Newsletter

Issue 1, October 2020

Foreword

Marathon to Operation (M2O) project has been building on the results of previous FP7project Marathon, followed by DynaFreight and FFL4E S2R projects. M2O collaborated with FR8RAIl II CFM partners project to develop Long Trains with Distributed power (DPS) involving up to 4 traction units (TUs) for a length reaching 1500m. All guided TUs were to be remotely controlled by GMS-R (two TU setup) or LTE (up to four TU setup). LTE could be an intermediate step towards the future FRMCS communication solution for which more details will be issued soon.

This newsletter sums up the main results achieved by the Marathon2Operations Consortium. All project documents and deliverables can be found on the project website at: https://www.marathon2operation.eu/web/.

FACTS AND FIGURES

Total budget
€0,6 million

Duration
25 Months

Project start date
01/12/ 2018

Project end date
31/12/2020

Partners
6 partners from 4 Countries

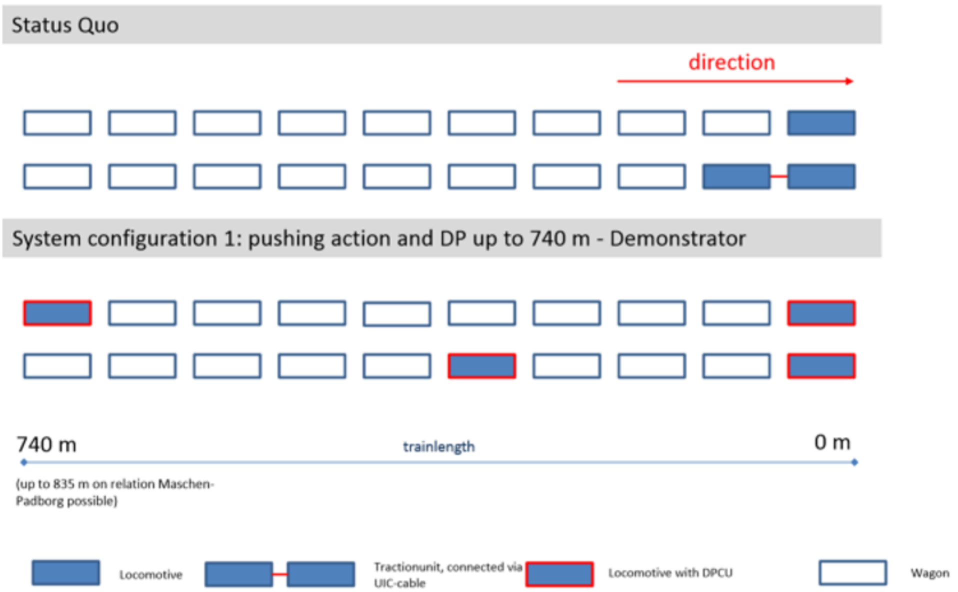
Grant agreement
826087

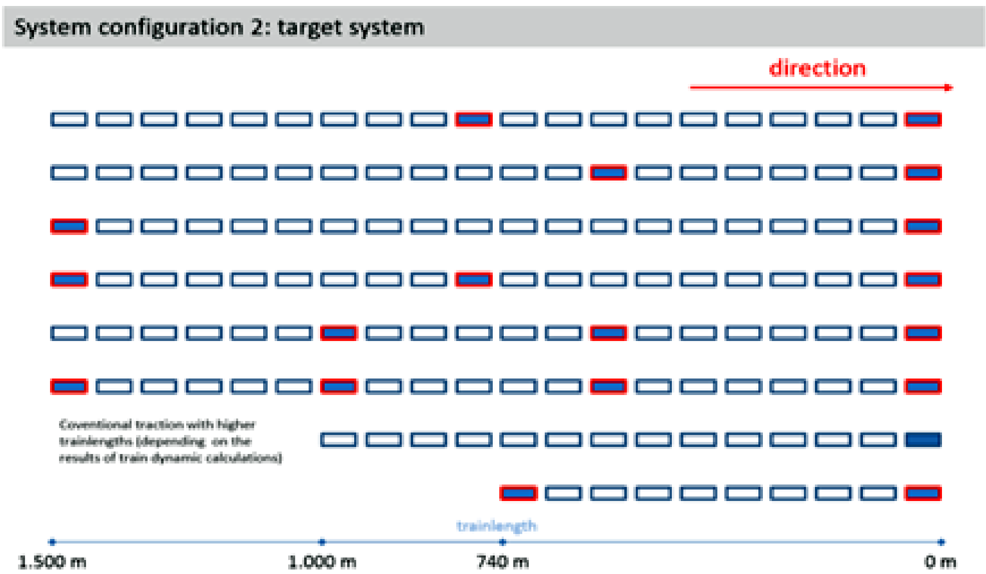
Project Coordinator
Università degli Studi di Roma "Tor Vergata"

M2O was responsible of the radio communications and the global safety of the consist based on simulations performed with TrainDy software in order for FR8RAIL II to perform demonstrator train tests at the end of their project.

A collaboration agreement was set up with the FR8RAIL II partners responsible of the choice of the track tests, of the train composition involving the Traction Unit Types, the specific Driver Brake Control Unit (DBCU) and the wagons.

