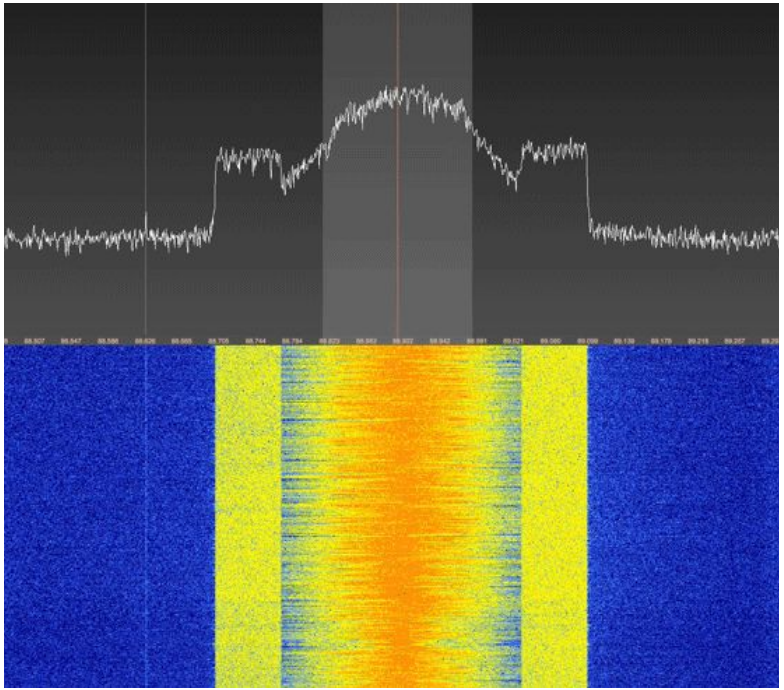
The Great Haystack RFI Hunt

Brian Malkan

Background

- RFI (Radio Frequency Interference)
- Fourier Transform / Waterfall Plots
- Motivation: Record and Annotate RFI Signatures



Project Outline

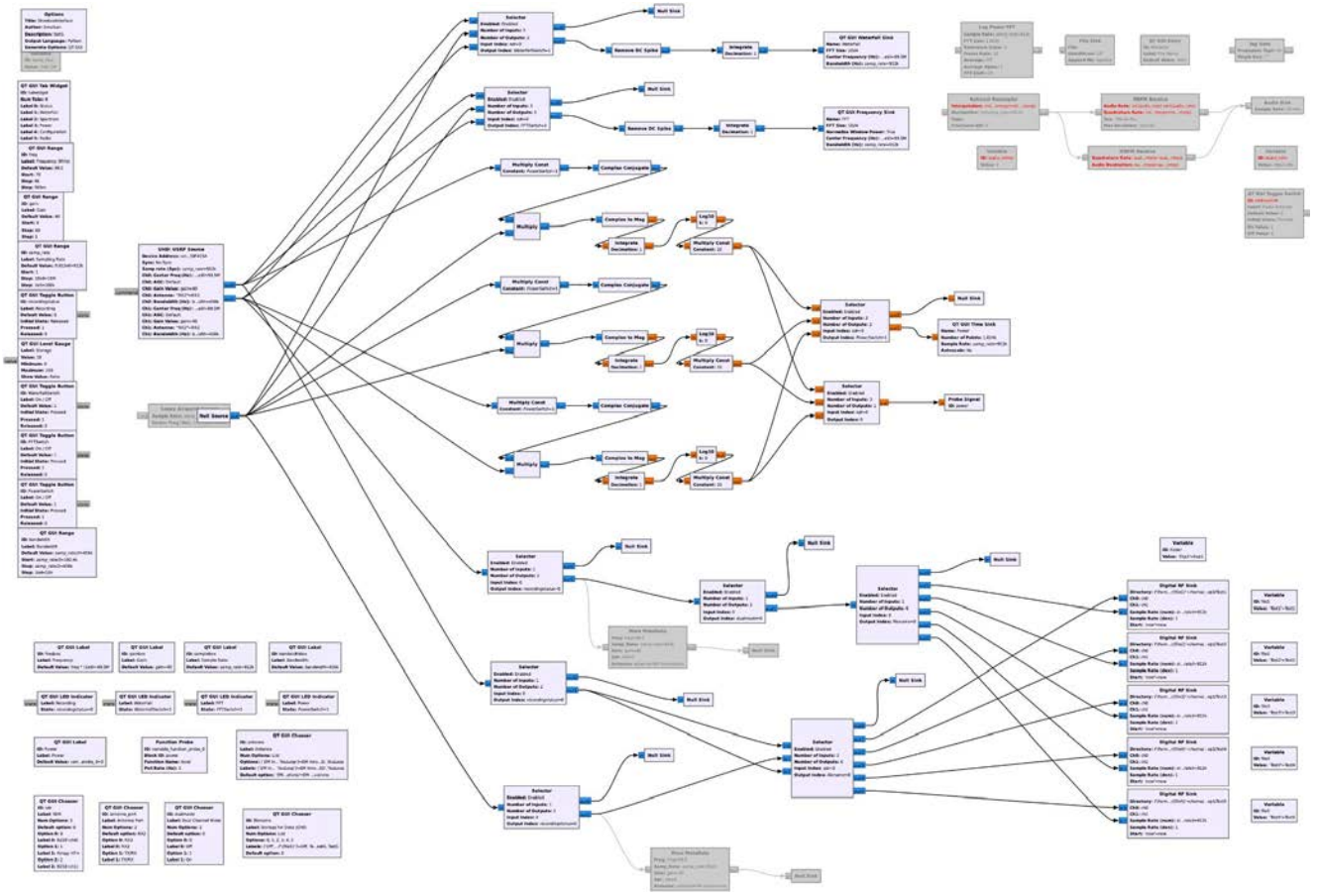
1. Making software
2. Assembling hardware
3. Finding / recording radio frequency interference
4. Viewing / annotating data through dash
5. Create training data for potential neural network

