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Title: NASA's Lidar Technology and Risk Reduction Program for Space-based Atmospheric Remote Sensing

Abstract: Recent peer reviews of NASA's space-based lidar missions and of the technology readiness of lasers appropriate for space-based lidars indicated a critical need for an integrated research and development strategy, which combines technologies from government, industry, and university towards advancing solid laser transmitter technology from low technical readiness levels to higher levels required for space missions. In view of the Independent Laser Assessment Review Committee's report and concern over the recent difficulties experienced in a number of programs in bringing laser based instruments to mission readiness in a timely and cost effective fashion, NASA HQ chartered the Goddard Space Flight Center and the Langley Research Center to develop an integrated laser/lidar systems strategy for risk reduction and thus improving the overall process by which laser based instruments are developed for space flight application. The goal of such a strategy is to assure the availability of the suite of technologies required to enable the successful development of the broad range of lidar missions envisioned by NASA. Center management at GSFC and LaRC selected three representatives from each center, representing science and engineering disciplines involved in lidar technology, to serve on the Integrated NASA Laser/Lidar Systems Strategy Team (INLSST). Team also included representatives from Earth Sciences Technology Office and NASA headquarters. Starting beginning of 2001, INLSST team met several time among themselves, and with the researchers at GSFC and LaRC to develop an approach that utilizes the existing expertise at NASA Centers and leverages other technological advancements at other government agencies, industry, and universities. For laser transmitter, INLSST made three key recommendations: • Establishing Space-hardened Laser Transmitter Test Beds (1μm laser at GSFC & 2μm at LaRC) • Development and Qualifications of Space-based Laser Diode Arrays • Advancing Wavelength Conversion Technologies for Multiple Lidar Applications The Strategy Team also recommended development of eye-safe space-based solid-state laser transmitters for multiple lidar applications. The concern of eye-safety is promoting the development of solid-state eye-safe laser transmitters in the UV and mid-IR. Using the non-linear optical devices, such as optical parametric oscillator (OPO), optical parametric amplifier (OPA), and wave mixing technologies; the tunable wavelength range can be extended to target the different atmospheric constituents, such as ozone, carbon monoxide, ammonia, methane, etc. This paper presents a multi-Center efforts leading to formulation of an integrated NASA strategy to provide the technology and maturity of systems necessary to make Lidar/Laser systems viable for space-based study and monitoring of the earth's atmosphere.

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