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MAKING THE INVISIBLE VISIBLE: PRECISION RF-EMITTER GEOLOCATION FROM SPACE BY  
THE HAWKEYE 360 PATHFINDER MISSION

**Abstract**

HawkEye 360 is developing a novel technology which will enable precision geolocation of RF-emitters worldwide. The company will place a constellation of at least eighteen spacecraft in low earth orbit, organized in clusters of three, each equipped with a wide-band radio payload, to multilaterate the position of RF emissions of interest. Opportunities and applications that arise from this high-precision radio frequency mapping and analytics technology are enormous and appeal to a broad array of business enterprises and government users. The ability to locate and characterize RF signals across many bands from space, for example, will allow regulators, telecommunications companies and broadcasters to monitor wireless usage and to identify areas of interference. In the field of transportation, RF signals transmitted from the air, ground or sea could be monitored. The system might also be used to expedite search and rescue operations by quickly pinpointing activated emergency beacons.

As a precursor to a full low-Earth orbit commercial constellation, HawkEye 360 has contracted Deep Space Industries (DSI) and the Space Flight Laboratory (SFL) to design the HawkEye 360 'Pathfinder' demonstration mission. The Pathfinder mission, scheduled for launch in mid-2018, will validate key enabling technologies and operational methods necessary to provide unprecedented analysis of wireless signals data for commercial and government applications. The mission will consist of a constellation of three formation-controlled microsatellites built by SFL based on its 15-kg Next-generation Earth Monitoring and Observation (NEMO) platform. Each spacecraft will host a HawkEye 360 payload, consisting of a Software Defined Radio (SDR) capable of covering various RF segments spanning VHF through Ku-Band, as well as DSI's innovative Comet-1000 water-based propulsion system. SFL was selected for this mission in part due to the importance of formation flying by multiple satellites for successful RF signal geolocation and analysis. SFL has developed compact, low-cost formation flying technology at a maturity and cost that no other small satellite developer can credibly offer at present. This precise formation control was demonstrated on-orbit by SFL in the highly successful CanX-4/CanX-5 mission (2014).

This paper describes the HawkEye 360 Pathfinder mission, the core enabling platform and payload technologies, and glimpse ahead to the full commercial constellation.