GSM-R – the only approved world telecom standard for railways
Agenda

- Why GSM-R
- GSM-R market
- GSM-R Community & GSM-R Industry group
- GSM-R key advantages
- Conclusion
Why GSM-R? In A Nutshell…

- **Interoperability: Railway communication without system borders**
  - Increase average travel speeds through optimized breaking points
  - Increase maximum speeds with line of sight signals replaced with radio
  - Increase track capacity through minimized inter train distance
  - Guaranteed high speed (500 km/h) and conventional lines operation
  - Seamless border crossing

- **Efficiency: Railway communication at reduced cost**
  - Reduce infrastructure cost by using widely adopted GSM technology
  - Only one Radio system for all applications including ETCS
  - Reduce infrastructure cost through competition
  - Standard products available off the shelf

GSM-R standardized by railways and industry in EIRENE, validated in MORANE and in commercial operation since more then 10 years - provides operational and commercial advantages to railways and makes them more competitive in a changing environment.
GSM – A Solid and Mature System

- GSM - Solid platform
  - Standardized by 3GPP/ETSI
  - In commercial operation since 1992 with more than 3 billion user
  - Expected to grow even further
  - Significant development towards IP almost finished
GSM-R – A Solid and Mature System

- GSM-R - Solid communication platform for Railways
  - Based on GSM
  - Standardized by railways to perform their operational needs – EIRENE
  - Validated and approved in the field - MORANE
  - In daily commercial operation since 2000
  - Specified for voice and data (CS and PD) services
  - Radio bearer for the European ERTMS standard
  - Continuously adaption of EIRENE considering new applications, services and railway operational rules
  - Future oriented technology (IP) based on ETSI/ TC-RT standardization for new functionalities and capabilities
Extensive standardization and validation to prove GSM-R

**Study**

UIC decided for GSM – (R) against TETRA

**Specification phase - EIRENE**

ASCI features are specified by EIRENE & ETSI
Specification of railway operational features

**Trial phase - MORANE**

Test tracks are deployed to prove the standard
GSM-R End-to-End system validated & approved
First products available

**Network implementation phase**

Deployment and operation in all European railways at high speed and conventional lines
Deployment and operation abroad Europe

As result of MORANE railways approved GSM-R as future voice and data bearer in 2000


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GSM-R Market

Europe market status (source: UIC/ December 2011)

- The overall European railway network is 221,100 km and 159,966 km are planned to be covered by GSM-R (70%)
- GSM-R as part of European Union ERTMS program has to be implemented in all EU countries based on EU decisions (law)
- December 2011 appr. 85,000 km constructed and 68,000 km of them are in commercial service including appr. 115,000 GSM-R handhelds, 40,000 cab radios, 2,000 EDOR’s, dispatch systems, etc.

Market status abroad Europe

- Some thousand of track km are in service in China, India and Turkey already
- Other railways are in deployment or tender processes, e.g. Saudi Arabia, UAE, Algeria, Tunisia, Libya, Morocco, Australia, Russia, Turkmenistan, etc.
GSM-R – A World Railway Standard

Contracts awarded
1998-2011

Projects in preparation

56 countries in 5 continents expected to select GSM-R until 2016

- Germany
- Italy
- Sweden
- UK
- Netherlands
- Spain
- Belgium
- Finland
- France
- Norway
- Slovakia
- Switzerland
- China
- India
- Saudi Arabia
- Czech Republic
- Algeria
- Turkey
- Austria
- Bulgaria
- Greece
- Lithuania
- Australia
- Libya
- Tunisia
- Denmark
- “Eurotunnel”
- Portugal
- Morocco
- Ireland
- Hungary
- Luxembourg
- Poland
- Romania
- Russia
- Slovenia
- Brazil
- Venezuela
- Egypt
- Israel
- Turkmenistan
- Kazakhstan
- Belarus
- Latvia
- Croatia
- Estonia
- Argentina
- South Africa
- Iran
- Iraq
- Korea
- Ukraine
- Turkmenistan
- Uzbekistan
- Bosnia-Herzegovina
- Macedonia
- Moldavia
- Serbia


www.gsm-rail.com
GSM-R Community (main player)

- **UIC/ ERIG**
  - Dedicated team of railway telecom experts to update EIRENE standard
  - Define new applications and services based on their daily GSM-R system operation experiences
  - Working in several working groups related to specific topics
  - Updating GSM-R considering future strategies and needs

- **ETSI TC-RT**
  - ETSI sub group for railway specific feature implementation into GSM/ GSM-R standards

- **ERA**
  - European Commission entity with the system authority for ERTMS/ GSM-R
  - Owner of TSI (technical Specification for Interoperability) – transform EU directives into railway law

