EOS AURA Satellite (Courtesy of NASA and TRW

DETECTOR MODULES FOR OMI OZONE MONITORING INSTRUMENT ONBOARD NASA EOS AURA SATELLITE

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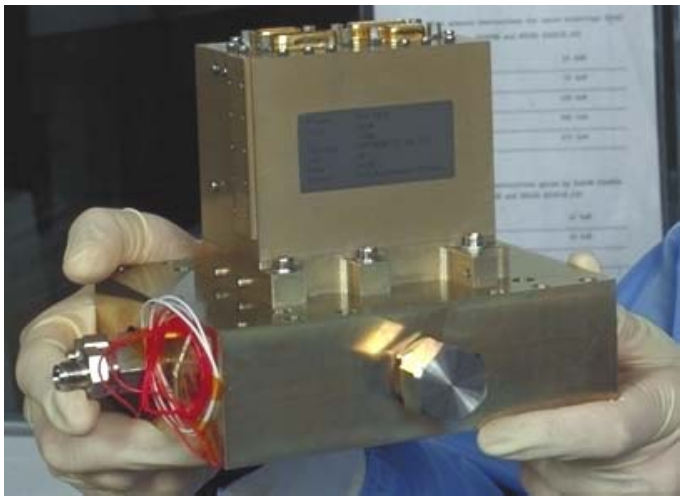
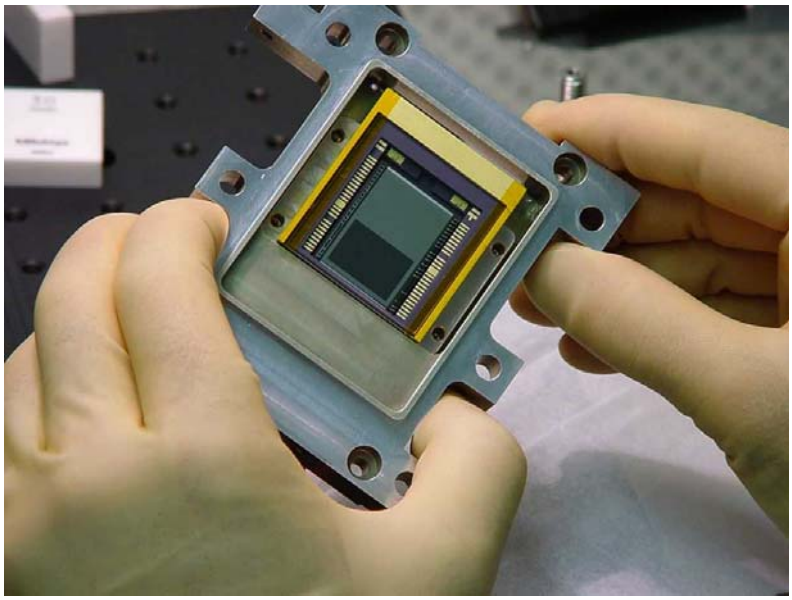
VTT Information Technology has developed two CCD-based detector modules for the UV- and Visible spectral channels of the OMI-EOS instrument. The scattered light signal from the sun in the UV-channel contains the ozone profile information. This signal has a large dynamic range of more than 5 decades. Therefore, the straylight and noises of the CCD detector and its associated electronics have been optimised for maximum performance. The UV and Visible channel Detector Module Flight Models have been delivered to The Netherlands. The measured performance of the devices was found to fulfil the requirements.

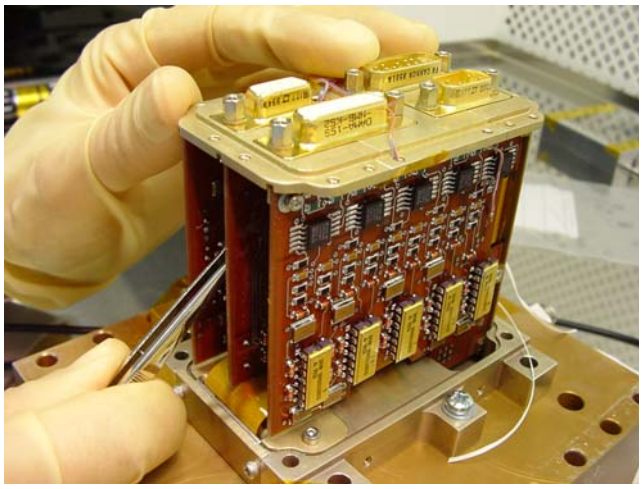


The OMI Detector Module after the space qualification tests.



