

OPPORTUNITIES TO REACH TARGET EFFICIENCY BY SPACE SURVEY OPTICAL-ELECTRONIC SYSTEMS, BUILT AT ORBITS OF DIFFERENT TYPES

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The most important performance indicators of target efficiency at the stage of designing and developing of space survey optical-electronic systems (SS) are space vehicle (SV) productivity, survey periodicity, efficiency of the delivered information, quality of the received information and system cost, which, in the first approximation, depends on amount of SV in an orbital group.

The represented efficiency indicators also depend on orbital structure parameters and are used in optimization shaping for choosing of the rational version in SS orbital organization [1,2] and determine the orbit type.

In this case we'll compare ballistic SS organization with SV, being located on two types of izorouting elliptical (or circular) orbits with twenty-four-hour track recurrence interval, approximately identical height values in apogee and perigee (on a range of 500...3000km) and different inclination values only. It is possible to obtain equality between angular precession velocity of orbit node and angular velocity of Sun moving, while choosing of an orbital altitude and its inclination. As a result we have an orbit with constant plane sunrelative orientation – a sun-synchronous orbit (SSO). By analogy, orbits with an inclination less than 90° and with variable plane sunrelative orientation are orbits "without constant solar orientation" (WCSO).

We receive, that SV, disposed on various types of orbits, have the same characteristics (for example, on weight, on onboard systems) and are equipped by optical-electronic hardware (telescope) with identical characteristics (on a focal length, on a sanction element size, on an angle of vision). Let's take into account one SV for each orbit in SS.

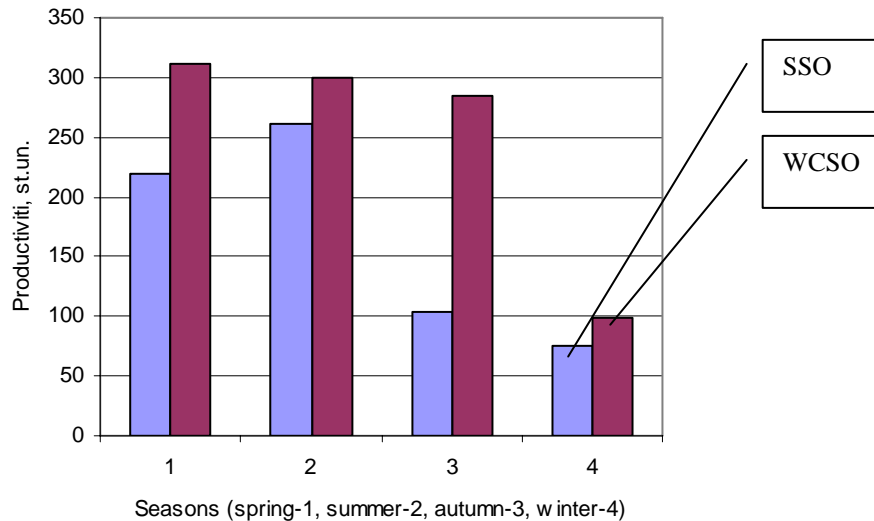
It is necessary to note, that foreign systems are constructed [3, 4], on the whole, in sun-synchronous orbits: Ikonos, QuickBird, OrbView-3, Landsat-7, EO-1, Aqua, Eros-A,B,C, ALOS, SPOT, Formosat, Kompsat, IRS, WorldView, GeoEye, etc. In Russia there was a successful experience of areas supervision from orbits WCSO with inclination $63,4...70^\circ$ ("Resurs-DK", "Arkon-1").

Many words to be spoken about advantages of SSO in the literature related with space survey systems. However it is necessary to notice, that such advantages of SSO as opportunity to observe the Earth during the same local time, approximately constant Sun elevation angles in observation point, etc., are lacks for separate consumers. It speaks that for some survey objects various solar light exposure for detection of the determined attributes of these objects is required. Besides, SSO lacks are: rotation of apsides, and also impossibility of observation of inaccessible areas both at initial orbital system construction, and in the further. Therefore the most preferable are orbits WCSO from point of view of survey areas characteristics for the determined consumers.

Besides orbits WCSO have advantages before SSO on duration of a working site (a time interval on each orbit pass where SV can spend shooting of potential survey areas) and on total time of visibility from ground points, which directly influences upon the productivity value as limits capabilities to reset all saved information from SV.

Comparison of two orbit types and selection of preferable one took place with using the criterion of maximal productivity achieving by SV, and with limitation on such efficiency indicators as periodicity, efficiency and sanction.

SV productivity calculation results for two types of orbits are presented as a histogram on pic.1. We can see that productivity value on orbit WCSO surpasses productivity value on SSO. Thus the most preferable for examined SS are elliptical (circular) orbits WCSO from point of view of maximal productivity value achieving.



Pic.1. Dependability of SV productivity on SSO and orbit WCSO from a season

The most preferable are SSO from point of view of productivity integral estimation for a year. However mean diurnal productivity value for orbits of two types is approximately identical.

Comparison of SS, constructed on two types of orbits, on productivity value, periodicity and efficiency shows that orbit WCSO has a maximal productivity value ~300 st.un. for periodicity of 1-5 time/day, efficiency not worse than 8 hours, sanction not worse than set.

Thus, at ballistic designing and development of SS it is expedient to use elliptical (circular) orbits without constant solar orientation for the solution of target tasks with greater efficiency in interests of the determined consumers.

Literature

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