Spoofing Civil GPS-Based Timing

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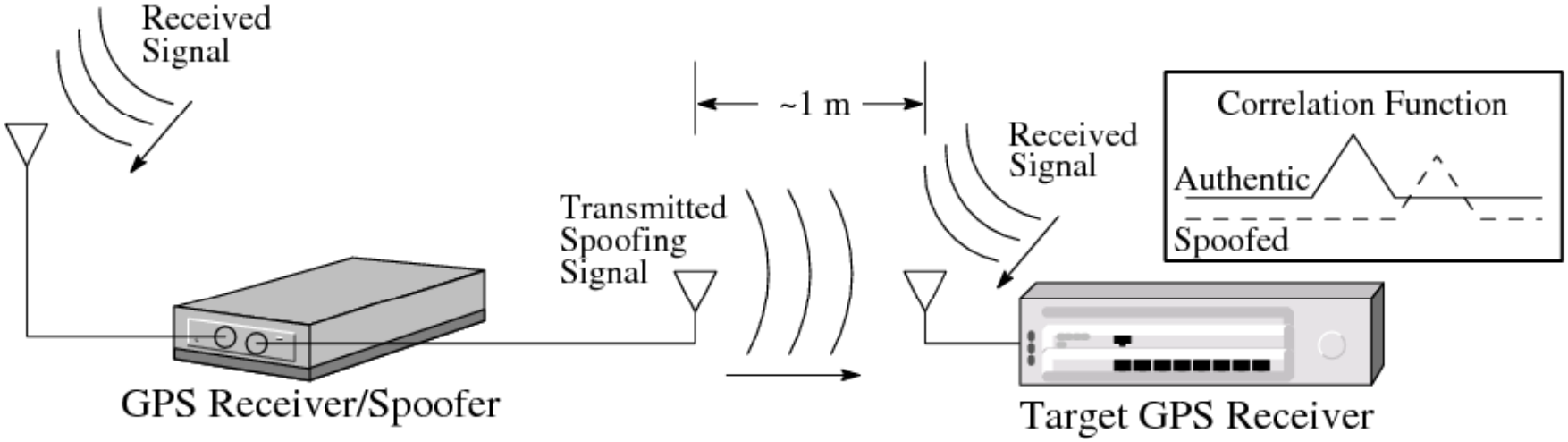
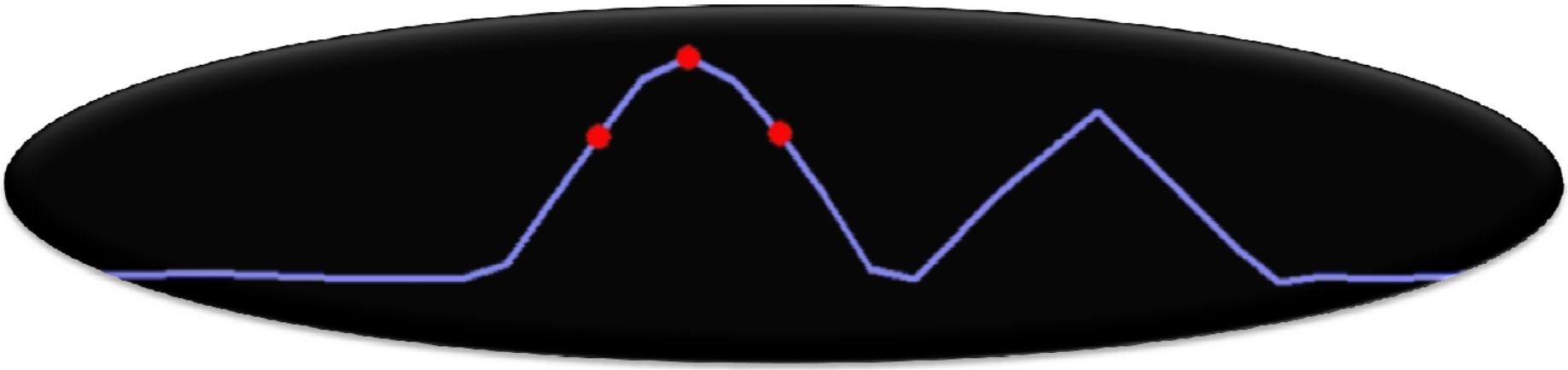
Emerging Threat: Civil GPS Spoofing





Spoofing and Jamming are Different Threats

- Spoofing is more difficult & costly
- Spoofing leaves no trace – victim receiver doesn't know it's being spoofed
- Spoofer typically targets a single receiver
- Many countermeasures to jamming are ineffective against spoofing

