Satellite Time and Location (STL) as an Augmentation or Alternative to GNSS for Critical Timing Applications

GPS – Your primary reference

Available worldwide
Great accuracy to UTC (and traceable!)
25 ns to UTC *However:* Sensitive to Jamming and Spoofing



Other GNSS



- Same sensitivity as GPS to jamming/spoofing
- Provides some extent of additional resilience
 - Slightly different frequencies
 - Independent ground control stations
 and time sources
 - Different signal formats



Atomic Clock – The Backup

Keeps the time right when things go wrong
Smoothens the effects of spoofing
Must be carefully chosen and disciplined

STL Satellite Time and Location Signal

- New signal available today
 Broadcast on the Iridium satellites
- >30 dB stronger than GPS
 Encrypted signal





• Some might be required for critical systems nationwide

Higher jamming and interference resistance

• Operates indoors

Inherenetly anti-spoof

Subscription-based serviceAvailable for civilian use

•



66 Iridium satellites
Global coverage
500 mile altitude
1000x stronger than GPS

STL

24 GPS satellites
Global coverage
12,500 mile altitude
25 x further away



Strong Signal with Spot Beams

Iridium: ~100 minute orbit
 GPS: 12 hour orbit

- Encrypted signal with subscriber keys
- Positioning determination

Spot beam location (gross)
Range and Doppler updates
Convergence over minutes
Geo-location security





- Re-purposed paging channels
- 1620 MHz band, 25 kHz channel, QPSK
- Spread Spectrum coded signal, 90 msec frame,
- ~1.4 sec burst on average
- UTC traceable timing
- ±500 nsec spec.
 100-200 nsec typical
- Timing updates to a precision local oscillator for continuous time and frequency sourcing



Time Sync

- Augment GNSS with an independent stronger signal
- Anti-spoof with subscriber authentication of encrypted signal

Deep Indoor Penetration

- No outdoor installation or cabling required
- 1000x stronger than GPS

Trusted Location

• Security-based on geo-location





Indoor Timing

GPS roof antennas can be challenging:

Landlord permission/roof rights
Zoning restrictions in major cities
Building hazards (e.g., asbestos)
Outdoor equipment maintenance
Typical installatoin \$10k + \$1k/month



Building image from Greg Jacobs, Bicsi

New York Stock Exchange Indoor Demonstration

January 2017 – ATIS Time and Money Event
Wall Street – One of the most difficult urban canyons in the world for GPS reception
STL signal received and locked to UTC time with Spectracom's SecureSync

Interior room, 7th floor
Weak signal
~30 min to converge

System Integrity!

- Three references to phase out ambiguity in the event of a failure of one of them
- Local clock trustability is fully rebuilt!



• spectracom An orolia brand.