

MAPPING RADIO FREQUENCY FROM SPACE:

CASE STUDY TO DEVELOPING A
NATIONAL RF MAP

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U.S. GEOLOGICAL SURVEY: GEOGRAPHER

Support the Civil Applications Committee:

Facilitates the appropriate civil uses of overhead remote sensing technologies and data collected by military and intelligence capabilities, including from commercial sources.

[Civil Applications Committee Fact Sheet](#)

U.S. NAVAL RESERVE OFFICER:

National Geospatial Intelligence Agency

Command Pacific Fleet

FUN FACT:

Was a Park Ranger at Yosemite National Park 2017



The Rogers Family

OBJECTIVES :

OVERVIEW

- 05: What is Radio Frequency
- 07: Commercial Space Companies
- 08: Concept National RF Spectrum Map
- 10: National Transportation Noise Map
- 12: VIIRS Nighttime Lights Map

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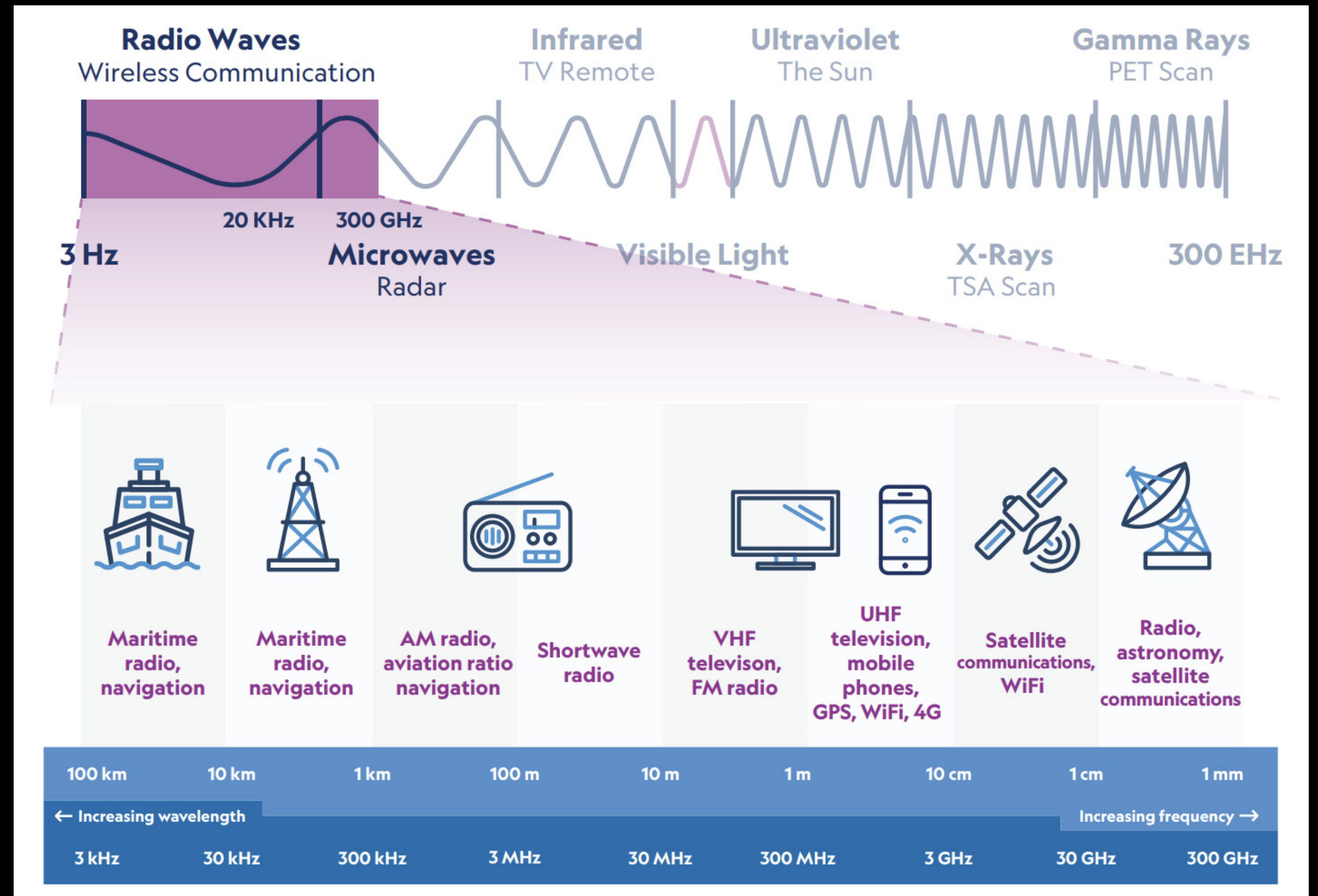
REFERENCES

- 32: Citations

OVERVIEW

RADIO FREQUENCY:

- Apart of the Electromagnetic Spectrum
- Range 3 Kilohertz (KHz) TO 300 Gigahertz (GHz)
- Federal Communications Commission and National Telecommunications and Information Administration are responsible for licensing and managing these bands for private, commercial and federal use
- RF propagation describes the behavior of electromagnetic radiation from a point of transmission as it travels through the surrounding environment.

