Autonomous Detection of Electromagnetic Interference in the GPS band

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Content

Background
- increased use of jammers
- Internet search
- needs – ideas - test

The portable detection system
- architecture
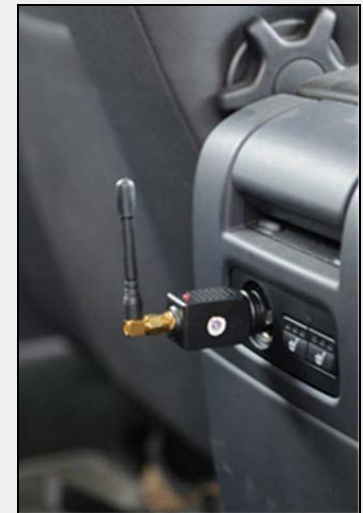- measurements
- analyses
- interference classification

Results and Conclusions

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Background – increased use of portable jammers

N.J. man fined $32K for illegal GPS device that disrupted
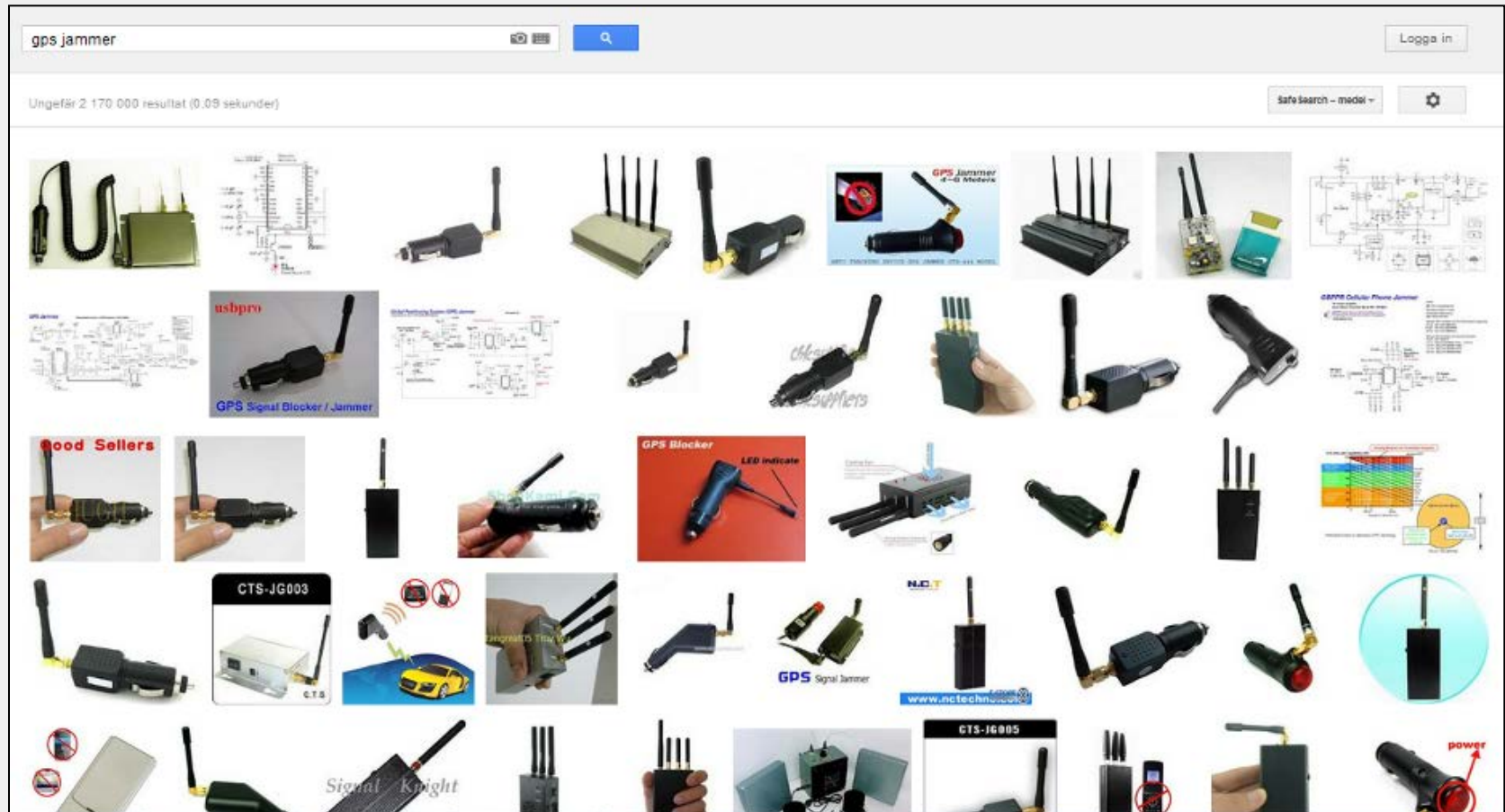Newark airport system (8 Aug 2013)

