GPS Technologies and Threat Mitigation for Wide Area Sensing

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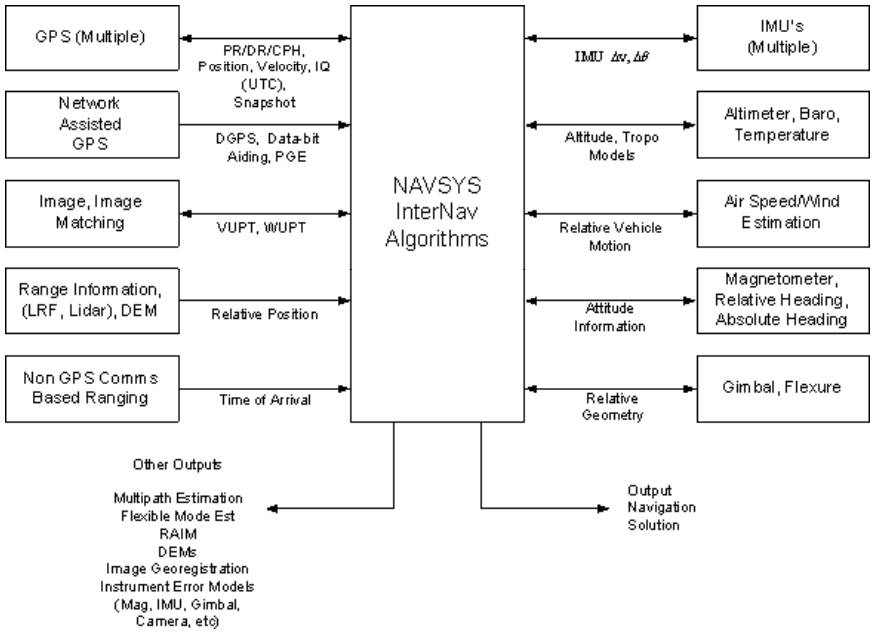
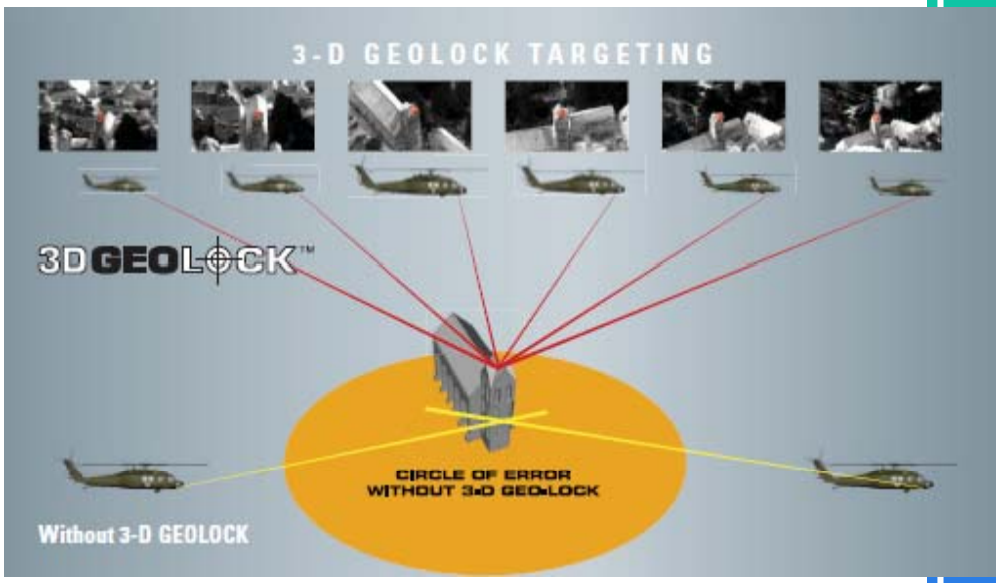
InterNav GPS/Inertial SW

