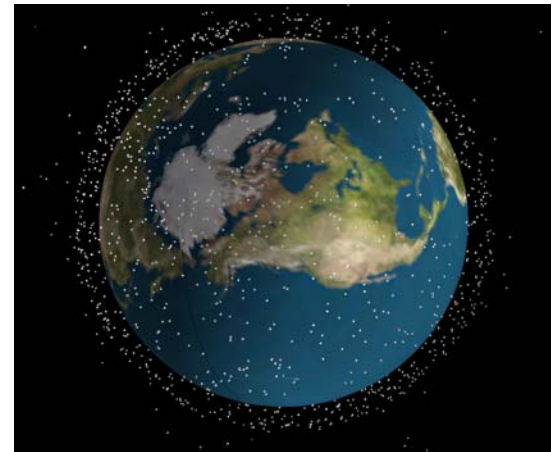




Collision in Space Avoided!

The Earth Sciences Constellation is composed of a series of earth observing satellites whose long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans will provide an improved understanding of the Earth as an integrated system. Currently nine satellites make up the constellation, with several more planned.



The Customer
NASA's Earth Science Mission Operations (ESMO)

The Challenge
Scientists had to assess and mitigate all potential risks of space collisions for the spacecraft in the Earth Sciences Constellation

The Solution
a.i. solutions' automated Conjunction Assessment Tool Suite

The Results
a.i. solutions' Conjunction Assessment team provided timely risk analysis and mitigation strategies, resulting in the first time GSFC maneuvers a satellite to avoid collision

The Earth Observing System (EOS) missions are a vital link in Earth Sciences constellation. However, increasing concerns for collisions with debris and other satellites in the crowded low-earth region prompted the Earth Science Mission Operations (ESMO) Program to search for a way to keep their satellites out of harm's way.

To take on the challenge, **a.i. solutions** assembled the Earth Observing System (EOS) Conjunction Assessment (CA) Team. They began by sending daily EOS satellite orbit solutions to the USAF Cheyenne Mountain Operations Center (CMOC) for comparison with their database of over 8,000 tracked objects. Given a pre-defined, 3-dimensional ellipsoid around each earth sciences spacecraft to avoid, CMOC sent back information on any objects violating the 3-dimensional space. Initial conjunction analysis consisted solely of trending "miss distances". However, the team was seeing almost daily violations. They soon realized that for true risk assessment, they needed to find a way to increase accuracy and assess the *actual probability of collision*. Using a combination of existing models and their own probability algorithm, the team began development of a conjunction assessment tool through the use of **FreeFlyer®**, MATLAB™ and a SQL Database®.

The Results –Theory Becomes Reality

Just as the team was integrating their software tools into an automated collision assessment system, or **AutoCAS**, a "near miss" was predicted to occur between EOS Terra and a piece of space debris. With only 6 days until the predicted collision, the **a.i. solutions'** CA team put their tool to the test and determined that the probability of collision was high and would remain high as they neared the day of closest approach. Each day they re-evaluated their orbit solutions and their probability analysis—with the same result: The debris could pass within less than 60 meters, with a probability of collision on the order of 1 in 100—the highest the team had ever seen.

Three days before the predicted collision, the team presented their analysis to the NASA ESMO Project, along with strategies for maneuvering Terra to minimize impact to its science operations and fuel budget. The ESMO Project was convinced, and on October 21, 2005 (just 2 days before the predicted collision), Terra was moved out of harm's way. The event marked the first time a NASA Goddard Mission maneuvered a spacecraft to avoid a collision in space.

a.i. solutions' EOS Conjunction Assessment Team continues to protect NASA's investment in the Earth Sciences Missions with daily collision analysis. Their quest for more accurate and more efficient conjunction assessment is paving the way for the future in avoiding collisions in space.

Smarter analysis. More options. Better decisions. Risk Mitigation.

a.i. solutions is proud to be a part of the Earth Sciences Mission Team.