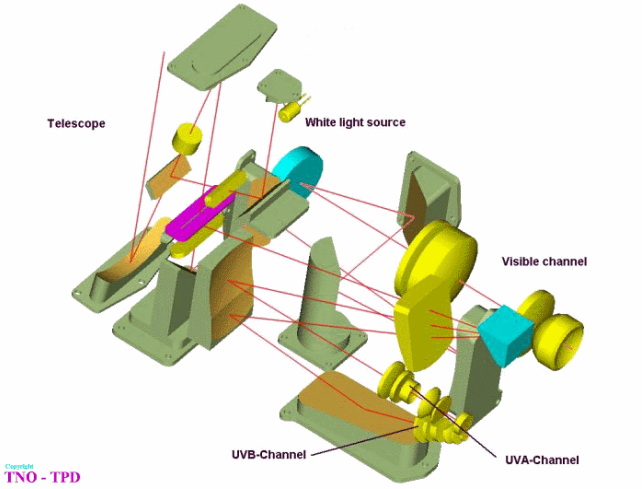
OMI Detector Module seen from the CCD side.

Ozone Monitoring Instrument (OMI) based on an Imaging Spectrometer has been developed for the EOS AURA Atmospheric Chemistry Mission of NASA Earth Observing System (EOS) being a part of Earth Science Enterprise. The EOS-AURA satellite will be launched in 2004. The OMI instrument will fly together with three other instruments, whose data will provide atmospheric measurement data covering wavelengths from UV to submillimeter region. The OMI instrument will measure ozone columns and profiles. In addition, it will contribute to the knowledge of atmospheric effects of volcanic eruptions, biomass burning and urban pollution.



A view of the folded printed circuit board of the Detector Module during the integration.

A Dutch-Finnish consortium consisting of Dutch Space B.V. & TNO Institute of Applied Physics (TPD) from the Netherlands, and Finnish Meteorological Institute, Patria Oy, Space Systems Finland Oy and VTT Information Technology from Finland will deliver the OMI instrument. The instrument concept is build around a CCD detector in combination with an innovative telescope design which makes it possible to measure spectral information for different lines of sight in the swath direction without using a scan mirror.



OMI instrument layout (Courtesy of TNO-TPD).

Summary of the OMI Detector Module flight models performance.

Parameter	Requirement	Measured performance
RMS[1] noise of the video signal for correlated double sampling at 133 kHz pixel frequency for highest gain.	32 electrons	30 electrons (UV) 31 electrons (VIS)
Non-linearity/fitting error of the video signal vs. input light intensity must be less than 0.3 % for lowest gain.	4^{th} order pol. fit error[2] 0.3 %	4^{th} order pol. fit error[2] 0.02 %
Video signal settling time to the maximum video signal amplitude for all gains.	2.0 μs	< 1.5 μs for all gains
Charge transfer inefficiency	Vertical $1.3x10^{-5}$ Horizontal $1.3x10^{-5}$	$< 2.0x10^{-6}$ (0.2 %) $< 3.0x10^{-6}$ (-0.2 %)
Dark current at +5 °C CCD temperature	100 electrons/pixel/s	200 e/pixel/s (UV[3]) 400 e/pixel/s (VIS)

[1]The effective electrical bandwidth of the rms noise measurement is 450 kHz. It is determined by the correlated double sample circuitry.
[2]The output amplifier of the CCD was found to be non-linear for signal levels higher than $1.0x10^6$ electrons. The non-linearity could be corrected with a 4^{th} order polynomial.
[3]The dark current of the DEM is higher than the requirement. To decrease the dark current a larger CCD substrate voltage has been applied to UV-channel detector module.

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