The train compositions to be simulated were the following ones:

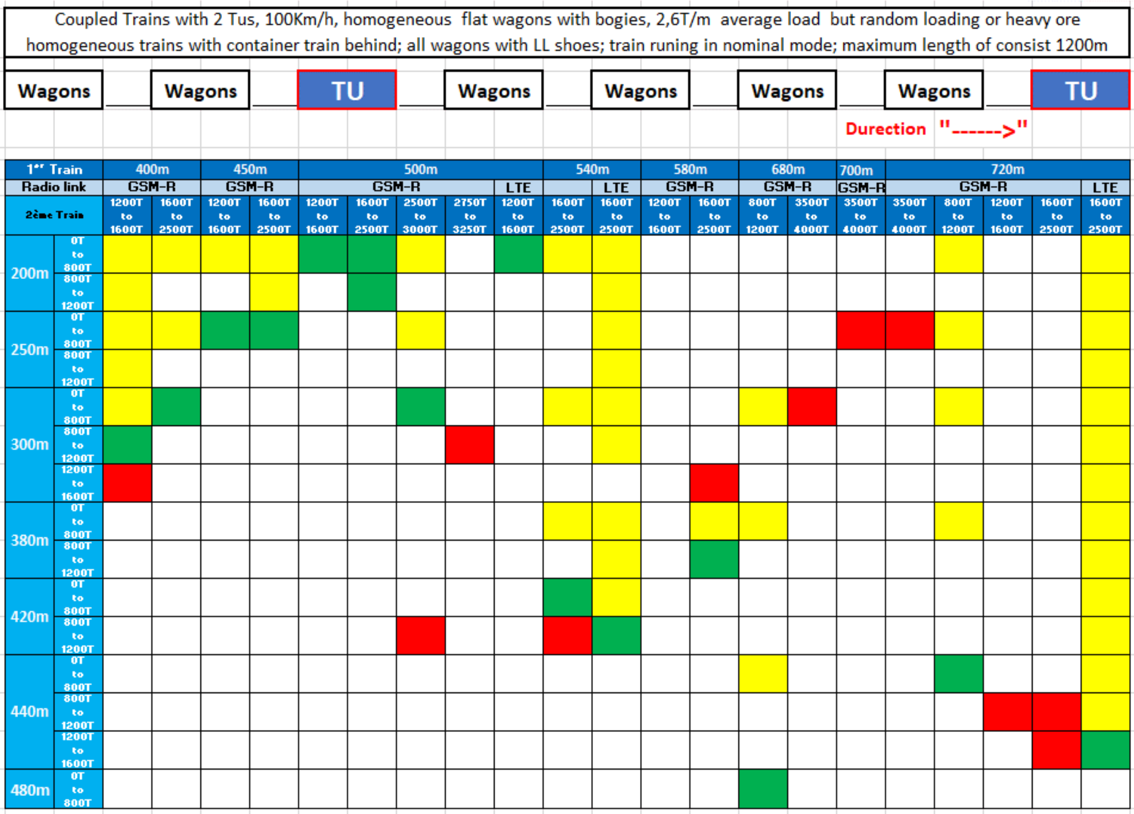




The architecture of the system involving the radio communication based on GSM-R, the specific Distributed Control Braking Unit and the Traction Control command System was defined enabling to test the most relevant parameters impacting the train dynamics simulated with TrainDy software in order to check the safety of a train in comparison with trains already running safely on the Rail Network.

Following this sensitivity analysis, enabling to focus on the most relevant parameters impacting longitudinal dynamics, and a detailed analysis of the GSM-R transmission capacity and latency, TrainDy software was used for Longitudinal dynamics simulations of family of trains characterised by their overall mass and length and by a random distribution of loads. It enabled to define some safe configurations. It also showed that remote control of more than 2 traction units by GSM-R could not insure acceptable longitudinal train efforts due to insufficient capacity and excess of latency time in transmission of orders.

An alternative radio communication solution based on LTE using VPN and a safety layer on the protocols of communication with a larger capacity and a shorter latency time showed improved results enabling to envisage configurations up to 4 traction units for a Distributed Power System for certain consists. A large number of such configurations, represented by families of trains with randomized loadings, confronted to critical situations have been simulated with TrainDy to assess their safety in nominal and degraded modes.



This figure shows some simulation results in green which are safe configurations, in yellow probably safe configurations which should be specifically simulated and in red configurations which are not safe at this stage

A comprehensive safety analysis performed on these consists enabled to define functional requirements, to classify the possible hazards in various operational situations and on different infrastructures with adequate proposed mitigation solutions preserving the safety of the consist.

To prepare the final part of the project the partners of FR8RAIL II have defined the demonstrator trains that they will run on a specific track incorporating steep gradients up to 27‰ in a mountainous sector. For that purpose, precise characteristics of the Traction Units and of the Distributed Brake Control Unit have been fixed for preparing a more accurate safety analysis for the consist chosen in families of trains incorporating 2 to 3 Traction Units, having an overall length up to 740m and a hauled mass up to 1850T:

with a reference train:

equiped with 2 drivers connected by radio

The corresponding global safety analysis is being completed and will be assessed on the basis of the fulfilment of the functional requirements by the Partners of FR8RAIL II concerned for the part being under their control and with mitigation solutions to preserve the safety of the consist in case of degraded modes. Based on the simulations results giving the limits to be respected the precise consist will be defined and the tests performed by FR8RAIL II in February 2021.

For railway undertakings these new consists may enhance their efficiency as with their existing driver team they will be able to produce more ton-km if the trains have maintained their filling coefficient. The infrastructure managers will see the capacity of their network increase as the capacity consumption per ton-km will be reduced by up to 40%.

The system should give an increased productivity of 30% which is with the reliability a major criterion for decision makers to use the rail mode. The system proposed offer a solution adapted to various kinds of traffics from short trains heavily loaded grouped in a single consist to long distance combined transport trains bundled in a single consist on their long trunk travel and separated for their different last parts of their travel.