# NASA STTR 2018 Phase I Solicitation

## T8.02 Photonic Integrated Circuits

**Lead Center: GSFC**

**Participating Center(s): GRC, JSC**

**Technology Area: TA8 Science Instruments, Observatories & Sensor Systems**

Integrated photonics generally is the integration of multiple lithographically defined photonic and electronic components and devices (e.g., lasers, detectors, waveguides/passive structures, modulators, electronic control and optical interconnects) on a single platform with nanometer-scale feature sizes. Â The development of photonic integrated circuits permits size, weight, power and cost reductions for spacecraft microprocessors, communication buses, processor buses, advanced data processing, free space communications and integrated optic science instrument optical systems, subsystems and components. This is particularly critical for small spacecraft platforms. Â This topic solicits methods, technology and systems for development and incorporation of active and passive circuit elements for integrated photonic circuits for:Â

- Integrated photonic sensors (physical, chemical and/or biological) circuits: NASA applications examples include (but are not limited to): Lab-on-a-chip systems for landers, Astronaut health monitoring, Front-end and back-end for remote sensing instruments including trace gas lidars Large telescope spectrometers for exoplanets using photonic lanterns and narrow band filters. Â On chip generation and detection of light of appropriate wavelength may not be practical, requiring compact hybrid packaging for providing broadband optical input-output and also, as means to provide coupling of light between the sensor-chip waveguides and samples, unique optical components (e.g., Plasmonic waveguides, microfluidic channel) may be beneficial. Â Examples: Terahertz spectrometer, Optical spectrometer, gyroscope, magnetometer, urine/breath/blood analysis.
- Integrated Photonic Circuits for Analog RF applications: NASA applications include new methods due to Size, Weight and Power improvements, passive and active microwave signal processing, radio astronomy and Terahertz spectroscopy. Â As an example, integrated photonic circuits having very low insertion loss (e.g., ~1dB) and high spur free dynamic range for analog and RF signal processing and transmission which incorporate, for example, monolithic high-Q waveguide microresonators or Fabry-Perot filters with multi-GHz RF pass bands. Â  These components should be suitable for designing chip-scale tunable opto-electronic RF oscillator and high precision optical clock modules. Examples: Ka, W, V band radar/receivers.
- Integrated photonic circuits for very high-speed computing and free space communications: Advanced computing engines that approach Teraflop per second computing power for spacecraft in a fully integrated combined photonic and electronic package. Â  Free space communications downlink modems at the > 1 Terabit per second level for Near-Earth (Low-Earth Orbit to ground)Â and > 100 Mbls for > 1 AU distances. Examples: Transmitters, receivers, microprocessors.