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A VARIANT OF THE RUSSIAN SPACE TRAFFIC MANAGEMENT PLATFORM: MAIN
PRINCIPLES AND COMPONENTS

Abstract

The framework for development of the Russian space traffic management platform is based on the integration and generalization of the best practices used to control various spacecraft and orbital constellation missions, designed in the USSR and Russian Federation. Space traffic management (STM) should be provided by the Mission Control Center in cooperation with the Russian Academy of Sciences. Continuously increasing activity of the space community with regard to the near-Earth space exploration drives the need to solve the space traffic management issue. This activity may cause dangerous situations of various kinds to occur in the near-Earth space. The situations are graded based on the event, which takes place. Specific principles of STM depend on the risk criteria for each individual situation that requires a certain systematization of dangerous situations. Russian experts proposed systematizing all possible dangerous events in the near-Earth orbits into a common classifier. The classifier contains a complete vision of the possible situations, which will pose a threat to the safety of space activities under various scenarios. The paper demonstrates that the need to perform a collision avoidance maneuver – as part of the STM strategy – is driven by the dangerous situation probability, when exceeding threshold values of risk criteria. The development of risk criteria for each individual situation is the part of “rules of conduct” in space. Russian scientists and experts see STM as transition from control of single spacecraft to control of orbital constellations, taking into account complete situational awareness of objects and events in the near-Earth space, as well as proactive development of recommendations to conduct maneuvering, while minimizing the consequences for an orbital constellation mission. The Russian space traffic management platform will include an integrated planning system, a complex of ballistic models (integrated solutions of ballistic and navigation support), an integrated analysis system and an automated warning system. A complex of ballistic models is a distributed system, which is mainly designed to integrate navigation solutions – with required accuracy and efficiency – to support missions of various spacecraft, which make part of the Russian orbital constellation, under scenarios of possible encounters with space debris. STM is provided by the distributed network-centric system, which comprises advanced decision-making support tools in the event of various situations using artificial intelligence methods, supercomputer technologies (including quantum computers). The paper also addresses risk criteria required for decision-making to mitigate negative effects under various space activity scenarios.