GNU-Radio

- Python Based software used for radio application

- Blocks, Flowcharts

- Make interface for using radios

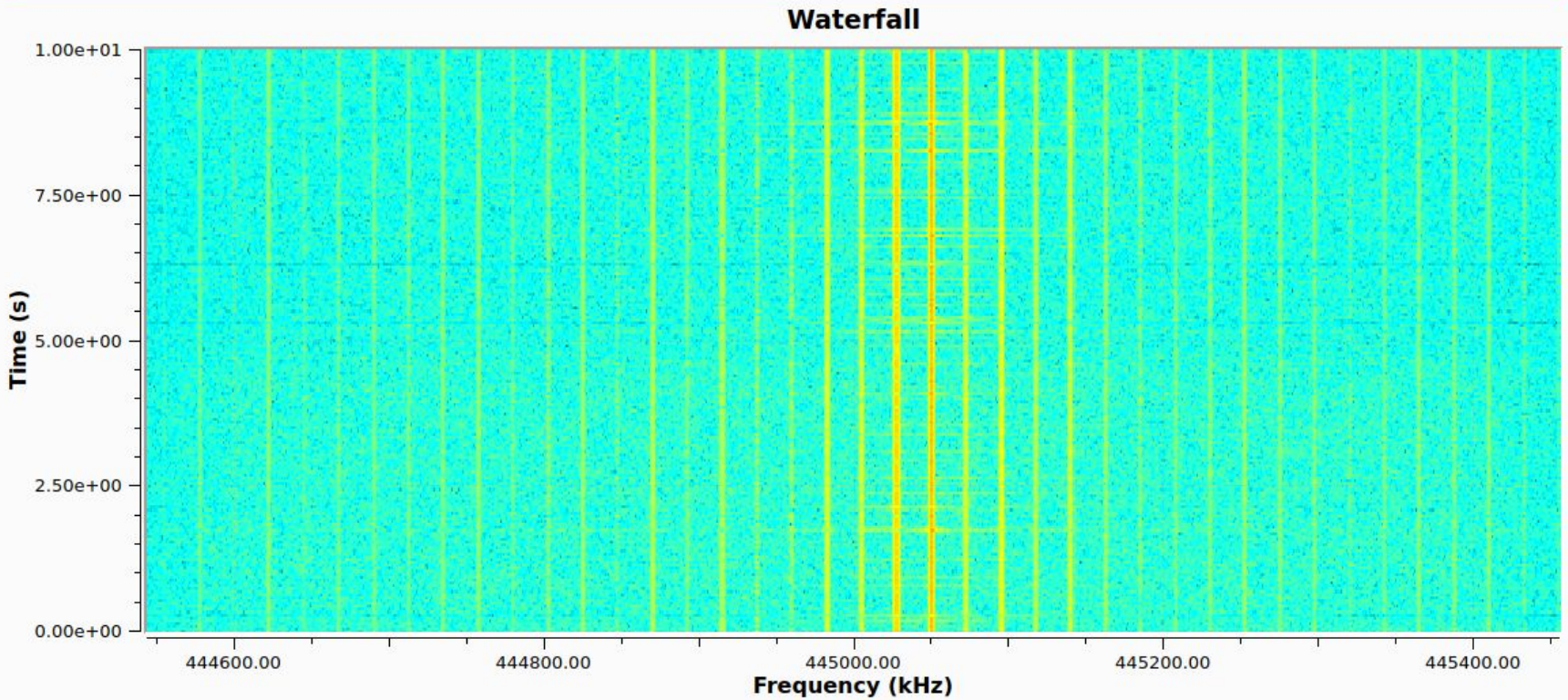


GNU Flowgraph for RFI Box

ShoeboxInterface

Status | Waterfall | Spectrum | Power | Configuration | Radio

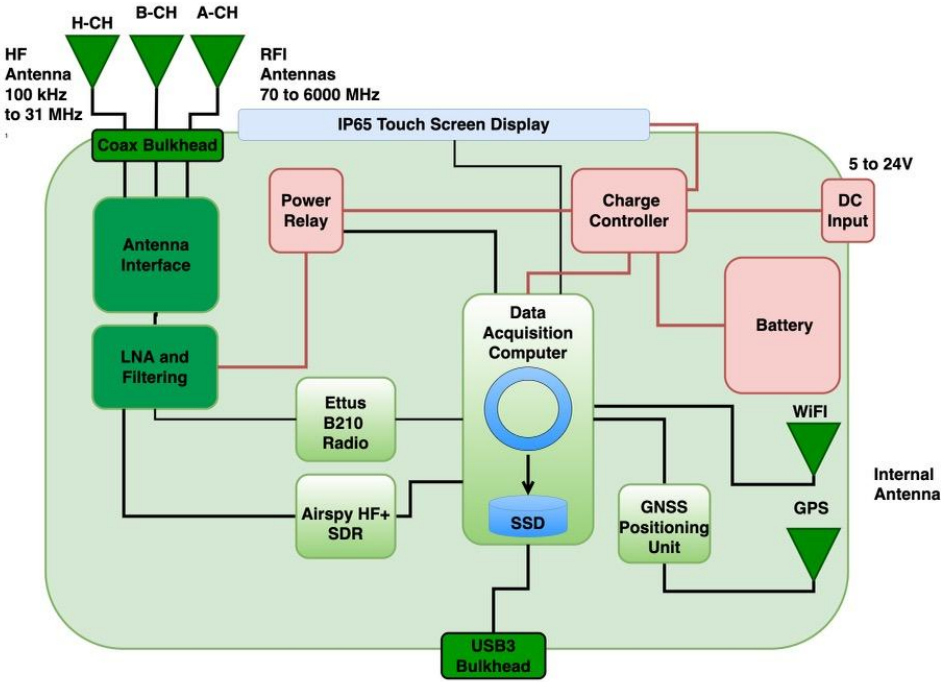
On / Off



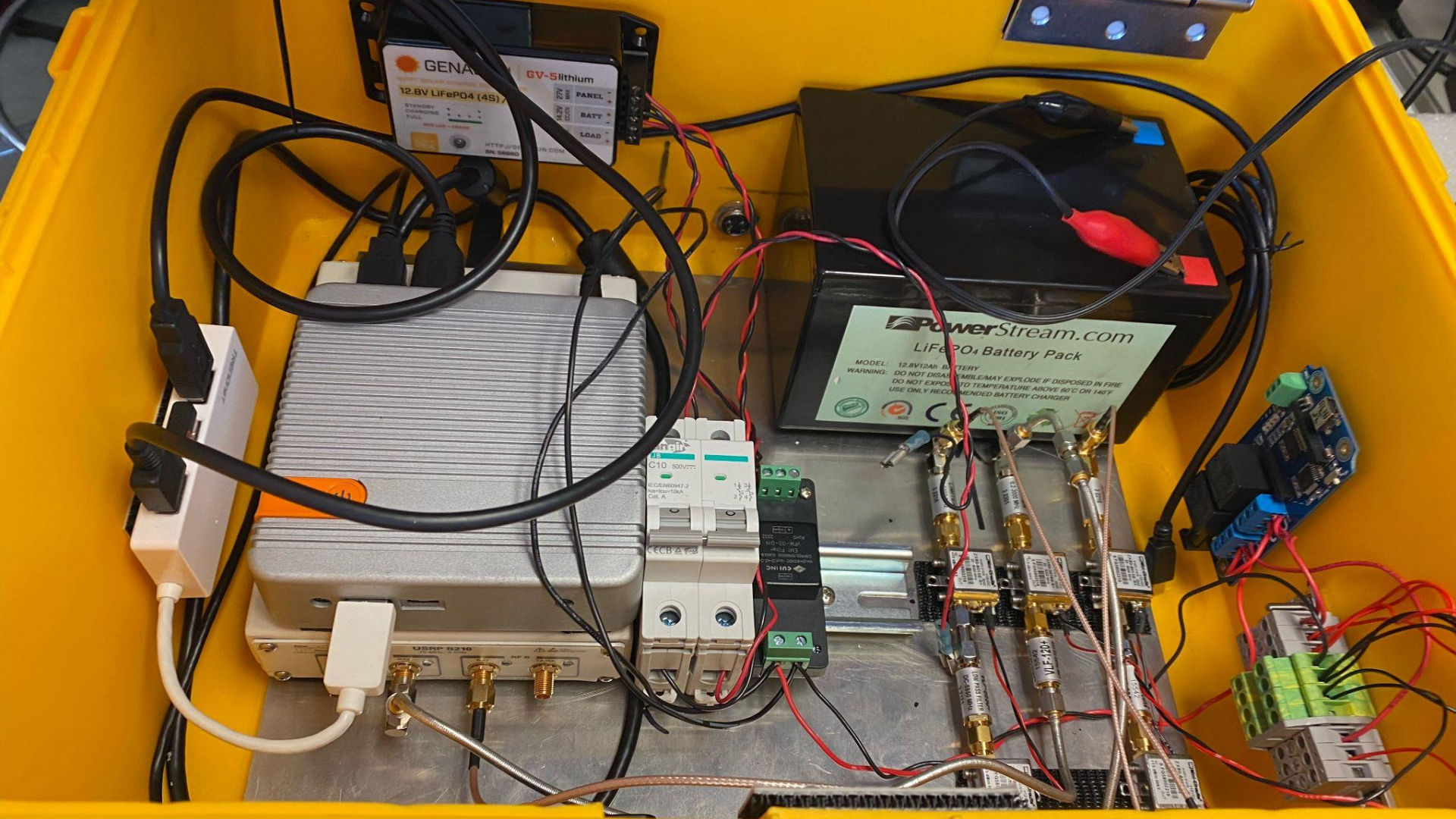
Frequency (MHz) 445.000

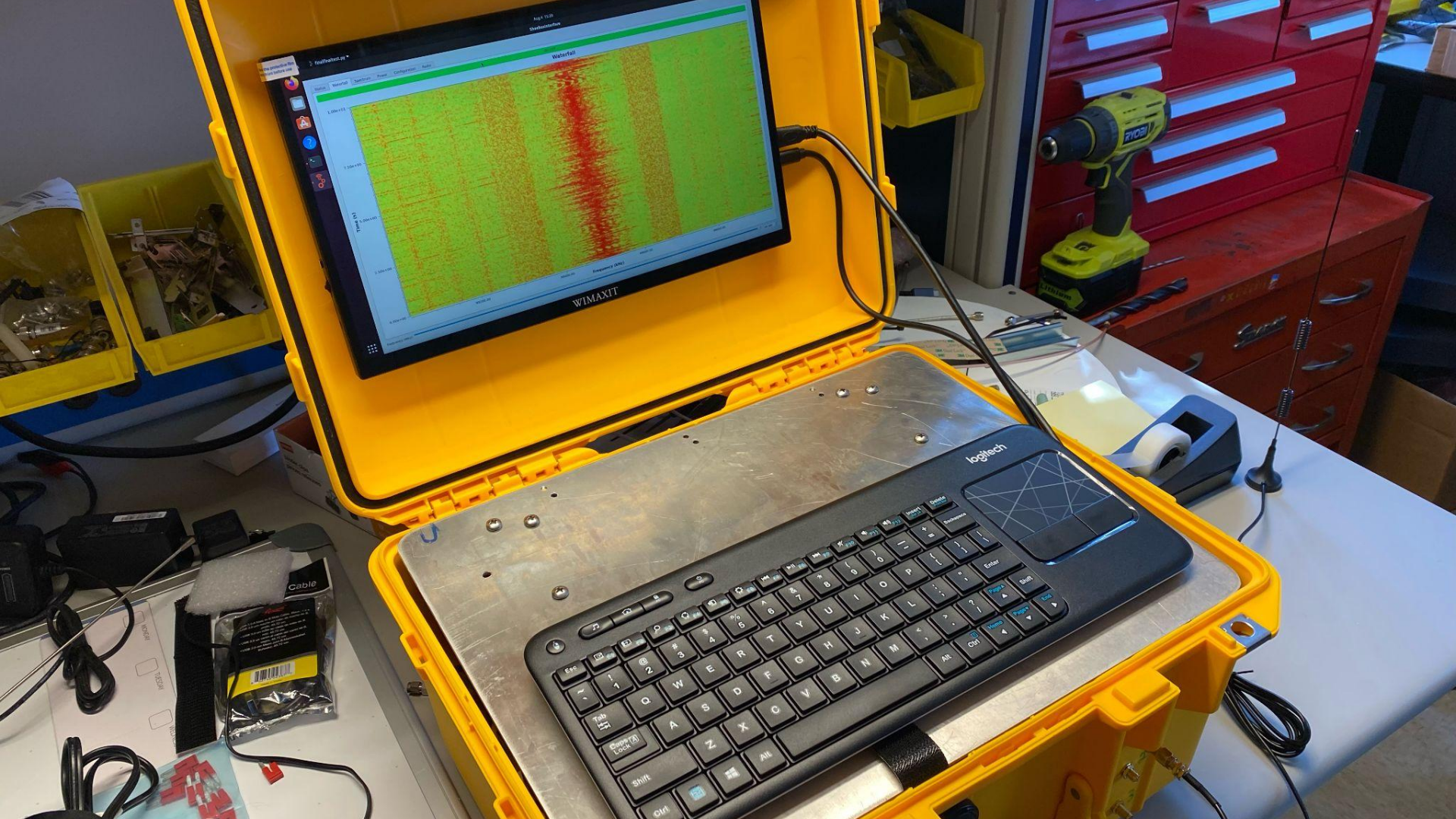
Assembling RFI hunting tools

- Portable Software Radio “Shoebox receiver”
- Two Radios (HF + UHF)
- Interactive Display and Controls




GENASUN
GV-5lithium
12.8V LiFePO4 (4S) / 5A
PANEL
BATT
LOAD
RTL-SDR.COM
