

# Protect



# Protect Agenda

- Introduction
- Guest speakers
  - Dennis Akos, UC Boulder
  - Michael Rhodes, FCC Enforcement Bureau
- Summary and PNTAB Discussion

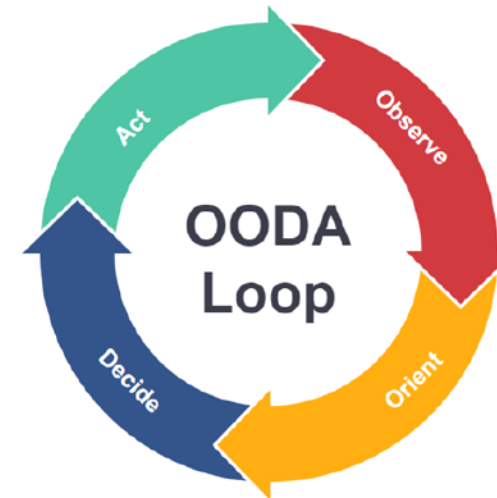


# Protect, Toughen, and Augment Civil Use of GPS

- **Protect:** Measures that prevent or remove conditions that degrade, distort, or deny GPS use:
  - Spectrum management that maintains a “clean radio frequency environment” for GPS receivers
  - Education, policies, laws, and enforcement that deter intentional interference and spoofing
  - Capabilities that promptly detect, characterize, and remove unintentional or malicious sources of significant interference or spoofing
  - Steps that ensure the GPS Space and Control Segments meet the GPS Performance Standard even in the presence of challenges (natural events, unintentional events, or malicious actions)

## Today's Focus: Responding to GNSS Interference

- **Observe** – Interference detection
- **Orient** – Collect, characterize, process interference data
- **Decide** – Whether and how to respond
- **Act** – Regulatory, legal, law enforcement, User alerts

