



**8TH Interference Detection and Mitigation
Workshop - Baska, Croatia
14 May 2019**

International Committee on GNSS (ICG)
8th IDM Workshop
Royal Institute of Navigation (RIN) Baška GNSS Conference
Baška, Croatia 14-15 May, 2019

UN

14 May, 2019 (*Open to all conference participants and ICG WG-S members*)

1500: Opening Discussion / Introductions

1510: Development and Operation of a GPS Jammer Localization System at Incheon International Airport - *Dr. Deok Won Lim, Ph.D./Senior Researcher, Navigation R&D Division, Korea Aerospace Research Institute*

1530: Measurement Test of Purchased Radio Equipment - Short Range Device -
Mr. Takahiro Mitome, SKY Perfect JSAT Corporation

1550: Interference from Amateur Services to GNSS within the 1260-1300 MHz band (Galileo E6 /BeidouB3 band) – *Mr. Matteo Paonni, Scientific/Technical Officer, European Commission, Joint Research Centre*

- 1610: Project Introduction: GNSS Interference Detection and Localization in the City -**
Ms. JIN Ruimin, China Research Institute of Radio-wave Propagation
- 1640: Systematization of Information on Various Types of GNSS Receivers and Various**
Types of Interference – *Mr.Egor Zheltonogov, Geysler-Telecom Ltd.*
- 1710: GNSS RFI Status Downlink–** *Mr. Gerhard Berz, Focal Point Navigation*
Infrastructure, EUROCONTROL (by Teleconference)
- 1740: Actual Question of Monitoring in the Navigation Situation –** *Mr. Sergey Silin,*
Design Bureau of Navigation Systems (NAVIS Inc.)
- 1800: Discussion**

Adjourn

Development and Operation of a GPS Jammer Localization System at the Airport



Deok Won Lim
Korea Aerospace Research Institute

Conclusions

- South Korea experiences nation-state purposeful jamming affecting thousands of wireless communications stations, ships and aircraft.
- Localization system developed and tested at Incheon International Airport using algorithms guaranteeing integrity and continuity of air navigation systems.
- System verification tested in indoors environment
- Week-long live-sky test provided results indicating real jamming case, <6 second localization and position origin of interference signal.



*Measurement Test of
Short Range Device Samples*

*The 8th Interference Detection and Mitigation
(IDM) Workshop
- International Committee on GNSS (ICG) -*

14 May 2019

Takahiro MITOME (Japan)

Measurement Test of Short Range Device Samples in Japan

- In Japan, electromagnetic emission limits of non-licensed emitters are defined and a “Measurement Test of Short Range Device (SRD) Samples” is conducted every year.
- In this test, some commercially available non-licensed emitters/devices are randomly selected, purchased by the telecommunication administration and checked for compliance with established limitations.
- In this year’s test, one device was found to exceed the limit at the frequency of 1585.464 MHz, as shown below.

