MAE STUDENT MAE CLUB

Twin Engineers Navigating the Future of Autonomous Maritime Systems

For twin brothers **Tz Yuan** and **Tz Lung**, engineering has always been more than just a field of study - it is a shared passion that drives them to push boundaries. As **MaritimeONE** scholars pursuing **Mechanical Engineering at NTU**, they were drawn to the intersection of maritime and automation, leading them to take on leadership roles as Deputy Team Leads in the **Archimedes Autonomous Vehicles student club**.

Now, they are steering their team towards RobotX 2026, a world-class competition jointly organised by MINDEF and the U.S. Office of Naval Research. The competition challenges students to develop Autonomous Maritime Systems capable of navigating and performing complex maritime tasks at sea. From assembling a diverse team of engineers to overcoming technical and logistical hurdles, the twins have played a pivotal role in shaping the club's success.

In this feature, we dive into their journey - how they got involved, the challenges they have faced, and their vision for the future of autonomous maritime systems.



Tz Yuan (Left)
Tz Lung (Right)

BY KAREN CHAI & KENDRA KEE

From Passion to Leadership in Autonomous Maritime Systems

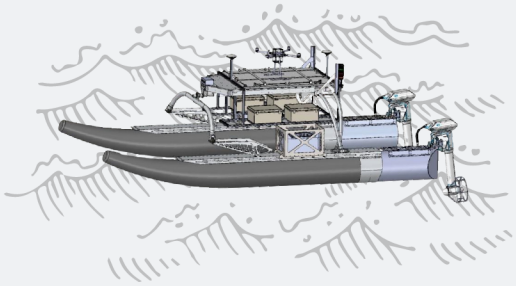
Bridging Theory & Application



Q: Can you introduce yourselves and share more about your leadership roles in Archimedes Autonomous Student Club? How did you get involved, and what projects is the team currently working on?

As **MaritimeONE** scholars studying **Mechanical Engineering**, we have always been passionate about exploring the intersection of engineering and maritime. The Maritime RobotX Challenge presented the perfect opportunity to apply our knowledge to the development of autonomous vessels and vehicles. Motivated by this, we joined **Archimedes Autonomous Vehicles** in May 2024 as **Deputy Team Leads**, taking responsibility for leading the team toward RobotX 2024 in November.

Our current team consists of 42 undergraduates from Year 1 to 3, spanning nine faculties, and is organised into subsystems such as planning, perception, communication, control, mechanical, Unmanned Aerial Vehicle (UAV), acoustics, electrical hardware, and software.



With the recent conclusion of our 2025 recruitment, new members are onboarding and learning key topics in autonomous systems. We are also working on **expanding our UAV's capabilities** for the Student Unmanned Aerial Systems (SUAS) Competition this June. Over the next few months, we will focus on **rebuilding both our Autonomous Surface Vehicle (ASV) and Unmanned Aerial Vehicle (UAV)**, conducting simulations, and preparing for a stronger comeback at RobotX 2026.

Applying MAE Knowledge to Real-World Challenges



Q: How has your experience in MAE helped you succeed in this club?

The hands-on CAD skills from **Engineering Graphics** and **Engineering Experiments** were essential for designing and prototyping the mechanical components of our autonomous vehicles. These modules provided practical experience in translating design intent into manufacturable parts and navigating real-world engineering constraints.



Intro to Computational Thinking and **Intro to Data Science & Artificial Intelligence** helped build a solid foundation in programming and data handling, which was critical for implementing communication systems and object recognition. Meanwhile, **Control Theory** and **Machine Intelligence** provided the theoretical grounding needed to develop autonomous navigation logic and troubleshoot dynamic system behaviour. Altogether, these MAE modules directly supported the technical demands of the project and helped bridge theory with application.



Overcoming Challenges, One Innovation at a Time

Q. What are some challenges your team has faced, and how did you overcome them?

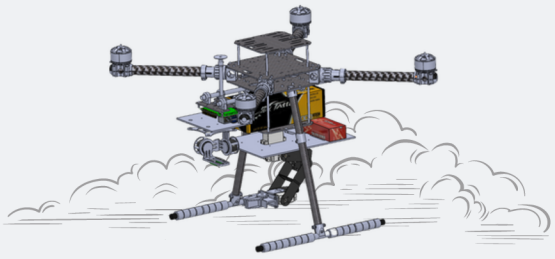
Going into RobotX 2024, our team encountered several significant challenges. We lacked prior experience in competing in RobotX and did not have senior members to guide us, unlike many other teams. Additionally, the presence of international dissertation students on our team created collaboration difficulties due to time zone differences and limited opportunities for in-person testing.



Financial constraints were another major hurdle, but through persistent effort, we managed to secure external sponsorships, which proved essential during the later stages of development. Logistically, handling legal documentation and strict cargo packing requirements for international shipment was daunting, especially with no prior experience. However, Tz Yuan successfully navigated the complex shipment process, ensuring the smooth transport of equipment to and from the U.S.

Despite these challenges and our limited resources, we secured **5th place at the 2024 Maritime RobotX Challenge**, a remarkable achievement for our team.

Breaking Barriers: Lessons from the Frontlines of Autonomy





Q. What were some breakthroughs or key learning points?

One of the biggest lessons we learned was the **power of boldness and perseverance**. Initially, we did not expect to make it to the Autonomy Challenge semi-finals, let alone the finals, as many of our systems were not working as expected. However, we decided to press on, continuously refining our components and adjusting our strategies as needed. **These efforts, even when small, gradually paid off and led to our best-ever finish in 10 years.**

Another critical takeaway was the importance of fully understanding the operating requirements of all system components. During the finals, our batteries had enough charge to last the entire competition. We debated replacing them with fully charged backups but ultimately decided against it, fearing that disconnecting cables could cause unexpected failure - if it ain't broke, don't fix it. Unfortunately, we later discovered that the batteries had a built-in safety shutoff at 30% capacity, which caused our vessel to shut down mid-run, impacting our performance in the finals compared to the semi-finals.



Reflecting on the Journey and the Support that Made it Possible

As the team reflects on their remarkable journey, they are quick to acknowledge the invaluable support they received along the way. The guidance of their professors has been a key factor in their success.

Associate Professor Xie Ming provided essential supervision and technical advice, particularly in autonomous systems and machine vision. **Emeritus Professor Ng Heong Wan's** expertise in mechanical integration proved crucial in the development of their systems, while **Associate Professor Li King Ho, Holden**, played a pivotal role in securing funding, ensuring the team could continue their work without financial constraints.

With their unwavering support, the team was able to overcome countless obstacles, and they remain deeply grateful for the mentorship that helped propel them toward success.