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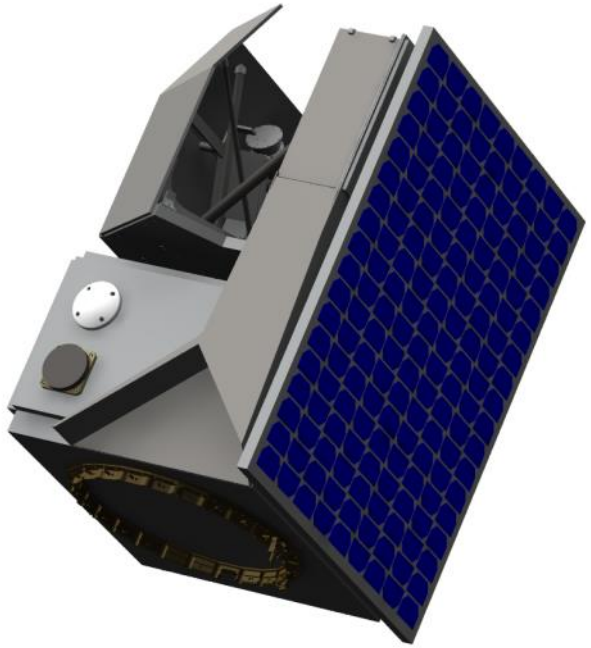
SATELLITE SYSTEMS

