

Case ID:M21-120P

Published: 3/29/2024

Inventors

Sharanya Srinivas

Daniel Bliss

Contact

Shen Yan
shen.yan@skysonginnovations.
com

Hybrid In-Situ & Signal of Opportunity Calibration for Antenna Arrays

Modern day aircrafts rely on a plethora of communications and navigation systems to enable secure and reliable flight operations. These systems are designed in isolation and physically separated to prevent interference between services. These choices lead to stove-pipe designs that lack backward compatibility. As a direct consequence, exteriors of aircrafts are studded with more than thirty antennae protruding from their bodies, which disturb the laminar air flow along the aircraft's skin. The additional drag created by the antennae increases fuel consumption and, therefore, operational expenses. In addition, installing each antenna is mechanically nontrivial and individual connections and dedicated processing chains are expensive.

Researchers at Arizona State University have developed a hybrid in-situ and signal of opportunity calibration for antenna arrays. The calibration leverages cooperative satellites in direct line-of-sight of a radio frequency (RF) device with an antenna array (e.g., an aircraft with a conformal antenna array) to optimally steer beams. These external calibration sources supplement an in-situ source mounted on a common platform with the antenna array (e.g., placed on the aircraft's tail).

The calibration method includes receiving calibration signals from each of an in-situ RF source and one or more remote RF sources. The method further includes estimating a direction of arrival for the in-situ RF source and the one or more remote RF sources to produce a set of estimated directions of arrival. The set of estimated directions of arrival are compared with a corresponding set of known directions of arrival to calibrate the antenna array.

Related publication: [Conformal Multi-Service Antenna Arrays: Hybrid In Situ & Signal of Opportunity \(SoOP\) Calibration](#)

Potential Applications:

- Calibration of antenna arrays
- Communication and navigation systems on air vehicles (e.g., aircraft)

Benefits and Advantages:

- Enables on-line and in real time calibration of conformal antenna arrays to ensure secure communications
- Assess and corrects phase errors arising from the time dependent variations in array geometry
- Provides for adaptive adjustment of the calibration based on reliability of source information

