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ANALYSIS OF THE STATE OF THE ART AND THE TRENDS IN THE DEVELOPMENT OF ORBITAL CONSTELLATIONS OF SMALL AGRICULTURE-ORIENTED EARTH REMOTE SENSING SPACECRAFT

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The goal of this paper is to assess the existing capabilities of orbital constellations of agriculture-oriented Earth remote sensing spacecraft and the prospects for their development in the nearest future. The paper analyzes the state of the art and the trends in the development of modern orbital constellations of private companies' small Earth remote sensing satellites used in solving agricultural problems. Important sources of information in the space industry, such as NewSpace Index, Gunter's Space Page, and WMO OSCAR, were analyzed. 52 constellations of spacecraft for optical multispectral and hyperspectral, thermal, and microwave (radar) imaging are considered. It is shown that they provide a survey frequency of several times a day. The minimum spatial resolution of optoelectronic surveillance sensors is 1 m (in the panchromatic channel). This allows one to solve problems at an intrafield level, quasi-continuously monitor the plant condition, and use spectral patterns and texture features in solving applied agricultural problems. All the constellations of radar satellites use the X-band, except for the radars of the Spacety constellation (China), which use the C-band. It is shown that the number of constellations of small remote sensing spacecraft in the period 2021–2025 is to be increased by more than three times compared to the period 2016–2020. The number of countries developing constellations of Earth remote sensing satellites has increased significantly. The leading countries and companies in the number and size of constellations are the United States and China and Planet (USA) and Chang Guang Satellite Technology Corporation (China), respectively. Private developers are particularly interested in thermal infrared imaging and hyperspectral optical imaging data. A new line in the private space industry, which is expected to facilitate the solution of agricultural problems, is the deployment of constellations of small meteorological satellites.

Keywords: *remote sensing, agriculture, satellite constellation, small satellite, optical imagery, hyperspectral imagery, thermal infrared imaging, synthetic aperture radar*.

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