**EML 4551C**

**FAMU-FSU College of Engineering**

**Need Specifications and Project Planning**

**Carbon Nanotubes Based Antenna**

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**Senior Design Project #16**

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# Introduction

The goal of this project is to produce a slot antenna that utilizes carbon nanotubes (CNT’s) inherent electrical properties to streamline existing products. This will further the knowledge of CNT’s electrical properties, as well as create a novel technique for producing slot antennas.

# Product Specifications

## **Antenna**

The antenna has to be able to communicate with a wavelength of 2.4-2.5 GHz, this will influence the size of the slots in the antenna. Based on rough calculations, this would mean that the slot size will be from 2.5 in high to 1.25 in wide in order to achieve this correct frequency range. The antenna will be a rectangular slot antenna, which will have a linear polarization between 50-60 degrees in order to have a clear signal. This has to fit on an unmanned vehicle and must fit on a space that is 1.5 ft by 1.5 ft in.

## **Breadboard**

The breadboard is going to be simply designed, and its only purpose at this time is to provide energy to the antenna to create a magnetic field. This will be tested later on using antenna testing equipment.

## **Working Environment**

The antenna will be attached to unmanned vehicles that could be ground, air or water based. This means that the antenna will have to be corrosive resistant, to be able to handle the sea water, as well as keep the same material properties at temperatures ranging from -40 to 100 degrees Fahrenheit. To handle this, the antenna will most likely be made up of an composite, because of their tolerance to extreme temperatures and the resins ability to withstand corrosive environments. We believe that vinyl ester resin will be the best choice in a composite matrix because it can withstand those specifications. The fibers will also most likely be glass fibers, since carbon fibers are more expensive and can short circuit the antenna if handled improperly(Mallick 2007).

## **Carbon Nanotubes**

The purpose of this project is to further research the use of carbon nanotubes and their possible use in creating a slot antenna based solely on the CNT’s inherent electrical properties. In normal slot antennas a physical slot is cut into the antennas surface which resonates at a certain frequency. What this project is aimed at is creating the same effect as the slot, but without cutting a physical slot. It is theorized that one would be able to create the same effect by using different orientations of CNT’s in order to keep electrical current out of the slots, but still allow current to flow around it, causing the same magnetic field. Single walled nanotubes will be employed since multi-walled nanotubes do not have the same electrical capabilities.

## **Preliminary Cost**

Carbon nanotubes are fairly expensive to buy, up to $168 per gram, but it is expected that there are resources at the High Performance Materials Institute that may help us in creating our own or covering the cost of some of the CNT’s. The rest of the cost would come from the composites that we hope to use in building our antenna, such as vinyl ester resin, and carbon or glass fiber. Finally, the last cost would be in the building of the breadboard.

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| Item | Amount | Cost |
| Vinyl Ester Resin | 1 gallon | $ 74.95 |
| Glass fiber | 38” X 180” | $ 24.95 |
| Carbon Nanotubes | 1 g | $ 168.00 |
| Breadboard | 1 | $ 16.00 |
|  |  |  |

# House of Quality



# Project Planning

# Bibliography

Mallick, P. K. (2007). Fiber Reinforced Composites: Materials, Manufacturing and Design, CRC Press.