Mobile laser-based technologies for high resolution ground-based methane detection

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We propose a program of work that will develop a powerful new laser based technology capable of making ground based measurements of methane emissions.

LIDAR (Light Detection And Ranging, also LADAR) is an optical remote sensing technology that can measure the distance to, or other properties of, targets by illuminating the target with laser light and analyzing the backscattered light. A variant of this approach, often refereed to as DIAL, or differential absorption LIDAR, which combined with appropriate laser sources, is of particular promise for measuring methane emissions.

The Institute of Photonics and Advanced Sensing (IPAS) at the University of Adelaide has developed DIAL systems capable of remotely monitoring water vapour. Researchers within IPAS propose to extend this technology to remotely quantify methane concentrations. This will be achieved by building on our expertise in laser development, in particular on our world-leading Er:YAG solid-state laser technology platforms.

Er:YAG lasers are ideally suited to the detection of methane from a mobile platform. They can produce short laser pulses and their emission band includes the right wavelength to be absorbed by methane and extremely sensitive detectors exist that allow the detection of the faint signatures of distant methane using this wavelength. The wavelengths these laser emit are safe for the human eye, which is a critical feature of any laser based system that must operate in the vicinity of human activity.

The development of robust, compact, efficient solid-state lasers and remote sensing are key areas of expertise of IPAS. This research area at The University of Adelaide was recently ranked at the highest possible level in the recent assessment of research quality (ERA 2012 rating 5) undertaken by the Commonwealth Government, one of only 3 universities in Australia to receive this ranking for this field of reserach.

It is important to note that the combination of high altitude hyper-spectral imaging technologies combined with the rapid high spatial and temporal resolutions measurements from the class of ground-based measurements we propose to develop here is an extremely promising approach to quantifying the emissions of methane from natural gas reserves. Satellite imaging allows broad area coverage whilst the ground-based measurements allow more continuous coverage and ground “trothing” of the satellite data.

We propose to rapidly develop a breadboard based DIAL system that can be deployed in the cooper basin to monitor the methane concentration over multi-square kilometer areas in a time frame compatible with the deployment of the high altitude hyper spectral imaging system.

The cost of this program will be $600k pa for two years, followed by $300k in the third year which will include the support the salary of three dedicated researchers plus dedicated equipment. The University of Adelaide will provide in-kind support through the provision of Academic’s time and access to specialized state of the art roof-top laboratories within the new IPAS headquarters building “The Braggs” which will open in March 2013. These roof-top labs have hatches that open to the sky that have been specifically designed for atmospheric sensing.

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