SnT 2023
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
HOFBURG PALACE - Vienna and Online
19 TO 23 JUNE

Data Transmission System for On-Site Inspection

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CTBTO PREPARATORY COMMISSION

INTRODUCTION

The development of telemetry-enabling technologies opens opportunities to improve the operational capabilities of the Inspection Team (IT) during On-Site Inspection, which can be done by adopting a Data Transmission System.

METHODS/DATA

Data Transmission System is based of LTE technology which offers real-time data transfer solution from Inspection area to Base of Operation. The solution is embodied into a robust housing ready for deployment.

START

RESULTS

The recent upgrades of the system shows convincing data transmission capabilities, field deployable use, and interesting information protection features.

CONCLUSION

The use of LTE-based Data Transmission System helps in fully coping with the Treaty's requirements by saving time and human resources, precious asset of an On-Site Inspection

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Introduction: On-Site Inspection operational constraints

Treaty provides with provisions on OSI:

- No Standing Inspectorate
- Use of approved inspection Equipment
- Inspection Area Max 1000 km2
- Inspection team (IT) size Max 40 persons
- Inspection duration: up to 130 days (60 + 70)

An OSI is an operational and technological complex mission.

Some techniques, especially the Passive Seismic Monitoring, are time consuming and resources consuming activities. The two main advantages of the Data Transmission System for OSI are:

- Real time data collection and speeding up the analysis in working area
- Freeing up Inspectors' time for more productive activities

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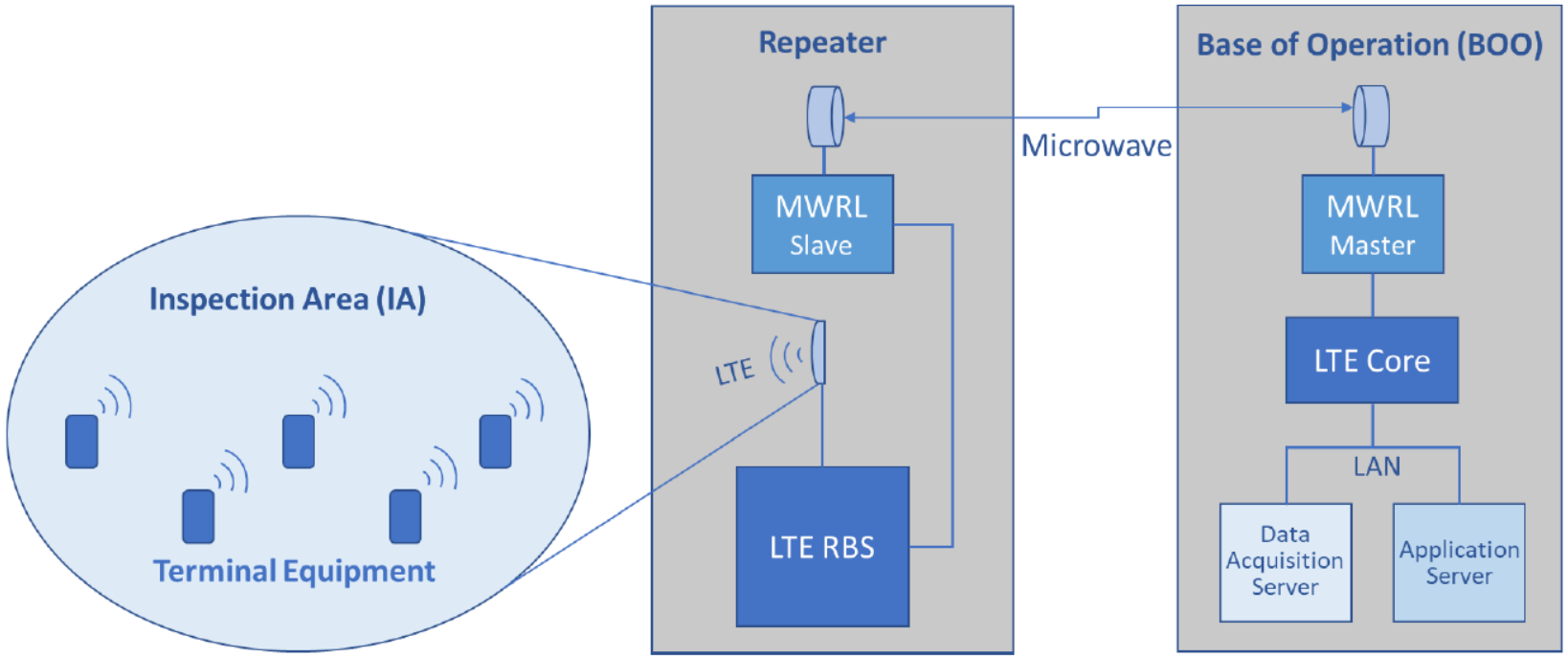
Objective: Design of Pilot solution for Data Transmission system for OSI

