High Altitude Shuttle System (HASS): Suborbital Reusable Launch Vehicle (SRLV) Surrogate

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Abstract

Commercial suborbital vehicles will allow the next generation of scientists, engineers, technologists and educators to fly and operate experiments in the new environment of suborbital space. NSC's High Altitude Shuttle System (HASS) has successfully completed a two-flight campaign for NASA's Flight Opportunities Program (FOP) demonstrating the utility of using the HASS qualified flight vehicle as a surrogate winged SRLV platform to evaluate Entry, Descent, & Landing (EDL) architectures and associated systems as the vehicle descends in a controlled glide through the

National Airspace System (NAS) from the Johnson Near Space Center in Tillamook, OR.

HASS payloads on these SRLV surrogate flights included ADS-B transponders (either a 1090MHz ES transponder with Mode-S, or a 978 Universal Access Terminal (UAT) transponder), VHF aircraft band (FM) radio, and radar reflector. ADS-B is part of the FAA's NextGen air traffic control system and all SRLVs are expected to incorporate an ADS-B system to facilitate routine SRLV re-entry into the NAS vs. sterilizing large blocks of airspace to support SRLV recovery. A VHF aircraft band radio was tuned to Seattle Center's frequency for the high altitude sector the HASS was using for each flight to evaluate bleed-over and any potential for confusion between adjacent FAA Air Route Traffic Control Centers (ARTCCs) on similar frequencies. A radar reflector was also flown to a) ensure the low radar cross section of the HASS vehicle could be seen by FAA primary radars, and the efficacy of using FAA primary radars as a back-up source of position information in case of ADS-B failure.

Commercial Opportunities

The capabilities demonstrated by HASS in the SRLV Surrogate role provide a variety of applications for commercial applications. Principal among these would be the ability to evaluate specific SRLV payloads or components in a highly relevant environment (airspeeds, descent rate/flight profile, G-loading, etc.) at reasonable expense in preparation for either SRLV and/or orbital flights. HASS is constructed of RF transparent materials to allow integration of antennas, either inside, outside, or integral to the shuttle airframe, depending on customer requirements.

Conclusions

Over the course of the two flight campaign, NSC proved the utility of using the HASS to evaluate SRLV re-entry concepts and flight plans, associated communications, and real-time tracking via both transponder and primary radars. The HASS autopilot can be programmed to effectively mimic the performance of any commercial SRLV winged return platform to continue evaluations to integrate SRLV operations as seamlessly as possible within the NAS. This also supports effective evaluation of SLRV concepts, options, and the ability to place SRLV payloads or components in a highly relevant environment to support testing and TRL enhancement.

Figure Insert: HASS Surrogate SRLV Being Prepared for Flight *(Adam Diedrich in photo)*