"Toughen" Team

2 June 2014

"Toughen" Scope

- "Toughen" is the ability for satnav receivers to reject or operate through contaminated or invalid inputs, including:
  - In-band or out-of-band interference
  - Invalid signals transmitted by satellites
  - Invalid signals transmitted by unauthorized sources (spoofers)
  - Space weather (e.g., scintillation)

- Toughen applies to all satnav signals

"Toughen" Status

- Aviation
  - MITRE presentation on FAA and RTCA activities
  - Multi-constellation MOPS planned for 2018 is next opportunity for toughening
- Consumer
  - Broadcom presentation
  - Ability to operate through GLONASS events using multiple satnav systems and long term ephemeris
- Critical infrastructure
  - DARPA presentation on PNT technology development
  - Emphasis on high quality clocks

"Toughen" Issues

- Common themes
  - Lack of threat model, including future threats, to guide toughening
  - Lack of "user pull" for "toughening" receivers
- Aviation
  - Time and cost to field upgraded user equipment
  - ITAR and FOUO restrictions
  - Legacy avionics last for decades
- Consumer
  - Limited view of the sky hinders RAIM
  - Handset component costs dominate capabilities
- Critical infrastructure
  - GPS is the "invisible ubiquity"
  - Unclear responsibility for toughening critical infrastructure

"Toughen" Recommendations

- Develop threat models for the present & future
  - Increase awareness
  - Encourage "good enough" toughness
- Follow the consumer model:
  - With more systems comes more system failures—expect them
  - Use multi-constellationp, multi-frequency receivers, & exploit the redundant information
  - Use long term ephemeris for crosschecking as well
  - Third parties can also provide independent verification of transmitted signals
- Consider increasing openness of threat information and toughening techniques
  - Reexamine export restrictions & FOUO information
  - Make users & service providers more aware, concerned, motivated
  - Share & field toughening techniques