- **GSM-R Industry Group**
  - Association of the nine GSM-R industry key suppliers
  - Regular technical and marketing meetings to take care and develop/ update the GSM-R components/ system in line with GSM-R standards and TSI standard updates

- **ERTMS Users Group**
  - Coordinator of TEN ERTMS/ GSM-R research, development and interoperability projects
GSM-R Industry Group portfolio

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<th>Network R99/R4</th>
<th>Cab Radio</th>
<th>EDOR</th>
<th>Transportable Radio 8W</th>
<th>GPH</th>
<th>OPH</th>
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<th>Radio Module 8W</th>
<th>Dispatcher Terminal System</th>
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GSM-R Industry Group commitment

- Safeguard of the Railways investment is at the heart of the GSM-R Industry Group strategy.
- The active global promotion of the GSM-R technology.
- Strong cooperation with GSM-R bodies and partners – UIC/ERIG, ETSI, ERA, ERTMS Users Group, etc.
- Minimize integration efforts and railway migration costs.
- All the GSM-R IG members are committed to support and develop GSM-R at least until 2025.
- GSM-R IG is also committed to support Railways in identifying and selecting a new technology beyond GSM-R for a Future Railway Mobile Radio System (FRMRS)
- Migration to FRMRS with uninterrupted and undisturbed Railway operation and sufficient capacity is a key target to be worked out by Railways and GSM-R IG using their combined expertise.

www.gsm-rail.com
GSM-R – Economic and Future Oriented

- GSM-R guaranties economical advantages
  - Based on GSM as a mass market product oriented towards IP
  - Future evolution based on GSM/ETSI & 3GPP roadmap
  - No operational risk – approved and in operation on high speed and conventional lines since more than 10 years and several 10,000 km
  - No product risk – products based on GSM product roadmaps and are available off the shelf
GSM-R – Interoperable from the beginning on

- **GSM-R guarantees Interoperability**
  - Standardized at main system interfaces
  - Between suppliers (infrastructure/ track side, mobile terminals, dispatcher systems
  - Periodical interoperability test (IOT) campaigns since 2002 supported by EU to guaranty EIRENE conformance
  - Enables seamless roaming between national infrastructures/ border crossing
  - Guarantee shared GSM-R infrastructure networks between different suppliers

<table>
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<tr>
<th>EIRENE</th>
<th>Issued</th>
<th>Phase 1 &amp; 2</th>
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<th>Global IOT Phase 3 extension</th>
<th>EIRENE Phase X</th>
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MORANE: 1995 - 2000

www.gsm-rail.com
GSM-R – A Reliable System

- GSM-R guaranties reliability and availability
  - Very high reliability and availability of products and networks based on long term experience and proved in public systems and railway networks
  - Dedicated engineering and system optimization processes
  - Superior internal redundancy and full geographical redundant solutions
  - Network management system incl. real time fault and disaster management
  - Double coverage functionality, particular for very high ETCS reliability
  - Fall back available into public networks – GSM-R terminals are operating in entire 900 & 1800 MHz GSM band (manual or automatic switch over)
Only GSM-R fulfils the entire railway services as standardized in EIRENE.

TETRA and other digital trunking systems are only regular PMR standard solutions to support basic PMR functions, but doesn’t support railway specific requirements and QoS parameters.
GSM-R as bearer for European Train Control System ETCS – approved and in operation

- Integration of independent subsystems into a single train control and command solution
  - ETCS and GSM-R (voice and data) are the building blocks of the European Railway Traffic Managements System (ERTMS)
  - ERTMS is designed for International communication and signaling

- International standardizations and interoperability
  - Increase competition in the signalling market
  - Speed up of border crossing travel reduces travel time and cost
  - Integrate existing ATP systems

![Functional structure of ERTMS and associated European activities](image)

- Traffic Management Layer: Europtirails
  - Strategic planning, time tabling
  - Information, Monitoring, pass assembling
  - etc.

- Signalling: INESS Integrated European Signalling System
  - Remote control automated/manual
  - Track-side occupancy proving based block control, safe route setting
  - Control of level crossings
  - Control of Switch points, ...
  - Control of line side signals
  - etc.

- Train control-command: ETCS European Train Control System
  - Automatic train protection and warning
  - Automatic train command with in-cab signalling
  - Train-side location based block control
  - etc.

www.gsm-rail.com
Conclusions

GSM-R is a mature and widely used system…

… a world standard for railways in successful operation

… interoperable and stable for all rail track versions including high speed

… reliable as bearer for ETCS

... open for improvement and future development

Industry is committed to long term support

Industry in close cooperation with UIC for the definition of the next generation and migration strategies