



School of Electrical and Information Engineering University of the Witwatersrand, Johannesburg

ELEN 4000/4011 Design II 2018

Antenna Array Design to map man made space “junk” in low earth orbit

Brief Problem Description

With the increase in space travel, it is becoming more and more important to know where potentially fatal problems may arise due to man made space junk/debris.

The man made space junk is made of small objects travelling at high velocity, (usually metallic). This occurs due to bits and pieces breaking off from satellites, rockets, space stations, intentional satellite destruction by missiles etc.

This was highlighted in the movie “Gravity”

Startup companies such as LEOLABS (www.leolabs.space) have begun to address this problem.

You will be required to do a theoretical design similar to LEOLABS phased array radars in order to track space debris, including the operational environment **and** costing of the system for a South African Site.

FEKO will be made available to the students in the DLAB to run simulations.

A visit factory visit to Alaris antennas will be organised to ask questions of engineers in industry. (week 3 or 4)

More Details

The design of the space junk mapping system will require thought around the following components (but is not limited to this alone):

- 1) Choice of technology (passive or active?)
- 2) Individual and array simulations (including feeding and phasing networks)
- 3) Cost Optimisation (building an operation. How many elements are required?)
- 4) Choice of physical location in South Africa (Will passive work in all locations? Data connection)
- 5) What impact will the system have on the environment. (including power requirements)
- 6) Sensitivity analysis (i.e. what can be expected from the system? What type of debris can be mapped)

The final report needs to follow the guidelines of the School of EIE.

In depth analysis in appendices is expected!