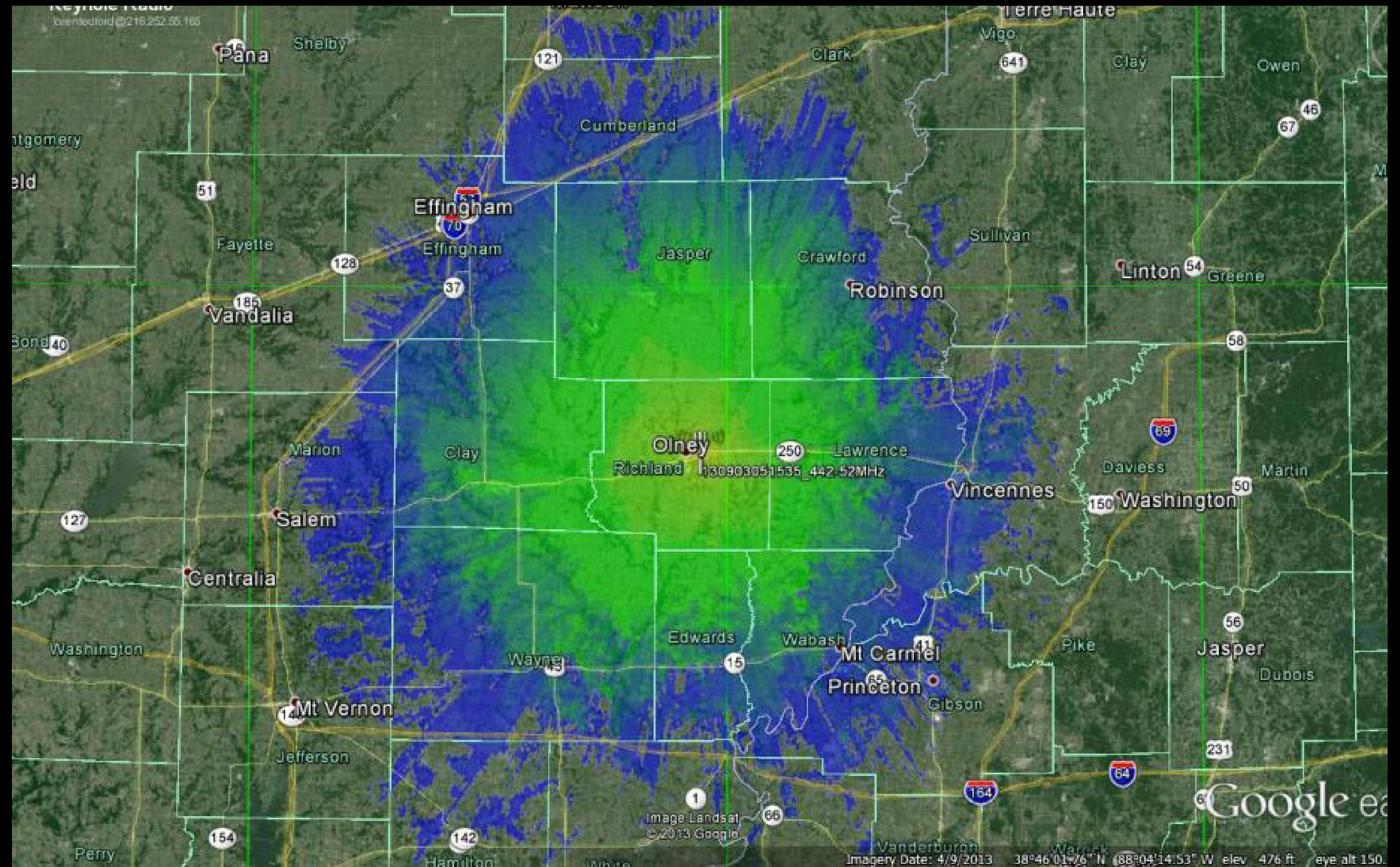


The Electromagnetic Spectrum

Credit: Infographic Spectrum - Aurora Insight

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Example of RF Propagation Map

