



**Ansaldo STS**

A Finmeccanica Company

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**Integrated Applications Promotion Programme  
(ARTES 20)**

**Ġ Train Integrated Safety Satellite System (3InSat)  
Demonstration projectĠ**

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***Mouna Lekchiri***

***Rome, 18 April, 2013***





# Presentation Agenda

Ansaldo STS: About Us

Satellite-based Signalling System Trends

The 3InSat Satellite-based Project

Conclusions

move WITH US

## About us: Ansaldo STS



**Ansaldo STS** is a leading technology company listed on the Milan Stock Exchange. It operates in the global Railway & Mass Transit industries, providing signalling systems, transportation solutions and services.

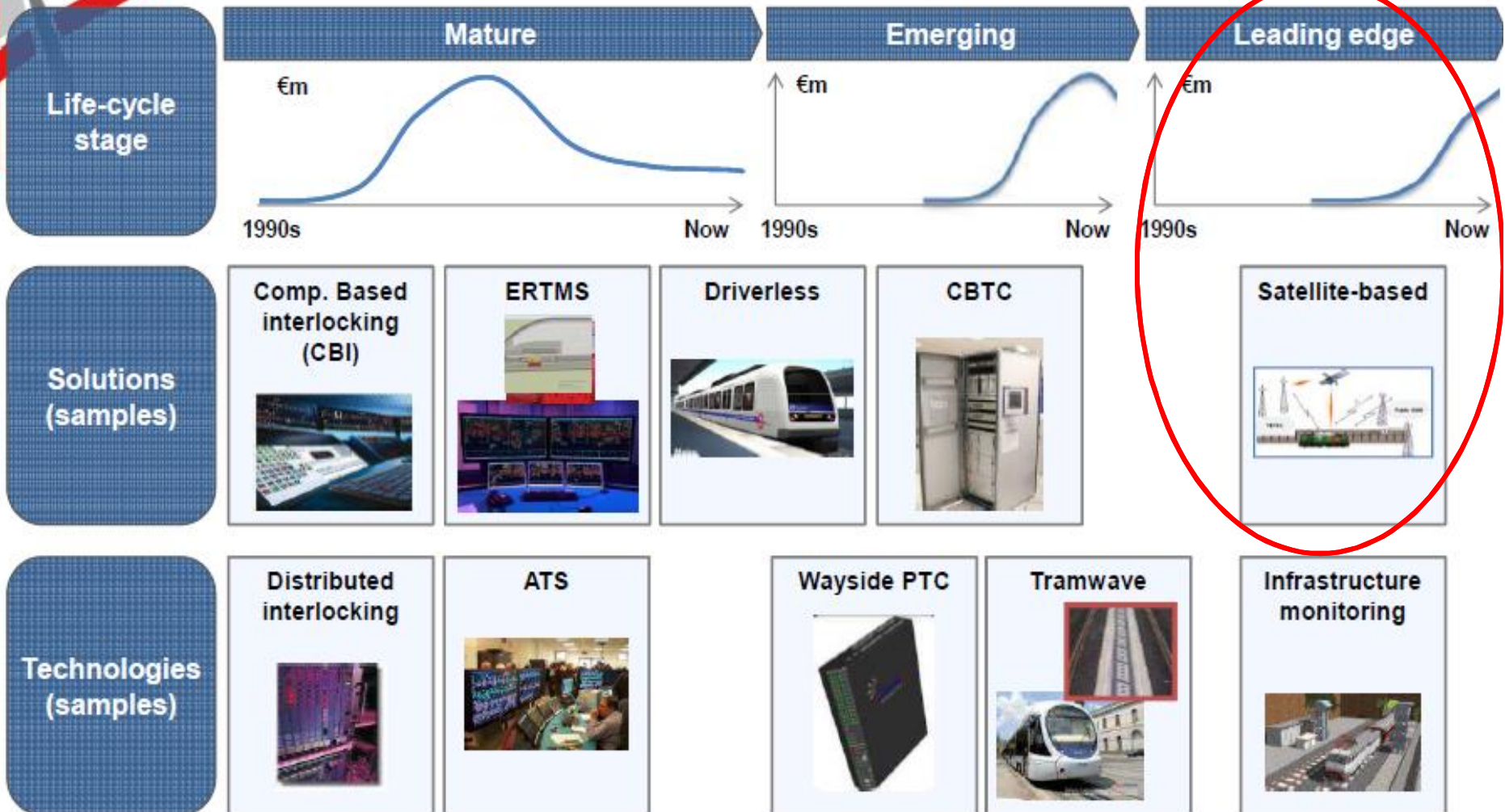
Ansaldo STS also acts as lead contractor and turnkey provider on major projects worldwide.

