SEQUOIA MARINE SOLUTIONS

California State University, Fresno - Fresno, CA USA

Our mission is to empower students through the MATE ROV International Competition by providing a collaborative environment to develop hands-on technical expertise, cultivate leadership, and unlock enriching academic and career opportunities.

ABSTRACT

The Sequoia Marine Solutions (SMS) MATE ROV team at California State University, Fresno is a team of undergraduate students that are designing, constructing, and marketing an ROV and vertical profiling float to compete in the 2026 MATE ROV World Championship in St. Johns, Canada. SMS is proud to present R.O.S.I.E., the Remotely Operated Submersible for Innovation and Exploration, an ROV designed to complete all of the designated tasks this year, including species collection, servicing subsea observatories, and oil platform maintenance. R.O.S.I.E. is modular, lightweight, and has a small profile, making it well suited to complete these tasks.

DESIGN RATIONALE

The main goals of the design were modularity, compactness, lightweightedness, and strength. The design for R.O.S.I.E. surrounded the pressure hull that MATE had provided. Initially, 1" PVC pipe was used to make the chassis around the pressure hull, however, the team soon gained access to some aluminum t-slot rail that increased the modularity of the build while remaining lightweight. PETG was used as the main filament for 3D printed parts because it does not warp if left in cars in the Central Valley heat (the way that PLA does) and because it is more durable in saltwater. Most external components of the ROV were 3D printed because it was cost effective and supported the modularity of the piece. To maintain strength, each print was infilled at 35% with five walls around the print. The t eam opted not to waterproof the 3D prints because when water filled the prints it added ballast, as well as wanting to make sure the ROV stayed under 18 kg.

THEME

ROSIE and ADAM have been developed to complete a wide variety of scientific and industrial research and exploration tasks. An emphasis was placed on vessel performance in extreme and harsh conditions, with the philosophy that if they can perform at the extreme, then they can perform in any condition. MATE has directed special attention towards the Earth's cryosphere in this year's Request For Proposals (RFP). This is aligned with the UN's Decade of Ocean Science for Sustainable Development program and its goals to develop and research solutions to achieve the "ocean we want" (UNESCO). As an example, the RPF asks companies to develop solutions for mapping a coral ridge garden (Task 1.2), which relates to challenge eight: creating a digital representation of the ocean. Almost every task can be related back to the ultimate goal of creating a better ocean for the future.



Figure 1: Bubblegum Coral in a Coral Garden Photo Credit: Monterey Bay Aquarium Research Institute: https://www.mbari.org/know-your-ocean/revealing-the-secrets-of-sur-ridge/exploring-sur-ridges-coral-gardens/

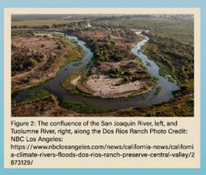


Figure 2: The confluence of the San Joaquin River, left, and Tuolumne River, right, along the Dos Rios Ranch Photo Credit: NBC Los Angeles: https://www.nbclosangeles.com/news/california-news/california-climate-rivers-floods-dos-rios-ranch-preserve-central-valley/2873129/

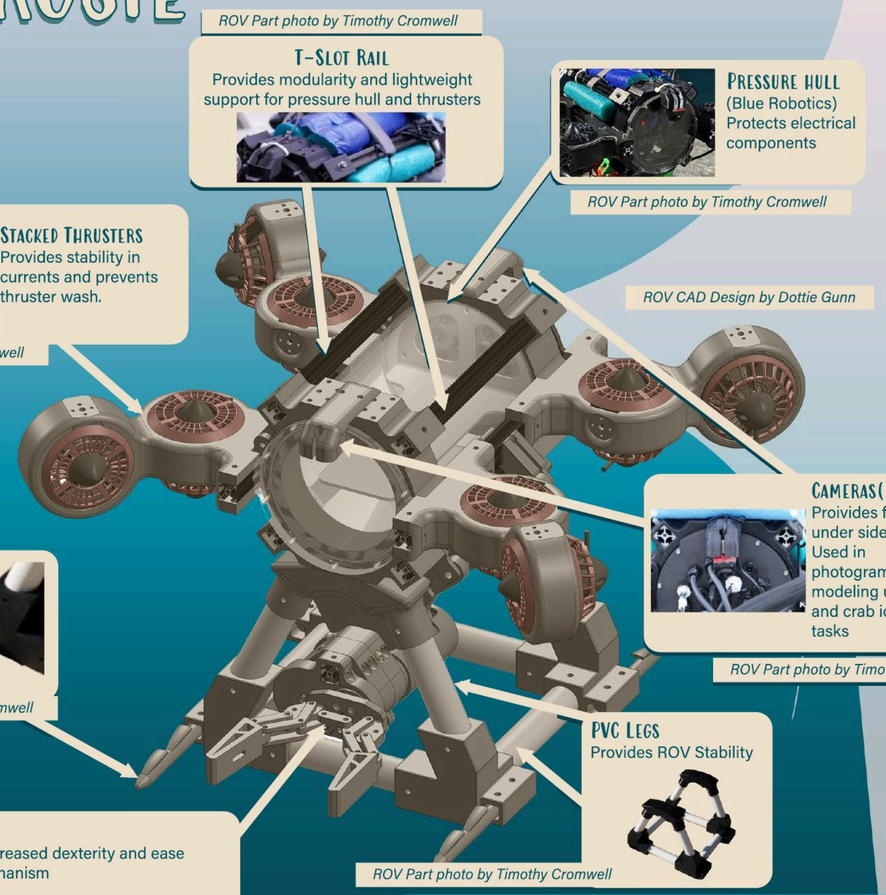
While the cryosphere is the primary focus of this year's RFP, that is not everything that SMS' vessels are capable of. In California's Central Valley, which is SMS' base of operations, there are numerous bodies of water where ROVs would be useful, ranging from basins to canals to dams and lakes. Inspection and repairs to the local man-made structures has been a specific focus of SMS when talking with local governance and industry contacts, and with the specific modular payloads designed for ROSIE and ADAM, they are ready to tackle anything that the environment throws at them.