Data Transmission System based on LTE technology = most suitable wireless technology for broadband communication. The pilot solution should include:

- LTE Core equipment and application server on BOO site
- Data acquisition server on BOO site
- Microwave Radio link between BOO and repeater site
- LTE Radio base station equipment at repeater site
- Terminal equipment equipped with LTE capability, located in the Inspection area



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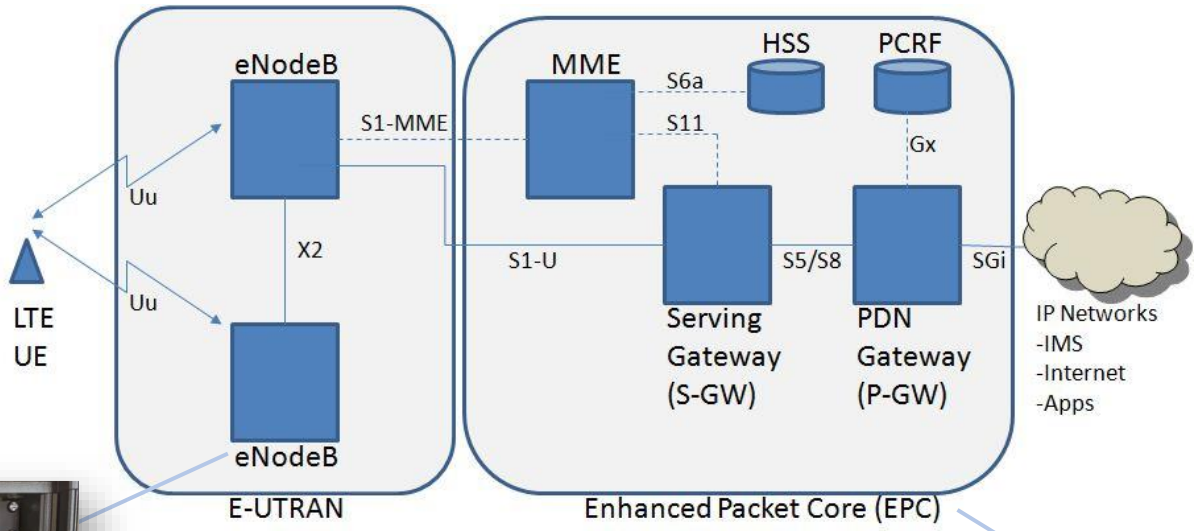
Methods and Data: LTE architecture

LTE technology which consists of a rapid network deployment solution developed including:

- Evolved Packet Core server
- Network Time Protocol server
- eNodeB (x1) composed of Base Band Indoor Unit and 3 Radio units operating in LTE bandwidth B20
- Sim-cards with testing IMSI



