THERMAL CONTROL OF NEW GENERATION SPACECRAFT OPTICAL TELESCOPE ASSEMBLY

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Currently, to compete with the leading countries in the field of Earth remote sensing, such as the U.S., France, China, it's necessary to create a national spacecraft optical telescope assembly- with spatial resolution 0.5 m for panchromatic images and 2 mfor multispectral images. The current generation of Russian spacecraft optical telescope assemblywas developed over 15 years ago and now technically obsoleted. Today, the world's leading spacecraft optical telescope assemblieshave betteroperational features, less weight and less power consumption.

Currently operated Russianoptical telescope assemblies have an optical system with a solid primary mirror with diameter up to 1.5 m and the thermal control system with a liquid coolant. The primary mirror is lightened by using special materials, such as Citall, and by making lots of hexagon-shaped pockets in the back of the mirror.

To achieve spatial resolution of 0.5 m it’s necessary to increase the diameter of the primary mirror up to 3 m and more, but in this case it will be required new approaches to solving the primary mirror mass problem and thermal control problem. With such significant increase in the size of primary mirror weight and size characteristicsand power consumption of thermal control system increases to unacceptable values.

For large sizeoptical telescope assembliesa precision thermal control system is suggested [1, 2].This system based on electric heaters and heat shields, and can be used on large and small spacecrafts.Thefeatures of this system is the high accuracy of the thermal control, small weight and size and low power consumption compared to conventional systems. The problem of primary mirror mass is already solved in large ground-based telescopes, which use segmented mirrors [3], the same approach can be applied to the creation of large size optical telescope assemblies.

There is many papers devoted to development of large optical systems with segmented mirrors in many papers [4-5], but it mainly deals with optics, alignment or strength, and do not receive enough attention to the thermal control of such mirrors. Use of segmented mirrors will increase the effectiveness of precision thermal control system, the ability to control the temperature of each segment independently leads to a decrease in weight and size and power consumption characteristics of system.

This paper considers optical telescope assembly with Ritchey-Chrétienoptical scheme and a segmented primary mirror (Fig. 1).

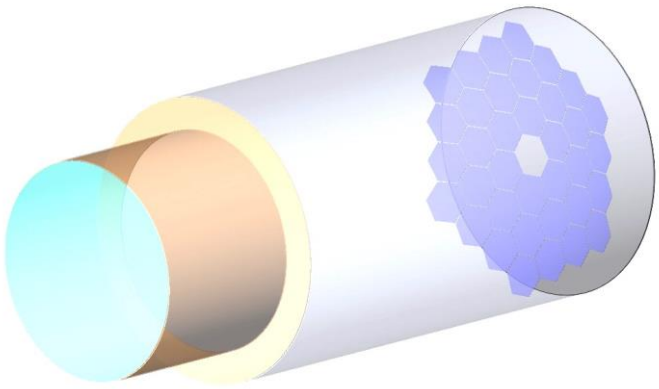

Fig. 1.Telescope model with a segmented primary mirror.

Primary mirror made of silicon carbide, this material has high specific stiffness and a relatively high coefficient of thermal conductivity. Precision thermal control system is used [1]. The calculation of the telescope temperature field under space conditions is carried out.

References

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