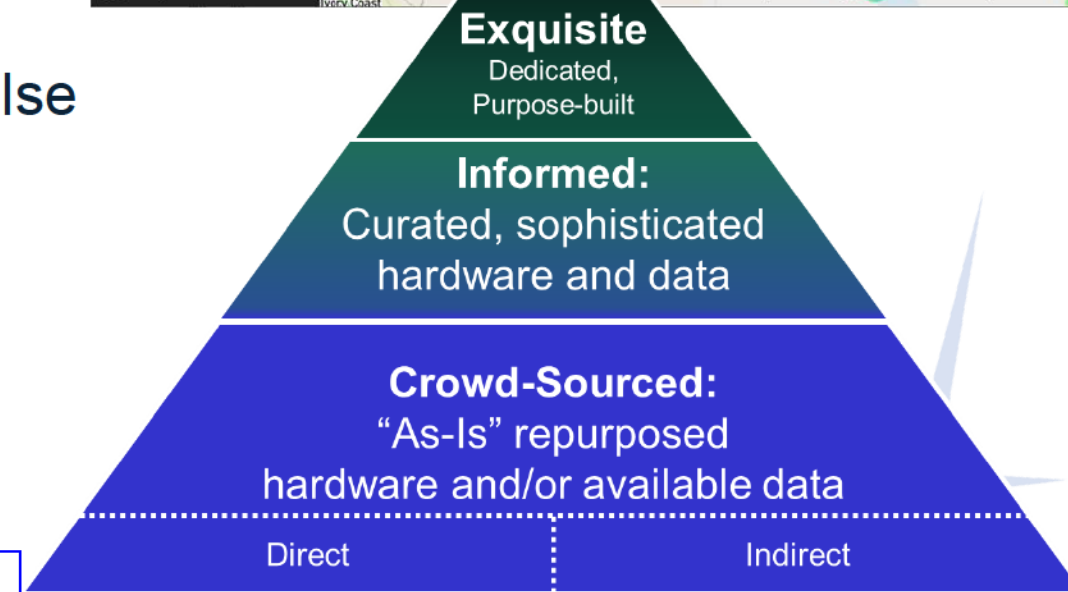
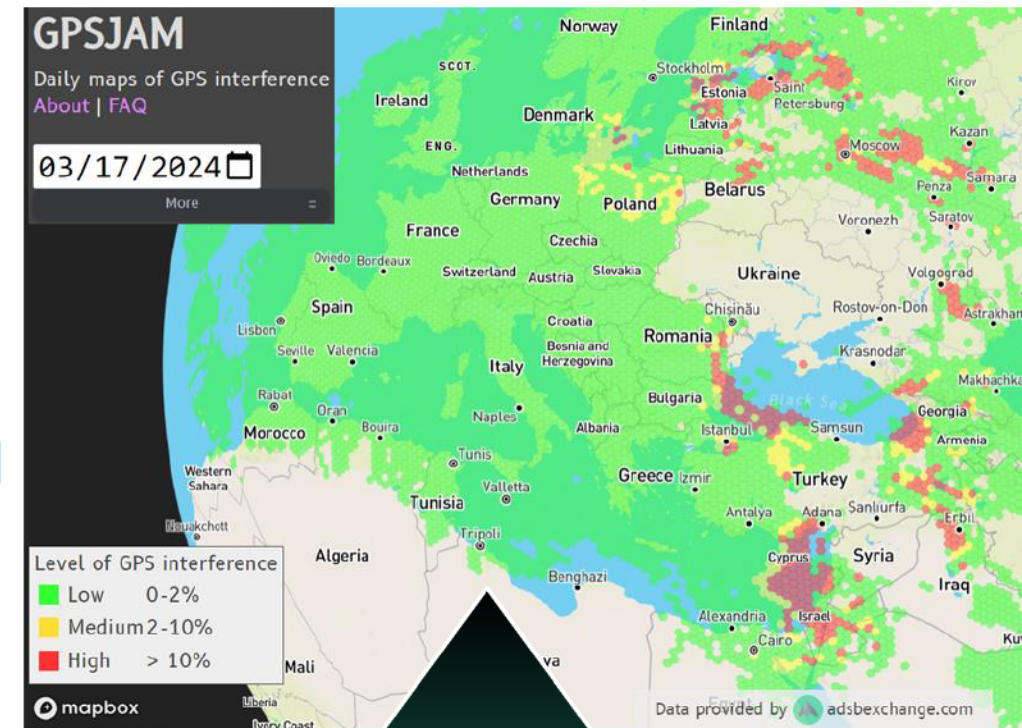


