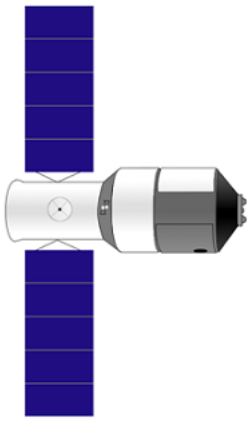
Tiangong-1



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In early 2018 a large object of special interest will re-enter into the Earth's atmosphere: the former Chinese space station Tiangong-1 (NORAD ID: 37820 / COSPAR ID: 2011-053A). The object was launched in September 2011 by a "Long March 2" launch vehicle from Jiuquan LA-4/SLS-1 into a Low Earth Orbit (LEO) with an inclination of approximately 43°. During its operational life time the station has hosted two manned Missions with six astronauts in total. On 21.03.2016 Chinese "Manned Space Engineering Office" announced that they disabled data service to their space station. Analysis of the objects' orbit has shown that no significant manoeuvres have been made since December 2015. Since that moment in time, the height of the object has permanently dropped mainly due to the atmospherical drag. The objects' altitude decreased from its' original position of 400km to 270km by the end of January 2018. The lower the orbit the faster the decrease in altitude will be due to the increase of the atmospheres' density. Due to the mass of approximately 7600kg and its size of about 11m x Ø3,5m (without solar arrays) the object is of special interest.

Most recent analysis show that the object will re-enter between March 31st / April 2nd plus/minus the uncertainty (typically 20% of the remaining orbital lifetime) that comes along with the re-entry prediction due to the unknown long-term behaviour of the Earth's atmosphere (influenced by the solar activity), which is mainly responsible for the decrease in orbit altitude. It can be expected that some larger pieces will survive the re-entry and reach the Earth's surface. A rough estimation is to assume the equivalent of approximately 40% of the object dry mass, which leads to a total mass of surviving fragments of approximately 3 tons. Especially massive components such as the engines, tanks or massive part of the primary structure are most likely to partially survive. In any case, these pieces will not accumulate at a certain re-entry point but instead be spread over a large area along the final trajectory, which will be approximately 1000km long and a few hundred kilometres wide. Due to the inclination of the object, the re-entry will happen between ±43° geographical latitude. Thus all locations north and south of this latitude-band can be discarded from being affected. Consequently, mid and northern European countries such as Germany, Austria, Switzerland, Hungary or Romania, as well as most parts of France (except a small region close to the border of Spain and Corsica) are not within the re-entry region.

Within the region of ±43° geographical latitude most part of the Earth surface is covered by ocean so the statistical probability of an impact on soil is low. However, due to the orbital mechanics, the probability of a re-entry at the northern or southern boundary (±43°) of this region is a bit higher than at the equator simply because the residence time at certain latitude is lowest near the equator. Thus, European countries such as Portugal, Spain, France, Italy, Malta, Greece, Bulgaria and Rep. of Cyprus are exposed to a slightly higher risk.

Besides other organisations, this object is also being monitored by EUSST. Sensors capable of tracking the object are used to permanently collect orbit-tracking data towards the end of the orbital life time of the object. Together with data of other sources (e.g. space weather data, etc.) analysis are performed to produce the best possible estimation for the expected re-entry location and time. However, due to the large uncertainties within re-entry predictions in general (approximately ±20% of the remaining lifetime) a precise estimation will be possible only a few hours before the re-entry actually occurs. Even one day in advance the uncertainty in the remaining lifetime of the object will be in the order of around ±5 hours and, considering the velocity of the object, this implies a very wide portion of Earth's surface. However, based on the regions without overflights during the remaining lifetime some regions can already be excluded at an early stage.