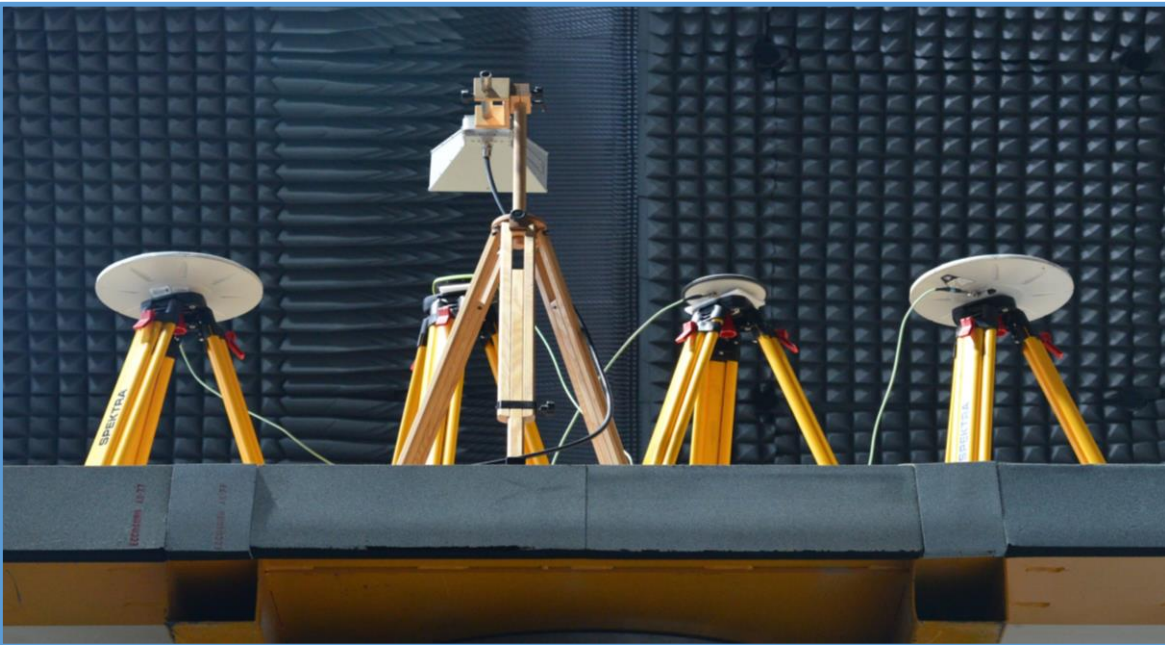
Frequency (MHz)	Polarization	Measured result ($\mu\text{V}/\text{m}$)	Limit($\mu\text{V}/\text{m}$)
1585.464	Horizontal	389045.1	35
1585.464	Vertical	131825.7	35

- An example of Japan’s regulatory process to suppress devices which produce larger emissions than allowable. It is encouraged that each country exchange in ICG their practical framework for the prevention of GNSS jammers.

Compatibility Assessment Between Amateur Radio Services and Galileo in the E6 Band

• M. Paonni

Joint Research Center (JRC), European Commission, Ispra, Italy



**8th Workshop on Interference
Detection and Mitigation**

Baska, Croatia

14.05.2019

Summary

- **Experimental tests** with **live signals** were carried out using high-end **E6**-enabled receivers and a testplan coordinated with IARU members
- Realistic scenarios have been considered with a variety of **emissions** with different **power/distance** profiles
- **Very important degradation** for different KPIs (C/N_0 , Pseudorange variance and Bit Error Rate) for different E6 receivers measured
- Noting the ATV impacts on the Galileo E6 signals (and certainly **other RNSS systems** using the same frequencies):
 - ✓ AS already acknowledges its secondary status and has indicated **compliance** where necessary
 - but, **additional** radio regulatory **decisions** may be required
 - ✓ Galileo working with EU national authorities to determine **appropriate measures**
 - ✓ wider decisions at **CEPT** and **ITU** level could be expected in future
- Important to underline that **some AS applications** may be easily **compatible with GNSS**



GNSS interference detection and localization in city

Ruimin Jin , Weimin Zhen, Dongliang Lv, Xin Chen, Di He

Conclusion

- A project named “GNSS Interference Detection and Localization in City” from the China Ministry of Science and Technology was briefly introduced.
- A critical technology called GNSS interference detection and localization based on pattern recognition was presented in detail.
- The GNSS electromagnetic environment was measured in some typical cities and scenarios including an airport, central business district, harbour, city road, etc.
- Because transmission of RFI in a city maybe affected by reflection and refraction of buildings, it is difficult to localize the RFI source with traditional methods.
- Detection and localization of GNSS interference through feature study of carrier and noise ratio at the monitor node is the focus of this study.
- The project will be completed by the end of 2020.
- The technology will be applied to engineering of GNSS detection and localization in China.

Systematization of Information on Various Types of GNSS Receivers and Various Types of Interference

Dr. D. Aronov
E. Zheltonogov

Baška, Croatia, 12-15 May 2019

Further actions

Systematization of protection criteria, and approaches to interference estimation depending on the types of RNSS receivers to elaborate reference values of the electromagnetic environment for their subsequent monitoring to protect GNSS spectrum from radio interference from other radio services other than the radionavigation satellite service.

