Abstract— The compact eye-safe LIDAR system for an environmental remote sensing (ocean and atmosphere) was developed. LIDAR is based on low energy diode pulsed laser in combination with single photon avalanche diode (SPAD) which operates in Geiger mode. A review of applications for both climate change detection and ecology monitoring by eye-safe LIDAR is presented.

Keywords— laser remote sensing, eye-safe lidar, ecology monitoring

A review of portable diode eye-safe lidar system for ecological applications is presented. The lidar system is based on low radiation diode laser (μJ-nJ/pulse) and photo counting detector (Geiger mode) are discussed. The unique characteristics of the developed lidar (eye-safe, fully digital circuit, low weight and power consumption, high sensitivity) make it an ultimate winner for aerosol study in Mars atmosphere according to the NASA Mars Surveyor Lander-99 Space mission.

Now days such eye-safe compact lidar systems is a perspective tool for laser remote sensing for a numerous ecology applications: atmosphere pollution monitoring, sea surface oil leaks detection, forest biomass estimation and trees heights profiling. Recently, the compact lidar was able to detect predict seismic activity (earthquake) by tectonic aerosol monitoring [1].

A rapid growth of unmanned vehicle technologies makes possible to perform low cost and fully automated the measurements by compact lidar system for a different applications like detecting global climate changes the ecology monitoring. The developed eye-safe compact digital lidar with extremely low energy laser pulses give opportunity to perform these measurements in any environment conditions including crowded areas in downtown or airports [2,3].

Examples of the oil spills/spots detection on sea surface in a kilometer range in both active and passive lidar operation modes are presented. A new approach to increase sensitivity of pollution detection by two-beam probing of skin sea layer is discussed. Ten-fold increased backscattering was detected for micron thick oil film at sea surface. The ocean global pollution by oil products resulted in a wide ocean area covered with micron thick oil film. This film changes the sunlight sea surface reflectance and scattering profile according to our measurements that dramatically influence on thermodynamics in upper ocean layers and can be a key fact that is responsible for Gulfstream shift detected during past decade.

Compact lidar system can be effectively used for ecology monitoring of tourists centers to estimate human activity pressure on nature environment in very sensitive systems as Baikal Lake or Kamchatka region. A fully automated UAV with installed compact eye-safe lidar can patrol local area without risk of tourists being hurt or disturbing by laser radiation or sound noise.

A new indicator of global climate change was suggested recently: the growth of the forest-tundra biomass in Polar Siberia and Arctic regions. The only way to estimate such growth with high precision for vast Arctic areas is a laser remote sensing by automated UAV equipped with compact lidar. In fact the Arctic’s ice thickness estimation and its dynamics (evolution) is the interesting and prospective application of such lidar in UAV board also.

REFERENCES