The MATS micro satellite mission – Tomographic perspective on the mesosphere

Presentation outline

- The Mission
- The Science
- The Satellite
- Simulated results
- Conclusion



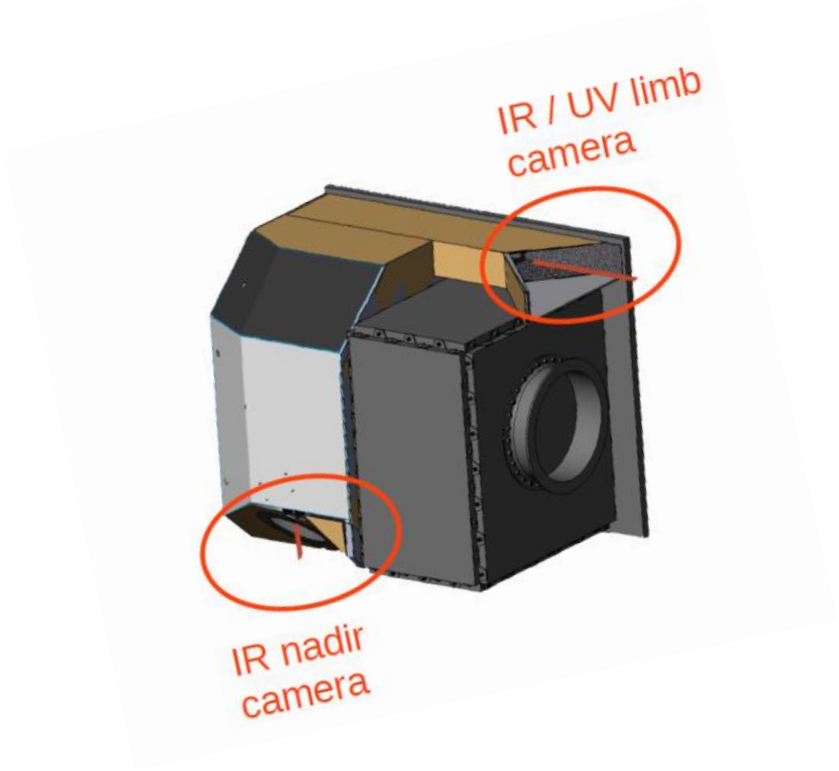
The MATS project teams

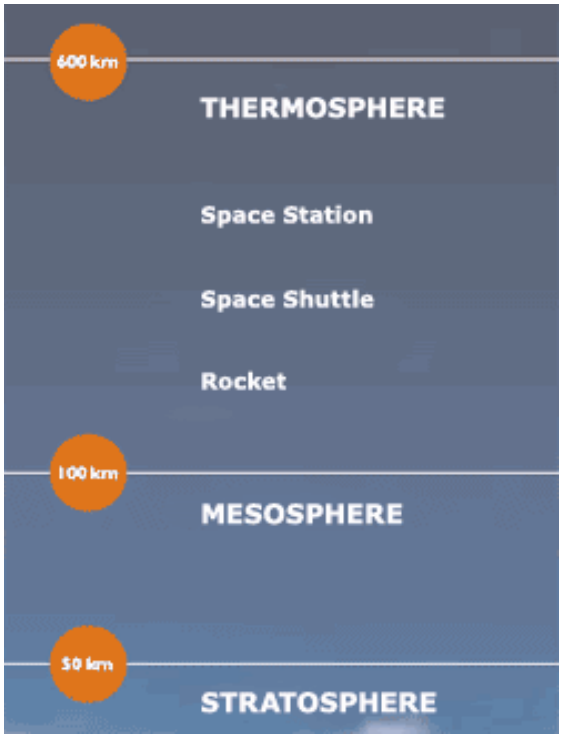
Payload Team

Platform Team

The MATS mission

Mesospheric **A**irglow/Aerosol **T**omography and **S**pectroscopy



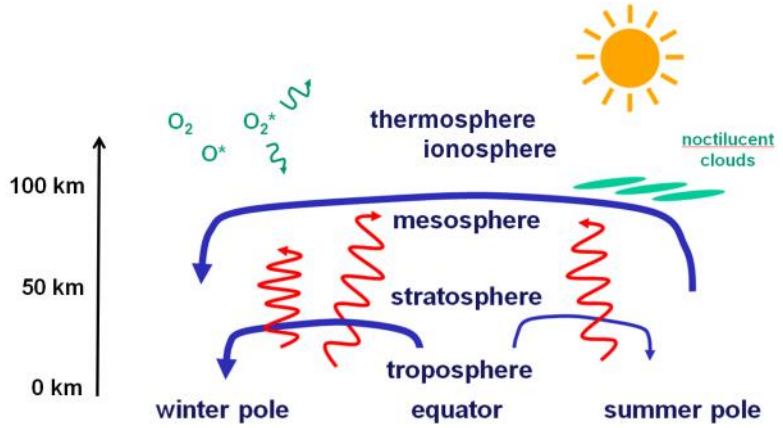


MATS science background

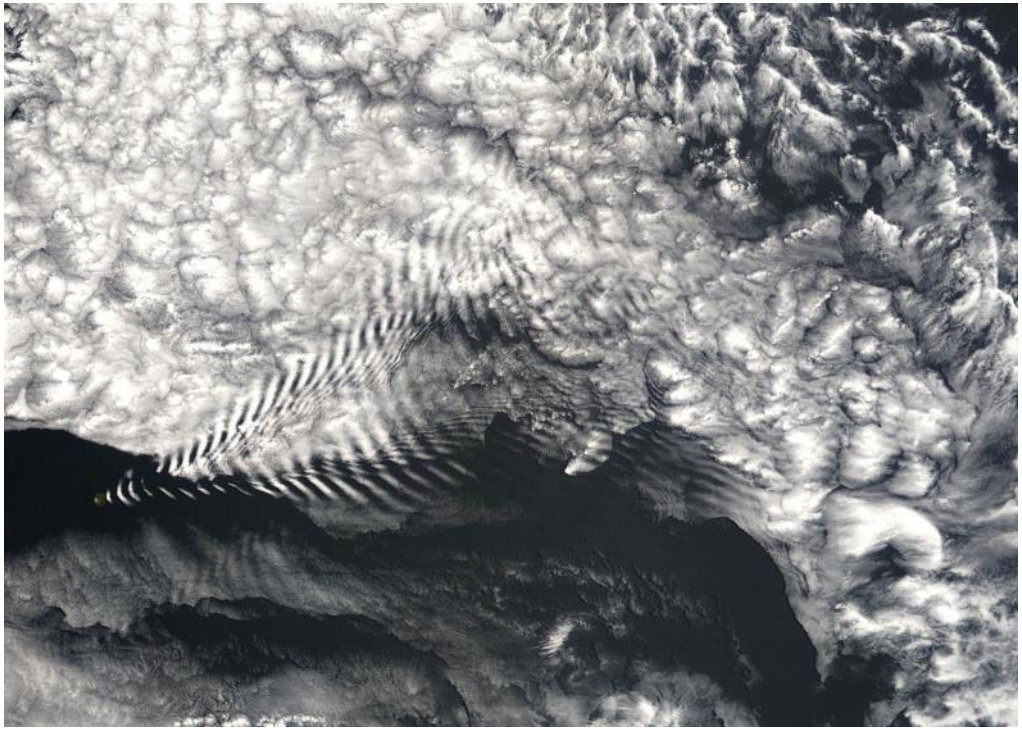
Mesosphere and Lower Mesosphere (MLT):
A transition region between lower and upper atmosphere.

