University Defence Research Collaboration (UDRC)
Signal Processing in a Networked Battlespace

LiDAR sampling and full waveform processing for information capture and situational awareness

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Abstract

Full waveform single- and multi-spectral LiDAR data [1, 2, 4] has been analysed to extract structural and physiological properties from forest canopies and to detect and classify partially obscured subjects for situational awareness. Combining current open-source and in-house approaches to 3D data analysis we shall investigate two principal scenarios in accordance with DSTL challenges: first, land-based multi-vehicle multi-sensor; and second, aerial vehicle reconnaissance.

Exemplar Scenario 1a

Airborne Platform to extract obscured structural data

Long range : Full wave form multi/hyper spectral data

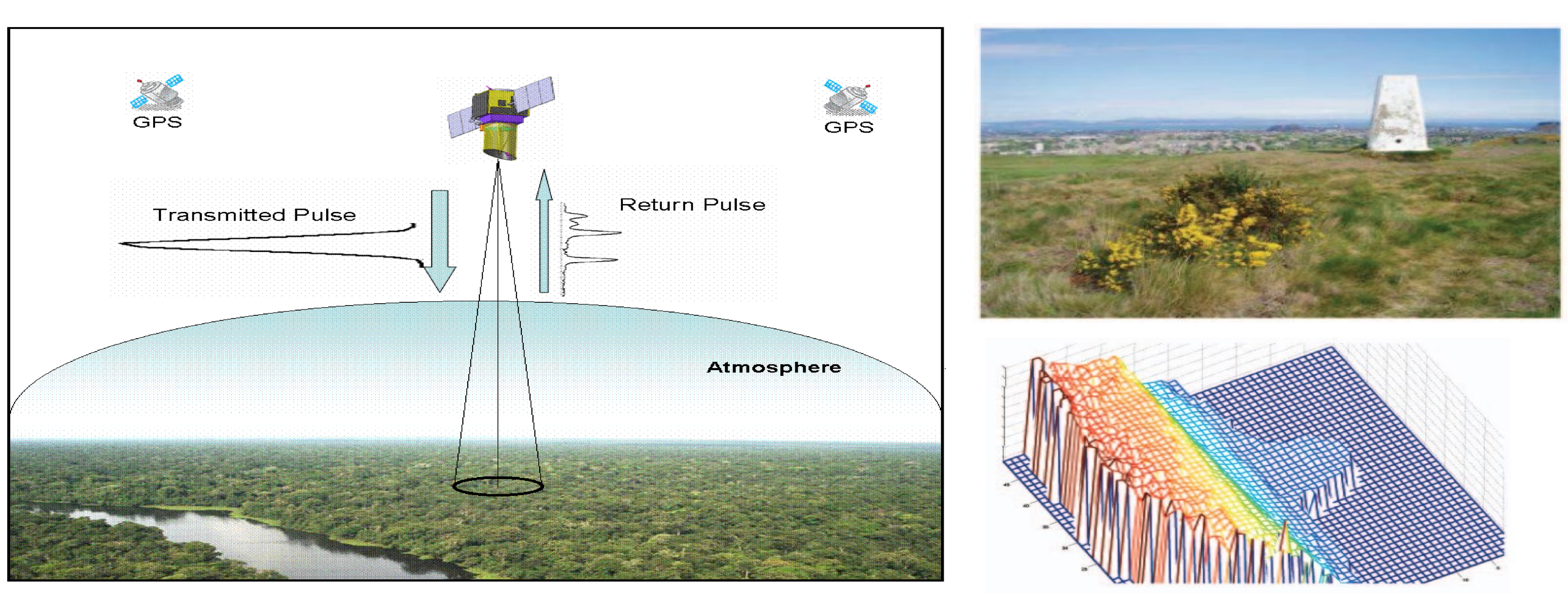

Fig 1: One possible scenario is full wave form long range LiDAR either satellite (left) or terrestrial (right) (> 5km).

Exemplar Scenario 1b

Multi-Vehicle (Ground and Air)

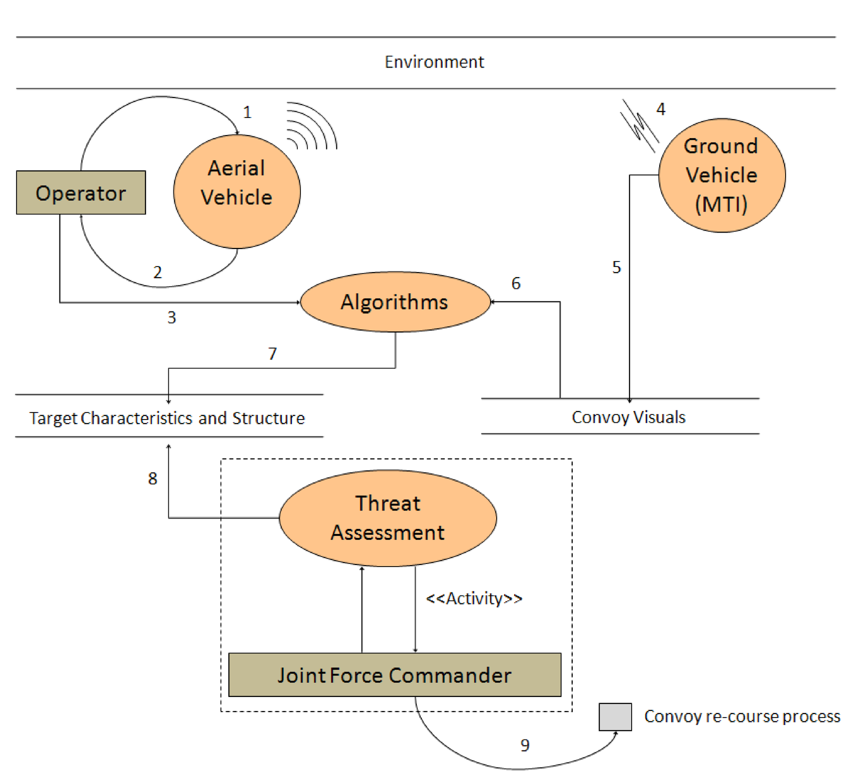

Fig 2: A convoy threat assessment using aerial and ground vehicles equipped with LiDAR and visual sensors. Ground vehicles based at safe distances can capture information using short range LiDAR whereas air vehicles can support long-range full-waveform LiDAR