Assessing the Threat

- Multi-frequency, multi-system receivers inherently resistant to spoofing
- Vast majority of GPS receivers in critical applications are single-frequency L1 C/A (easily spoofable)
- Software radio techniques are game-changer, enabling one to “download” a spoofer
- Strong financial incentives encourage “complicit spoofing” (spoofing one’s own receiver)
- Timing receivers used in communications infrastructure are attractive target

Civil GPS Spoofing Testbed at UT Austin

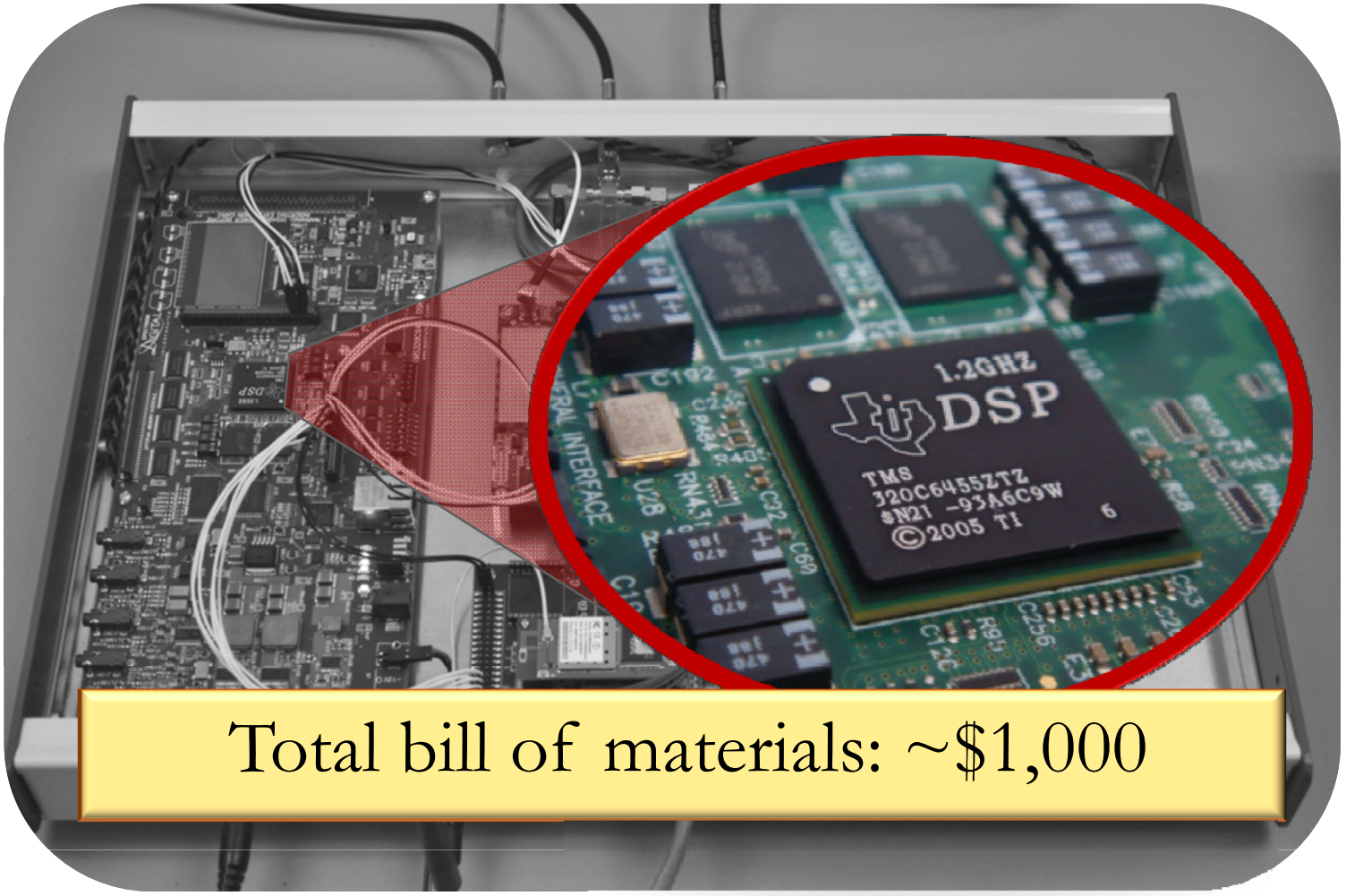
Spoofer **Defender**

- GPS L1 C/A output
- Software radio platform
- Output precisely synchronized with authentic signals via feedback
- Finely adjustable output signal strength
- Remotely commanded via Internet

- Vestigial signal defense
- Data bit latency defense
- Cryptographic defenses
- Phase trauma monitoring
- Dual-frequency tracking

