



PEERS Presentation

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January, 19th

Clean Sky Info Day on 11th Call for proposals

www.cleansky.eu

SOG - Smart Operations on Ground Power Electronics with Energy Recycling System

Product Overview and SOG System goals



- Develop a high integrated system in order to control **efficiently aircraft motion on ground** during landing, taxiing and parking phases.
- This SOG System will allow an aircraft to be **autonomously operated on ground** by the pilot **without the use of engines** relying only on the APU electrical power source.
- Such a system shall lead to **reduce** both **in-service costs** (fuel burn reduction) and **pollutant emission** without decreasing passengers traffic. Benefits will be increased if the developed system has a small weight and is very compact.
- This system will also lead to **cost operation reduction** through towing device deletion and ground crew reduction.
- Regarding noise emission on ground, some extra improvements may be made in **reducing noise** due to the use of brake cooling fans during both taxi & parking phases.



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General System Description

The **SOG System** consists of :

- The **Wheel Actuators** to provide mechanical torque and power to the main landing gear wheels. The Wheel Actuators include :
 - The electric motors
 - The transmissions
 - The engagement/disengagement sub-systems to mechanically connect and disconnect the transmission to the wheels
- The **Power Electronics** (supported by PEERS) equipment and the control units to pilot the wheel actuators.
- Each main landing gear wheel is driven and controlled independently.

Main Functions

The **SOG System** provides the following aircraft functions :

- Aircraft **reverse motion** for pushback phase
- Aircraft **forward motion** for taxi phases with Engines stopped
- Aircraft **driving, steering** and **braking** should be ensured by the System



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PEERS System Overview

The **PEERS System** should be divided into 2 main parts :

- A **Power Electronic Unit (PEU)** which drives the wheel actuator motors. It is mainly composed of :
 - A **Power Drive Units (PDU)** which includes inverters, filters, etc.
 - A **Control Unit (CU)** which manages the WA sensors acquisition and which embeds the WA Control Laws. The CU will also acquire orders coming from high-level controller of the SOG System (cockpit).
- A **Power Supply Unit (PSU)** which manages both power coming from the aircraft network and power provided to other aircraft systems.

Phase Description

- **Acceleration Phase :**
 - The PSU is providing power to the PEU in order to transmit the needed motion torque to the aircraft thanks to the WA. This power may come from Aircraft Network or local energy storage device.
- **Braking Phase :**
 - Regenerative power is transmitted from the Wheel Actuator Motors to the Power Supply Unit, through the Power Electronic Unit.