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY


GV-5lithium
12.8V LiFePO4 (4S)
PANEL
BATT
LOAD
PowerStream.com
LiFePO4 Battery Pack
USRP B210


Waterfall
WIMAXIT
logitech
Cable

Satcom interference

- Known interference at ~ 467MHz

- Interferes with the Westford UHF Satcom band


Groton Transfer Station
Cow Pond Soccer Fields
Cow Pond Brook Rd
Haystack Observatory
Millstone Rd
Keyes Rd
Cow Pond Baseball Fields
Firepond
Millstone Rd
Millstone Rd
Millstone Rd
Flavell Rd
Hoyts Wharf Rd
Cow Pond Brook Rd
Hoyt St
Westford Radio Telescope
Market Vantage
Valliria Dr
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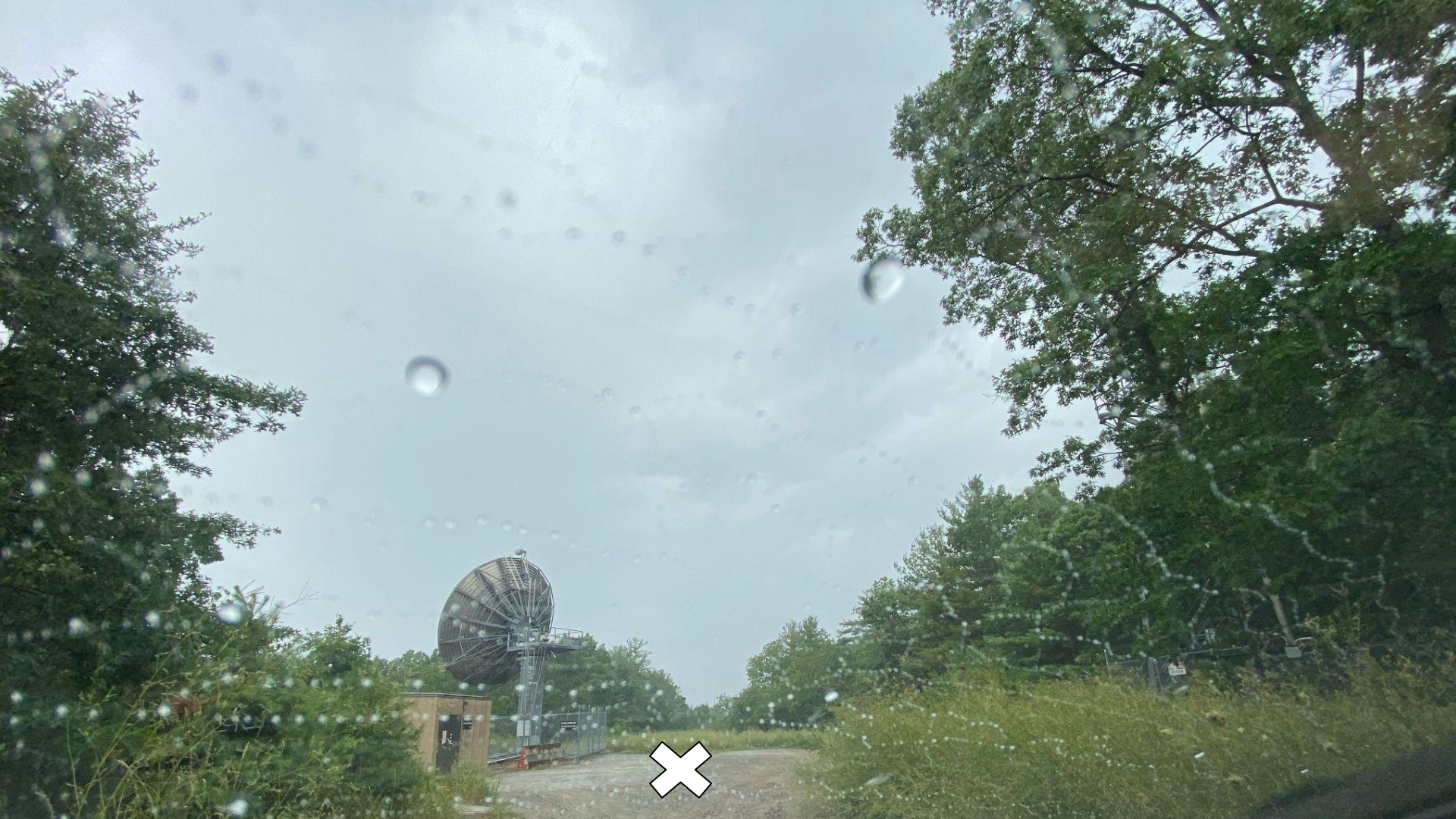

