

ASTRODYNAMICS SYMPOSIUM (C1)
Mission Design, Operations and Optimization - Part 2 (2)

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OPTIMISATION OF SPACE OBSERVATION SYSTEMS CONSTELLATIONS ON THE BASIS OF
OPERATIVE PLANNING OF THEIR TARGET FUNCTIONING**Abstract**

Modern satellite observation systems are projected so that to provide multi-functionality of their target application, i.e. to give for consumers (users, customers, etc.) a wide spectrum of space services and information, for example, different shots of terrestrial territories or local objects in various spectral ranges, obtaining in any meteo- and light exposure conditions. Thus systems orbital constellations can include any number of spacecrafts (SC), located in different altitudes of planes as well as at two or more orbital segments. Constellations optimization is necessary for increase of efficiency of systems target functioning, for example, achievements of the required film-making informativeness, productivity of SC on-board equipment, operationability of data transmission or another requirement depending on criterion of efficiency. Generally, such optimization is a fundamental problem of the modern control theory which is characterized by polynomial complexity. Universal approaches to its solution are not offered till present. The purpose of the paper is presentation of the methodical approach for problem solution. It realizes the following computing scheme: 1) choice of an initial variant of system orbital constellation; 2) modeling of system target functioning process; 3) optimization of operative plan of system target functioning by the criterion; 4) estimation of system target functioning efficiency; 5) variation constellation parameters and transition to stage 2; 6) parametrical analysis of results repeatedly calculated at stages 2 - 5, and a choice of the most preferable parameters of the constellation. As a matter of fact, the offered approach is based on the repeated solution of optimization of operative plans with feedback that allows to vary parameters and to optimize constellation of SC. Statement and solution of such problem distinguishes it from earlier considered and presented here for the first time. For automation of the offered approach the special software is developed which realizing models and methods of operative planning optimization presented and published by authors earlier. Several examples of model optimization problems are considered: for constellation of 8 different active observation SC, located in orbits from 400 to 700 km and carrying out monitoring of local terrestrial objects; for constellation of 3 – 5 observation SC with project parameters of "RapidEye" system, making square shooting of Earth surface; for constellation of 2 - 6 observation SC with project parameters of "CBERS" system, carrying out shooting of given territory. The results are illustrated and discussed. The paper was supported by The Russian Foundation for Basic Research (project 09-08-01208-a).