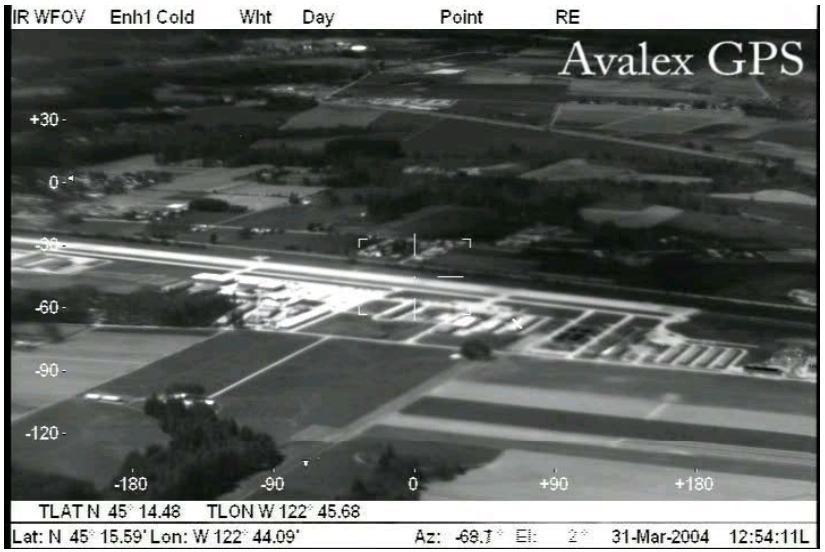


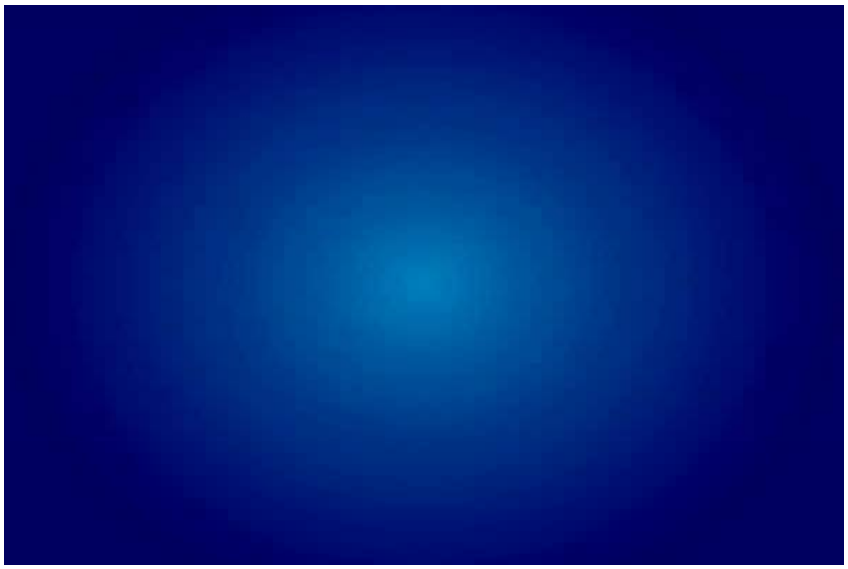


- Tightly coupled GPS/inertial navigation
- Provides navigation or sensor registration
- Used for 3D-GeoLOCK feature in FLIR's products