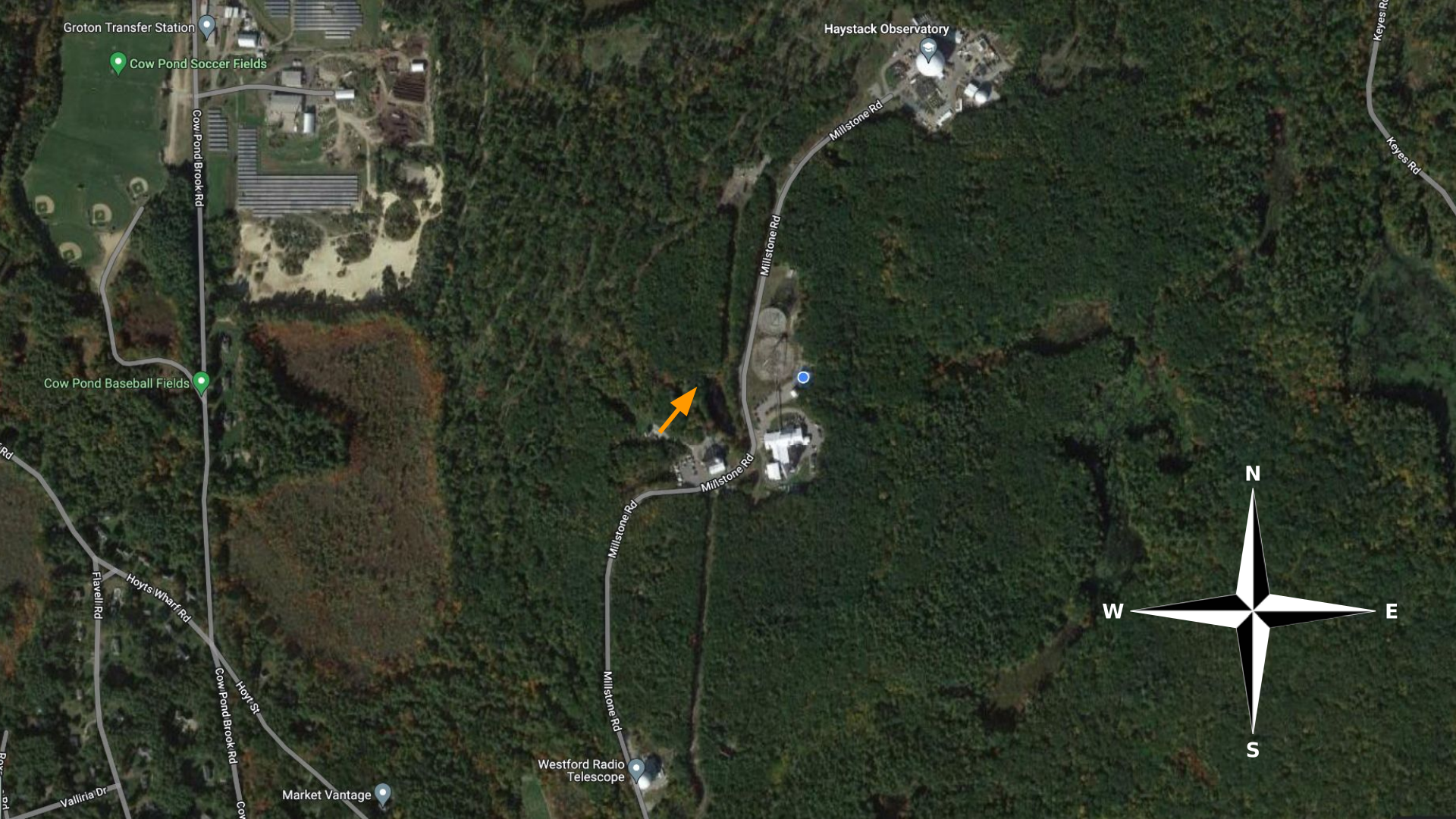
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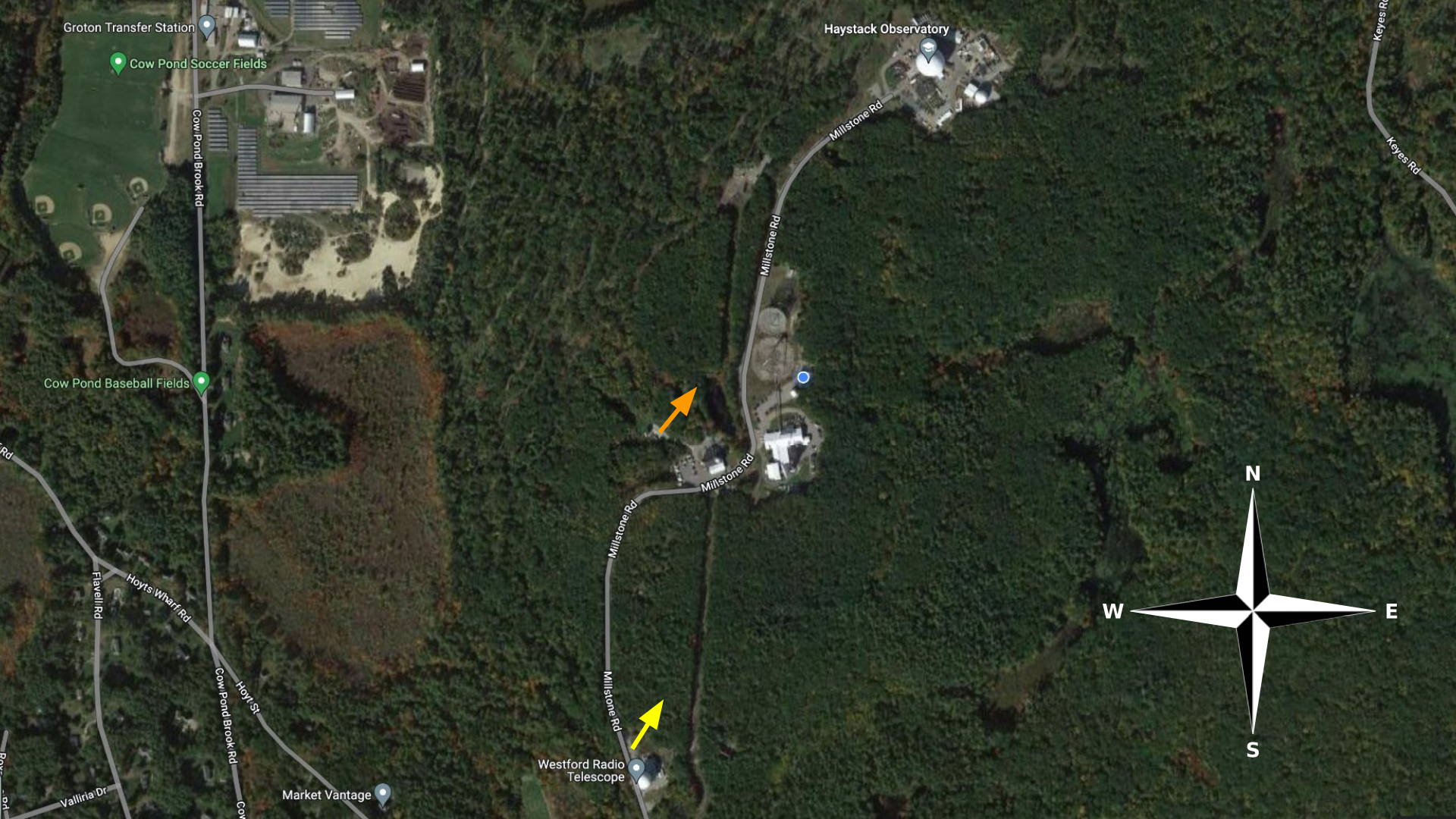
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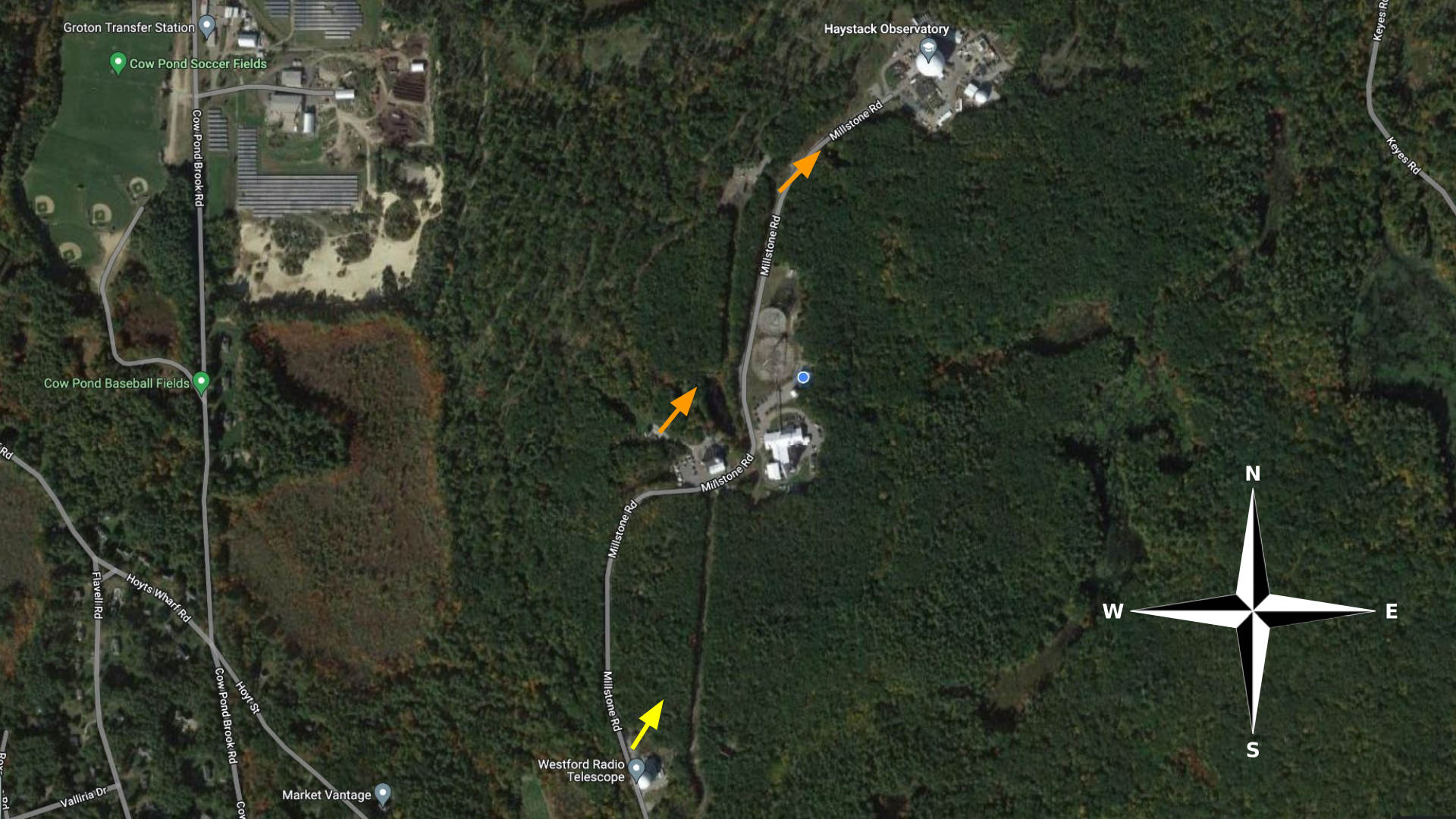
