NASA SBIR 2008 Phase I Solicitation

S1.01 Lidar System Components

Lead Center: LaRC

Participating Center(s): ARC, GSFC

Accurate measurements of atmospheric parameters with high spatial resolution from ground, airborne, and space-based platforms require advances in the state-of-the-art lidar technology with emphasis on compactness, efficiency, reliability, lifetime, and high performance. Innovative lidar component technologies that directly address the measurements of the atmosphere and surface topography of the Earth, Mars, the Moon, and other planetary bodies will be considered under this subtopic. Innovative technologies that can expand current measurement capabilities to spaceborne or Unmanned Aerial Vehicle (UAV) platforms are particularly desirable. Development of components that can be used in planned missions or current technology program is highly encouraged. Examples of planned missions and technology programs are: Ice, Cloud and land Elevation Satellite (ICESat, http://icesat.gsfc.nasa.gov), Laser Interferometer Space Antenna (LISA, http://lisa.nasa.gov/index.html), Doppler Wind Lidar, Lidar for Surface Topography (LIST), and Earth and planetary atmospheric composition (ASCENDS).

Research should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 prototype demonstration. For this Program year, we are soliciting only the specific component technologies described below.

- High speed fiber multiplexers for multimode fiber (200 micron core, 0.22 NA) operating at 1064 nm wavelength. We require an N by M multiplexer (where N is 1 or more and M is 10 to 100 or more) capable of switching at speeds on the order of 10 microseconds with low insertion loss (<2 dB). The unit must be small, lightweight, capable of long life, and low power consumption.
- Space-qualifiable high reliability frequency-stabilized CW laser source with 1 W output power. A master oscillator power amplifier (MOPA) configuration is desirable since the source must be phase-modulated.
- Development of polarization-maintaining Er and/or Yb doped optical fiber amplifiers that are optimized for suppression of stimulated Brillouin scattering (SBS). Resulting fiber amplifier must be capable of single frequency (< 1MHz linewidth), peak power of > 1 kW, and M2 beam quality < 1.3.
- Efficient and compact single frequency, near diffraction limited fiber lasers operating in near infrared (1.0 -1.7 Î¼m) and mid-infrared (3 - 4 Î¼m). Requirements include: polarization maintaining output (better than 100:1), M2 beam quality < 1.5, wavelength stability <50 pm over one hour. Both pulsed lasers with repetition rates of the order of 10 KHz and pulse energies greater than 0.5 mJ, and CW lasers in multiwatts regimes are applicable. Wavelength tunability over 10s of nanometers is desirable for certain applications.
- Efficient and compact single mode solid state or fiber lasers operating at 1.5 and 2.0 micron wavelength regimes suitable for coherent lidar applications. These lasers must meet the following general requirements: pulse energy 0.5 mJ to 50 mJ, repetition rate 10 Hz to 1 kHz, and pulse duration of approximately 200 nsec.
- Single frequency semiconductor or fiber laser generating CW power in 1.5 or 2.0 micron wavelength

regions with less than 50 kHz linewidth. Frequency modulation with about 5 GHz bandwidth and wavelength tuning over several nanometers are desirable.
- Development of efficient, compact, and space qualifiable laser absorption spectrometry-related technologies for measuring atmospheric pressure and density. Components of interest include but not limited to fiber based Raman amplifier-based transmitter architecture. Remote sensing of oxygen in the 1.26-micron spectral region for measuring atmospheric pressure is of particular interest.

Proposals should show an understanding of one or more relevant science needs, and present a feasible plan to fully develop a technology and infuse it into a NASA program.