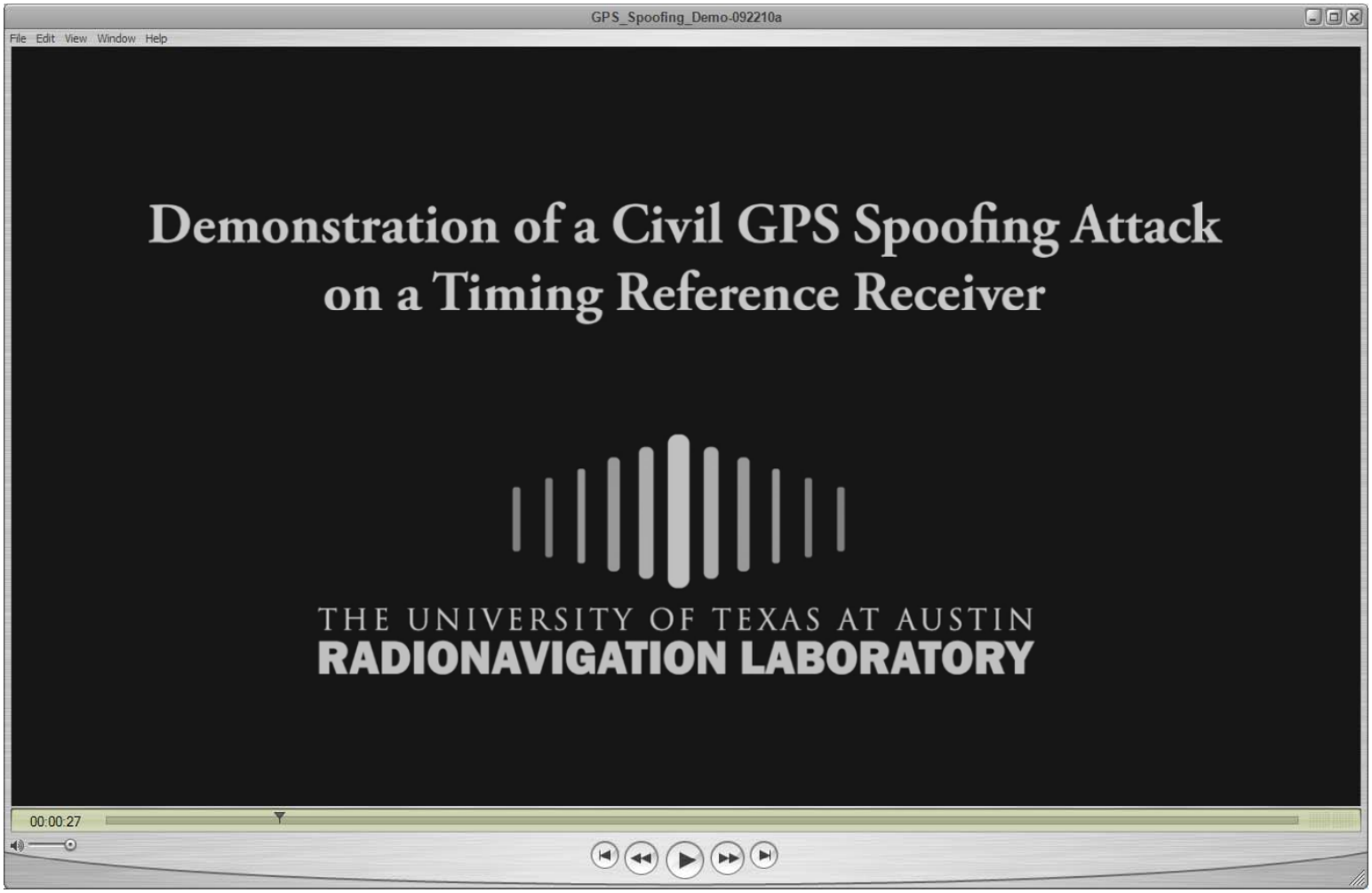
Inside the Box

Software-defined spoofer running on COTS components



Total bill of materials: ~$1,000

Video Demonstration of Spoofing Attack (http://radionavlab.ae.utexas.edu/index.php/videos)



Observations

- “Flywheel” capability of GPS timing receivers protects against jamming but not spoofing
- CDMA cell phone base stations can be disabled within about 1 hour; power grid PMUs in less time
- J/N meters in receiver front end are essential for spoofing detection
- Practical backward-compatible spoofing defense: Navigation Message Authentication on GPS CNAV data stream (even effective against replay attacks if properly implemented)

More Information

http://radionavlab.ae.utexas.edu