IAF SPACE SYSTEMS SYMPOSIUM (D1)
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AN L-CLASS MULTIROLE OBSERVATORY AND SCIENCE PLATFORM FOR NEPTUNE

Abstract

The newer super heavy-lift launch vehicles, enabled by the ongoing revolution in commercial space access, have generated immense interest in crewed spaceflight. Little to no attention as yet, however, has been paid to the potential high-mass, high-volume uncrewed scientific probes that can now be realised. Bolder missions with direct deep-space transits, larger instrument payload capacities, and multirole deep-space science platforms can now be launched. With this in mind, a new multinational research group, Conex, has proposed a mission to the outer Solar System considering science goals, mission profile and instrumentation. The Arcanum mission is presented here in an attempt to translate the numerous discussions about new human spaceflight opportunities offered by this new class of launch vehicle into a similar synergetic forum on uncrewed missions.

Missions to the outer planets are regularly investigated, and numerous working groups in the planetary science community have previously advocated in detail for these with complete science cases and spacecraft proposals. Arcanum, however, is a large multirole orbiter-lander spacecraft, with primary science goals surrounding Neptune, Triton, and Kuiper Belt observations. When at its destination in a highly-eccentric

Neptunian orbit, the orbiter will use a 1-metre diameter telescope to observe Kuiper Belt Objects and undertake a search for a potential ninth planet. At the same time, other instrumentation on the orbiter will answer questions about Neptune's magnetosphere and atmosphere, while working in tandem with two landing penetrators and a soft-landing probe; answering questions about Triton's weak atmosphere, surface and subsurface at several distinct locations. The mission is supported by a number of astrodynamic simulations; instrument suites designed to answer a diverse range of science goals; high fidelity models showing a complete and complex spacecraft layout; power and mass calculations.

Conex Research, a portmanteau of Conceptual and Exploration, was founded in April 2020 during the first COVID-19 lockdown as a platform for early-career professionals - mainly consisting of current undergraduate and recently graduated students - to develop their skills in research and space mission proposal writing. Since then the small group has grown, with participants spread across six continents and bringing experience in astrodynamics; astronautical, electrical, design, mechanical and nuclear engineering; planetary science; graphic design and project management.