# Group 14 - Space Based Geoengineering

The biggest current threat facing humanity is climate change, the effects of which may soon become irreversible. Because current efforts to reduce the output of greenhouse gases are failing to meet their objectives, more intrusive measures are starting to be seriously considered from a practical, rather than a purely ethical point of view. Geoengineering is one such measure and involves the deliberate, large-scale manipulation of processes controlling Earth's climate. While many distinct approaches to geoengineering exist, this project has investigated a space-based geoengineering approach to provide a temporary solution to the rapidly increasing temperatures on Earth. The project's objective is:

**Design a space mission capable of blocking up to 2% of solar radiation reaching Earth with 10 students in 10 weeks, constrained by a theoretical design budget of 1 trillion USD.**

As a solution, we present EOS – Earth Obscuring Sunshield. The mission consists of sending a constellation formed of 67,991 spacecraft to the Sun-Earth L1 point in space point. These spacecraft will each use a large circular shield to block a cumulative total of 1.8% of sunlight directed towards Earth. This serves to reduce global warming by effectively reducing the solar energy hitting received on Earth so as to reduce temperatures to the expected values for a healthy planet. The project is an ambitious creation of a system of satellites in order to save the planet from this global crisis. The large circular shields of the many spacecraft will work together and distribute the darkening of the Earth across its surface although such that the difference should only be noticeable in solar appliances.

The design uses a combination of novel and previously used designs. It takes inspiration from spinning satellites that uses circular motion to deploy a payload, and it resembles solar-sail missions as they have become increasingly popular in recent years. It further uses the up-and-coming research into folding origami shapes for efficient stowing of material for the shield itself as well as the new Starship launcher and its orbital refueling capabilities. In terms of advancements in the domain of space engineering, the mission breaks new ground in the sheer scale of the satellites themselves. Each spacecraft bus alone will be 8 meters tall with a diameter of 2.4 meters. This bus must carry a payload (the shield) of over 103 tons of material which will form a 10.6 km diameter polyethylene naphthalate shield once deployed. It shall be deployed into the unstable Lissajous orbit, where it will hold its position through periodic orbit maintenance. The quantity and size of satellites pose an extreme challenge for the current space industry as it requires a global contribution with automated production lines and large quantities of materials. The constellation is to be ready in 10 years' time and will be operational for 20 more years thereafter. The final surface area which will be covered by the spacecraft will sum up to over 6 million $km^2$ with a total mass of 7 million tons. We believe that