1 Introduction

Orbital debris from defunct satellites, rocket stages, and/or fragments of disintegrated space objects increasingly clouds the orbit around Earth. This debris poses a significant collision threat to operational satellites and spacecraft.[1] There are many concepts proposed to remove the orbital debris, with the most developed being a robotic debris-removal satellite, which would bring the debris into a low orbit to accelerate its entry into the atmosphere. This concept is shown in Fig. 1.

A LADAR is a key sensor for the relative navigation between a debris-removal satellite and debris ranging from a fragment of only a few centimeters in size to a defunct satellite that could be many meters in size. Comparing sensors, such as visible cameras, IR cameras, and radars, LADAR can provide better range, speed, and 3-D positional information about a debris target. While a LADAR is an active sensor with its own light source and no need for sunlight for its operation, it does, however, require more resources about mass, volume, and power (MVP) than a passive sensor. The design of a space LADAR instrument should achieve the required performance with a minimum MVP. It can be analyzed by the so-called LADAR equation that links the maximum range to the three main components of LADAR, i.e., laser, optics, and detector.

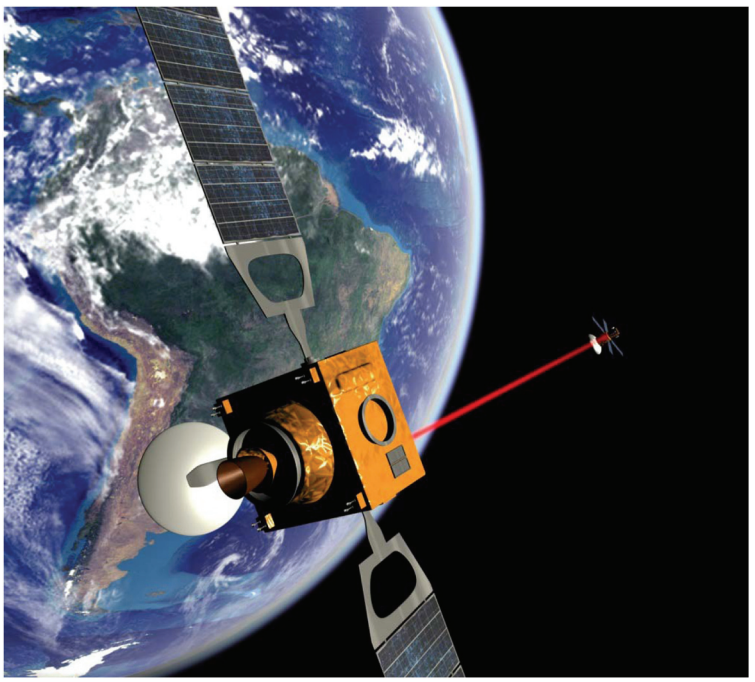

Figure 1 Concept of LADAR application in a robotic debris-removal mission.