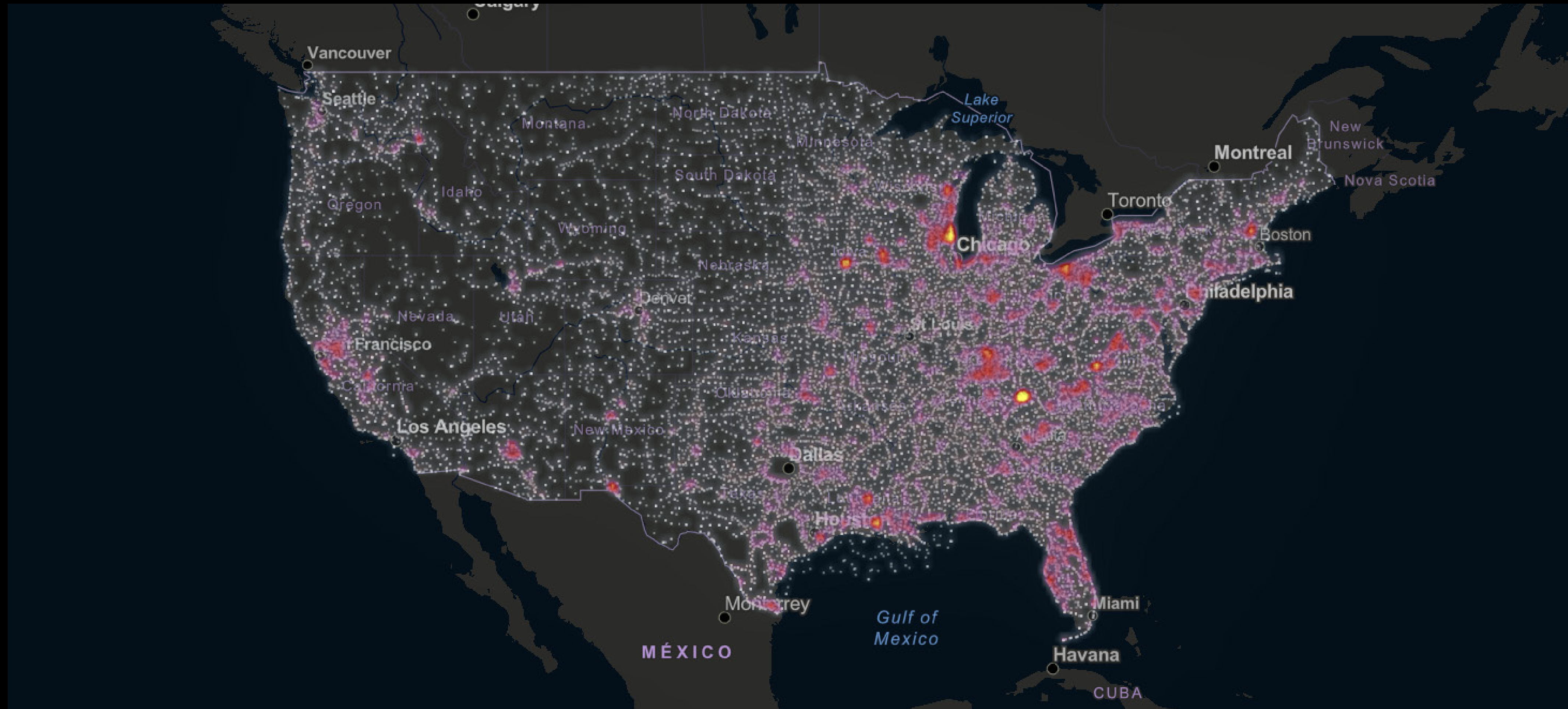
Credit: RF Propagation Map

COMMERCIAL SPACE RF SENSOR COMPANIES

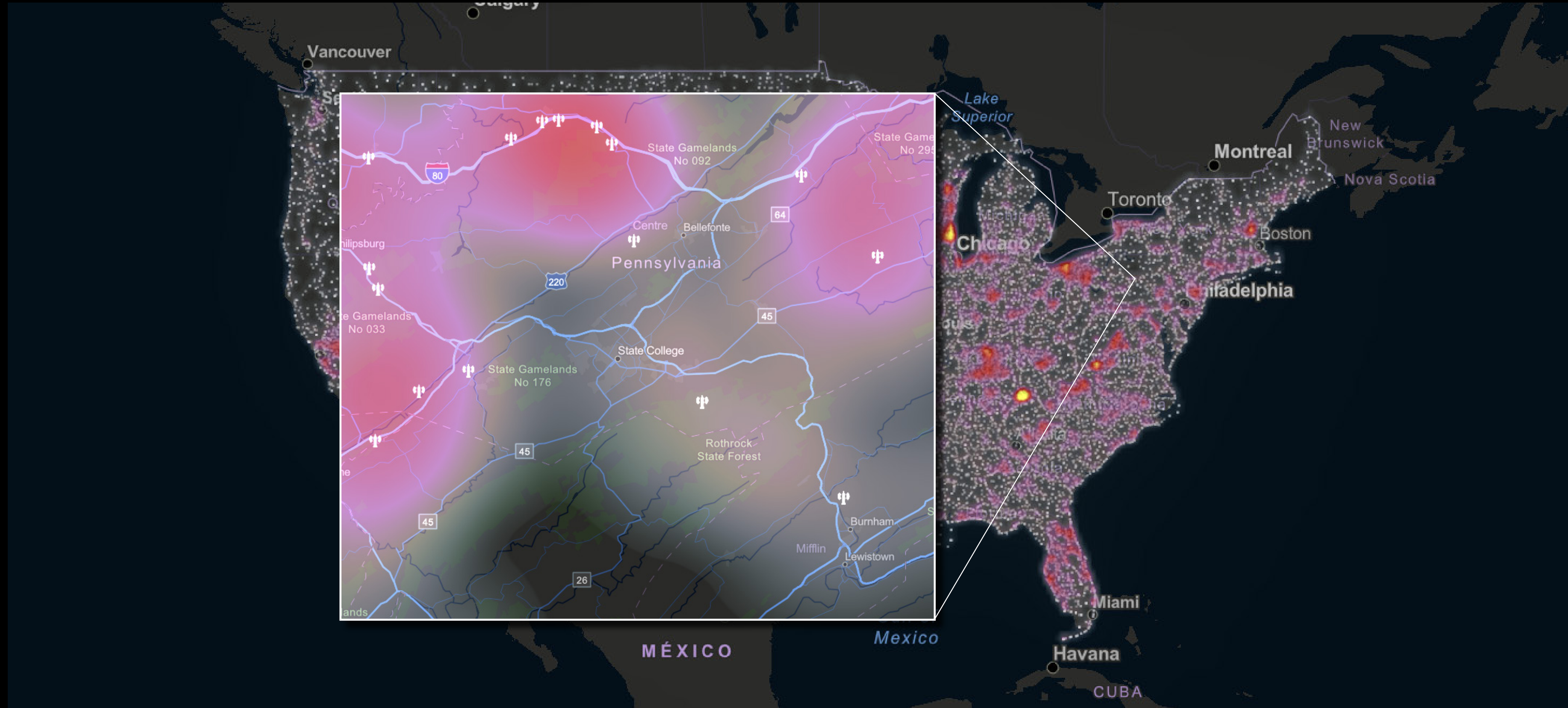


