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MIST-A THE MWIR SPECTROMETER TO EXPLORE THE ASTEROID BELT

Abstract

In the frame of the Emirates Mission to the Asteroid Belt (EMA), scheduled for launch in 2028 to investigate seven primordial and water-rich asteroids, Leonardo is going to design, manufacture and test the MIST-A imaging spectrometer. It follows a long heritage of previous imaging spectrometers in the VIS-NIR-MWIR spectral bands for planetary exploration which have been realized by Leonardo in the past decades under the PI-ship of INAF-IAPS members. In particular, the MIST-A optical design is derived from the JIRAM instrument (flying on board the NASA JUNO mission to Jupiter), while significant changes have been implemented in the thermo-mechanical and electronic design. The differences are due to both obsolescence of some components and new environmental requirements. MIST-A will perform spectral mapping of the illuminated surfaces of the target asteroids with a ground sampling of 25 m/px from a distance of 100 km. The MIST-A spectral range is 2-5 μm covered through 336 spectral bands. Detector is a HgCdTe array on a CMOS ROIC with a pixel pitch of 38 μm . Optical bench is passively cooled down to <135K while the detector is maintained at its operative temperature (<90K) thanks to a cryo-cooler. Key attention is given to the thermal insulation from the S/C. A separated Electronics Unit is present to accomplish all the functionalities of power conditioning, detector temperature control,

science acquisition, compression and TM/TC exchange. MIST-A aims at identifying and mapping of the distribution of various classes of relevant compounds for primitive targets, as well to infer diurnal temperature from emission at longer wavelengths than $3 \mu\text{m}$. This paper aims to summarize the key design characteristics of the MIST-A instrument together with a description of the scientific goal of the payload. The instrument is developed under Italian Space Agency (ASI) funding.