

Design of a Marine Debris Removal System

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Abstract: Approximately eight billion kilograms of human debris entered the ocean in 2010, a number that has risen exponentially each year by 10%. The most common pollutant is plastic which composes about 80% of the debris. Plastic takes approximately 500 years to decompose, and in that time, it is harming wildlife while collecting in the ocean's circular currents called gyres, the largest being the Subtropical Convergence Zone at seven million square miles. The estimated cost of environmental damage from human generated debris is about three billion dollars. A multi-attribute utility function was used to evaluate the following alternatives in the categories of performance, technology readiness level (TRL), and risk: autonomous vacuum at 5.87, artificial floating island at 4.86, barge with autonomous surface vehicles at 3.69, vessel with nets at 5.40, and vessel with unmanned aerial vehicles at 3.70. The autonomous vacuum was determined to be the best solution due to its high rate of removal and moderate capacity size. Alternatives were most sensitive to performance, and with 20% adjustment of the weights the vessel with nets becomes the best option for efficiency focused needs.

Keywords: Human debris, gyres, Subtropical Convergence Zone