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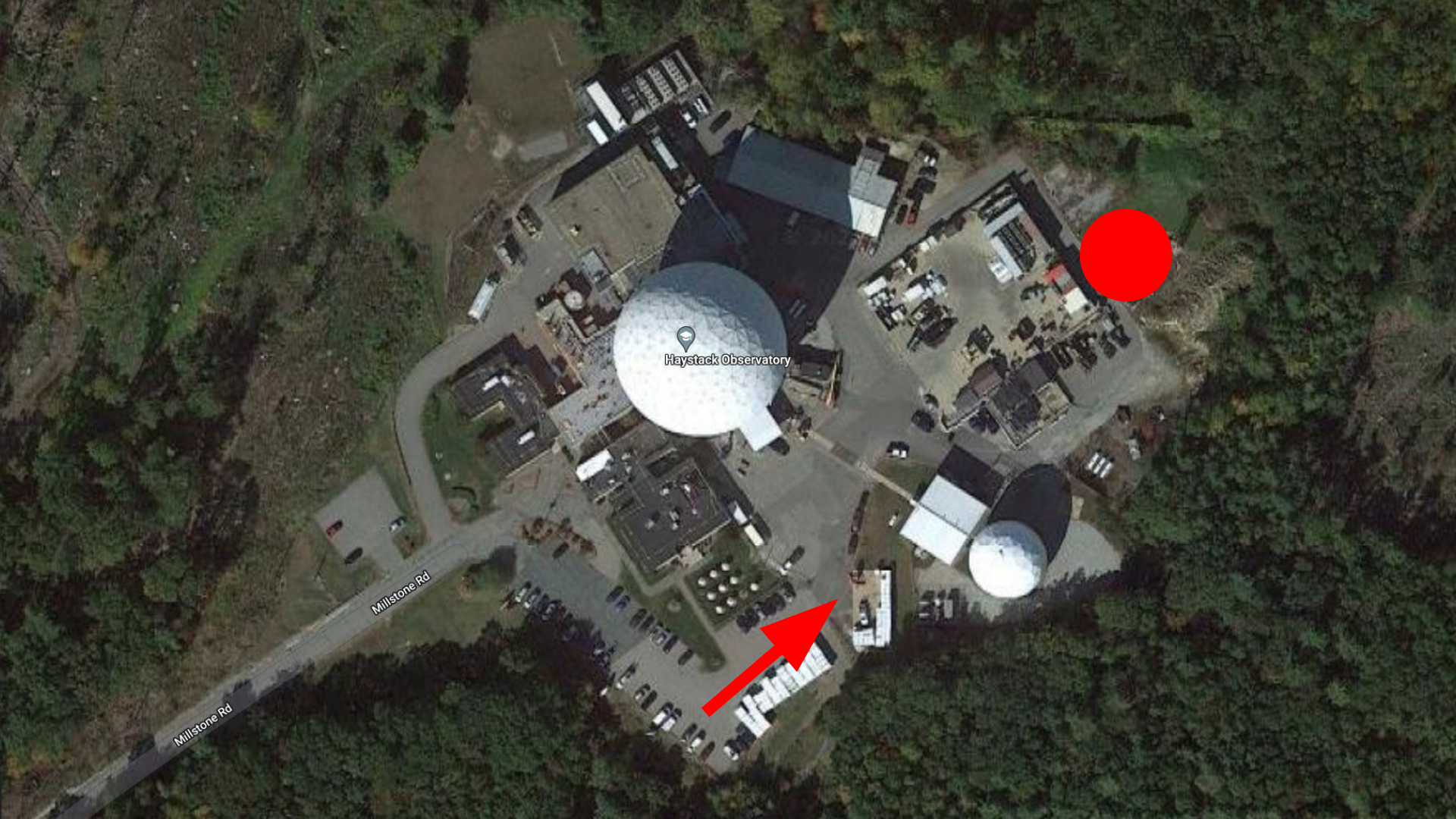
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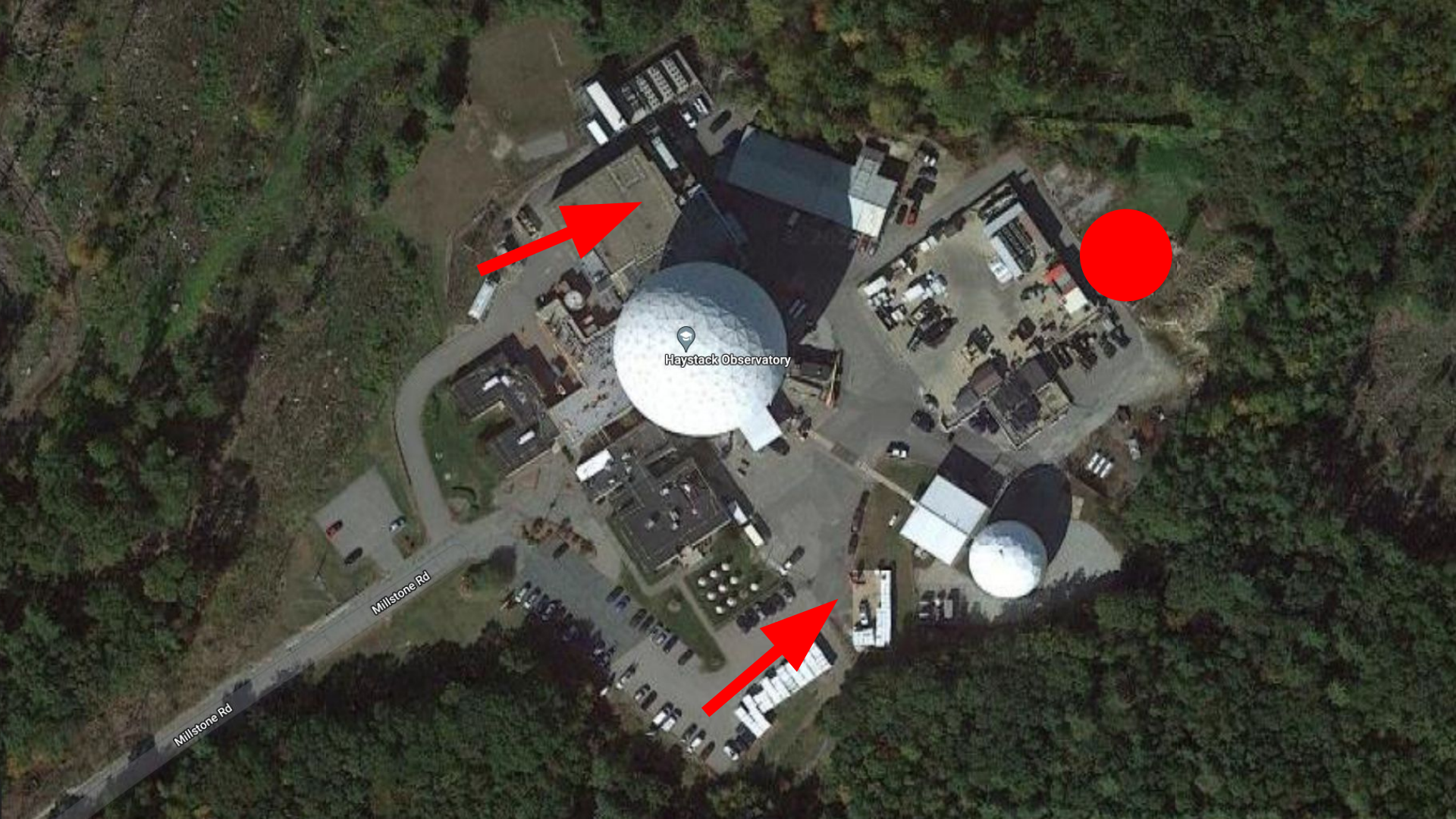