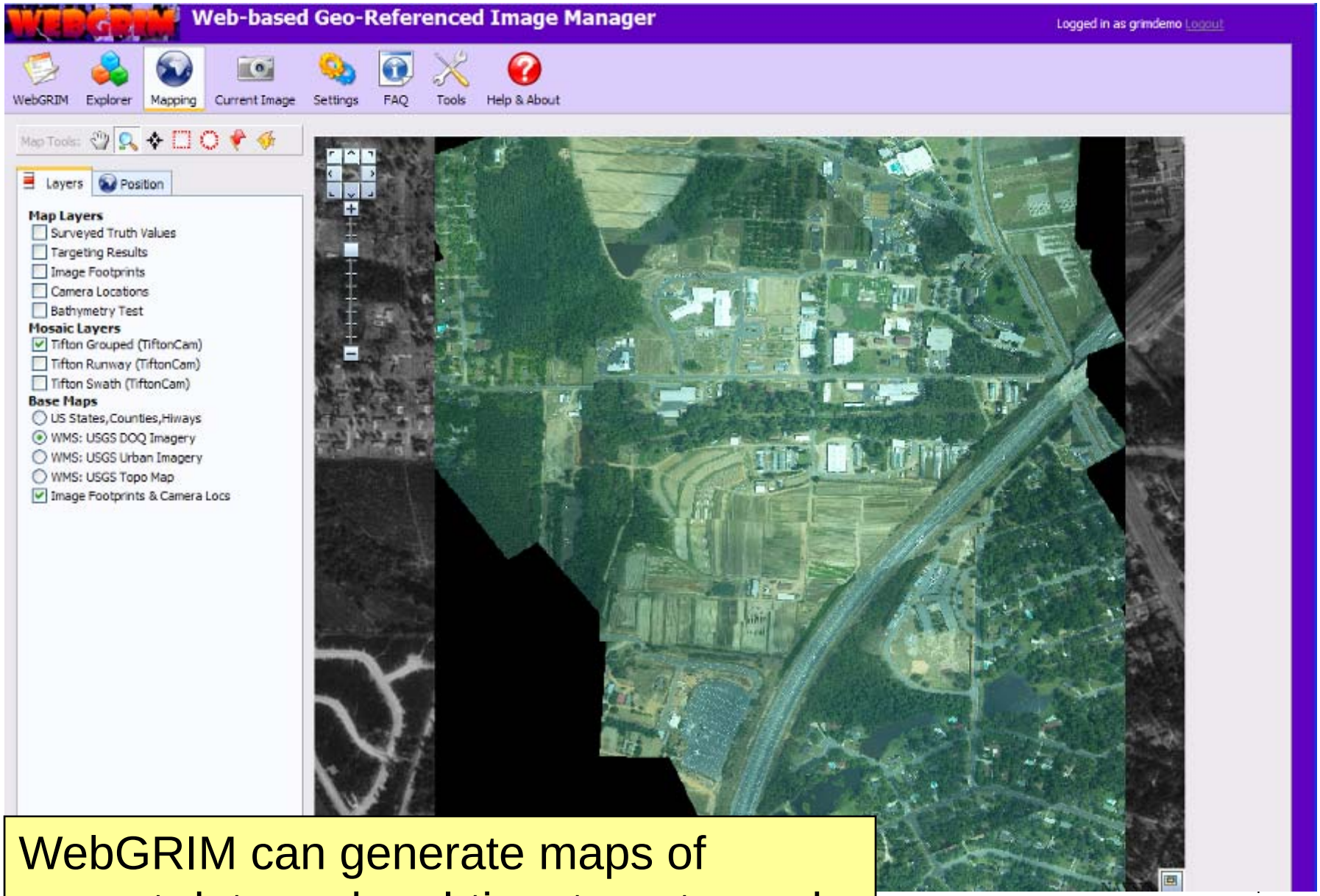
InterNav Geopointing Performance

FLIR Star SAFIRE III





navsys CORPORATION



WebGRIM can generate maps of current data and real-time target coords

GPS Jammer & Spoofer Threat

- GPS jammers
  - 1 watt COTS jammer creates 20 km area outage
  - Cigarette size battery pack gives 10 hrs operation

- GPS spoofer
  - COTS simulators can spoof the GPS C/A code
  - Iranians claim RQ-170 was captured through spoofing

GPS Jammer Location System (JLOC)

