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FLAT-SAT HIGH RESOLUTION TELESCOPE CONCEPT

Abstract

Observation telescopes are and will be one of the most important instruments for monitoring activity on the surface of the Earth, but also other celestial bodies and imaging deep space. The basic requirement is to obtain the highest possible imaging resolution. Telescopes in the Cassegrain configuration are most often used. They are characterized by a relatively simple and proven design. Their disadvantages are dimensions and weight, which forces the use of a large satellite structure. A spectacular achievement of recent years is JWSP. Its distinguishing technical solution is the folding secondary mirror, which makes it possible to build this telescope on a structure much smaller than in the case of using a classic configuration of a telescope with fixed mirrors. The idea behind the solution described here is such a construction of the telescope that will enable obtaining high resolution imaging, and at the same time it will be possible to build with the smallest possible structure of the satellite. These requirements contradict each other, however, the analysis carried out by the authors showed that it is possible to achieve this goal.

The modified Cassegrain and off-axis configuration was proposed. A primary mirror with an aperture of 400 mm, a telescope focal length of 8 m, and a sensor with a pixel size of 5.5 μm were used for the analysis. For the assumed apogee of the Earth's orbit of 550 km, the GSD is <40 cm. The satellite's "board" structure with dimensions of 0.5x1x0.2 m3 was selected for analysis. The primary mirror and other mirrors modeling the light beam and imaging instruments are built inside the structure. The secondary mirror (M2) is deployed beyond the outline of the structure to a distance not greater than the longest side of the satellite structure. This M2 will be equipped with an active vibration correction.

The concept of a small, flat "board" satellite with a deployable secondary mirror, whose parameters are comparable to those of large observation satellites, has been proposed. In the full version of the article, an in-depth analysis of the optical properties of the telescope will be presented and the structure will be discussed, with particular emphasis on the mechanism of deploying the secondary mirror and active vibration correction.