**Ansaldo STS:** Over a century of innovation around the World, and continuing

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# Unique portfolio: wide range of solutions and technologies



Development times and costs to achieve certified solutions as well as client references represent a defensible barrier to entry

# Innovation: strengthening the core and selectively expanding footprint



**SIG/TS**

**Core: satellite based**



Satellite based  
train localization  
and protection

**TS**

**Core: Tramwave**

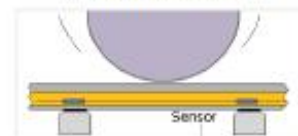
Catenaries-free  
solution for light rail



**Adjacencies:  
infrastructure  
monitoring**

**SIG**

Weigh in motion



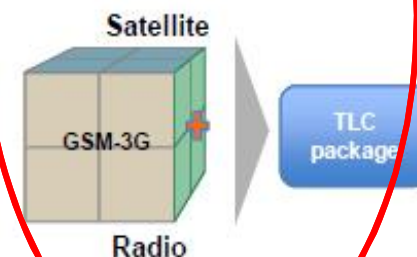
Train conformity check



**SIG/TS**

**Services/OpEx:  
connectivity solutions**

Bundle different TLC  
carriers





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## ***Needs of the users and New Market Trends***

***Virtual Balises and GNSS Location Determination Systems ensure safety in both Dark Territories and Low Traffic Routes***

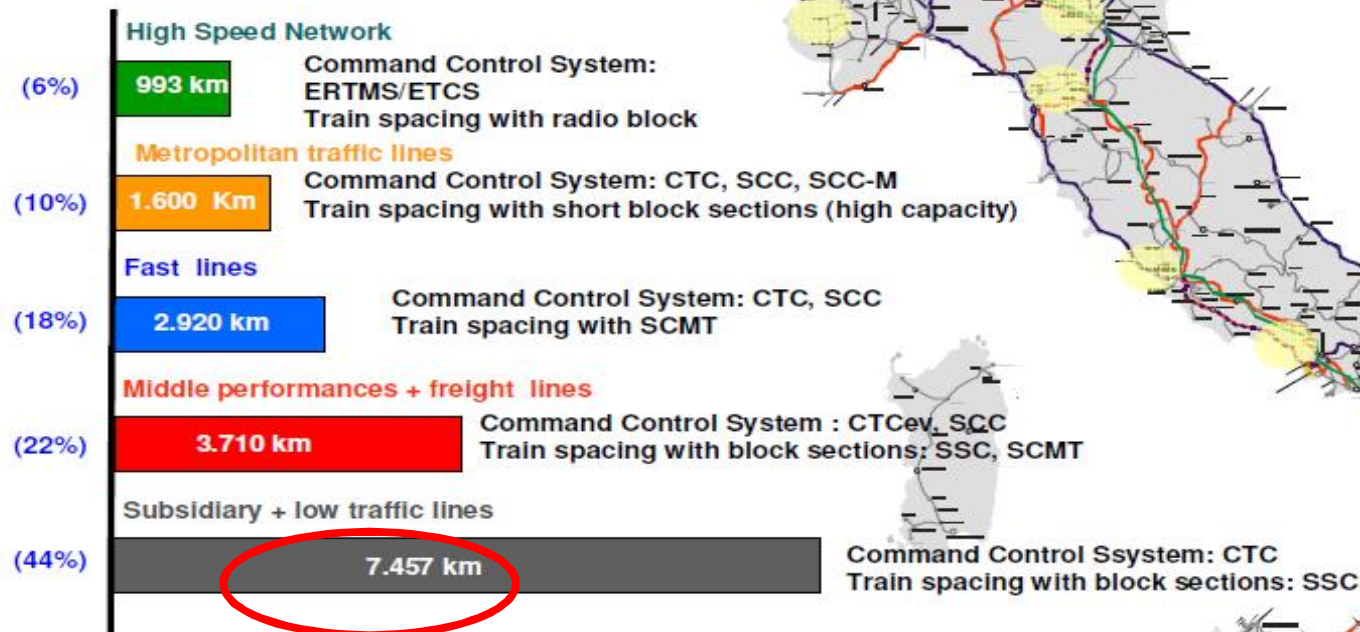
	The needs	Virtual Balises / GNSS answers
<b>Dark Territories</b>	Ensure cost-effective train localization and protection over long stretches of semi-desert areas	Satellite-based localization with SIL 4 accuracy combined with TETRA IP-based TLC Networks •Significant cost for TETRA communications still cost-competitive vs. traditional technologies •Next step: two-ways satellite-based communications
<b>Low Traffic Routes</b>	Efficiently ensure safety on low traffic passenger lines with satellite-based ATP solutions •Command-control systems or ETRMS/ETCS systems are too expensive to be used on low traffic density lines	Satellite based localization combined with communications based on public 3G-4G networks instead of GSM-R (e.g., Virtual GSM-R over LTE) •Major reduction in ground infrastructure cost
<b>Market expected to boom: &gt; 1B€ in 3 years</b>		