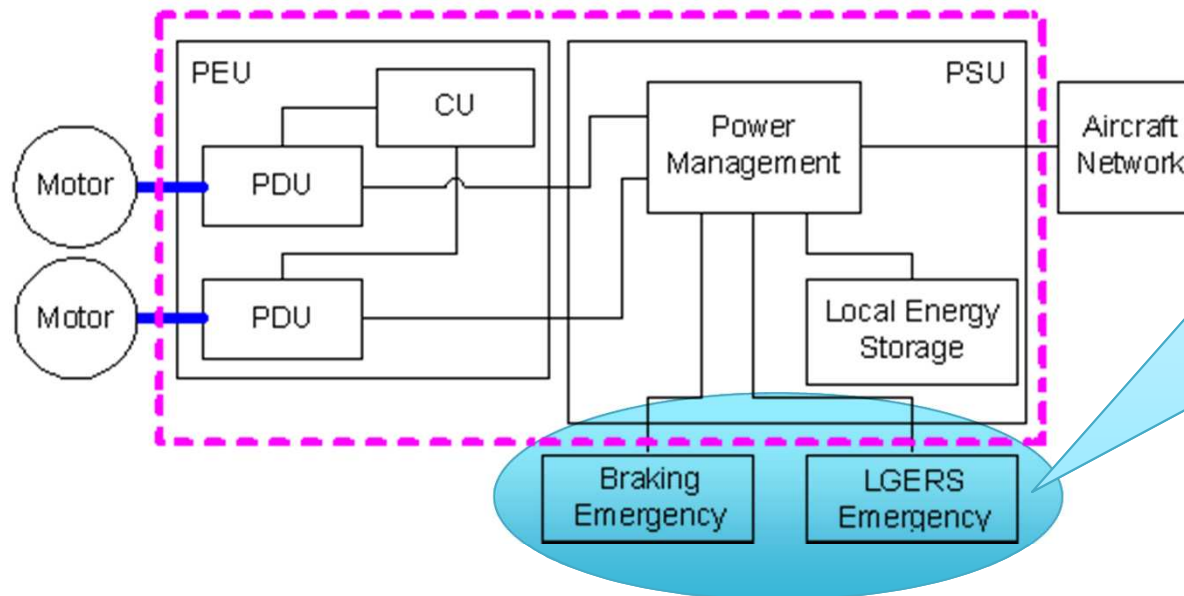


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System Configuration

Depending on **PEERS Configuration** the power may be :

- Stored in the **Local Energy Storage** device.
- Transmitted to the **Aircraft Network** to supply other Aircraft Systems.
- Burned in **dedicated device** (resistances, etc.)

