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ESSenCe Campaign 2011

This payload reflects the proposed

The ESA Sounder Campaign saw the first deployment of the novel GLORIA-AB infra-red limb imager together with MARSCHLAS and the infra-red limb sounder MIPAS-STR.

observation capabilities of PREMIER ever more closely than before.

MARSCHALS and the novel GLORIA-AB infra-

11th and 16th Dec 2011. The flight of the 11

includes sampling of a tropopause fold and bearvations of circus clouds. The flight of

MARSCHALS

Millimetre-wave Airborne Receivers for Spectroscopic Characterisation in Atmospheric Limb Sounding

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Abstract

MARSCHALS is an airborne, submillimetre-wave. limb emission sounder for the detection of atmospheric trace gases. It closely replicates the observation capabil of the proposed Explorer Mission PREMIER. MARSCHALS was built on ESA contract at



Instrument Description

The main target species O₃, H₂O, HNO₃ and CO are detected in three different frequency bands by individual heterodyne receivers using ambient temperature Schottly diode mixers. All three receivers operate in single sideband mode. Radiometric calibration is carried out using a cryogenically cooled target and an ambient target, both featuring extremely low reflectivity. An inertial navigation system assures high pointing accuracy for the atmospheric limb scan-





Block diagram of the MARSCHALS receivers

UAMS Upgrade

In 2009 the UAMS project saw extensive upgrades to the MARSCHALS instrument. All three receivers were rebuilt and improved.
The pointing system was made more reliable.
Thermal stability was improved and extensive lab measurements to characterise the instrument functions have been

Tanget Spacies 0, H₂O, 0, C₂ (HO₂O₃)
Band Freq. (GHz) 294.0 - 305.5 316.5 - 325.5 342.2 - 349.8
Resolution (GHz) 0.2 0.2 0.2 0.2
RSIT / (pow) oil 94.7 (194.) 104.7 (194.) 94.7 (194.)
Sidoband reject. >3048 >3048 >3048 Instrument specifications after the upgrade.

esa

Science Rationale

MARSCHALS is specifically designed to make measurements of climate relevant trace gases in the upper troposphere – stratosphere (UTLS) region of the atmosphere. The mission concept exploits the fact that circus clouds are transparent at serving frequencies of MARSCHALS. Simultaneous operation of the infra-red limb simultaneous operation of the infra-red limb sounder MIPAS-STR and the infra-red limb imager GLORIA-AB from the near-space vantage point on the stratospheric aircraft GEOPHYSICA results in a payload that nbles that of the proposed PREMIER Earth Explorer sate



with a cloud insensitive millimetre-wave sounder (similar to MARSCHALS) is the rationale of the PREMIER Explorer Miss

Campaign Deployment

As of the year 2012, MARSCHALS has been ployed in the following flight campaigns

Feb 2005	Test Campaign	Munich, Germany
Dec 2005	SCOUT-03	Darwin, Australia
Nov 2009	Test Campaign	Munich, Germany
Mar 2010	PREMIER-Ex	Kiruna, Sweden
Dec 2011	ESSenCe	Kiruna, Sweden

SCOUT-03 Campaign 2005

The main focus of the SCOUT-O3 campaign was the in-situ study of tropical convection but a remote sensing flight with MIPAS-STR and MARSCHALS took place on the 5th Dec 2005. On its maiden flight MARSCHALS



RAL Space



PREMIER-Ex Campaign 2010

The PREMIER-Experiment was a dedicated ESA campaign to demonstrate the PREMIER mission objectives of a synergistic use of

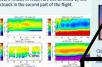


The GEOPHYSICA outside of the hangar at

The PREMIER-Ex flight of 10th Mar 2010 took place in the polar vortex and the vortex mixing region, with a short excursion into mid-latitude air masses at around 9am UTC



and nitric acid have been retrieved and compared to correlative measurements and model simulations. The infra-red results are much better resolved, but the millimetrewave results in return are not affected by the









The Road Ahead





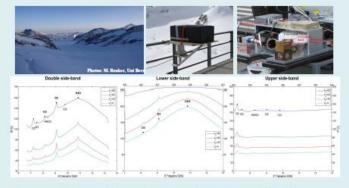






The Road Ahead

Several UK activities currently address the development of sub-harmonic image rejection mixers (SHIRM) to be tested and deployed on MARSCHALS in conjunction with a high resolution spectrometer. In addition to field testing this promising new technology for PREMIER, these instrument improvements would allow the (improved) detection of the biomass burning tracers CO and HCN.



Ground-based testing of the new SHIRM mixers on the Jungfraujoch (3500 m.a.s.l.)