# The Italian Rail Network: Finding an Economical Sustainability for Railway Regional Lines

## Infrastructure specialization

### Goals

Lines clasification related to traffic development  
(time horizon 2013)



 **RFI**  
RETE FERROVIARIA ITALIANA  
GRUPPO FERROVIE DELLO STATO

Target lines for exploiting new technologies



# TLC for signalling : THE NEXT CHALLENGES

## ENHANCE SPEED

- up to 350 Km/h

## ENHANCE CAPACITY

- by packet switching

## COEXISTENCE WITH UMTS

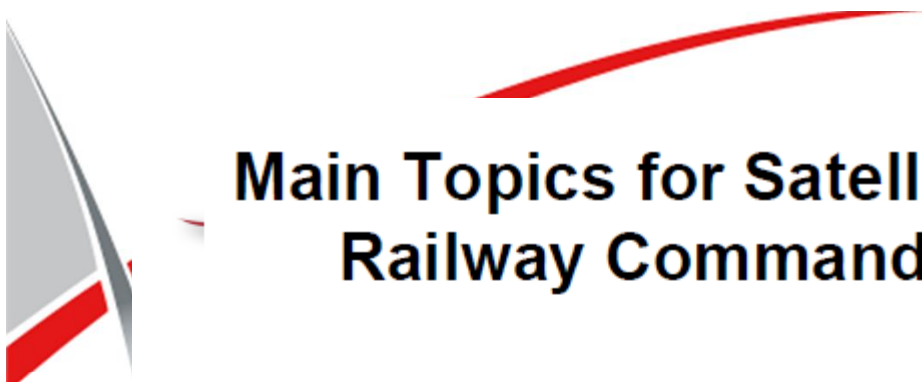
- by technical-legal bindings and costs

## PREPARE MIGRATION

- over 2025 : UMTS, LTE, WiMax, clouding

## INTEGRATE WITH OTHER TECH.

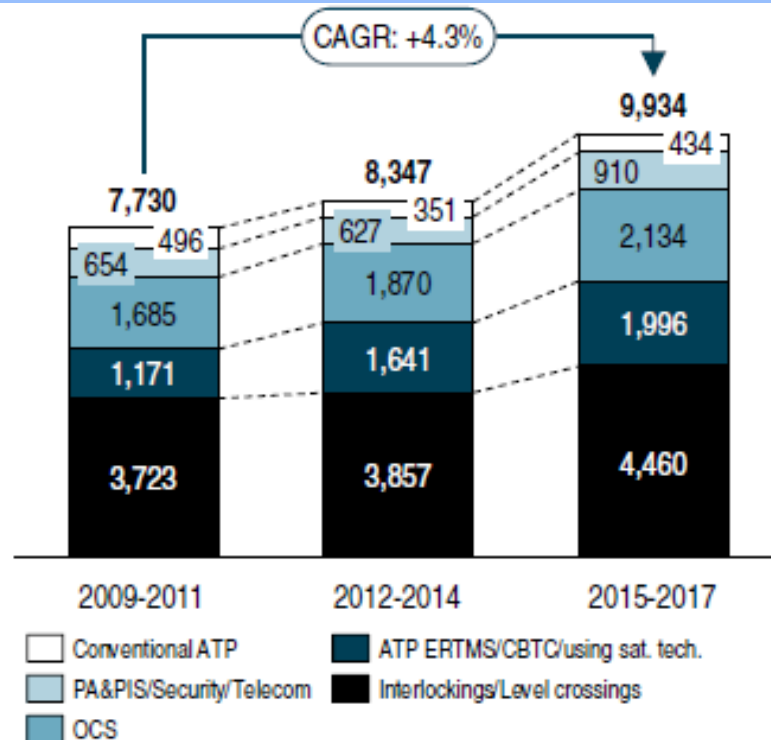
- satellite



## Main Topics for Satellite application in the next Railway Command and Control Systems

- **Regional lines**: Concentrated Application for :
  - ERTMS Regional match perfectly the satellite solution :  
**Need High availability** for Railway application (moving block, safe head and tail train detection)
- **High Density Train demand** in big nodes area
  - Satellite solution to increase capacity: combine GNSS with alternative localization techniques based on WiFi, 3G etc.

