/06/5-Stony-Brook-Technical-Report-2022.pdf

[6] “INTERFERENCE PHENOMENON IN DESIGN OF TRIMARAN SHIP”Patrick Queutey, https://www.researchgate.net/profile/Patrick-Queutey.

[7] “RECENT HISTORY” Earth Race, https://www.earthrace.net/about/history/

List of Appendix

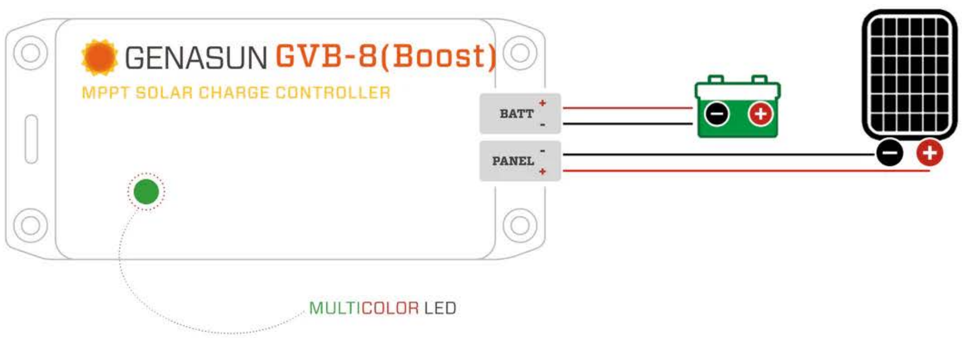
Appendix A: Battery and Electronics Documentation

SPECIFICATIONS:

Nominal Battery Voltage:	12V | 24V | 36V | 48V
Max Panel Power:	105W | 210W | 325W | 350W
Continuous Current Rating:	8A*
Recomm. Max Panel Voc at STC:	50V

*Panel ratings have increased since we designed the GVB. Although we don't believe in changing specifications without a corresponding engineering change, based on both our customers' experiences over the years as well as the headroom we designed into the GVB, we feel comfortable recommending the GVB for panels with Imp up to 9A.

8A @ 12V, 24V, 36V, 48V	GVB-8
Self Consumption(low light):	6mA
Peak Efficiency:	99%
Tracking Efficiency:	99%
Operating Temperature:	-40°C - 85°C
Environmental Protection:	IP40
Certifications:	cETLus, CE, FCC, RoHS
Dimensions:	14x6.5x3.5cm
Weight:	185g
Warranty:	5 Years



Appendix A-A Genasun GVB-8 Boost Tech Sheet

MADE IN U. S. A.

NATIONWIDE BATTERY

MARINE | GOLF | INDUSTRIAL | AUTO | SPECIAL APPLICATIONS | SOLAR

ODYSSEY THE EXTREME BATTERY

EXTREME SERIES PC1100

EXTREME POWER AND ENDURANCE

- **MAITENANCE FREE – AGM VALVE REGULATED**
  - BCI Group N/A, 12V
  - CCA 500 / MCA 650 / PHCA 1100
  - Reserve Capacity [min]: 87@25 A
  - Reserve Capacity [Ah@20hr rate]: 45
  - Weight: 27.50 lbs.
  - Length- 9.80 in (250 mm)
  - Width- 3.80 in (97 mm)
  - Height- 8.10 in (206.00 mm)

ODYSSEY Extreme Series Battery Model PC1100
(M6 SS studs)

Whether for everyday or emergency use, today's vehicles are loaded with more electronics than would have been imaginable just a few years ago. ODYSSEY batteries have been designed to keep up with the changes. Because their plates are made of pure virgin lead (unlike the lead alloy in most batteries), we can pack in more plates. And more plates mean more plate surface area, and much more power - twice the overall power and three times the life of conventional batteries - up to 400 cycles at 80% depth of discharge!

ODYSSEY batteries deliver the massive starting power, rapid recovery, and amazing deep cycling capability that today's vehicles demand.

WWW.NATIONWIDE-BATTERY.COM

EnerSys Power/Full Solutions

Appendix A-B 32 Battery Data Sheet

SAFETY DATA SHEET

Form #: SDS 853027
Revised: AH
Supersedes: AG
ECO #: 1002485

I. PRODUCT IDENTIFICATION

Chemical Trade Name (as used on label):
Cyclon®, Odyssey, Genesis®, SBS, XE®, Armsafe Plus®, MILPC, Nexsys, or Large TPPL.

