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OPTIMIZATION OF OPERATIVE PLANNING FOR MULTIFUNCTIONAL SATELLITE  
OBSERVATION AND COMMUNICATION SYSTEMS

**Abstract**

Modern projects of satellite observation and communication systems are characterized by such major factors as multisatelliteness (orbital segment includes tens or more spacecrafts (SC) in different planes) and multifunctionality providing the multi-target maintenance of consumers by services. Thus even separately systems of observation or communication can be multifunctional. Both specified factors cause a number of features of target functioning which are necessary for considering at operative planning. The main purpose of the report is presentation of the methodical approach for optimization of multifunctional system functioning which consists in formation of plan (plans) reception/transfer information which provide the maximum system effectiveness on the chosen criterion function. General statement of the problem and approach to its decision, illustrated on some multisatellite systems, have been presented earlier in the authors' publications. But it is considered for multifunctional systems for the first time. Two variants of multifunctional system orbital segments are considered in the report: 1) two space segments located in orbits of different height; 2) Constellation of several observation multifunctional SC without links among themselves. Corresponding scenarios of system functioning and their mathematical formalization are considered. As some system projects provide SC-to-SC communication links then the information transfer is possible by considerable quantity of routes which is defined by characteristics of SC on-board target equipment and their technical resource. Generally it is a scientific and technical problem of polynomial complexity, unequivocal approaches of its decision it is not offered till now. Several examples of optimization of operative planning for some multifunctional satellite systems are given in the report: for the project with two orbital segments (low and medium-altitude) for two general variants of data transmission (the fixed and mobile subscribers) by criterion of operativity of information delivery; for the constellation of 8 low-orbit (from 400 to 700 km) SC carrying out monitoring of 22 local Earth objects during time interval of 1 day or 2 days by criterion of utility of the cumulative film-making information, taking into account precondition on quantity of pictures for each object in the plan (1 shooting or 2 shootings); for the project of RapidEye system which orbital segments (from 1 to 5 SC) carrying out monitoring of Earth surface regions during time interval from 1 to 5 days by criterion of maximum of film-making square. The results are illustrated and discussed. The report is realized under the support of Russian Foundation for Basic Research (grant 09-08-01208-a).