# Robbin Records

After months of scheduling and logistics, Andrew finally signed the last piece of paperwork that gave him and his team legal ownership of the boat. With a firm closing handshake, it was time for assembly. The shop was buzzing with excitement as this boat would serve as the main frame for Princeton Electric Speedboating's (PES) newest entry into the upcoming Promoting Electric Propulsion race, a collegiate speedboating competition designed to inspire young engineers to work with electric watercraft. As they were assembling the boat after unloading it from the U-Haul, Andrew, who was securing a latch to the hull, turned to a nearby freshman and asked, "Why do you think it's designed with a rubber spacer underneath this nut?" His voice was inviting. Not testing, but teaching. As the team continued to assemble the boat around them, it was clear in that moment that Andrew was doing more than just building a boat. He was building a team. This was the type of leader that Andrew was. No matter their experience, he made sure that every member was constantly learning and integrated them fully into the team. It's through these small lessons that Andrew sees every moment as a chance to learn and grow as a team working to break their next world record.

Andrew's journey to becoming a leader started long before he set foot on campus. Originating from Port Huron, Michigan, Andrew naturally spent most of his summer days at Lake Huron, which was just a few miles away. Whether it was waterskiing, tubing, or recreational boating, he was always on the water. It was during one of these summers in high school that he got his first taste of powerboating when cruising 105 mph on a 42-foot V-bottom Cigarette boat. "This is where a lot of my interest and respect for the high performance marine industry started," recalls Andrew. "The neat thing that I realized is that there are no real speed limits on big bodies of water." It was from this point that his curiosity and desire took over.

In Andrew's senior year of high school, he started an internship at Tyler Crockett Marine, an engine building shop about 20 minutes away from his house. It was during this internship that Andrew not only solidified his love for both engineering and boat racing, but also gained his technical experience with engine design. "The ability to work on everything from small 500 horsepower V8s to the owner's 3500 horsepower drag racing engine was the best experience I could ask for," says Andrew. "It really gave me a broad spectrum of what you could do with engines." This experience at the engine shop would serve as the foundation for the rest of Andrew's mechanical engineering career, especially at PES.

Andrew joined PES during his first semester at Princeton in the fall of 2021 when the team was still relatively young. The team had tinkered around with some prototypes and built a boat that could max out at 26 mph. While some members of the team were satisfied, Andrew was not. He had his sights set on the world record of 88.61 mph set by Jaguar Vector Racing in 2018. "It was a tall task especially since they had massive funding and the research from an entire Formula E (the electric version of Formula 1 Racing) team behind them," Andrew remembers. "But even as a freshman on the team, I knew that we could break their record. It became my target to break the 100 mph speed barrier." As he and the team worked towards this goal, it was apparent that certain aspects of the boat needed a complete redesign.

Andrew began by studying the Jaguar boat for inspiration. While it was fast, 88 mph was not all that impressive, especially when equipped with a 300 horsepower Formula E engine. Andrew noticed that while each individual part of the Jaguar boat was impressive, they didn't complement each other. For example, Jaguar's well-designed hull, while sleek and fast, could not support the weight of the powerful engine. This caused the boat to sit too low in the water,

increasing its drag and slowing it down. Thus, despite having two great pieces of equipment, the boat actually worked against itself, preventing it from reaching its peak speed.

This was how Andrew's team was going to beat Jaguar. They didn't need the newest or best equipment. They just needed everything to work together, much like the team he is leading. So, the search for perfect equipment began.

After talking to many experts in the field, Andrew concluded that they should start their journey by investing in a hull that was proven to be fast. By starting with a body that is designed to cut through the water at 900 pounds, the team would be able to focus all their efforts on molding the engine and battery pack to perfectly hit that weight and optimize the performance of the boat. After teaming up with Black Sheep Racing, Andrew finally found a fast and, crucially, affordable hull known as Big Bird. Big Bird was a Pro-Outboard hydroplane, a slightly different style than the Jaguar hull, but was proven to be quite fast in previous competitions. Big Bird's design was more akin to an airplane than a boat, leveraging its aerodynamics to help bring air underneath the boat to lift it up and out of the water to reduce drag. This meant that the boat must be both fast enough for the aerodynamic effects to kick in and light enough for it to be lifted out of the water. An efficient and well-designed engine was a must.