Sensor Data Collection

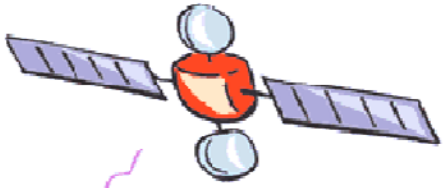
Process

Subscribe

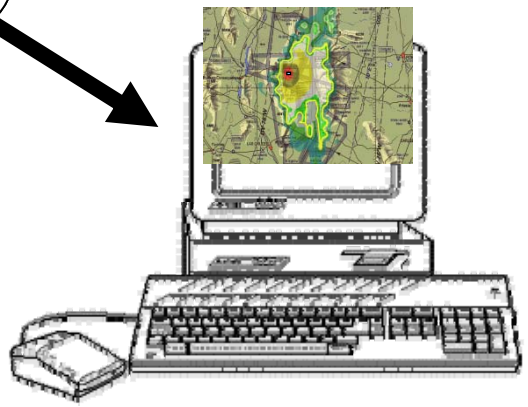
Publish

Network

Alerts, Reports, Plots



Jamming/Interference Detection

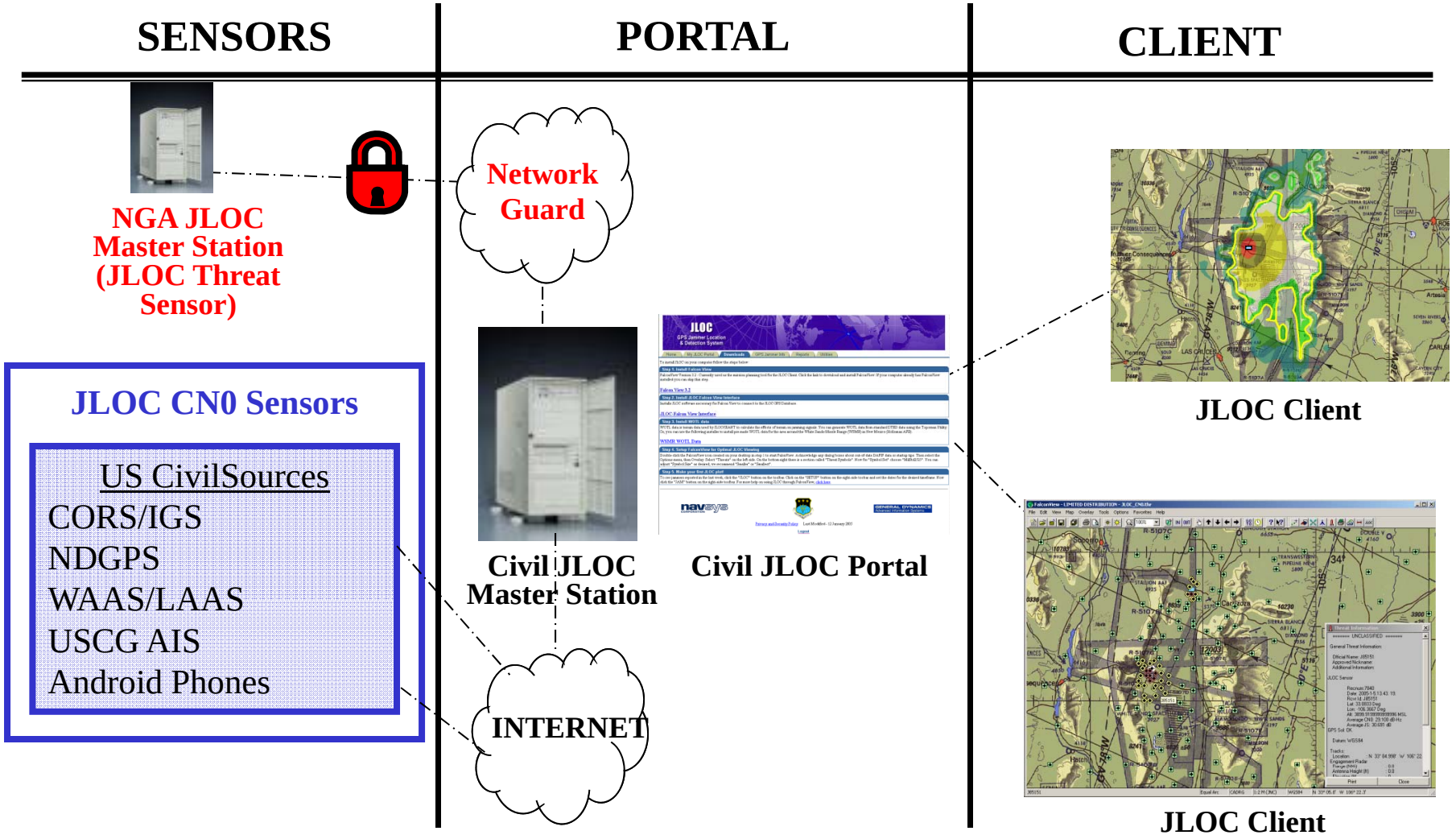


Sensors / GPS User Equipment

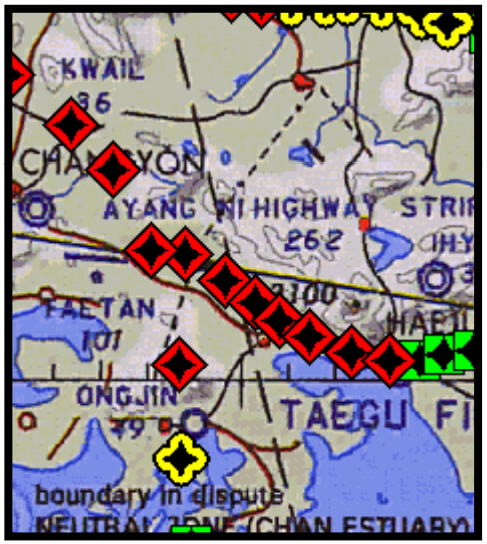
JLOC Master Station

JLOC Users

Examples of Potential Civil JLOC Feeds