~300 mW (L1/L2)

~80 mW (L1)

Background - a search on the Internet...

Background – need/idea/test

<u>Need</u>
- Un-manned autonomous detection of GPS interference
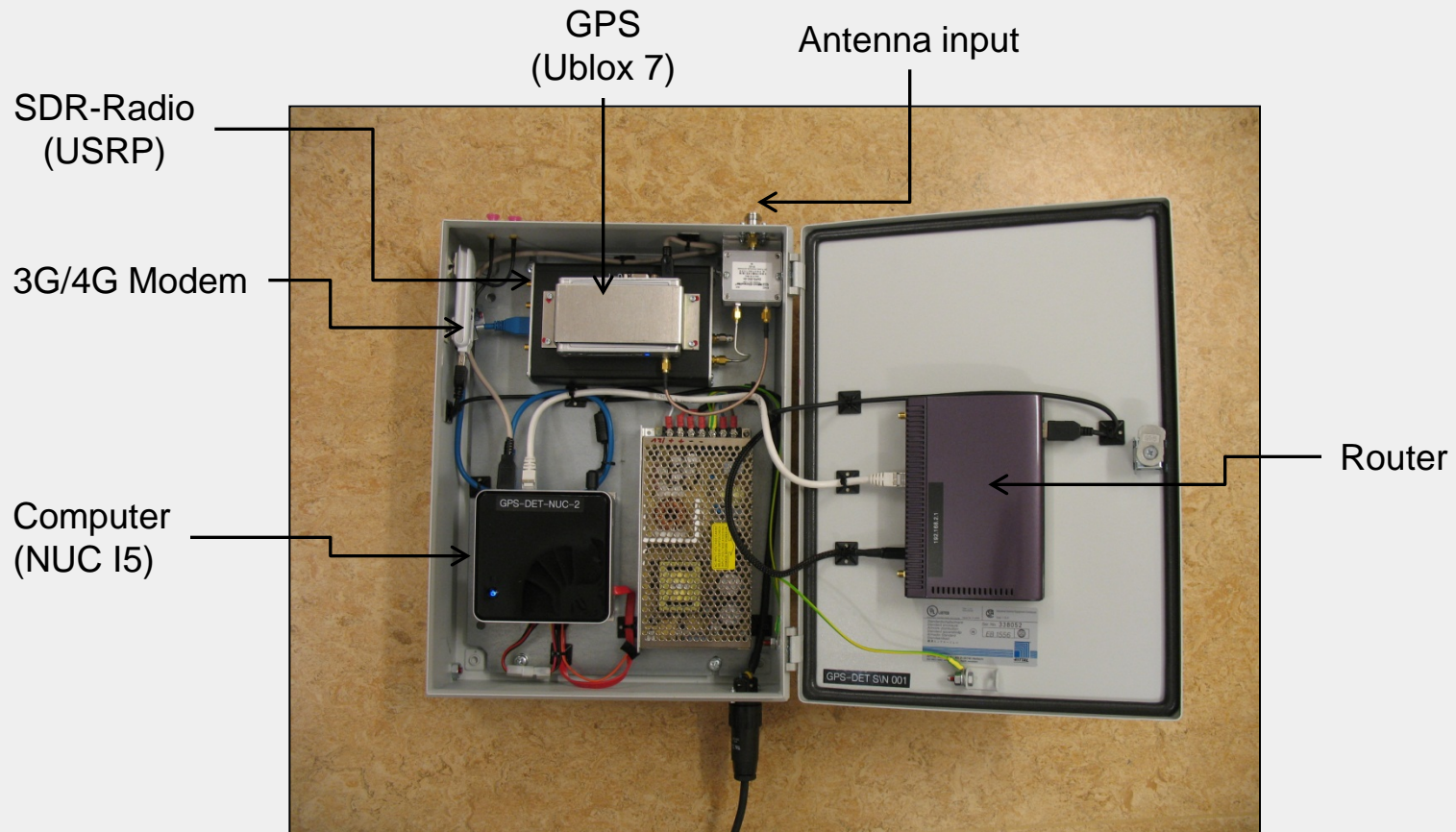- Analyses of occurrence, variation over time etc.

