



Radio Infill, a way to improve ERTMS Level 1 performance: the first worldwide trial application

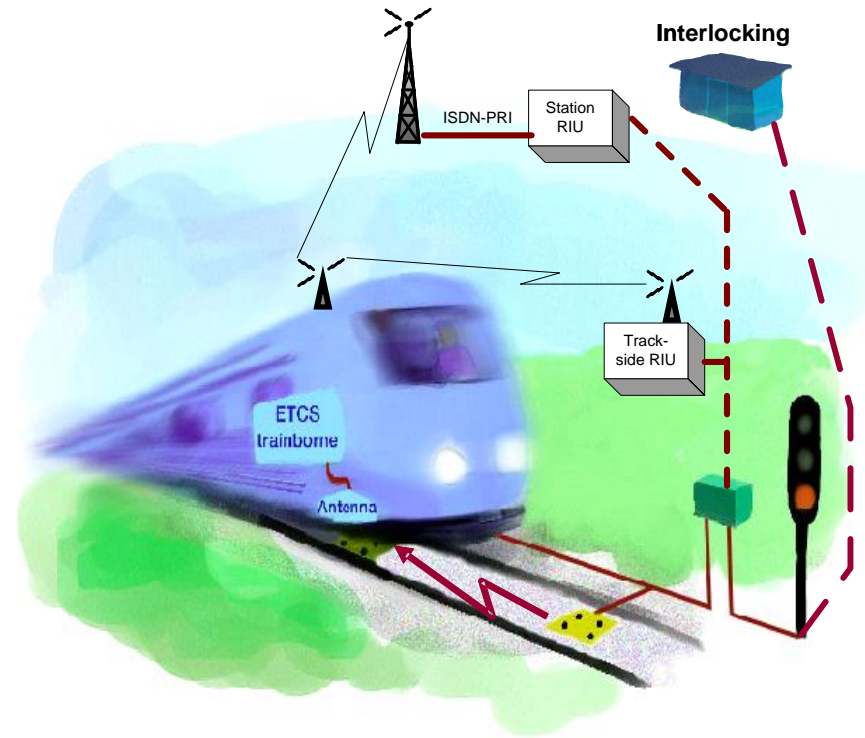
Giancarlo Trignani

Bombardier Rail Control Solution



ERTMS / ETCS L1 + Radio Infill

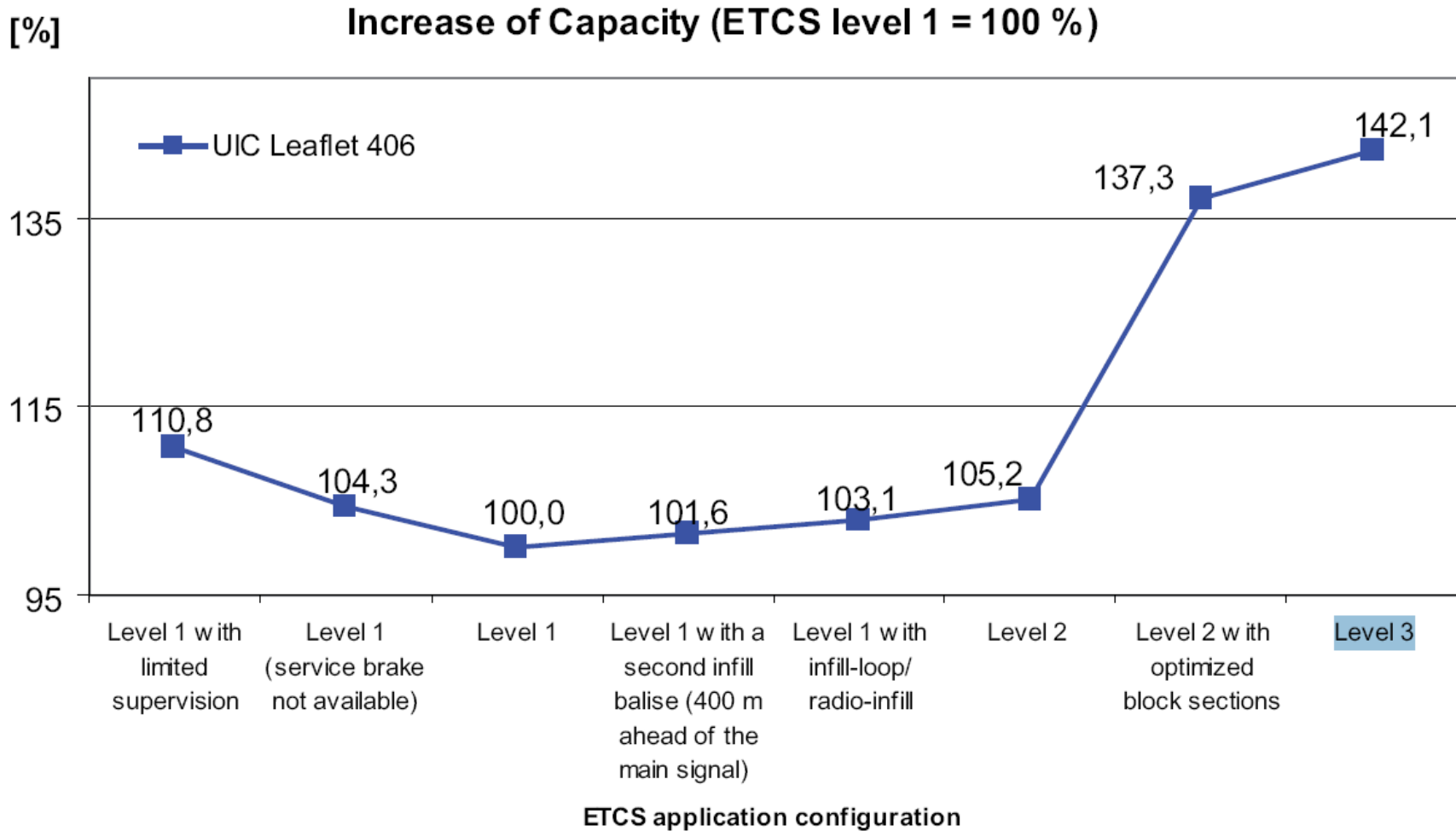
- The **Radio Infill Subsystem** provides to the train signalling information **in advance** as regard to the next main signal in the train running direction
- The ETCS on board system will be able to show **new information** to the driver as soon as they are available and even at standstill, allowing to start again or to release the brake curve if the main signal in the train running direction becomes more permissive



The advantages of Radio infill

- Full reuse of the existing ERTMS / ETCS L1 equipments in case of line upgrades
- It guarantees to ETCS trains the continuity of the infill messages sent while passing from a signal to the next one
- Enhancement of permitted speed (ceiling speed)
- Refresh of section timer
- Increase safety for Level Crossing
- Release speed = 0 at entry signal
- Increased exploitation of the existing GSM-R network coverage (enhanced payback of investment and of radio channels availability)
- Better performance compared with ERTMS / ETCS L1 with other Infill device
- Lower cost compared with ERTMS L2

