1ST UIC GLOBAL CONFERENCE ON SIGNALLING
The Evolution of ERTMS
MILAN 2018 26-28 March

"The ERSAT Galileo Game Changer"

ERSAT GGC

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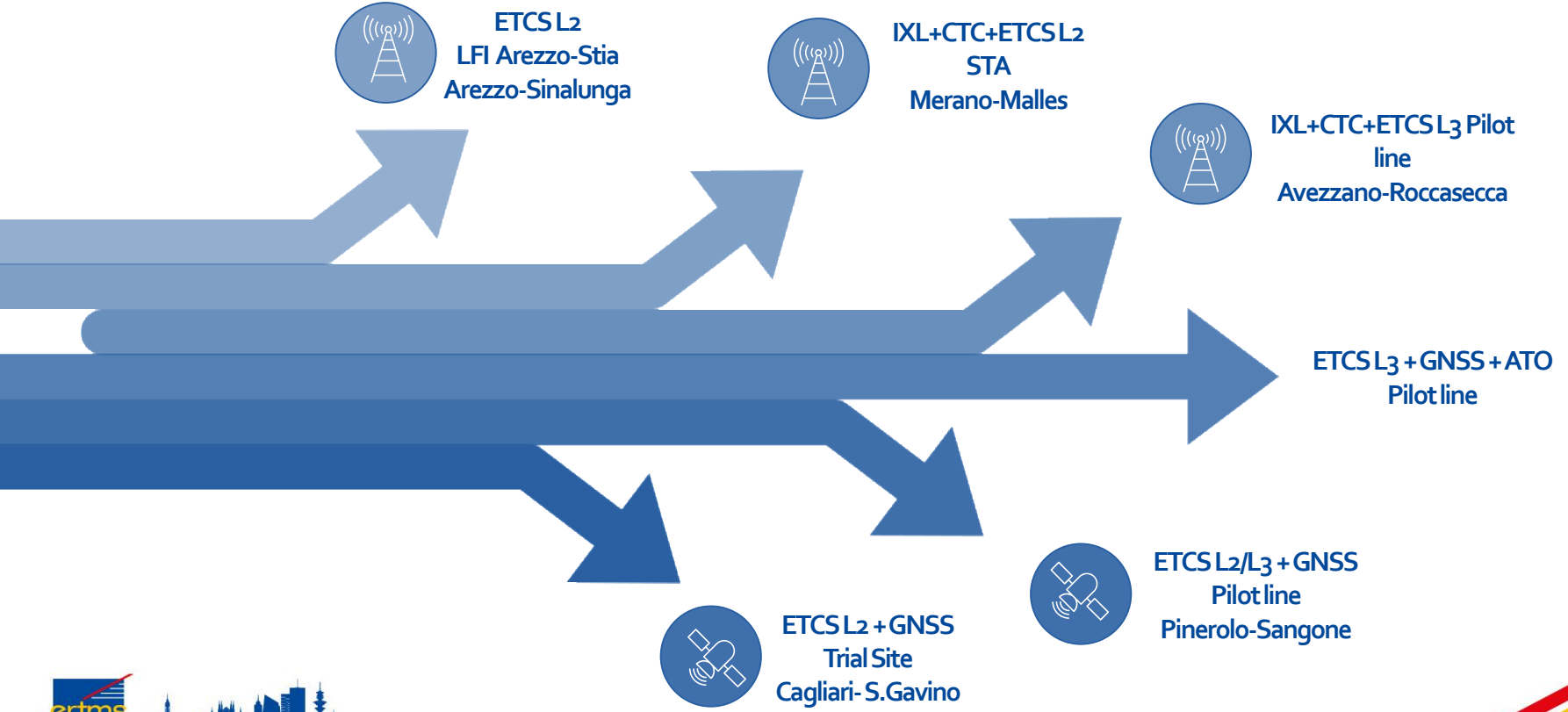
Summary

