GPS Vulnerability

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NAVSTAR Global Positioning System

SATELLITES PROVIDE RF SIGNAL

USER EQUIPMENT COMPUTES POSITION, VELOCITY AND TIME

26 SATELLITES ON ORBIT

CONTROL SEGMENT PROVIDES SATELLITE EPHEMERIS, CLOCK SYNCH AND COMMUNICATION INTERFACES
GPS Position Error

2-D Error

- P(Y)-Code Tracking
- L1 C/A-Code Only

Elapsed Time (Hrs:Mins)
The TOP 3 Reasons for GPS Vulnerability:

**#1 REASON: Signal Interference**
- Threat
- Blue-on-Blue
- Unintentional/Foreign Frequency Allocations

**#2 REASON: C/A-Code Signal Spoofing**

**#3 REASON: Growing Dependency on GPS**
### Navy GPS

#### #1 REASON

<table>
<thead>
<tr>
<th></th>
<th>POWER</th>
<th>RANGE</th>
<th>ACCURACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC-182/210</td>
<td>20 W</td>
<td>300 NM</td>
<td>N/a</td>
</tr>
<tr>
<td>JTIDS/MIDS</td>
<td>200 W</td>
<td>300 NM</td>
<td>30-90 Meters</td>
</tr>
<tr>
<td>GPS</td>
<td>60 W</td>
<td>10,980 NM</td>
<td>8 Meters</td>
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</tbody>
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- **Received Power at Earth’s Surface:**
  - 0.0000000000000001 Watts \((10^{-16} \text{ W})\)

- Signal below Thermal Noise Threshold by 15 dBW
NKC-135 at 10,000 ft.
Target at Ground Level
Power: 400W

Location: Fort Bragg, N.C.

- Green  Civil Receivers Affected
- Yellow  Civil Receivers Denied
- Red    Military Receivers Affected
- Purple Military Receivers Denied

JTFX 98-1 Affected Target Areas
• Must Acquire P(Y) Code through C/A Code First
• C/A & P Codes are Published in Open Literature, Worldwide
GPS Jamming Environment

- Enhanced Tracking Goal
- Enhanced Acquisition Goal

### J/S (dB)
- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100
- 110
- 120

### Range NM
- 1
- 10
- 100
- 1000

- 1W
- 10 kW
- 100 kW

- P-code tracking
- Direct Y Acquisition
- C/A-Code Acquisition
REASON #1:
-Low power signal can be easily jammed when acquiring GPS

REASON #2:
-Military GPS receivers are Spoof Resistant once tracking Y-Code

REASON #3:
-Do NOT become a GPS cripple

ALWAYS OPERATE IN THE “KEYED” MODE!