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# RESEARCH ON SAFETY OF LAUNCHING SATELLITES INTO GEOSTATIONARY ORBIT

**Abstract**

Launching a satellite into a circular geostationary orbit is a two-stage operation, involving a lower circular orbit – called a parking orbit – and an elliptical transfer orbit. In the process the launch vehicle with the payload need flight from about 200 km low earth orbit (LEO) to the 35 800 km geostationary orbit (GEO), and any failure could arouse serious problem for the future orbit safety. The paper simulates several typical breakup events during the geostationary satellite launching to analyze the debris cloud evolution and the effects to the space safety. If the breakup took place in the parking orbit with the height of 200 400 km, the debris would be dangerous to the International Space Station (ISS), the manned spacecraft and the remote sensing satellites in short period, but the lifetime of the debris would not be long due to the atmosphere. If the breakup happened during the third stage working phase, for the energy not enough to the geosynchronous transfer orbit (GTO) and the debris would be only dangerous to the LEO and the long term effect depended on the breaking speed and the evolution of the debris cloud. And if the breakup took place in the transfer orbit not only the LEO satellites but the MEO and GEO satellites would be affected. The lifetime of the debris on transfer orbit is determined by the atmospheric drag near perigee, the solar-lunar perturbation near apogee and the initial state into the orbit.