



Star tracking with aspheres

Project description:

Satellite technologies are indispensable in earth and climate observation as well as navigation. One important factor in the success of such projects is the completely autonomous attitude determination with high accuracy. One of the leading companies in developing attitude sensors is Terma A/S. Over the last few years it has been possible to develop very compact Star Trackers – an autonomous digital camera of high accuracy that determines a satellite's orientation in a matter of seconds using star constellation recognition. In order to meet the very challenging space requirements for a satellite, a very compact design was required. Consequently, the core piece - the optical system - had to be optimized in size. An outstanding optical quality should be achieved with a smaller number of lenses/ components. Additionally, there are high demands on the thermal stability and reliability without limiting the accuracy.

Project realisation:

asphericon made it possible to develop an ultra-compact optical system using a combination of aspheric and spherical components. The lens system is based on radiation-resistant glasses, high-end surface form tolerances ($\leq 0,5$ fr), surface roughness ($\leq 0,002$ μm) and surface imperfection tolerances for ideal support of the demanding attitude system. A highly sophisticated super wideband AR-coating (ARSBB 480 - 850nm) supports the thermal stability of the entire system. The use of aspheres ultimately made it possible to create not only a very efficient, but also an economically extremely attractive optical system.

Parameters

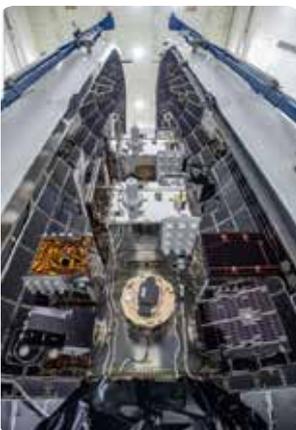


Fig. 1 One of six satellites | © U.S. Air Force

- = Six satellites placed in temporary circular orbit 720 km above the ground
- = Star catalog containing more than 5,000 star directions
- = Attitude determination by tracking catalog stars at a rate of up to 10 Hz with arc-second ($1/3,600$ of a degree) accuracy

Objectives

- = Most precise attitude determination of satellites
- = Increasing the reliability and usefulness of earth observations by satellites in meteorological satellite missions



Fig. 2 Objectives for the star trackers | © Terma A/S