



# Anti-Jamming for Airborne Platforms

PNT Advisory Board Briefing

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Collins**

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## Bottom Line Up Front

- GPS Threats are real and becoming more numerous
- Mitigation technology is mature and available
  - Deployed on multiple platforms
  - Satisfying urgent operational needs for military operators
- Users have been slow to adopt
  - Aircraft integration cost
  - Changes in threat environment
  - New Signals & Applications (modernization, multi-constellation)
- Potential use in civil aviation and other commercial uses is limited by policy

# The need for Threat Mitigation

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TECHNOLOGY - SCITECH

## GPS Jammers Illegal, Dangerous, and Very Easy to Buy




By John Brandon  
Published March 17, 2010 | FOXNews.com

## North Korea GPS jamming device has 100km range

By Edwin Kee on 09/07/2011 00:31 PST

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### GPS chaos: How a \$30 box can jam your life

 <p>Free Shipping</p>	 <p>Free Shipping</p>	 <p>Free Shipping</p>	 <p>Free Shipping</p>
17 W Low Power Multi-band Jammer	4 Band 4W Portable GPS Cell Phone Signal Jammer	5 Antenna Portable Cell phone & WI-Fi & GPS L1 Jammer	5 Antenna Portable Signal Jammer for GPS, Cell Phone, WiFi
★★★★☆ <input type="checkbox"/> Compare	US\$141.56 ★★★★☆ <input type="checkbox"/> Compare <input type="button" value="Add To Cart"/>	US\$229.99 ★★★★☆ <input type="checkbox"/> Compare <input type="button" value="Add To Cart"/>	US\$190.58 ★★★★☆ <input type="checkbox"/> Compare <input type="button" value="Add To Cart"/>



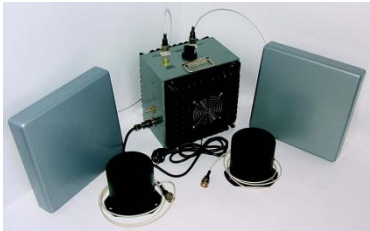
Iranian Gen. Moharam Gholizadeh, the deputy for electronic warfare at the air defense headquarters of the Islamic Revolutionary Guard Corps (IRGC), told the *Far News*, "We have a project on hand that is one step ahead of jamming, meaning 'deception' of the aggressive systems... we can define our own desired information for it so the path of the missile would change to our desired destination...all the movements of these [enemy drones are being watched]" and "obstructing" their work was "always on our agenda."

# How Much Protection is Needed?



1 Watt-class jammers are small devices typically used for jamming personal location devices in commercial industries. They have a limited range and are typically battery operated.

Example: Intermittent jamming at Newark Airport



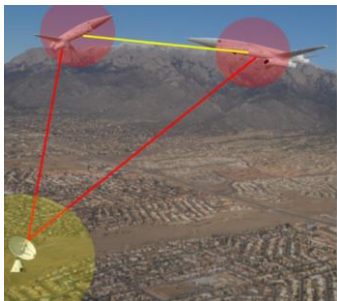
10-100 Watt-class systems could be fixed site or mobile, designed to deny GPS in a localized area.

Example: San Diego GPS Jamming incident ~2007



Kilowatt-class jammers would be large systems designed for denial over a large area.

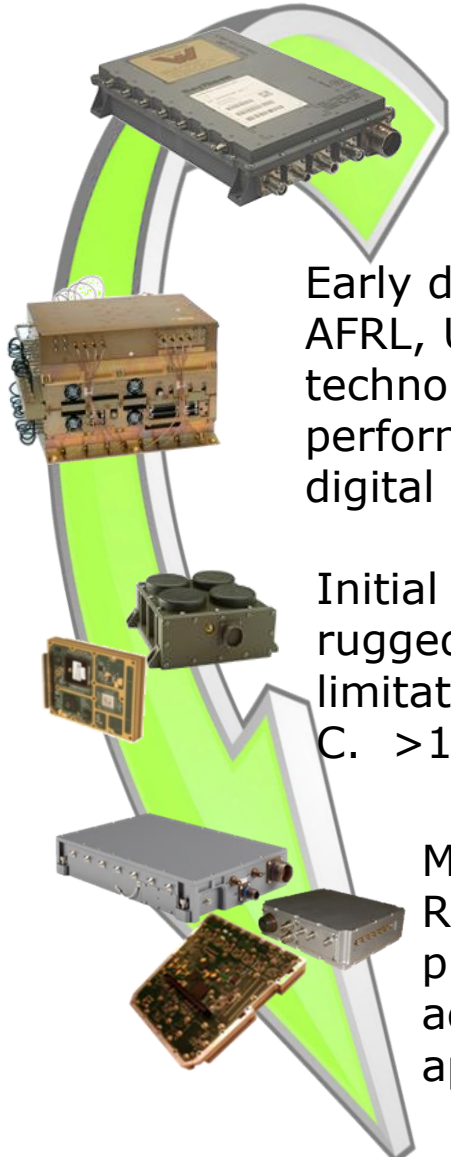
Example: Training exercises



Deceptive GPS Jammers attempt to mislead target users through generation of GNSS-like signals.

Example: University of Texas at Austin demonstrations

# Technology Evolution



Analog nulling systems (1980s) were limited by array factor, RF mismatch, linearity, and processing power. Gain patterns could not be manipulated or optimized for individual satellites.

Early digital multi-beamforming electronics developed by DARPA, AFRL, USN (1998-2003) provided platforms for proof of concept and technology maturation. Digital implementation permitted improved performance and optimization with complex signal processing and digital receiver interface.

Initial production digital multi-beamforming units (2005) provided ruggedized platforms operational capability. Performance limitations were driven by processing density and platform SWAP-C. >150,000 delivered

Modern software defined anti-jam platforms provide exquisite RF performance and capitalize on the economy of digital processing power. Modern processors and FPGAs permit adaptable, threat-agile systems that can be tailored by application and respond as the environment dictates.



## Current Generation Airborne Anti-jam



- Miniaturized anti-jam electronics
- Top-level interfaces to support aviation applications
  - Multiple Analog “Protected RF” outputs
  - Digital multi-beam output and control/status interface
- ~70% size reduction from traditional aircraft antenna electronics
- Dual Frequency fully programmable signal processor
  - Space-time adaptive processing
  - Space-frequency adaptive processing
  - High integrity beamforming (Landing Systems)
  - Y and M-code capable
- P(Y) and M-code compatible
- 7 element antenna aperture interface
  - 1-piece Captive harness ensures proper connection

# AJ Performance



- DIGAR AJ units have been subjected to more than 30 jamming test events by contractor and government entities
- Demonstrated ability to maintain GPS in exceptionally high jamming
- Verification and Validation in laboratory and live-sky testing
- Fielded in combat aircraft

# Civil Aviation and Safety-Critical Use

- High integrity Anti-Jam is a proven technology
  - Developed for use in Joint Precision Approach and Landing Systems, Automated Refueling, and other safety critical applications
  - Demonstrated in 70+ auto-landings on land and at sea
- FAA and other Airspace authorities are discussing operational standards for civil aviation
  - Traditionally dealing with unintentional GPS interference
  - Broad move toward detecting and mitigating intentional threats
    - RTCA SC-159: “New MOPS should address, to the extent practicable, the threats of intentional interference and spoofing”
    - FAA GNSS Intentional Interference and Spoofing Study Team (GIISST)
- Hurdles to technology transition
  - Export Restrictions
  - Security/Classification





**Thank you!**