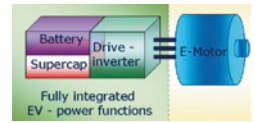


CASTOR

Integration of multi propulsion powertrain

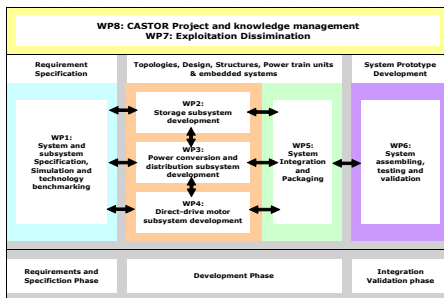


Motivation and Objectives

Future electrical propulsion concepts require more efficiency and less complexity with great functionality, robustness and light weight, and the ability to operate in a wide ambient temperature range. CASTOR will explore architectural advantages of fully integrated powertrain electronics for distributed propulsion systems that enable future generations of electric vehicle (EV) and personal propulsion systems.

- Advancements in efficiency and safety will be achieved by implementing a multi-propulsion powertrain based on the synergic integration of the energy storage with the propulsion unit.
- The research will focus not only on the integration of the component functionalities but also adopt an holistic approach for thermal management.
- The research is aimed to achieve 10~20% energy saving, 25% cost reduction, 15~20% improvement in vehicle range, and increased safety and integrability against the current state-of-the art EV propulsion systems.

Project Plan, Partners and Deliverables



Components	Motor drive	
	accumulators	
Silicon		
System Integration and Packaging		
power train application		
On-board integration		

Fuels and Powertrain

Technical Approach

Integration of the:

- Energy storage and propulsion considering power conversion topologies & conversion losses,
- Battery and super-cap to enhance cycle robustness, power density, temperature properties,
- Accumulator (battery, super-cap) with inverter to minimise power distribution losses,
- Control structures of the vertical functional layers of the powertrain,
- Management of the drive dynamic network.

Achievements

WP1: Finalize specification and requirements for two highly integrated intrinsic failsafe powertrain topologies. The first concept is based on a central multiphase motor while the second concept is based on distributed propulsion with 2 PDD motors and a central motor with gear. The main target was to establish requirements against the vehicle classes and target performances and to study the influence of voltage level on system performance, efficiency, size and cost to establish through simulation and trade off studies the best-fit strategy between batteries, super capacitors, power electronics and electrical motors.

WP2: System level specification and the requirements for a integrated battery system based on super-cap and battery integrated on cell basis or on DCDC conversion.

WP3: Development of electronic modules including architectures and design for the integration in the sub systems developed in both powertrains for application of 37kW (one 6-phases motor) and 4 kW (two 3-phase modules) power rating including the selection the semiconductor technologies IGBT and MOSFET against the defined DC-LINK targeted for both the Light electric vehicle and the Urban Vehicle.

WP4: Direct-drive motor subsystem development. The aim is to achieve high power density and high efficiency over NEDC cycle, and to reduce dependence on rare-earth magnets. It is likely that the pseudo direct drive (PDD) will be suitable for the distributed powertrain. For the first powertrain configuration, high speed motor with two independent 3-phase sets would be a suitable choice, as it offers redundancy and fail-safe operation.

Budget	6 M€	Funding	3.5 M€
Duration	36 months	Start	June 2010
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Partners	6 partners: CRF, VW, Ficos, University Sheffield, Sintef, Magnomatics		
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