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 ongoing.
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?