Interference types Receiver types	Wideband	Narrowband	Pulsed
Air-navigation	-	-	-
Maritime	-	-	-
Ground-based	-	-	-
Space-based	-	-	-

ICG participants are invited to supplement the proposed material regarding possible types of receivers, and their protection criteria for various types of interference

Speculation

Further actions

Speculation

Systematization of protection criteria, and approaches to interference estimation depending on the types of RNSS receivers (**Protection criteria and methods of interference detection should be standardized according to receiver type.**) to elaborate reference values of the electromagnetic environment for their subsequent monitoring to protect GNSS spectrum from radio interference from other radio services other than the radionavigation satellite service. (**Reference values within the electromagnetic environment should be established and subsequently monitored to protect GNSS spectrum from harmful interference outside the radionavigation satellite services.**)

Interference types \ Receiver types	Wideband	Narrowband	Pulsed
Air-navigation	-	-	-
Maritime	-	-	-
Ground-based	-	-	-
Space-based	-	-	-

ICG participants are invited to supplement the proposed material regarding possible types of receivers, and their protection criteria for various types of interference. (**ICG participants are invited to provide established limits in their countries to fill in the proposed matrix regarding different types of receivers, and their protection criteria for various types of interference.**)

Speculation

GNSS RFI Status Downlink

Gerhard BERZ

Senior Expert Navigation Systems
CNS Evolution Unit, DECCA/RTD

UN ICG / IDM Workshop
Baska, Croatia 14 May 2019

gerhard.berz@eurocontrol.int



Presentation Summary

- EUROCONTROL developing near and long term RFI mitigation capabilities for aviation
 - Driven by increase of GNSS issues in pilot reporting in 2018
- Evaluating use of ADS-B in “aircraft crowdsourcing”
 - Determine area of impact for operational management to keep airspace open safely as long as possible
 - Approximate airborne RFI source location to enable efficient elimination by radio regulatory enforcement on ground
- Proposing improvements to future equipment functions
 - Direct detection of RFI at GNSS receiver and broadcast to ATC
 - Many technical, operational and programmatic open questions remain, R&D exchanges on topic are welcome
 - Main technical challenge remains getting suitable test data to validate approach and quantify benefits

Arguments for Jammer Prevention

- Ensure implementation of suitable location privacy laws and awareness to help limit motivation of private citizens and employees to purchase jamming devices
- Consider outreach to ensure that / to:
 - Help citizens and employees understand that location privacy laws are in place to protect them
 - ✓ Operating a jammer in a company vehicle is a legal reason to fire someone, tracking an employee is not (EU regulation)!
 - Information is available in local and relevant foreign languages about jammers being illegal (internet searches) and the significant fines in place when caught
 - Alert to the risks they can pose to infrastructure and services (without too detailed explanations)
 - Explain that operating a jammer may lead to being tracked by law enforcement as a suspect of illegal activities



Actual Issues of Navigation Conditions Monitoring

International Committee on GNSS (ICG)
Working Group S

IDM Subgroup

Alexey MURAVYEV
Sergey SILIN
NAVIS Inc.



Conclusions

- Conditions navigation monitoring is a relevant task.
- It is offered to use the navigation and information systems for conditions navigation monitoring in responsible zones.
- Researches of questions of methodical ensuring monitoring of navigation and information systems are planned in actions for development of GLONASS system.
- The first results of researches were discussed on the Working Group S meeting of International Committee on GNSS in 2018, on International GLONASS/GNSS Forum in Moscow in 2019 and on the some Russian scientific conferences.
- Offers on the organization of the international project are prepared.