Partnering with Flux Marine, a start-up founded by Princeton alumni, Andrew and some of the team embarked on a mission to customize Flux Marine's standard 100 horsepower engine to fit the demanding needs of Big Bird. One of the biggest challenges in this customization process was not just increasing the power of the engine but doing so without adding more weight. "To solve this issue, we took some inspiration from some of the existing EV auto-motorsport engines in Formula E," says Andrew. "We combined a couple parts from separate engine units to create our own motor that dramatically increased the peak horsepower." Andrew

and the team brought Big Bird's engine from the original 100 horsepower to now 180 horsepower while keeping it under the budgeted weight limit. This new and improved engine was now more than powerful enough to take full advantage of Big Bird's aerodynamic capabilities.

Armed with two essential pieces of a world record electric speedboat, the only thing left for Andrew and the team to figure out was the power supply from the battery pack. This proved to be rather simple due to the nature of Big Bird's purpose: travel two kilometers, the standard course for speed records, very fast. In order for the world record to count, Big Bird must complete a one-kilometer pass, and after a short break, complete the same pass in the opposite direction. This meant that the battery would only need to function properly for about 20 to 30 seconds. "Once we realized this, cooling, which had been a pain for us to figure out, no longer became a priority," states Andrew. "We could run the battery and engine at maximum capacity and then wait a few minutes for it to cool down before starting the second run."

Now that all of the upgrades and modifications have been implemented, it was time to find out whether or not the boat could actually perform under pressure. Towards the end of October in 2023, the team traveled down to Lake Townsend in North Carolina for an official world record attempt. Piloted by a professional, the boat completed the first pass at 111.08 mph and the second in 117.50 mph for a world record of 114.20 mph. Andrew had successfully led a group of undergraduate engineering students to the top of the sport. And they didn't just beat Jaguar, they crushed their record. "Easily one of the best days in my life," says Andrew. "I was confident in breaking the record as we smashed it during testing, but to actually see it happen was awesome. Definitely something that I will never forget." Andrew's team was no longer just a

group of college kids, but they solidified themselves as a fierce competitor in electric speedboating.

Now, over a full year later, that same record still stands. No other team, collegiate or professional, has come close to that number. The PES team is so fast that they complete a full racecourse in just one-third the time of the second-place finisher. While these achievements were led by Andrew, he's quick to emphasize the collective effort behind their success. "Being able to work with alumni at Flux Marine was honestly a game changer," Andrew notes. "There were a lot of people involved in breaking this world record and partnering with them was the real treat."

As Andrew goes into his final semester at Princeton, he has recognized PES to be more than just a team looking to build a fast boat. It is a wide community of alumni and professionals that helps young aspiring engineers to gain real hands-on work experience. "With the way that Andrew has taken over the team, it really operates more like a startup than a club," says Professor Luigi Martinelli, a mechanical and aerospace engineering professor at Princeton and one of the advisors of PES when they first started in 2020. "It's been great to see how Andrew has really molded the team into a mentorship style system that really helps the underclassmen gain valuable opportunities." This sense of team and collaboration is something that Andrew has learned to value more than any record.

In addition to building high performance speedboats, providing opportunities to engineering students that aspire for a career in mechanical engineering has become a large priority for Andrew. "The biggest thing that I have learned from my time running this team is how valuable these opportunities were for my career," says Andrew. "Being a part of this team has taken me to places that I would have never seen. This team has truly changed my life and it is now my priority to make sure that everyone that comes through the team has the same

opportunities that I did." After graduation in May, Andrew's focus will turn from building speedboats to rockets as he will begin his full-time mechanical engineering career at SpaceX in Dallas where he hopes his experience in the water will translate to space.