## ASTS is pionering new TLC and GNSS technologies



**ATP/ERTMS with satellite technology lead the growth**

### US and Australia

#### 1° LTE



**Installation and FRA certification of the SEPTA PTC system (€73m)**

- First major PTC project as a prime contractor

#### 1° SATCOM



**Rio Tinto (€408m)**

- Autohaul
- Other projects

#### 1° GNSS



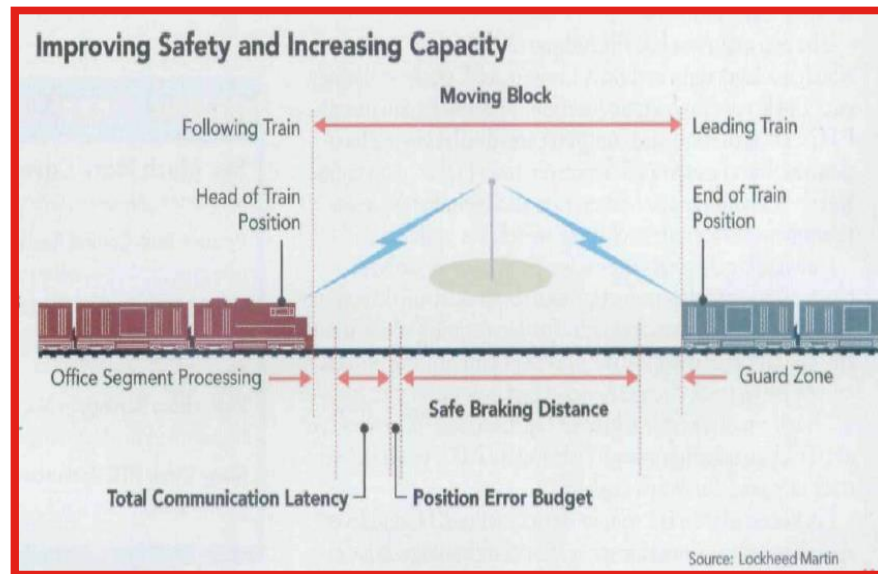
**Roy Hill (€118m)**

- Centralized routing and automatic train protection (ATP) with satellite positioning

# GNSS & wireless TLC are becoming tightly intertwined

## *The need*

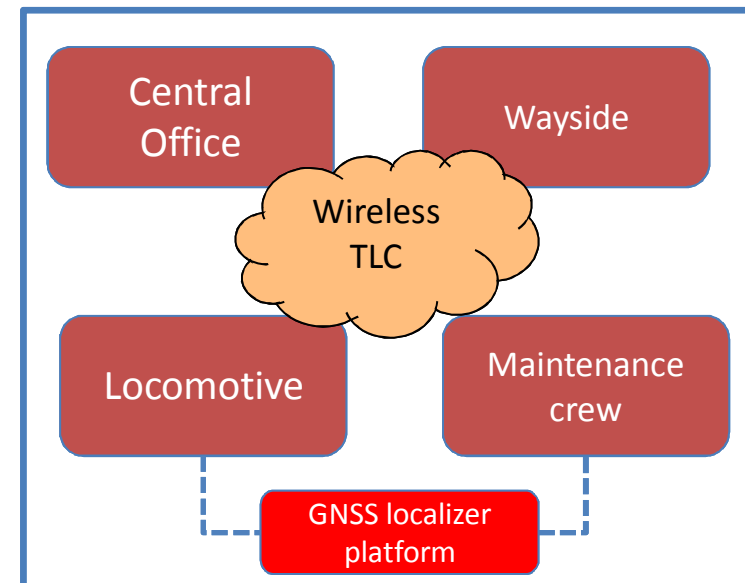
cost-efficient train control systems to maximize the use of scarce resources and optimize the investments in infrastructure.



