Relevant Abstracts and Technologies

SEE offers mission planning and flight dynamics analysis and operational tools based on software including Copernicus, General Mission Analysis Tool (GMAT), Ansys' Systems Tool Kit (STK), and Orbit Determination Tool Kit (ODTK). SEE also offers commercial, end-to-end flight dynamics operational solutions for cost effective space missions. Built around STK and ODTK, SEE's Flight Dynamics Tool (FDT) and other in-house software solutions enable full mission analysis from initial concept through flight operations. SEE's team has deep experience developing and operating missions in cislunar space. In particular, SEE has a proven track record of developing trajectories that take advantage of emerging commercial options for access to space. SEE developed the ascent trajectory for Rocket Lab's Lunar Photon upper stage that deployed the CAPSTONE spacecraft.

Additionally, SEE is supporting multiple other commercial operators who are developing orbital transfer vehicles with a wide-range of lunar and cislunar capabilities. SEE has supported lunar and cislunar missions including Korea Pathfinder Lunar Orbiter (KPLO), Beresheet, Lunar Atmosphere and Dust Environment Explorer (LADEE), Interstellar Boundary Explorer (IBEX), and Clementine. The SEE team has flight operations experience in Lagrange point and interplanetary missions including gravity assists. Team members have also supported occultation observing campaigns, and have worked together with NASA teams to support proposal concept development over the range of mission classes, from SIMPLEx to New Frontiers. The SEE team looks forward to partnering with science teams to provide support throughout the full mission life cycle.

A sampling of the missions where we could help develop mission concepts or perform trade studies include:

<u>Rockstar: A Thermal Infrared Hyperspectral Imager for Meter Scale Data Collection form Orbit</u>
SEE has expertise developing and operating missions in low lunar orbit, in particular LADEE and Clementine. SEE could contribute their expertise to provide a dedicated lunar transfer solution as well as mission trajectory for imaging in low lunar orbit.

<u>The SelenITA Mission</u>
SEE has expertise developing and operating missions in low lunar orbit as well as cross-cutting expertise in multi-spacecraft, rendezvous and proximity operations missions. The SEE team has deep experience supporting lunar and multi-spacecraft missions (HelioSwarm, Starling, Restore-L/OSAM-1). Additionally, SEE has developed mission trajectories that leverage commercial orbit transfer vehicle capabilities to access lunar and cislunar space. SEE could contribute this expertise and mission enabling technology to the SelenITA mission.

Shadow Chaser: a smallsat concept to determine the middle and upper atmospheric structures of Uranus and Neptune through stellar-occultation measurements from Earth orbit
SEE has experience designing, analyzing, and supporting missions in highly elliptical, lunar resonant orbits on IBEX, TESS, Arcus, and HelioSwarm. These orbits, with periods of approximately 1-2 weeks, offer stable, unperturbed orbits well suited for long duration observations. SEE also has experience designing and operating ΔV rideshare missions using orbit transfer vehicles like Rocket Lab's Lunar Photon kick stage and Spaceflight's Sherpa-ES. SEE can also identify timing for stellar occultations for feasibility studies.

SAEVe: A mission concept for Seismic and Atmospheric Exploration of Venus
SEE has developed transfer trajectories for small payloads leveraging commercial access to space (e.g. small launch vehicles, rideshare). Venus transfers are accessible with this class of launch and enable small landers to be cost-effectively launched.

The Lunar Geophysical Network Mission
SEE has experience with modeling parent to lander deployment to identify deployment sequences that can meet lander spacing requirements, in addition to experience in cislunar trajectory design.

Mars Polar LAnder and ClimatE Record Network (Mars PLACER Net or MPN)
SEE has extensive experience running trade studies to validate mission concepts, mission design studies for trades between launch options, and Monte Carlo studies for dispersion analyses and for generating ΔV budgets for Trajectory Correction Maneuvers (TCMs).

Monitoring Areostationary Constellation for Atmosphere and Weather in Space (MACAWS)
SEE has experience with constellation analysis including deployment sequencing, and low thrust mission design.

Mercury Scout
SEE has experience evaluating mission designs using alternative very low thrust propulsion systems.

Jupiter System Observatory at Sun-Jupiter Lagrangian Point One
SEE has operational experience in trajectory design and navigation around Lagrange points.

Interstellar Object Interceptor Missions
SEE is interested in helping to explore what could be possible from a trajectory design standpoint to determine mission concepts that would allow observation of interstellar objects.

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