IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

Author: Dr. Rainer Kirchhartz
German Aerospace Center (DLR), Germany, rainer.kirchhartz@dlr.de

Dr. Kathrin Schoppmann
Deutsches Zentrum für Luft- und Raumfahrt, Germany, kathrin.schoppman@dlr.de
Dr. Stefan Völk
DLR (German Aerospace Center), Germany, stefan.voelk@dlr.de
Mr. Wolfgang Jung
DLR (German Aerospace Center), Germany, wolfgang.jung@dlr.de
Mr. Marcus Hörschgen-Eggers
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, marcus.hoerschgen-eggers@dlr.de
Mr. Markus Wittkamp
Deutsches Zentrum fur Luft- und Raumfahrt e.V. (DLR), Germany, markus.wittkamp@dlr.de
Mr. Alexander Kallenbach
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, alexander.kallenbach@dlr.de

SOUNDING ROCKET RESEARCH INFRASTRUCTURE DEVELOPMENTS

Abstract

Sounding rockets are unique experimental infrastructure for a broad variety of research disciplines. The unmanned, readily available and cost-effective platform provides high quality, multi-minute microgravity conditions with residual accelerations as low as 10^{-6} g for experiments in research areas such as material physics, life sciences or fluid dynamics. In atmospheric research, in-situ measurements in all layers of the atmosphere from sea level to space are possible. For hypersonic research, suppressed trajectories allow experiment times of the order of minutes in denser atmosphere layers at high dynamic pressures in contrast to classic parabolic "up-and-over" trajectories. Technology testing under space or re-entry conditions and astronomy complete the service portfolio of sounding rockets for scientific experimentation.

The German Aerospace Center (DLR) with its Mobile Rocket Base (MORABA), employs a "mix-and-match" concept in the adaption and combination of vehicle systems and rocket motors that, together with new developments and optimizations, results in a full performance portfolio of launch vehicles from the lower end (100 kg to 100 km) to the upper end (400 kg to 260 km). A further extension of the performance envelope at the upper end will allow heavier payloads to be brought to higher apogees or faster speeds.

As a service to the experimenter, MORABA offers highly performant payload support systems for the success of a flight and the experiments on board. New strategies employing standard technologies for the flight infrastructure result in an increase of the bitrate from 0.8 to 8 Mbit/s and will reach 20 Mbit/s live downlink per channel in the future. Onboard Ethernet and an IP routers offer standardized communication interfaces that facilitate adaptations as well as decentralized testing. The new sea recovery system features an independent location device and extended floatation times for significant improvements in recovery probability. The mission management and design disciplines establish strategies impacting on campaign logistics and resulting in science condition optimization and cost reduction, for example by parallel launch operation scenarios and on-range refurbishment, or by reducing payload preparations at the launch site.

This paper describes the capabilities and development strategies employed by MORABA for the constant development of its sounding rocket based service portfolio. Examples of the evolutionary developments of new launch vehicles as well as payload support systems, providing scientists with optimal and

customized research conditions, will be presented. The improvements for the research community and the extension of the application envelope will be discussed.