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Author: Dr. Salvatore Alfano
Analytical Graphics, Inc., United States

Mr. Daniel Oltrogge
Analytical Graphics, Inc., United States
Dr. Holger Krag
European Space Agency (ESA), Germany
Dr. Klaus Merz
European Space Agency (ESA), Germany
Mr. Robert Hall
Analytical Graphics, Inc., United States

RISK ASSESSMENT OF RECENT HIGH-INTEREST CONJUNCTIONS

Abstract

There have been several recent high-profile space events, notably the conjunctions of the Aeolus and Starlink spacecraft (both maneuverable) and the IRAS and GGSE-4 spacecraft (both dead). Here, we examine the timeline, activities, and risks associated with each of these conjunction events. To accomplish this, we fused observations from the Space Surveillance Network (SSN) to produce a sequence of high-accuracy orbit solutions and used that sequence to generate three-dimensional, dynamic progressions of each conjunction's miss distance, collision probability and its relation to the dilution threshold. Probability of Collision (Pc) is an essential tool for assessing conjunction threats. The Pc Topology tool characterizes the evolution of a conjunction's miss distance and collision probability, both of which are critical inputs to the maneuver avoidance decision-making process and exposing SSA deficiencies.

The European Space Agency commanded the Aeolus spacecraft to perform an emergency maneuver to avoid this high-probability collision hazard. Our results indicate that this maneuver was warranted based upon ESA's decision threshold criteria and the Pc Topology trending analysis. While both collision events fortunately did not occur, we estimated the potential debris fields that these events may have generated had they occurred. We then assessed the impact of these fragmentation fields upon estimated operator workload and subsequent collision risk.