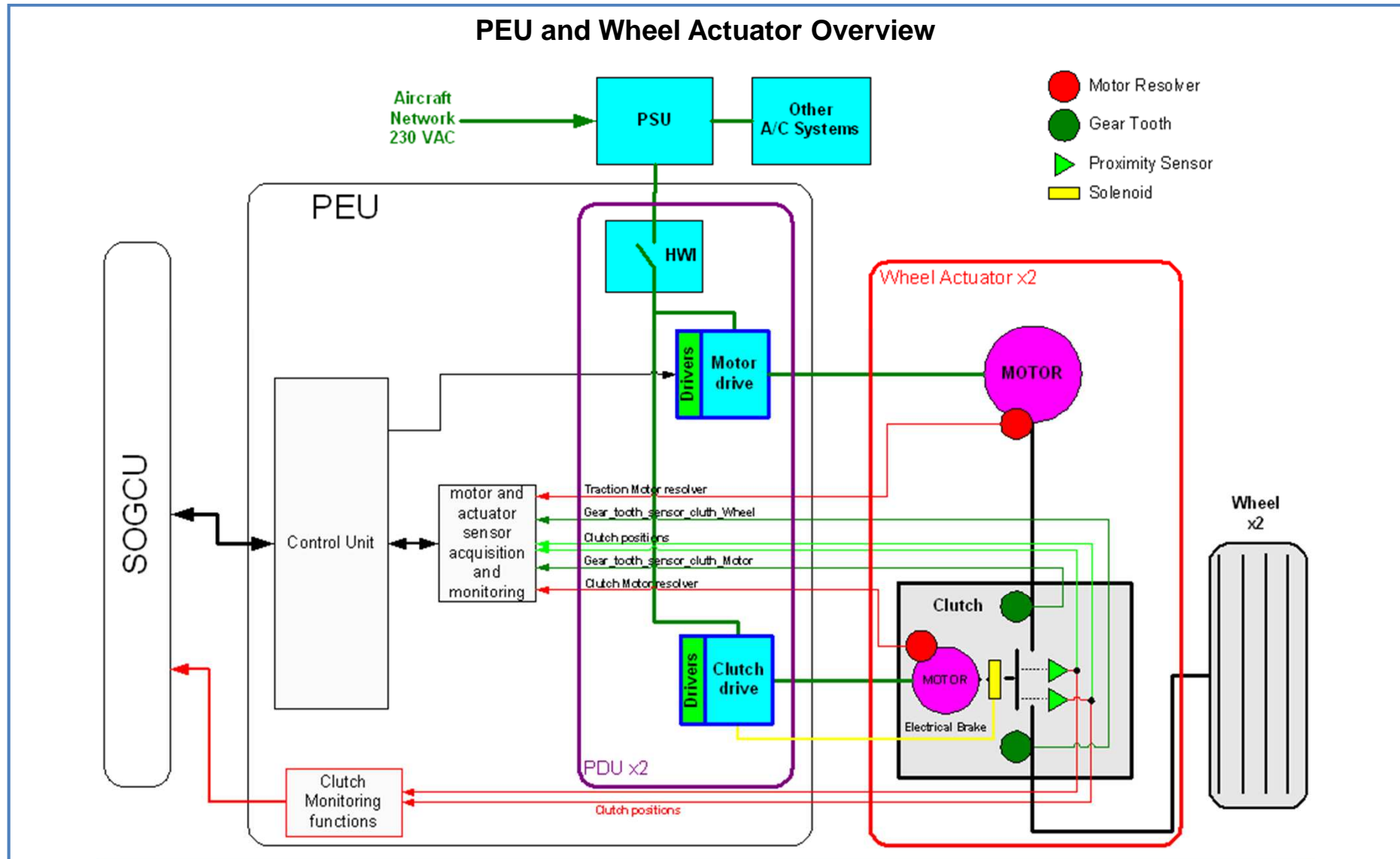


The power embedded in the Local Energy Storage Device may be used for example to supply :

- **Braking Emergency System**
- **LGERS Emergency System**

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PEU and Wheel Actuator Overview



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Purpose of this CfP

- Design, manufacture and test the PEERS before its integration at SOG System level.
- Lead Trade Off activities to propose the better compromise between **burning** vs. **storing** ability.
- PEERS System is a **long term** Aircraft application development ! Thus, technology breakthrough might be needed in some fields such as :

Burning	Storing	Burning + Storing
Resistance	Battery	Best combination ?
Regeneration in APU (reversible WACU)	Super Capacity	
Other?	Other?	

- The best combination will be the result of trade off between parameters such as **Performance**, **Weight** and **Safety (reliability, MTBF)**.



Smart Operations on Ground Power Electronics with Energy Recycling System

Expected Type of Work

- Design of a Power Electronic with Energy Recycling System (PEERS) :
 - ❑ Architecture and Technology study and choice.
 - ❑ Joined integration studies with SOG Members (plateau Phase).
 - ❑ Preliminary and detailed design.

- Manufacturing of a Power Electronic with Energy Recycling System (PEERS).

- Test of the Power Electronic with Energy Recycling System (PEERS).
 - ❑ Acceptance Tests.
 - ❑ Performance Tests.

- Technical support to SOG Member Team during power system integration at SOG System.



Smart Operations on Ground Power Electronics with Energy Recycling System

Major Deliverables and Schedule

Deliverable	Title	Description (if applicable)	Due Date
D1	PEERS Architecture		T0 + 5 months
D2	Conformity matrix vs. Specification		T0 + 5 months
D3	PEERS ICD	Interface Control Document	T0 + 5 months
D4	PEERS DJP	Definition Justification Plan	T0 + 5 months
D5	PEERS Components Specification		T0 + 8 months
D6	Tests programs, Acceptance Test Procedure		T0 + 12 months
D7	PEERS Prototype		T0 + 15 months
D8	DJD	Definition Justification Dossier	T0 + 17 months
D9	Tests Reports		T0 + 17 months





PEERS Presentation

Back-up

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Topic #: JTI-CS-2011-3-SGO-03-014

Context & Technical Challenges

- Development of new aircraft function with economic and ecological goals
- Wheel actuators integration in aircraft landing gears driven by power electronics

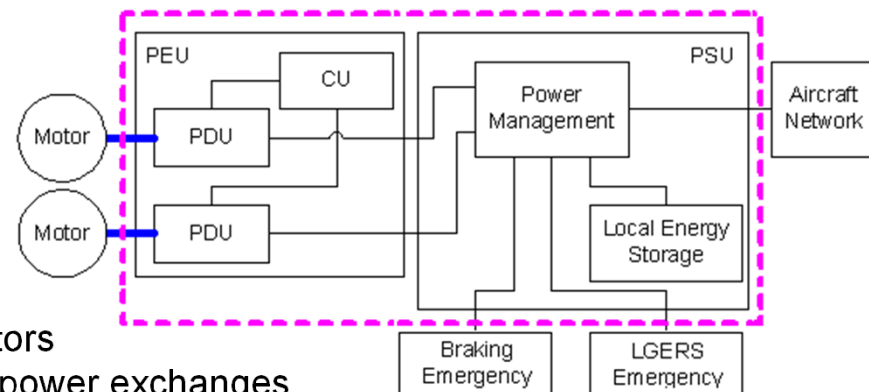


Main difficulties

- Developing a complex power electronics which includes energy recycling system
- Using a technology and a design compliant with aeronautical rules

