International Committee on
Global Navigation Satellite Systems

Interference Detection Concepts

Disclaimer

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Interference Detection

- As the society is more dependent on GNSS as a source of PNT, the interference detection and possible mitigation is now more seriously being considered.
- In many parts of the world, experimental/trial projects of Interference Detection are now on-going

Interference Detection Concepts

- Geometry defines the coverage and drives the required technology
  - Local area (airport, seaport, bank, brokerage)
  - Transportation route (road, railway, coastline, canal)
  - Large area (town, city, country)
- Enforcement authority also drives decisions
  - Federal, state, local government or private entity
- No one approach is best for all requirements
  - Requirements include deployment cost, operational cost, privacy rights, etc.
- Benefits may not justify the cost
  - Could severe legal penalties suppress incidents?

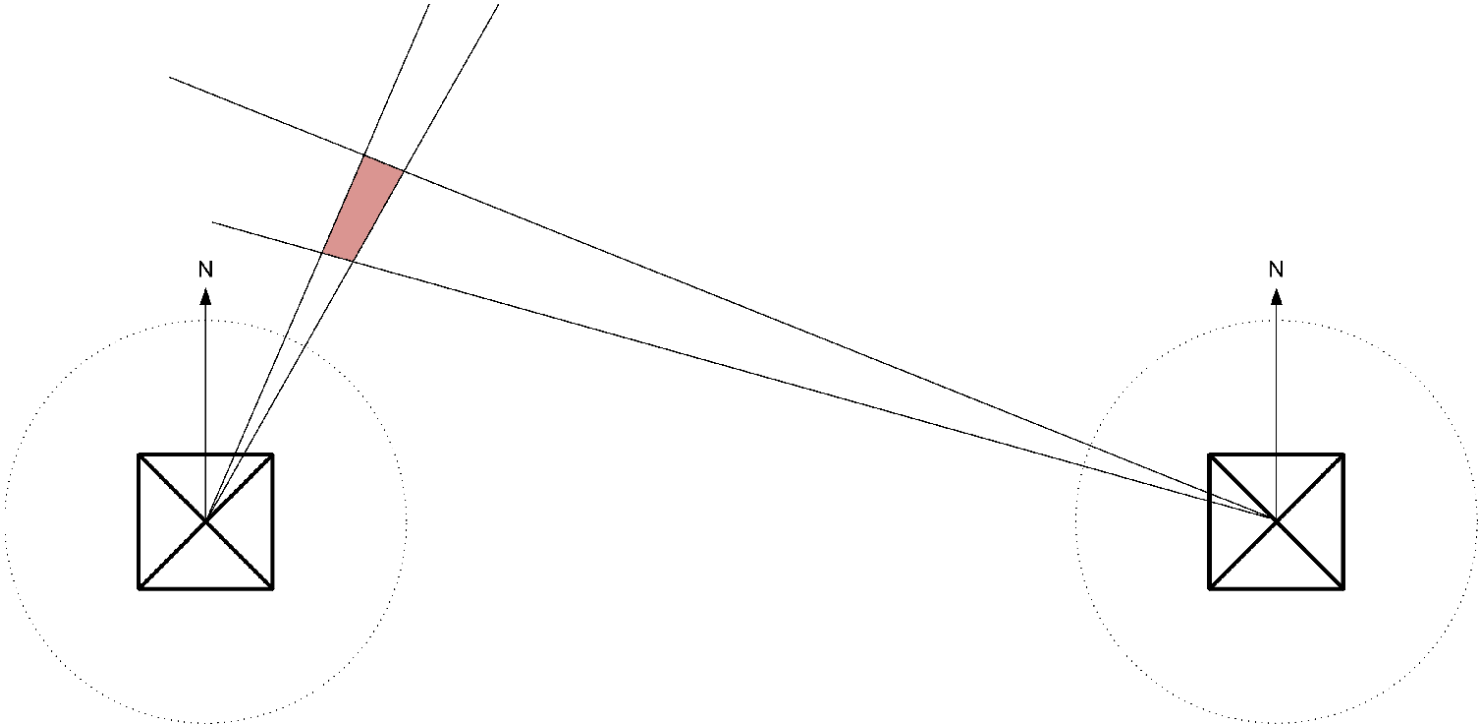
Four Basic Types of Detection (1 of 2)

- Direction of signal arrival (D/F)
  - Two or more detection sites with narrow-beam antennas measuring angle of arrival
  - Intersection of two or more angles indicates position
  - Coordination needed between sites to verify target
- Time difference of signal arrival (hyperbolic)
  - With three or more detection sites with very precise time synchronization it might be possible to measure time difference of arrival of a jamming signal
  - This would define two hyperbolic lines intersecting at the jammer source
- Terrain and building clutter and multipath limit both types

Four Basic Types of Detection (2 of 2)

