Electrospray thrusters are electrostatic accelerators of charged particles using the electrohydrodynamic effect known as *Taylor cone* to generate thrust [1]. These particles could be charged droplets, solvated ions, or a mix of the two. Since the new advances in electrospray technology that occurred in the late 1980s [2], the field of electrospray propulsion has experienced a renaissance, specifically aiming to provide efficient high-tunable precision low-thrust engines for micro-satellites and high accuracy astrophysics missions [3]. The MIT’s Space Propulsion Laboratory and the Microsystems Technology Laboratories are currently pursuing the development of a micro-fabricated electrospray emitter array for space propulsion applications. The project is developing, in parallel, two radically different concepts, a pressure-fed engine and a surface tension-fed engine. This abstract reports the design, fabrication, and experimental characterization of a hybrid macro-fabricated/micro-fabricated, externally fed planar array of micro-fabricated electrospray emitters with macro-fabricated electrodes (Figure 1). An externally-fed engine has a number of advantages compared to the other implementations reported in the literature. For example, the engine lacks a static pressure difference between the plenum and the emitters; therefore, there cannot be propellant emission unless it is electrically activated. In this sense, the planar array is less vulnerable to unplanned propellant emission compared to pressure fed schemes. Additionally, clogging is not an issue in this engine because the propellant is not doped, and the flow channels are open. The planar array uses the ionic liquid EMI-BF$_4$ as a propellant. The ionic liquid EMI-BF$_4$ has a very low vapor pressure, making it suitable to be used in an open architecture engine. The array is composed of a set of spikes, i.e., emitters, coming out from a propellant pool. There are two configurations for the emitters: fully sharpened slender emitters, i.e., pencils, and truncated pyramidal emitters, i.e., volcanoes. The arrays have between 4 and 1024 emitters in an active area of 0.64 cm$^2$. The surface of the engine (tank and emitters) is covered with “black silicon” that acts as wicking material. The hydraulic system has been experimentally characterized, including: start-up tests (Figure 2), wettability tests, current-per-emitter versus voltage characteristics, imprints of the exit stream on a collector, and a thrust test in agreement with the current-per-emitter versus voltage characteristics and the time-of-flight measurements that we have independently obtained at the Space Propulsion Laboratory. Preliminary results demonstrating the feasibility of obtaining substantially larger emission currents at the same extraction voltage by controlling the temperature have also been obtained. The emission from the array seems to be described by a Schottky emission mechanism.

**REFERENCES:**