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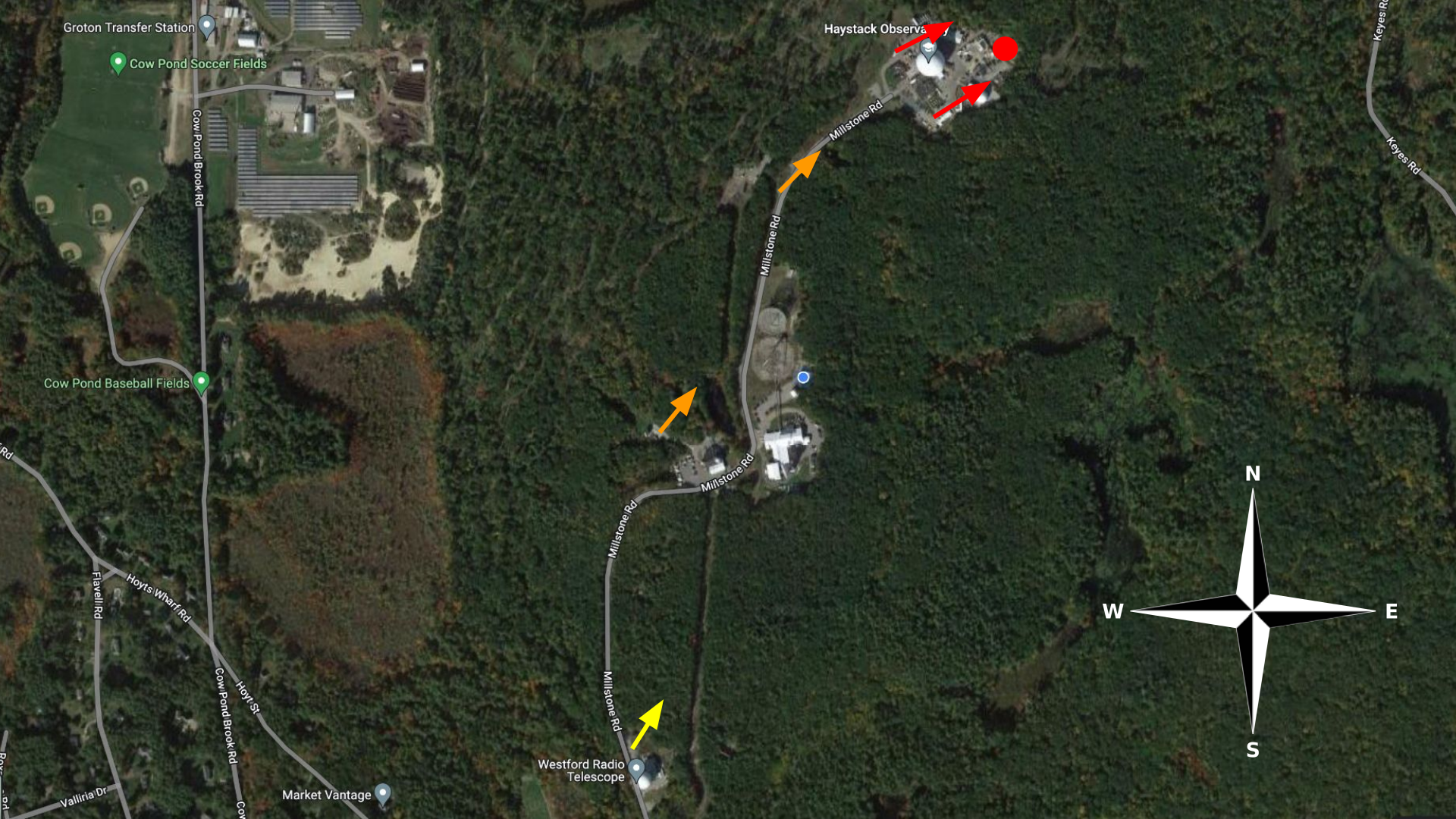
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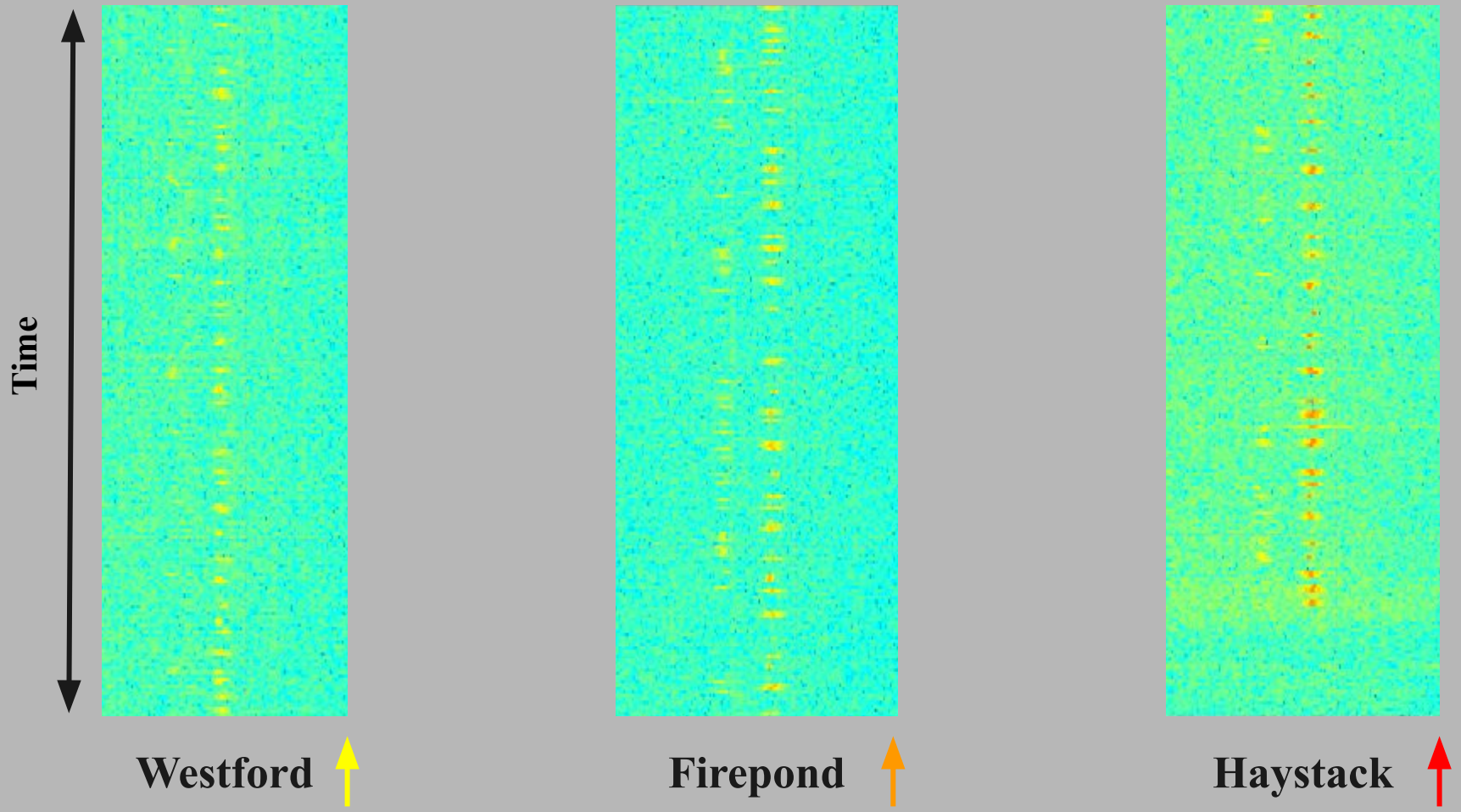
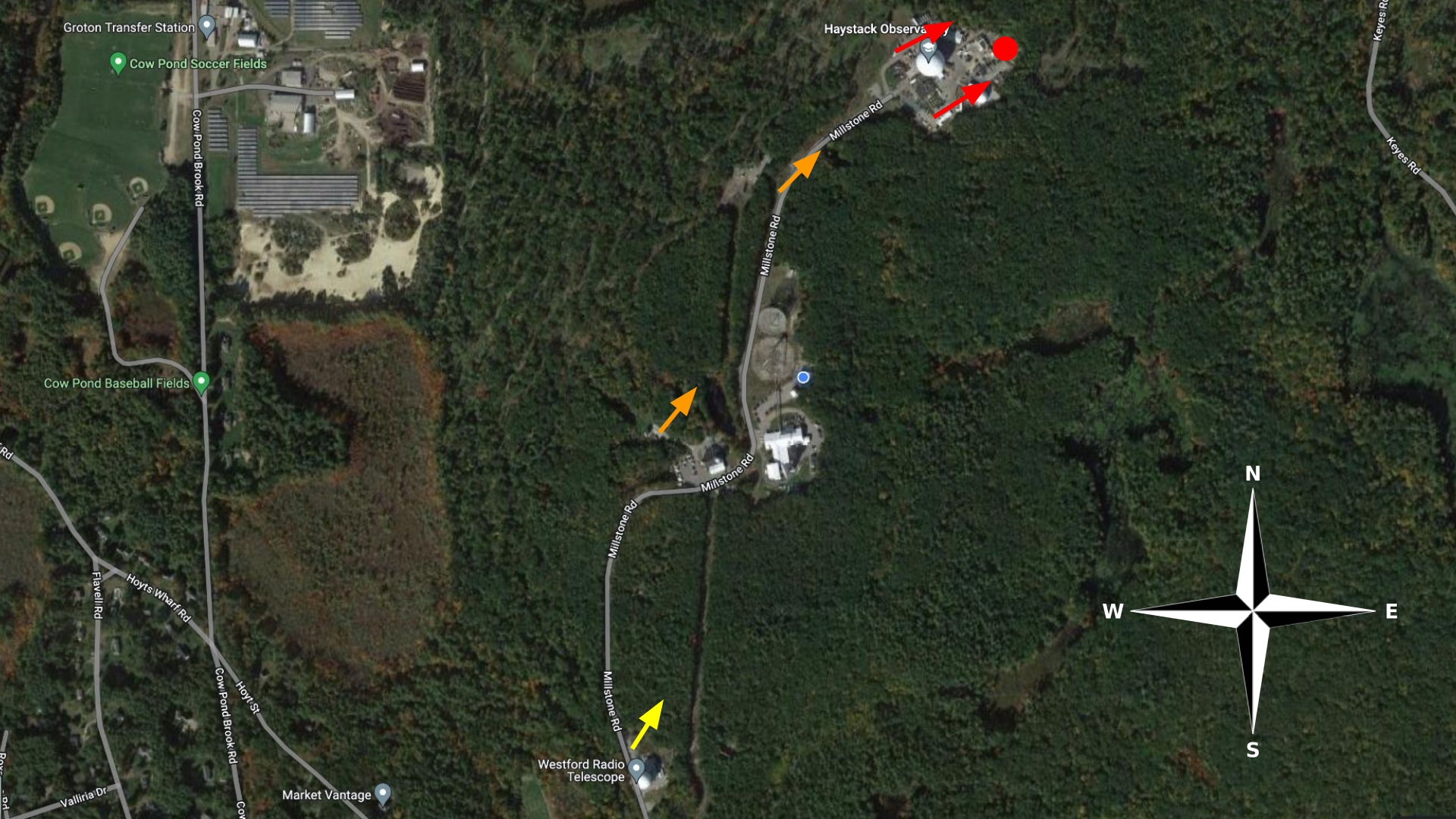

