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# **Double tracking antennas for drone communication**

- Automation and control -

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Project Report  
Group 832

Aalborg University  
Electronics and IT

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Here you can write something about which tools and software you have used for typesetting the document, running simulations and creating figures. If you do not know what to write, either leave this page blank or have a look at the colophon in some of your books.



**Electronics and IT**  
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## **AALBORG UNIVERSITY**

### STUDENT REPORT

**Title:**

Double tracking antennas for drone communication

**Abstract:**

Here is the abstract
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**Theme:**

Multivariable control

**Project Period:**

Spring Semester 2016

**Project Group:**

Group: 832

**Participant(s):**

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Elektronik og IT  
Aalborg Universitet  
<http://www.aau.dk>

## AALBORG UNIVERSITET

### STUDENTERRAPPORT

**Titel:**

Double tracking antennas for drone communication

**Abstract:**

Her er resuméet
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**Tema:**

Multivariable control

**Projektperiode:**

Spring 2016

**Projektgruppe:**

Group: 832

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**Oplagstal:** 1**Sidetal:** 20**Afleveringsdato:**

9. februar 2016

*Rapportens indhold er frit tilgængeligt, men offentliggørelse (med kildeangivelse) må kun ske efter aftale med forfatterne.*






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# Todo list

Figure: A overview of the project! . . . . .	1
 Is it possible to add a subsubparagraph? . . . . .	20
 I think that a summary of this exciting chapter should be added. . . . .	20
 I think this word is misspelled . . . . .	20
Figure: We need a figure right here! . . . . .	20



# Preface

Here is the preface. You should put your signatures at the end of the preface.

Aalborg University, February 9, 2016

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# Chapter 1

## Introduction

Here is the introduction. The next chapter is chapter 2.



A overview of the project!



## Chapter 2

# Scenario

### 2.1 Communication

The free space path loss (FSPL) is the loss in signal strength that occurs when an electromagnetic wave travels over a line of sight path in free space. In these circumstances there are no obstacles that might cause the signal to be reflected, refracted, or that might cause additional attenuation. Equation 2.1 represents the loss in signal strength.

$$L = 20 \log \left( \frac{4\pi d}{\lambda} \right) \quad (2.1)$$

The wave length can also be described by a relationship between the frequency and the velocity which is the light speed because radio waves are electromagnetic waves. This relationship is described by the equation 2.2.

$$\lambda = \frac{c}{f} \quad (2.2)$$

Considering an area of a

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{f \times 10^6} = \frac{300}{f} = \frac{3}{10f} \quad (2.3)$$

## 2.2 Rescue missions

### 2.2.1 What do they do today?

### 2.2.2 Compare the rescue missions

## 2.3 Pipeline survey

The pipeline survey could be to transport oil from a factory to another facility. To ensure that there is no thieves that want to steal the oil, they have to hire people to patrol. Instead they could use a drone to search the area. Potential danger

**Figure 2.1:** Pipeline survey

- Terrorist
- Thiefs



## Chapter 3

# Hardware setup

Our hardware setup.

### 3.1 Drone (eBee)



**Figure 3.1:** The professional mapping drone *eBee* ([www.sensefly.com](http://www.sensefly.com)). Fully autonomous drone to capture high-resolution aerial photos that can transform into accurate 2D orthomosaics & 3D models.

## **3.2 Basestation**

### **3.2.1 Laptop**

### **3.2.2 Antennas**

### **3.2.3 Gimbals (Camera)**

## **Chapter 4**

# **Telecommunication**

Our telecommunication.

### **4.1 Telemetry**

### **4.2 MavLink (protocol)**

### **4.3 Link Budget**



## Chapter 5

# Verification

Our verification.



## Chapter 6

# Simulation

Our simulations.

**6.1 Drone model**

**6.2 Controller**

**6.3 V-Rep**

**6.4 Drone in real life (real data)**





## **Chapter 7**

# **Discussion**

Our discussion.



## **Chapter 8**

# **Conclusion**

Our conclusion.



# Bibliography

- [1] Lars Madsen. *Introduktion til LaTeX*. <http://www.imf.au.dk/system/latex/bog/>. 2010.
- [2] Frank Mittelbach. *The LATEX companion*. 2. ed. Addison-Wesley, 2005.
- [3] Tobias Oetiker. *The Not So Short A Introduction to LaTeX2e*. <http://tobi.oetiker.ch/lshort/lshort.pdf>. 2010.



# Appendix A

## Appendix LaTeX Tips

### A.1 Example 1

You can also have examples in your document such as in example A.1.

#### **Example A.1 (An Example of an Example)**

Here is an example with some math

$$0 = \exp(i\pi) + 1 . \tag{A.1}$$

You can adjust the colour and the line width in the `macros.tex` file.

### A.2 How Does Sections, Subsections, and Subsections Look?

Well, like this

#### **A.2.1 This is a Subsection**

and this

#### **This is a Subsubsection**

and this.

**A Paragraph** You can also use paragraph titles which look like this.

**A Subparagraph** Moreover, you can also use subparagraph titles which look like this. They have a small indentation as opposed to the paragraph titles.

I think that a summary of this exciting chapter should be added.

Is it possible to add a subparagraph?

### A.3 Example 2

I think this word is misspelled

Here is chapter 2. If you want to learn more about  $\text{\LaTeX} 2_{\epsilon}$ , have a look at [1], [3] and [2].

