

SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)Author: Mr. Mark Sonter
Deep Space Industries Inc., AustraliaPATHWAYS TO COMMERCIAL SPACE EXPLORATION & ASTEROID MINING: PRIVATE
INDUSTRY MISSIONS BEYOND LEO**Abstract**

Deep Space Industries is designing its first asteroid rendezvous mission, Prospector-1, to assess asteroid insitu mineral resources for supply to the developing in-orbit markets. Several major design innovations have been identified and are being developed, which will make it possible to fly smaller, cheaper, more frequent and more timely and responsive missions beyond LEO, and thus they open multiple market opportunities, even as we move to launching our own asteroid resources survey and geotechnical evaluation probes. DSI intends to advance rapidly to lander and then sample return missions. This paper will address two areas: the concepts involved in application of mineral exploration to asteroids, and the resulting technical design demands; and the broader near-term applicability of the innovations which have been identified. We discuss the terrestrial mineral exploration flowsheet and its mapping across to the exploration of small bodies; and we address also our innovations in the following areas: - design philosophy and mission architecture - spacecraft radiation-resistance via new design in avionics - imaging, GNC and near-NEO Conops - high-impulse propulsion for Earth-departure and target arrival. All will dramatically reduce costs for both interplanetary and high-orbit missions.

DSI proposes to enter the marketplace to offer ‘instrument rides’ to asteroids for institutes which have failed to obtain flights on present space missions (albeit to targets of DSI’s choice), and to offer to contract to build, or to build and fly and operate, entire missions for clients as required. Potential cubesat and smallsat missions ‘out of LEO’ include: – to Earth-Moon Lagrange Points (L1, L2, L3, L4 / L5) – to Earth-Sun L1 and L2 – to E-S L4 / L5 (for along-ecliptic search for Trojans, etc; to L5 for solar storm / CME early warning) – to Magnetopause / Magnetotail (solar-terrestrial physics) – to GEO cheaply and easily (for comms, observation, or science) – to Venus-Sun L4, L5 (search for IEOs / Atens; and for Earth-Sun space weather predictions) – to Phobos / Deimos (orbiters, landers) and into Mars orbit, for science. All of these missions are on the cusp of becoming 100 times cheaper than previously, and in addition, decoupled from specific long-lead launch constraints. They represent the emerging stepping-stones to bulk resources returns and large-scale space industrialization.