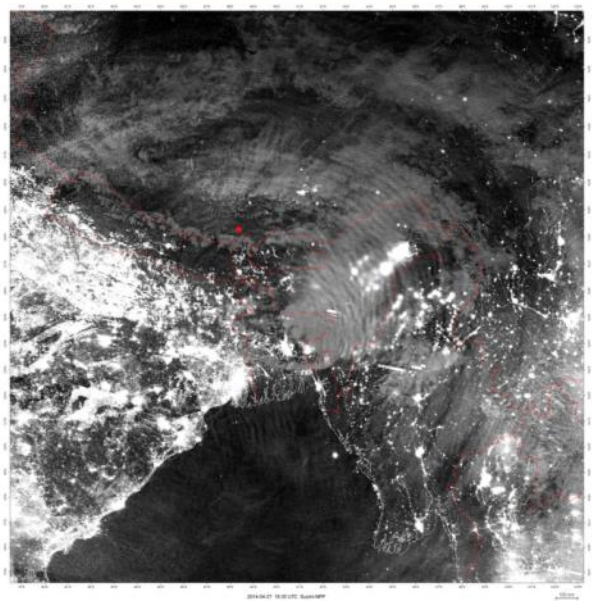
There are strong dynamical links between the upper and lower parts. However, traditional atmosphere models treat these separately.

Increased knowledge about this remote part of the atmosphere, allows for a better understanding of the large scale motion of the middle atmosphere, and may help improve future climate and weather forecast models



MATS science background





MATS science objectives

Based on a 2-year mission, the primary goal is to globally map structures and waves over a wide range of spatial scales.

Based on the resulting MATS database, and in close collaboration with other missions, meteorological data, and modeling studies, the focus of the scientific analysis will be in the following areas:

- Local wave properties and the state of the mesosphere
- Coupling to the lower atmosphere
- Coupling to the thermosphere/ionosphere
- The physics of noctilucent clouds

