

ESCAPADE: ESCAPADE: low-cost formation flying for unique space weather science at Mars.

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Multi-spacecraft missions after 2000 (Cluster II, THEMIS, Van Allen Probes, and MMS) have revolutionized our understanding of the causes, patterns and variability of a wide array of plasma phenomena in the terrestrial magnetospheric environment. ESCAPADE is a twin-spacecraft Mars mission concept that will similarly revolutionize our understanding of how solar wind momentum and energy flows throughout Mars' magnetosphere to drive ion and sputtering escape, two processes which have helped shape Mars' climate evolution over solar system history.

ESCAPADE will measure magnetic field strength and topology, ion plasma distributions as well as suprathermal electron flows and thermal electron and ion densities, from precessing elliptical 150 x ~8500 km orbits. ESCAPADE are small spacecraft (<200 kg dry mass), following ballistic Hohmann transfers to Mars. Our strategically-designed 1-year, 2-part scientific campaign of temporally and spatially-separated multipoint measurements in different regions of Mars' diverse plasma environment, will allow the cause-and-effect of solar wind control of ion and sputtering escape to be unraveled for the first time.

ESCAPADE is a Category 3 Class D Tailored small satellite mission selected under the SIMPLEX program and funded by NASA's Heliophysics division, with a PI-managed cost cap of <\$60 million. Designing, developing, and operating two spacecraft at Mars for this budget necessarily entails a combination of high heritage instrumentation, streamlined processes, a higher risk tolerance than is common for many scientific missions, and an innovative approach to rideshare. ESCAPADE is due to launch on the first New Glenn launch in September 2024. This presentation will focus on lessons learned by NASA and the ESCAPADE team that may be applied to future low-cost deep space missions.