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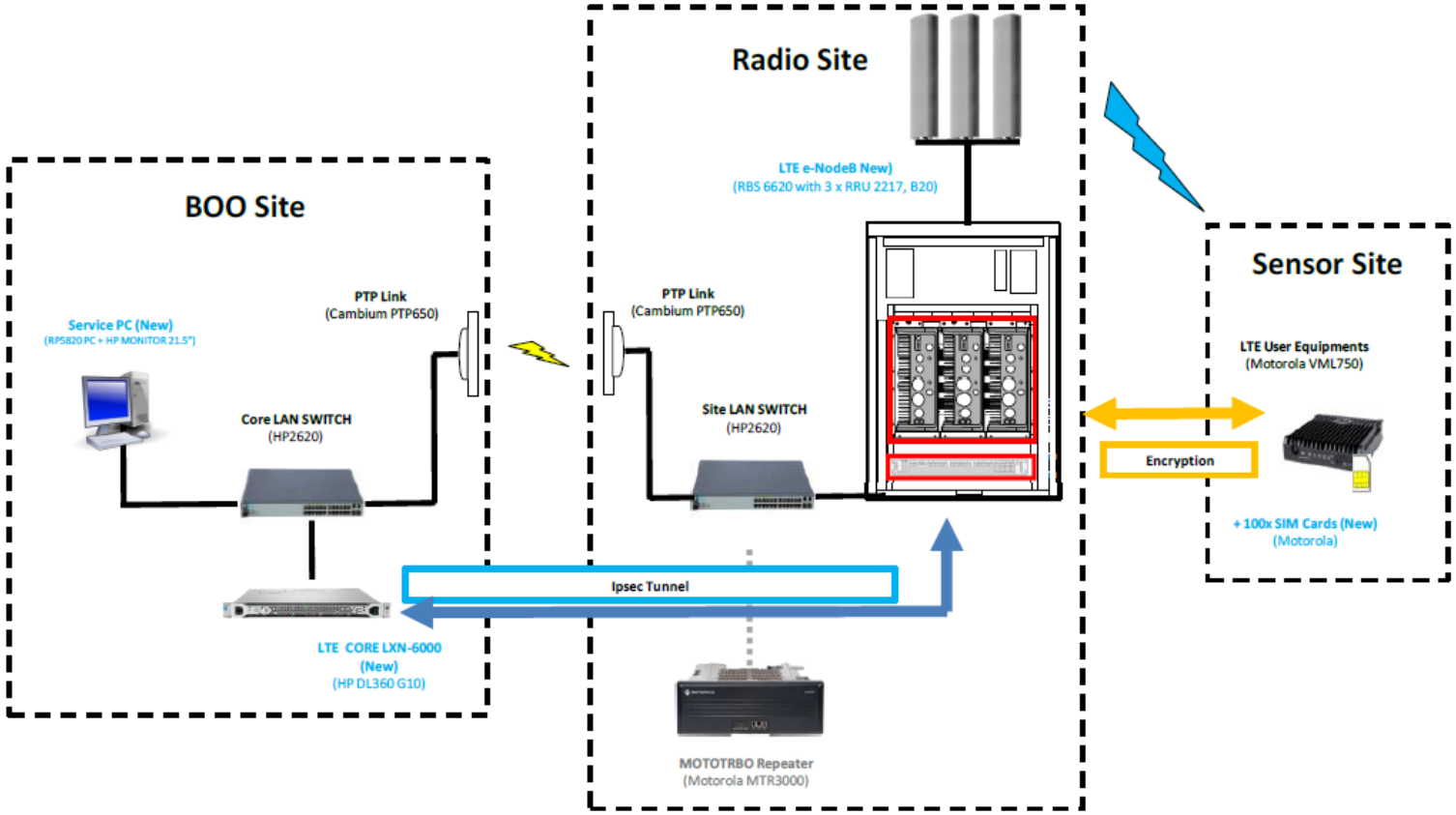
Methods and Data: Security features of LTE architecture

Secure connections

- Ciphering encryption over the air interface between User Equipment and e-NodeB
- Blackhaul link protection with IPsec tunnel between LTE core and e-NodeB