MATS science instruments

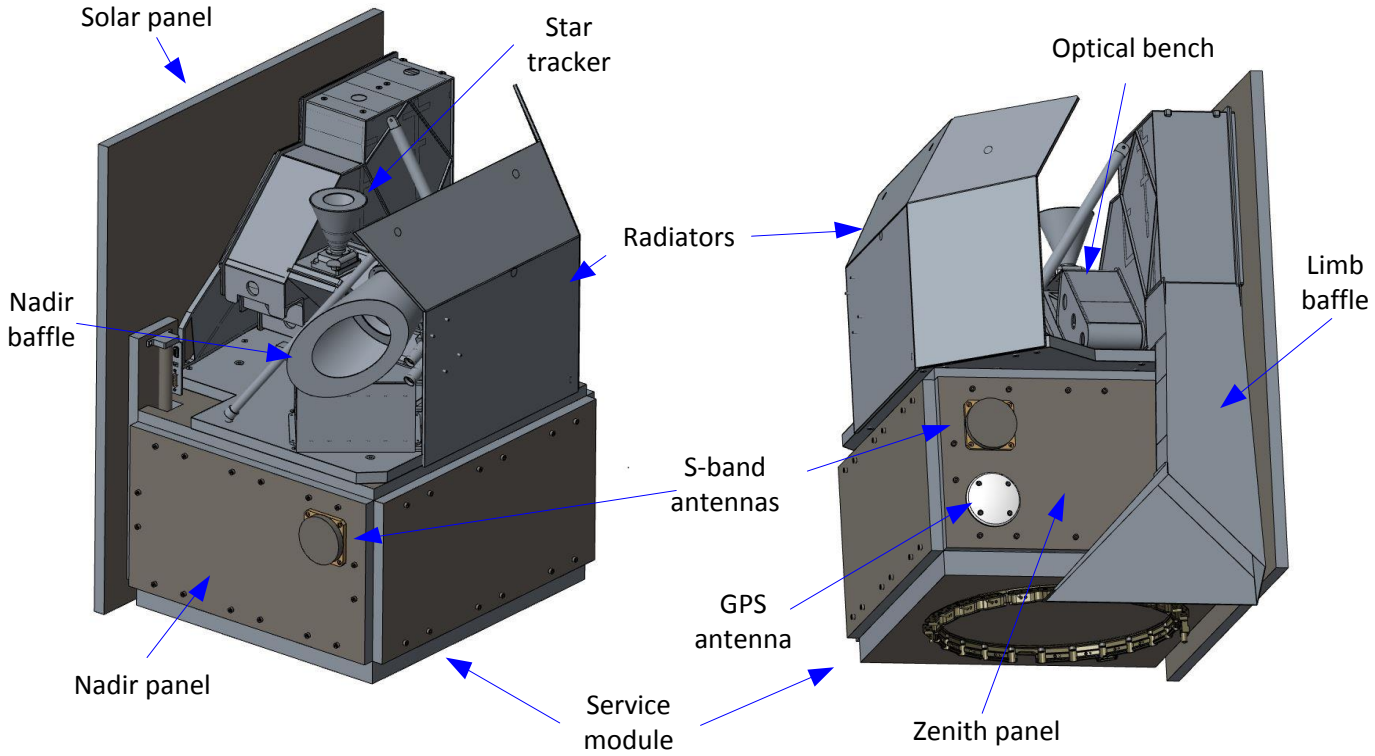
Measurement targets are the O_2 Atmospheric Band dayglow and nightglow (4 imaging channels at 750-770 nm), and Noctilucent Clouds (NLC) (2 imaging channels 270-300 nm).

Limb imaging and tomography will address structures from global scales down to below 100 km horizontally, and 1 km vertically.

Spectroscopic analysis will be applied to retrieve atmospheric temperature, atomic oxygen densities, noctilucent cloud microphysics etc.

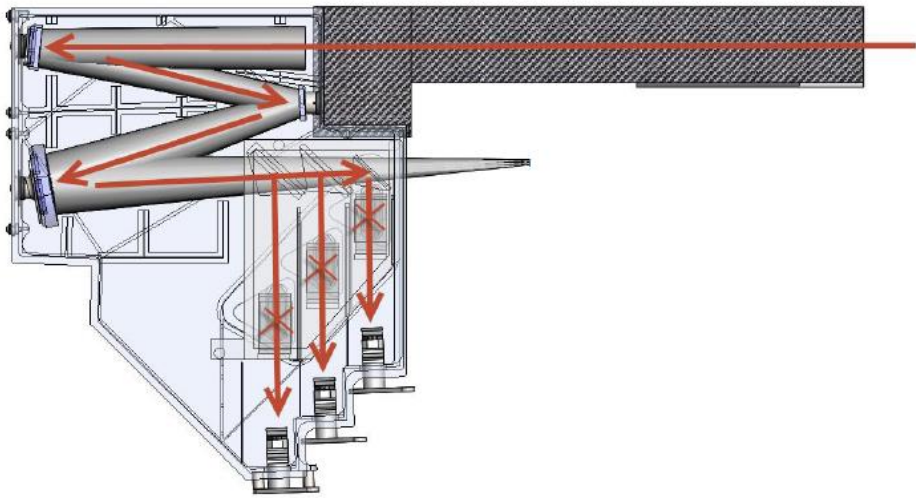
A complementary nadir imager will study horizontal structures down to tens of kilometers in the O_2 Atmospheric Band nightglow.

