# Team First Report

**Context and Purpose**

This project explores the dynamic between two fluids mimicking an ocean high wave, I wanted to do that by using a jar filled with oil and water. The water was dyed blue and mixed with glitter, while the oil phase contained droplets of water that were dyed green. The goal was to simulate wave motion and investigate how these fluids interacted, particularly at their interface. This independent work aimed to demonstrate the separation of fluids and the movement patterns of glitter and droplets within each phase.

**Flow Apparatus and Phenomenon**

The apparatus consisted of a transparent jar partially filled with two immiscible fluids: water and oil. The blue-dyed water, enhanced with glitter for better visualization, represents one phase, while the oil contained small, suspended water droplets that were dyed green.

When the jar was shaken rapidly, wave-like motions were made, producing a range of fluid behaviors such as swirling and wave formation. Although the two fluids remained separate, their interface showed complex interactions through the motion of glitter particles in the water and the green droplets in the oil.

To quantify the observed wave dynamics the Froude number (Fr) was calculated. The Froude number compares the wave's inertial forces to gravitational forces, using an estimated wave

speed of 0.3 m/s and a characteristic wave height of 5 cm, Giving us a Reynolds number of approximately 1.33. This result shows that inertia dominated, which aligns with the prominent wave motion observed.

**Visualization Technique**

The visualization strategy relied on the contrast between the blue-dyed water and the yellow oil. The blue glitter particles in the water highlighted its flow patterns, while the green droplets suspended in the oil provided a secondary layer of motion complexity and a beautiful reflection.

A bright LED light placed behind the jar emphasized the boundary between the two fluids and enhanced the visibility of both glitter and droplets. Conducting the experiment in a controlled, low reflectivity environment ensured consistent observations without interference from external air currents.

## Photographic Technique

The image was captured using the following photographic setup:

- **Camera**: iPhone 12 Pro
- **Lens**: Built-in wide-angle lens
- **Field of View**: Approximately 25 cm
- **Distance from Object**: 15 cm
- **Resolution**: [2833 × 1620] pixels
- **Exposure Settings**: Shutter Speed 1/60 s. Aperture f/1.6, ISO 200

Post-processing was minimal, involving slight adjustments to contrast and picture cropping to enhance the visibility of key elements. No significant image manipulation was made beyond these basic enhancements.

Original uncropped and edited picture

**Image Analysis and Reflection**

The captured image effectively showcases the interaction between oil and water under wave-like motion. The glitter provides clear tracers of water flow, while the green droplets illustrate the behavior of dispersed water within the oil phase. LED lighting played a crucial role in highlighting these features, making the interfacial dynamics particularly vivid.

While the outcome met expectations, future improvements could focus on using a high shutter speed camera to capture finer details of the motion. Additionally, experimenting with varying shaking methods could provide insights into how different energy inputs affect fluid interaction and wave strength.

**References**


1. Fiveable. (n.d.). *Flow visualization techniques in fluid dynamics*. Fiveable Library. https://library.fiveable.me/key-terms/fluid-dynamics/flow-visualization-techniques
2. Hennigh, O., & Ferziger, J. H. (2017). *Visualization and simulation of multiphase flows*. arXiv. https://arxiv.org/abs/1705.05138