<u>Idea</u>
- Cooperation between Lantmäteriet and FOI
- Benefit from the infrastructure of the SWEPOS network
  + coverage over almost the whole area of Sweden
  + Infrastructure in place, controlled environment
  - certain distance from roads => lower levels from intentional jammers
- Benefit from a portable autonomous detection system developed by FOI
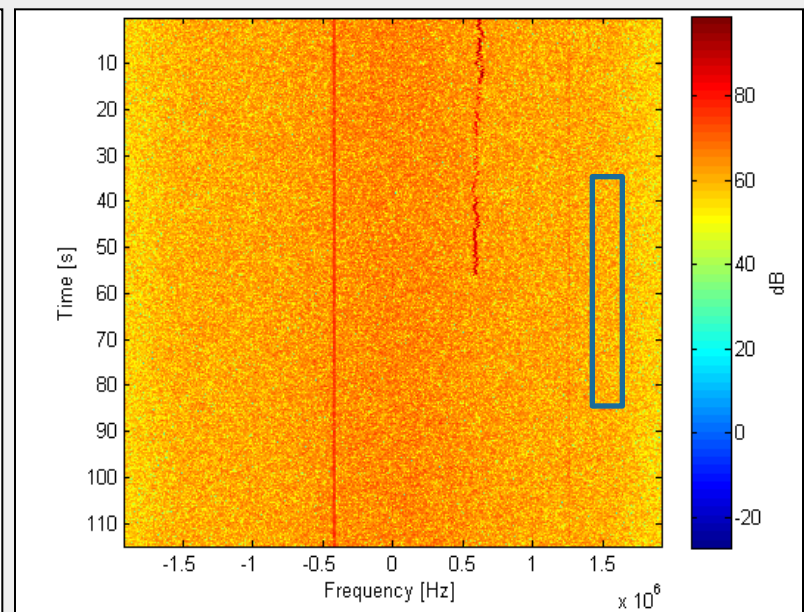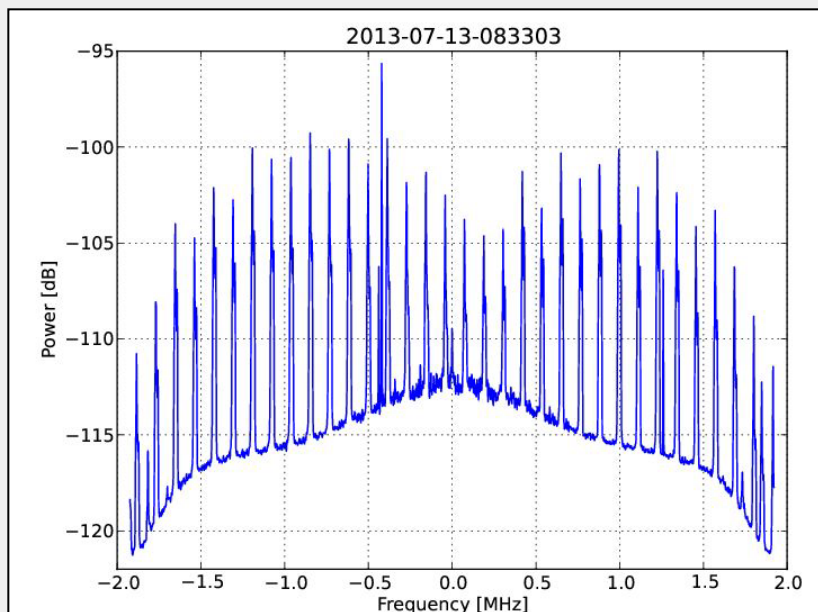
<u>Test</u>
- Install the detection system in SWEPOS measurement station/s
- Evaluation of functionality and measurement results

