

Vertically Air Lifted High Altitude Light Launch Apparatus (VALHALLA)

Abstract

Project VALHALLA (Vertical Air Lifted High Altitude Light Launch Apparatus) is a high altitude launch platform with the objective of providing a cost efficient option for collegiate rocket organizations to perform high altitude research.

This project primarily consists of a platform that will be lifted to 100,000 feet using several clusters of high altitude balloons that will be inflated using Helium. From 100,000 feet, the rocket will be launched and the platform will then descend to the ground by retrieving the helium and absorbing it back into storage tanks while pressurizing it.

Currently, the project is on phase two which is prototyping and testing of various systems prior to implementing those systems in a Mk.0 build. This involves using simulation programs such as Ansys to test how air will flow around the structure and visualize the structural strains on the platform. This phase is expected to last through the 2019-2020 academic year and will allow the team to begin building the Mk.0 system in Fall 2020.

Structure

The Structure Team has been working on the modeling and simulation of the launch platform. So far, two CAD models have been created in CATIA and one of them has been tested in a simulation software called ANSYS.

This year, structure team is attempting to get storage and workspace in the Micaplex. Once this has been achieved, the team will begin creating a prototype of the entire system out of corrugated plastic and will also begin to lay out the various components that make up VALHALLA.

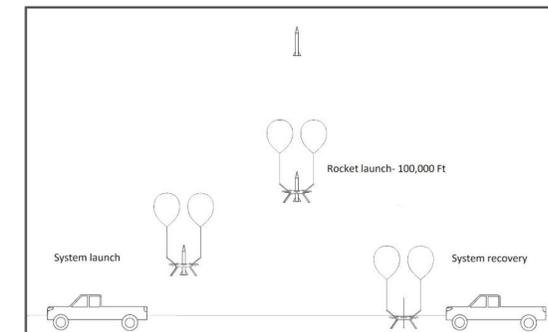
Looking forward, structure team will be doing destructive and nondestructive testing on the system and has the goal of building and testing the Mk.0 model by spring 2021.



Policy & Safety

Currently, the Policy and Safety team has been in contact with many legal and technical experts. The team first contacted an attorney for OneWeb by the name of Ryan Noble for consultation and his opinion on the challenges we faced. Through him we were put in contact with the Federal Aviation Administration's Office of Outer Space Transportation (FAA-AST) with which we consulted on the project. Through FAA-AST we asked many questions in regards to launch site, trajectory, insurance, communication regulations and air traffic. FAA-AST doesn't regulate the type of launch we are going to perform but was more than happy to answer these questions regardless. Launch site location would be a major factor in regards to safety with trajectory being tied into that location selection. Insurance was not needed by law but still recommended we obtain some sort of coverage due to the nature of the project. Communication regulations are established by the FCC and as long as we follow their regulations, we will be following the proper protocol. Air traffic is something we will have to work out with the FAA office of Air Traffic Control. FAA-AST gave us the contacts for all of the other various regulatory agencies we will need to reach out to and that process is still ongoing.

On the safety side, the team is assembling a risk matrix that will evolve with the new developments in the project. Trajectory analysis and launch site selection are currently underway as well, this is important as with all launches as we will need to launch over unpopulated areas to reduce the risk to the general uninvolved public.



Helium Recycling

The Helium Recycling System (HRS) team is currently working to model the lift of balloons as a function of altitude to determine the size of the VALHALLA platform and the scope of the hardware required to recover the helium used for each mission. Once an initial baseline is established, Work will then focus on the primary mission of HRS which is returning VALHALLA to the ground with as much helium as possible. This achieves two goals: reducing the price and lowering the environmental impact of each launch by reusing as much helium as possible which is currently in short supply and thus expensive.

The next steps for HRS in spring 2020 are to finalize initial research and then begin construction on a small scale prototype to test the validity of the mathematical models created, the dynamic stability of a system of 4 balloons and a basic system layout of the components of the HRS.