Chemical Family/Classification:
Sealed Lead Battery

Synonyms:
Sealed Lead Acid Battery, VRLA Battery

Manufacturer's Name/Address:

EnerSys Energy Products Inc.	Canada Corporate Office
617 N. Ridgeview Drive	3-61 Parr Boulevard
Warrensburg, MO 64093-9301	Bolton, Ontario
	L7E 4E3

Telephone:
For information and emergencies, contact EnerSys Energy Products Environmental, Health & Safety Dept. at 660-429-2165

24-Hour Emergency Response Contact:
CHEMTREC DOMESTIC: 800-424-9300 CHEMTREC INT'L: 703-527-3877

II GHS HAZARDS IDENTFICATION

HEALTH		ENVIRONMENTAL	PHYSICAL
Acute Toxicity		Aquatic Chronic 1	Explosive Chemical, Division 1.3
(Oral/Dermal/Inhalation)	Category 4	Aquatic Acute 1	
Skin Corrosion/Irritation	Category 1A		
Eye Damage	Category 1		
Reproductive	Category 1A		
Carcinogenicity (lead compounds)	Category 1B		
Carcinogenicity (acid mist)	Category 1A		
Specific Target Organ Toxicity (repeated exposure)	Category 2		

GHS LABEL:

HEALTH	ENVIRONMENTAL	PHYSICAL
		

Hazard Statements	Precautionary Statements
DANGER!	Wash thoroughly after handling.
Causes severe skin burns and serious eye damage.	Do not eat, drink or smoke when using this product.
May damage fertility or the unborn child if ingested or inhaled.	Wear protective gloves/protective clothing, eye protection/face protection.
May cause cancer if ingested or inhaled.	Avoid breathing dust/fume/gas/mist/vapors/spray.
Causes damage to central nervous system, blood and kidneys through prolonged or repeated exposure.	Use only outdoors or in a well-ventilated area.
May form explosive air/gas mixture during charging.	Contact with internal components may cause irritation or severe burns. Avoid contact with internal acid.
Explosive, fire, blast, or projection hazard.	Irritating to eyes, respiratory system, and skin.
May cause harm to breast-fed children	Obtain special instructions before use.
Harmful if swallowed, inhaled, or contact with skin	Do not handle until all safety precautions have been read and understood
Causes skin irritation, serious eye damage.	Avoid contact during pregnancy/while nursing
	Keep away from heat./sparks/open flames/hot surfaces. No smoking

III. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Approximate % by Weight
Inorganic Lead Compound:		
Lead	7439-92-1	45 - 60
Lead Dioxide	1309-60-0	15 - 25
Tin	7440-31-5	0.1 - 0.2
Sulfuric Acid Electrolyte (Sulfuric Acid/Water)	7664-93-9	15 - 20
Case Material:		5 - 10
Polypropylene	9003-07-0	
Polystyrene	9003-53-6	
Styrene Acrylonitrile	9003-54-7	
Acrylonitrile Butadiene Styrene	9003-56-9	
Styrene Butadiene	9003-55-8	
Polyvinylchloride	9002-86-2	
Polycarbonate, Hard Rubber, Polyethylene	9002-88-4	
Polyphenylene Oxide	25134-01-4	
Polycarbonate/Polyester Alloy	--	
Other:		
Absorbent Glass Mat	--	1 - 2

Inorganic lead and sulfuric acid electrolyte are the primary components of every battery manufactured by EnerSys Energy Products.

Page 1

Appendix A-C Battery Safety Sheet

SPEC QUICK VIEW

Product Dimension:	
58.1*31*0.08 inches	
Weight:	
7.05 lbs	
Open Circuit Voltage Voc:	
20.1±5%V	
Max Power Current Imp:	
11.7±5%A	
Max Power Voltage Vmp:	
17.1±5%V	
Short Circuit Current Isc:	
12.28±5%A	

Appendix A-D Solar Panel Data Sheet

www.alltraxinc.com

SR SPECIFICATIONS

Model	Peak (Amps)	2 Min (Amps)	5 Min (Amps)	Continous (Amps)
SR48300	300/350[1]	300	230	125
SR48400	400/460[1]	400	300	140
SR48500	500/575[1]	500	350	175
SR48600	600/690[1]	600	425	210
SR72300	300/350[1]	300	275	130
SR72400	400/460[1]	400	300	150
SR72500	500/575[1]	500	400	210

Note[1]: The larger number represents the value when the "Peak Amp Mode" is enabled in the Alltrax Toolkit program.

