Venus is often called Earth’s sister planet. While its size and composition are indeed similar to Earth, its scorching temperatures and acidic clouds make a visit to Venus all but a pleasant stay. Many of Venus’ atmospheric phenomena are still not fully understood and its internal dynamics and seismic activity mostly remain a mystery even after decades of research. This results in a significant knowledge gap concerning our neighbouring planet. With the use of new techniques, not used on Venus yet, the BLOON mission will aid this quest for answers.

---Mission Objective---

Thus, the objective of BLOON is to design a mission for a platform that can perform in-situ atmospheric measurements of Venus, to analyse phenomena such as super-rotation and the Hadley cell structure. The mission will also detect or study the tectonics and seismic activity of the planet by means of infrasound measurements. To fulfill this goal, the mission will have both elements in the atmosphere and an element in space.

---System Design---

The atmospheric segment will consist of a high-altitude balloon, loitering just above the Venerian cloud layer, where it will perform in-situ measurements, including the atmospheric composition and gas concentrations, in order to study the previously mentioned meteorological phenomena. This way both the evolution and the current state of the Venerian atmosphere can be studied. Using two microbarometers, the balloon will detect infrasound signals to observe seismic activity. This method uses dense atmosphere of Venus to its advantage to measure earthquakes in a way never done before. To reach the deeper regions of the atmosphere, dropsondes will perform measurements down to an altitude of 25 km. To shield all components from the extreme conditions, state-of-the-art multilayer insulation is used in conjunction with composite laminates that prevent outgassing of the balloon.

As a means to send the data back to Earth, a relay satellite is used, also known as the orbiter. Besides the science link, a continuous beacon signal, which sends system housekeeping data, ensures high reliability and short communication time. The satellite will perform its own measurements: BLOON will be the first mission to analyse the ionosphere of Venus with a mass spectrometer below 250 km. An onboard camera will take 20,000 photographs with a resolution down to 100 meters per pixel, mapping parts of the planet with more accuracy than ever done before. The satellite will reach its orbit by aerobraking, minimising the fuel required. The balloon and orbiter both take advantage of the proximity of Venus to the sun to fully run on solar power.

As of the writing of this jury summary, the latest design iteration has been completed. This design concerns the balloon, orbiter, and a transfer module including aeroshell, required for orbit insertion. The complete mission timeline has been designed. In the remaining time of the DSE, the team will perform more detailed subsystem design and will complete their analysis on stability, reliability, sustainability, and cost. Final CATIA models, including manufacturing steps, will also be made. Lastly, verification and validation of all systems will be completed soon. These steps will lead to one final iteration cycle. The BLOON team looks forward to the Symposium where we will share the full story of the space mission that will advance our knowledge of Venus.