SPACE SYSTEMS SYMPOSIUM (D1)
Enabling Technologies for Space Systems (2)

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THE HYDROGEN VALUE CHAIN: APPLYING THE AUTOMOTIVE ROLE MODEL OF THE HYDROGEN ECONOMY IN THE AEROSPACE SECTOR TO INCREASE PERFORMANCE AND REDUCE COSTS

Abstract

Hydrogen will assume a key role in Europe's effort to adopt its energy dependent society to satisfy its needs without releasing vast amounts of greenhouse gases. The paradigm shift is so paramount that one speaks of the "Hydrogen Economy", as the energy in this new and ecological type of economy is to be distributed by hydrogen. However, H2 is not a primary energy source but rather an energy carrier, a means of storing, transporting and distributing energy, which has to be generated by other means. Various H2 storage methods are possible, however industries' favourite is the storage of gaseous hydrogen in high pressure tanks. The biggest promoter of this storage methodology is the automotive industry, which is currently preparing for the generation change from the fossil fuel internal combustion engines to hydrogen based fuel cells. The current roadmaps foresee a market roll-out by 2015, when the hydrogen supply infrastructure is expected to have reached a critical mass. The hydrogen economy is about to take off as being demonstrated by various national mobility strategies, which foresee several millions of electric

cars driving on the road in 2020. Fuel cell cars are only one type of "electric car", battery electric as well as hybrid cars - all featuring electric drive trains - are the others. Which type of technology is chosen for a specific application depends primarily on the involved energy storage and power requirements. These considerations are very similar to the ones in the aerospace sector, which had introduced the fuel cell already in the 1960s. The automotive sector followed only recently, but has succeeded in moving forward the technology to a level, where the aerospace sector is starting considering to spin-in terrestrial hydrogen technologies into its technology portfolio. Target areas are again high power/high energy applications like aviation, manned spaceflight and exploration missions, as well as future generation high power telecommunication satellites. Similar trends can be expected in the future for RADAR Earth Observation satellites and space infrastructure concepts of great scale. This paper examines current activities along the hydrogen value chain, both in the terrestrial and the aerospace sector. A general assessment of the synergy potential is complemented by a thorough analysis of specific applications serving as role models like a lunar pressurised rover, an aircraft APU or a high power telecommunications satellite. Potential performance improvements and cost savings serve as key performance indicators in these comparisons and trade-offs.