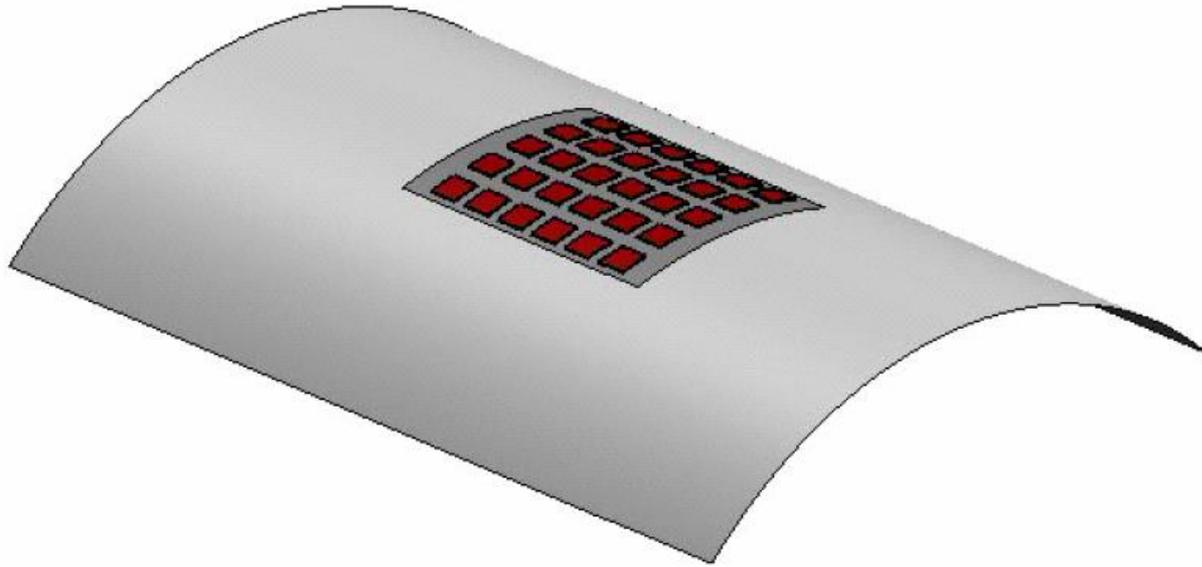


# Optical Beam Forming

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## Optical Beam-Forming

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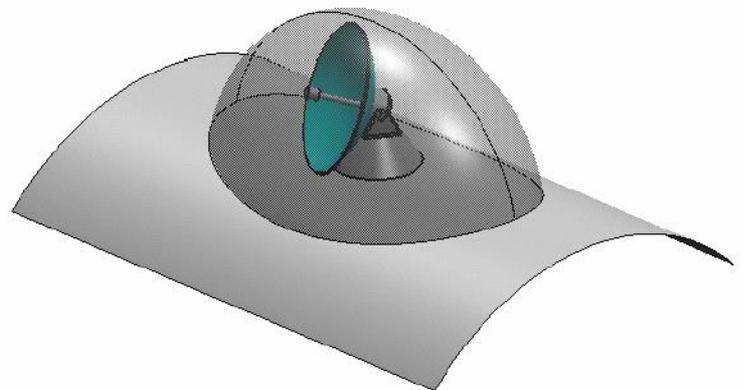


### Introduction

Hello all, my name is Laurens Blik and I am doing my PhD research in the group of prof. Verhaegen. The topic is optical beam-forming, and the final application is a system that can enhance the reception of satellite signals on airplanes. The system could be used to provide internet and television services on airplanes. I will explain the context of this project below.

### Dish Antennas

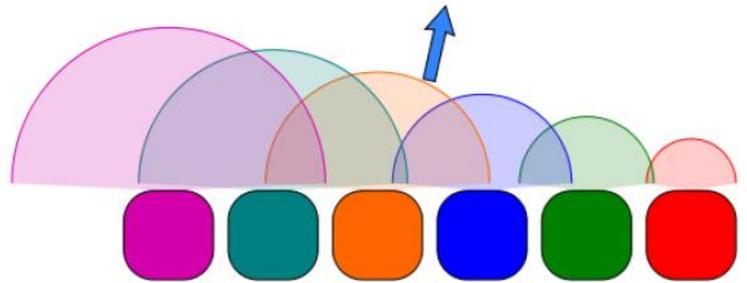
Since satellite signals have to travel a long distance, most antennas will not receive the signal because it is too weak. And if your antenna is too strong, it will receive many other unwanted signals, not just the ones from the satellite. A (parabolic) dish antenna solves this problem by amplifying signals from one direction, and suppressing other signals. However, if you place a dish antenna on an airplane, there are many drawbacks. For one, an airplane moves, so the antenna would have to be directed towards the satellite by moving the dish



continuously. It also needs to be protected because of the extreme environment in the air, and this will make the whole device heavy and not really aerodynamic. The aircraft will spend more fuel, which is bad for the environment.

## Phased array antenna

A phased array antenna uses the beam-forming principle to amplify signals from one direction and suppress other signals. Multiple antennas are used, and the same signal arrives at each antenna at a different time. Correcting for this time delay by delaying the signal at each antenna results in positive interference in the desired direction.



Such a system is more fit for the communication between air-planes and satellites. However, a so-called beam-former is needed to control the delays at each antenna. It essentially steers the antenna, but electronically instead of mechanically. Usually, a beam-former is an electronic device.

## Optical beam-former

In this project, an optical beamformer is investigated. It has many advantages over electrical beamformers, such as a light weight, low loss, and large bandwidth. But many research needs to be done to control the delays with this device. Knowledge about optics, signals, electronics, but also optimisation and control, is required to make this device work correctly. There should be several possibilities for a bachelor or graduation project.

