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InMotion
The Road to Le Mans
- Student team building the car of the future.

- Be the first students ever to finish the 24h of Le Mans, the most prestigious endurance race in the world.

- Breaking the lap record on the 22 km long Nürburgring Nordschleife, which is over 35 years old (6:25.91; Stefan Bellof; Porsche).

- Using Model-Based Design to reduce development time, which enables InMotion to have the car on the grid when the lights turn green.

Key Takeaways
What to remember
Road to Le Mans
- The Goal: IM01
- The Origin: Formula Bio
- The Development-platform: KP&T IM/e

Using Model based development to have the racecar ready in time
- Applying Motar at InMotion
- Model-Based Design in practice

Innovative challenges and achievements
- Realizing the KP&T IM/e
- Competing with the established order
Specifications

Bio-ethanol

Weight: 350 kg
Power: 120 hp
Speed: 205 km/h
IM01
Le Mans Racer
IM01
Aerodynamics
Goals and milestones
How the road to Le Mans evolves
Specifications

Fully Electric

Weight: 655 kg
Power: 544 hp
Top Speed: 285 km/h

IM/e
The Development-platform
IM/e
The Development-platform
From Coding to Modeling
Motar workflow

- Simulation Model
- Motar blockset
- Simulink Control Model
  - Code Generation
- External Mode
- Target Hardware
  - Compilation
  - Compiler/Linker toolchain
  - Flashing
- AUTOSAR-based source code
  - Application Layer
  - Runnable Environment (RTE)
  - Service Interface
  - Component
  - Communication Interface
  - Communication API
  - Device Interface
  - Device API
  - Library
  - OSTC

GCC
A new way of development
Motar in the InMotion KP&T IM/e

InMotion KP&T IM/e systems under Motar control:

- Active Aerodynamics
- Energy management
- Anti-lock brakes
- Traction control
- Electric power train
- Human Machine Interface
Motar & InMotion

Central ECU  Satellite ECU  Communication bus
Motar in practice
Motar in practice
Motar in practice
Motar in practice
Motar in practice
Motar in practice
Motar in practice
Motar in practice
Motar in practice
Realization of the KP&T IM/e

- **Car presentation:**
  - 17th of October 2015

- **Shakedown:**
  - October 2016 (delayed from August 2016)

- **Electric record Zandvoort:**
  - Before 31<sup>st</sup> of December 2016

- **Electric record Nürburgring:**
  - Before 31<sup>st</sup> of December 2017

Innovative challenges and achievements

Tight deadlines of motorsports
Innovative challenges and achievements
Zandvoort Masters 2016
Innovative challenges and achievements
Competing with the established order

Toyota Motorsport GmbH

- Over 250 professional fulltime employees
- More than 20 years of experience in motorsports (since 1993)
- 30,000m² facility
- Electric record Nürburgring since 2011
- Time to beat: 7:22.33
Stefan Bellof – Porsche 956

- Stefan Bellof: King of the Nürburgring
- Porsche 956 Fastest car ever to lap the Nürburgring
- Average speed 202.073 kph
- All-time record Nürburgring since 1983
- Time to beat: 6:25.91

Innovative challenges and achievements
Competing with the established order
Nissan Motorsport Ltd. (Nismo)

- Over 200 professional fulltime employees
- More than 30 years of experience in motorsports (since 1984)
- Over € 20 billion annual revenue
- 24h of Le Mans Garage 56 contender 2012 and 2014 (Both DNF)

Innovative challenges and achievements
Competing with the established order
Partners
Helping on the road to Le Mans
- Team of students capable of building the racecar of the future
- Beating the established order of automotive and motorsports
- Model-Based Design platform enables the team to finish the car in time
- Innovations that are enabled by limitless engineering