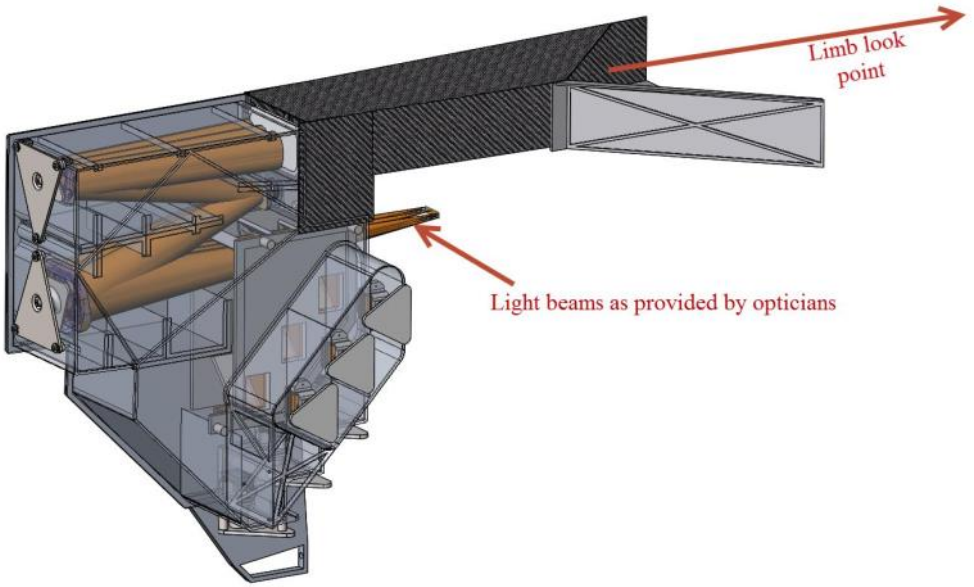
MATS preliminary satellite design



MATS main instrument: Limb imager

- Off-axis three mirror telescope
- 6 CCD channels
- Stray light supression





The standard InnoSat platform

S/C mass and size: 70 x 60 x 85 cm, ~50 kg (incl. payload)

Max payload size: 65 x 53 x 48 cm (blue volume)

Max payload mass: 15 kg

Max payload power: 40 W (average)

Solar array: 170 W installed power

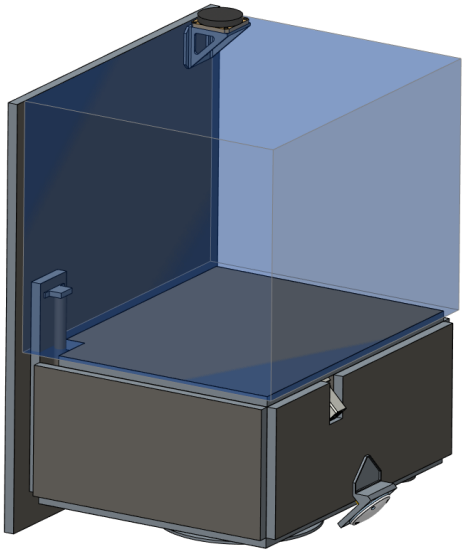
Downlink bitrate: 3-5 Mbps (S-band)

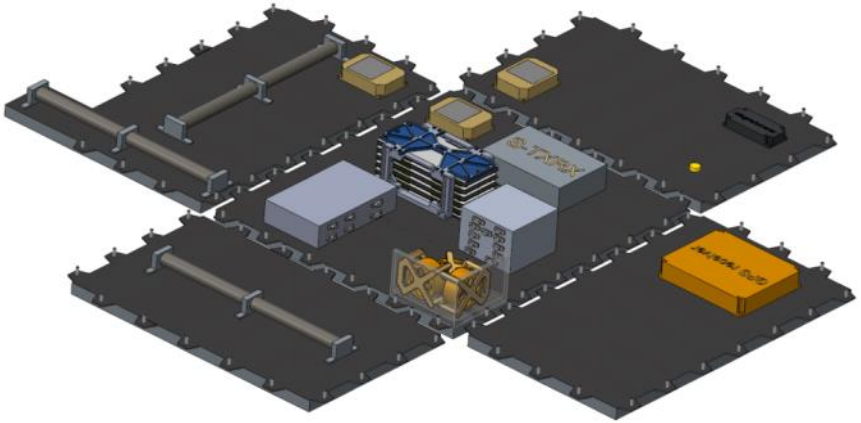
Stabilization: 3-axis with RW and Star Tracker

Orbit: 550 to 650 km dawn/dusk (SSO)

