

**AT A GLANCE**

**What is it?**

The Light-sheet Anomaly Resolution And Debris Observation (LARADO) is a local space situational awareness sensor concept. Applications range from small debris detection for anomaly resolution and/or debris mapping to aiding proximity operations.

**How does it work?**

LARADO consists of a camera with a widefield lens and a light-sheet that is created using a collimated light source and a diffusive optic (e.g., an axicon, diffuser, Powell lens). Objects in the vicinity of the sensor that are penetrating the light-sheet will scatter light into the camera, which allows the determination of the 3D position of an object.

**What will it accomplish?**

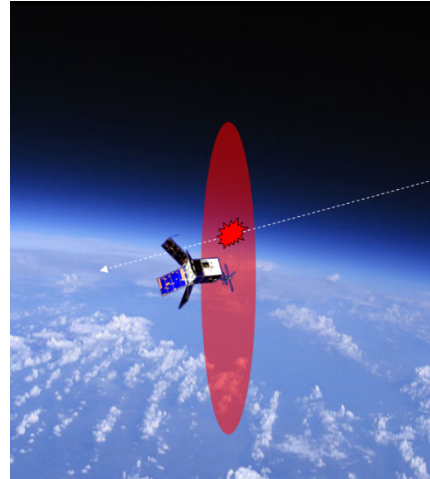
The LARADO concept was initially envisioned for the detection of small debris (a few cm to 0.1 mm) for host satellite anomaly attribution. The concept can also be applied to debris mapping, especially in debris clouds or as an aid in proximity operations.

**R&D Sponsor(s)**

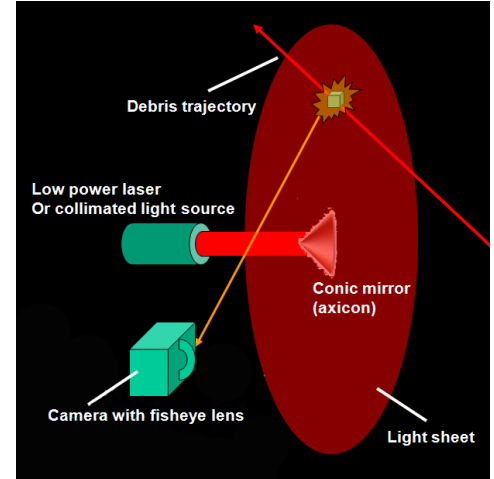
Chief of Naval Research  
NASA  
STP

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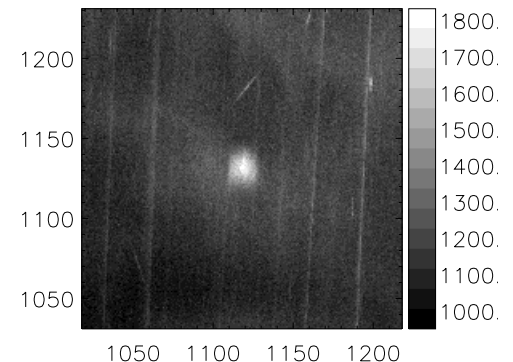
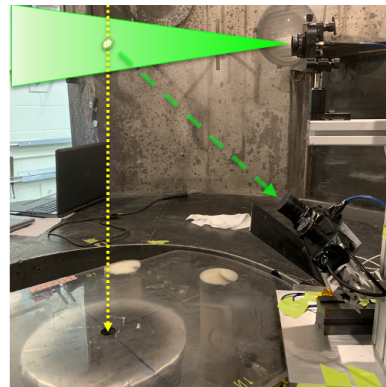
Andrew Nicholas, PI.  
Naval Research Laboratory  
Space Science Division, Code 7634  
andrew.nicholas@nrl.navy.mil



*Light-sheet concept for local space situational awareness.*



*A light-sheet is created using a collimated source and a shaped mirror. Light scattered by a penetrating object is observed with a wide field camera.*



*January 2022 testing at the NASA AMES Vertical Gun Range (above left) significantly increased TRL of the LARADO design. Objects of varying size (1/4" to 1/16") and speed (2.32 – 6.46 km/s) were observed. Above (right) is a zoomed image of a laboratory observation of a 1/8" (3.175 mm) object moving through the lasersheet at 6.46 km/s.*

The LARADO concept can be adapted to individual applications. For example, the detection range can be increased with a stronger light source, two light-sheets can be used to retrieve information about object trajectories, and camera filters can be used to match the light source in order to increase signal to noise. False alarms due to signals from high energy radiation penetrating the camera can be avoided by comparing two simultaneously recorded images, either on the same focal plane or on two different focal planes. Demonstration flight is scheduled for 2025 via DoD Space Test Program.

More information can be found in Englert et al., (2014) *Acta Astronautica*, doi:10.1016/j.actaastro.2014.07.031 and U.S. Patent 8,976,245.