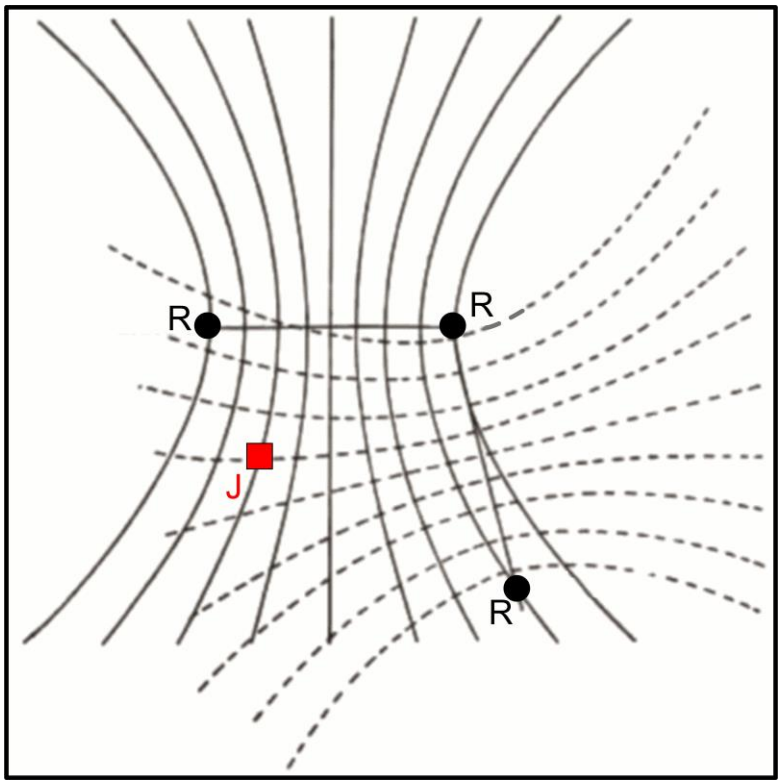
- Linear – detectors along a roadway
- Impact zone (crowd sourcing)
  - A high density of sensors with the ability to detect and report jamming intensity can localize a jammer by evaluating many nearby sensor reports
  - The ideal way to do this is to embed detectors in cell phone chipsets, cause wireless providers to collect the data and report to a “detection center”, allowing the detection center to forward the information to a local law enforcement agency
  - A close parallel is the way e911 operates in the U.S.
  - Crowd sourcing could be implemented with many of the same system elements

Angle of Arrival



- A jammer can be located by measuring the angle of arrival at two or more known locations
- Accuracy depends on distance, beam width, and multipath

Time Difference of Arrival



- Three or more receivers with nanosecond-level time coordination can determine the location of a jammer by measuring time difference of arrival of the jammer signal

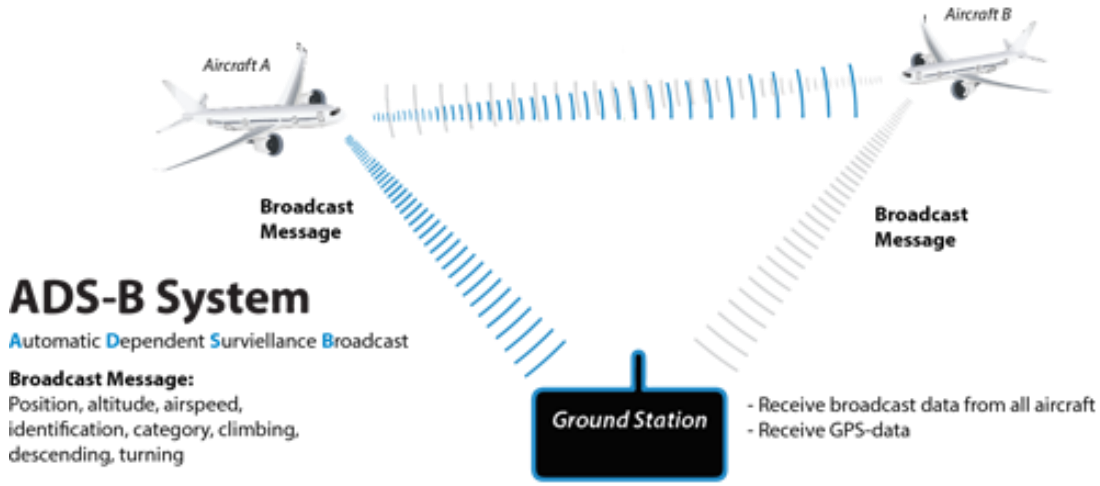
Crowd Sourced Phone Data

- For monitoring wider coverage, crowd sourcing concepts for interference detection using cell phones/ smartphones are now being realized.

Every cell phone can be a GPS jamming detector.
Requires a Public/Private Partnership.

ADS-B Aviation Data

- Aircraft could play a key role in helping to find interference sources in future
- Aircraft ADS-B transmissions contain GNSS data to help air traffic control (ADS-B can be freely received)



- Several projects have shown that this data can collectively show where interference is occurring

ADS-B data openly available, and not subject to data protection laws - could be easier to build detection systems

Thank You

Questions?