IAF SPACE POWER SYMPOSIUM (C3)
Space Power System for Ambitious Missions (4)

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GOSOLAR – A GOSSAMER SOLAR ARRAY CONCEPT FOR HIGH POWER SPACECRAFT APPLICATIONS USING FLEXIBLE THIN-FILM PHOTOVOLTAICS

Abstract

The power demand for future satellite applications will continue to rise. Geostationary telecommunication satellites currently approach a power level of up to 20 kW. Future spacecraft will provide yet more transponders and/or direct mobile-satellite services. Electric propulsion is in-creasingly used for station keeping, attitude control and GEO circularization. Interplanetary mis-sions already use kW-range electric propulsion. Space Tugs are studied for several fields. Suitable engines require 100 kW or more. The envisaged use of such engines and the operation of future GEO satellites lead to a renewed interest in large, deployable and ultra-lightweight power gen-erators in space.

Within the GoSolAr (Gossamer Solar Array) activity, DLR develops a new photovoltaic array technology for power generation. It is based on the DLR Gossamer approach using lightweight, deployable CFRP booms and a polymer membrane covered with thin-film CIGS photovoltaics. The booms are arranged in a crossed configuration with a central deployment unit. The photovol-taic area is composed of one large square membrane with double folding using two-dimensional deployment.

Even though the efficiency of thin-film photovoltaics is currently only about 1/3 of that of con-ventional photovoltaics, a membrane based array can already achieve better mass/power ratios.

A 50 kW array requires an area of approximately 20 m x 20 m. In a first step, DLR develops a fully functional 5 m x 5 m demonstrator partially covered with thin-film photovoltaics, using the DLR small satellite platform S2TEP. Space compatible thin-film photovoltaics need to be select-ed and tested. They are integrated on standardized generator modules that will be assembled into a large, foldable and deployable membrane. A controlled deployment of structure and membrane, and a sufficiently stiff support structure for operation are key development topics.

We present the conceptual design of the GoSolAr demonstrator, the main requirements, preliminary technical budgets and the development strategy. An overview will be given on the selection and the maturity of the key technologies and subsystems, such as deployable membrane with in-tegrated photovoltaic generators; deployable CFRP booms including deployment mechanisms; photovoltaic cell selection and integration to generator units; the array harness concept as well as the electronics concept, for operation and photovoltaics characterization. Furthermore, an over-view of the first manufactured breadboard models and their testing will be presented, e.g. com-bined testing of booms and mechanically representative generator arrays to evaluate deployment and interface forces for the preliminary design.