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Overview of detection system

GPS
(Ublox 7)

Antenna input

SDR-Radio
(USRP)

3G/4G Modem

Computer
(NUC I5)
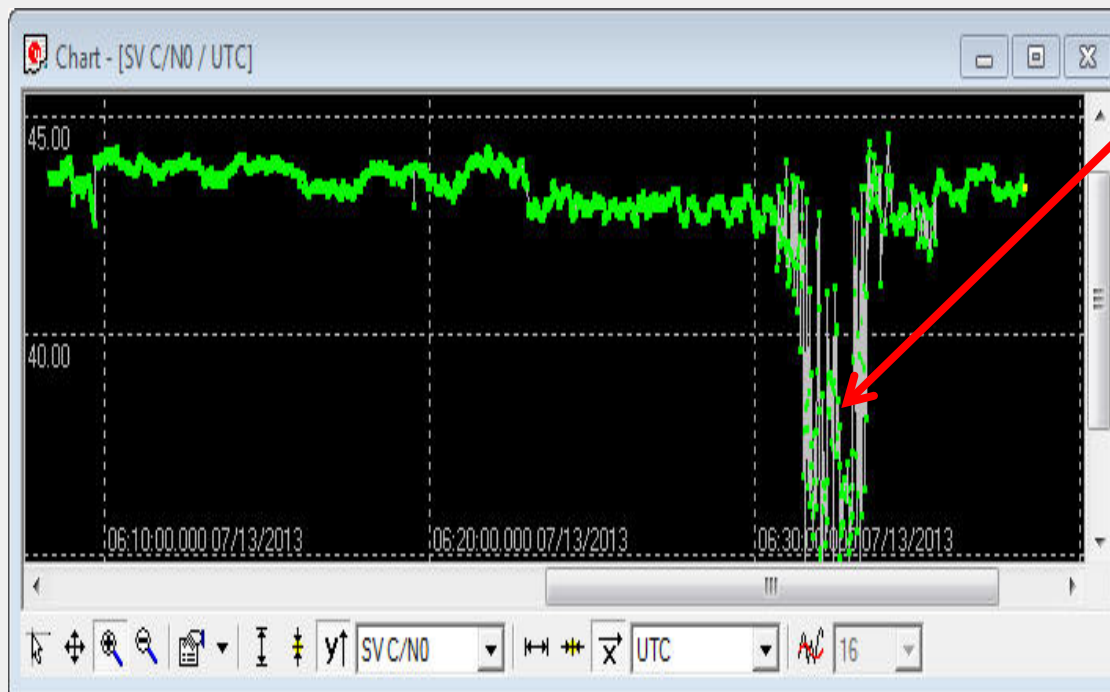
Router

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Example of detection, SDR

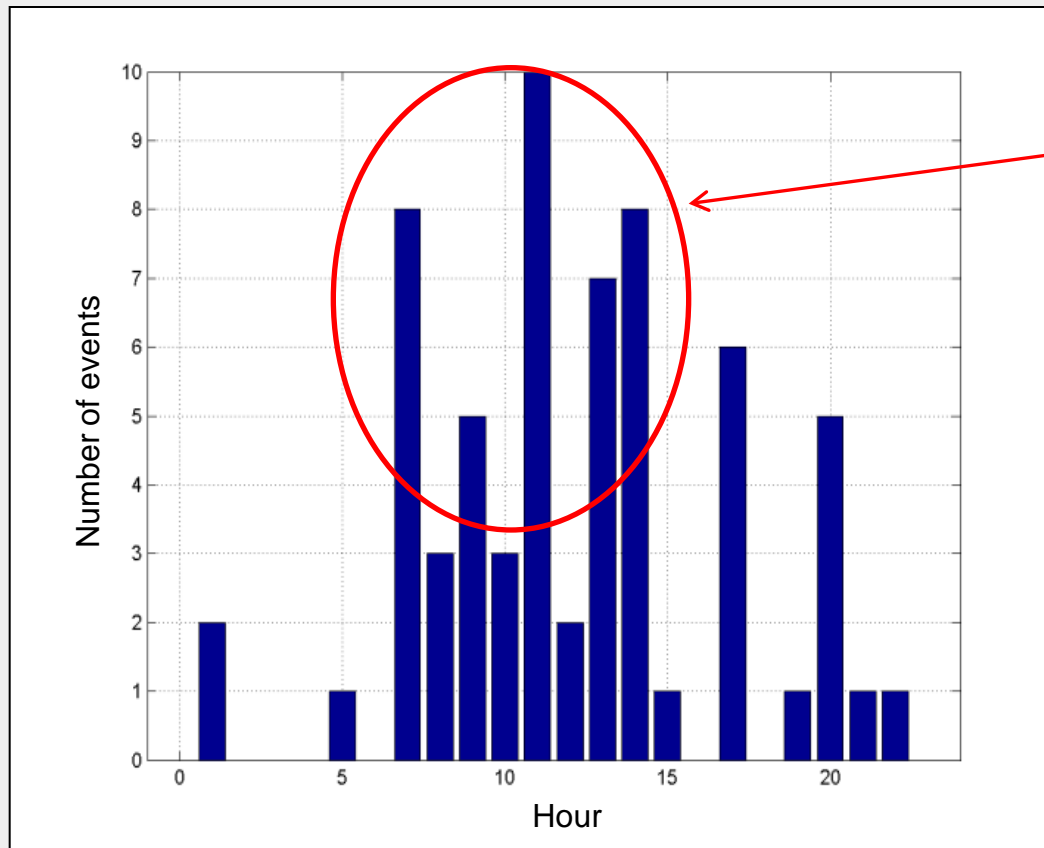- Interference level & spectrum

- Impact on GPS-receiver (Ublox 7)

