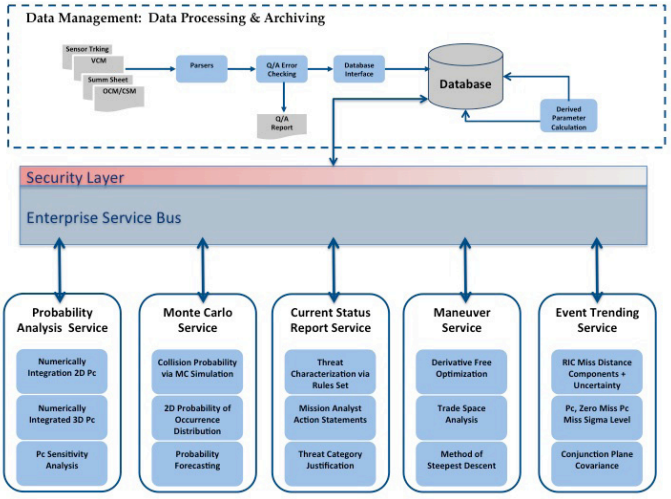
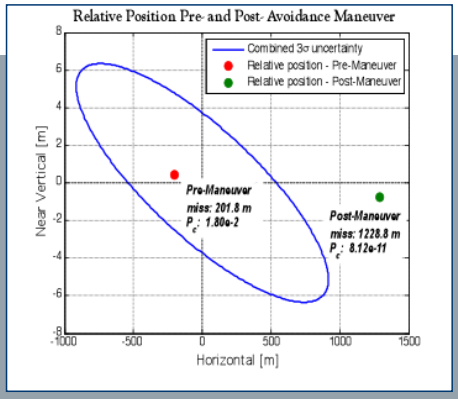
Space Situational Awareness - Collision Avoidance

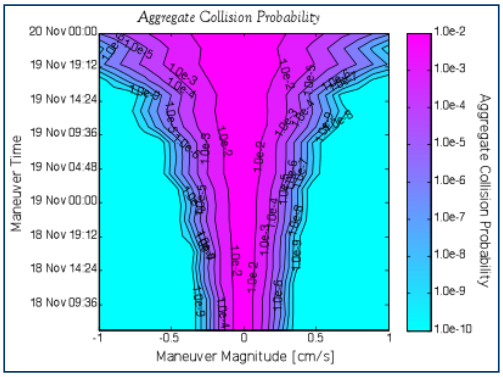
SpaceNav's Collision Risk Management software enables spacecraft operators to analyze & qualify high interest conjunction events. The software tools produce various figures and graphs, which aid in analyzing the event data. Optimal avoidance maneuver solutions are generated for a user-defined set of goals and constraints.



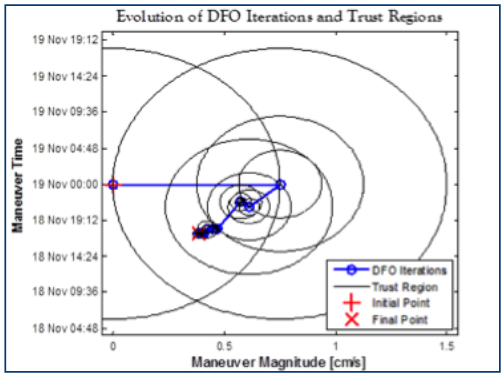
Once a high-risk conjunction event is identified, various avoidance scenarios are generated. An acceptable maneuver plan must produce an orbit change that reduces the collision risk, while still meeting various operational constraints. Common operational constraints include restrictions on: maneuver magnitude, maneuver direction, and the time of day when the maneuver can be executed.

SpaceNav's approach to collision avoidance is to create a maneuver sequence that reduces the total collision risk for one or more conjunction events. The SpaceNav software is comprised of a trade space utility and a constrained optimization algorithm.





SpaceNav's Maneuver Trade Space utility generates a series of new trajectories spanning a set of user selected maneuver times and maneuver sizes. For each perturbed state, new points of closest approach are identified and a collision probability calculation is made. Contours of equal probability show regions of maneuver times and magnitudes that effectively mitigate the collision risk.



SpaceNav's optimal collision avoidance software employs a derivative-free optimization (DFO) technique. The DFO algorithm varies both maneuver time and maneuver magnitude to produce an optimal strategy, which probabilistically reduces the collision risk to a user-specified probability threshold. Operational constraints are applied by forming penalty functions that are added to the original cost function.