DEFENCE R&D DÉFENSE

Defence R&D Canada – Valcartier

Mobile Lidar Laboratory

- **Simultaneous remote measurement of particle size and density**
- **Detailed mapping of natural or artificial clouds**

Determination of Atmospheric Characteristics

The performance of military electro-optical systems in the visible and infrared portion of the spectrum is degraded by atmospheric conditions. Fog, smog, dust clouds or other atmospheric phenomena decrease visual range and hinder target detection. To predict the performance of surveillance systems, guided missiles and countermeasures used against such systems, DRDC Valcartier offers solutions to these military problems based on an extensive theoretical and experimental expertise in the physics of cloud and aerosols in suspension. This expertise may also be applied to civilian applications such as pollution measurement and the dispersal of aerosols in the farming industry.

In response to these needs, DRDC Valcartier has developed a mobile laboratory equipped with two lidars. These devices make detailed measurements of the evolution of clouds in space, dynamically and remotely. The lidars also provide useful information on relative cloud concentration and homogeneity, their range (horizontal, vertical and temporal profiles), particle shape (spherical or not) and granulometry (for dense and stable clouds).

The two lidars are installed inside a trailer. One operates at wavelengths of 1064 and 532 nm, and the other at 1570 nm (in the eye-safe spectral band). Both lidars are equipped with a programmable hemispheric scanning turret. Each system is mounted on an elevator that raises the turret through an opening in the trailer top. The lidars can operate in any weather, simultaneously and independently. Both devices are equipped with a multiple field-of-view optical receiver and can take measurements in two orthogonal directions of polarization. This makes it possible to determine if particles are spherical or not, to calculate optical attenuation, and in the case of sufficiently dense clouds, to deduce the average particle size. Several microphysical and optical parameters of clouds may also be determined, such as droplet concentration, volumetric content, attenuation at various wavelengths, emissivity, etc. For some applications, a range-gated intensified camera can be used for detection at 532 nm.

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Numerous Applications

Originally developed in response to military needs (obscurants, electro-optic system performance prediction), the RDDC Valcartier lidar is backed by a team of scientists with an in-depth expertise in light scattering and in techniques for the interpretation of information collected by lidars. Because it is capable of sampling and measuring cloud parameters dynamically, the mobile aerosol measuring system can also be used in civilian applications.

Here are a few examples of recent achievements:

- Measuring the concentration and average diameter of water droplets forming natural clouds near local airports. This measurement campaign was held in support of a feasibility study concerning new methods to foresee dangerous icing conditions on airplanes;
- Measuring the temporal characteristics and the density of smoke from industrial chimney stacks, from about 5 km away, providing useful information to organizations responsible for monitoring air quality;
- Studying the form of aerosol dispersion associated with a new model of sprayer mounted on an aerial crop duster. The information collected proved useful to organizations responsible for protecting neighbouring zones and to the sprayer manufacturer. Each was interested in obtaining an optimal distribution of insecticide sprayed and in accurately measuring dispersion and settling rates.

For more information

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Fact Sheet OS-311-A

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