Moving blocks with minimum  
wayside equipments

## *Technology shift*

Network Centric Railroading  
utilizing intelligent GNSS & TLC



the same technologies used in:

- Air traffic control systems
- Maritime vessel tracking system
- Military command and control



# Satellite technologies on the roadmap for new cost efficient train control system



GPS



GLONASS



GALILEO



BEIDOU

Concept

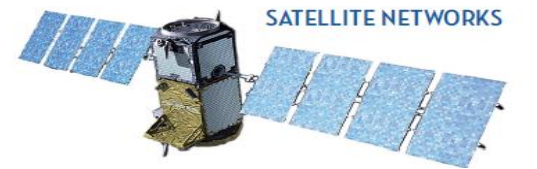
GNSS OFFERS A REDUNDANT & RESILIENT GLOBAL INFRASTRUCTURE FOR REALIZING ACCURATE, SAFE AND COST EFFECTIVE TRAIN CONTROL SYSTEMS

Increased GNSS capabilities

- Higher integrity
- Lower vulnerability
- Higher accuracy

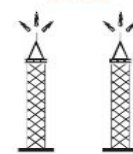
New features

- Satellite localization SIL-4
- Virtual blocks operation
- No way-side equipments

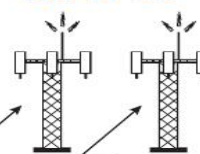


SATELLITE NETWORKS

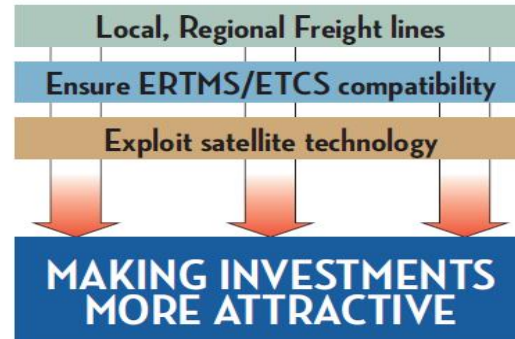
TETRA



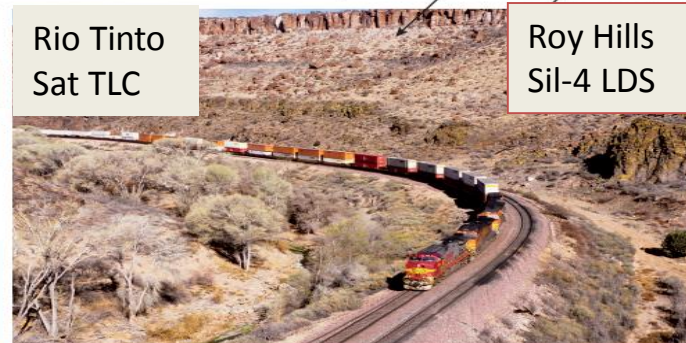
GSM - 3G - LTE



System



Rio Tinto Sat TLC



Roy Hills Sil-4 LDS

Validation



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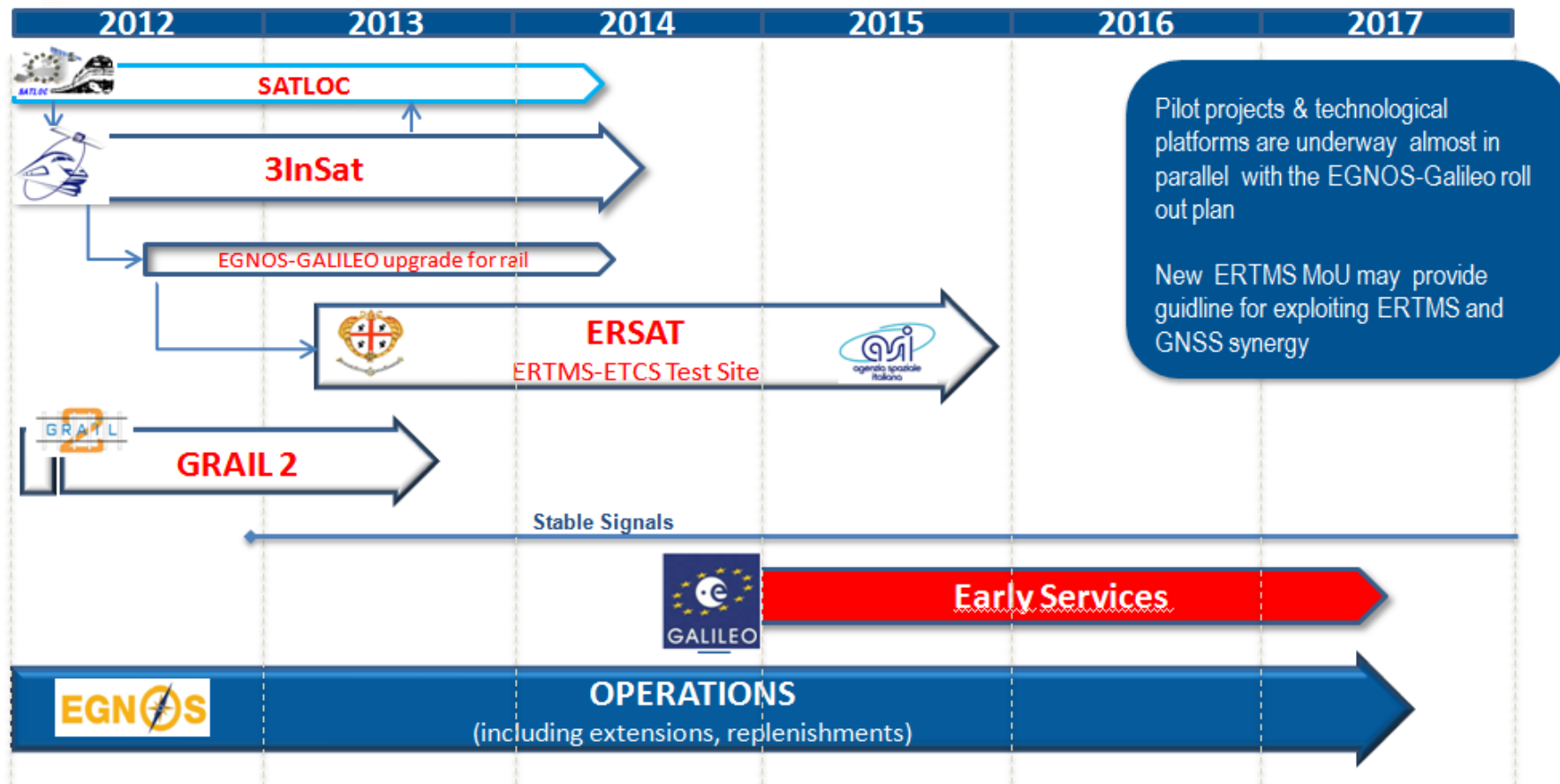
Conclusions

