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3D Flash LIDAR for UGV Night Vision, Navigation and Mapping Applications

Advanced Scientific Concepts, Inc. (ASC) produces a compact 3D Flash LIDAR camera (3DFLC), the TigerEye (Figure 1), designed for terrestrial eye-safe 3D imaging at frame rates of approximately 20Hz. Figure 2 is an example of a 3D image taken by the camera, an aircraft in flight in the TigerEye's trigger mode. The 3D focal plane array (3D FPA) of the TigerEye is also capable of an imaging mode called SULAR (staring underwater laser radar) which allows imaging through dust, smoke and fog. Figure 3 is an example of imaging through smoke. The current TigerEye FPA is 128 x 128 with larger arrays in development.
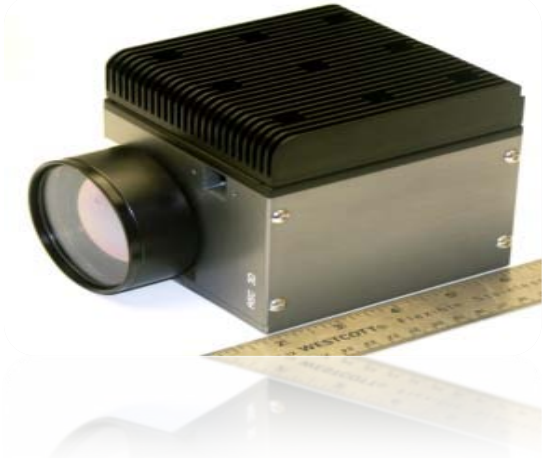

Figure 1. ASC TigerEye 3D Flash LIDAR Camera with 9-degree receiver lens.

The camera is completely self-contained, including the laser, receiver and receiver optics. This approximately 4" x 4' x 5" camera is capable of imaging objects at 300 m. ASC designs and tests all the camera components and subsystems, and integrates, calibrates and tests the compete camera system.

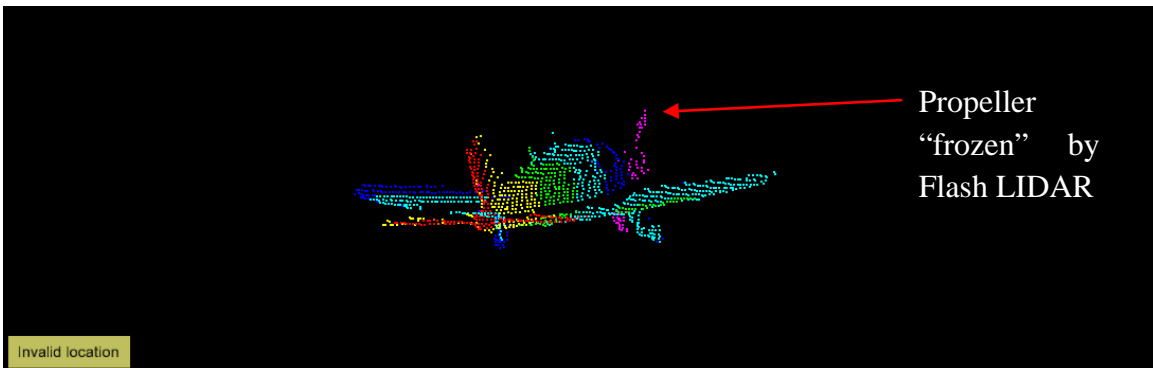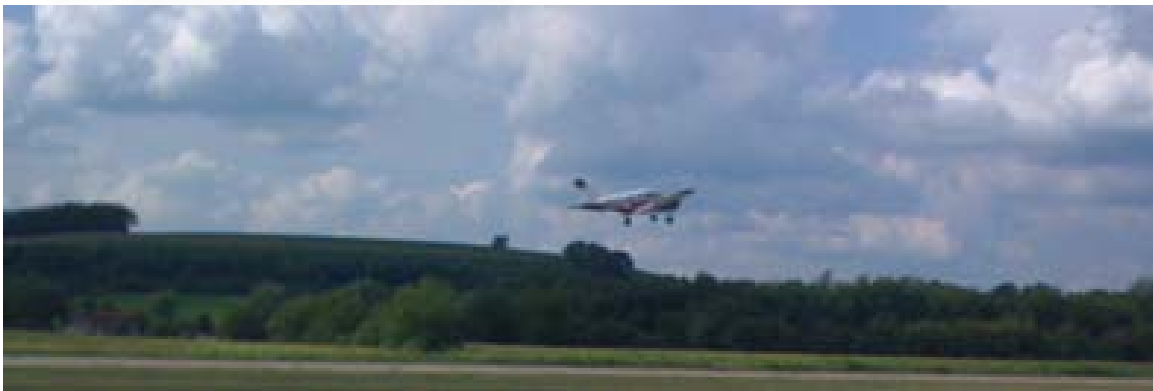Propeller "frozen" by Flash LIDAR

Invalid location

Figure 2. 3D Airplane in flight. Propeller is frozen by instantaneous Flash of LIDAR Camera allowing accurate moving object identification day or night. Color coded for range.

Figure 3. ASC's 3D camera can penetrate smoke to return 3D images in real-time
a) Visible image of smoke filled room taken with a digital camera. b) 2D intensity image taken
with ASC's 3D camera in smoke penetration mode. c) ASC's camera returns range and intensity
of objects in the smoke cloud. Image is color encoded for range
Data 2008 Used by permission from Applied Research Laboratory, Penn State University

The Figure 1 TigerEye 3D camera, fitted with a 45 degree lens (Figure 4 b) instead of the 9-degree lens, can be used for large scene navigation and mapping. Figure 4a is a Tokyo-street 2D image taken with a typical digital camera. Figure 5 is the corresponding 3D image taken with the Figure 4b TigerEye 3D camera, mounted on an automobile. Figures 5a and 5b are the same data but rotated to illustrate the 3D nature of the image.

Figure 4a. Shibuya Street Scene   **Figure 4b. TigerEye with 45-degree Lens (**11.2 cm x 12.2 cm x 11.9 cm; 1.87 kg)
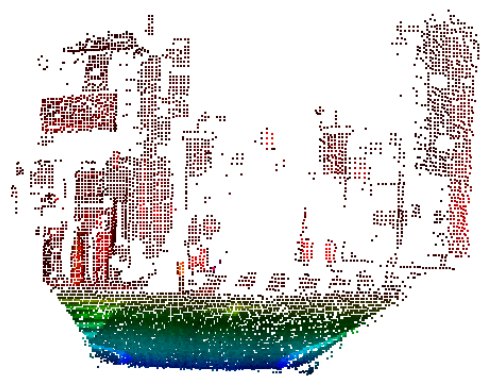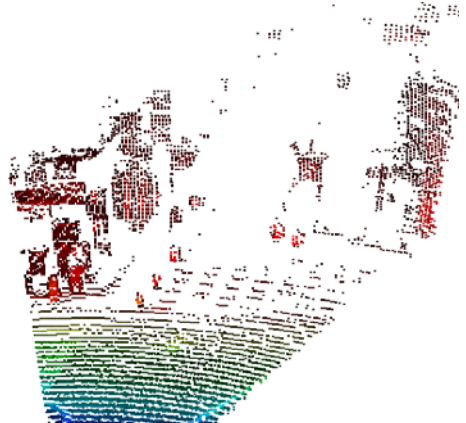

Figure 5a and 5b. Same 3D, dimensionally accurate, point cloud taken with the Figure 4b camera. The two images are rotated with respect to each other and color coded for range. Sparse data appearance due to 128 x 128 (16384) pixels spread over large field of view.