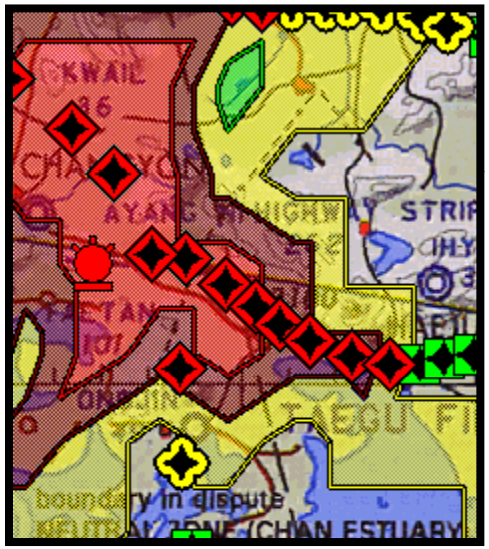


GPS Defender - Android App



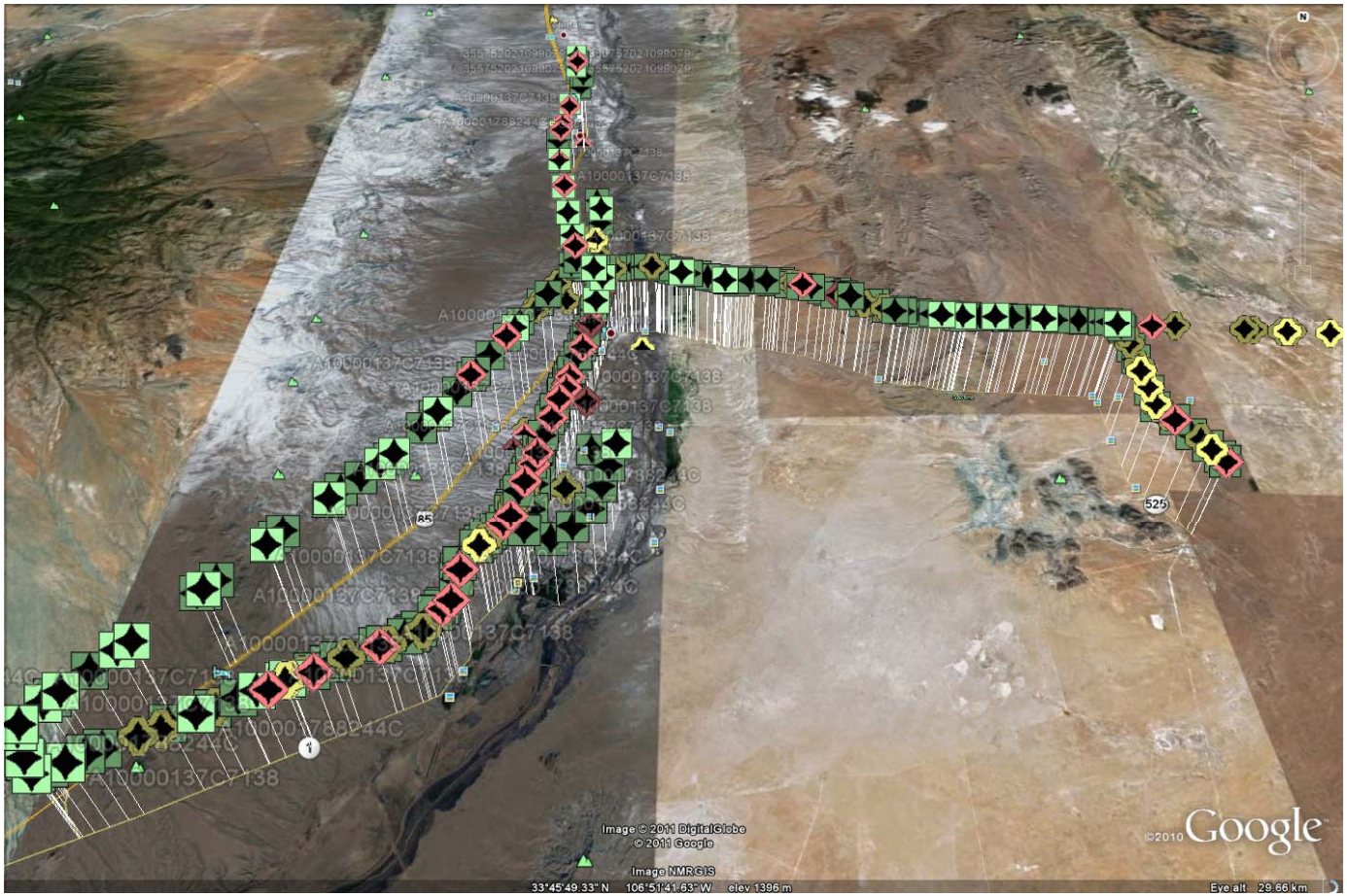
App detects GPS interference and sends report to JLOC server