Commercial Space RF Providers

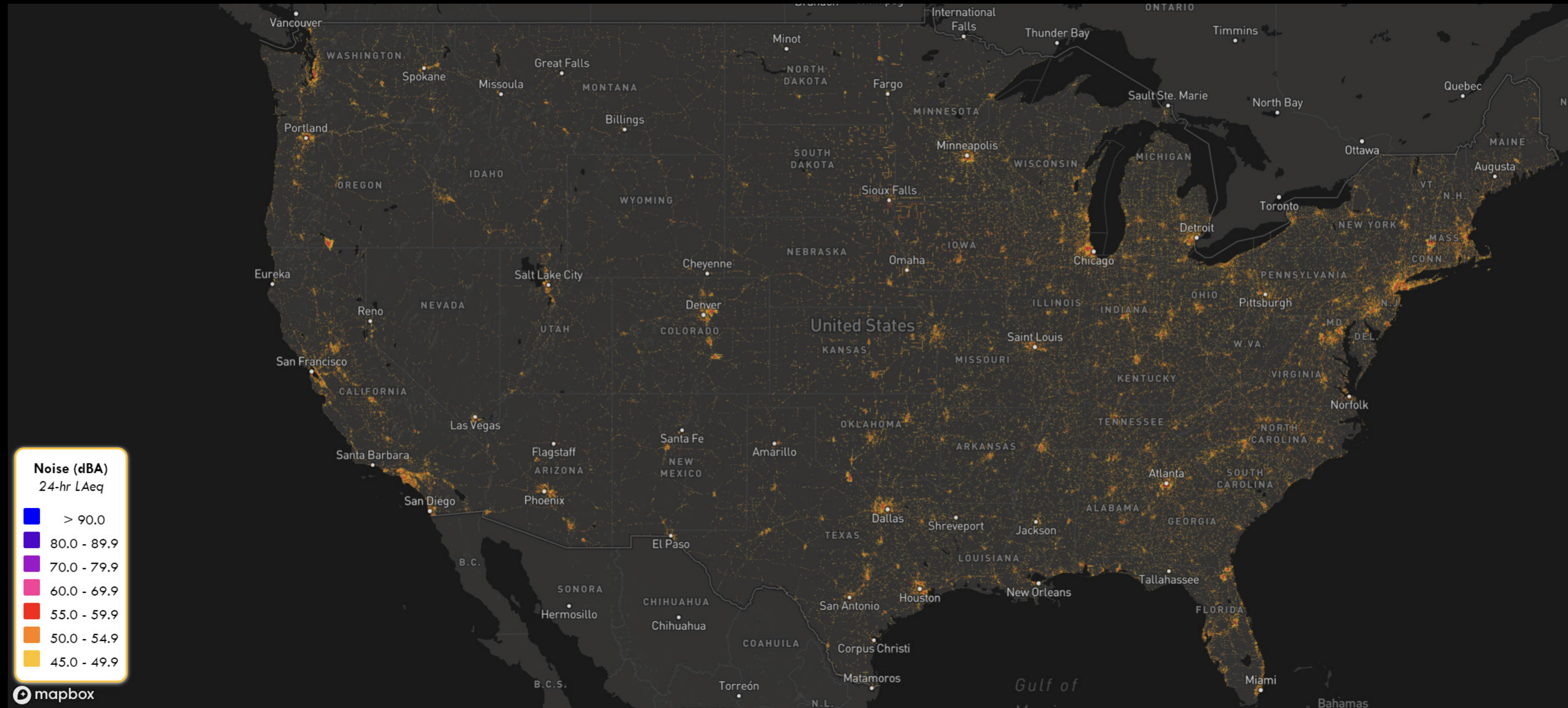
Credit: Hawkeye 360, Maxar, Aurora Insight), KLEOS, PredaSAR