- Regional lines and GNSS for a new CCS Standard
- ERSAT GGC
- Risk Management and Pilot Line
- Trenitalia contribution and Field Test Results
- Opportunities for Railway Undertakings
- Trenitalia expectations from ERSAT

Regional lines and GNSS for a new CCS Strategy



What has been done – ERTMS on Satellite Projects

2013	2014	2015	2016	2017	2018	2019	2020

3inSAT
GNSS & Satcom Signalling Demonstrator

ERSAT EAV + GGC
ERTMS Application + Test Site

DB4RAIL
Antispoofing and Antijamming technology

SAT4Train
TLC Application

SBS phase 2
Technology Demonstrator

PILOT LINE
Pinerolo - Sangone

2013-2016 — esa, asi

2015-2019 — GSA

2017-2019 — esa, asi

2017-2019 — esa, asi

2018-2020 — esa, asi

2017-2020

ERSAT GGC - A unique european team

- **22 satellites launched**
- **Initial operational services** "on"
- **12 additional** satellites in production
- **4 satellites** per year until 2020

Primary goals of ERSAT GGC are to launch an operational line by 2020, the same year GALILEO services will be operational and to contributing the standardization process at European level for including the satellite requirements into the new ERTMS TSI.

ERSAT GGC - project planning

	2017	2018				2019			
	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
WP1 Project Coordination and Management	Dec 2017 – Nov 2019								
WP2 Enhanced ERTMS Spec and Architecture	Dec 2017– Sep 2018								
WP3 Safety and Hazards Analysis	Jan 2018 – Sep 2018								
WP4 Track Survey and Track Classification	Dec 2017 – May 2019								
WP5 Assessment of Enhanced ERTMS architecture and of Survey process and related toolset		Jun 2018 – Nov 2019							
WP6 Demonstration						May 2019 – Nov 2019			
WP7 Exploitation and Dissemination	Dec 2017 – Nov 2019								

