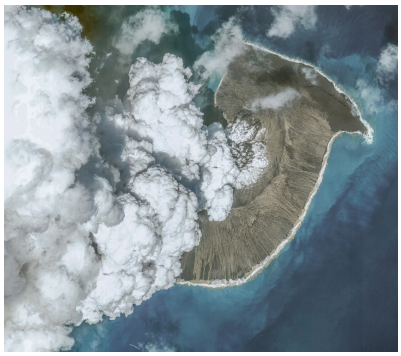
DSE group 22 - Emergency Communication Node

Jury Summary - 8th June 2022



Maintaining a high speed, secure and robust connection to the world is of paramount importance in modern society. This proved especially true during a recent volcanic eruption in the small island nation of Tonga, where the only optical fiber line to the country was severed due to the cataclysm and completely disconnected the island from the rest of the world. The lack of communication made the disaster relief to the eruption more complex. Furthermore, it evidenced the need for an alternative means of communication that can be swiftly deployed. Consequently, a Mission Need Statement has been formulated to drive the design of such an alternative: **Provide a mobile bi-directional air-to-ground optical communication node to be fastly deployed in emergency situations.** To achieve this characteristic link, a series of attributes must be designed, such as the optical subsystem, ease of transportation, and structural integrity, among others. As such, a Project Objective Statement has been proposed: **Design a mobile and rugged ground station which communicates with a UAV using optical communication with 10 students within 10 weeks.**

This project culminated in the design of an exceptionally environmentally rugged communication node, that is both easy to operate and capable of being deployed anywhere in the world within 48 hours. The node is capable of data transfer at 100 Gbps with High Altitude Platform Stations and 1 Gbps with a Low Earth Orbit (LEO) stationed satellite. Conventionally used radio frequency (RF) communications cannot easily achieve data transfer at these rates, thus more novel and more capable laser-based communications were chosen for the design. Notwithstanding the clear advantage of laser communication over RF solutions, it also necessitates significantly better pointing, steering and tracking capabilities, thus adding to the challenges encountered during development.

Throughout the project, sustainability has been addressed by making a full operational cycle analysis of the Node, from Design to End-of-Life and identifying where sustainable choices can be made. This includes Material Selection, Recycling Strategy, Transportation Emission, and Manufacturing Techniques, among others. This is all done to minimize the carbon footprint of the project, thus taking steps in slowing the increase of natural catastrophes due to climate change.

It can thus be confidently said that the Emergency Communications Node will successfully provide emergency relief teams with a new and exciting tool to minimize the impact of natural disasters all around the world.