Proliferation of GPS/GNSS Jammer Devices

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Jamming vs. Spoofing

- Jamming is intended to prevent a receiver from acquiring, tracking, or navigating with GNSS signals
- Spoofing is intended to fool a receiver so it provides false position, navigation, and/or time (PNT)
  - Thus allowing the Spoofer to control the victim's PNT
- Smart-Jamming is intended to cause receivers to acquire false signals, which either:
  - Prevents navigation *(with less power than for jamming)*,
  - Or, causes false *(but uncontrolled)* PNT results

What Are Jammers?

Generally includes devices commonly called signal blockers, GPS jammers, cell phone jammers, text blockers, etc

- Illegal radio frequency transmitters
- Designed to block, jam, or otherwise interfere with authorized radio communications

ICG International Committee on Global Navigation Satellite Systems

How do jammers work?

- A jammer can *block all radio communications* on any device that operates on radio frequencies within its range.
- *Emits radio frequency waves* that prevent the targeted device from establishing or maintaining a connection.
- Generally *does not discriminate* between desirable and undesirable communications.
- Jammers can:
  - prevent your cell phone from making or receiving calls, text messages, and emails;
  - prevent your Wi-Fi enabled device from connecting to the Internet;
  - prevent your GPS unit from receiving correct positioning signals; and
  - prevent a first responder from locating you in an emergency.

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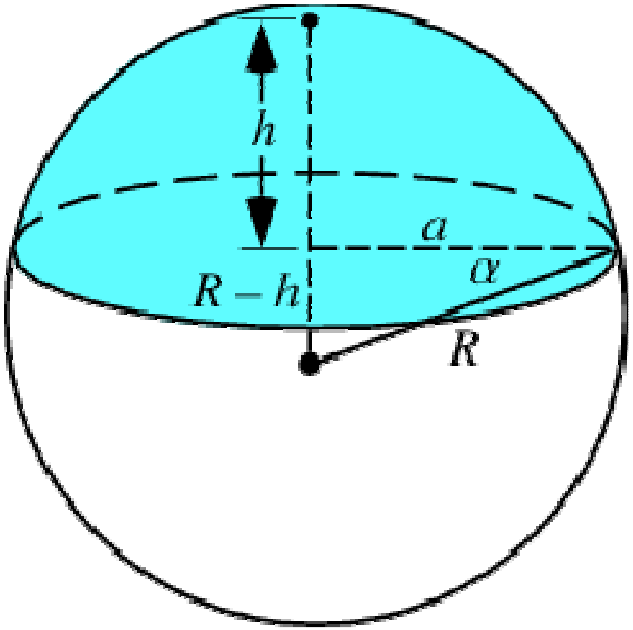
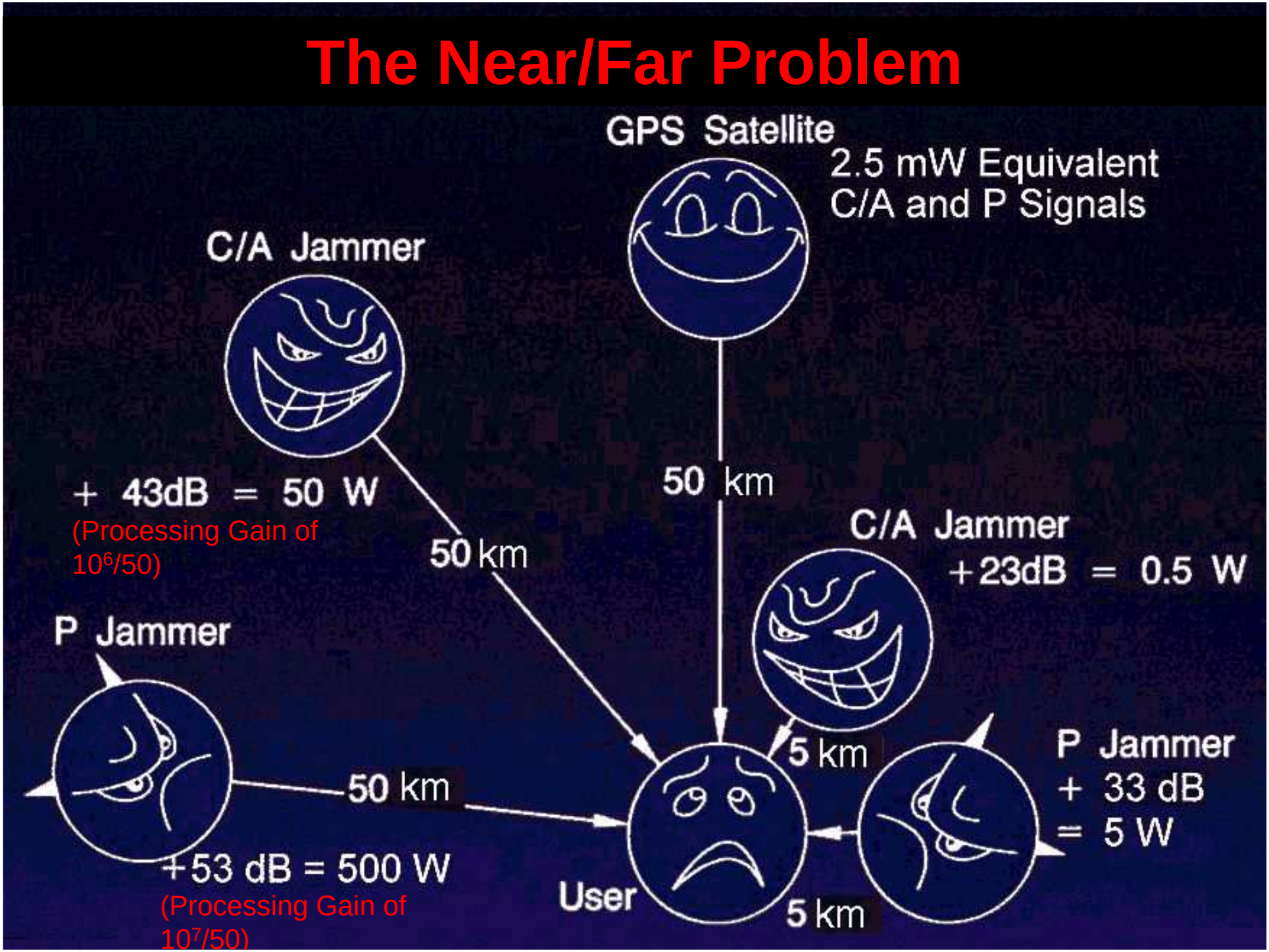
Received GPS Signals are Weak