Example of detection, GNSS receiver

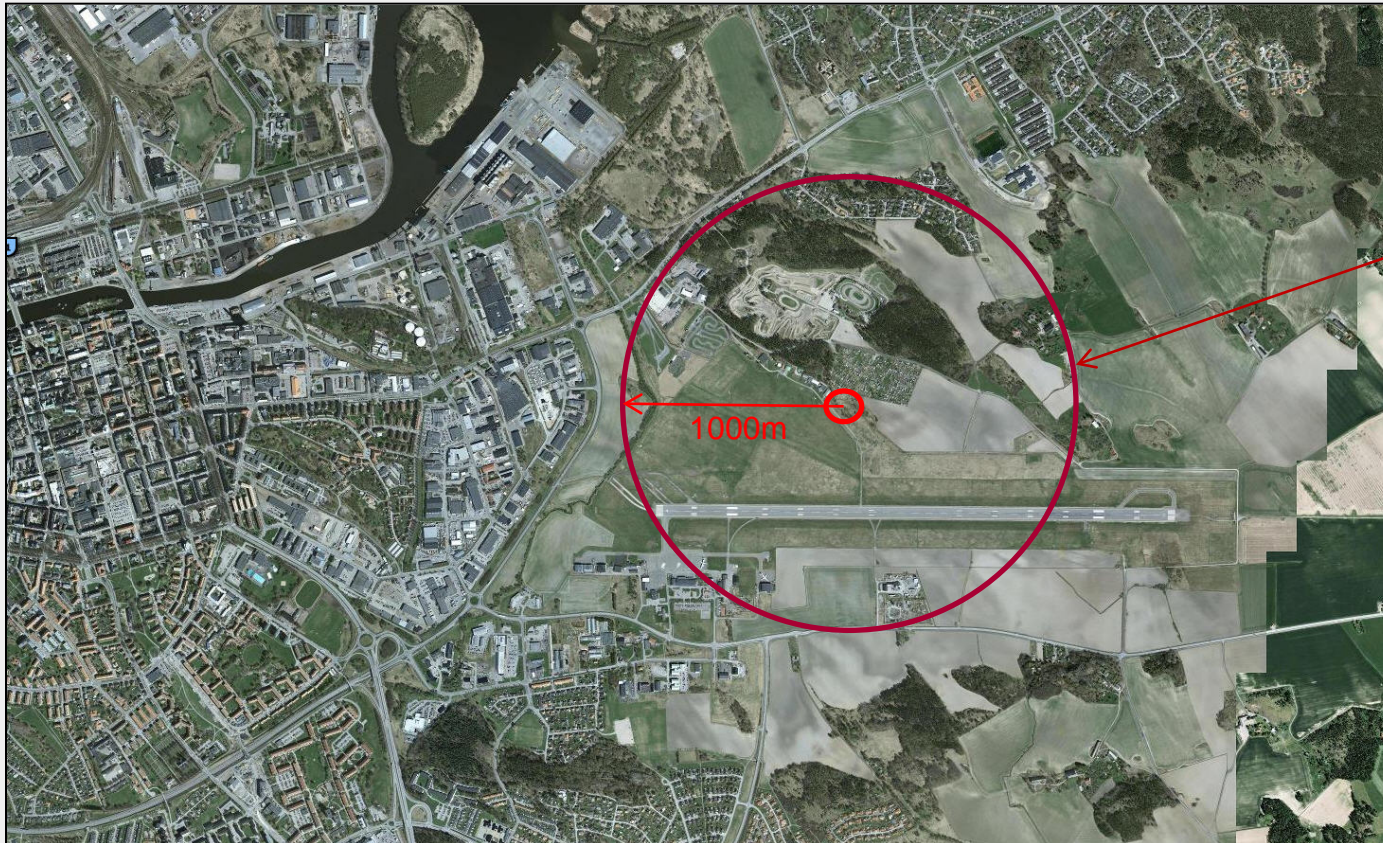The variation of the signal-to-noise [dB/Hz] averaged over all tracked satellite signals.

Interference event
- duration ~2 min
- loss of 1 satellite
- C/N_0 decreased by 10 dB

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Examples - analyses of events over time

Obviously "Man-made" interference at working hours

Overview of the test location

No traffic within a 1 km range

1000m

Close-up of test location

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Norrköping SWEPOS antenna

the detection system is using the SWEPOS reference antenna

Results and conclusions

- No detections of jamming events were made during the test period (20/7 2013 until today)