Speculation

Conclusions

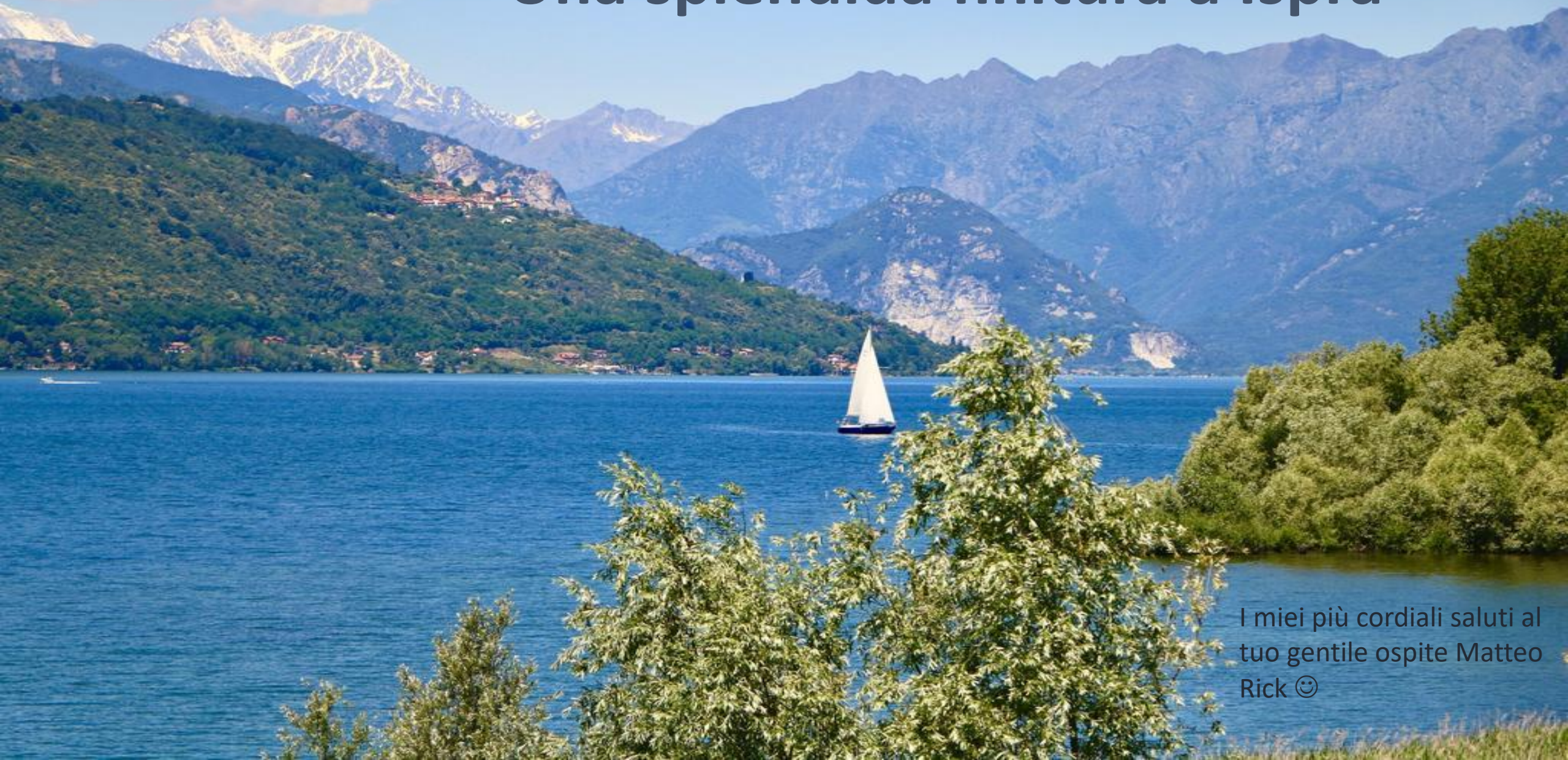
Speculation



- Conditions navigation monitoring is a relevant task. (Monitoring of the spectrum environment for appropriate navigation conditions is an important task)
- It is offered to use the navigation and information systems for conditions navigation monitoring in responsible zones. (A method to use navigation and information systems for interference monitoring in areas of critical infrastructure is proposed)
- Researches of questions of methodical ensuring monitoring of navigation and information systems are planned in actions for development of GLONASS system. (Studies of various analytical methods for monitoring of navigation and information systems are in planning within the GLONASS program).
- The first results of researches (studies) were discussed on the Working Group S meeting of International Committee on GNSS in 2018, on International GLONASS/GNSS Forum in Moscow in 2019 and on the some Russian scientific conferences.
- Offers on the organization of the international project are prepared. (Proposals for the organization of this international project are being prepared).

Speculation

Una splendida finitura a Ispra



I miei più cordiali saluti al
tuo gentile ospite Matteo
Rick 😊