

Aircraft detection and laser avoidance system for satellites

Joint Interdisciplinary master thesis between SpE and C&O



Background

Laser satellite communications is an emerging research topic with a bright societal and economic perspective. It aims at providing higher data throughput and better security than conventional radio frequency (RF) communications links. Its implementation has brought up some appealing research questions. At our faculty, we want to build an optical ground terminal, and we want to be sure this ground terminal is safely operated.

As such laser intersects with aviation airspace, it may hinder the safety of current flight operations. For this project, we want to investigate such potential safety concerns. We need to build a system that avoids the laser being pointed at the direction of an aircraft.

This **interdisciplinary** challenges include the prediction of both aircraft trajectories and satellite orbit, as well as understanding the uncertainties in these predictions. Firstly, we need to obtain the aircraft locations, and to predict where their positions in a brief time horizon. Secondly, we need to know the orbit of the satellite and where the laser is pointing. In the event where the laser may intersect with an aircraft, it needs to be turned off. When the hazard is over, the laser shall be turned on again.

Research objectives:

- Track airplanes based on Automatic Dependent Surveillance-Broadcast (ADS-B) system and provide short term predictions and uncertainty bounds.
- Determine satellite orbits and estimating the uncertainty band. Inventory of pointing uncertainties, and error models.
- Build a model for the area and time when the laser needs to be turned off, while maintaining a given probability of safety.
- Assist the implementation of a robust real time detection and avoidance system.
(This requires the student to have good skills on computer network and programming)

Supervision and support

This project will be supported and co-supervised by Dr. Junzi Sun (aircraft detection), Dr. Bart Root (tracking of the satellites) and Dr. Rudolf Sathof (laser coms).