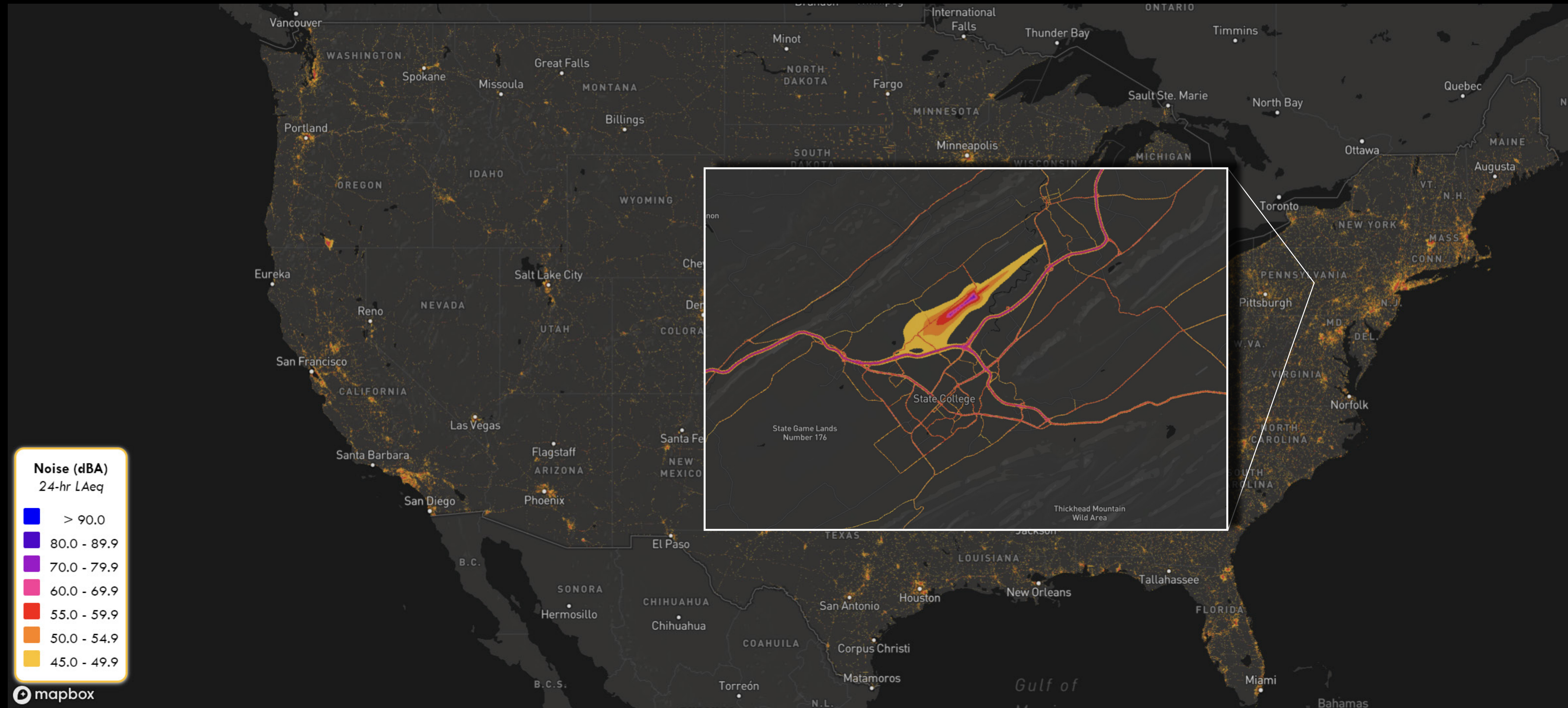
Concept: Small Scale View of National RF Spectrum Map



