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ALARM FATIGUE AS AN OPERATIONAL SAFETY CONCERN FOR SPACE TRAFFIC CONTROLLERS

Abstract

As the number of space objects orbiting the Earth increases, so does the likelihood of a collision on orbit. To combat the deleterious consequences of such a collision, space surveillance networks warn operators when space collisions are imminent, so that the operators can make protective maneuvers (eg. Canada's Space Surveillance Mission, ESA's SST, and the USA's SSN). The burden of response falls upon the operators of the satellites, which, ideally, receive the warnings and react appropriately, coordinating to determine the best course of action with any other involved party. While there are automated decision-making softwares for conjunction avoidance in development, the majority of decisions falls on human operators. Since humans are part of the process, that process must be protected against human error and shortcomings.

Alarm fatigue is a type of human error that is a very common issue in medical settings, and is defined as a reduced reaction in operators to important alarms due to high-occurrence and/or commonly false or irrelevant alarms. Alarm fatigue is particularly common in environments were the consequences of a missed alarm are high, so long as the incidence of false positives is also very high. The space conjunction monitoring environment would qualify as such an environment. Hundreds of thousands of conjunctions are reported every year (the US Air Force 18th Space Control Squadron provided data for 308,984 events in 2017). Further, any collision event with even a low probability of occurring must be reported (the US Space Surveillance Network, for example, only provides warnings to operators when there is a 1-in-10,000 chance of a collision) and has resulted in flood of collision reports. Oftentimes, operators of the at-risk spacecraft sometimes choose not to respond to the warning, rendering the collision warnings technically "irrelevant" or "false" alarms.

The team conducted a review of literature concerning current orbital conjunction alert methods and their frequency, as well as a review of alarm fatigue mitigations utilized in other industries, like medicine. We found that human operators of space objects have a high likelihood of developing alarm fatigue, and recommends potential countermeasures that can be incorporated by both the space surveillance networks that provide conjunction warnings and the operators who receive them. Careful consideration of space object conjunction alerts is required to ensure that the future of the space domain is clear, since the problem of space congestion and conjunction preponderance will only become worse as time progresses.