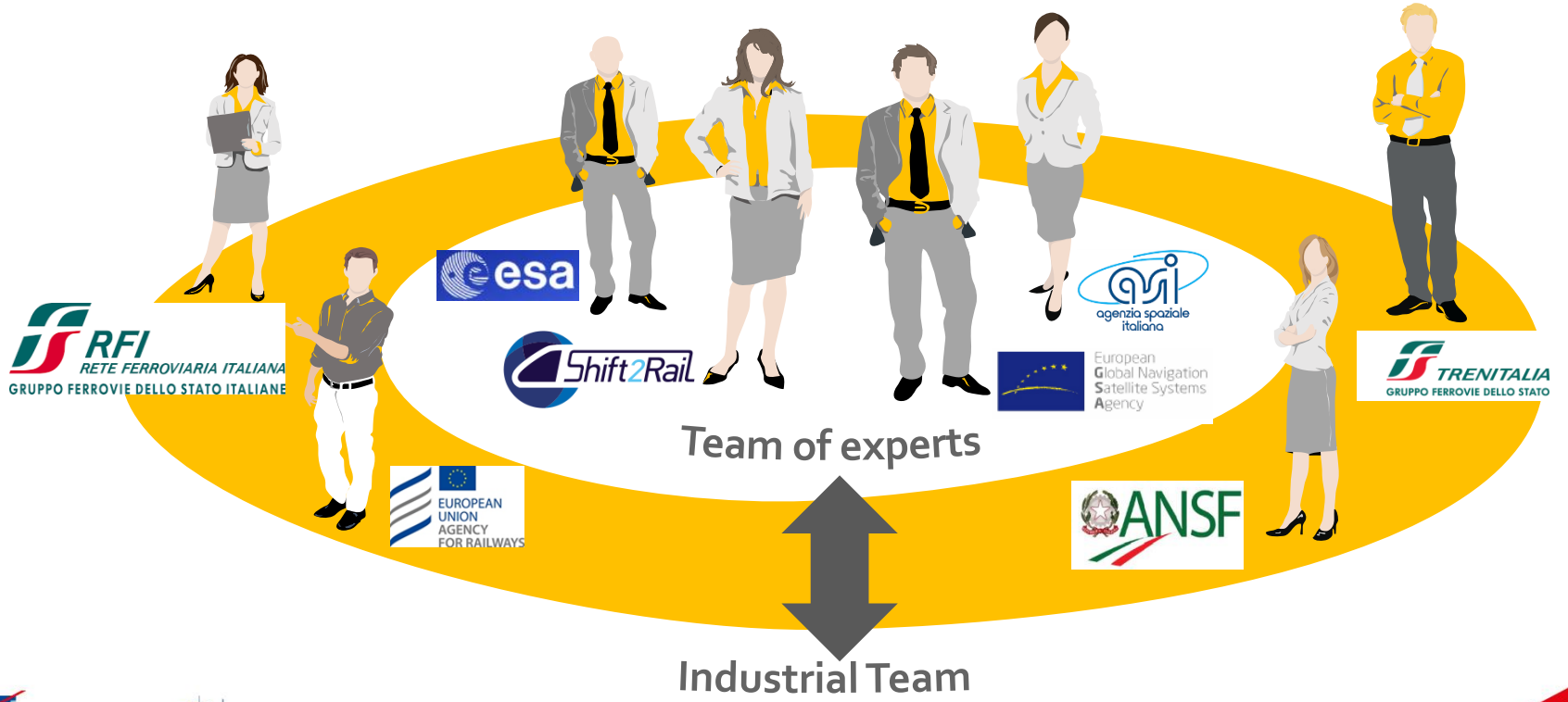
ERTMS on Satellite - Risk Management

Activated **First Formal Certification Process in Europe** for using GNSS & Public Telecom as primary communication infrastructure in ERTMS platform

CE 402/2013 Regulation - **Coordinator of technical committee & Responsible for Authorization Request to ANSF**: RFI

Team of external experts: Ansaldo STS, Radiolabs, Sogei, Telespazio

Working Group to support the certification process



Pilot Line *Pinerolo-Sangone* - Roadmap

2017

Selection – Oct 12

Selection of Train Set and Logistic elements for deploying local Augmentation Network

2020

Activation of ERTMS L2
+ GNSS
+ Local Augmentation Network
+ IP Based Public TLC

Activation - Nov 29

2021

Upgrade – Nov 21

Upgrade to ERTMS
+ GNSS
+ EGNOS Based SBAS

2022

Implementation ERTMS L3
+ GNSS
+ IP Based Public TLC

L3 Impl. - Nov 29

New Annex A TSI CCS

2023

Readyness – Sep 25

Activation ERTMS L3
+ GNSS
+ IP Based Public TLC

ERSAT to modernizing regional lines:
Great opportunity for a lot of Passengers!

Passengers per day

+2 million by train

Every day

+8.500 trains

Trenitalia contribution on ERSAT

- Rolling Stock
- Engineering (V&V, field-tests, design)
- Train Driver
- Maintenance

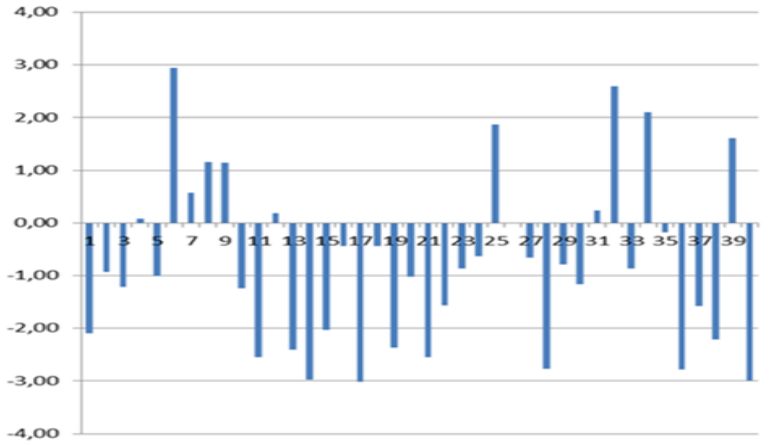
Next step: Tests with 2 rolling stocks contemporary active in the pilot line

