ALARP

A railway automatic track warning system based on distributed personal mobile terminals

Funding: European (7th RTD Framework Programme)
Duration: Jan 2010 - Apr 2013
Status: Complete with results
Total project cost: €3,941,877
EU contribution: €2,626,610

Call for proposal: FP7-SST-2008-RTD-1
CORDIS RCN : 93402

Background & policy context:
An innovative efficient Automatic Track Warning System to improve the safety of railway track-side workers.

Objectives:
The objective of ALARP was to study, design and develop an innovative and more efficient Automatic Track Warning System ("ATWS") to improve the safety of railway track-side workers. ALARP will:

- selectively inform the track-side workers about: (i) approaching trains on the track, (ii) maintenance events on power lines and/or safety equipment on the concerned tracks that may put worker's safety at risk (e.g. being hit by a train or by receiving an electrical shock), (iii) emergencies on the tracks and in nearby tunnels (e.g. tunnel fires, toxic smoke) and (iv) escape routes in case of emergencies.

- keep track of the operating conditions of devices and the localisation of workers (especially those at risk and those who do not respond).

Methodology:
The ALARP project has been based on the following main components:

- the track-side Train Presence Alert Device ("TPAD"): this device is able to sense an approaching train on the interested track without interfering with the signalling system;

- a set of distributed, low-cost, wearable, context-aware, robust, highly reliable, wireless mobile terminals ("MTs") to inform workers about possible approaching trains and/or other events that could put their safety at risk.

Parent Programmes:
FP7-TRANSPORT - Transport (Including Aeronautics) - Horizontal activities for implementation of the transport programme (TPT)

Institute type: Public institution
Institute name: The European Commission
Funding type: Public (EU)

Lead Organisation:

Ansaldo Sts S.p.a.
Address: Via Paolo Mantovani 3-5 16151 Genova Italy

Organisation Website: http://www.ansaldo-sts.com

EU Contribution: €559,930

Partner Organisations:

Resiltech Srl

Address: Via B. Gigli 27 56021 Cascina Italy

Organisation Website: http://www.resiltech.com

EU Contribution: €359,560

Ftw Forschungszentrum Telekommunikation Wien GmbH

Address: Donau City Strasse 1/3 1220 Wien Austria

EU Contribution: €340,305

Proprs Ltd.

Address: Hurst Rise Road 58 Oxford OX2 9HQ United Kingdom

EU Contribution: €296,400

Universita Degli Studi Di Firenze

Address: Piazza San Marco 4 50121 Florence Italy

Organisation Website: http://www.unifi.it

EU Contribution: €294,640

Elbit Systems Ltd

Address: Advanced Technology Center Haifa 31053 Israel

Organisation Website: http://www.elbitsystems.com
Technische Universität Darmstadt

**Address:**
KAROLINENPLATZ 5
64289 DARMSTADT
Germany

**Organisation Website:**
http://www.tu-darmstadt.de

**EU Contribution:** €195,270

### Technologies:
- Infrastructure management
- Track-side train presence alert

**Development phase:** Research/Invention

### Key Results:
The main achieved results of the ALARP project can be summarised as the viability of overall system approach, the integration of the main expected features and the validation of the selected technical solution.

The utilised methods will result in an enhanced Train Presence Alert Device, enjoying an improved and high detection rate. This in turn will result in the hazard rate being reduced and the false alarm rate being lowered.

### Innovation aspects
The core components and innovative characteristics of the ALARP project were made up of the following features:

- Mobile Terminal (MT)
- Payload Services
- Train Presence Alert Device (TPAD)

Mobile Terminal (MT), fully based mainly on standard (COTS) hardware components and designed to become labelled as a Safety Integrity Level 2 (SIL 2 according to CENELEC railway standards). The Mobile Terminal architecture is organised in different layers:

- A Localisation Component was developed based on a hybrid data fusion approach utilising low-cost GPS receivers augmented by electronic fences and a map model to significantly improve worker to work site zone mapping. The flexible design will enable future sensor enhancements to GPS/GNSS (e.g., low cost Real Time Kinematic) and continuous/discrete augmentation sensors;

- An Application Logic, which contains the functional applications of the device (e.g., signalling of approaching trains, monitoring the health and the position of the worker, showing information through the dedicated Human Machine Interface);

- A Management Middleware, which provides time-keeping, security and fault tolerant services, guaranteeing resilience for Mobile Terminals. Following the paradigm of architectural hybridisation, it is subdivided into a wormhole and a payload and hides the presence of these two different subsystems from the other layers. The services in the wormhole are located as such because they require stronger assumptions on timelines and security).

Payload Services are mainly monitoring and fault tolerance mechanisms that provide the required Safety Integrity Level. These use the wormhole services through the wormhole gateway, which is based on sockets with well-defined interfaces.

- A Communication Layer provides reliable wireless connectivity in between MTs on a work site and from remotely connected TPADs, disseminating alerts and warnings within a time frame of 11 seconds, according to the real constraint of approaching trains;
An Ergonomic Layer and a man-machine interface design is based on a solid but simple structured layout for fast user interactions. The alert and warning signals are transmitted over the visual and acoustic human channels.

The Train Presence Alert Device (TPAD) is an autonomous, self-powered and easy to install/self-calibration sub-system. The TPAD uses and combines three different types of train approaching detection devices ( 

**Strategy targets**

1.1. An efficient and integrated mobility system;

1.2. Promoting quality jobs and working conditions;

1.3. Secure Transport

**STRIA Roadmaps:** Smart mobility and services

**Transport mode:** Rail transport

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Safety/Security, Decarbonisation, Societal/Economic issues

**Geo-spatial type:** Other