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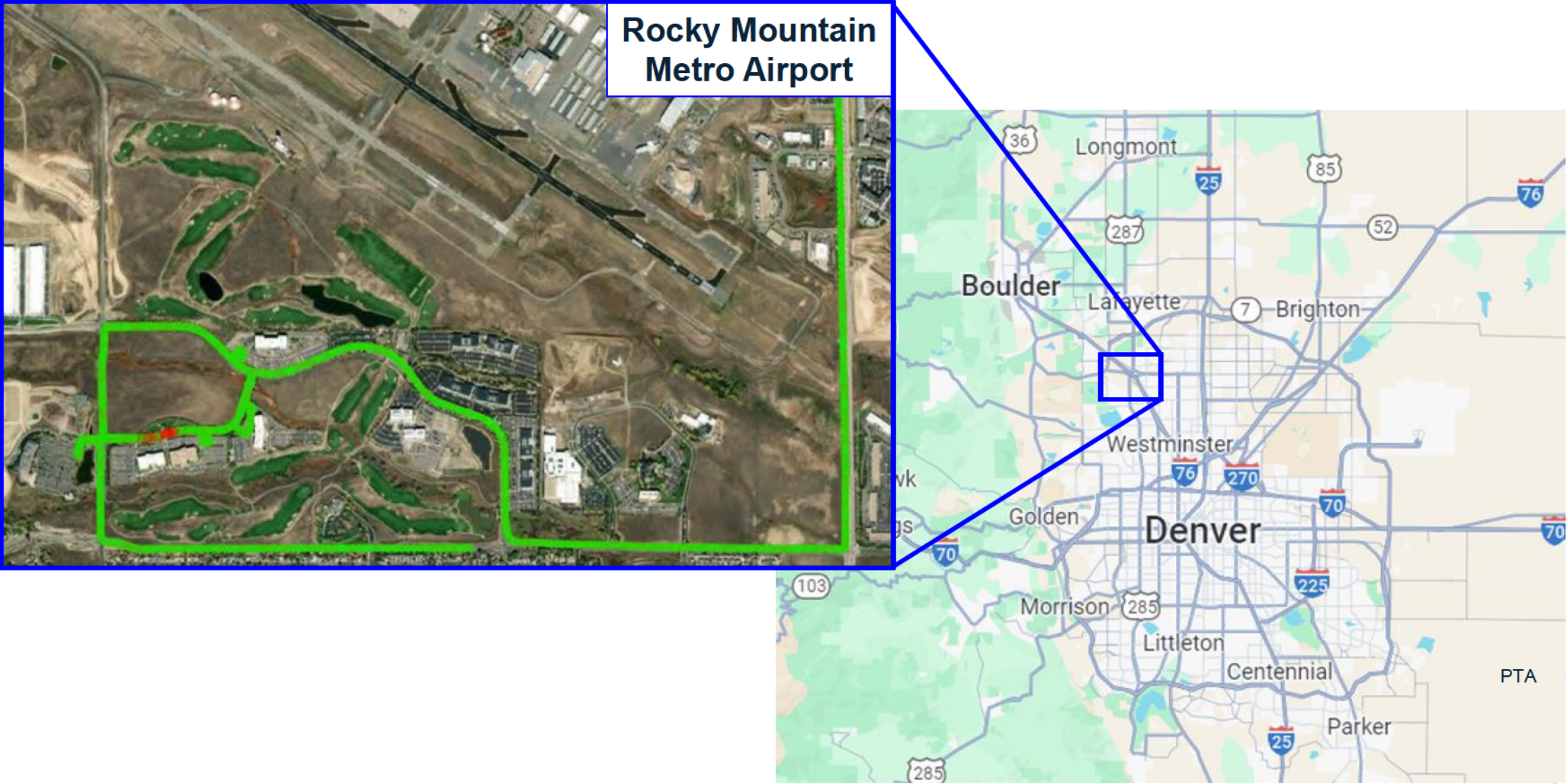
# GNSS IDM Approaches

- Dedicated purpose-built interference sensors
  - Pro's – accurate, attributable to GNSS interference
  - Con's – expense, less coverage than crowd-sourced
- Crowd-sourced from GNSS receivers
  - Pro's – broad, multiple-domain coverage; terrestrial, aviation, maritime, spacecraft
  - Con's – Significant data reduction and curation; false alarms; data privacy concerns
- User Reports
  - Pro's – direct evidence of user impacts
  - Con's – Users unlikely to attribute to interference; missed detections; lack of actionable details

**No single approach likely to be effective**



# Case Study: Broomfield, CO Easter 2024 event



# **Prof. Dennis Akos**

## **UC Boulder**

(Powerpoint Presentation)



**Mr. Michael Rhodes**  
**FCC Enforcement Bureau**



# OVERVIEW OF FCC ENFORCEMENT BUREAU OPERATIONS



**Michael Rhodes**  
Assistant Bureau Chief/Field Director



# Agenda

- Mission
- Overview
- Spectrum Enforcement Division
- Field Division
- Complaint Portal
- Statutory References
- Q&A

# Enforcement Bureau Mission

- Primary FCC unit responsible for enforcing the Communications Act, Commission rules, orders, and various licensing terms and conditions
- Established in 1998
- EB dedicates its resources to investigations and enforcement actions involving FCC-regulated services, equipment, and programs that significantly impact:
  - Consumer Protection and Privacy;
  - Data Security, Cybersecurity, and Supply Chain Integrity;
  - National Security, Public Safety, Emergency Services, and Harmful Interference;
  - Fraud Targeting Critical FCC-Funded and Administered Programs; and
  - Fair Competition and Equal Opportunities.