JLOC Server provides jammer location through data fusion or from other sources

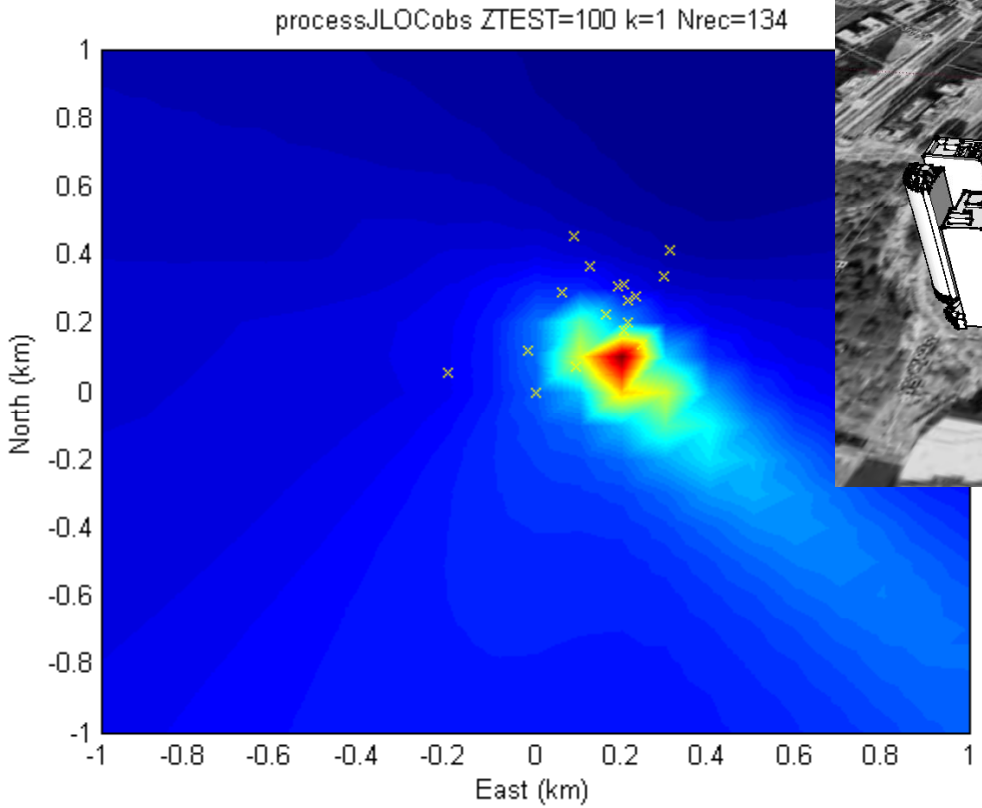


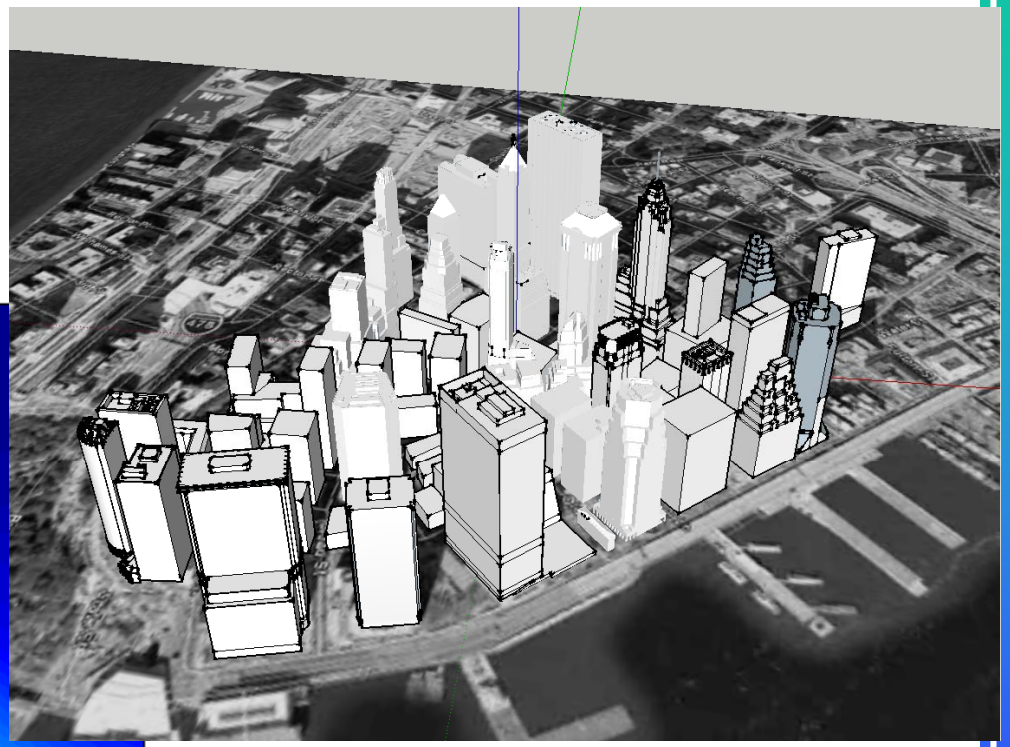
Users are alerted on threat location and can request a GPS Effectiveness plot from JLOC Server