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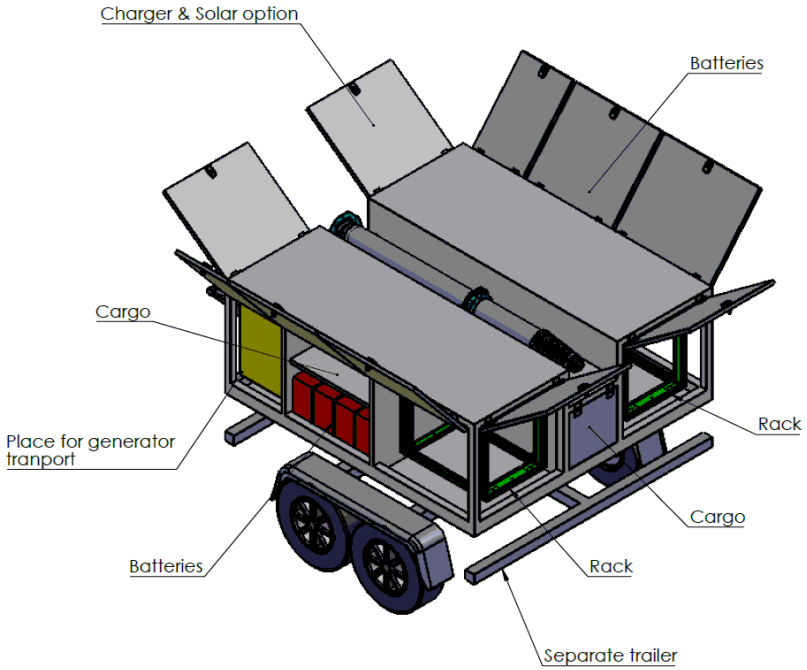
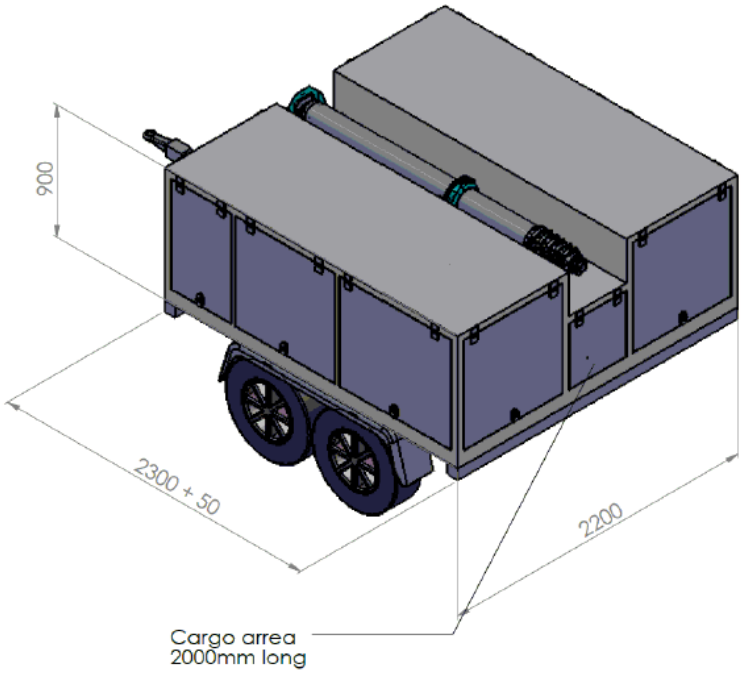
Methods and Data: Deployable trailer for housing the repeater

Modular standalone trailer with characteristics:

- Off-road robust trailer
- 2 x 12 RU racks with fans for telecommunication equipment
- Pneumatic mast (10m) for antennas
- Uninterruptible Power supply including
  - 48V batteries pack with inverter, MPPT solar charger and converters.
  - 12/24/48V DC and 230V AC available
  - 4 kW diesel generator