# Enforcement Bureau Divisions

- Telecommunications Consumers Division
- Market Disputes Resolution Division
- Investigations & Hearings Division
- Fraud Division
- Spectrum Enforcement Division
- Office of the Field Director

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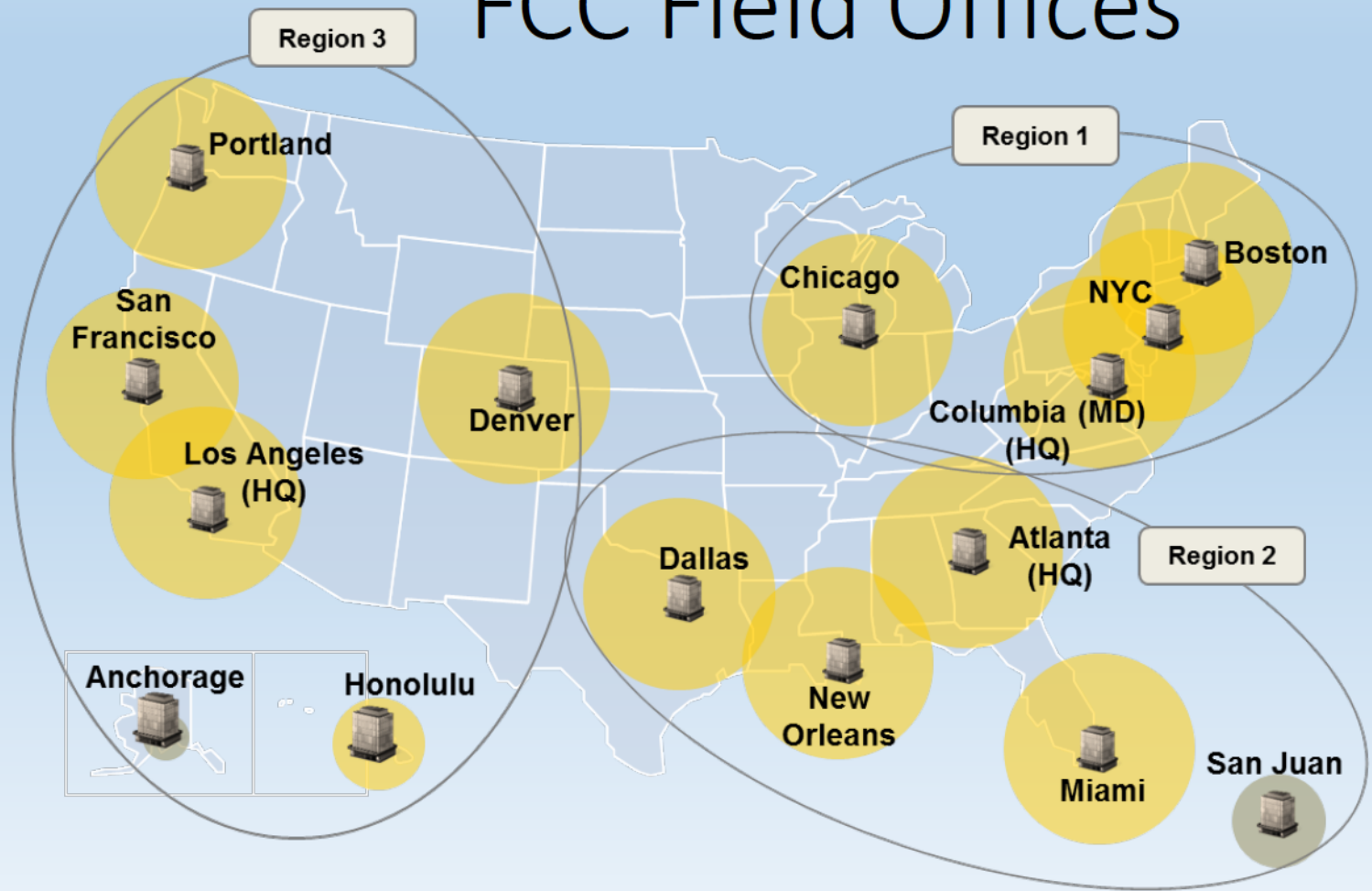
# EB – Spectrum Enforcement Division

