

Mission Design for the Emirates Mission to Explore the Asteroid Belt. F. S. Alhameli¹, J. S. Parker^{2,3}, M. T. Caudill³, S. Baskar³, M. Rosen³, A. D. Koehler³, S. Chikine³, P. Imler² ¹Flight Dynamics Systems Engineer – UAE Space Agency (f.alhameli@space.gov.ae), ²Mission Design Lead – Advanced Space (parker@advancedspace.com), ³Advanced Space, LLC., 1400 W 122nd Ave Suite 200, Westminster, CO, 80234

Introduction: The Emirates Mission to Explore the Asteroid Belt is an Emirati interplanetary mission that is part of the Projects of the 50 series of developmental projects being advanced by the government of the United Arab Emirates. The mission is being developed in partnership with the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado, Boulder. The mission is an exploration mission that will fly through the inner solar system and then investigate asteroids in the main belt between Mars and Jupiter. The mission launch is planned for 2028. The primary objectives of the program are in the areas of Space Resources technologies and fundamental Science. Additional, high-priority objectives are innovation, public engagement and the development of space sector industry infrastructure in the UAE.

The primary objectives of the program are: 1) Space Resources Technologies and 2) Science. The Science and Resources Traceability Matrix (SRTM) defines the high-level goals and objectives. Additional, high-priority objectives are: 1) innovation, 2) public engagement and 3) space sector industry infrastructure in the UAE. The mission goals are: 1) Understand the origins and evolution of water-rich asteroids, 2) Assess resource potential of asteroids, and 3) Prepare the way for future asteroid resource use.

Mission Design: The mission will launch in 2028 and visit 7 main belt asteroids, including 6 high-speed flyby encounters en route to a rendezvous with the asteroid 269 Justitia. The mission is enabled by solar electric propulsion and gravity assist flybys of Venus, Earth, and Mars, bringing the total number of mission encounters to 10. The trajectory design presented will include the overall timeline of the mission, launch targets, launch period, overall duration of the encounters, design of the encounters, and trajectory modeling. Mission design analyses include designing the Deep space maneuvers (DSMs) prior to the rendezvous with Justitia and design Justitia's orbits and maneuvers to accomplish the lander deployment.

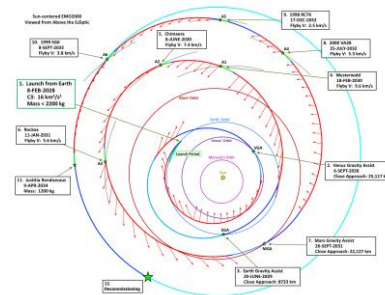
For the flyby encounters, a solar electric propulsion system will be used as the primer thruster to attain the large total change in velocity, where the Trajectory correction maneuvers (TCMs) and proximity operations at Justitia are conducted via blow-down monopropellant hydrazine system.

List of Bodies: The mission will visit the following asteroids:

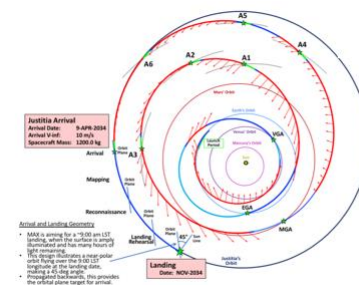
- Flyby: 10253 Westerwald (2116 T-2)
- Flyby: 623 Chimaera (A907 BC)
- Flyby: 13294 Rockox (1998 QC105)
- Flyby: 88055 (2000 VA28)
- Flyby: 23871 (1998 RC76)
- Flyby: 59980 (1999 SG6)
- Rendezvous: 269 Justitia (A887 SA)

The poster will cover the timeline, geometries, distances, and the trajectory design that will detail out the flyby encounter for the flybys targets and it will show the events and activities that will be conducted.

The overview trajectory of the mission is presented in the figure below:



The overview the proximity operations is presented in the figure below:



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.