

# Improvement of TLE Data using backwards propagation

The Joint Space Operations Center of the USA provides with the so-called TLE (Two Line Elements) catalogue the most complete database of objects in earth orbit. For each object in this catalog, there is a time series of records containing the identification of the object, a time stamp, averaged orbit data, and some other properties required for orbit prediction. The mentioned catalog provides a very comprehensive amount of data, but its quality is limited.

Due to the way TLEs are created, there is the possibility to improve data quality with clever propagation: TLEs are based on observations of objects. This means that for a certain point in time, highly accurate information about the position of the observed object is available, although this point in time is not known externally. The data that were published, however, were usually propagated over a certain period of time, so that the accuracy has decreased within the capabilities of the propagator used. For TLE data the so-called SGP-4 propagator is used, which has a lower accuracy. In the context of this work it shall be checked, at which point of the propagation the TLE data will be most exact, in order to start propagating with higher accuracy from that point. In detail, the following steps have to be carried out:

- Familiarization with the topics orbit propagation and TLE data,
- Search for highly accurate reference data from sources other than TLE,
- Comparison of TLE and reference data,
- Investigation whether and under which conditions the accuracy of TLE can be improved,
- Documentation of the work.

OKAPI:Orbits is a spin-off start-up at the Institute of Space Systems of the TU Braunschweig, Germany. Our focus is to provide the NewSpace market with software for the safe operation of satellites in Earth orbits in a simple way. More information about us can be found at [www.okapiorbits.space](http://www.okapiorbits.space).

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