References
IPCC. (2019). Special Report on the Ocean and Cryosphere in a Changing Climate. Intergovernmental Panel on Climate Change.
UNESCO. (2021). The United Nations Decade of Ocean Science for Sustainable Development (2021-2030). UNESCO Publishing.
United Nations. (2015). Transforming our world: The 2030 Agenda for Sustainable

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Special thank you to the Burk family, who've helped keep us fed and have let us use their home as our base of operations for build days, water testing, and practice throughout the season.

MEET ROSIE



ROV Part photo by Timothy Cromwell

T-Slot Rail
Provides modularity and lightweight support for pressure hull and thrusters

Pressure Hull
(Blue Robotics)
Protects electrical components

ROV Part photo by Timothy Cromwell

Stacked Thrusters
Provides stability in currents and prevents thruster wash.



ROV Part photo by Timothy Cromwell

ROV CAD Design by Dottie Gunn

Cameras(x3)
Proivides front, rear, and under side vision. Used in photogrammetry(3D modeling using pictures) and crab identification tasks

ROV Part photo by Timothy Cromwell

Harpoons(x4)
Allows ROSIE to pick-and-pull samples and wires throughout the tasks



ROV Part photo by Timothy Cromwell

PVC Legs
Provides ROV Stability

ROV Part photo by Timothy Cromwell

Manipulator
Completes tasks with increased dexterity and ease due to rotating claw mechanism



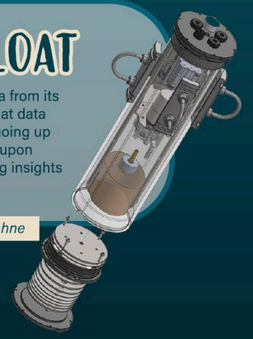
Manipulator CAD Design by Caleb Bahne

Safety Features
Shrouds(Protective net-like cover over the thrusters)
- Manipulator guard
- Rounded Edges



ROV Part photo by Timothy Cromwell

ADAM the Float
The vertical profiling float gathers data from its onboard sensor suite. It then stores that data while performing vertical profiles, or going up and down in the water, and transmits upon surfacing. This data is useful at gaining insights to the oceans' health.



Float CAD Design by Caleb Bahne

ROV Tether
Responsible for all communication from the surface and back. It carries power down to the ROV, and two-way communication via Ethernet.



ROV Tether Photo by Timothy Cromwell

COMPANY INFORMATION



Company Photo by Victoria Servin

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Wyatt Grogan (Float | Comp E)

COMPANY EVALUATION

Sequoia Marine Solutions (SMS) has spent its first year growing swiftly as the company develops ROSIE, the Remotely Operated Submersible for Innovation and Exploration, and ADAM, the Aquatic Drifter for Autonomous Monitoring. Alongside this development, SMS has also made the development of industry skills a focal point, having a core goal of developing each member in a way that prepares them for future job opportunities. Three areas through which the MATE ROV competition has encouraged growth have been through communication, creativity, and autonomy. All three of these have been critical to SMS' success so far, and will continue to be the core of the organization.

An area in which SMS experienced early growth was with communication, as a team of over fifty employees, the initial discussions of team structure had a lot of potential directions. Ultimately, after an extensive open forum, the company landed on our current subsystem structure- splitting into seven subsystems, each with their own lead and their own focus (for example, the ROV Controls and Electronics is separate from the ROV Chassis and Propulsion). This allows our members to focus on their tasks without getting overwhelmed, accommodating our larger team size and maximizing each member's efficiency.

Further into the semester, SMS' main growth point shifted to creativity. Now that the subsystems were designated, research and development began for every portion of both the ROV and the vertical profiling float. To get the creative juices flowing, especially regarding the manipulator design and the best methods for task completion, the Chief Design Officer ran several workshops focusing on idea generation and iteration. One direct result was the design of several rigid harpoon manipulators, capable of retrieving various samples and tof equipment from the ocean floor.

As research was nearing its first push, and development took greater focus, SMS grew greatly as the C-Suite directed the company towards further autonomy. Initially, most projects were being heavily supervised by the respective subsystem lead, but as the academic year went on, each employee was given more responsibility and more individual tasks to accomplish. This led to many members growing in their ability to assess tasks, work at variable schedules, and cooperate with other members to accomplish the greater goals. The ROV Chassis design in