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Author: Mr. Karan Sarda

Space Flight Laboratory, University of Toronto, Canada, ksarda@utias-sfl.net

Mr. Niels Roth

Space Flight Laboratory, University of Toronto, Canada, nroth@utias-sfl.net

Mr. Bryan Johnston-Lemke

Space Flight Laboratory, University of Toronto, Canada, bjlemke@utias-sfl.net

Mr. Braden Hommy

Space Flight Laboratory, University of Toronto, Canada, bhommy@utias-sfl.net

Ms. Monica Chaumont

Space Flight Laboratory, University of Toronto, Canada, mchaumont@utias-sfl.net

Dr. Benoit Larouche

Space Flight Laboratory, University of Toronto, Canada, blarouche@utias-sfl.net

Dr. Robert E. Zee

University of Toronto, Canada, rzee@utias-sfl.net

Mr. Lorin Metzger

United States, lorin@he360.com

Ms. Nicole Hilliard

United States, nicole@he360.com

TRANSFORMING THE INVISIBLE INTO SOLUTIONS FOR A BETTER WORLD: THE DESIGN
AND ON-ORBIT RESULTS OF THE HAWKEYE 360 COMMERCIAL CONSTELLATION

Abstract

One of the most defining features of today's world is invisible to the naked eye. Increasingly, the lifeblood of the modern, digital economy is carried by the electromagnetic spectrum. Many types of objects emit radio frequencies for vital functions such as communication, navigation, and operation. HawkEye 360 launched a first-of-its-kind commercial satellite constellation to identify and geo-locate a broad range of radio frequency (RF) signals from space to reveal previously invisible knowledge about activities around the world. The constellation delivers a brand new data layer never before available commercially — precise mapping of radio frequency emissions, enabling actionable insights into the security and defense, maritime asset tracking, telecommunications spectrum monitoring, and crisis response application markets among many others.

The constellation is comprised of several clusters of three satellites that fly in formation in low earth orbit. The first three-satellite 'Pathfinder' cluster was launched in December 2018. These three identical satellites were designed and built by the Space Flight Laboratory (SFL) in Toronto. In addition to being a world leader in delivering some of the most advanced nano and microsatellites in the world, 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. Each satellite is equipped with a software defined radio (SDR) payload designed by HawkEye 360, with a capability to be tuned across a frequency range from 144 MHz to 15 GHz (approximately VHF to Ku-Band). These spacecraft have been commissioned, commanded into formation and have successfully entered into operational commercial service.

Expanding on the success of the 'Pathfinder' mission, HawkEye has commissioned SFL to develop

another 15 next-generation satellites, based on SFL's DEFIANT platform. Equipped with deployable solar arrays, a generously sized payload bay, along with a design mindful of high-volume production, the DEFIANT platform offers significant payload capability at a cost and schedule point that is attractive to constellation applications. The first cluster of these DEFIANT-class spacecraft for the HawkEye constellation will launch in late 2020.

This paper describes the design and on-orbit results of the HawkEye 360 Pathfinder mission, as well as a look ahead to the upcoming DEFIANT-class spacecraft that will form the backbone of the HawkEye 360 commercial constellation, which, with unprecedented capability, will transform the invisible into solutions for a better world.