Emirates' Mission to Explore the Asteroid Belt Payload Overview. H. Reed (Heather.Reed@lasp.colorado.edu) [1], M. O. Al Ameri[2], M. E. Landis[3], G. Filacchione[4], C. S. Edwards[5], P. Christensen[6], P.O. Hayne[7], H. A. Albllooshi[8]

[1]Laboratory for Atmospheric and Space Physics (LASP), University of Colorado, Boulder, CO, USA, [2]UAE Space Agency, Abu Dhabi, UAE, [3]LASP, University of Colorado, Boulder, CO, USA, [4]Instituto di Astrofisica e Planetologia Spaziali, INAF, Rome, Italy, [5]Northern Arizona University, Flagstaff, AZ, USA, [6]Arizona State University, Tempe, AZ, USA, [7]LASP, University of Colorado, Boulder, CO, USA, [8]UAE Space Agency, Abu Dhabi, UAE

Introduction: The Emirates' Mission to Explore the Asteroid Belt will explore seven asteroids in the Main Belt (MB) in a series of six flybys from 2030 to 2033 that will culminate with a rendezvous with (269) Justitia in 2034. The mission is designed to further accelerate the United Arab Emirates' space engineering, scientific research, and exploration capabilities, while also driving innovation and new opportunities in the country's private sector. The list of candidate targets [1] includes a wide variety that will provide context for the rendezvous target, (269) Justitia.

Payload Overview: The scientific instrument suite will make synergistic remote sensing observations of flyby asteroids accomplishing coverage consistent with the time spent at the asteroid during the flybys, anticipated to be on the order of 2-12 hours. A complete mapping of (269) Justitia is planned during the final seven month investigation period.

The mission's science and space resources goals are: 1) to understand the origins and evolution of water-rich asteroids, "water" includes H2O, -OH, and hydrated organic compounds, and volatile species, 2) to assess the resource potential of asteroids, and 3) to prepare the way for future asteroid use [2]. Although these goals are set to answer questions from two asteroid interest groups, the remote sensing measurements are complementary to both.

To address these goals, the following four instruments have been selected: 1) a visible narrow angle framing camera, 2) a mid-wavelength IR imaging spectrometer, 3) an IR spectrometer, and 4) an IR imager.

The visible narrow angle framing camera will acquire images to be used for geologic context and shape model/gravity model retrieval, crater counting (surface age), for data location on the asteroid's surface with the other science instruments, and for navigation.

The Mwir Imaging Spectrometer for Target-Asteroids (MIST-A) measures surface reflectance spectra in the 2-5 μm range where diagnostic spectral features of primitive asteroids are located, including hydrated minerals, organic matter, salts and carbonates. MIST-A will infer also surface temperature by measuring the thermal emission between 4-5 μm [3].

The potential EMIRS instrument, a copy of the Emirates Mars InfraRed Spectrometer (EMIRS) will observe the infrared spectrum from 6-70+μm. This observation will satisfy multiple mission science objectives related to the composition and thermophysics of the target asteroids. The EMIRS disk resolved mosaics of the largest objects in proximity mode will be used to assess the mineralogy/emissivity and surface physical properties, including via measured temperature. Surface anisothermality (roughness and rock abundance) will be directly addressed. [4]

The thermal imager will provide finer-spatial scale regolith physical properties of the asteroids including grain size, porosity, and thermal inertia. [5]

This presentation will introduce the scientific payload for the asteroid mission, identify the measurements from each instrument, and the institutional collaborations associated with each.

Acknowledgments: Funding for the co-development of the Emirates' Mission to Explore the Asteroid Belt is provided by the United Arab Emirates Space Agency to its knowledge partner, the University of Colorado Boulder's Laboratory for Atmospheric and Space Physics. The MIST-A instrument is contributed by the Italian Space Agency.

References:

1. Albllooshi et al. ACM 2023
2. AlMazmi et al. ACM 2023
3. Filacchione et al. ACM 2023; Raponi et al. ACM 2023
4. Haberle, C., Edwards Christopher, S., Tai Udovicic, C. J., Bandfield, J., & Clark, B. (2021). *SURFACE ROUGHNESS OF BENNU DERIVED FROM OSIRIS-REX THERMAL EMISSION SPECTROMETER OBSERVATIONS.* Paper presented at the Geological Society of America Abstracts with Programs. Vol 53, No. 6.
5. DellaGiustina, D., Emery, J., Golish, D., Rozitis, B., Bennett, C., Burke, K., Ballouz, R.-L., Becker, K., Christensen, P., & Drouet d'Aubigny, C. (2019). Properties of rubble-pile asteroid (101955) Bennu from OSIRIS-REx imaging and thermal analysis. *Nature Astronomy, 3*(4), 341-351.