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# Roadmap for GNSS adoption on rail



“The Navigation Satellite System (GNSS) can play a major role in the rail sector, both for fleet management and rail safety (signalling and train control). The EGNOS and GALILEO would fundamentally contribute to increase reliability and reduce cost of the ERTMS odometer ...” (extract from the new ERTMS MoU)



# The 3InSat Project: main challenges



- ✓ Development and validation of a satellite-based platform compatible with ERTMS-ETCS
  - Exploitation of new satellite TLC technologies
  - Introduce a SIL-4 GNSS system ( world's first application)
- ✓ Managed by ESA , contributing also with its heritage on EGNOS-GALILEO and SATCOM
- ✓ Roadmap up to the validation and certification phase

## Benefits:

- Increased network capacity/efficiency
- Improved safety levels
- Lower capex & operational costs

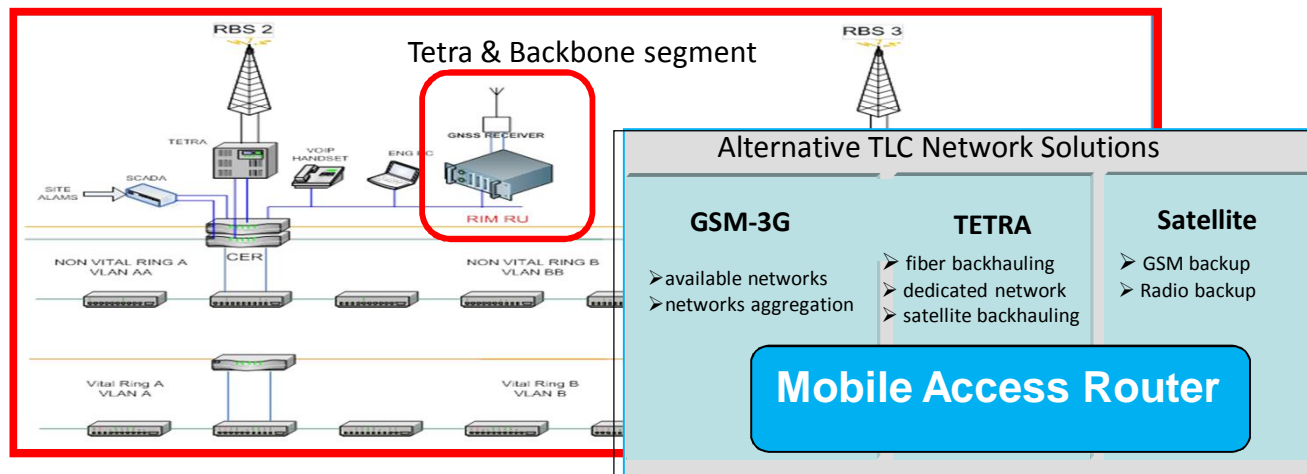
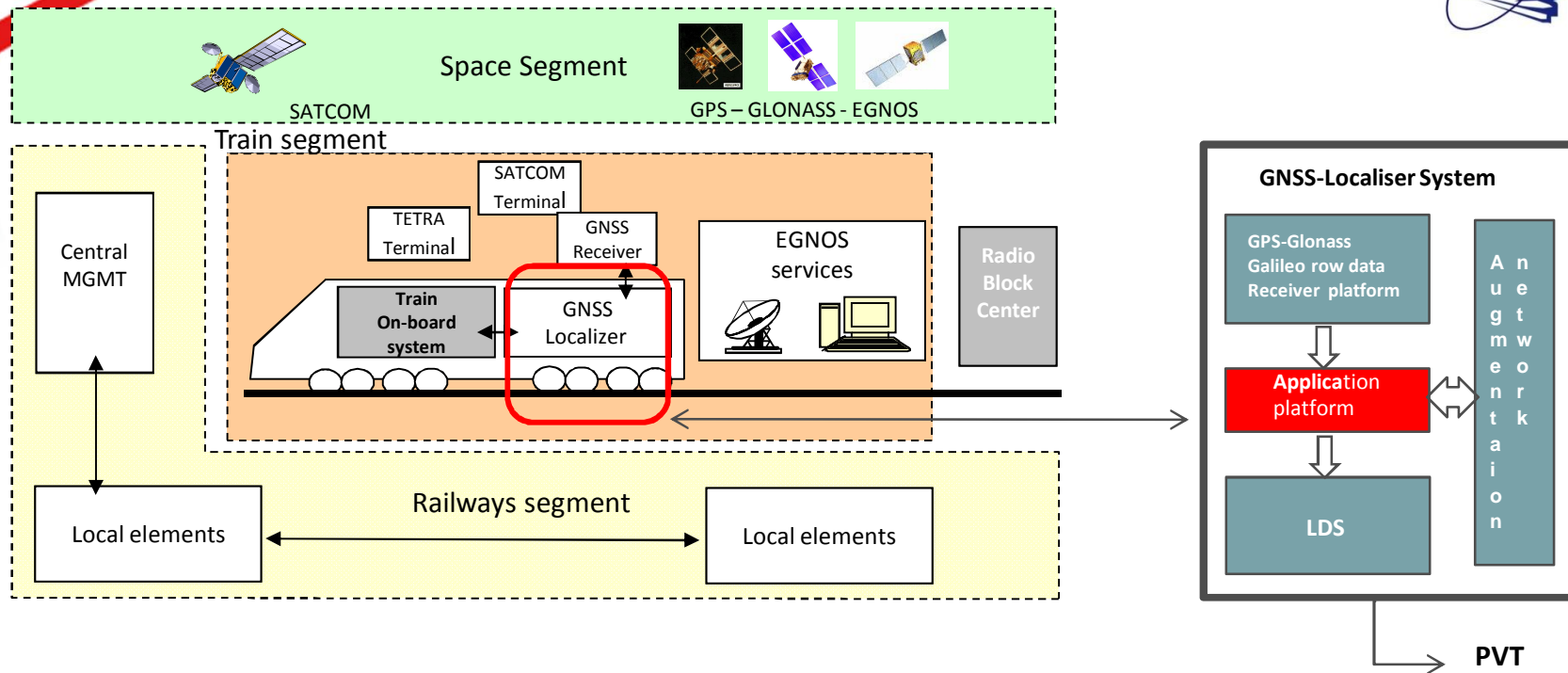
## Main technology gaps

GNSS-LDS (SIL-4)