- Resolves violations of FCC rules involving spectrum use, public safety, communications equipment, environmental and historic preservation, and technical issues. These include:
  - 911 service reliability, network outage, and related reporting obligations
  - Equipment authorization, marketing, and importation rules
  - Environmental/historical review violations involving communications towers.
  - Coordinates with U.S. Customs and Border Protection and other federal agencies on importation of unauthorized equipment.
- Report suspected violations to: [EB-SED-Response@fcc.gov](mailto:EB-SED-Response@fcc.gov)

# EB - Office of the Field Director

- Includes the FCC Field Agents in 13 Field Offices across the US and EB Equipment Development Group. Primary mission of Field Agents is to investigate complaints of interference and related issues.
- Activities involve:
  - Jammers
  - Unauthorized Operation and Intruders
  - Unintentional Interference
  - Pirate Radio Broadcasters
  - Tower Marking & Lighting
  - Support for Communications Restoration in Disasters (FEMA ESF #2)
  - National Special Security Events

# FCC Field Offices



Office (250 mi radius)

# Types of Cases

- **Public Safety cases**
  - Federal/State/Local Municipalities
  - FAA Interference including GPS
- **Commercial/Enterprise Licensee cases**
  - Cellular Telephone / Wireless Broadband
  - Broadcast / Unauthorized “Pirate”
  - Land Mobile
  - Tower Lighting (Ops Center files NOTAMs)
- **Consumer Complaint cases**
  - Broadcast Coverage
  - Interference to wireless service
  - Amateur/GMRS/CB



# GPS Interference

- FCC Ops Center is available 24/7 and receives reports of GPS anomalies from Federal Agencies (particularly FAA, DHS, USCG and DOD)
  - These reports are immediately forwarded to multiple offices within the FCC including EB
  - EB dedicated website for interference reporting from PS and ES entities
  - Consumer Complaint Center takes in reports on suspected interference
- FCC Op Center is staffed to immediately alert multiple offices within the FCC including EB
- FCC EB available to deploy and investigate credible interference reports
  - Federal agencies help to narrow down suspected GPS interference
    - Ensure 'healthy' status of GPS satellites
    - Gather and relay information on location and area of reported anomaly, time and duration of anomaly, etc.

# Examples of Tools Currently in Use

- Potomac field strength meters for AM/HF
- Tektronix and Keysight analyzers
- R&S PR200 & DDF007 mobile locate
- Narda RF Survey Meters
- FCC Long range HF-DF network
- Wi-Fi analysis tools
- Fixed monitoring equipment located at field offices
- Various antennas, amplifiers, and filters
- Custom covert mobile direction finding (MDF) vehicles



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# MDF System Overview

- Chevy Tahoe and Dodge Durango installations
- Switched amplitude AOA DF
- Homing style mobile DF system
- Covert cavity backed annular slot antennas
- 5 band automatic switching
- System designed and built at EB's EDG facility in Powder Springs, GA



