21st IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Spacecraft for Deep-Space Exploration (8)

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INSPIRE: INTERPLANETARY NANOSPACECRAFT PATHFINDER IN RELEVANT ENVIRONMENT

Abstract

The INSPIRE project will demonstrate the revolutionary capability of deep space CubeSats by placing two NanoSpacecraft in Earth-escape orbit. Prior to any inclusion on larger planetary missions, CubeSats must demonstrate that they can operate, communicate, and be navigated far from Earth – these are the primary objectives of INSPIRE. Spacecraft components, such as a JPL X-band radio and a robust watchdog system, will provide the basis for future high-capability, lower-cost-risk missions beyond Earth. These components will enable future supplemental science and educational opportunities at many destinations.

The nominal INSPIRE mission will last for three months and will achieve an expected Earth- probe distance of 1.5x108 km (dependent upon escape velocity as neither spacecraft will have propulsion capability). The project will monitor onboard telemetry; operate, communicate, and navigate with both spacecraft; demonstrate cross-link communications; and demonstrate science utility with an onboard magnetometer and imager. Lessons learned from this pathfinder mission will help to inform future interplanetary NanoSpacecraft and larger missions that might use NanoSpacecraft components.

The INSPIRE flight system comprises two identical, three-axis-stabilized 3U spacecraft that combine existing subsystems for CDH watchdog, attitude determination, and power functions with next-step

modifications of subsystems for cold-gas attitude control and deep-space navigation communication. Demonstrating the integrated system performance of these core spacecraft components will establish a proven foundation for diverse future NASA missions to host special-purpose payloads in deep space.

The spacecraft will also host a science payload: a half-U JPL compact vector-helium magnetometer to measure the fine structure of the solar wind, and prove the science utility of such a small platform.

INSPIRE's demonstration of CubeSat functionality and utility in the deep-space environment is crucial as a stepping-stone for interplanetary CubeSats. By leveraging JPL's 50 plus years of deep space experience, INSPIRE will establish a flight heritage for future interplanetary CubeSat missions, as well as creating a cadre of partners experienced with the challenges of interplanetary missions.

In this paper we will provide technical details of the INSPIRE project, discuss current status and lessons learned to date, and detail some of the future missions enabled by the INSPIRE project.

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