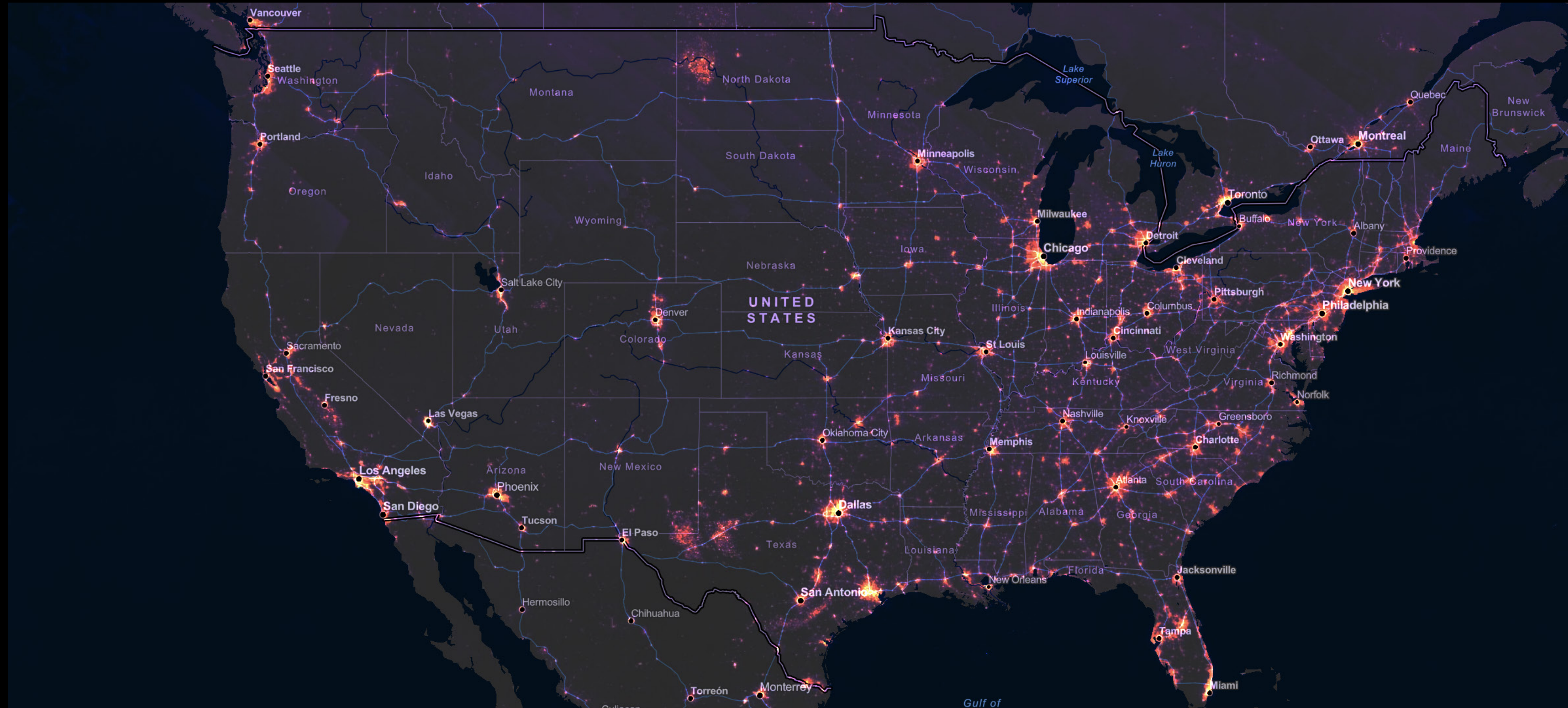
Concept: Large Scale View of National RF Spectrum Map



National Transportation Noise Map - Department of Transportation



National Transportation Noise Map – Department of Transportation
Large Scale View of State College, Pennsylvania



VIIRS Nighttime Lights Monthly Cloud-Free Composite

MAPPING RADIO FREQUENCY FROM SPACE

OBJECTIVES

OBJECTIVES:

Identify a commercial space RF sensor provider to assist in the development of a National RF Spectrum Map.

Develop a standardized process to generating a RF Spectrum Map.

Develop a report and recommendation on implementing a collection strategy and process to supporting a National RF Spectrum Map Initiative.

IDENTIFY



STANDARDIZE



REPORT

IDENTIFY:

Identify a commercial space RF sensor provider to assist in the development of a National RF Spectrum Map.

1. Develop collection requirements needed for developing a RF Spectrum Map
2. Feasibility study of current commercial space RF sensor providers, that meet the collection requirements
3. Submit collection requirements for tasking of 2-3 sample sites
4. Receive collections for 2-3 sites for post-processing

STANDARDIZE:

Develop a standardized process to generating a RF Spectrum Map.

1. Generate a heatmap of RF Spectrum across the sample sites
2. Develop a 24-hour approximate average RF spectrum across the sample sites
3. Compare traditional RF Signal Propagation, Loss, and Terrain analysis tool (SPLAT) coverage maps to Space collected RF Spectrum Map

REPORT:

Develop a report and recommendation on implementing a collection strategy and process to supporting a National RF Spectrum Map Initiative.

1. Collection strategy recommendation
2. Identify storage requirements
3. Identify processing requirements
4. Generate a post-processing standardization procedure
5. Recommend web-hosting services
6. Generate an estimated timeline of National RF Spectrum Map completion

