Repurposing Suborbital Technologies to Assist in Debris Mitigation and Orbital Launching Capabilities.

Sarah Beattie - Undergrad in Commercial Space Operations and Dr. Pedro Llanos – Assistant Professor in Commercial Space Operations.
Embry-Riddle Aeronautical University, Daytona Beach, Florida, USA, Earth

Abstract

By re-purposing existing suborbital technology, a launch system can be designed to help reducing debris and allow scientists, researchers, and technologists to have shorter mission profiles for their experiments. Many suborbital vehicles expect to be launching science experiments with a consistent schedule in the next few years. The payload bay on a suborbital vehicle can be used to house a small rocket that will ascend to the desired altitude to launch new small satellites that will aid in the retrieval of pieces of debris that are no longer in use. From this altitude the rocket will re-enter the Earth's atmosphere with the captured items safely in the payload bay or tethered to the rocket so they can be burned up in the atmosphere.

Suborbital Vehicle

In choosing the suborbital vehicle certain constraints have to be considered. The vehicle will have the ability to carry the rocket and has to be able to launch that rocket out of the payload bay. For this reason, many suborbital vehicles have been disqualified. In the end, however, two suborbital vehicles, Blue Origin's New Shepard and Rocketplane's Kistler, the Kistler K-1, will be able to be used for this launch system under certain circumstances and two vehicles, XCOR's Lynx Mark III and Virgin Galactic's Spaceship II have the ability to complete this launch system with no modifications to the launch vehicle.

Sounding Rocket

For this launch system, only sounding rockets were analyzed to be placed in the payload bay. These rockets are relatively small in nature and they are commercially available. Ten sounding rockets were analyzed for this system. The first constraint was the payload size. For this system smaller payloads were more desirable, so the payload capabilities were capped at 100 kg. The second constraint was the size of the payload bay specifically the payload bay door. They have to be able to be stored and launched out of the payload bay.

Payload

This launch system can fit a variety of different payloads from small satellites to debris reduction technology. It is a preferred launch system for short mission profiles that launch and recapture an experiment and technology capable of retrieving pieces of orbital debris.

Conclusion

This launch system will be able to repurpose suborbital technologies for orbital use. It will also be able to launch more quickly than some of its orbital counterparts and be fully reusable. This technology already exists, it is just a matter of using it for a different purpose. This new purpose will allow for novel applications in space that suborbital vehicles and related technologies will have the ability to participate in. The Suborbital Space Flight Simulator (SSFS) at Embry-Riddle Aeronautical University will be able to help simulate this new launch system and its capabilities. Pilots, mission control, and mission specialist will be able to work together to mimic this new launch system and all of its working parts. We understand the different challenges involved but this launch system will have many benefits for industry partners and academia.

"We're in danger of people seeing it as a new hobby for billionaires. That's not what it's about, or what it should be about. It's about creating a better life for humans on our planet, and other planets."- Hannah Kerner, Executive Director of Space Frontier Foundation.