COMSPOC Orbit Determination SSA ODSSA

Orbit Determination Space Situational Awareness (ODSSA) is an ODTK plugin that automatically characterizes non-cooperative maneuvers and allows analysts to examine and fix observation association problems.

Analysts often have to perform orbit determination on RSOs that are uncooperative (meaning little is known about their key characteristics such as mass, area, and maneuver schedule). This is further complicated with many spacecraft now using low-thrust engines as their only method of propulsion. With so little information, solving for the orbit and doing maneuver reconstruction poses unique challenges.

ODSSA helps you address two core problems:

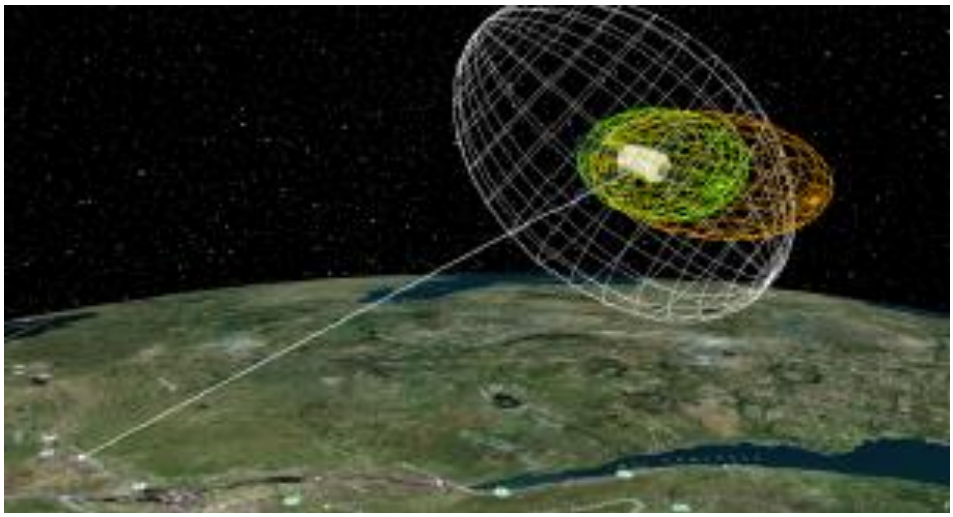
- **Has this RSO maneuvered?** If so, what are the potential maneuver solutions that fit the tracking data I have? How do these maneuver solutions evolve over time as I get new data?
- **How do I assess whether the tracking data is even for the RSO of interest?** Is the data co-mingled with data for other RSOs? How do I retag data from one RSO to another?

You can quickly understand real-world situations and accurately reconstruct them to gain insight into mission and intent; and evaluate how different sensors can contribute toward a better understanding of what is happening.

If sensors have mistagged measurements, ODSSA allows you to generate measurement residuals from multiple RSOs and sensors in different analysis frames to graphically group them and retag the measurements.

ODSSA helps you by:

- Automating maneuver processing with a high degree of both accuracy and speed
- Automatically refining the solution until it meets your criteria
- Allowing you to directly modify the maneuver hypothesis and customize the algorithm
- Including single and two-burn maneuver hypothesizes and is sensitive to both large and small objective function errors
- Taking advantage of multi-core processing for improved system performance



Core capabilities

- **Computes and analyzes residuals**. ODSSA computes the residuals of the "no maneuver" solution and removes bad data. ODSSA then creates user-configurable maneuver hypotheses. Both single-burn and two-burn hypotheses are available, with options to specify and solve for cant angles. The simulated hypothetical residuals are compared to the actuals to determine an initial maneuver estimate.
- **Evaluates the objective function**. ODSSA evaluates each maneuver estimate with an objective function. The objective function is sensitive to both large errors, where the residuals are not acceptable, and small errors, where the residuals may be acceptable but the filter/smoother consistency is not acceptable. ODSSA also computes the objective function with no maneuver, the null hypothesis, for comparison.
- **Refines the solution**. ODSSA uses the Nelder-Mead algorithm to refine the initial maneuver estimates to optimize their objective function value.
- **Automatically recovers.** If no solutions have acceptable objective function values, the maneuver start and stop times and the thrust uncertainty are adjusted until an acceptable recovery solution is found.
- **Reevaluates with new data**. When more tracking data is available, ODSSA can re-evaluate and refine existing solutions against the new data in the extended analysis span.
- **Algorithm control and feedback** While ODSSA is running a log window gives details of each iteration of the process, to give insight into how well solutions are converging. It also offers full control of the algorithm through an advanced panel, with settings saved with the ODTK scenario.