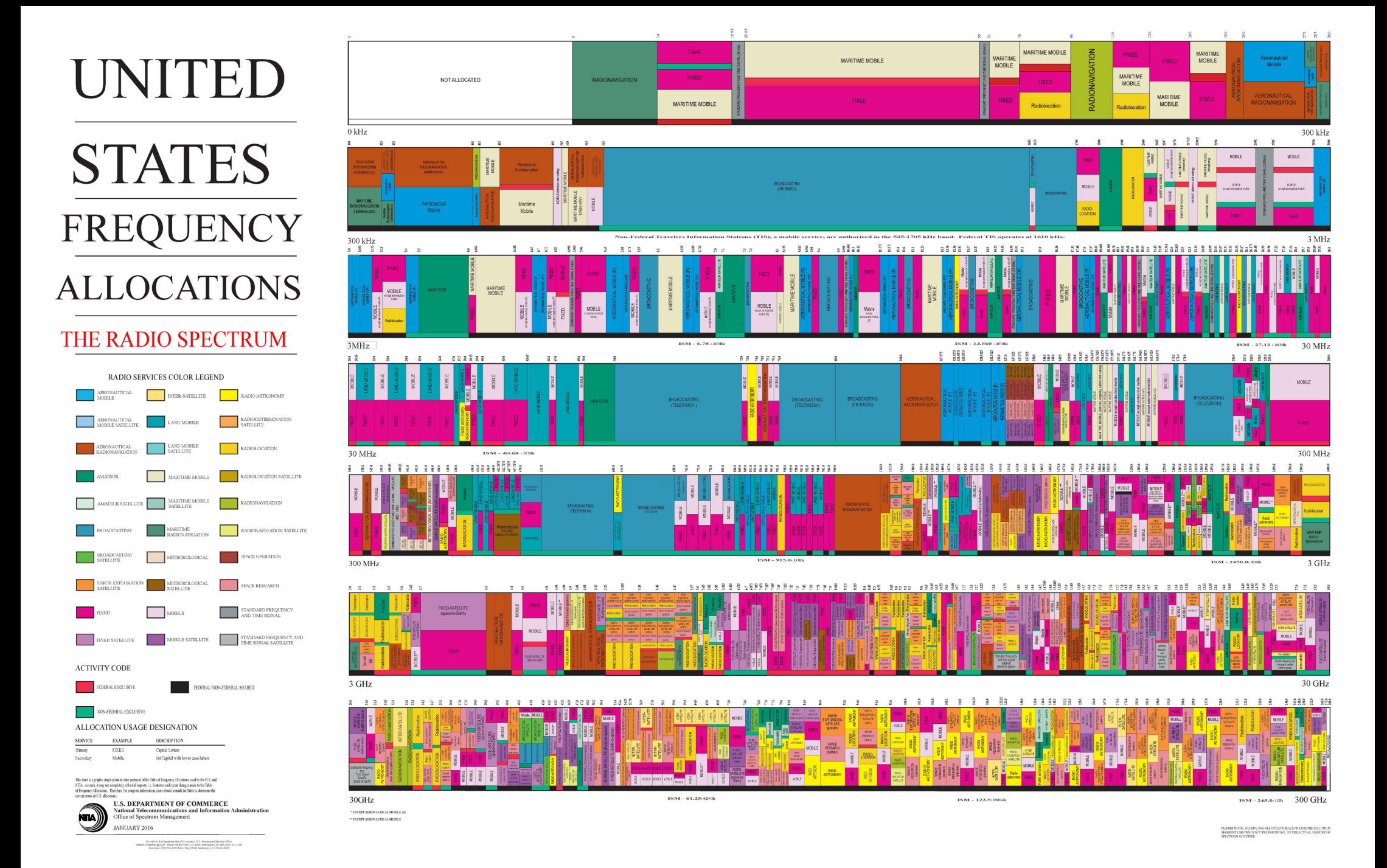
METHODS

METHODS:

Feasibility study on leveraging commercial space RF sensors in developing a RF Spectrum Map:

Assessment will be based on 3 primary factors: Spectrum Range, Maturity of Constellation, Access to sample data

1. Spectrum range between 225 MHz – 7.125 GHz (Federal Government Spectrum Use Reports – National Telecommunications and Information Administration–US Department of Commerce)
2. Operational constellation of satellites currently in orbit
3. Must have access to sample data (requested through established government process or directly with the vendor)



United States Frequency Allocations: The Radio Spectrum (Poster) – Department of Commerce

METHODS:

Develop RF Spectrum heatmaps of sample sites:

1. Leverage the Institute for Telecommunication Sciences- Propagation Modeling Website (PMW) to model the propagation of RF

****This step will produce a shapefile output****

2. Perform Raster calculations provided by the PMW output

- Sum of total number of RF transmitters within a given resolution
- Sum of RF power within a given resolution

3. Perform calculations to determine 24hr RF Spectrum average

METHODS:

Develop a report and recommendation on implementing a collection strategy and process to supporting a National RF Spectrum Map Initiative:

