

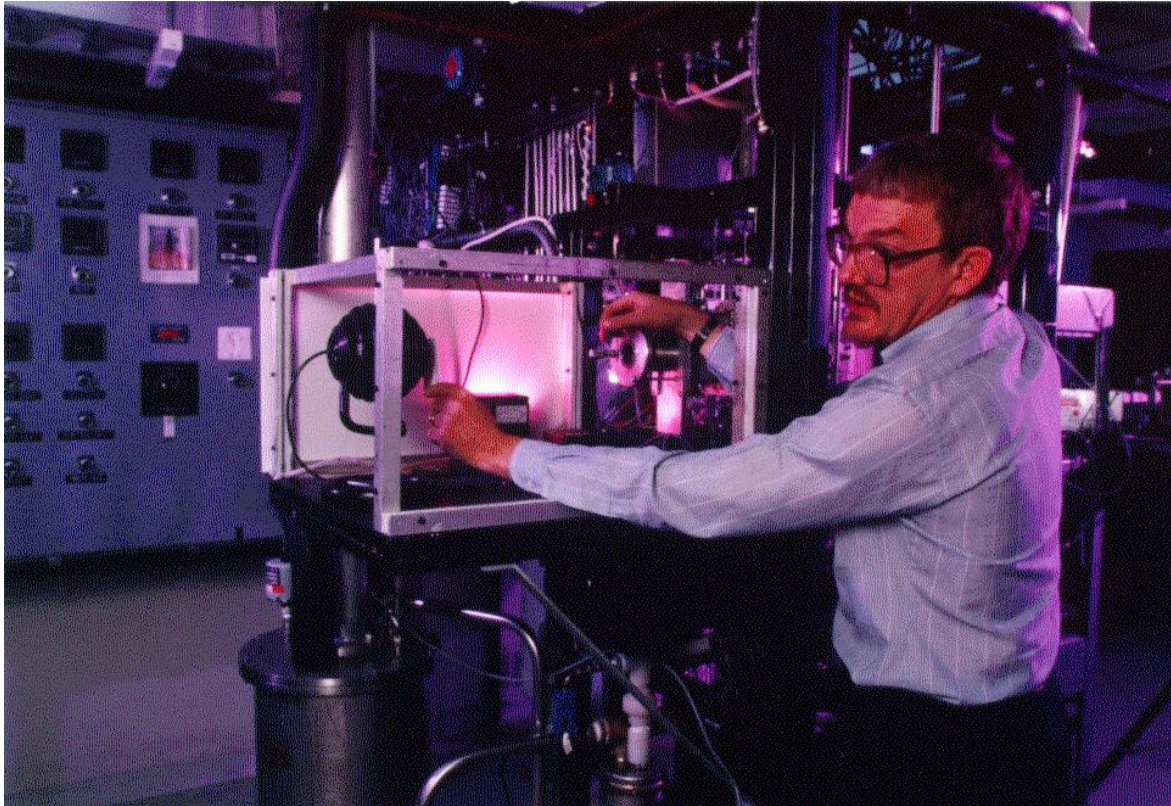


FACT SHEET

UNITED STATES AIR FORCE

Air Force Research Laboratory, Office of Public Affairs, 3550 Aberdeen Avenue S.E., Kirtland AFB, NM 87117-5776
(505) 846-1911; Fax (505) 846-0423
INTERNET: <http://www.de.af.mil/factsheets/>

CHEMICAL OXYGEN-IODINE LASER (COIL)



The chemical oxygen-iodine laser, or COIL, is the world's shortest wavelength, high-power chemical laser.

Operating on an atomic iodine laser transition, COIL emits light with a wavelength of 1.315 micrometers (μm).

An excited state of molecular oxygen, $\text{O}_2(^1\Delta)$, is generated by the chemical reaction between chlorine gas and an aqueous mixture of hydrogen peroxide and potassium hydroxide (basic hydrogen peroxide). The byproducts of this reaction include salt (potassium chloride) and heat. Water vapor in the gas flow is removed because it interferes with the laser gas kinetics. Molecular iodine is then injected and mixed with the gas flow, and some of the energy in the oxygen is used to dissociate the iodine. Resonant energy transfer from the excited oxygen to the atomic iodine excites the iodine, and the gas flow is accelerated to a supersonic velocity in an expansion nozzle to create the laser gain region. Light is extracted with a laser cavity positioned transverse to the gas flow, and the exhaust gases are scrubbed to remove the residual chlorine and iodine.

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COIL was invented in 1977 at the Air Force Weapons Laboratory, which became part of the Phillips Laboratory and then Air Force Research Laboratory at Kirtland Air Force Base, New Mexico, in 1990 and 1997, respectively. The Air Force continues to develop COIL technology using two test stands at the Air Force Research Laboratory's Directed Energy Directorate: a 10 kilowatt-class device called RADICL (Research and Development Iodine Chemical Laser) and the one-kilowatt device called VertiCOIL. A third test stand, a 40 kilowatt-class device called RotoCOIL can be reactivated for high-power testing.

Several key breakthroughs by Air Force scientists, engineers, and their contractors have resulted in efficient, scalable, and reliable laser technology for use in various applications. Significant "firsts" achieved under the Air Force Weapons Laboratory and Phillips Laboratory COIL development program are as follows:

DATE	EVENT
1977	Invention of COIL
1982	Demonstration of world's highest power subsonic gas flow COIL
1984	Demonstration of the first supersonic gas flow COIL
1984	Development under Air Force contract of the compact, rotating disk oxygen generator by TRW Corporation
1984	Development under Air Force contract of the COIL supersonic mixing nozzle array by Rockwell Corporation
1987-1990	Demonstration of COIL scalability to 40 kilowatts by RotoCOIL device
1987	Invention of pulsed COIL by use of a magnetic Q-switch
1989	Demonstration of high-power (700 Watts) continuous wave frequency doubling
1992	Demonstration of high-power COIL pulsing by use of magnetic gain switching

Power: 1 kilowatt to 40 kilowatt
Wavelength: 1.315 μm
Energy Source: chemical reaction
Type of operation: continuous wave or pulsed

(Current as of JULY 2002)