

IAF SYMPOSIUM ON ONGOING AND NEAR FUTURE SPACE ASTRONOMY AND  
SOLAR-SYSTEM SCIENCE MISSIONS (A7)  
Technology Needs for Future Missions, Systems, and Instruments (3)

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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  $\mu\text{m}$  covered through 336 spectral bands. Detector is a HgCdTe array on a CMOS ROIC with a pixel pitch of 38  $\mu\text{m}$ . 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.