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SEEKER ROBOTIC FREE FLYER EVOLUTIONARY DEVELOPMENT APPROACH

Abstract

Over the past year, the National Aeronautics and Space Administration's (NASA) Johnson Space Center (JSC) has begun development on external robotic free flyers for inspection of human spaceflight. This effort, dubbed "Seeker" recently achieved a milestone of delivery a prototype vehicle for launch and operations aboard the International Space Station (ISS) NG-11 Cygnus cargo vehicle. This prototype (Seeker 1.0) is the first step towards an evolutionary strategy of developing advanced free flyers capable of operating in close proximity to human spacecraft.

This paper will lay out the evolutionary approach proposed in developing a vehicle architecture capable of inspecting human spacecraft while operating at close proximity. The paper will discuss how this approach differs with previous efforts including the unique opportunities and challenges the birth of the CubeSat industry presents. Emphasis will be made on how getting to flight quickly enables the development team to quickly gain experience towards future designs. This is done at the cost of accepting higher risk to mission success which can be made acceptable as long as it does not pose a hazard to astronauts or critical spaceflight infrastructure.

The paper will go into depth on the Seeker 1.0 vehicle capabilities and lay out a path which incrementally increases inspection capability, autonomy, and safety over a series of flights. Under this approach, a new sensors such as lidar or advanced vision based navigation can be tested without influencing the operation of the vehicle. Once these new sensors are adequately developed and tested in parallel, they can be implemented into the base flight architecture on future iterations.

Finally, the paper will discuss how safety capabilities such as fault detection, isolation, and recovery (FIDR) and redundancy will be incrementally increased as well as process overhead to ensure safe operation around human spacecraft.