

# Airborne and Spaceborne Single Photon 3D Imaging Lidars

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Single photon SLR technology is now being routinely applied to large scale airborne mapping operations with measurement rates up to 6 million ground pixels per second. These rates are achieved via lasers operating at pulse rates up to 60 kHz with the ground returns from each subnanosecond pulse illuminating a 10x10 pixel array detector. As a result, large cities and rural areas extending to thousands of square kilometers can be mapped in a matter of hours with few cm range precision and few decimeter point resolutions. The use of the 532 nm wavelength, which is highly transmissive in water, allows the instrument to generate combined high resolution topographic and bathymetric maps. The systems have also demonstrated the ability to penetrate tree canopies for measurements important to biomass and forestry applications. The presentation will provide recent examples of all of these applications.

The SPL technique is already being utilized in space with the launch of NASA's ICESat-2 into a roughly 500 km high, near polar Earth orbit in late September 2018. The latter instrument will use a 5W, 10 kHz, nanosecond pulse laser split into 6 beams to monitor ice sheet thickness response to global warming among other science applications. At lower orbital altitudes suitable for planetary moons (e.g. 100 km), the same laser, combined with a nominal 0.5 m telescope, a 10x10 pixel array detector and dual wedge optical scanner, can be used to generate globally contiguous, few meter resolution, topographic maps in a matter of months.