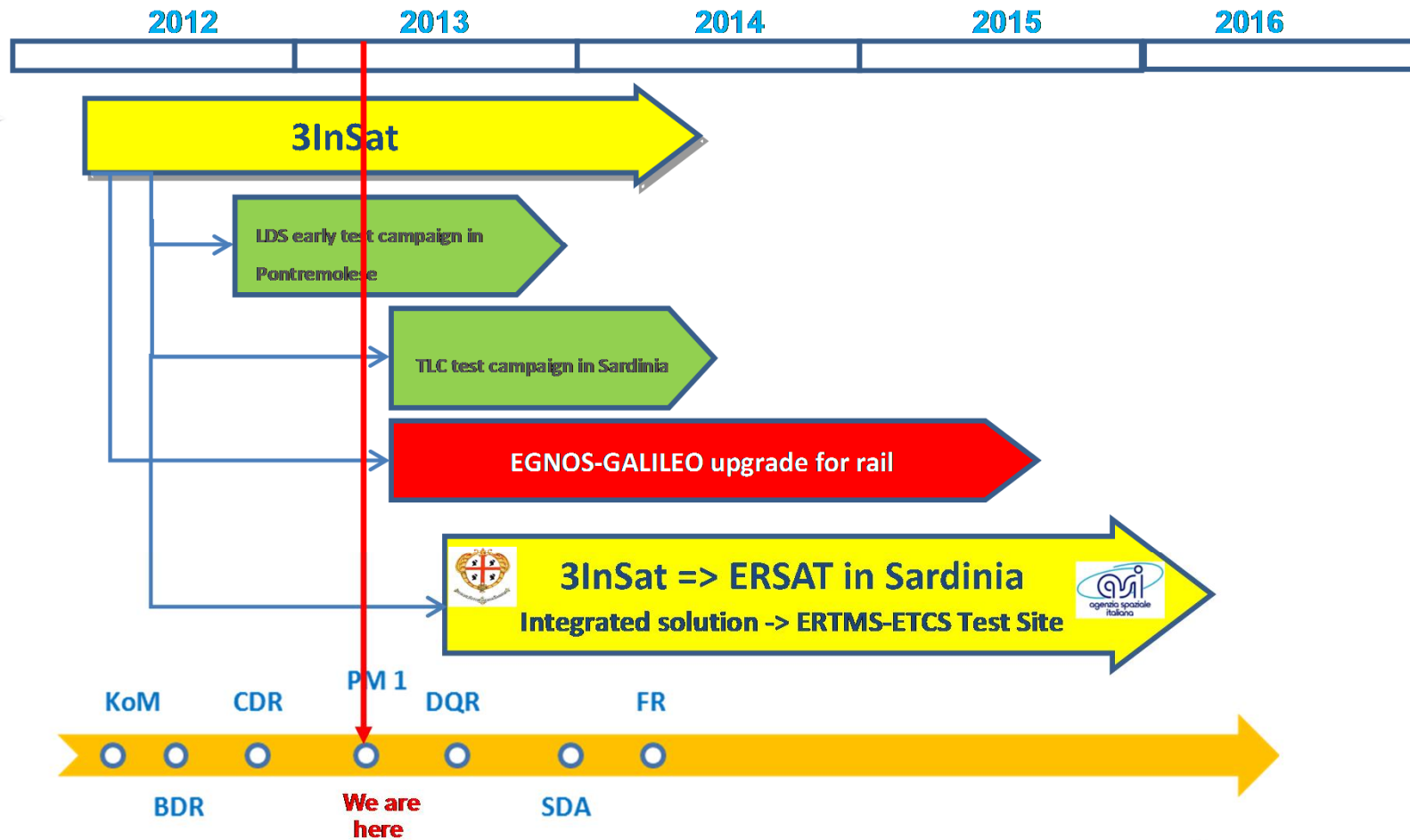
Satellite Terminals with high MTBF



# Reference Architecture



# Project Status & Roadmap



# The Test Site – Olbia-Cagliari line (Sardinia)



## Phase 1: 3InSat (satellite assets validation)

- Total length: approximately 50 km
- Double track: to test train localization on parallel tracks
- Satellite localization system at SIL-4 level
- Multi-bearer TLC network
- Augmentation network validation
- Test Procedures validation
- Independent assessment by a NoBo (Italcertifier)

## Phase 2: ERSAT (ERTMS on Satellite)

- deployment of an ERTMS-ETCS system
- integration of satellite localization SIL-4
- integration of a multi-bearer TLC network
- EGNOS “adaptation”
- fixed block (L2) train separation
- Moving block (L3)
- Certification



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# Conclusion



- ❑ **Satellite-GNSS & TLC technologies are *key enablers* for growing markets**
  - heavy haul freight lines
  - regional & local lines (in Europe represent 50% of whole lines)
  - low traffic lines
  
- ❑ **3InSat project is investing to validate new technologies with rail stake holders**
  - World's first SIL-4 satellite localization system
  - IP multi-bearer TLC solutions
  
- ❑ **A roadmap with key stake holders is a priority for the adoption of satellite systems**
  - *Rail sector: world's leader with ERTMS but behind USA and Russia for GNSS adoption*
  - *GNSS-EGNOS: up-grading for Sil-4 rail applications*
  - *Satellite TLC: optimised solutions for rail signalling applications*



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*Thank You for your kind attention*

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*We invite you to visit our project webpage:*

<http://iap.esa.int/projects/transport/3insat>