# Equipment Development Group

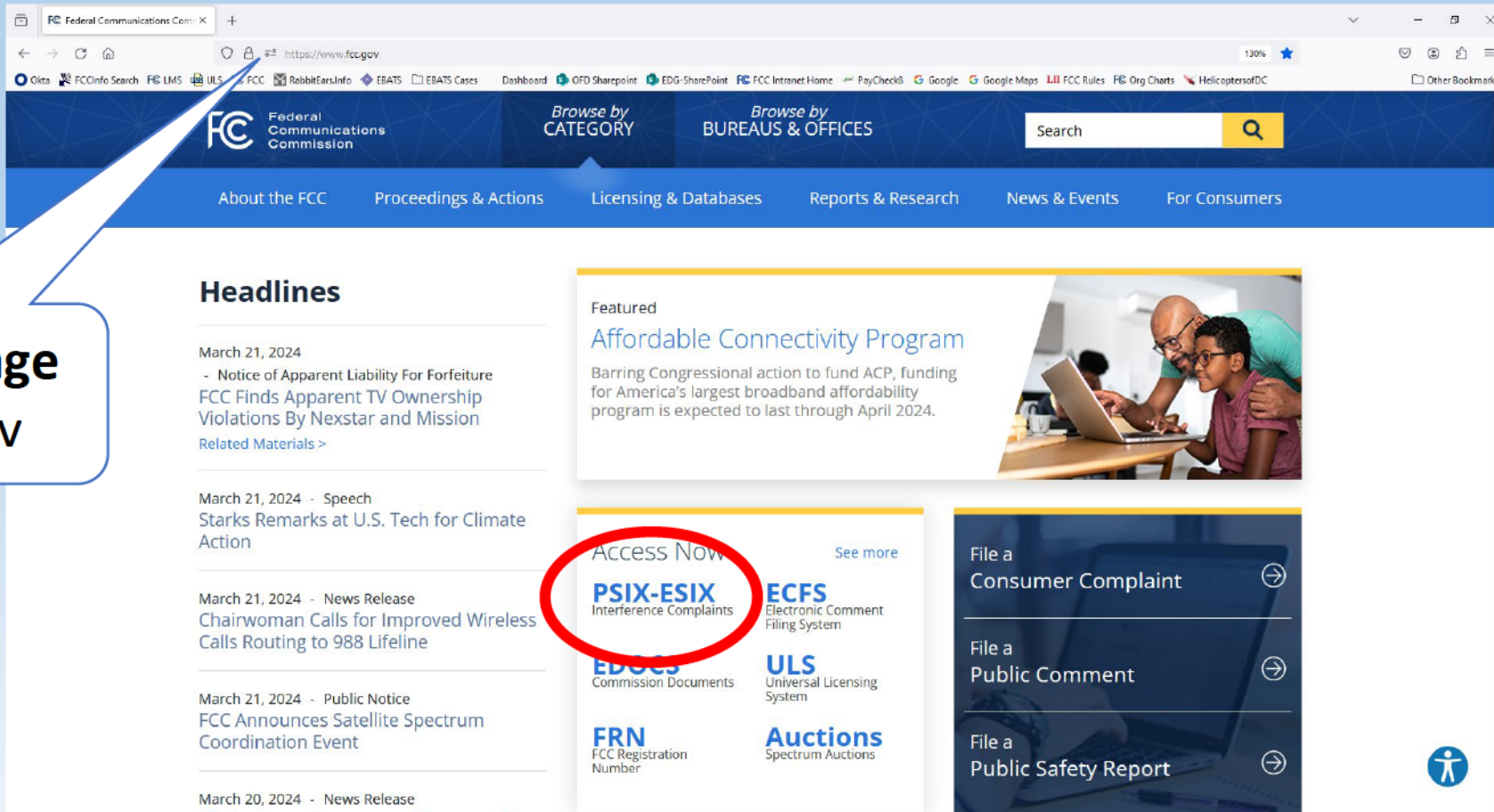
- Located in Powder Springs, GA
- Manufactures and maintains EB's mobile direction-finding fleet & other field equipment
- Capabilities
  - Custom software development
  - Electronics design and assembly
  - Mechanicals design and assembly
  - Antenna testing
  - Small quantity production



## Field Office Functions

- Executing on-scene investigations, inspections, and audits
- Responding to safety of life matters
- Investigating and resolving interference complaints
- Investigating violations in all licensee and/or operator services
- Coordinating with local, state, and federal public safety entities
- Carrying out special FCC priorities

# Complaint Portal



**FCC Home Page**  
[www.fcc.gov](http://www.fcc.gov)

## Complaint Portal (For Exclusive Use By Public Safety and Enterprise Entities)

<https://fccprod.servicenowservices.com/psix-esix>

- One-stop EB website dedicated to reporting interference with public safety radio frequencies (PSIX) and enterprise radio frequencies (ESIX)
- Complaints are directly routed to EB for investigation
- For emergencies and safety of life issues, complainants should call the FCC 24/7 Operations Center at:

**(202) 418-1122**

[FCCOPS@fcc.gov](mailto:FCCOPS@fcc.gov)

Consumers should file complaints online at the FCC's Consumer Complaint Center:

