

SPACE DEBRIS SYMPOSIUM (A6)  
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Russian FederationANALYSIS OF POSSIBLE DISPOSAL ORBITS FOR A REFINEMENT OF THE NEAR-EARTH  
SPACE IN ALTITUDE RANGE 900-1500 KM**Abstract**

The low earth orbits (LEO) in altitude range 900-1500 km is intensively exploited now by many countries conducting the space activity with the help of various spacecrafts. Together with the operating space vehicles the given near-earth space (NES) region is occupied also by out-of-operation spacecrafts, upper stages of launch vehicles and other space debris objects. Nowadays there are over 1000 man-made space objects (SO) having large-size in this area. Among them about 800 objects are actually the spacecrafts. Besides, more than 1000 artificial large-size SOs are in the orbits crossing the indicated region. The lifetime of SOs within the considered NES exceeds hundreds years. An accumulation of anthropogenic objects here creates a problem for the future safe space activity in this area. That is why a problem of both stability of space debris (SD) population and the refinement of working orbits of the considered NES region is now urgent. In the proposed paper the results of investigations of possible disposal orbits (stable graveyard ones or orbits having a lifetime  $< 25$  years), on which can be placed SD being in working orbits in the given region, are presented. Investigations were fulfilled on the base of a great number of the high precise orbit propagation calculations by means of the numerical integration of the SO' motion equations. Characteristic properties of different classes of the disposal orbits, selected for SD removal are investigated. The critical parameters influencing a stability of a disposal orbit, being in NES at an altitude  $H_{mid} = 2000$  km, are revealed. Dependence of a disposal orbit lifetime on its parameters, value of a ballistic coefficient and solar activity is established. At calculation of an atmospheric density the special models for forecasting of the solar and geomagnetic activity indexes developed by the IZMIRAN were used. Expenditure of energy required for transfer of SOs from near circular working orbits with mean altitudes 900-1500 km into chosen disposal orbits is estimated. The demanded energy cost were estimated in the form of characteristic velocity -  $\Delta V$ , and in the form of the corresponding fuel content required for realization of the re-orbital maneuver as well. Recommendations for the selection of the disposal orbits, meeting certain requirements are made.