Increased capacity



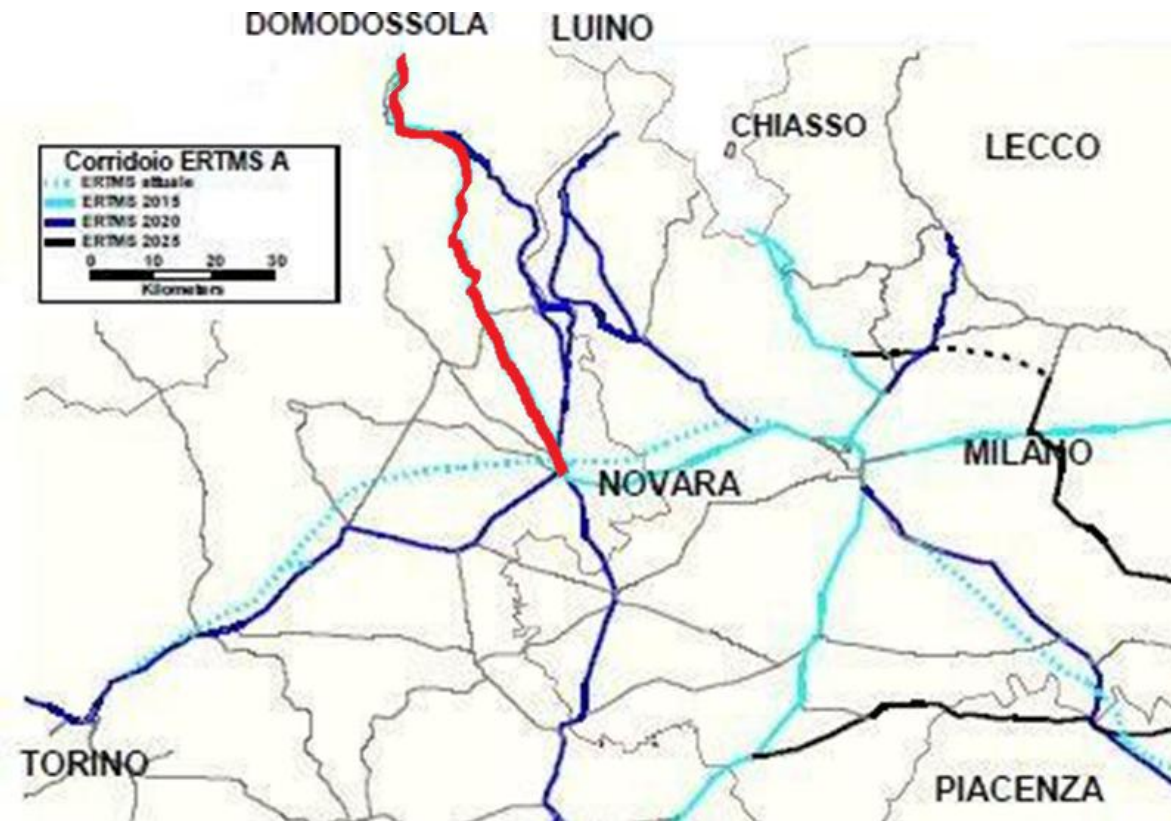
Domodossola-Novara Project

- Italy is involved on 3 prioritized European Corridors:
 - Corridor A: Rotterdam – Genoa
 - Corridor B: Stockholm – Naples
 - Corridor C: Valencia – Budapest
- RFI (Italian Infrastructure Manager) migration strategy for European Corridors:
 - ERTMS L2: HS / HC and primary traditional lines
 - ERTMS L1 + Radio Infill: secondary lines

The Domodossola – Novara line is part of European Corridor A and will be the first worldwide trial application for Radio Infill

Trial Project Data

- 84 Km single track railway line
- 15 stations
- 60 Level Crossings
- Maximum speed 130 Km/h
- Domodossola station cross border Italy / Switzerland
- Part of ERTMS European Development Plan



Trial Project Scope

- Upgrade SCMT (Italian Legacy system) to ERTMS / ETCS L1 + Radio Infill compliant to BL3 specifications
- Develop, homologate and EC certificate the related wayside products
- Test the feasibility to manage the European corridor interoperability and the SCMT equipped trains for national railway traffic at the same time



