

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Advance Higher Throughput Communications for GEO and LEO satellites (3)

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SWISSTO12'S ADDITIVE MANUFACTURING AND HUMMINGSAT SMALL GEO ENABLE NEW  
MISSIONS

**Abstract**

The High Throughput Satellite (HTS) market is expected to witness a significant expansion in the coming years, primarily driven by the growing demand for data services: broadband, broadcast, 5G, search and rescue communications, Internet of Things and data-driven AI. The potential of these applications is currently limited by the capacity, coverage and cost of HTS connectivity. In this context, SWISSto12 develops HummingSat, a brand new class of agile, GEO small satellite platform which can service a multitude of missions. HummingSat provides a long-life mission—a 15-year design life in GEO, with 2 kW and 200 kg of payload, across a wide range of RF frequencies from L-band to Q/V-band. HummingSat is designed to offer operators optimized payloads, from wide area shaped beams to high throughput spot beams. In addition, HummingSat is compatible across several launchers as a rideshare payload, which significantly reduces the launch cost. In addition, HummingSat performs its own transfer to geostationary orbit. Developed in collaboration with the European Space Agency (ESA), HummingSat makes high-speed connectivity more scalable, faster to deploy and lower cost: unlocking gap filling services, opportunities to replace large GEO assets as they reach end-of-life at a fraction of a cost and addressing new markets (telecom, space situational awareness, lunar communication, etc.) which were previously unaffordable. SWISSto12's HummingSat is also the world's first small GEO satellite leveraging 3D-printing technologies. Developed since 2015, SWISSto12's proprietary 3D-printing technologies (which includes design, 3D-printing, surface treatment) allow the manufacturing of passive Radio-Frequency products that are lightweight, compact, highly performing, and cost competitive. These space-qualified AM products have been deployed in missions across all orbits, including LEO and MEO constellations to large GEO spacecraft and beyond. Examples include clustered feed for multibeam antennas with integrated polarizers and diplexers to steerable array antennas, to waveguide filters and interconnects; these parts can be easily integrated with active RF products including Low Noise Amplifiers (LNAs), Solid State Power Amplifiers (SSPAs), and Traveling Wave Tube Amplifiers (TWTAs) to minimize transmission losses and offer enhanced flexibility and performance. SWISSto12's 3D printed products enable superior performance and contribute to the success of HummingSat. This paper will introduce how SWISSto12's innovative designs for HummingSat and its AM products lead to improved value for satellite operators. Specific use cases will be presented to demonstrate how the AM products can be included in HTS through UHTS missions and how HummingSat can deliver HTS performance using a small platform.