# Life below water – Oil Spill Cleaner-Upper

There are two versions of this project. One involves using just a micro:bit or even just the simulator in the [MakeCode editor](https://makecode.microbit.org/#editor) to design an algorithm for efficient cleaning. The other involves building the prototype which will require some additional hardware. Both activities could be done but would likely take more than a single lesson.

The big picture – why is this relevant?

Healthy oceans and seas are essential to our existence. They cover 70% of our planet and we rely on them for food, energy and water, yet we have managed to do tremendous damage to these precious resources. We must protect them by eliminating pollution and overfishing and immediately start to responsibly manage and protect all marine life around the world.

Learning objectives:

* Understand what the Global Goals are
* Understand what [goal 14](https://www.globalgoals.org/14-life-below-water) is and its significance
* Produce an Oil Spill Cleaner-Upper product to meet the success criteria
* Develop the product further with additional features

Engagement – How can I engage learners?

* Learners may be engaged and motivated by the Global Goals context
* Learners will enjoy testing their products as it has a physical aspect
* Using servos with micro:bit is a fun extension and opens up a world of physical interactions which may inspire learners to use the same techniques in other applications such as robotics

Assessment for learning

**Expected progress:**

* Learners follow the guide and create a product that meets one of the success criteria

**Good progress:**

* Learners create a product that meets more than one of the success criteria and improve the product from initial designs

**Exceptional progress:**

Learners create a complete product that meets all success criteria. Learners iteratively improve the product and add additional functionality

Key concepts:

* Global goals (target 14.1) Reducing marine pollution
* Servo motors being controlled and powered by a peripheral board
* Creating a repeatable algorithm

Key words:

* Servo - <https://en.wikipedia.org/wiki/Servomotor>
* Paddles - <https://en.wikipedia.org/wiki/Paddle>
* Smart material - <https://en.wikipedia.org/wiki/Smart_material>
* Algorithm - <https://en.wikipedia.org/wiki/Algorithm>
* Function - <https://en.wikipedia.org/wiki/Subroutine>
* Loops - <https://en.wikipedia.org/wiki/Control_flow#Loops>
* Variables - <https://en.wikipedia.org/wiki/Variable_(computer_science)>

Differentiation:

Some learners will get more out of the making elements of this project and so the .hex files could be provided to focus on the engineering elements. Getting the boat to just move forward will be an achievement on its own and some learners may struggle with the algorithm portion and so may require more support.

Resources:

* micro:bit(s)
* battery peripheral and batteries
* materials to make the floating body and paddles
* servo control board
* servo motors
* a sponge to simulate the smart material

Lesson flow

* Introduction to the Global Goals concept
* Introduction to the ‘life under water’ goal
* Discuss why this goal is important and what may happen if we ignore it
* Introduce the success criteria and discuss initial ideas on how to solve the problem
* Discuss the concept of an autonomous drone boat and how it might look and work
* Discuss how the smart material that soaks up the oil will be towed behind the boat and how we can simulate it using a sponge
* Discuss the IPO (input-process-output) process and discuss the suggested pattern for the boat to follow
* If needed, draw a flow chart that represents the steps needed and discuss which computational techniques would be best suited to efficiently implement the algorithm
* OPTIONAL: create the algorithm using a sprite on the micro:bit
* Remind learners to refer back to the success criteria

**The build:**

* Introduce the concept of the paddle wheel and why we need two servos (to allow steering)
* If needed, look at the suggested design for the boat and discuss
* Introduce the servo control board and if needed go over how to add the extension to MakeCode
* Encourage learners to design the algorithm and the boat before making it, encourage them to consider the materials and their suitability for use on water
* Provide the learners with the activity sheet, micro:bits and making resources, learners will need to extend the algorithm as only the first two steps are demonstrated
* Troubleshoot the making and programming and intervene where necessary
* Remind learners to refer back to the success criteria

Making

**BEWARE! Do not test the products in water. Micro:bits are not waterproof!**

* This activity includes making the floating body of the product – do not test in water.
* The paddles also need to be carefully designed and made so that the servos can move them, they will need to light weight enough for the servo you use
* The servos need to sit above the water line (as in the schematic in the activity sheet)