Time
Westford
Firepond
Haystack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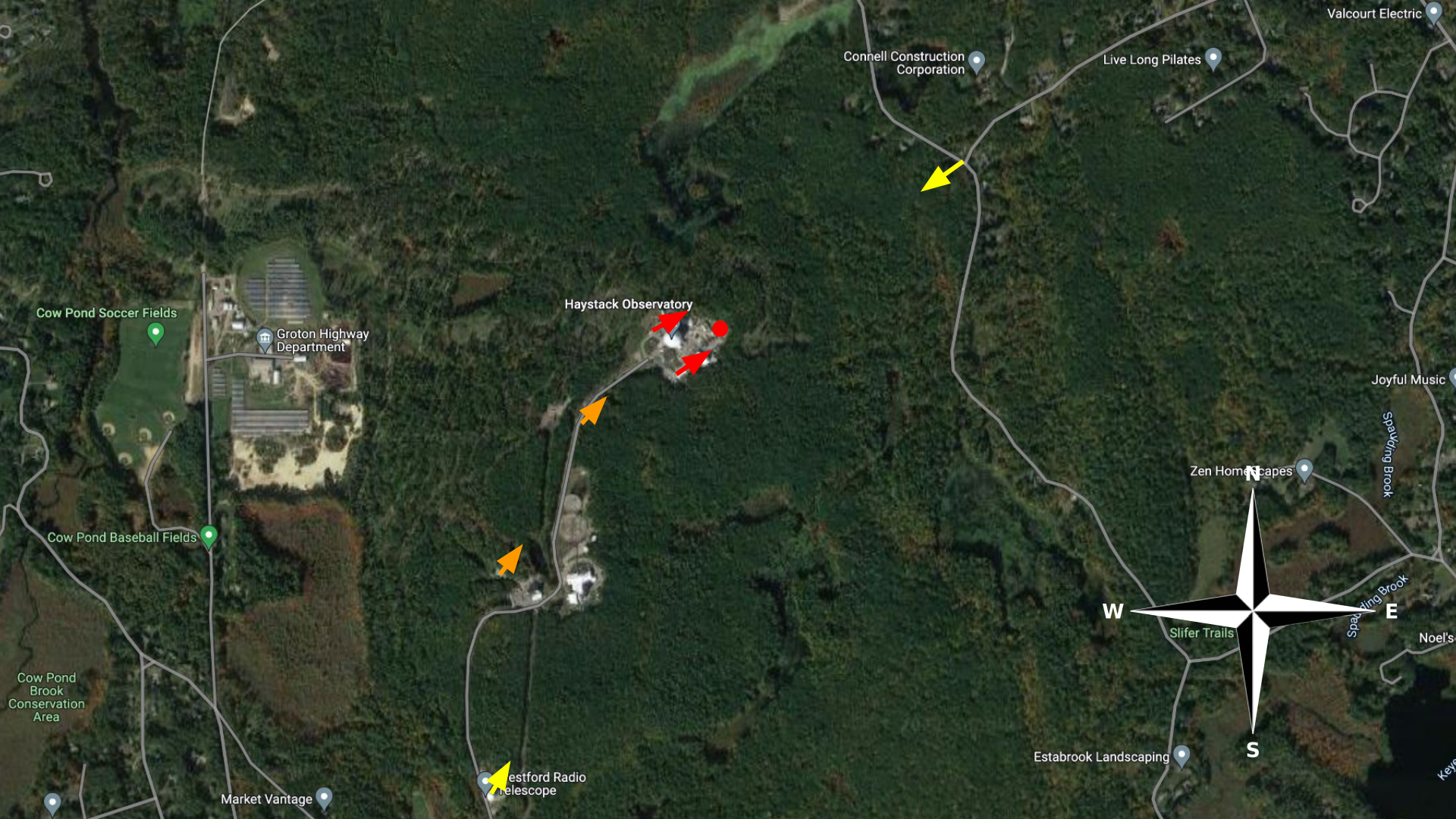
Valcourt Electric
Connell Construction Corporation
Live Long Pilates
Haystack Observatory
Cow Pond Soccer Fields
Groton Highway Department
Joyful Music
Zen Home Scapes
Cow Pond Baseball Fields
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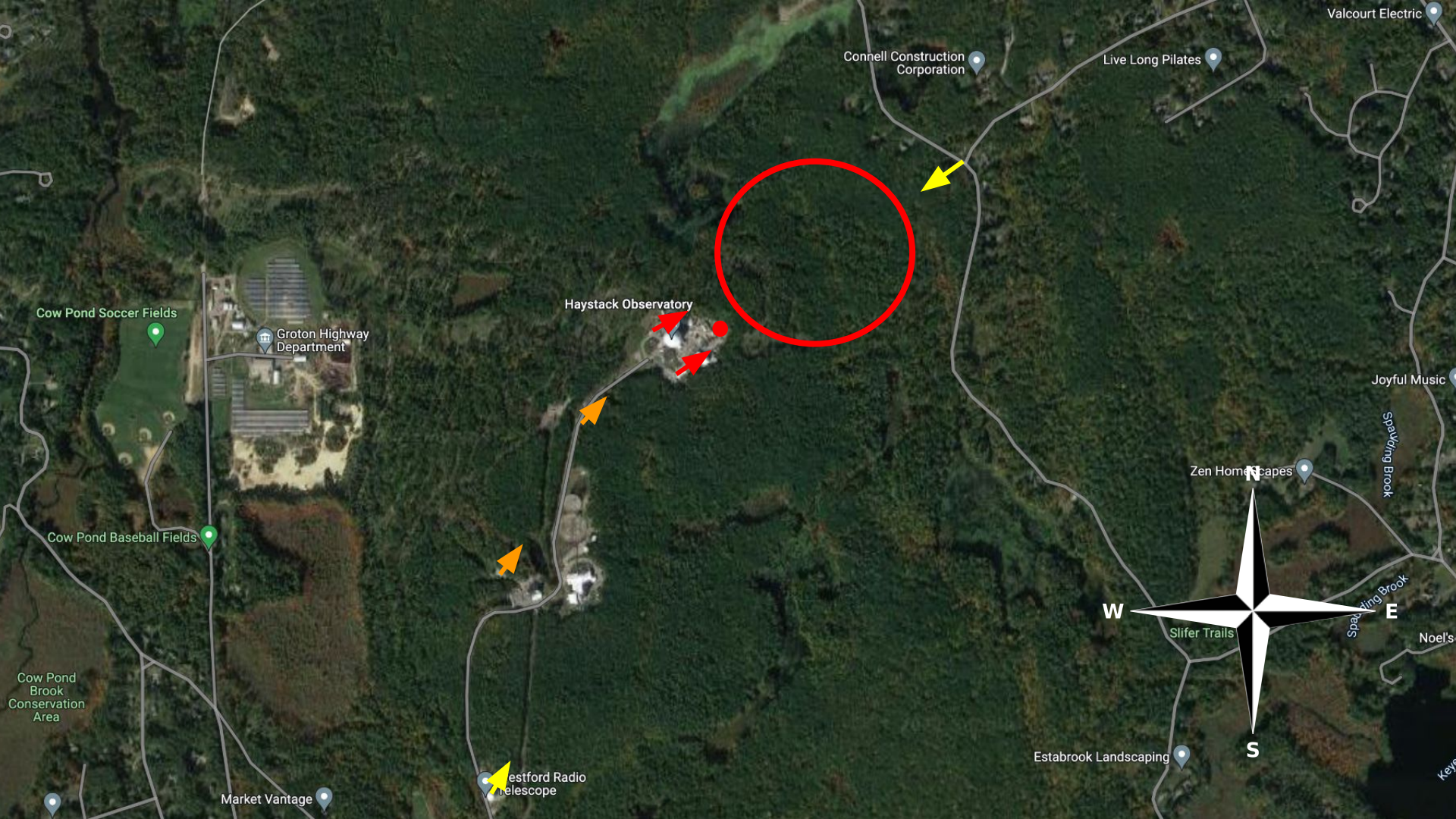
Slifer Trails
Noel's
Cow Pond Brook Conservation Area
Estabrook Landscaping
Market Vantage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Noel's
Cow Pond Brook Conservation Area
Estabrook Landscaping
Market Vantage

