# Floating Debris Clean-up Project

## Team Neptune Sting West Mesa NJROTC Albuquerque, New Mexico

## Abstract

This project explores how ROVs can assist in cleaning up floating debris from rivers, lakes, and oceans, reducing pollution and protecting wildlife. ROVs offer a safe and efficient method to remove trash from rivers, lakes, and oceans, reaching areas that are difficult or dangerous for humans. This project demonstrates the potential of ROVs as a practical solution for environmental cleanup, highlighting their role in preserving ecosystems and supporting sustainable water management.

## Background & Motivation

Floating debris is a major environmental problem in both oceans and inland waterways. Plastics make up most of the trash because they are lightweight, float easily, and do not decompose quickly. Instead, they break into smaller pieces called microplastics, which can be harmful to fish, birds, and other wildlife. Animals may accidentally eat the debris or become trapped in it. According to the National Oceanic and Atmospheric Administration, cleaning even a small percentage of the North Pacific Ocean would require many ships and years of work. This demonstrates that large-scale cleanup alone is not enough. Local efforts are also necessary to stop trash before it spreads into larger rivers and oceans. Our team was motivated to create a practical, low-cost solution that could remove debris from the water while also showing how engineering can be used to solve environmental problems.

## Approach

Design a trash-collecting attachment that can be mounted to the front of the SeaPerch ROV. The attachment's frame will be constructed from lightweight PVC because it is affordable, durable, and easy to assemble. A mesh basket will be positioned at the front of the ROV to allow floating debris to be pushed into the basket while water flows through it. A small closing gate will be added to prevent collected debris from escaping. Certain parts, such as the gate and support pieces, may be produced using a 3D printer to increase precision and reduce weight.Safety will be a key consideration in the design. Rounded edges will be incorporated to prevent injury to fish, turtles, or other aquatic life. Mesh openings will be made large enough to allow small animals to escape if they accidentally enter the basket. Additionally, the attachment will remain compact to avoid creating hazards for other boats or underwater vehicles.

## Next Steps

1. Structural Framework PVC Piping and Connectors: Lightweight modular framework providing structural support and impact resistance. 3D-Printed Brackets and Supports: Custom mounts for securing components and maintaining precise alignment.
2. Propulsion System Waterproof Motors (×4): Thrusters for multi-directional movement and maneuvering.Motor Mounts: Stabilized attachment points for precise thrust direction. Propellers: Designed for efficient water displacement and controlled speed.
3. Buoyancy and Stability Primary Flotation Foam: Ensures neutral buoyancy for stable operation.Auxiliary Foam on Tether: Fine-tunes stability and reduces tilting or pitching during movement.
4. Debris Collection Mechanism Plastic or Wire Mesh Basket: Captures and contains underwater debris Front Closing Gate: Retains collected material and integrates with hinge mechanism.3D-Printed Hinge for Gate: Allows smooth opening/closing actionsNetting / Container Frame: Secures collected items and supports basket structure.
5. Electrical and Control Systems Tether Cable: Provides power and signal transmission between ROV and surface controller. Controller with Buttons and Switches: User interface for precise control of propulsion and gate operation.Electrical Wiring and Waterproof Connectors: Ensure safe, reliable connections under submerged conditions. Battery or Power Supply: Provides necessary energy for motor and control systems.
6. Assembly and Fastening Materials Screws, Zip Ties, and Adhesives (Hot Glue / Waterproof Adhesive): Secure all components and prevent water ingress.Waterproof Tape: Reinforces seals and protects wiring and joints from moisture exposure

## Results & Discussion

Plan to test the prototype in water using a variety of debris, including plastic bottles, bottle caps, foam pieces, and plastic bags. It is expected that the ROV will be most effective at collecting larger items, such as plastic bottles and foam containers, which float and fit securely in the basket. Smaller objects, like bottle caps, may be more difficult to collect because they could slip through the mesh, and plastic bags may present challenges due to folding and unpredictable movement in the water.

The mesh basket and closing gate are designed to work together efficiently. The basket will allow water to pass through while minimizing drag, helping the ROV maintain stability and ease of control. The closing gate is intended to keep collected debris secure inside the basket. The attachment is designed to minimize any impact on the ROV's balance or maneuverability. These tests will help determine the effectiveness of the design in collecting floating debris while ensuring safe and stable operation.