<https://consumercomplaints.fcc.gov>



## Statutory references

### **The Communications Act of 1934** - Title 47 of the U.S. Code

- **Section 301** – Requires persons operating or using radio transmitters to be licensed or authorized under the Federal Communications Commission’s rules (47 U.S.C. § 301).
- **Section 302a(b)** – Prohibits the manufacture, importation, marketing, sale, shipment, or operation of signal jammers within the United States (47 U.S.C. § 302a(b)).
- **Section 333** – Prohibits willful or malicious interference with or causing interference to any radio communications of any station licensed or authorized by or under the Communications Act or operated by the U.S. Government (47 U.S.C. § 333).
- **Section 503** – Allows the FCC, among other things, to impose forfeitures for willful or repeated violations of the Communications Act, the Commission’s rules, regulations, or related orders, as well as for violations of the terms and conditions of any license, permit, certificate, or other instrument or authorization issued by the Commission (47 U.S.C. § 503).

## Statutory references

### **Federal Communications Commission's Rules** - Title 47 of the Code of Federal Regulations (CFR)

- **Section 2.803** – Prohibits the marketing of unauthorized RF devices, including the sale or lease, or offering for sale or lease, including advertising for sale or lease, importation, shipment, or distribution for the purpose of selling or leasing or offering for sale or lease (47 C.F.R. § 2.803).
- **Section 2.807** – Provides for certain limited exceptions, such as for use by authorized U.S. government agencies (47 C.F.R. § 2.807).

## Statutory references

### **The U.S. Criminal Code - Title 18 of the U.S. Code**

**(Enforced by the U.S. Department of Justice or the U.S. Department of Homeland Security)**

- **Section 545** – Prohibits the importation of illegal goods into the United States; subjects the operator to possible fines, imprisonment, or both (18 U.S.C. § 545).
- **Section 1362** – Prohibits willful or malicious interference to U.S. government communications; subjects the operator to possible fines, imprisonment, or both (18 U.S.C. § 1362).
- **Section 1367(a)** – Prohibits intentional or malicious interference to satellite communications, including GPS; subjects the operator to possible fines, imprisonment, or both (18 U.S.C. § 1367(a)).

### **State-level Intentional Interference laws**

- Some states may also have their own laws. The FCC enforces federal laws.

# Thank You!

Michael Rhodes

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FCC Operations Center

(202) 418-1122

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<https://fccprod.servicenowservices.com/psix-esix>

# Protect Conclusion



# National PNT Advisory Board Protect, Toughen, Augment Subcommittee Recommendation 4 May 2023

## Title of Recommendation: Commitment to Prompt Removal of Significant Interference to GPS Reception

### Finding:

Significant events of terrestrial-based interference to GPS reception continue to occur. Although most to date have been accidental, intentional ones are possible. Despite decades of concern, there is no nationwide capability to detect and remove such significant interference sources, and an insufficient sense of urgency to field such a capability. The DoT is undertaking an effort to detect and locate significant interference sources. Removing interference, however, is a complicated interagency process that needs to be streamlined.

### Recommendation:

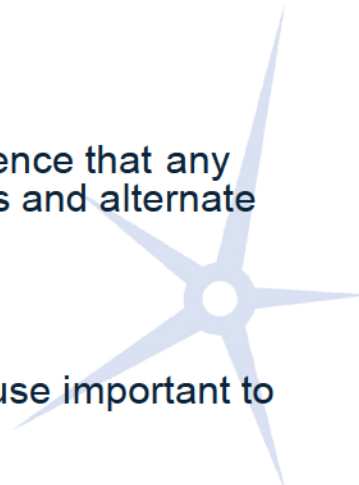
EXCOM publish a commitment this year, stating that **by 2026 no significant terrestrial-based interference event affecting GPS reception in the United States will persist for more than one day**, because the DoT-led interference detection process, combined with a streamlined removal process instituted under EXCOM leadership, will have stopped the interference.

### Reasons for Recommendation:

Critical infrastructure users of GPS are being encouraged to toughen and augment in case of GPS interference. Confidence that any interference events will be of limited duration will encourage and enable adoption of practical and cost-effective backups and alternate procedures.