Preliminary Field Test Results

10.000 km of field test – 22.000 generated Virtual Balises

The expected value of GNSS **Position Average Accuracy** per train run is less than **+/- 3 meters**

Std Dev: <4m (GPS); <2m (Galileo)



Control Command System performed different tests, **all >95% passed**

-Expected **Delivered** vs Planned Virtual Balises per train run

-Correct **Sequence** of Provided Virtual Balises per train run

-Virtual Balise Groups **detected** inside Expectation window per train run

-**Train Position Confidence Interval**

Integration with Satellite and Virtual Balise: An opportunity for the Railway Undertakings

1. **Increase in the Availability** of the OnBoard Signalling System

Now: **46 events/MLNkm** of unreliability of Signalling System due to failures of balises, problems with the on-board antenna, cable connections.....

on whole regional network would mean → 46 x 156 MLNkm/year ~ 7176 events/year (20 per day)

With ERSAT: The Virtual balise eliminates malfunctioning related to the detection of the physical balises

Integration with Satellite and Virtual Balise: An opportunity for the Railway Undertakings

2. **Increase of reliability** of Signalling System

Now: Problems related to on-board odometry (slipping/sliding wheel), already experienced in ERTMS

With ERSAT: Integration of satellite improve the accuracy of the odometry in condition of low adhesion rail/wheel

RUs benefits from the following savings:

- Savings in **energy** and **time** for unnecessary braking
- Savings for time spent at **starts of mission**

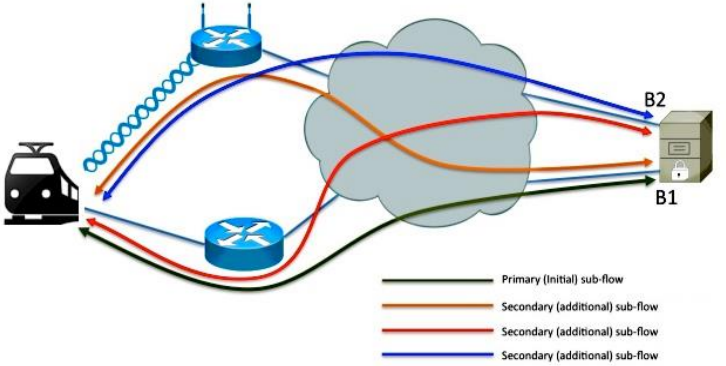
Multipath TCP communications

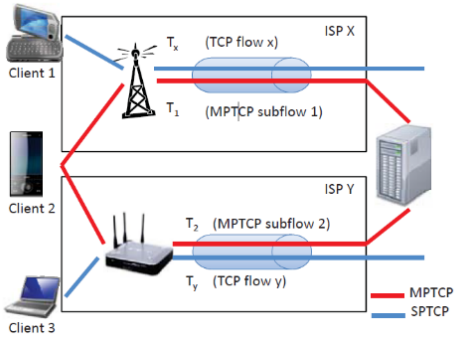
Seamless bearer independent connectivity using public networks

State of the art of Transmission Control Protocol allows connection to **use multiple paths** to **maximize resource usage and increase redundancy.**

Multipath TCP is particularly useful in the context of wireless networks.

Different bearers (GSM 3G/4G/5G mobile networks, Wi-Fi, Tetra, Satellite…) links may be added or dropped as the train moves in or out of coverage **without interrupting** the end-to-end TCP **connection.**





Same technology can be used also to **aggregate multiple mobile network operators increasing overall bandwidth.**

Trenitalia: long term expectations from ERSAT

1. **Reduction of** investment and maintenance **costs**.
2. Modernise signalling system at **lower costs** to **ensure sustainability,** according to the European scale numbers.
3. Guarantee a real and **long-term interoperable** European **standard**.
4. **Improve capacity** of transportation networks extending ERTMS system **on secondary lines and urban nodes.**
5. **Minimize Impact** on **Operational Rules.**

Thank you

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