Power Electronics with Energy Recycling System

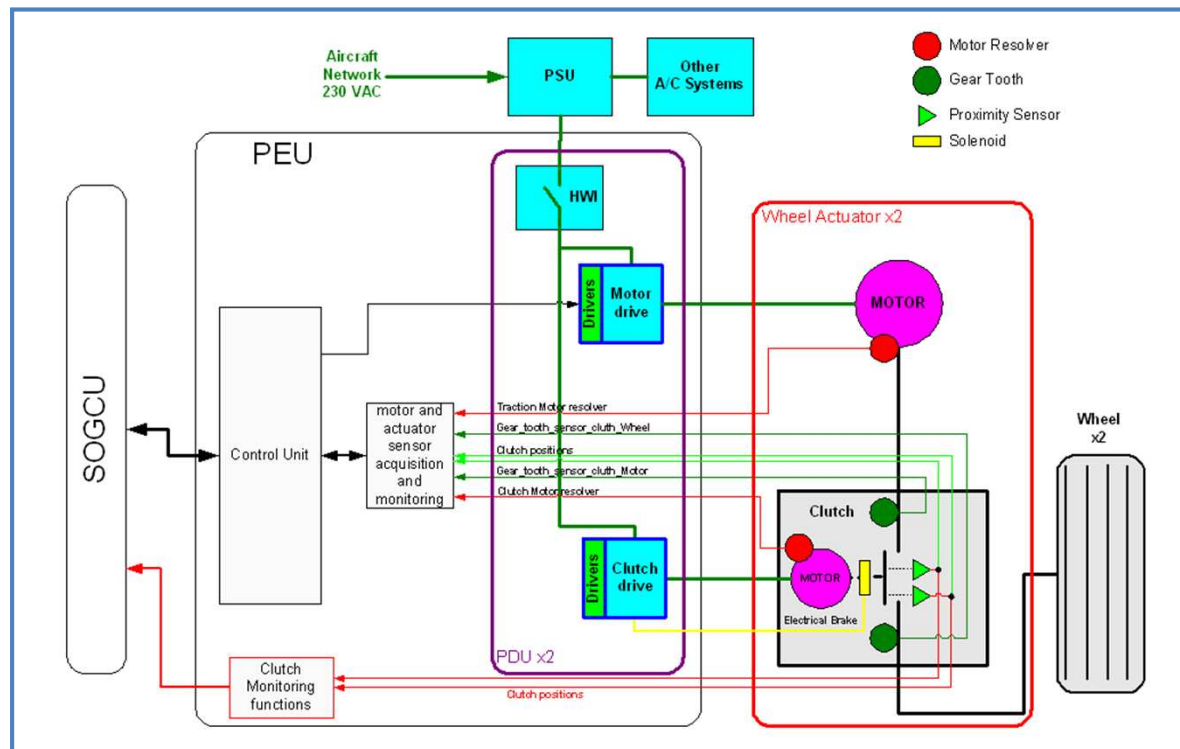
- Increase SOG System efficiency
- Develop and manufacture a double function system:
 - A power electronic which drives wheel actuators
 - An energy recycling system which manages power exchanges between aircraft and SOG System



Smart Operations on Ground Power Electronics with Energy Recycling System

Expected feedback

- Provide a prototype of a power electronics which will be able to drive Wheel Actuator motor topology and reach the expected performances based on the specification
- Get feedback of system behaviour during regenerative power phases (stability) in order to implement cruise control function



Additional Information

- Participation of a partner aware of aeronautical constraint and consortium organisation would be an asset

Topic value

- 1490 k€ maximum budget