

28th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)

Access to Space for Small Satellite Missions (5)

Author: Mr. Alan Thompson
Skyrora Ltd, United Kingdom

FROM SCOTLAND TO SPACE: BUILDING A UK SUPPLY CHAIN TO ALLOW LAUNCH
CAPABILITY AND SATELLITES TO BE DELIVERED TO A LOW EARTH ORBIT FROM A UK
SPACEPORT

Abstract

Skyrora is a UK launch vehicle provider aiming to support the government plans for space sector growth through the development of an orbital vehicle and carefully selected supply chain innovations that we believe will reinforce the industry for years to come. This paper will elaborate on the development process of Skyrora XL, our space transportation solution. It will discuss the innovative technologies that are used to help develop and build Skyrora XL. Skyrora's core business centres on the production and launch of the main orbital vehicle, catering for the burgeoning small-satellite market, both domestically and internationally. Skyrora XL will be capable of carrying 315kg of payload into polar and sun-synchronous Earth orbits. Skyrora utilises 3D printing to manufacture an array of infrastructural materials and rocketry components. Additive manufacturing consistently utilises fewer quantities of material than conventional manufacturing processes, as the procedures of 3D printing allow only the precise volume of material necessary in the production of a specific part to be used. Skyrora's Space Tug will have the potential to remove defunct satellites from orbit, and to transport these satellites and other space debris to disposal orbit. With the ability to de-orbit itself after use, the Space Tug will fall back to Earth and burn up in the atmosphere, omitting very little pollution and thus preventing further proliferation of space debris. Skyrora has the opportunity to lead the way in the development of a sustainable aerospace and domestic aviation sector. Ecosene aims to convert plastic waste into high-grade Kerosene for the aviation and aerospace sectors. Ecosene will reduce the volume of fuel required from petroleum-fed refineries by meeting part of the increasing fuel demand and therefore lessen the impact on the world's fossil fuel supply. As plastic pollution is a global concern, the production of Ecosene will use plastics that would otherwise be sent to landfill, reducing the amount of waste entering the Earth's ecosystems. Ecosene has been successfully tested on Skyrora's 3.5kN and 30kN engines and will continue to fuel all of our tests and launches to come. Skyrora's strategy is to take an incremental 'step-by-step' approach to allow for critical testing and de-risking, utilising proven technology in combination with advanced additive manufacturing methods. As part of the de-risking approach, Skyrora has developed four suborbital rockets in order to perform real-time testing of the avionics, ground control systems, payload deployment and recovery systems of the vehicles in parallel with the development of our orbital rocket. Skyrora's production facility is located in Loanhead, Midlothian, and we have three different rocket engines in an advanced stage of development. Our upper stage engine, or LEO, successfully tested Skyrora's eco-friendly fuel produced from unrecyclable plastics at our test site in Fife at the beginning of Q1 2020 and has since undergone multiple vacuum chamber engine tests to test the low Earth orbit engine under space-like conditions. In Q2 2020, Skyrora performed a static fire test of the Skylark L vehicle at a mobile launch site on the Kildermorie Estate in Ross-shire. During the successful test, the launch vehicle was held securely to the ground while the engine fired for 22 seconds, simulating a launch to space. To conclude the year in Q4 2020, Skyrora successfully completed a full upper stage static fire test of the orbital launch vehicle, Skyrora XL. The authors and partners involved have longstanding experiences and visibility within the involvement of rocket design, manufacture, and production alongside the processes involved with rocket launch. The authors involved

have additionally invested an immense amount of time building relationships with governmental bodies and legislatures relative to spaceflight and UK spaceflight regulations.