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The Impact of Single Photon SLR Technology on Large Scale Topo-Bathymetric Mapping

Sigma's current Single Photon Lidars (SPLs) were born out of NASA's SLR2000 program at the turn of the century with the introduction of the NASA "Microaltimeter"□, which demonstrated the feasibility of extracting surface features with single photon returns in broad daylight. SPLs have multiple advantages relative to conventional multiphoton lidars and are therefore garnering increased attention within the international surveying and mapping communities. SPLs are the most efficient 3D imagers possible since each range measurement requires only one detected photon as opposed to hundreds or thousands in conventional laser pulse time of flight (TOF) or waveform altimeters. Their high efficiency enables orders of magnitude more imaging capability (e.g. higher spatial resolution, larger swaths and faster areal coverage). Single photon sensitivity is combined with 2 nanosecond receiver recovery times and a multistop timing capability per pixel. Few cm RMS range resolutions are achieved through the use of subnanosecond laser pulsewidths, detectors and timing receivers. Our scanning 3D imaging SPLs currently provide contiguous, high resolution maps at aircraft AGLs between 1 and 11 km and speeds in excess of 200 knots. With 100 beamlets per pulse and laser fire rates up to 60 kHz, our newly developed moderate altitude (3.8 km AGL) HRQLS-2 lidar interrogates up to 6 million ground pixels per second. Furthermore, the 532 nm operating wavelength is highly transmissive in water, thereby permitting shallow water bathymetry and 3D underwater imaging from the same instrument.