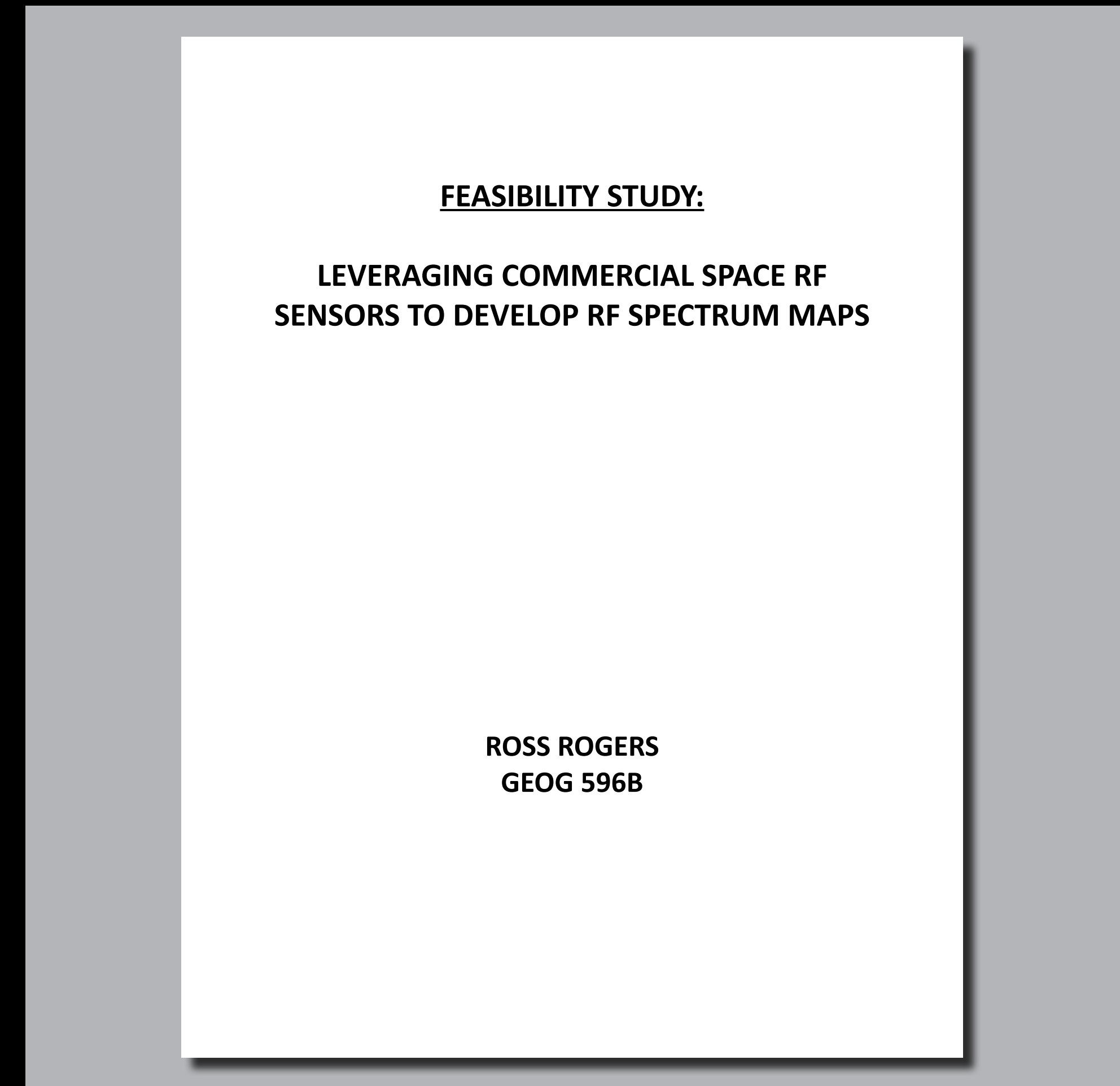
1. Determine a collection strategy
2. Identify storage requirements
3. Identify processing requirements
4. Generate a post-processing standardization procedure
5. Recommend web-hosting services
6. Generate an estimated timeline of National RF Spectrum Map completion

PRODUCTS

PRODUCTS:

The following products are intended to be produced from the research and efforts into the development of a RF Spectrum Map produced by commercial space RF sensor providers.

- Feasibility study on leveraging commercial space RF sensors in developing a RF Spectrum Map.
- Develop RF Spectrum heatmaps of sample sites.
- Develop a report and recommendation on implementing a collection strategy and process to supporting a National RF Spectrum Map Initiative.



**FEASIBILITY STUDY: LEVERAGING COMMERCIAL
SPACE RF SENSORS TO DEVELOP RF SPECTRUM MAPS**

TIMELINE

PHASES:

The following timeline has been developed to support the research and efforts into the development of a RF Spectrum Map produced by commercial space RF sensor providers.

PHASE 1 – Identify a provider

PHASE 2 – Submit collection requirements for tasking for 2-3 sites (Est. 2-4weeks)

PHASE 3 – Develop a post-processing standardization procedure (Est. 1-3weeks)

PHASE 4 – Develop a report and recommendation on implementing a collection strategy and process to supporting a National RF Spectrum Map Initiative (Est. 2-4weeks)

PHASE 5 – Present Research Findings

Start Phase 1 Fall 2022



Complete Phase 1 by end of March 2023



Start Phase 2 upon completion of Phase 1.



Start Phase 3 upon receipt of sample data.



Start Phase 4 upon completion of Phase 3.



Complete Phase 5 upon completion of Phase 4.

MILESTONES:

The following are milestones within the research and efforts into the development of a RF Spectrum Map produced by commercial space RF sensor providers.

- Identify if it's possible with the current providers constellations
- Create a collection plan or identify a previous collection sample
- Develop a standardized RF Spectrum Map process
- Develop a national collection strategy and implementation estimate

ASSUMPTIONS

ASSUMPTIONS:

The following assumptions apply to the research of developing a RF Spectrum Map.

- Commercial space RF sensor providers have mature constellations to meet collection requirements
- Access to sample data
- RF space sensor data supports the requirements to run the PMW

PROCUREMENT

PROCUREMENT:

The following are products and services identify as being key to supporting the research and efforts into the development of a RF Spectrum Map produced by commercial space RF sensor providers.

- Commercial space RF sensors provider's capability and limitations
- Sample dataset provided by the identified commercial space RF sensors provider
- Access to the PMW
- ESRI license

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QUESTIONS?

THANK YOU