All ratings are at 25°C,with nominal rated voltage at 50% PWM. Actual currents ratings are ±5% listed amperages.

Type: Series Motor Controller

Operating Frequency: 18kHz

Controller Voltage, KSI & Reverse:
SR48XXX 12-48V nom, 62V max
SR72XXX 12-72V nom, 90V max

Controller Operating Temp: -20°C to 75°C, shutdown @ 85°C

Environmental Operating Temp: -20°C to 50°C

Standby Current (Power up): <1W nom, <8W Fan on

Stand By Power : <20mA

Relay Drive Current: 5A peak, 1A Cont.

Throttles Supported: 0-5k, 5k-0, E-Z-GO ITS, Club Cart 5k-0 3 Wire (MCOR), 0-5v, Taylor Dunn 6v-10.5v, USB Throttle, Yamaha 0-1k, Absoute Mode

Terminal Torque: Torque to 60-80 in.lb (5-7 ft/lb, 6.77-9.4Nm)

DOC112-003-B SPEC-SR

Appendix A-E Motor Controller Data Sheet

GENERATING
MOVEMENT
EFFICIENTLY

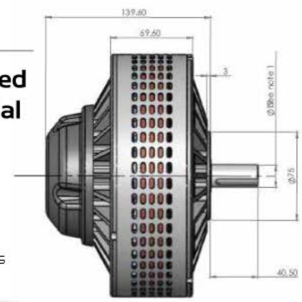
MOTORS LEM-200

Overview

The LEM-200 is an axial gap DC brushed motor suitable for traction and industrial applications.

Example applications include grass cutters, Go-Karts, motorcycles, golf carts, scissor lifts, lightweight vehicles, boats and generators.

The LEM-200 is available in 95, 126, 127 and 135 strip armatures with magnet grade selection dependant on application.

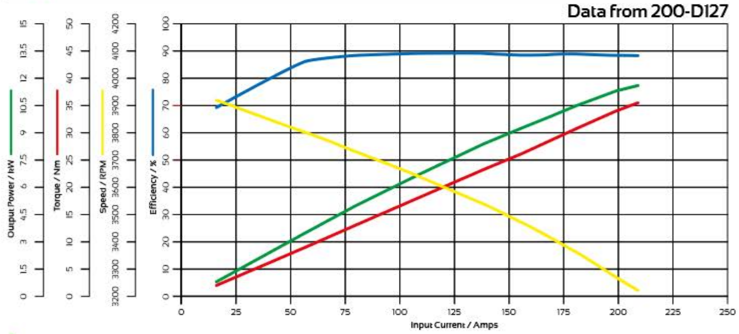


Features

- High efficiency (up to 93%)
- Lightweight design (11kg)
- Simple electronic control
- Long brush Life
- Interchangeable Shaft
- Rugged Construction
- CE Marked
- Ip20 rating
- Available from 12 to 110v
- Speed proportional to voltage

Typical Technical Data Curve

Data from 200-D127



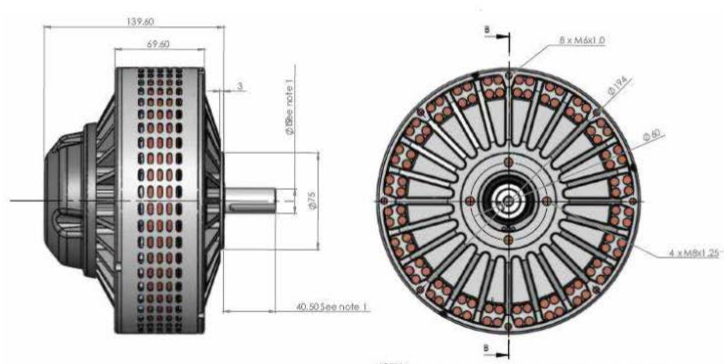
Important

Any model of the LEM-200 can be made up into the 2X2 version. This is 2 motors married together on a single shaft see 2X2 installation drawing for details on our website. This can also be supplied in a V-Twin layout which gives the same performance.