Orbit determination: On-board GPS

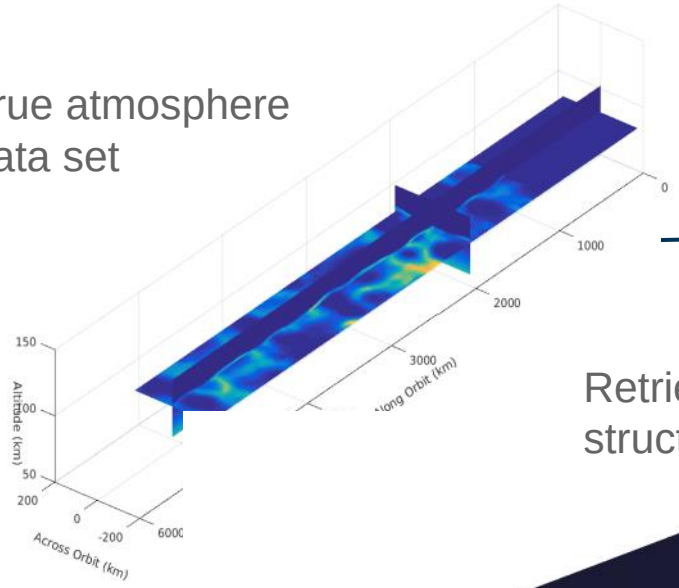
Payload can be Earth- Limb- or Space-facing



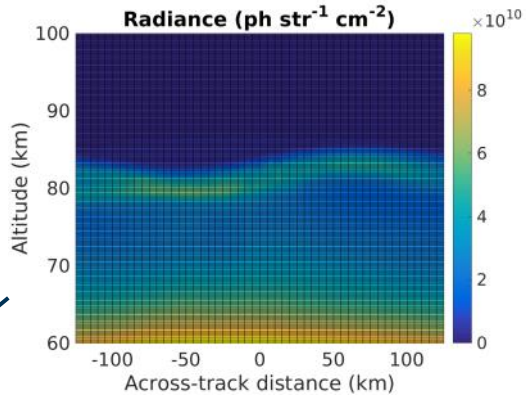


Simulated results

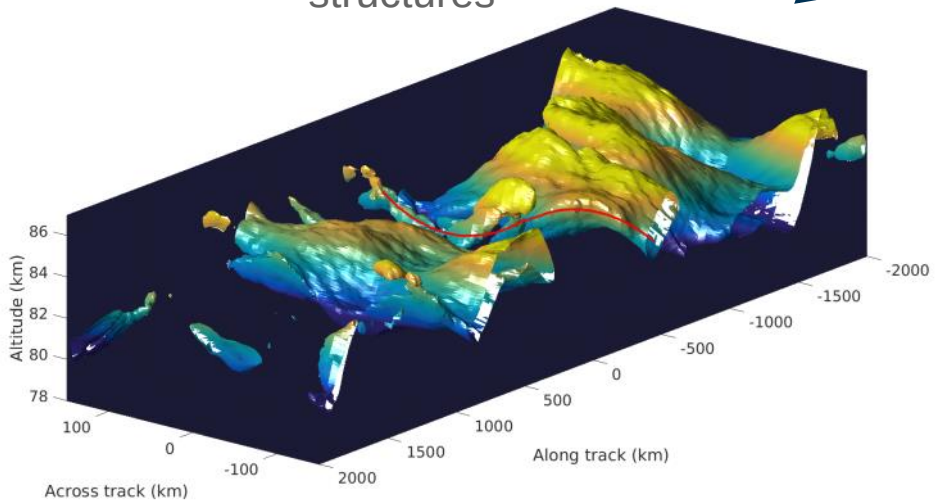
True atmosphere data set



Simulated measurement



Retrieved 3D wave structures



Conclusions

In conclusion the MATS instrument will be able to provide the first global map of gravity wave structures with horizontal wavelengths less than 100 km, and hence close an important gap in the current observational capabilities.

Closing this gap will allow for an increased understanding of wave activity in the middle atmosphere, with important implications for the modeling of this region in weather, climate and whole atmosphere models. Hence with a rather small instrument, a large impact can be made on the science of the middle atmosphere.