- The location of this station is well suited, and "quiet", if your intention is to receive GNSS-signals

- The location of this station is not optimal, and "to quiet", if your intention is to detect GNSS jamming from vehicles

- Cooperation and use of Lantmäteriets infrastructure and SWEPOS network may be a good solution, but the used station needs to be closer to traffic

- The location of Lantmäteriets antennas and the antenna type (choke-ring antenna), might not be the best solution due to the attenuation of low azimuth angle signals

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Questions?
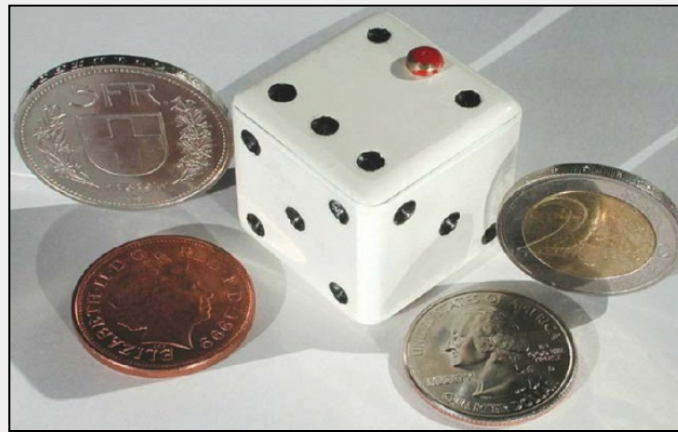
Tiny "device" demonstrated by at a GNSS simulator conference 2006

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