The GOATS Orbitology Component software was developed to specifically address the concerns presented by orbit analysis tools that are often written as stand-alone applications. These applications do not easily interface with standard JPL first-principles analysis tools, and have a steep learning curve due to their complicated nature. This toolset is written as a series of MATLAB functions, allowing seamless integration into existing JPL optical systems engineering modeling and analysis modules. The functions are completely open, and allow for advanced users to delve into and modify the underlying physics being modeled. Additionally, this software module fills an analysis gap, allowing for quick, high-level mission analysis trades without the need for detailed and complicated orbit analysis using commercial stand-alone tools.

This software consists of a series of MATLAB functions to provide for geometric orbit-related analysis. This includes propagation of orbits to varying levels of generalization. In the simplest case, geosynchronous orbits can be modeled by specifying a subset of three orbit elements. The next case is a circular orbit, which can be specified by a subset of four orbit elements. The most general case is an arbitrary elliptical orbit specified by all six orbit elements. These orbits are all solved geometrically, under the basic problem of an object in circular (or elliptical) orbit around a rotating spheroid. The orbit functions output time series ground tracks, which serve as the basis for more detailed orbit analysis. This software module also includes functions to track the positions of the Sun, Moon, and arbitrary celestial bodies specified by right ascension and declination. Also included are functions to calculate line-of-sight geometries to ground-based targets, angular rotations and decompositions, and other line-of-site calculations.

The toolset allows for the rapid execution of orbit trade studies at the level of detail required for the early stage of mission concept development.