Fiber-based, Trace-gas, Laser Transmitter Technology Development for Space

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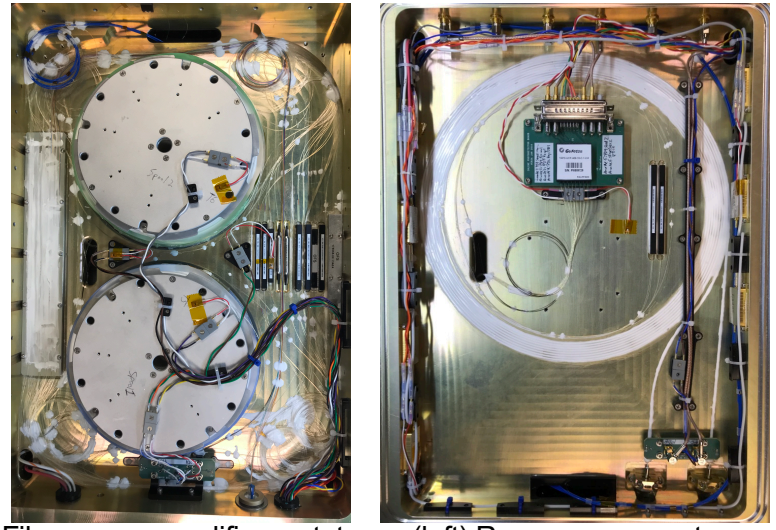
Objective

Develop key laser technologies to reduce the cost and risk of profiling CO_2 measurements from space

Demonstrate the key performance requirements for a space-based CO_2 sounder laser transmitter, including:

- Pulse Energy: >2.5 mJ/pulse
- Repetition Rate: 7.5 kHz
- Linewidth: ≤ 100 MHz (each channel)
- Beam Quality: M^2 < 1.5 (per channel)
- Wall-plug Efficiency: >10%



Fiber power amplifier prototype. (left) Raman pump system and (right) the Er-doped PM-VLMA fiber amplifier

Accomplishments

- Demonstrated seed, preamplifier and power amplifier modules and integrated laser transmitter exceeded the key performance requirements for a space-based CO_2 sounder laser transmitter.
- Demonstrated a single spatial mode Raman pump laser at 1480nm – >30 Watts optical –
  - Has applications for multiple Er-doped gain platforms: Er:glass, Er:YAG, Er:YGG
- Developed Vacuum-potting technique for improved thermal dissipation and mechanical stability – (NTR filed)
- Submitted polarization-maintaining very large mode area (PM VLMA) Erbium-doped fiber and a polarization maintaining, Er-doped VLMA amplifier patent (Publication number: 20190067895).
- Infused Fiber-based, Trace-gas, Laser Transmitter Technology Development for Space technologies into various NASA mission directorate applications including:
  - JPL's free-space laser communications ground station (HEOMD); Sodium Lidar and Methane spectroscopy (SMD); Autonomous Landing Hazard Avoidance Technology (STMD) demonstration: and the RESTORE-L Lidar (STMD)

Co-Is/Partners:
Jim Abshire, Tony Yu, GSFC; NuPhoton, Inc.; OFS Fitel, LLC;

TRL_{in}= 3 TRL_{out}= 4