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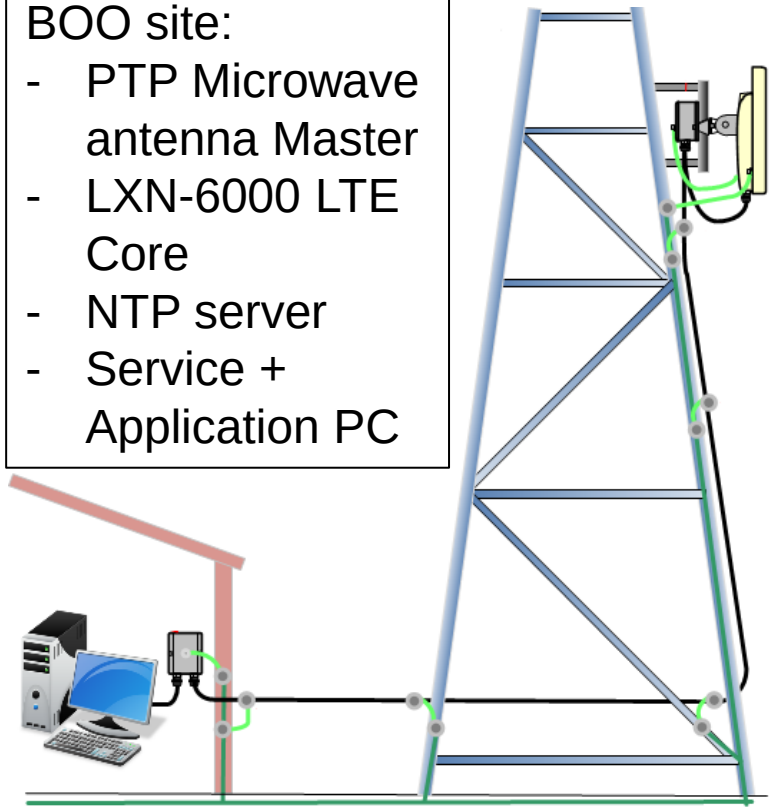
Results: Deployable OSI Data Transmission System

Deployable OSI Data Transmission System

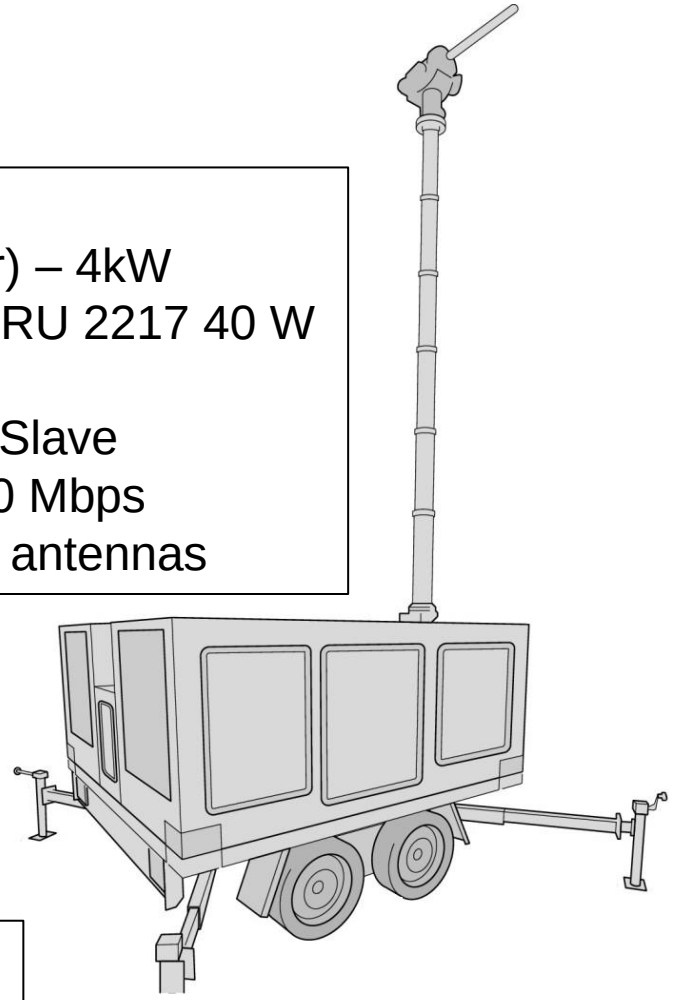
- Partially acquired in 2015 and completed in 2017, 2018 and 2022
- Tested in Field conditions in 2017 and soon in fall 2023
- Upgraded in 2022 and 2023

Concept of operations draft in 2018

BOO site:
- PTP Microwave antenna Master
- LXN-6000 LTE Core
- NTP server
- Service + Application PC