- Signals from each GPS satellite cover 38% of the earth or 194,244,017 sq km
- A 50 watt GPS transmitter thus provides ~2.6E-13 Watts per square meter on the earth
- A hemispheric L1 antenna "capture area" is ~0.006 m
- Received signal power thus is ~1.5E-15 Watts (-148 dBW) or ~1.5E-12 mW (-118 dBm)
- <u>Very weak signals!!!</u>

GPS defines the minimum C/A "open sky" signal power to be -158.5 dBW, 11 times weaker than calculated here

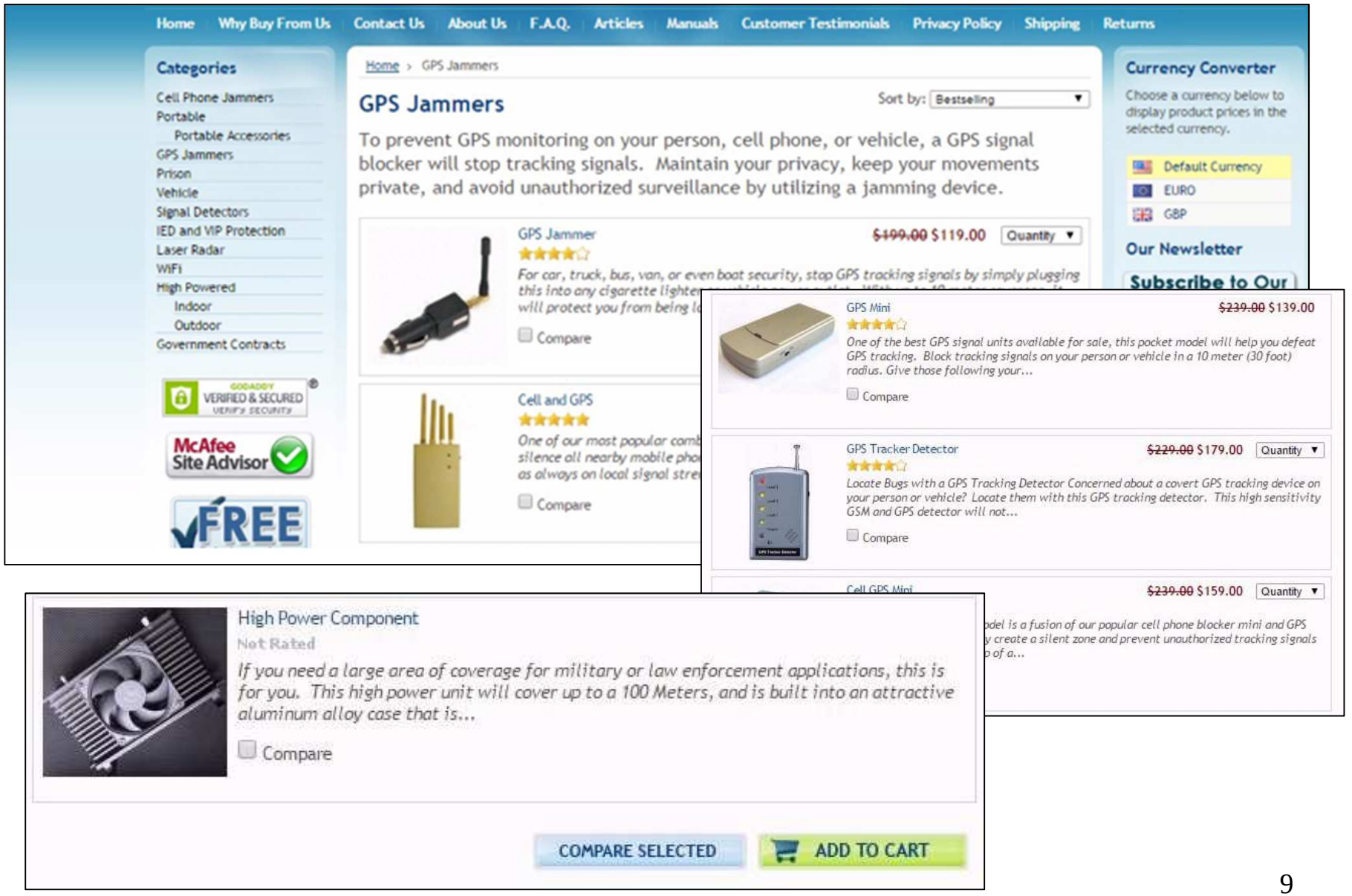
The Near/Far Problem



Jamming Sources

- Thrill seekers – interrupt GPS “for the fun of it”
- “Privacy” jammers, e.g., cigarette lighter devices
- Criminals
- Terrorists
- Government authorized services
  - Powerful adjacent channel signals causing overload
  - Higher order intermodulation products, e.g., $2f_1 – f_2$

Jammers for Sale



Thank You

Questions?