Aim and Objectives

Information Capture

- Make use of the current state-of-the-art full waveform Lidar systems to create accurate and reliable target images.
- Structural/material characterisation using full waveform LiDAR.

3D Point Clouds – Algorithms and Management

- **Algorithm Development** Feature extraction, target detection, and classification from range data.
- **Software** (In-house/open-source) for Point Cloud Management.

Year 1 Plan Projected Outcome

- **Phase 1a**: Devise exemplar scenarios (DSTL agreed) .
- **Phase 1b**: Work with DSTL and Industry partners for data capture.
- **Phase 2**: First exemplar: algorithm for target detection under trees.

Exemplar Scenario 2

Mobile-Vehicle Monitoring and Resource Allocation

Short range : Single waveform and visual imagery

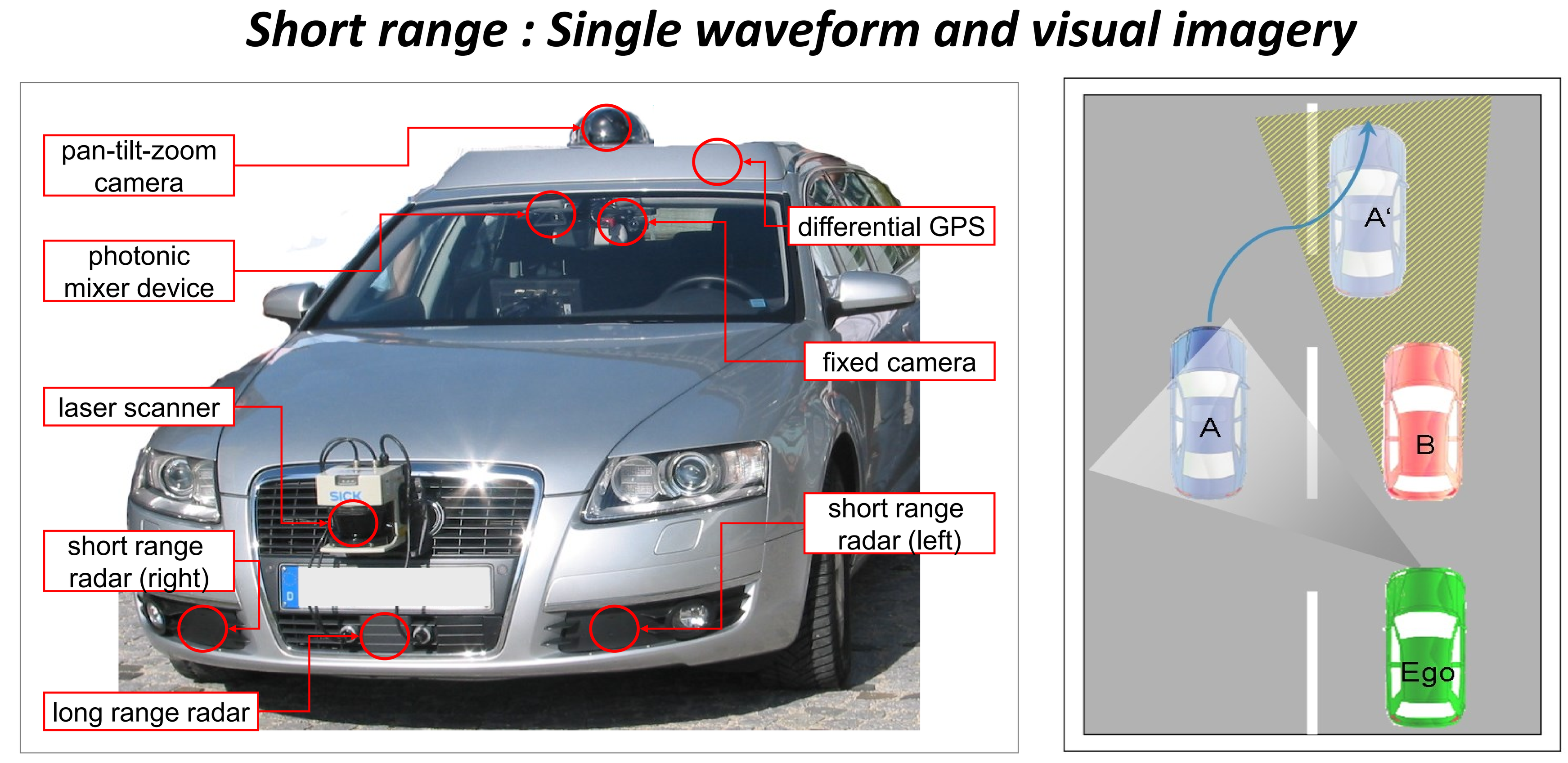

Fig 3: Ground vehicle with suite of sensors including: short range laser scanner; radar; pan-zoom camera, and others. Past work with **Audi** resulted in efficient resource planning and road-traffic classification [4], and audio-visual tracking of humans [5].

Fig 4: A ground vehicle (left) at **Thales** equipped with IR polarisation and imaging sensors (right).

References

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