

## NSRC 2023 Precision Payload Return for Stratospheric Balloons

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### Abstract

A significant limitation for stratospheric balloon operations is recovery of high value payloads. The payload is suspended from the balloon and at the completion of the mission, is typically released for recovery under a parachute. While this has some predictability, it is influenced by many variables that make payload recovery at a specific time and location difficult.

Near Space Corporation (NSC) developed a gliding shuttle deployed by stratospheric balloon beginning in 2005 for a combination of USAF, US Army, and then NASA projects. The shuttle is specifically designed to carry a critical payload, which can be operated remotely with the shuttle serving as the balloon system gondola. Ground operators can monitor the balloon system position and trajectory, and set a descent flight plan for the shuttle based on required recovery conditions. On command, the shuttle is released and begins autonomous or pilot-controlled flight. As an operational example, the shuttle was used for a NASA/FAA project to qualify ADS-B for suborbital aircraft flights.

### Flight History

The Near Space Shuttle System (NS3) completed developmental testing and over one hundred total flights in its current configuration. The NS3 has a total mass of 55 pounds, including up to 20 pounds of payload, and a maximum deployment altitude of about 90,000 feet. From a release point at that altitude, the NS3 can maintain an average of 7:1 glide ratio under moderate wind conditions.

### Current Development

The NS3 was assessed by NASA for flight service as a data buoy. In this operational scenario, the NS3 payload is a high-volume hard drive. Several of the NS3 aircraft are secured to the gondola of a NASA ULDB platform, and released on command to allow for precision recovery of full bandwidth scientific research data.

To meet these requirements, the NS3 required modification to operate and initially be released at an altitude higher than will support flight. The system changes were completed by NSC, internal test flights conducted, and a final demonstration flight for NASA was conducted in February 2023. The NS3 was also analyzed for expansion, to allow for payload masses up to approximately 100 pounds.



### Conclusion

The NS3 provides the ability to carry high value or sensitive sensors/payloads to the stratosphere on a low-cost balloon system; with precision recovery autonomously at a designated location for refurbishment and re-use