Appendix A-F Motor Technical Data 1

Technical Data

Motor	No Load Current	Torque Constant	Speed Constant	Armature Resistance DC	Armature Inductance @ 15kHz	Armature Inertia	Peak Power	Peak Efficiency	Peak Current	Rated Power	Rated Speed	Rated Voltage	Rated Current	Rated Torque
	A	Nm/A	Rpm/V	mΩ	μH	Kgm^2	kW	%	A	kW	Rpm	V	A	Nm
95	6	0.113	81	21.5	22	0.0238	18	92	400	10	3888	48	250	28
126	10	0.0737	105	175	6	0.0234	7.59	83	400	5.06	2520	24	270	19.2
127	5	0.15	54	22.5	23	0.0236	16.08	89	400	8.55	2592	48	215	31.5
D95B	6	0.14	76	20.5	11	0.0238	28.50	92	400	15.00	6000	72	210	30
D126	5	0.0748	100	138	5	0.0234	11.14	81	400	6.91	3600	36	250	18.3
D127	4	0.17	50	17.5	13	0.0236	25.38	92	400	12.56	3600	72	200	33.3
D135	3.5	0.185	45	16.75	16	0.0236	29.04	93	400	14.39	3780	84	200	36.4
D135 RAG	7.36	0.207	42	16.95	16	0.0238	34.32	93	400	16.84	4032	96	200	39.9
D135 RAGS	7.45	0.21	40	16.95	16	0.0238	36.00	93	400	18.00	4400	110	200	42.0



NOTES:
1). Dimensions are for the standard drive shaft only - Refer to drive shaft drawing for optional shaft configurations

GENERATING
MOVEMENT
EFFICIENTLY

LCM Limited, Lynch Motor Company Ltd, Unit 27,
Flightway Business Park, Dunkeswell, Honiton, Devon EX14 4RJ
Tel: +44 (0) 1404 892940 **Fax:**+44 (0) 1404 891990
email: sales@lmcltd.net **www.lmcltd.net**

ISO 14001
ISO 9001

Appendix A-G Motor Technical Data 2

AcuAMP DCT Series DC Current Transducers

DCT series current transducers combine a Hall effect sensor and signal conditioner into a single package for use in DC current applications up to 750A. The DCT series offers jumper-selectable or fixed current input ranges and industry standard 4-20 mA or +/-10 VDC outputs. The DCT series is designed to be compatible with most PLCs, data loggers and SCADA systems. Full-scale input ranges are jumper selectable to 400A (depending on model). This series is available in split-core or fixed-core models.

Applications

Battery Banks
- Monitor load current
- Monitor charging current
- Verifies operation

Transportation
- Measures traction power or auxiliary loads

Wind and Solar Generated Power
- Measure the current produced or consumed.
- Detect mechanical problems before failure occurs.

Electric Heating Elements
- Monitors heater loads
- Faster response than temperature sensors

Monitor DC Powered Motors
- Monitor current of cranes, saws, sorters and positioning equipment.

Features

- 4-20 mA or +/-10 VDC outputs
- Built-in mounting feet with optional 35mm DIN rail adapter available
- Factory matched and calibrated single piece transducer is more accurate than traditional two-piece field installed products.
- Selectable input ranges allow end users to tailor sensing ranges, improve the odds of having the right range for the job and reduces setup time.
- Output is magnetically isolated from the input for safety and to eliminate voltage drop.
- Reduced installation costs
- Split core models make installation a snap.
- Five-year warranty

Click on the thumbnail or go to https://www.automationdirect.com/VID-CT-0001 for a short introductory video on the AcuAmp Current Switches, Transducers and Indicators

Appendix A-H DCT300-10B-24-S Spec Sheet 1

AcuAMP DCT Series DC Current Transducers

DCT Series Specifications		
Models Available	**10B**	**42**
Power Supply	20-45 VDC	20-45 VDC, 22-38 VAC; Units 500A and over 24 VAC/DC - use Class 2 power supply, Power and signal are isolated.
Power Consumption	2VA	
Output Signal	+/-10VDC	4-20 mA sourcing
Output Load	50kΩ minimum	500Ω maximum
Output Limit	11.5 VDC	23mA
Accuracy	Split-core: 2% FS	Fixed-core: 1% FS; Units 500A and over 2% FS Split-core: 2% FS
Response Time	Split-core: 100ms	Fixed-core: 20ms; Units 500A and over 100ms Split-core: 100ms
Repeatability	1.0% FS	1.0% FS
Input Ranges	Fixed 0-100A, 0-200A & 0-300A	Jumper selectable from 0 to 400A; Fixed ranges on units 500A and over
Sensing Aperture	Split-core: 0.85" [21.6 mm] sq.	Fixed-core: 0.75" [19.1 mm] dia.; Units 500A and over 1.77" [45mm] dia. Split-core: 0.85" [21.6 mm] sq.
Isolation Voltage	3kV (monitored line to output)	
Frequency Range	DC	
Case	UL 94V-0 Flammability Rated	
Environmental	Operating Temperature: -4 to 122°F [-20 to 50°C]	
	Relative Humidity: 0-95% RH, non-condensing	
	Pollution Degree 2	
	Altitude to 2000 meters	
Certifications	cULus listed (E197592), CE	