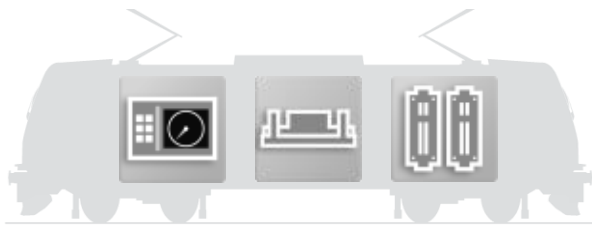
Why BaseLine3

- Usage of train category data and functions
- New Braking curve flexibility
- Usage of the Limited Supervision almost the same protection of ERTMS / ETCS L1 system
- Possibility to use Radio Infill with CR742 (double radio on board system)
- Pilot line to test the new specifications in Italy
- Possibility to apply for EU funding
- Permitted braking distance for managing the application of ERTMS / ETCS L1 on conventional line

Existing technology

Other suppliers:

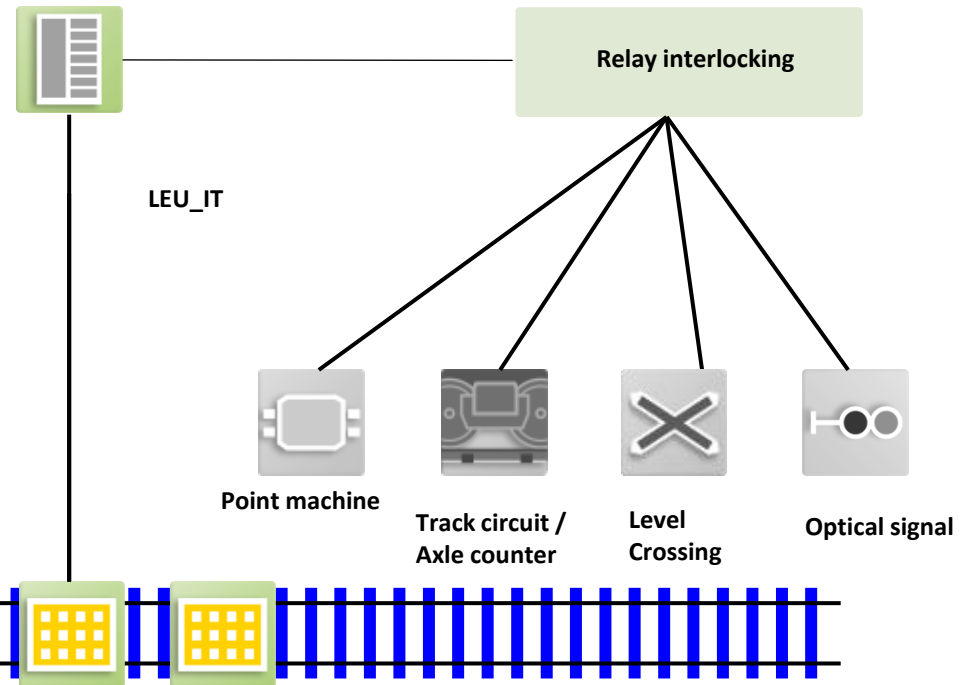
- Relay interlocking
- Axle Counter in line
- Track Circuit in station
- Relay Level Crossing



NTC SCMT onboard

Bombardier

- Controlled and fixed balises
- LEU_IT



Controlled and Fixed Eurobalises

Project status

Activity	Product/System	Date
Test on lab	SMR, Product test environment	Ongoing
Test on lab	Radio Infill Unit, Onboard simulator, ERTMS L1 tools, System test environment, SDM	Ongoing
Installation and Test & Commissioning	SCMT	05/2016
1° segment installation and Test & Commissioning	ERTMS / ETCS L1+Radio Infill	07/2016
2° segment installation and Test & Commissioning	ERTMS / ETCS L1+Radio Infill	03/2017
Tests on site	Onboard	09/2016

Conclusions

The Domodossola – Novara project, being the first worldwide trial of the Radio Infill solution, implementations is fully demonstrating its effectiveness

The ERTMS / ETCS L1 + Radio Infill solution is a simpler and cheaper solution to increase the capacity of already equipped ERTMS / ETCS L1 networks, avoiding the substitution of the equipment in use and maximizing the usage of the GSM-R network actual coverage

Thank You for your attention!!

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