Radio/Repeater site:
- UPS (batteries+generator) – 4kW
- eNode-B BB6620 + 3 x RRU 2217 40 W Up to 1Gbps
- PTP Microwave Antenna Slave LOS Range 200 km – 450 Mbps
- 3 x 65°- 698-896 Mhz RF antennas



Inspection equipment site:
- VML750 LTE Vehicle Modem
- LTE antenna

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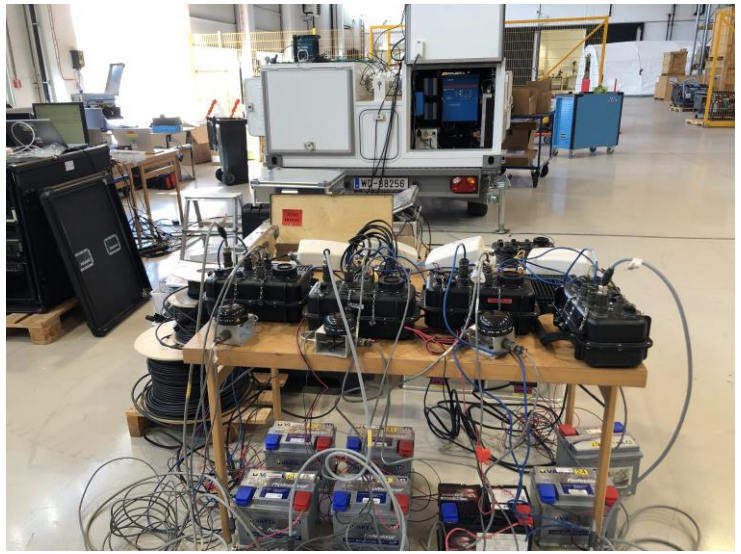
Results – Field and Operational testing

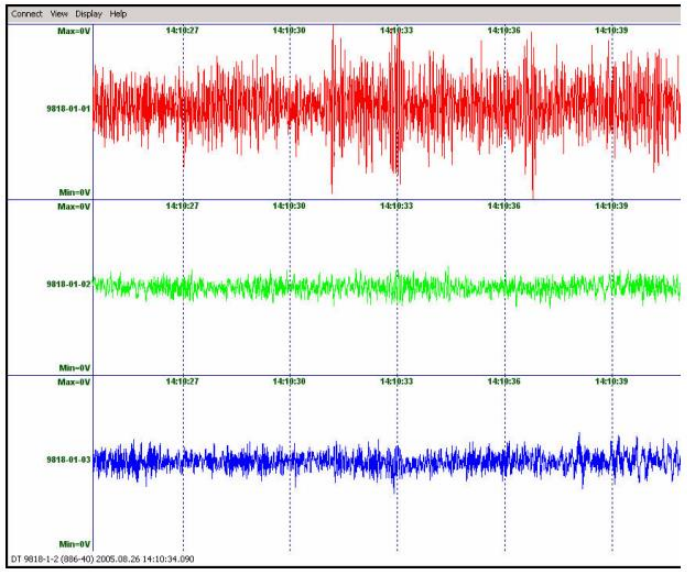
Field test in 2017 Seetaler Alpe = field conditions testing

- Longest transmission leg = 30km
- Continuous data transmission for Passive Seismic Monitoring technique
- Operational Tests on other techniques

Upgrade and operational testing in 2022 and 2023

- Validation on multiple and simultaneous User Equipment operations
- Validation for data transmission capabilities for Positioning technique and Gas sampler technique
- LTE network coverage and capacity extensions – 100km





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Conclusion – Data Transmission System for On-Site Inspection

- The Field and Operational Tests confirmed the technical capability of data transmission in relation to Passive Seismic Monitoring technique and indicated its potential use for other techniques such as Position Finding, Environmental Sampling.
- Operational security purposes were also tested and showed interesting results which must be further investigated.
- Recent upgrade extended theoretically the cell range up to 100km and should be tested soon for technical approval.
- In preparation for future exercises, a set of spares has been acquired
- Training and maintenance programme on the System has been reinforced to further build the capacity related to the deployment, the operation and the troubleshooting of the Data Transmission System
- A significant incoming step is the inclusion of the specific dataflow into the general On-Site Inspection dataflow.

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