Appendix A-I DCT300-10B-24-S Spec Sheet 2

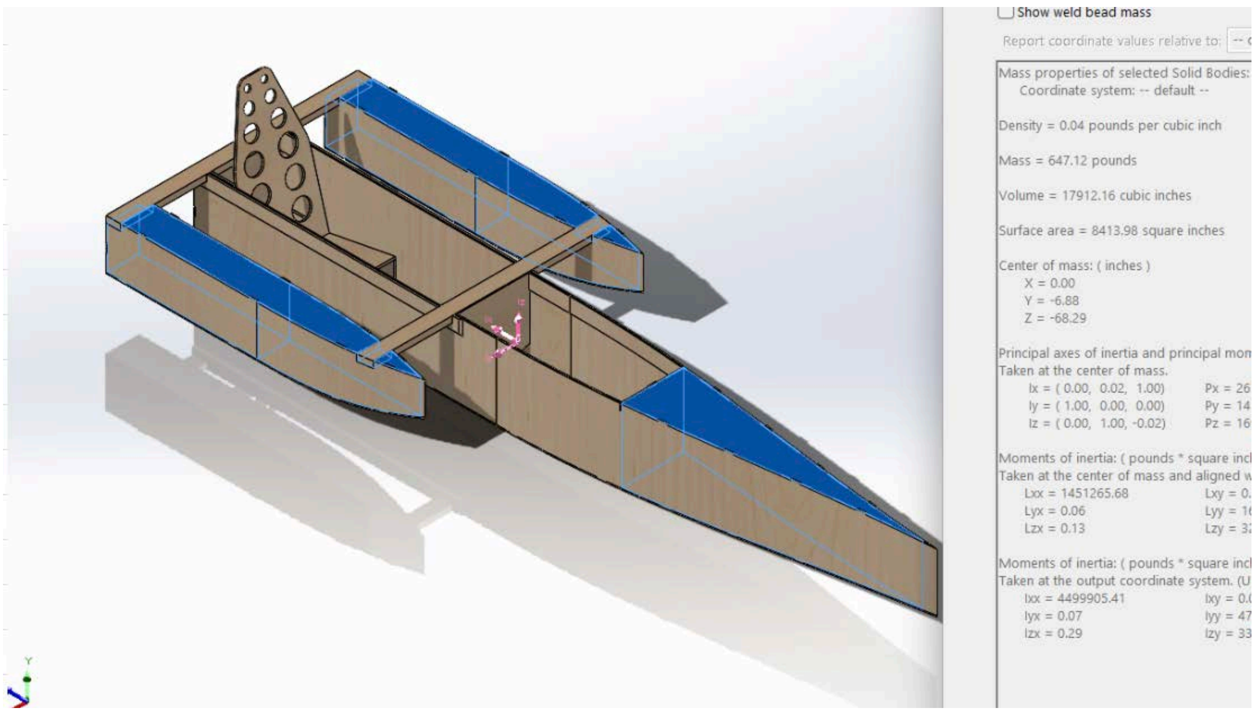
Raptor VeeCAN 320

- **3.5" LCD Color Display**
  - 320(H) x 240(V) QVGA
  - Full Sunlight Readable
- **Processor**
  - Freescale i.MX 286
- **9 Inputs**
  - 7 Analog Inputs
  - 2 Digital Inputs
- **4 Outputs**
  - 4 Low Side Drivers (PWM)
- **10-32 V Operating Voltage**
- **Communication**
  - 2 CAN 2.0B
  - 1 RS-232
  - 1 USB 2.0
- **Environmental**
  - -40°C to 70°C Operating Temp

Appendix AA-J New Eagle Display Spec Sheet

Appendix B: Hull Calculations

7.14.2 Buoyancy of Craft – Sufficient flotation must be provided on board so that the craft cannot sink, even when filled with water. A 20% safety factor must be included in the calculations. Verification calculations must be included in the Technical Report. Failure to do so will result in a **5-point penalty**. Revised calculations must be presented at Inspection if significant changes have been made since submission of the Technical Report.