Dash / Plotly Data Visualization and Annotation

Data Sample

Select File:

Test1

NFFT:

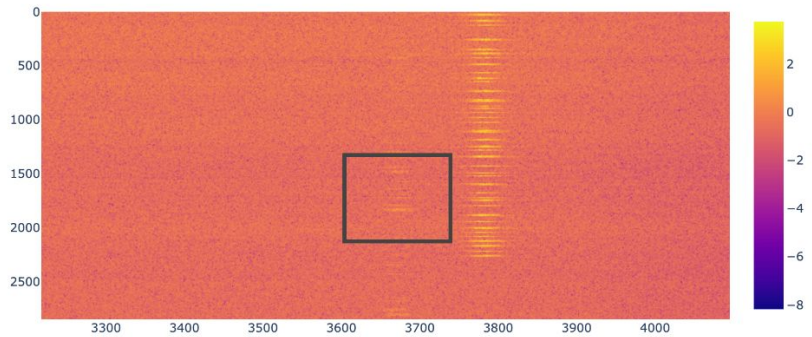
○ 512 ○ 1024 ○ 2048 ◉ 4096

Channel:

◉ ch0 ○ ch1

Metadata

Center Frequency	Gain	Sample Rate	Date	Location
467 MHz	20	912000	8-8-22	42.6820 -72.9183



Future Improvements

- Improved Data Visualization and Annotation
- A Faster Spectrum Analyzer like mode
- More efficient battery usage
- Improved construction with shielding to reduce self - interference
- Incorporation of RF and position data into RFI ‘heatmaps’

Acknowledgements

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