

# Second Generation Rocket Powered Lander Development for NASA Sponsored Suborbital Flight and Payload Integration Testing

Curt A. Walsh

Cygnidyne Heavy Industries, LLC.

## Abstract

As the need to develop new aerospace technologies continues to surge to meet the ever burgeoning needs of the current and future space industry, the necessity and demand for platforms capable of testing and certifying said technologies will become also become significant. This will specifically be the case for rocket powered lander vehicles. Rocket-powered lander vehicles include those platforms that are capable of performing a controlled ascent, controlled descent, and controlled vertical landing. These Vertical Take-off/ Vertical Landing (VTVL) platforms must also have the capability to safely traverse a predetermined flightpath. These VTVL systems utilize propulsion systems capable of powered operation with in a high vacuum environment. Cygnidyne Heavy Industries is currently developing new VTVL systems that can be utilized by NASA for the Commercial Suborbital Flight Opportunities program.

## Current Industry VTVL Platforms

As of this moment within the spaceflight industry, there is only one primary NASA-approved provider of low altitude VTVL rocket powered flights. The name of this provider is Astrobotic. In September of 2022, Astrobotic acquired the venerable industry innovator Masten Space Systems. With this acquisition, Astrobotic gained a substantial flight capability. Masten Space Systems has been developing and flying

VTVL systems since 2009. To their credit, Masten Space Systems has completed in excess of 600 rocket powered VTVL flights, an unmatched feat within the industry.

## Second Generation Lander Development

At Cygnidyne Heavy Industries, we are striving to deliver the same level of reliability in a next generation design. We are developing a smaller, lighter platform, with greater payload capacity and the durability necessary to achieve a higher rate of flight. Innovations in propulsion system development and new materials as well as continued miniaturization of components utilized in advanced guidance, navigation, and control systems, will allow Cygnidyne to field a viable flight system within the next two years. The first of these VTVL platforms will be powered by a gimbaled, 2200 Newton, LOX/ Isopropyl engine. This engine has been developed completely in-house, building upon knowledge and experience acquired during involvement in the Northrup Grumman Lunar Lander Challenge as well as the Google Lunar X-Prize.



Figure 1: Upper gimbal mount assembly developed for usage on a lunar lander test platform. The test platform was being fabricated for usage by Team Synergy Moon in its bid for the Google Lunar X Prize. A similar mount assembly will be used for future VTVL vehicles.