WUBBO OCKELS

Prof. Dr. Wubbo Johannes Ockels is a Dutch physicist and a former ESA astronaut. In 1985 he participated in a flight on a space shuttle, making him the first Dutch citizen in space. He currently is a professor at the Institute for Applied Sustainable Science, Engineering and Technology at the faculty for Aerospace Engineering, Delft University of Technology and the driving force behind the "Laddermill", among a variety of other projects.

Wubbo Ockels was born March 28, 1946, and obtained his MSc degree in 1973 and subsequently a PhD degree in physics and mathematics in 1978 from the University of Groningen. His thesis was based on experimental work at the Nuclear-physics Accelerator Institute (KVI) in Groningen.

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HIGH ALTITUDE WIND POWER, FROM THE EARLY DAYS UNTIL TODAY

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The TU Delft Institute for Applied Sustainable Science, Engineering and Technology, ASSET, has started in 2004 various developments in the field of kite power, focusing on the so-called "laddermill". In this concept, a ground-based electric generator is driven by kites that are attached to a vertical cable loop. The kites pull with a strong force while rolling outbound (ascending) and a low force while coming back (descending). The institute has developed a firm position in the global R&D landscape consisting of some 40 research and development groups.
The use of kites for electrical power production has been receiving a growing attention because of the urgent need to reduce CO2 emissions and because of the abundant wind energy available at higher altitudes. Its potential is significant, as well as in cost (lower than coal plants) and flexibility (developing countries). The wind availability at altitude was studied based on 20 years measurements. Higher altitudes (above 500m) are favourable for power, frequency and stability (laminar flow).
Several methods are studied nowadays to exploit the high altitude wind. A fundamental difference is the location of the generator, namely on ground or airborne. Advantages and disadvantages are discussed. The effect of a kite can be drastically improved through crosswind. The motion perpendicular to the wind increases the power which can be described as a virtual increase of surface. The drawback is a lower effective lift over drag, thus resulting in a lower elevation.
Fundamental questions arise related to the advantages of high altitude versus crosswind and other drawbacks of larger systems. The "spider" system is discussed, a combination of the laddermill and a two kites system. Of particular interest is insight in cost of kite surface versus maximum and cumulative load. Certainly, a large diversity of kite systems is required in this phase of pioneering. The application for propelling a ship is also considered, including upwind sailing. In this case, the ground station is not stationary, but its motion results in a higher apparent wind speed for the kite, while the horizontal component of the kite adds to the ships drag.