OAK RIDGE NATIONAL LABORATORY FACT SHEET
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

ORNL Developed Infrared Laser and Modulator Technology for "Last Mile Internet"

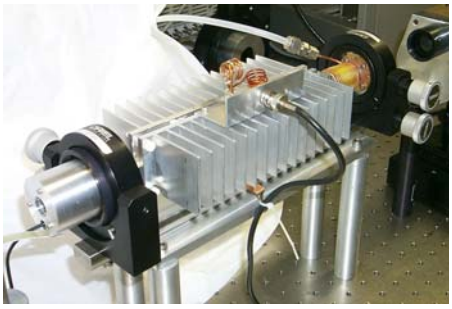
Infrared communications link penetrates fog, smoke and clouds for reliable all-weather free-space optical communications

Miniature CO_2 Lasers and Modulators developed at ORNL for all-weather military and civilian optical communications

Oak Ridge National Laboratory (ORNL) has been developing advanced long-wavelength infrared heterodyne receivers and laser transmitters for plasma diagnostics in fusion reactors for over 20 years. Long-wavelength infrared radiation possesses better all-weather transmission than the shorter wavelength laser sources in use today. The superior transmission through common atmospheric problems such as fog, clouds, and smoke coupled with improvements in LWIR laser and modulator design makes possible reliable optical replacements for radio and microwave communications links in many civilian and battlefield applications. In addition the recent development of a wideband, room-temperature QWIP receiver enables the fielding of a truly portable LWIR communications package. Another advantage of LWIR laser radiation is the inherent eye safety of this wavelength region. One of the drawbacks to more widespread applications for longer wavelength communications systems has been a compact source of 10-micron radiation. We have developed a compact CW RF-driven, air-cooled, sealed-off waveguide CO_2 laser featuring a power level of a few watts, a waveguide i.d. of 2.4-mm and a cavity length of 20-cm. This laser produces a power level of approximately 1.6 watts using $^{12}CO_2$ and 0.8 watts using $^{13}CO_2$, both in the EH_{11} fundamental waveguide mode. We have also developed a high-speed modulator using a hollow-dielectric waveguide design and based on the Stark-effect in ammonia vapor. Using a filling pressure of 8-torr, a digital data rate of over 300-Mbits/sec is possible. The modulator has been tested with an analog signal to a frequency of 900 MHz.

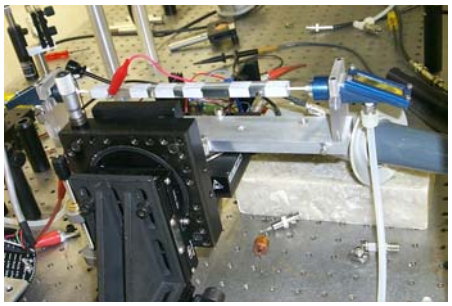
Laser Characteristics:

- 2.4-mm dia x 20-cm discharge, air-cooled
- Nominal 1-watt IR power at 35-watts RF drive
  - 1.6 watts $\Rightarrow$ $^{12}CO_2$
    - 0.4 watts $\Rightarrow$ 10.59 microns with grating tuning
  - 0.75 watts $\Rightarrow$ $^{13}CO_2$



Waveguide CO_2 Laser Prototype.

Point of Contact:
Dr. Donald P. Hutchinson
ALOTD Group
Engineering Science and Technology Division
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831
Phone: 865-574-4730
FAX: 865-574-9407
E-mail: hutchinsondp@ornl.gov
http://www.ornl.gov/lod



High-Speed Infrared Modulator.