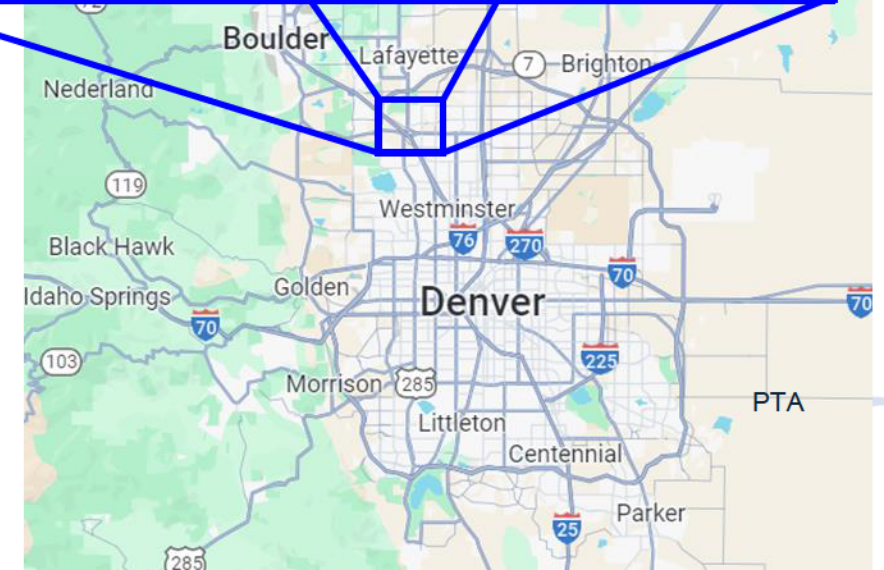
### Consequences of No Action on the Recommendation:

The U.S. will continue to be subjected to significant, long-lasting terrestrial-based interference events that disrupt GPS use important to economic activity and safety of life.



# Case Study: Broomfield, CO Easter 2024 event

Event	Elapsed Time
User Observed Interference (27 Mar 07:00)	
Interference reported to NAVCEN Website	1 day 12 hrs
Aerospace SPEAR Team notified	2 day 05 hrs
UC Boulder notified by SPEAR Team	2 day 07 hrs
UC Boulder deployed sensors	3 day 05 hrs
UC Boulder reports findings to SPEAR Team	3 day 09 hrs
UC Boulder re-deployed sensors	4 day 05 hrs
UC Boulder localized likely source location	4 day 07 hrs
SPEAR Team called FCC	5 day 02 hrs
FCC on-site response	6 day 01 hrs
Interference stopped (3 Apr 15:00)	7 day 08 hrs



Sun	Mon	Tue	Wed	Thu	Fri	Sat
24-Mar	25-Mar	26-Mar	27-Mar	28-Mar	29-Mar	30-Mar
31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr

\*Spectrum EMI, Awareness and Response (SPEAR)

# Summary and Discussion

- Are current IDM practices effective?
- How can IDM performance be improved?
- Some candidate metrics for IDM performance
- Candidate PNTAB “Protect” recommendations





# Candidate IDM Performance Metrics

- Accuracy
  - Emitter 3D location and motion
  - Waveform characterization, power, directivity
- Availability – ‘Always on’ to minimize missed detections
- Continuity – detect trends, ‘patterns of life’
- Integrity
  - False alarm, missed detection rates
  - Resistance to external manipulation
- Coverage
  - Geographic – US, global
  - Spatial – all GNSS user domains: terrestrial, aviation, maritime, space
  - Spectral – all GNSS and adjacent bands
- Timeliness
  - Time to alert users, time to stop interference



# Candidate PNTAB Protect Recommendations

- Implement SPD-7 IDM Strategy
  - Responsible Organization(s): [DOT, others?]
- Establish and document IDM performance metrics
  - Responsible Organization(s): [TBD]
- Deter use of privacy jammers at the DMV (e.g. Commercial DL license training, exams)
  - Responsible Organization(s): [TBD, DOT?]
- Include interference 'heat maps' on potential GPS HARS server
  - Responsible Organization(s): [TBD, USSF?]