Appendix B-AEmergency Flotation

The enclosed volume of the hull is filled with foam, which equal to 10.36583 ft^3.

Since 1 ft^3 of water weighs 62.41lbs, the volume of the enclosed area can be multiplied by the water it can displace to find the weight the enclosed volumes can support.

$10.36583 \text{ ft}^3 * 62.42\ lbs = 646.9317lbs$ of submergible buoyance via the flotation foam.

The emergency flotation including wooden hull pieces equal to 13.52014 ft^3.

$13.52014\ \text{ft}^3 * 62.42\ lbs = 843.7919 lbs$ of submergible buoyancy via foam and wooden hull.

843.7919lbs of buoyancy then needs to be compared to the weight of the boat.

Appendix B-B Weight Comparison 1

parts	weight 2024	weight 2025
Hull	70	130
Motor and Mount	55	24.25
Drivetrain	20	30.75
Solar	85	20.5
Batteries and Box	89	100
Steering	5	2
Misc	10	10

Appendix B-C Weight Comparison 2

Total w Driver	484	467.5
20% Safety Factor Total	580.8	561
Total w/o Driver	334	317.5
20% Safety Factor Total	400.8	381

Appendix B-D Weight Comparison 1

Total w/o driver	484	317.5
20% Safety Factor total	400.84	381
Emergency Weight Supported	382.39	843.7919
Difference From Total Weight	-18.45	462.7919

Appendix C: Proof of Insurance

ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 10/19/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Arthur J. Gallagher Risk Management Services, LLC 2850 Golf Rd Rolling Meadows IL 60008	CONTACT NAME: Jennifer Webber PHONE (A/C, No, Ext): 630-694-5462 FAX (A/C, No): 630-285-4062 E-MAIL ADDRESS: Jennifer_Webber@ajg.com
INSURED UNIVOFS-14 University Of Southern Indiana 8600 University Blvd. Evansville IN 47712-3597	

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : United Educators Ins, a Reciprocal Risk Retention	10020
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** 55246245 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY			M8613T	10/19/2023	10/19/2024	EACH OCCURRENCE	$ 1,000,000
	CLAIMS-MADE X OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 1,000,000
							MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 3,000,000
	X POLICY PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$ 3,000,000
	OTHER:							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	ANY AUTO						BODILY INJURY (Per person)	$
	OWNED AUTOS ONLY / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB / OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB / CLAIMS-MADE						AGGREGATE	$
	DED / RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						PER STATUTE / OTH-ER	
	ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH)	N / A					E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

RE: 2023-2024 Collegiate Design Competition for Solar Boat Design

CERTIFICATE HOLDER	CANCELLATION
Solar Splash Competition Attn: Jeff Morehouse 4040 Laybourne Rd. Springfield OH 45505	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE

ACORD 25 (2016/03) The ACORD name and logo are registered marks of ACORD

Appendix C-A Proof of insurance

Appendix D: Team Roster

	First Name	Last Name	Position	Role	Year	Major	In Attendance
Dr.	Susan	Ely	Faculty Advisor	Advising			No
Dr.	Paul	Kuban	Department Chair	Advising			Yes
Mr.	Keith	Pate	Faculty Advisor	Advising			Yes
	Jacob	Mills	Team leader	Hull, Motor Mount, Solar Mount, Drive Train	Senior	MFET	Yes
	Zoe	Tucker	Team leader	Hull, Graphics Design, Power Electrical, Solar Electronics	Junior	EE	Yes
	Kyle	Echart	Team Member	Drive Train, Hull	Junior	ME	Yes
	Mariah	Fulton	Team Member	Hull	Senior	ME	No
	Jacie	Graber	Team Member	Electronics, Hull	Senior	EE	Yes
	Lucas	Hoffman	Team Member	Hull, Steering	Junior	ME	No
	Charlie	Jackson	Team Member	Hull, Drive Train, Telemetry	Sophmore	ME	Yes
	Josh	O'Brian	Team Member	Electronics, Hull	Senior	EE	Yes
	Ethan	Payne	Team Member	Hull, Steering	Freshman	ME	Yes
	Reinard	Stanislaus	Team Member	Hull, Drive Train, Steering	Freshman	ME	Yes