

# Harmonic Radar: Drone Trial 2022-06-09

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# 1 Objective

The objective of this trial was to map the location of a single harmonic radar target placed beneath a linear transect flown by a drone.

## 2 Methods

A RECCO hand-held harmonic radar transceiver was suspended with rope about 1.5 feet beneath the landing struts of a DJI AGRIS MG-1 drone. A target consisting of 2 harmonic radar tags with antennae placed at right angles (Figure 1) was positioned in an open field and the drone was programmed to fly along a line which crossed this position.



Figure 1: Target.

### 2.1 Harmonic radar recording

The RECCO hand-held harmonic radar device generates an audio signal to indicate that a reflection from a harmonic radar tag has been detected. The amplitude of this signal is maximum when the receiving antennae points at the target and it increases as the target gets closer. A human operator locates the direction of a tag by directional scanning with the antenna while monitoring the signal using a built-in speaker or headphones. In this application, we point the receiving antenna straight down and record the signal by connecting a small digital audio field recorder (ZOOM F2) to the audio jack. The F2 records monophonic floating point WAV files at a rate of 48,000 samples per second.

An Audacity screenshot displays the waveform and spectrogram of the record created during the trial (Figure 2). The WAV file was processed using a Jupyter notebook which performed the following steps.

- Noise reduction: Background noise was removed from the signal by the ??? Python library.
- Data reduction: The mean absolute amplitude (MAA) of the signal was calculated for each second within the WAV file. MAA is used as a measure of signal strength.

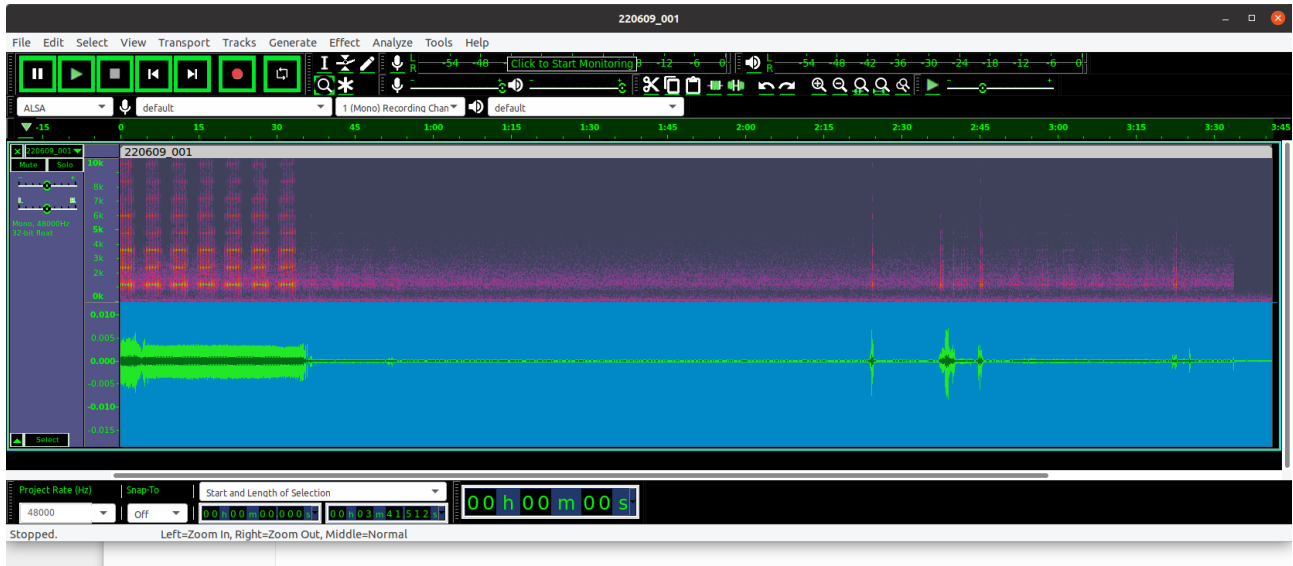


Figure 2: Audacity.

## 2.2 GPS track recording

The flight data log was downloaded as FLY275.DAT from the drone. This file was parsed using a free Java program named DatCon using parameters recorded in Figure 3.

DatCon

File Preferences Signal Groups Help

Version 4.2.3

.DAT file

/home/aubrey/Desktop/Harmonic-Radar/experiments/2022-06-09-drone/FLY275.DAT

Output Dir

/home/aubrey/Desktop/Harmonic-Radar/experiments/2022-06-09-drone

View It

Time Axis

Offset - time axis 0 point

☐ Recording Start
 ☒ Motor Start
 ☐ Flight Start

Lower

Upper

Time

.000

638.583

TickNo

335826539

3209451395

☐ Recording Start
 ☒ Motor Stop

☒ Motor Start
 ☐ Recording Stop

☐ GPS Lock

CSV

Sample Rate

1

Hz

☒ .CSV
 

FLY275.csv

View It

☐ Event Log (column in .csv)

Log Files

☒ Event Log File
 

FLY275.log.txt

View It

☐ Config Log File
 

FLY275.config.txt

View It

☐ RecDefs File
 

FLY275.recDefs.txt

View It

KML

KML File

FLY275.kml

View It

☒ Ground Track

☐ Profile
 

Enter HP Elevation

Meters

kml File : /home/aubrey/Desktop/Harmonic-Radar/experiments/2022-06-09-drone\FLY275.kml

Converting /home/aubrey/Desktop/Harmonic-Radar/experiments/2022-06-09-drone/FLY275.DAT  
 Csv file : /home/aubrey/Desktop/Harmonic-Radar/experiments/2022-06-09-drone\FLY275.csv  
 eventLog : /home/aubrey/Desktop/Harmonic-Radar/experiments/2022-06-09-drone\FLY275.log.txt  
 kml File : /home/aubrey/Desktop/Harmonic-Radar/experiments/2022-06-09-drone\FLY275.kml

Figure 3: DataCon.

## **3 Results and Discussion**

### **3.1 Harmonic radar recording**

### **3.2 GPS track recording**