European Consortium for Lithium-Sulfur Power for Space Environments

Berichterstattung

Projektinformationen

ECLIPSE

ID Finanzhilfevereinbarung: 687306

Projektwebsite

DOI
10.3030/687306

Projekt abgeschlossen

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Periodic Reporting for period 1 - ECLIPSE (European Consortium for Lithium-Sulfur Power for Space Environments)

Berichtszeitraum: 2015-12-01 bis 2017-11-30

Zusammenfassung vom Kontext und den Gesamtzielen des Projekts

Electrical power subsystems designed for space applications face uniquely harsh environments over their lifetime. Yet, today they are required to cope with new trends driven by the fast-growing space business: increasingly energy-hungry payloads, longer mission durations, ever more stringent safety requirements, lower satellite and launchers masses and smaller volumes. In order to pave the way for a competitive European space industry, the ECLIPSE project (European Consortium for Lithium-Sulphur Power for Space Environments) was brought to life by the European Commission under the H2020 framework. With a total budget of 1 Million Euros, ECLIPSE will prepare the next evolution of spacecraft and launchers battery technology by the end of 2017.
The current state-of-the-art of energy storage for space applications is exemplified by the Lithium-Ion technology, which has been used extensively in spacecraft electrical systems over the last 15 years. However, Lithium-Ion technology seems to be approaching the end of its product lifecycle, as ongoing Li-Ion developments have failed to yield significant improvements in performance. Fortunately, the next generation battery technology is around the corner; this time its chemistry is based on the Lithium-Sulphur process.
This technology could therefore represent the new breakthrough technology for energy storage on board spacecraft systems. In the future, Lithium-Sulphur technology could enable the production of batteries with an energy density twice as high as Lithium-Ion, a significant advancement in the field of inspace energy storage.
The main objective of the ECLIPSE project is to demonstrate the feasibility of the optimized Lithium-Sulphur cell technology so that it can make its way towards space applications. Using a new battery technology on a satellite or a launcher is only possible once a Technology Readiness Level (TRL) of 5 has been successfully demonstrated on three main levels: at cell, at battery and at system level.
In order to meet its key objectives, ECLIPSE will need to overcome certain challenges at these levels:
- At cell level: Maximising the high energy density (>400 Wh/kg) offered by the Lithium-Sulphur chemistry.
- At battery and cell encapsulation level: Building a prototype battery module and checking its suitability for the space environment.
- At system level: Creating an electrical model of the cell that takes into account ageing effects. The detailed cell design, the experimental results and the assessment of system-level impacts will also have to be developed.

Even if ECLIPSE's Li-S prototypes have not reached the performances targets at cell level, ECLIPSE activities helped to improve the technology performances compared to the state of the art at the beginning of the project. The project has led to patents, publications, innovations for future activities and also reinforcement of partnership between industry and research in order to prepare future European battery technology for space.

Arbeit, die ab Beginn des Projekts bis zum Ende des durch den Bericht erfassten Berichtszeitraums geleistet wurde, und die wichtigsten bis dahin erzielten Ergebnisse

The work from December 2015 to December 2016 has concerned the following activities:
- Specifications : elaboration of specifications to define the needs for cells components, cells and battery performances as well as model features have been edited as input to the different work-packages to ensure the work is in accordance to ECLIPSE objectives
- Dissemination : creation of a website including a private access for ECLISPE members, creation of a project brochure and presentation of the project in some conferences
- Electrochemistry development : different materials solutions have been evaluated at both material and cells levels in order to define the best options for ECLIPSE cells
- System analysis : a first version of system analysis has been edited to identify the LiS cells features and the potential impacts on space systems. This analysis will be continued in 2017 with new data from cells and models developed in ECLIPSE
- Modeling :a first issue of beginning of life model has been issued based on the current LiS cells. Some first assessments regarding the ageing behavior of cells have been. The complete model will be updated with new data from cells developed in ECLIPSE.
- Battery design : some specific tests have been performed to evaluate the cells series or parallel connection and the needs of balancing functionality. A module design has been proposed for ECLIPSE cells.

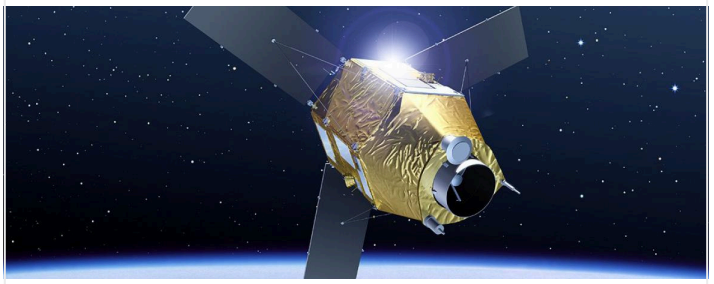
Fortschritte, die über den aktuellen Stand der Technik hinausgehen und voraussichtliche potenzielle Auswirkungen (einschließlich der bis dato erzielten sozioökonomischen Auswirkungen und weiter gefassten gesellschaftlichen Auswirkungen des Projekts)

The expected outcomes of ECLIPSE are:
- Spacecraft and launchers battery mass reduction by a factor two. This will result in a cost reduction at all spacecraft levels: subsystem, system as well as launch costs.
- Consolidation of an independent European industrial supply chain for Lithium-Sulphur batteries
- An increased maturity of the technology with the goal of achieving Technology Readiness Level (TRL) of 5 at the end of the project.

In conjunction with the advances of battery technology in the terrestrial domain, the progress on the Lithium-Sulphur cell technology for space applications made by ECLIPSE will reinforce European competitiveness and leadership the establishment of complete value chains for satellite and launchers technology. And last but not least, Lithium-Sulphur cells will be significantly less toxic then existing battery solutions, since they do not contain any heavy metals and are highly recyclable.

The Lithium-Sulphur technology has the potential to improve space systems and empower exciting new missions, employing interplanetary probes and rovers. Naturally, advances made by the ECLIPSE project will also benefit other domains such as the automotive or aviation industry.

launcher4.png



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