NAVFEST Android Test Data



Simulation Results showing JLOC GPS Spoofer Geolocation



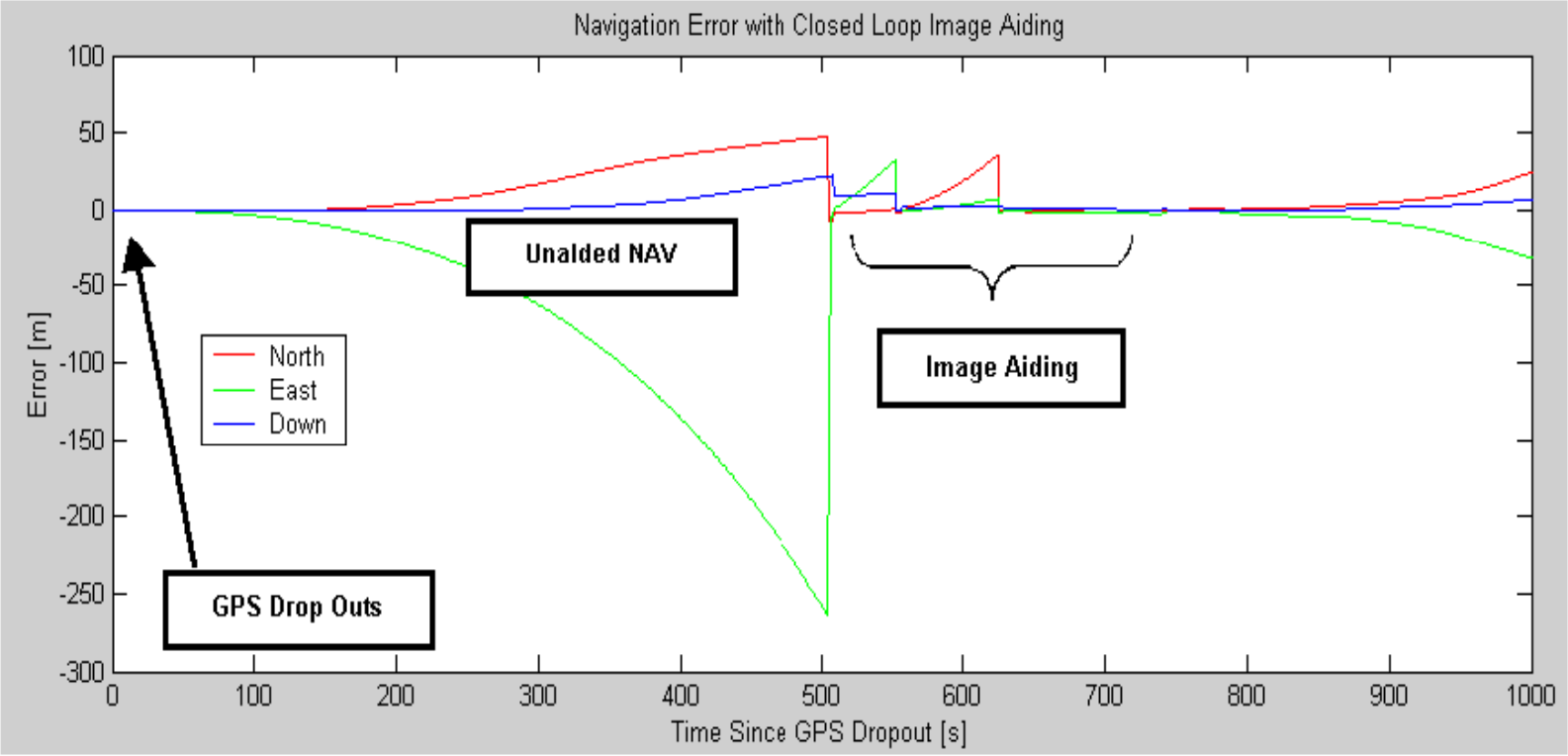


Conclusion

- Wide Area platforms and sensors are heavily dependent on GPS for operations
- Precision GPS/inertial meta-data can provide real-time mapping and targeting from sensors
- For national security, GPS protection is needed to detect, alert and mitigate GPS interference or spoofing
- Wide area sensors can be integrated with GPS JLOC system for jammer or spoofer mitigation

BackUp

Airborne Navigation Performance with Image Aiding



Steady-State Nav Error < 5 m with 2 updates per minute

GPS JLOC History

- ‘98: AFRL initial JLOC contract awarded
  - Developed JLOC system design and lab units
- ’00: GATOR Space Battlelab Initiative: JLOC prototype testing at White Sands & Woomera
  - Built prototype JLOC system for field testing
  - Located jammers from ground and airborne units using conventional and modified GPS UE
- ’04: AF TENCAP JLOC Phase III contract
  - Built and tested operational JLOC system
- ’07: JLOC Operational Capability
  - JLOC Master Station located at NGA’s Monitor Station Network Control Center (MSNCC)